NATIONAL
SERVICE MANUAL

NATIONAL AUTOMOTIVE SERVICE

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A PERPETUAL MAINTENANCE DATA SERVICE

Supplying the Combined Authoritative Service Information From
All Automobile and Equipment Manufacturers

Kept Up-to-Date By Loose Leaf Supplements

NATIONAL AUTOMOTIVE SERVICE
SAN FRANCISCO

Automatic Choke Adjustment—Standard setting for ordinary fuel is with mark 'R' on thermostatic spring case lined up with reference projection on housing. If this setting too rich (engine overchokes or loads up), rotate case to 'M' mark (leaner setting). Use 'H' position for highly volatile fuel.

Air Cleaner:—AC #1528631 oil-wetted type Std., #1528256 heavy duty oil-bath type Optl. (this type standard in severe dust condition states).
NOTE—AC #1528665 oil-vent air cleaner used with oil-wetted type air-cleaner, #1528629 heavy duty type with oil-bath cleaners.

Fuel Pump:—AC Type J #1521797 combination fuel-and-vacuum pump.
See article in Carburetion Equipment Section.

Gasoline Gauge:—Auto-Lite (Motometer) Electric. Model No. NG-8711D (dash unit).
See article in Carburetion Equipment Section.

MANIFOLD HEAT CONTROL:—Thermostatic coil type. To check valve, unlatch thermostatic coil (free outer end from bracket on manifold), operate valve by hand and see that shaft is free (shaft can be cleaned with emery if necessary). Make certain that thermostatic coil is properly latched to bracket and that tension spring (from shaft to clip on flange) is in place.

VALVE TIMING:—To Check—Set tappet cl. #1 intake at .020". This valve should open with piston 15° or .0915" before top dead center when mark 'IN.OP/1-8' on vibration dampener at front of engine lines up with pointer on timing gear cover. Reset tappet clearance at .016" cold.
Motor Gauge—Weidenhoff Adapter # 104. Rod #2.

Tappet Clearance:—.016" all valve, engine cold.

Valve Spring Pressure:—125-135 lbs. at 1¾" (valve open).

LUBRICATION:—Crankcase Capacity—8 qts.
Normal Oil Pressure—40 lbs. at 40 MPH. (warm oil).

BATTERY:—Willard, Type WHT-2-105. 6 volt, 15 plate, 105 ampere hour capacity (20 hour rate).
Starting Capacity—133 amperes for 20 minutes.
Zero Capacity—300 amperes for 3.9 minutes. Five second voltage—4.27 volts.
Grounded Terminal—Positive (+) terminal.
Battery grounded to frame. Engine grounded by separate ground strap at front engine mounting.
Dimensions—Width 7 1/16". Length 10 5/16". Height 8 13/16".
Location—On left hand side under front seat.

STARTER:—Model No. 1107903. Armature No. 820158.
Drive—Overrunning Clutch (solenoid pinion shift).
Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—24-28 ounces each.
Cranking Engine—110 RPM., 150-200 amperes, 5-5.5 volts.

Performance Data

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	6000	5.0	60
16 "	Lock	3.0	600

Removal:—Starter flange mounted on left front face of flywheel housing. To remove, take out flange mounting screws (remove starter and solenoid switch as an assembly).

Starting Switch:—Solenoid Switch Type 1546. Mounted on starter field frame and controlled through relay (in switch case) by pushbutton switch on instrument panel.
See article in Electrical Equipment Section.

Solenoid Switch

Closes against 70 lb. pull with ½" air gap drawing 65-71 amperes at 5 volts. Holds switch closed with current draw of 12-14 amperes (hold-in coil only).

Solenoid Relay

Contacts Close—1.9 volts Max. **Open**—1.0-1.2 volts.
Contact Gap—.035". **Air Gap**—.010".

GENERATOR:—Model No. 1102653. Armature No. 1857866. Shunt (two brush) type with external vibrating voltage and current regulation. Ventilated by fan on drive pulley.
Charging Rate Adjustment—No adjustment at generator. Charging rate controlled by Voltage Regulator and maximum output controlled by Current Regulator. See Control Unit section below.
Maximum Charging Rate—26 amperes (cold) with discharged battery as indicated on test ammeter connected in charging line at regulator 'BAT' terminal. Decreases as battery comes up on charge. Generator output constant at all speeds above 1750 R.P.M. or 21.1 M.P.H.

Performance Data—Generator Cold

Amperes	Volts	R.P.M.
25	8.0	1650

Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—22-26 ounces each.
Field Current—2.0-2.2 amperes at 6.0 volts.

Removal:—Generator now pivot mounted at left front of engine. To remove, take out pivot and clamp bolts.

Belt Adjustment:—Loosen pivot and clamp bolts, pull generator out or away from engine until fan can just be turned with belt held stationary.

CONTROL UNIT:—Model 5818. Mounted on dash. Consists of Cutout Relay, vibrating type Voltage Regulator, and Current Regulator in a single case.
NOTE—Cover is sealed and units serviced on exchange basis if seals not broken. Unit can be checked without breaking seal but cover must be removed to make adjustments.
See article in Electrical Equipment Section.

Cutout Relay

Cuts In—6.7-7.6 volts, 800-850 R.P.M., 9.7 M.P.H.
Cuts Out—0-3.0 amperes discharge current.
Contact Gap—.020". **Air Gap**—.020" (closed).

Voltage Regulator

Setting—7.5-7.95 volts (70°F.), 7.4-7.6 volts (150°F). Regulator over-compensated for temperature and must be checked at these points.
To Check (without breaking seal)—Disconnect lead at 'IGN' terminal on regulator, connect jumper between 'IGN' and 'BAT' terminals, connect ammeter in charging line at 'BAT' terminal, connect voltmeter between 'IGN' terminal and ground. Operate generator at 2800-3400 R.P.M., adjust charging rate to 8-10 amperes (use variable rheostat or AVR set). Voltmeter reading should check with setting given above.
To Adjust (with cover removed)—Change armature spring tension by bending spring hanger at lower end of spring slightly. Check performance as directed above.
NOTE—Voltmeter regulator readings must be taken with cover in place and setting should be checked by decreasing speed until Cutout Relay contacts open, and then increasing speed to original point.
Contact Gap—.020". **Contact Spring Tension**—3.5 oz. **Air Gap**—.063" between armature and core with armature down so that fibre bumper just touches stop. .010" between fibre bumper and stop with armature up.

Current Regulator

Setting—26 amperes.
To Check (without breaking seal)—Disconnect lead on 'IGN' terminal of regulator, connect ammeter in charging line at 'BAT' terminal, operate generator and check output.
NOTE—Generator voltage must not be allowed to exceed 8.5 volts with Voltage Regulator disconnected.
To Adjust (with cover removed)—Change armature spring tension by bending spring hanger at lower end of spring slightly. Check performance as directed above.
Contact Gap—.020". **Contact Spring Tension**—3.5 oz. **Air Gap**—.075" between armature and core with armature down so that fibre bumper just touches stop. .010" between fibre bumper and stop with armature up.
NOTE—Repolarize generator whenever Control Unit disconnected or removed by connecting jumper between 'GEN' and 'BAT' terminals momentarily after all leads have been connected. Do not operate engine.

LIGHTING:—Headlamps—Corcoran-Brown, prefocused type. Upper and lower beams controlled by selector switch on toeboard (lower beam deflected slightly to right).
Headlamp Adjustment—With car unloaded, on level floor 25' from screen, and with upper beams lighted, aim each headlamp so that upper edge of beam is slightly above horizontal line at lamp-center height, and beam is centered on vertical line directly ahead of lamp center. Adjusting screw for horizontal movement located on side of lamp body (remove hood side panel for access to screw), screw for vertical movement at rear of lamp body.
Beam Indicator—Green dot on face of speedometer dial, illuminated whenever upper beams in use.

Switches

Lighting—Douglas.
Beam Selector—R.B.M. #1081.

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps	32-32	2331
Headlamps (Export)	32-32	2330
Parking, Ign., Instrument	1½	55
Stop & Tail	21-3	1158
License	3	63
Trunk	6	81
Dome	15	87

FUSES:—Lighting—20 ampere. On back of lighting switch (nearest to instrument panel).
Accessory—20 ampere. On back of lighting switch (protects Heaters, Radio, etc.)

HORNS:—Klaxon, Model K-33-S. Type 2077 (Low Note, L.H. horn), Type 2078 (High Note, R.H. horn). Vibrator type, matched tone, twin horns operated by horn relay.

Type	Current (at 6 volts)	Air Gap
2077 (low note)	12-14 amperes	.032-.036"
2078 (high note)	11-13 amperes	.042-.046"

Horn Relay:—Delco-Remy Model No. 1116756.
Contacts Close—2.7-4.0 volts.
Contact Gap—.020". **Air Gap**—.015".

NOTE:—Engine hood hinged at cowl and lifts from forward end. To raise hood, pull out hood lock handle (radiator emblem) at bottom, lift hood up at forward end. Hood side panels secured by wing nut at radiator, 2 wing nuts at lower edge and one nut at engine dash on upper edge of panel.

SERIAL NUMBER:—On plate riveted to frame side rail under left front fender. First number G-00001 (South Bend), G-800001 (Los Angeles).

ENGINE NUMBER:—Stamped on pad at upper left front corner of engine. First number 101.

COMPRESSION:—**Ratio**—6.5-1 std. cast-iron head. **Pressure**—100 lbs. at 130 RPM. (cranking speed).

VACUUM READING:—17-18" steady at 8 MPH. idle spd.

IGNITION:—**Coil Model CE-4636.** Service coil (less switch and cable) CE-3264S. Mounted on dash. **Ignition Current**—½-1½ ampere idling, 4-5 stopped.

Ignition Switch:—Mitchellock. Connected to coil by armored cable.

Distributor Model IGW-4131. Single breaker, 6 lobe cam, full automatic advance type with auxiliary vacuum spark control and Octane Selector adjustment.

Breaker Gap—Set at .020".

Breaker Arm Spring Tension—16-20 ounces.

Cam Angle or Dwell—35° closed, 25° open (distr.).

Rotation—Counter-clockwise viewed from top.

Condenser—No. IGB-1025. Capacity .20-.25 mfds.

Automatic Advance

Distributor Degrees	R.P.M.	Engine Degrees	R.P.M.
Start	400	0	800
.8	500	1.6	1000
3	830	6	1660
5	1120	10	2240
7	1400	14	2800

Vacuum Spark Control Model VC-4009—Mounted below distributor and linked to advance plate. Provides additional advance at speeds above idling except when engine accelerated or operated with wide open throttle when spark retarded by return spring within unit. Starts at approximately 4" of HG., max. advance 9° (distr.), 18° (eng.) at approximately 14" of HG.

Distributor Removal:—Mounted on left side of engine. To remove, loosen advance arm clamp bolt (not necessary to disturb vacuum unit connection). NOTE—When installing distributor, insert .016" feeler between hold-down plate and advance plate while tightening advance plate clamp bolt to prevent binding and allow free advance plate motion.

IGNITION TIMING:—Standard setting as follows (see Octane Selector Setting following for correction dependent on fuel regularly used):

Flywheel Degrees	Piston Position
2° BTDC	.0015" BTDC.

To Set Timing—Crank engine by engaging gears and rolling car on floor. With #1 piston on compression, turn engine over until 'IGN' mark (approx. 13/16" ahead of U.D.C.1-6 mark) on flywheel is in line with pointer on engine rear plate on left side of car. Loosen advance arm clamp bolt, rotate distributor until contacts begin to open, insert .016" feeler between advance arm and hold-down plate (to insure clearance for free advance arm movement), tighten clamp bolt, remove feeler gauge. NOTE—Car manufacturer recommends use of Neon timing light.

Octane Selector Setting—With engine at normal operating temperature, adjust Octane Selector so that slight ping evident when accelerating with wide open throttle (rotate distributor clockwise if no ping, counter-clockwise if ping too severe).

Firing Order:—1-5-3-6-2-4. See diagram.

Spark Plugs:—Champion No. 8. 18 MM. Metric. NOTE—Champion No. 7 or 13 (colder plugs) may be used for extremely fast driving in hot weather.

Spark Plug Gaps—Set at .025".

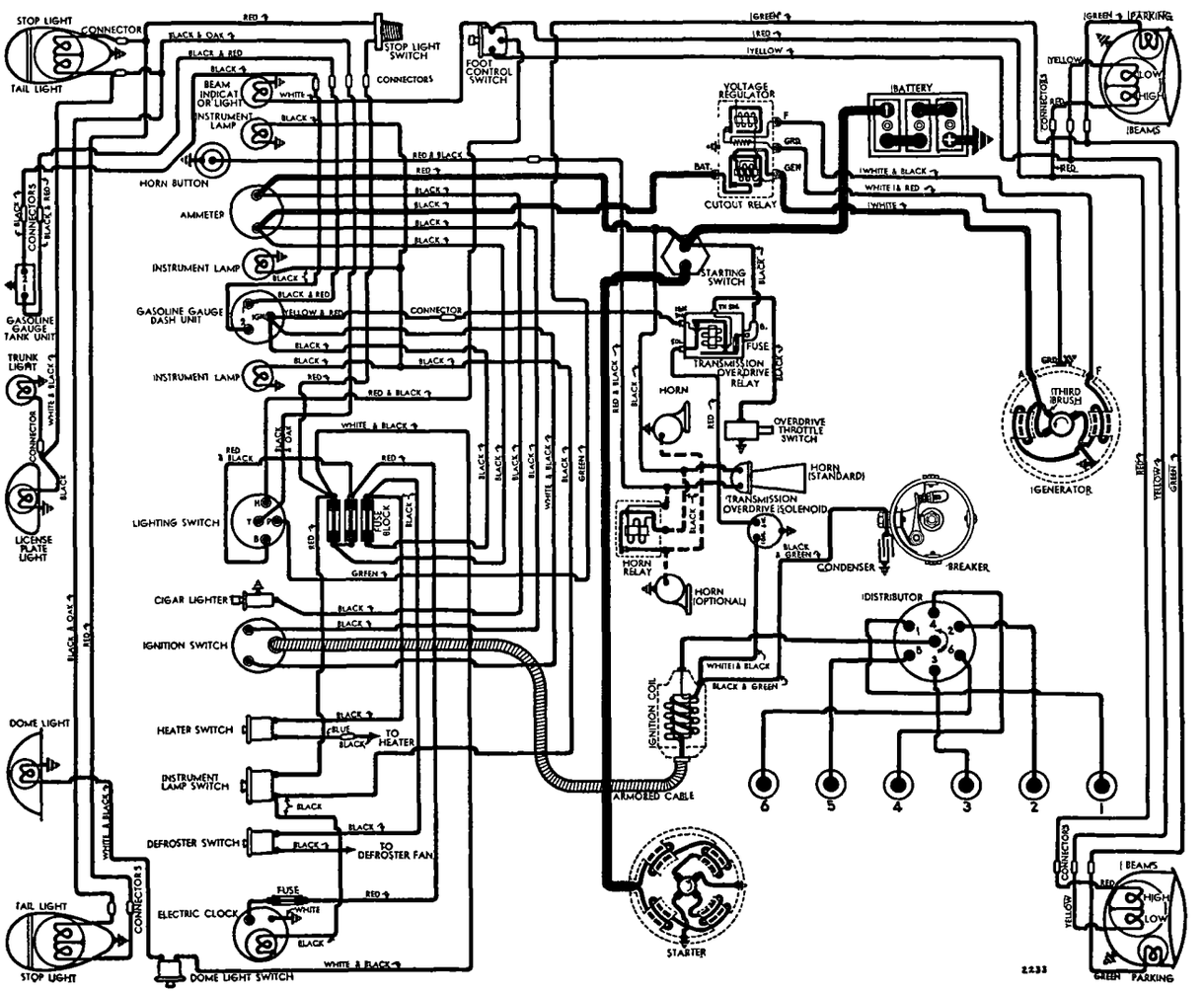
CARBURETION:—**Carburetor**—Carter Model WO Type 444-S (Early—may de identified by #229 cast on flange), Type 453-S (Later cars). New type, single barrel, 1¼" downdraft type. IMPORTANT PRODUCTION CHANGE NOTE—See Carburetor article for part changes for Type 444-S to change over to latest type 453-S.

See article in Carburetor Section for data.

Idle Adjustment—With engine warm and choke valve wide open (fast idle inoperative), adjust throttle stopscrew so that engine idles at 600 RPM. or 8 MPH. Turn idle adjusting screw in until engine begins to miss or lag, then turn screw out until engine begins to roll, finally turn screw in slowly until engine fires smoothly. Final setting should be ¾-1¼ turns of screw open from inner or closed position. Readjust throttle stopscrew for correct idle speed.

Accelerating Pump—Non-adjustable type.

Fast Idle:—Inter-connected to choke valve. Throttle in fast idle position with choke valve closed. With 3/32" diameter drill inserted between throttle valve and body and choke valve in wide open position, choke connector link upper hole should just slide over pin.



Air Cleaner:—AC. oil-wetted type standard. Heavy duty oil-bath type optional.

Fuel Pump:—AC. Diaphragm type standard.

Gasoline Gauge:—Auto-Lite (Motometer) electric. No. NG-9211D (dash unit).
See article in Carburetion Equipment Section.

MANIFOLD HEAT CONTROL:—Thermostatic coil type. To check, unhook coil from pin (valve in closed position, counterweight up). Hooked end of coil should be ¼ revolution away from pin (replace coil if not within this limit). Car manufacturer recommends application (every 1000 miles) of kerosene and baking soda solution on shaft at coil to insure free operation of valve shaft.

VALVE TIMING:—To Check. Set tappet clearance #1 intake valve at .020". This valve should open with piston 15° or .0835" before top dead center when flywheel mark 'IN-OP.1-6/' lines up with pointer on left rear engine plate. Reset tappet clearance at .016" (cold).

Tappet Clearance:—.016" all valves with engine cold. NOTE—Self-locking tappet screws used (no locknuts).

Valve Spring Pressure:—77-83 lbs. at 1 7/16" (valve open).

LUBRICATION:—Crankcase Capacity—5 quarts.

Normal Oil Pressure—40 lbs. at high speeds.

Oil Pressure Regulator—On right front corner of engine block. Opens at 40 lbs.

COOLING SYSTEM:—Capacity—10½ quarts.

Thermostat—In cylinder head water outlet. Starts to open at 156° F. to 160°F.

Temperature Gauge—Auto-Lite (Motometer) Vapor tension type. Part No. H-9210.
See article in Mechanical Equipment Section for data.

TRANSMISSION OVERDRIVE CONTROL:—Electric type with accelerator pedal operated 'kick-down' switch.
See article in Mechanical Equipment Section for data.

Overdrive Solenoid—Delco-Remy Model 1569.

Control Switch—Hersee #1687S. Adjust so that shoe on idler lever just contacts switch plunger with throttle valve wide open (lever against stop). See Mechanical Equipment Section for complete data.

Control Relay—Auto-Lite Model HR-4201S. NOTE—Use only 14 ampere fuse on relay.

BATTERY:—Willard, Type SW-1-90. 6 volt, 13 plate, 90 Ampere Hour capacity (20 hour rate).

Starting Capacity—114 amperes for 20 minutes.

Zero Capacity—300 amperes for 3.0 minutes. Five second voltage—4.1 volts.

Grounded Terminal—Positive (+) grounded to dash.

Engine Ground—Strap connector at right front mounting bolt.

Dimensions—Length & Height 9". Width 7".

Location—In carrier on left front side of dash in engine compartment.

STARTER:—Model MZ-4066. Armature MZ-2120 (early). Model MZ-4074. Armature MZ-2130 (later).

Drive—Barrel type Bendix No. A-2033 (similar in design to Ford '60' type A-1806).

IMPORTANT—A-2033 drive marked 'D' on pinion barrel. Must not be interchanged with Ford type due to difference in structure of pinion teeth.

Rotation—Counter-clockwise at commutator end.

Brush Spring Tension—42-53 ozs. (new brushes).

Cranking Engine—160 amperes, 5.2 volts, 130 RPM.

Performance Data

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	4300	5.5	70
.65 " "	2500	5.5	100
2.55 " "	1325	5.0	200
4.95 " "	750	4.5	300
7.65 " "	220	4.0	400
7.8 " "	Lock	3.0	420
11.8 " "	Lock	4.0	560

Removal:—Starter flange mounted on right rear engine plate. To remove take out mounting bolts and lift starter off.

Starting Switch:—A-L Model SW-4011. Mounted on left side of car below clutch pedal. Operated by depressing clutch pedal fully.

GENERATOR:—Model GDF-4812A. Armature GDF-2006. Third brush control type with external vibrating voltage regulation. Ventilated by fan on drive pulley.

Maximum Charging Rate—30 amperes (cold), 28 amperes (hot), at 8.0 volts, 3000 R.P.M. (generator), 32.5 M.P.H. Actual charging rate controlled by Voltage Regulator and dependent on battery condition.

Charging Rate Adjustment—Maximum output controlled by third brush. Do not adjust third brush for output greater than shown in table below (with field terminal grounded to render regulator inoperative). See Regulator Section (following). NOTE—Third brush setting 2 bars 1 mica strip to 2 bars 2 mica strips from insulated main brush.

Performance Data

Cold			Hot		
Amperes	Volts	R.P.M.	Amperes	Volts	R.P.M.
Start	6.4	920	0	6.4	1000
4	6.6	1030	4	6.6	1140
8	6.8	1140	8	6.85	1280
12	7.0	1300	12	7.1	1440
16	7.25	1460	16	7.3	1640
20	7.45	1650	20	7.55	1840
24	7.65	1880	24	7.75	2220
28	7.9	2220	28.3	8.0	3200
32	8.0	3100			

Rotation—Counter-clockwise at commutator end.

Brush Spring Tension—53 ozs. max. (new brushes).

Field Current—1.90-2.10 amperes at 6.0 volts.

Motoring Current—5.3-5.9 amperes at 6.0 volts.

Removal:—Pivot mounted at left front of engine. To remove, take out pivot and clamp bolts.

Belt Adjustment:—Loosen pivot and clamp bolts, move generator out away from engine until fan can just be rotated with belt held stationary.

REGULATOR:—Model VRD-4006B. Voltage Type. Consists of cutout relay and vibrating volage regulator in a single case on engine side of dash.
See article in Electrical Equipment Section for data.
NOTE—Regulator cover sealed. Serviced on exchange basis if seals not broken.

Cutout Relay

Cuts In—6.4-7.0 volts Cold, 900 RPM., 9.1 MPH.

Cuts Out—.5-3.0 amperes discharge current.

Contact Gap—.015" minimum.

Air Gap—.034-.038". Contacts open—measure at hinge end of core.

Voltage Regulator

Setting—7.3-7.6 volts at 70° F.

To Check (without breaking seals)—Connect ammeter in charging line at regulator 'B' terminal, voltmeter between 'B' and 'GD' terminals. Operate generator at speed equivalent to 30 MPH., charging battery, until voltage is steady. Voltage reading should be 7.4-7.9 volts.

To Adjust (with cover removed)—Change regulator armature spring tension by bending lower spring hanger. See Electrical Equipment Section for complete directions.

Contact Gap—.010-.020" (armature against stop pin).

Air Gap—.0595-.0625" with contacts just opening.

LIGHTING:—Headlamps—Corcoran-Brown, pre-focused type. Upper and lower beams controlled by selector switch on toeboard (lower beam deflected slightly to right—special 2331 bulb).

Headlamp Adjustment—With car unloaded, 25' from screen, and with upper beams lighted, aim each headlamp so that top of beam is 2" below horizontal line at lamp-center height, and beam is centered on lamp vertical center-line. Brass adjusting screws located behind lamp rim at top (vertical movement), at side (horizontal movement).

Beam Indicator—Red dot on speedometer face. Lighted when upper beams in use.

Switches

Lighting—Douglas No. 5724.

Beam Selector—R-B-M No. 1081.

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps	32-32	2331
Headlamps (Export)	32-32	2330
Parking, Ign. Sw., Trunk	1½	55
Instrument	1½	55
Stop & Tail	21-3	1158
License Plate	3	63
Dome	15	87

FUSES:—Lighting—Three 20 ampere. On fuse block on back of instrument panel at center. Protects circuits as follows: **Top**—Clock, Dome, Stop, Instrument lamps. **Center**—Head and Tail lamps. **Lower**—Accessories.

Transmission Overdrive Control—14 ampere. On Relay.

HORNS:—Delco-Remy. Model K-26-H Single Horn Std., Model K-33-S No. 601 (low note—right), 602 (high note—left) twin horns with horn relay Optl.

Model	Current (at 6 volts)
K-26-H	6.5-8.5 amperes
K-33-S 601	10-12 amperes
K-33-S 602	9-11 amperes

Horn Relay:—Delco-Remy Model 1116792.

Closing Voltage—2.3-3.5 volts.

Contact Gap—.020". **Air Gap**—.015" (closed).

SERIAL NUMBER:—First number 4110001 (South Bend), 4802301 (Los Angeles). Stamped on plate on left frame member under left front fender.

ENGINE NUMBER:—First number H-42501. Stamped on boss on left hand side of cylinder block.

COMPRESSION:—**Ratio**—6.0-1 Std., 7.0-1 Optl. (High Alt.).
Pressure—105 lbs. (6.0-1 head), 110 lbs. (7.0-1 head) at 150 RPM. cranking speed.

VACUUM READING:—18-20" steady at 8 MPH. idling speed.

IGNITION:—**Coil Model IG-4653.** Mounted on the dash. Service Coil IG-3033ZS (less switch & cable).
Ignition Current—½-1½ ampere idling, 4-5 stopped.
Ignition Switch:—Mitchellock Model 24-R, No. 8056.
Ignition Lock—Yale & Towne. Mitchellock #8078.
Distributor Model IGW-4101, IGW 4111—With Tachometer Drive. Single breaker, 6 lobe cam, full automatic advance type with auxiliary vacuum spark control and Octane Selector Adjustment.
Breaker Gap—Set at .020".
Cam Angle or Dwell—35° (closed), 25° (open).
Breaker Arm Spring Tension—16-20 ozs.
Rotation—Counter-clockwise viewed from top.
Condenser—No. IGB-1025. Capacity .20-.25 mfd.

Automatic Advance

Distributor		Engine	
Degrees	R.P.M.	Degrees	R.P.M.
Start	400	0	800
3	700	6	1400
6	1000	12	2000
10	1400	20	2800

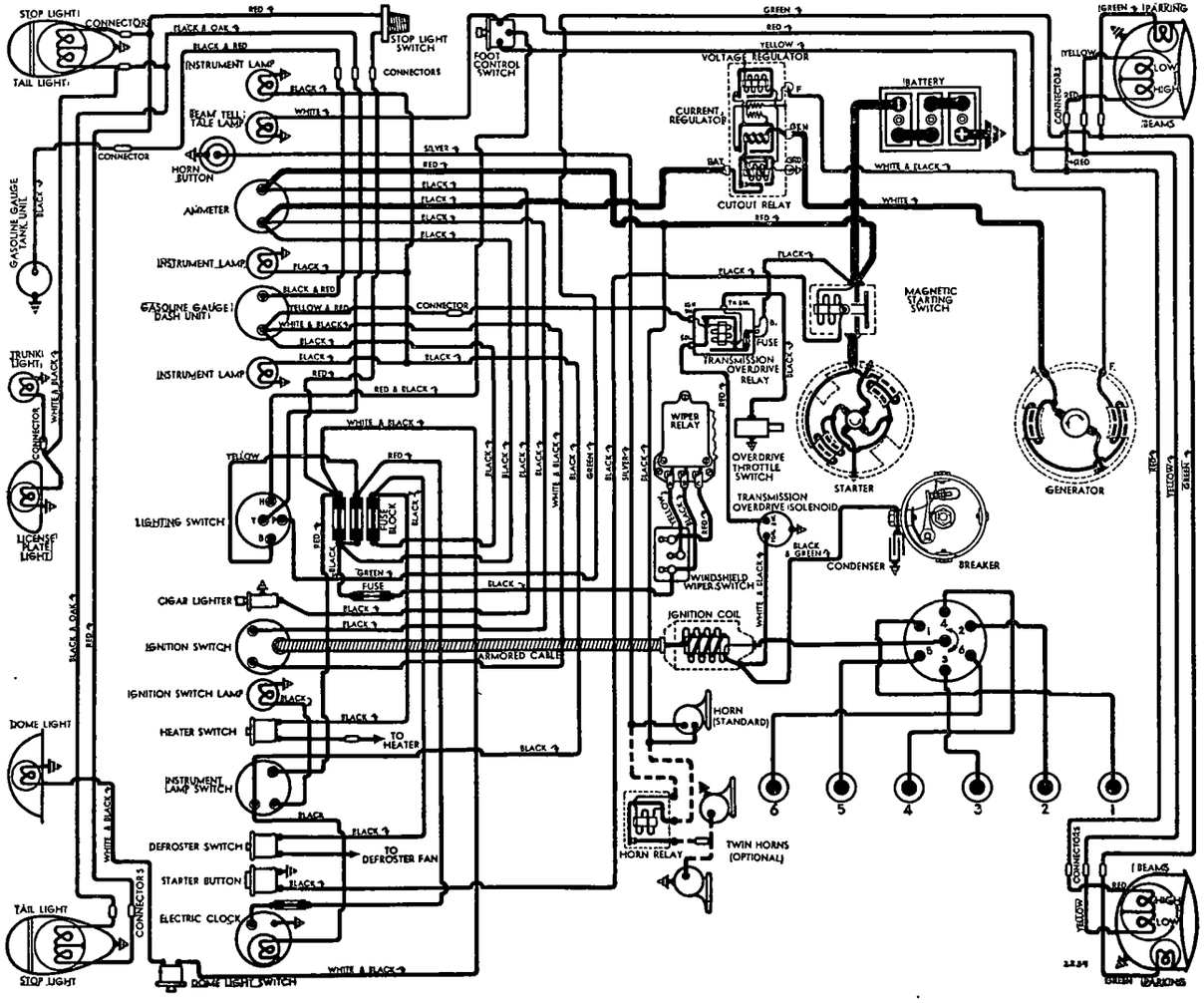
Vacuum Spark Control Model VC-4004:—Mounted below distributor and linked to advance plate. Provides additional advance at speeds above idling except when engine accelerated or operated with wide open throttle when spark retarded by return spring within unit. Maximum vacuum advance 6° (Distr.). 12° (Eng.) on IGW-4101, 3° (Distr.), 6° (Eng.) on IGW-4111.
Distributor Removal:—Mounted on left side of engine. To remove, loosen advance arm clamp bolt (not necessary to disturb vacuum unit connection).
NOTE—When installing distributor, insert .016" feeler between hold-down plate and advance plate while tightening advance plate clamp bolt to prevent binding and allow free advance plate motion.

IGNITION TIMING:—For all engines as follows (see Octane Selector Setting following for correction dependent on fuel regularly used):

Flywheel Degrees	Piston Position
2° BTDC	.0016" BTDC.

To Set Timing—Crank engine by engaging gears and rolling car on floor. With #1 piston on compression, turn engine over until 'IGN/' mark on vibration dampener at front of engine lines up with pointer on timing gear cover (this mark is 2° or 9/64" before top dead center mark '/UDC.1-6'). Loosen advance arm clamp bolt, rotate distributor until contacts begin to open, insert .016" feeler between advance arm and hold-down plate(to insure clearance for free advance arm movement), tighten clamp bolt, remove feeler gauge.
Motor Gauge—Weldenhoff Adapter #104, Rod #2.
Octane Selector Setting—With engine at normal operating temperature, adjust Octane Selector so that slight ping evident when accelerating with wide open throttle (rotate distributor clockwise if no ping, counter-clockwise if ping too severe).
Firing Order:—1-5-3-6-2-4 (see diagram).
Spark Plugs:—Champion No. 8. 18 MM. Metric.
NOTE—Champion No. 7 or 13 (colder plugs) may be used for extremely fast driving in hot weather.
Spark Plug Gaps—.025".

CARBURETION:—**Carburetor**—Stromberg Model BXO-26, 1¼" single, downdraft type.
See article in Carburetor Section for data.
NOTE—Metering jets need not be changed when heavy duty oil-bath type air cleaner installed. First size smaller main metering jet can be installed to secure greater fuel economy with slight loss of performance. ***See Jet Specification table in Carburetion Section for complete jet data.***
Idle Adjustment—With engine warm, Fast Idle and Automatic Choke inoperative so that engine idles at hot or slow idle speed, set throttle stopscrew so that idling speed is 7-8 MPH., turn idle adjusting screw in until engine begins to miss or lag, turn screw out until engine begins to roll, finally turn screw in slowly until engine fires smoothly. Readjust stopscrew for correct idling speed.
Accelerating Pump Adjustment—Three holes provided in throttle lever for pump link engagement. Change setting for seasonal requirements.
Inner Hole (Min. stroke)—Extreme warm weather.
Center Hole—Normal operating conditions.
Outer Hole (Max. stroke)—Extreme cold weather.
Fast Idle:—Integral (Built-in carburetor).
See article in Carburetion Equipment Section.
Setting—No adjustment required (if stopscrew set for correct hot or slow idle speed above). See that stopscrew rests on highest step of fast idle cam with choke valve fully closed.
Automatic Choke:—Integral (built-in carburetor).
See article in Carburetion Equipment Section.
Setting—Mark 'R' on thermostatic spring case should line up with projection on housing (ordinary fuel). If this setting too rich (engine loads up), rotate case to 'M' mark (leaner setting). Use 'H' position only for very volatile fuels.
Air Cleaner:—AC #1528630 oil-wetted type Std., #1528632 oil-bath type Optl. (Std. in severe-dust states).
NOTE—AC #1528665 oil-vent air cleaner Std., #1528629 type used with oil-bath air cleaners.



Fuel Pump:—AC Type W #1522227. Diaphragm type. *See article in Carburetion Equipment Section.*

Gasoline Gauge:—Stewart (Stewart-Warner) Electric type. No. G-99370. *See article in Carburetion Equipment Section.*

MANIFOLD HEAT CONTROL:—Thermostatic coil type. To check valve, unlatch thermostatic coil by freeing outer end from bracket on manifold, operate valve by hand and see that valve is free (shaft can be cleaned with emery if necessary). Make certain that coil is properly latched on bracket and that tension spring (from shaft to clip on manifold flange) is in place.

VALVE TIMING:—To Check—Set tappet clearance #1 intake valve at .020". This valve should open with piston 15° or .0942" before top dead center when mark 'IN-OP.1-6/' on vibration dampener at front of engine lines up with pointer on gear case cover. Reset tappet clearance at .016" cold.
Motor Gauge—Weidenhoff Adapter #104, Rod #2

Tappet Clearance:—.016" all valves, engine cold.

Valve Spring Pressure—125-135 lbs. at 1¾" (valve open).

LUBRICATION:—Crankcase Capacity—6 qts.
Normal Oil Pressure—40 lbs. at 40 MPH.

COOLING SYSTEM:—Capacity—14½ qts.
Thermostat—Bishop & Babcock or Fulton. In cylinder head outlet. Starts to open 156-160°F.
Temperature Gauge—Stewart (Stewart-Warner) No. G-99386.

TRANSMISSION OVERDRIVE CONTROL:—Electric type with accelerator pedal operated 'kick-down' switch. *See article in Mechanical Equipment Section for data.*
Overdrive Solenoid—Delco-Remy Model 1569.
Control Switch—Hersee #1687S. Adjust so that shoe on idler lever just contacts switch plunger with throttle valve wide open (lever against stop). *See Mechanical Equipment Section for complete data.*
Control Relay—Auto-Lite Model HR-4201S. NOTE—Use only 14 ampere fuse on relay.

BATTERY:—Willard Type SW-1-95. 6 volt, 15 plate, 95 A H. capacity (20 hour rate).
Starting Capacity—117 amperes for 20 minutes.
Zero Capacity—300 amperes for 3.1 minutes. Five second voltage 4.2 volts.
Grounded Terminal—Positive (+) grounded to frame.
Engine Ground—Separate ground strap.
Dimensions—Length 9". Width 7". Height 8 13/16".
Location—In engine compartment on left side.

STARTER:—Model MAW-4015. Armature MAW-2091.
Drive—Outboard Barrel Type Bendix No. A-1719.
Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—43-52 ozs. (new brushes).
Cranking Engine—130 RPM., approximately 175 amperes at 5 0-5.5 volts.

Performance Data

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	4900	5.5	65
.6 "	3300	5.5.	100
2.75 "	1480	5.0	200
5.45 "	820	4.5.	300
8.5 "	400	4.0	400
11.5 "	Lock	3.0	505
18.0 "	Lock	4.0	670

Removal:—Starter flange mounted on left front face of flywheel housing. To remove, take out two flange mounting screws, remove starter and switch as assembly.

Starting Switch:—R.B.M. Model 2214. Magnetic type. Mounted on starter and controlled by Douglas #5701 pushbutton switch on instrument panel.

GENERATOR:—Model GDA-4804A. Armature GDA-2606F. Two brush, shunt wound type with vibrating voltage and current regulation. Ventilated by fan on drive pulley.
Charging Rate Adjustment—Adjusted by changing Voltage & Current Regulator settings (no adjustment at generator). See Regulator data below.
Maximum Charging Rate—28 amperes, 8.0 volts, 2025 R.P.M., 20.5 M.P.H. with load or discharged battery (Current Regulator setting). Actual charging rate controlled by Voltage Regulator and dependent on battery condition.

Performance Data

Cold			Hot		
Amperes	Volts	R.P.M.	Amperes	Volts	R.P.M.
0	6.4	930	0	6 4	1010
4	6.6	1060	4	6 6	1180
8	6.85	1210	8	6.85	1350
12	7.1	1350	12	7 1	1530
16	7.3	1500	16	7 3	1730
20	7.5	1660	20	7 5	1950
24	7 75	1830	24	7 75	2220
28	8 0	2025	28	8 0	2520

NOTE—28 amperes is Current Regulator setting.
Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—53 ozs. Max. (new brushes)
Field Current—1.66-1.84 amperes at 6.0 volts.
Motoring Current—3 50-4.15 amperes at 6.0 volts.

Removal:—Pivot mounted at left front of engine. To remove, take out pivot bolts and clamp bolts.

Belt Adjustment:—Swing generator out until it is just possible to rotate fan with belt held stationary.

REGULATOR:—Model VRB-4012A. Consists of Cutout Relay, Vibrating Voltage Regulator and Current Regulator in case on left hand side of dash. *See article in Electrical Equipment Section.*
NOTE—Regulator cover is sealed. Serviced on exchange basis if seals not broken.

Cutout Relay

Cuts In—6.4-7.0 Volts Cold. 900 RPM., 7.8 MPH.
Cuts Out—.5-3.0 ampere discharge current.
Contact Gap—.015" minimum.
Air Gap—.034-.038" Contacts open—measure at hinge end of core.

Voltage Regulator

Setting—7.3-7.6 volts at 70°F.

To Check (without breaking seals)—Connect ammeter in charging line at regulator 'B' terminal, voltmeter between 'B' and 'GD' terminals. Operate generator at speed equivalent to 30 MPH., charging battery, until voltage is steady. Voltage reading should be 7.3-7 6 volts (Cold—70°F), 7.1-7.4 volts (Hot—140°F).

To Adjust (with cover removed)—Change regulator armature spring tension by bending lower spring hanger slightly. See Electrical Equipment Section for complete directions.

Contact Gap—.010-.020" (armature against stop pin).

Air Gap—.0595-.0625" with contacts just opening.

Current Regulator

Setting—27-29 amperes (marked '28' on cover).

To Check (without breaking seals)—Connect test meters as for Voltage check (above). Operate generator at 30 MPH., charging battery, add load (use bank of headlamp bulbs, or turn on car lights and discharge battery) so that generator charges at peak rate and Current Regulator operates. Charging current should not exceed 28 amperes. If more than slight excess noted, regulator is defective.
Adjustment, Contact Gap, Air Gap—Same as for Voltage Regulator (above).

LIGHTING:—Headlamps—Corcoran-Brown pre-focused type. Upper and lower beams controlled by selector switch on toeboard (lower beam deflected slightly to right).

Headlamp Adjustment—With car unloaded, 25' from screen, and with upper beams lighted, aim each headlamp so that top of beam is on horizontal line at lamp-center height, and beam is centered on lamp vertical center-line. Adjusting screws located behind lamp rim at top (vertical movement), at side (horizontal movement).

Beam Indicator—Red dot on speedometer dial Illuminated when upper beams in use.

Switches

Lighting—Douglas, #5740.
Beam Selector—R.B.M. #1081.
Instrument—Douglas, #5697.

Bulb Specifications

Position	Candlepower	Mazda No
Headlamps	32-32	2331
Headlamps (Export)	32-32	2330
Parking, Ign , Trunk	1½	55
Instrument	1 & 1½	51 & 55
Stop & Tail	21-3	1158
License Plate	3	63
Dome	15	87

FUSES—Lighting—Three 20 ampere On fuse block on back of instrument board at center Protect circuits as follows: **Top**—Clock, Dome, Stop, Instrument Lamps.
Center—Head and Tail Lamps **Lower**—Accessories.
Transmission Overdrive Control—14 ampere. On Relay.
Windshield Wiper—20 ampere. In control switch lead.

HORNS:—Klaxon. Delco-Remy Model K-33-S, type 601 (right hand, low note), 602 (left hand, high note). Vibrator type, matched tone, twin horns operated by relay.

Horn Current—10-12 amperes (601), 9-12 (602).

Horn Relay:—Delco-Remy No. 1116756. Closing Voltage 2.3-3.5 volts.

Contact Gap—.020". **Air Gap**—.015" (closed).

WINDSHIELD WIPER:—Auto-Lite Model EW-5003 (early cars), **EW-5103** (later cars). Electric type.
Windshield Wiper Switch—A-L No. XA-535. *See article in Mechanical Equipment Section.*
NOTE—Use only 20 ampere fuse in wiper switch lead.

SERIAL NUMBER:—First number 7125501 (South Bend), 7802501 (Los Angeles). Stamped on plate on left frame member under left front fender.

ENGINE NUMBER:—First number B-30201. Stamped on boss on left rear of cylinder block.

COMPRESSION:—Ratio—6.0-1 Std. cast-iron head.
Pressure—105 lbs. at 150 R.P.M.

VACUUM READING:—Steady 18" at 450 RPM., 8 MPH.

IGNITION:—Coil Model 1115021. Mounted on dash.
Ignition Current—2.5 amperes idling, 4.0 stopped.
Ignition Switch:—Mitchellock Model 24-R, No. 8056. Delco-Remy No. 1116268 (switch & cable).
Ignition Lock—Yale & Towne. Mitchell #8078.
Distributor Model 662-M:—Double breaker, 4 lobe cam, full automatic advance type with auxiliary vacuum spark control and Octane Selector adjustment. NOTE—Contacts must be synchronized (See Timing).
Firing Interval—Movable contacts open 45° (distr.) after fixed set.
Breaker Gap—Set at .020". Limits .018-.024".
Cam Angle or Dwell—33° (closed), 12° (open). Both sets operating together and synchronized.
Breaker Arm Spring Tension—22 ounces.
Rotation—Clockwise viewed from top.
Condenser—Part No. 1838163. Capacity .18-.25 mfd.

Automatic Advance

Distributor Degrees	Distributor R.P.M.	Engine Degrees	Engine R.P.M.
Start	300	2.5	600
14.5	1800	29	3600

Vacuum Spark Control Model 681-S.—Mounted under distributor and linked to advance arm. Provides additional advance at speeds above idling except when engine is accelerated or operated with wide open throttle when spark is retarded by return spring within unit. Plunger travel—17/64".

Vacuum Advance

Dist. Degrees	Eng. Degrees	Vacuum (" of HG)
Start	0	5-7"
6°	12°	13-16"

Removal:—Mounted on right hand side of cylinder head. To remove, loosen advance arm clamp bolt (not necessary to disturb vacuum unit or vacuum connections).

IGNITION TIMING:—Standard setting as follows (see Octane Selector Setting following for correction dependent on fuel regularly used):

Flywheel Degrees	Piston Position
0° (At TDC.)	.0000" TDC.

To Set Timing (Stationary Contacts)—Crank engine by engaging gears and rolling car on floor. With #1 piston on compression, turn engine over until piston reaches top dead center, stop when dead center mark 'U.D.C.1-8' on vibration dampener at front of engine lines up with pointer on timing gear cover. Loosen advance arm clamp bolt, rotate distributor until stationary breaker contacts (mounted directly on breaker plate) begin to open, tighten clamp bolt, then synchronize movable contacts.
Synchronization (On Engine)—Turn engine over 90° to #6 firing position with vibration dampener mark 'U.D.C.3-6' lined up with pointer on timing gear cover. Loosen lockscrews on movable sub-plate carrying second set of contacts, turn eccentric adjusting screw until contacts begin to open, tighten lockscrews.
Synchronization (Using Tool)—Use Delco-Remy tool #1838182. See Distributor Synchronization in Electrical Equipment Section for complete instructions. Distributor firing intervals regular 45-45-45°.
Motor Gauge—Weldenhoff Adapter #104. Rod #2.
Octane Selector Setting—With engine at normal operating temperature, adjust Octane Selector so that slight ping secured when accelerating with wide open throttle (rotate distributor counter-clockwise if no ping noted, clockwise if ping too severe).

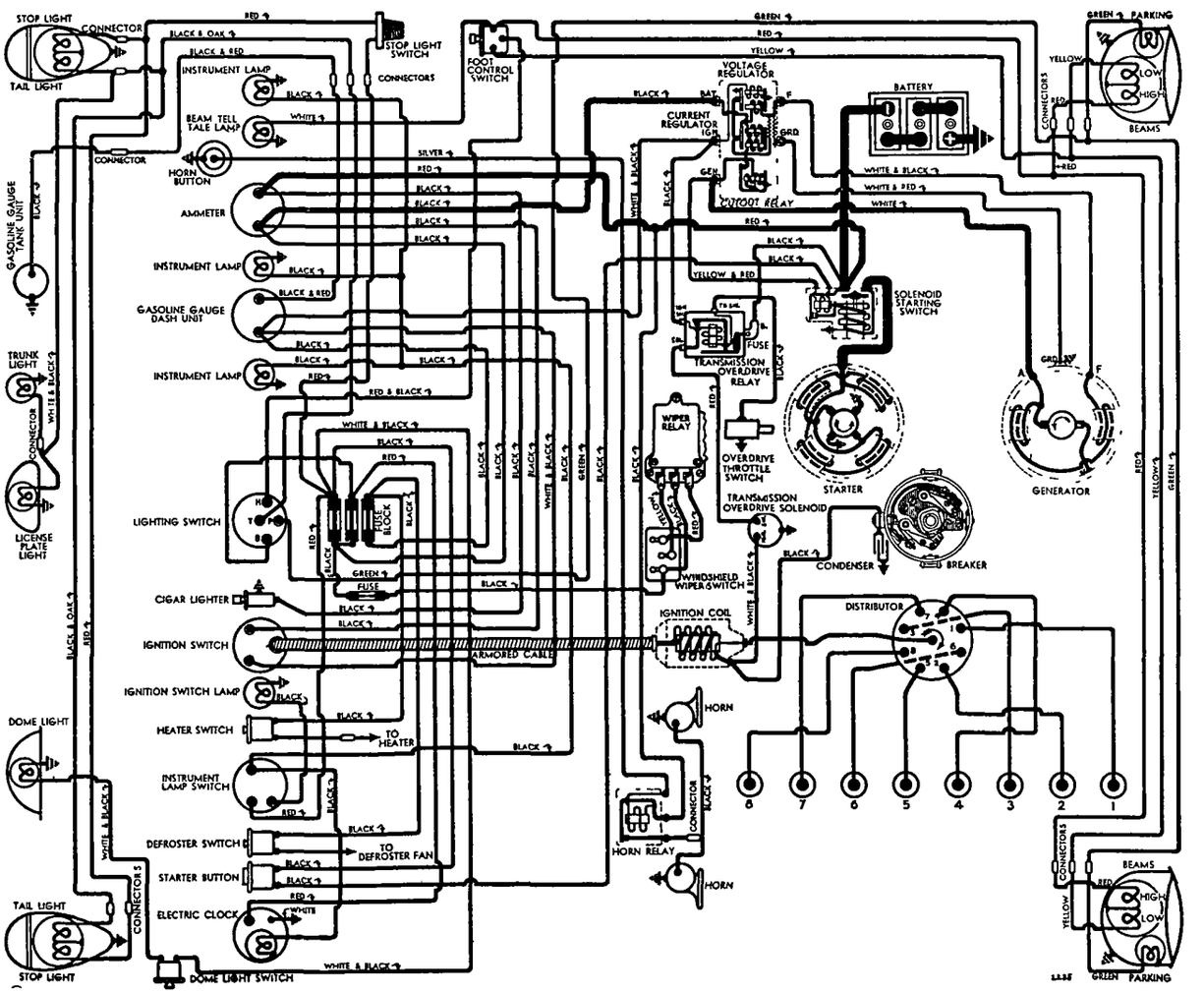
Firing Order:—1-6-2-5-8-3-7-4 (see diagram).

Spark Plugs:—Champion No. 8. 18 MM. Metric.
NOTE—Champion No. 7 or 13 (cooler plugs) may be used for extremely fast driving in hot weather.
Spark Plug Gaps—.025".

CARBURETION:—Carburetor—Stromberg Model AAO-161, 1" Dual Downdraft type.
See article in Carburetor Section for data.
NOTE—Metering jets can be changed to first smaller size for increased fuel economy with slight loss in performance (jets for both barrels must be same size and should be changed as a unit). ***See Stromberg Jet Specifications in Carburetor Section for complete jet data.***
Idle Adjustment—With engine warm so that Fast Idle and Automatic Choke inoperative and engine idling at hot or slow idling speed, set throttle stop-screw for 7-8 MPH. idling speed, turn idle adjusting screw for each carburetor barrel (in succession) in until engine begins to lag or miss, out until engine begins to roll, finally turn screw in slowly until engine fires smoothly. Readjust throttle stopscrew for correct idling speed.
Accelerating Pump Adjustment—Two holes provided in throttle lever for pump link engagement. Adjust for seasonal requirements as follows:
Inner Hole (Min. stroke)—Summer temperatures.
Outer Hole (Max. stroke)—Winter temperatures.

Fast Idle:—Integral (Built-in carburetor).
See article in Carburetion Equipment Section.
Setting—No adjustment provided.

Automatic Choke:—Integral (built-in carburetor).
See article in Carburetion Equipment Section.
Setting—Mark 'R' on thermostatic coil case should line up with projection on housing (ordinary fuel).



If this setting too rich (engine loads up), rotate case to 'M' mark (leaner setting). Use 'H' position only for very volatile fuels.

Air Cleaner:—AC #1528631 oil-wetted type Std., #1528256 oil-bath type Optl. (std. in severe-dust states).

NOTE—AC #1528665 oil-filler air cleaner Std., #1528629 heavy duty type with oil-bath cleaner.

Fuel Pump:—AC Type J #1521797. Diaphragm type combination fuel-and-vacuum pump.

See article in Carburetion Equipment Section.

Gasoline Gauge:—Stewart (Stewart-Warner) Electric type. No. G-99370.

See article in Carburetion Equipment Section.

MANIFOLD HEAT CONTROL:—Thermostatic coil type. To check valve, unlatch thermostatic coil (free outer end from bracket on manifold), operate valve by hand and see that shaft is free (shaft can be cleaned with emery if necessary). Make certain that thermostatic coil is properly latched to bracket and that tension spring (from shaft to clip on flange) is in place.

VALVE TIMING:—**To Check**—Set tappet clearance #1 intake valve at .020". This valve should open with piston 15° or .0915" before top dead center when mark 'IN.OP/1-8' on vibration dampener at front of engine lines up with pointer on timing gear cover. Reset tappet clearance at .016" cold.

Motor Gauge—Weidenhoff Adapter #104. Rod #2.

Tappet Clearance:—016" all valves, engine cold.

Valve Spring Pressure:—125-135 lbs. at 1¾" (valve open).

LUBRICATION:—**Crankcase Capacity**—8 qts.

Normal Oil Pressure—40 lbs. at 40 MPH. (warm oil).

COOLING SYSTEM:—**Capacity**—17 qts.

Thermostat—Bishop & Babcock or Fulton. In cylinder head outlet. Starts to open 156-160°F.

Temperature Gauge—Stewart (Stewart-Warner) No. G-99386.

TRANSMISSION OVERDRIVE CONTROL:—Electric type with accelerator pedal operated 'kick-down' switch.

See article in Mechanical Equipment Section for data.

Overdrive Solenoid—Delco-Remy No. 1569, 1573 (12 volt Exp.).

Control Switch—Hersee #1687S. Adjust so that end of throttle rod just contacts switch plunger with throttle valve wide open (lever against stop). See Mechanical Equipment Section for complete instructions.

Control Relay—Auto-Lite Model HR-4201. NOTE—Use only 14 ampere fuse on relay.

BATTERY:—**Willard Type SW-1-95.** 6 volt, 15 plate, 95 A.H. capacity (20 hour rate).

Starting Capacity—117 amperes for 20 minutes.

Zero Capacity—300 amperes for 3.1 minutes. Five second voltage 4.2 volts.

Grounded Terminal—Positive (+) grounded to frame.

Engine Ground—Separate strap connector.

Dimensions—Length 9". Width 7". Height 8 13/16".

Location—In engine compartment on left side.

STARTER:—**Model No. 1107903. Armature No. 820158.**

Drive—Solenoid pinion shift & overrunning clutch.

Rotation—Counter-clockwise at commutator end.

Brush Spring Tension—24-28 ozs. each.

Cranking Engine—110 RPM., 150-200 amperes, 5-5.5 volts.

Performance Data

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	6000	5.0	60
16 "	Lock	3.0	600

Removal:—Flange mounted on left front face of flywheel housing. To remove, take out flange mounting screws (remove starter and solenoid switch as an assembly).

Starting Switch:—Solenoid Switch Type 1546. Mounted on starter and controlled through relay (in switch case) by pushbutton switch (Douglas #5701) on instrument panel.

See article in Electrical Equipment Section.

Solenoid Switch

Closes against 70 lb. pull with ½" gap drawing 65-71 amperes at 5 volts. Holds switch closed with 12-14 ampere current (hold-in coil only).

Solenoid Relay

Contacts Close—1.9 volts Max. **Open**—1.0-1.2 volts.

Contact Gap—.035". **Air Gap**—.010" (closed).

GENERATOR:—**Model No. 1102656. Armature No. 1873866.** Two brush, shunt type with external vibrating Voltage and Current regulation. Ventilated by fan on drive pulley.

Charging Rate Adjustment—No adjustment at generator. Charging rate controlled by Voltage Regulator and maximum output by Current Regulator. See Regulator data below.

Maximum Charging Rate—30 amperes (cold), 8.0 volts, 1700 R.P.M., 20 M.P.H. and above with load or discharged battery (Current Regulator setting). Actual charging rate controlled by Voltage Regulator and dependent on battery condition.

Performance Data

	Amperes	Volts	R.P.M.
Cold	30	8.0	1700

Rotation—Counter-clockwise at comutator end.

Brush Spring Tension—25 ounces each.

Field Current—2.0-2.2 amperes at 6.0 volts.

Removal:—Pivot mounted at left front of engine. To remove, take out pivot and clamp bolts.

Belt Adjustment:—Swing generator out until fan can just be turned with belt held stationary.

REGULATOR:—**Model 5861 (Vibrating Voltage & Current Type).** Consists of Cutout Relay, vibrating Voltage Regulator and Current Regulator in case on dash.

See article in Electrical Equipment Section.

NOTE—Regulator cover sealed. Serviced on exchange basis if seals not broken.

Cutout Relay

Cuts In—6.9-7.6 volts, 800-850 RPM., 9.7 MPH.

Cuts Out—0-4.0 ampere discharge current.

Contact Gap—.020". **Air Gap**—.020" (closed).

Voltage Regulator

Setting—7.5-7.9 volts at 70°F. 7.4-7.6 volts at 150°F. Regulator over-compensated for temperature and must be checked at these points.

To Check (without breaking seals)—Disconnect charging lead at regulator 'BAT' terminal, connect ¾ ohm fixed resistance (Nicrome wire capable of carrying 10 amperes) between this terminal and ground, disconnect lead on 'IGN' terminal, connect jumper between this terminal and 'BAT' terminal. Connect voltmeter between 'IGN' and 'GRD' terminals. Operate generator and increase speed to 2800-3000 R.P.M., note voltmeter reading (see setting above). NOTE—This test method recommended by manufacturer, does not require adjusting charging rate as with other methods (see Electrical Equipment Section for alternative checking directions).

To adjust (with cover removed)—Change armature spring tension by bending spring hanger at lower end of spring slightly. Recheck performance.

NOTE—Cover must be in place when regulator tests made. Check setting by decreasing speed until Cutout contacts open and then increasing speed to original point.

Contact Gap—.020". **Contact Spring Tension**—3.5 ozs.

Air Gap—.063" between armature and core (armature down so that fibre bumper just touches stop). .010" between fibre bumper and stop (armature up).

Current Regulator

Setting—28-30 amperes.

To Check (without breaking seals)—Connect ammeter in charging line at regulator 'BAT' terminal, disconnect lead at 'IGN' terminal (to eliminate regulator action), turn on car lights. Operate generator and increase speed until Current Regulator limits output, note ammeter reading.

NOTE—Generator must not be operated on open-circuit and voltage must not be allowed to exceed 8.5 volts with Voltage Regulator disconnected.

To adjust (with cover removed)—Same as for Voltage Regulator (see directions above).

Specifications—Contact Gap, Contact Spring Tension, Fibre bumper clearance same as for Voltage Regulator (above). Armature Air Gap should be .075".

LIGHTING:—**Headlamps**—Corcoran-Brown pre-focused type. Upper and lower beams controlled by beam selector switch on toeboard (lower beam deflected slightly to right).

Headlamp Adjustment—With car unloaded, 25' from screen, and with upper beams lighted, aim each headlamp so that top of beam is on horizontal line at lamp center height, and beam is centered on vertical lamp center-line. Adjusting screws located behind lamp rim at top (vertical movement), one side (horizontal movement).

Beam Indicator—Red dot on face of speedometer dial. Illuminated whenever upper beams lighted.

Switches

Lighting—Douglas #5740.

Beam Selector—R.B.M. # 1081.

Instrument—Douglas #5697.

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps	32-32	2331
Headlamps (Export)	32-32	2330
Parking, Ign., Trunk	1½	55
Instrument	1 & 1½	51 & 55
Stop & Tail	21-3	1158
License Plate	3	63
Dome	15	87

FUSES:—**Lighting**—Three 20 ampere. On fuse block on back of instrument board at center. Protect circuits as follows: **Top**—Clock, Dome, Stop, Instrument lamps.

Center—Head and Tail lamps. **Lower**—Accessories.

Transmission Overdrive Control—14 amp. On Relay.

Windshield Wiper—20 ampere. In control switch lead.

HORNS:—**Klaxon.** Delco-Remy Model K-33-S, Type 1999601 (right-low note), 1999602 (left-high note). Vibrator type, matched tone, twin horns operated by relay.

Horn Relay:—Delco-Remy No. 1116756. Closing voltage 2.3-3.5 volts.

Contact Gap—.020". **Air Gap**—.015" (closed).

WINDSHIELD WIPER:—**Auto-Lite Model EW-5003 (first cars), EW-5103 (later cars).** Electric type.

See article in Mechanical Equipment Section.

NOTE—Use only 20 ampere fuse in wiper switch lead.

CAR SERIAL NUMBER:—Stamped on plate on right front side of dash and on right top side of front frame cross member (forward engine support).

ENGINE NUMBER:—Stamped on plate on right side of cylinder cover and on right crankcase wall back of distributor.

BATTERY:—**Prest-O-Lite, Type A-617-SP,** 6 volt, 17 plate, 160 ampere hour capacity (5 ampere rate). Starting capacity 170 amperes for 20 minutes. Negative (—) terminal grounded. Battery mounted under driver's seat. Battery size 7 inches wide, 13 inches long, 9⅝ inches high.

IGNITION:—**Coil Model 528-C** (two used). Coils are mounted under the hood on the right side. Ignition current is 10 amperes at 6 volts with engine stopped and 6 amperes at 6 volts with engine running. The ignition switch is a Delco-Remy Dual-lock Model 426-K.

Distributor Model 4043. Breaker contact gap exactly .017". Set contact gap by loosening lock nut on stationary contact mounting stud and turning up stud until correct gap is obtained with breaker arm on lobe of cam. Resurface contacts when necessary with a fine flat contact file or on a medium hard oilstone. Breaker arm spring tension 17-21 ounces (measured at tip of breaker arm with spring scale at right angles to contact surface). There are two sets of contacts operating on a six lobe cam. Contacts open simultaneously to fire both spark plugs in each cylinder. Contacts must be synchronized (see Timing). Distributor is semi-automatic. Maximum manual advance is 38° (engine).

Cam Angles—Closed 36°. Open 24° (distributor) each set independently.

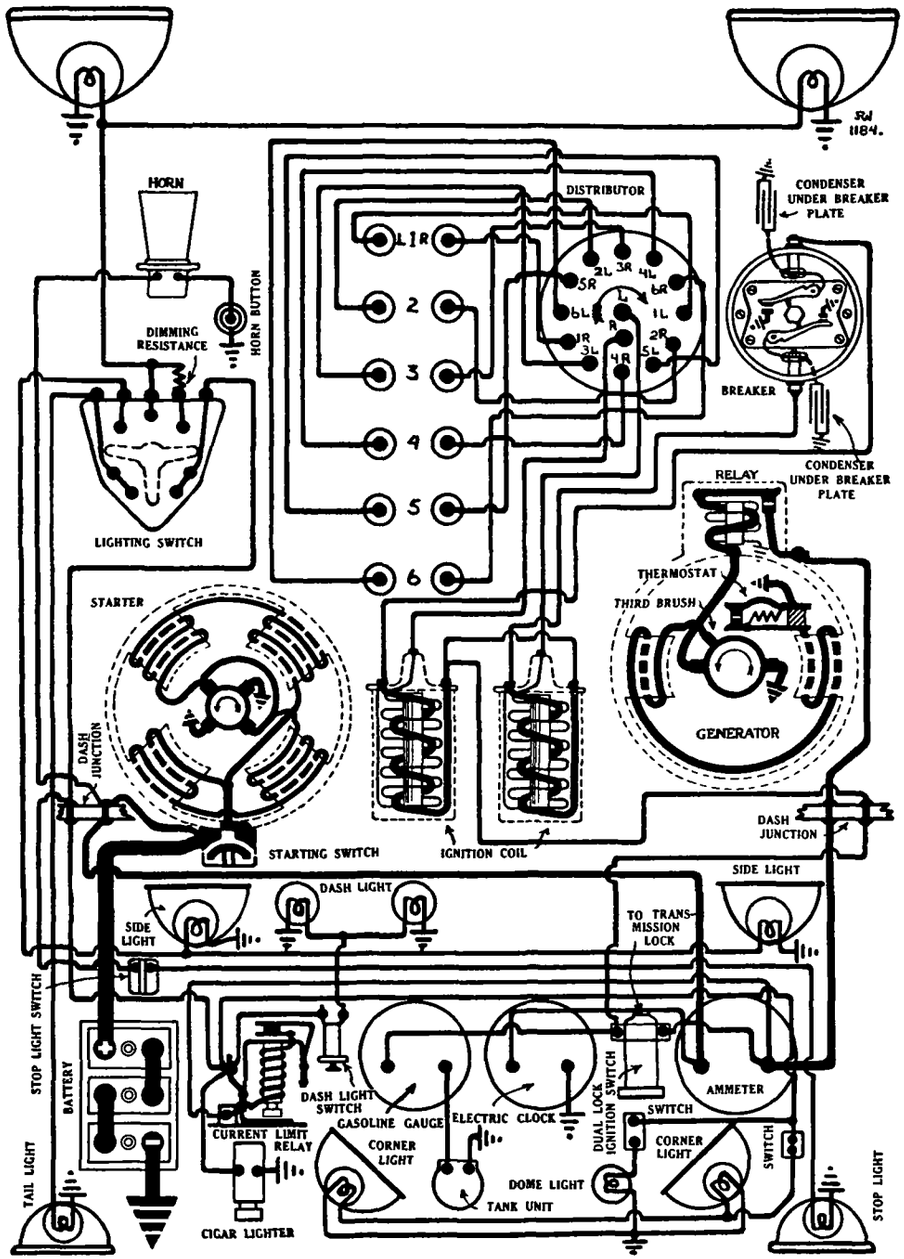
		Automatic Advance			
Degrees	Distributor	R.P.M.	Degrees	Engine	R.P.M.
Start		300	2		600
6		700	12		1400
11		1275	22		2550

Mounting:—Distributor is mounted on accessory bracket at right of engine. To remove distributor, disconnect manual advance rod and primary leads and remove distributor head with cables intact. Then remove manual advance stop screw and lift distributor from place.

Oiling:—Put 8 or 10 drops of light engine oil in the oiler on the side of the distributor every 750 miles. Every 1000 miles remove the distributor head and rotor and put a small amount of vaseline on the face of the breaker cam and oil the breaker arm pivot pins with light engine oil.

Timing:—**Synchronization of Contacts.** Contacts must be synchronized so that they open at the same instant firing both spark plugs in each cylinder simultaneously. Connect a six volt lamp in each primary circuit. Turn ignition on and crank engine over slowly. The lamps will go out as each set of contacts open. If both lamps go out at the same instant the contacts are synchronized. If they do not, loosen the four lock screws on the breaker plate and shift the plate causing one set of contacts to open earlier or later until synchronization is effected. Then tighten lock screws and check contact gap with breaker arm on lobe of cam. If outside limits of .015-.020 inch, reset at .017 inch and repeat synchronization.

Timing Distributor to Engine. Standard setting 15 degrees (on flywheel) before top dead center with manual spark control fully advanced. To set timing, fully advance manual spark control, see that distributor is rotated counter-clockwise as far as possible, take off cover over inspection hole in flywheel housing. With No. 1 piston on compression stroke turn engine over until flywheel mark 'AD.SPK.1 & 8' is directly opposite indicator in inspection hole in housing. Loosen lock screw in center of breaker cam, carefully locate cam so that contacts are beginning to open, tighten locking screw. Connect spark plugs as indicated on diagram.



NOTE:—The flywheel mark 'AD.SPK.1&8' is not provided on Model LA cars and ignition should be set with piston on top dead center with spark control advanced 6/10.

Firing Order:—The firing order is 1-5-3-6-2-4. Spark plugs are connected 1R-6L-5R-2L-3R-4L-6R-1L-2R-5L-4R-3L clockwise around the distributor head. Spark plugs are right (R) and left (L) in the cylinder head as viewed from the driver's seat and No. 1 cylinder is nearest the radiator.

Spark Plugs:—18 MM. Metric Champion No. 7. Set gaps at .022 inch.

VALVE TIMING:—Valves in cylinder head operated directly by overhead camshaft. Camshaft driven from transfer sprocket on front of engine block by silent timing chain. Transfer sprocket driven from crankshaft by silent timing chain. Automatic idler take-up sprockets are used on both chains.

	Head Diameter	Stem Diameter	Length	Seat Angle	Lift
Intake and Exhaust	1 21/32"	3/8"	6 11/32"	45°	11/32"

Tappet Clearance	Spring Pressure
Intake .028" (see Note)	56 pounds (length 2 27/64")
Exhaust .028" (see Note)	102 pounds (length 2 5/64")

Intake Valves	Timing	Exhaust Valves
Open—1° before top dead center.		Open—49° before lower dead center.
Close—55° after lower dead center.		Close—7° after top dead center.

Note on Tappet Clearance or Lash. Valves equipped with conventional removable valve stem guide (inner guide) and piston guide (outer guide) screwed on end of valve stem. Valve cap (which bears against cam face) screwed on end of valve stem against valve piston. To set tappet clearance or lash, turn camshaft until nose of cam points up at 45° angle with heel of cam at one side of metering pin directly over valve cap. Insert bar in hole in valve piston (piston guide cut away on left side) to hold valve piston from turning and turn valve cap by bar inserted in hole. Adjust lash to .028 inch by screwing valve cap and piston up or down on valve stem.

To Set Valve Timing. Cam shaft sprocket should be taken off cam shaft and automatic adjusting sprocket must be off engine. Crank engine over until piston No. 1 reaches a position 7 degrees past top dead center when the flywheel mark 'EX.CL.1 & 6' should be in the exact center of the inspection hole in the upper flywheel housing. Then turn cam shaft until the heel of the first cam at the front of the engine is directly above No. 1 valve (exhaust valve in cylinder No. 1). Set lash or clearance between valve cap and cam at .028 inch (this is very important). Then turn cam shaft in direction of rotation (clockwise) until the valve has opened and just closed. This may be determined by inserting pin in hole in valve cap and oscillating valve. The added drag when the valve seats will be perceptible. Then mesh cam shaft sprocket in upper chain and rotate sprocket counter-clockwise to take up all the slack in the driving side of the chain. Line up holes in sprocket and cam shaft flange by slipping chain one tooth at a time on the transfer sprocket. Insert four cap screws mounting sprocket on cam shaft. Mesh automatic adjusting sprocket in chain and insert eccentric adjusting hub. Wind up spiral spring one and one half turns to provide proper chain tension and insert spring tongue in nearest slot. Assemble plain washer on sprocket shaft and insert cotter.

STARTER:—Model 726-C. Starter is connected to the engine through a clutch and manual pinion shift connected to the starting switch. The direction of rotation is counter-clockwise, viewed from the commutator end. Brush spring tension is 24-28 ounces.

Starter Data

Torque	R.P.M.	Volts	Amperes
0 lb. ft.	6000	5	65
15 "	Lock	3.15	570

Mounting:—Starter is flange mounted at left of engine on forward side of flywheel housing. To remove starter, disconnect cable and starting pedal linkage and remove three flange mounting cap screws. Then pull starter forward and lift from place.

GENERATOR:—Model 391. The direction of rotation is counter-clockwise, viewed from the commutator end. Generator current regulation is by third brush shunt field and thermostat. Thermostat contacts open at 165°F. cutting the resistance across the thermostat contacts in series with the shunt field and reducing the output approximately 40%. To adjust generator output, take off commutator cover band and shift third brush using a screwdriver inserted in the notch in the third brush plate to shift the plate. Shift third brush counter-clockwise to increase or clockwise to decrease the charging rate. Third brush mounting plate held in position by friction. With standard car setting maximum charging rate is 12 amperes (hot) at 7.6 volts reached at 1600 R.P.M. or 32 M.P.H.

Generator Data

Cold Test			Hot Test		
Amperes	Volts	R.P.M.	Amperes	Volts	R.P.M.
22-24	8.2-8.62	1400	10-12	7.35-7.65	1600

Shunt field current is 1.8-2.3 amperes at 6 volts. Brush spring tension is 20-28 ounces.

Mounting:—Generator is flange mounted at right of engine on rear of accessory bracket. To remove generator, disconnect water pump drive coupling and generator lead and remove three flange mounting cap screws. Then pull generator to rear and lift from place.

RELAY:—Model 266-N. Relay is mounted on the generator. Relay contacts close at 575 R.P.M. or 8 M.P.H. when the generator voltage reaches 7-7.5 volts and open with a discharge current of 0-2.5 amperes. Contacts separate .015-.020 inch. Air gap is .014-.021 inch with contacts closed.

LIGHTING:—Delco-Remy Switch Model 486-G. Lighting switch is mounted at lower end of steering column. Headlights are dimmed by resistance on lighting switch. Lighting switch positions:

1. Lever vertical—All lights off.
2. No. 1 right—Headlights dimmed through resistance, tail light on.
3. No. 2 right—Headlights on bright, tail light on.
4. No. 1 left—Cowl lights on, tail light on.

Lamp Sizes

Position	Voltage	Candlepower	Base	Mazda No.
Headlights	6-8	32	S.C.	1133
Parking Lights	6-8	3	S.C.	63
Dash and Tail Lights	6-8	3	S.C.	63
Stop Light	6-8	15	S.C.	87
Dome and Corner Lights	6-8	15	S.C.	87

CURRENT LIMIT RELAY:—Model 410-C. This device is a vibrating circuit breaker mounted on the dash and connected in the lighting circuits. It begins to vibrate when the current flow reaches 20-30 amperes and continues limiting the current to 2-15 amperes. Contacts separate .012-.030 inch. Air gap is .019-.025 inch with contacts closed.

CAR SERIAL NUMBER:—Stamped on plate on right front side of engine dash and on right top side of front frame cross member (forward engine support).

ENGINE NUMBER:—Stamped on plate on right side cylinder cover and on right crankcase wall back of distributor.

ENGINE:—Eight cylinder, 'I' or overhead valve type, 3⅜x4½" bore and stroke, 322 cubic inch displacement, rated at 46.4 H.P., develops 113 H.P. at 3300 R.P.M. Standard compression ratio 5.5-1. Optional low compression ratio 5.0-1.

BATTERY:—**Prest-O-Lite, Type A-619-ST,** 6 volt, 19 plate, 145 ampere hour capacity (5 ampere rate). Starting capacity 173 amperes for 20 minutes.
Grounded Terminal:—Negative (—) terminal grounded to frame.
Mounting:—On left hand side of frame under driver's seat.
Dimensions:—Width, 7". Length, 13". Height, 9 3/16".

IGNITION:—**Coil Model 531-C (2 used).** Coils are mounted at right of engine.
Ignition Current:—6 amperes at 6 volts (engine running), 10 amperes at 6 volts (engine stopped) total for both coils.
Ignition Switch:—**Oakes** 'Hershey' type co-incidental ignition switch and steering post lock.

Distributor Model 4028. Two breaker arm, 8-lobe cam type with semi-automatic advance. Breaker contacts open simultaneously to fire both spark plugs in each cylinder. Contacts must be synchronized—(see Timing). Manual advance is controlled by left hand lever on steering wheel. Maximum manual advance is 38° (engine).
Breaker Gap:—Set contact gap at .017". Hold within limits of .015-.020".
Breaker Arm Spring Tension:—17-21 ounces measured at tip of breaker arm with spring scale at right angles to contact surface.

Automatic Advance

Degrees	Distributor R.P.M.	Degrees	Engine R.P.M.
Start	300	2	600
6	700	12	1400
11	1275	22	2550

Mounting:—Distributor mounted on accessory bracket at right front of engine. To remove, disconnect manual spark control, take off distributor cap, take out hold-down screw in advance arm, lift distributor out.

Oiling:—**750 Miles.** Put 8-10 drops light engine oil in oiler on side of distributor cup.

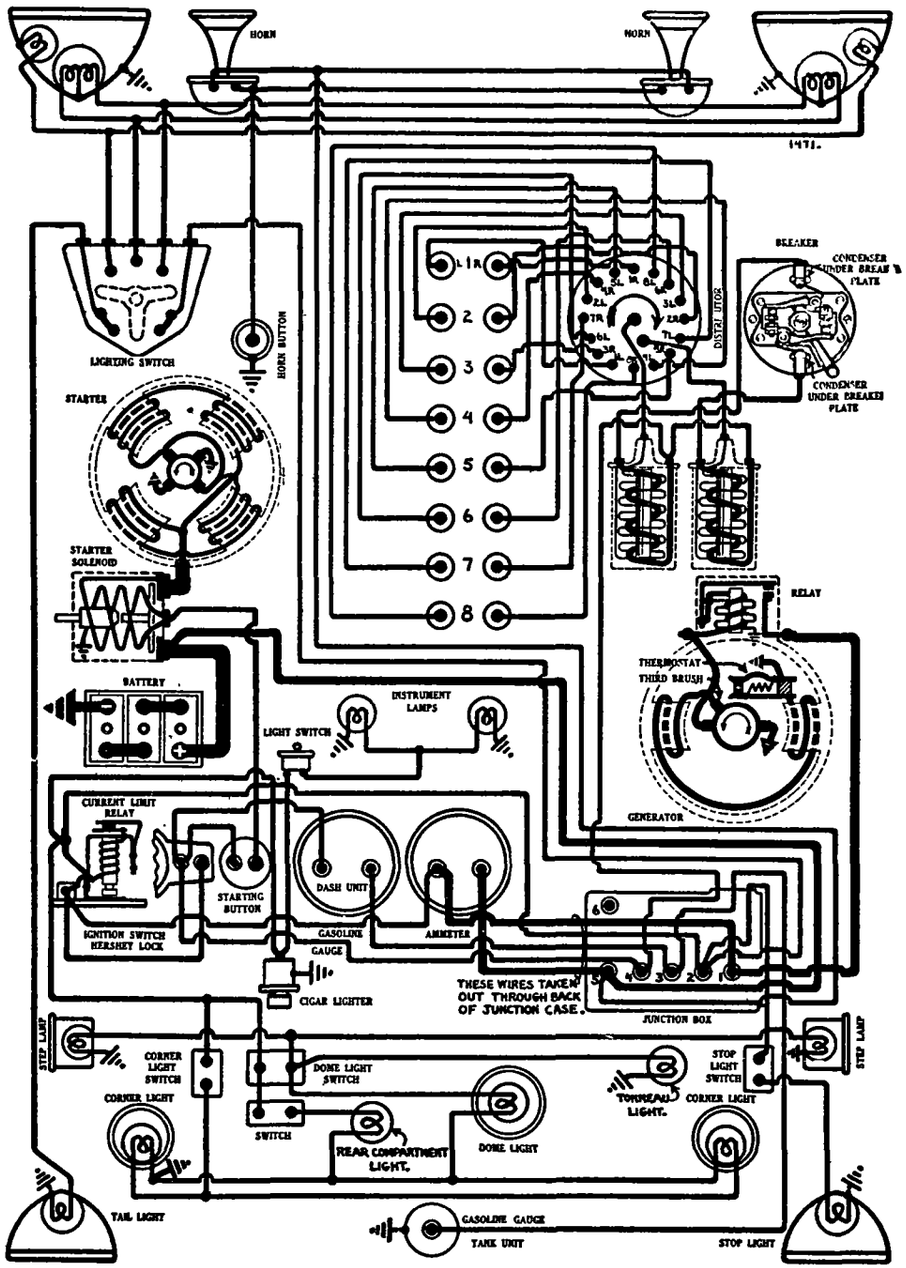
1000 Miles. Take off distributor cap and rotor. Put one drop oil on breaker arm pivot pins, apply thin film vaseline to face of breaker cam.

Timing:—Standard setting 15° (on flywheel) before top dead center with manual spark control fully advanced. To set timing, first advance manual spark control (pull lever down), see that distributor is rotated counter-clockwise to end of advance arm slot, take off cover over inspection hole in top of flywheel housing. With No. 1 piston on compression turn engine over until piston is slightly before top dead center with flywheel mark AD.SPK. 1 & 8' directly opposite indicator on housing, loosen taper lock screw in center of breaker cam, carefully locate cam so that contacts are beginning to open (use test lamp), tighten locking screw, connect spark plugs as indicated on diagram.

Synchronization of Contacts. To synchronize contacts, connect test lamp in each primary circuit, loosen four lock screws on movable breaker sub-plate, shift plate until both sets of contacts open at the same instant. Synchronization should be checked whenever contacts are adjusted or ignition is set.

Firing Order:—1-6-2-5-8-3-7-4. No. 1 cylinder nearest radiator. See diagram for order in which spark plug cables are connected around distributor head.

Spark Plugs:—18 MM. Metric. Champion No. 7. Set gaps at .022 inch.



VALVE TIMING:—Valves in cylinder head operated directly from overhead camshaft. Camshaft driven from transfer sprocket on front of engine by silent timing chain. Transfer sprocket driven from crankshaft in tandem with accessory sprocket by silent timing chain. Automatic idler sprockets on both chains.

Valve Specifications

	Head Diameter	Stem Diameter	Length	Seat Angle	Lift
Intake and Exhaust	1 21/32"	3/8"	6 11/32"	45°	11/32"

Tappet Clearance		Spring Pressure	
Intake	.028" (see note)	Closed	56 pounds (2 27/64")
Exhaust	.028" (see note)	Open	102 pounds (2 5/64")

Intake Valves	Timing	Exhaust Valves
Open—1° before top dead center.		Open—49° before lower dead center.
Close—55° after lower dead center.		Close—7° after top dead center.

Note on Tappet Clearance or Lash:—Valves equipped with conventional removable valve stem guide (inner guide) and piston guide (outer guide) screwed on end of valve stem. Valve caps (which bears against cam face) are screwed on valve stem against valve piston. To set tappet clearance or lash, turn camshaft until nose of cam points up at 45° angle with heel of cam at one side of metering pin directly over valve cap. Insert bar in hole of valve piston (piston guide cut away on left side), hold valve piston from turning, turn valve cap with bar inserted in hole to loosen. Adjust lash to .028" by screwing valve cap and piston up or down on valve stem.

To Check Valve Timing. Set tappet clearance or lash of No. 1 exhaust valve at .028" (see above). With No. 8 piston on compression turn engine over until No. 1 exhaust valve begins to close (insert valve adjusting rod in hole in valve cap and oscillate valve until added drag indicates that valve has begun to seat). Flywheel mark 'EX.CL.1 & 8' should be directly opposite indicator on housing (inspection hole at top or side of flywheel housing).

To Set Valve Timing—with upper chain and idler sprocket off engine and camshaft sprocket off camshaft. Turn crankshaft until flywheel mark 'EX. CL.1 & 8' is directly opposite indicator on housing. Turn camshaft in direction of rotation until No. 1 exhaust valve has begun to close (see paragraph above). Mesh camshaft sprocket in chain, turn sprocket counter-clockwise to take up all slack in driving side of chain, slip chain on transfer sprocket one tooth at a time until cap screws can be inserted without disturbing position of camshaft (a closer adjustment can be obtained by rotating camshaft sprocket one quarter turn which changes the timing ¼ tooth). After mounting camshaft sprocket, mesh automatic sprocket, turn eccentric hub clockwise to take up all slack in chain, wind up spring 1½ turns to secure proper spring tension, insert end of spring in nearest slot in stud, assemble plain washer and cotter pin. Wire camshaft sprocket cap screws. Check setting and set tappet clearance or lash of all valves at .028 inch.

CARBURETION:—Zenith Updraft Dual Carburetor (see Carburetor Section for complete data).

Fuel System:—Kingston Vacuum tank mounted on dash.

Gasoline Gauge:—Stewart-Warner electric type.

STARTER:—Model 726-C ('31-32), 727-C ('33-34). Starter drive—manual pinion shift operated by pedal on toeboard (1931-32), or by solenoid starting switch Type 1501 (1933-34). See article in Electrical Equipment Section for complete data on this solenoid switch. Rotation counter-clockwise at commutator end. Brush spring tension 24-28 ounces.

Starter Data

Torque	R.P.M.	Volts	Amperes
0 lb. ft.	5500	5.0	65
16 "	Lock	3.0	600

Mounting:—Starter flange mounted left front face flywheel housing. To remove, disconnect cable, disconnect starting pedal linkage, take out 3 flange mounting screws, pull starter forward to clear pinion housing, lift out.

Oiling:—750 Miles. Put 8-10 drops light engine oil in commutator end oiler. Intermediate bearing and drive end bearing are graphite bronze oilless.

GENERATOR:—Model 391. Third brush regulation, thermostat control. Thermostat operates at 160°F. (contacts open, cuts in resistance) reducing output approximately 40%. Rotation is counter-clockwise at commutator end. Maximum charging rate is 12 amperes (hot) at 7.3 volts reached at 1600 R.P.M. or 32 M.P.H.

Charging Rate Adjustment. Take off commutator cover band, shift third brush by prying on brush mounting plate by means of a scrwdriver inserted in the slot in the plate. Shift third brush counter-clockwise to increase, or clockwise to decrease charging rate. Third brush mounting plate is held in position by friction.

Generator Data

Cold Test			Hot Test		
Amperes	Volts	R.P.M.	Amperes	Volts	R.P.M.
22-24	8.2-8.6	1400	10-12	7.3-7.6	1600

Brush Spring Tension:—20-28 ounces on each brush.

Field Current:—1.8-2.3 amperes at 6 volts across field terminals.

Mounting:—Generator flange mounted on rear face of accessory bracket at right of engine. To remove, disconnect water pump drive coupling, disconnect lead, take out 3 flange mounting screws, pull generator to rear to disengage drive coupling, lift out.

Oiling:—750 Miles. Put 8-10 drops light engine oil in oiler at each end.

RELAY:—Model 266-N. Relay mounted on generator. Contacts close at 600 R.P.M. of generator or 7 M.P.H. with generator voltage of 7-7.5 volts and open with discharge current of 0-2.5 amperes. Relay contact gap limits .015-.025 inch. Air gap limits .012-.017 inch (contacts closed).

LIGHTING:—Delco-Remy Switch, Model 486-G. Lighting switch mounted at lower end of steering column controlled by lower lever on steering wheel. Headlamps dimmed by resistance on switch (1931-32). On 1933-34 models, double filament bulbs used for 'depressed beam' dimming and are controlled by lighting switch.

Lamp Sizes

Position	Voltage	Candlepower	Base	Mazda No.
mostat operates at 160°F. (contacts open, cuts in resistance) reducing				
Position	Voltage	Candlepower	Base	Mazda No.
Headlights	6-8	32-32	D.C	1000
Parking Lights	6-8	3	S.C	63
Dash and Tail Lights	6-8	3	S.C	63
Stop Light	6-8	15	S.C	87
Dome and Corner Lights	6-8	15	S.C	87

NOTE—Headlamp bulbs for 1931-32 models 32 cp. SC., Mazda No. 1133.

CURRENT LIMIT RELAY:—Model 410-C, N, F. Vibrating circuit breaker mounted on back of instrument panel at extreme left. Circuit breaker begins to vibrate with current load of 35-40 amperes (410-N), 30-35 amperes (410-F) limiting load to 5-22 amperes with direct short-circuit.

Contact Gap:—.012-.030". Air Gap:—.015-.025" with contacts closed.

Spring Tension:—5 ounces minimum measured at brass button with spring scale at right angles to contact arm.

HORNS:—Klaxon Model K-26, Type 1509 (low note), **Type 1510** (high note) matched tone twin horns. Current draw 6.0-8.5 amperes at 6.0 volts (Type 1509), 5.0-6.5 amperes at 6.0 volts (Type 1510).

CAR SERIAL NUMBER:—Stamped on plate on right front side of engine dash and on right top side of frame front cross member (front engine support).

ENGINE NUMBER:—Stamped on plate on right side cylinder head cover and on right crankcase wall back of distributor.

ENGINE:—Eight cylinder, 'I' or overhead valve type with separate intake and exhaust camshafts mounted on cylinder head and two intake and exhaust valves per cylinder. Bore and stroke 3⅜x4½", 322 cubic inch displacement, rated at 46.4 H.P., develops 156 H.P. at 3900 R.P.M. Standard compression ratio 5.0-1. Optional high compression ratio 5.5-1.

BATTERY:—**Prest-O-Lite, Type A-619-ST,** 6 volt, 19 plate, 145 ampere hour capacity (5 ampere rate). Starting capacity 173 amperes for 20 minutes.
Grounded Terminal:—Negative (—) terminal grounded.
Mounting:—On left hand side of frame under driver's seat.
Dimensions:—Width, 7". Length, 13". Height, 9 3/16".

IGNITION:—**Coil Model 531-C.** Coil mounted on bracket at right front of engine beside generator. Ignition current 3 amperes at 6 volts (engine running) 5 amperes at 6 volts (engine stopped). Ignition switch is Oakes 'Hershey' type co-incidental ignition switch and steering post lock.

Distributor Model 660-W. Two breaker arm, 4 lobe cam type with semi-automatic advance. Breaker contacts open alternately at 45° intervals corresponding to 90-degree firing interval of engine. Contacts must be synchronized (see Timing).
Manual Advance:—40 degrees (engine) maximum.
Breaker Gap:—Set contact gap at .020". Hold within limits of .018-.024".
Breaker Arm Spring Tension:—17-21 ounces measured at tip of breaker arm
Cam Angles—Closed 33°, open 12° (distributor) when synchronized.

Automatic Advance

Degrees	Distributor	R.P.M.	Degrees	Engine	R.P.M.
Start		300	2		600
6		700	12		1400
18.5		2100	37		4200

Mounting:—Distributor mounted on accessory bracket at right front of engine. To remove, disconnect lead, disconnect manual spark control, take off distributor cap, take out hold-down screw in advance arm, lift distributor out.

Timing:—Standard setting 20° (on flywheel) before top dead center with manual spark control fully advanced. To set timing, first advance manual spark control (pull lever down), see that distributor is rotated counter-clockwise to end of advance arm slot, take off cover plate over inspection hole in top of flywheel housing. With No. 1 piston on compression stroke, turn engine over until flywheel mark 'AD.SPK.1&8' (which is 20° before top dead center mark 'TOP C.1 & 8') is directly opposite indicator in inspection hole, loosen advance arm clampscrew, rotate distributor until first set of contacts mounted directly on breaker plate begin to open (use test lamp), tighten clamp screw, connect spark plugs as indicated on diagram.

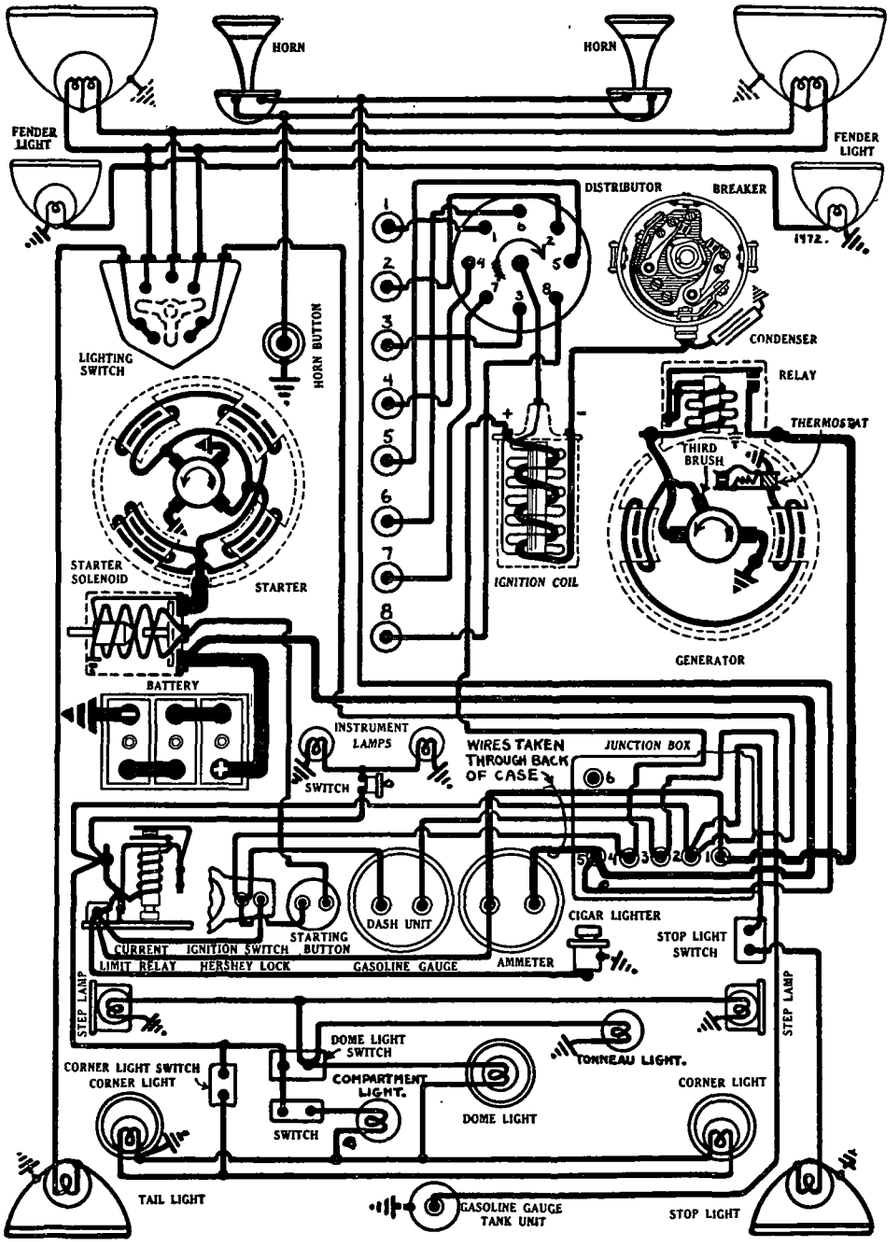
Synchronization of Contacts. Use special Delco-Remy tool, Part No. 1838182 and follow complete directions in Equipment Section. No flywheel marks provided to check synchronization by timing distributor using second set of contacts.

Firing Order:—1-6-2-5-8-3-7-4. No. 1 cylinder nearest radiator.
Spark Plugs:—18 MM. Metric. Champion No. 7. Set gaps at .022 inch.

VALVE TIMING:—Exhaust valves (two per cylinder) in cylinder head at right of engine operated by overhead exhaust camshaft. Intake valves (two per cylinder) in cylinder head at left of engine operated by overhead intake camshaft. Both camshafts driven in tandem by silent timing chain from transfer sprocket on front of engine block. Transfer sprocket driven in tandem with accessory sprocket by silent timing chain from crankshaft. Both chains equipped with automatic take-up idler sprockets, no adjustment necessary in service.

Valve Specifications

Valve	Head Diameter	Stem Diameter	Length	Seat Angle	Lift
Intake and Exhaust	1 9/32"	⅜"	5 21/32"	45°	11/32"



Tappet Clearance	Valve Springs
Intake .....028" or .046" see note	Open .....115 pounds (1 15/16")
Exhaust .....028" or .046" see note	Closed .....53 pounds (2 9/32")

Intake Valves	Timing	Exhaust Valves
Open—5° before top dead center.	Open—46° before lower dead center.	
Close—41° after lower dead center.	Close—10° after top dead center.	

Note on Tappet Clearance or Lash:—Tappet clearance on various engines set at either .028" or .046". Correct tappet clearance for each engine is stamped on name plate on engine and should be consulted when tappet clearance is being set. Valves are fitted with conventional removable valve stem guide (inner guide) and piston guide screwed on end of valve stem (outer guide). Valve cap (which bears on cam face) is screwed on valve stem against valve piston. To set tappet clearance or lash, turn camshaft until nose of cam is perpendicular (at right angles to face of valve cap), with metering pin turned off valve cap. Insert adjusting bar in hole in valve piston (piston guide cut away on inside), hold valve piston from turning, insert second bar in hole in valve cap and turn cap to loosen. Adjust lash to .028" or .046" by screwing valve cap and piston up or down on valve stem. All turning must be done on valve cap to avoid formation of burs on valve piston.

To Check Valve Timing Intake Camshaft:— Set tappet clearance No. 1 intake and exhaust valves at .028" or .046" (see name plate on engine), take off cover plate over inspection hole in top or side of flywheel housing. Turn engine over until No. 1 intake cam is about to touch valve cap (tappet clearance taken up—valve about to open), insert adjusting bar in valve cap hole so that bar is pointed across engine and loop rubber band over bar fastening other end of band to engine so that band tension is slightly less than amount necessary to rotate valve. Turn engine over slightly until band begins to rotate valve indicating that valve has left its seat. Flywheel mark 'IN.OP.1 & 8' (which is 5° before top dead center mark "TOP. C. 1 & 8') should be directly opposite indicator on housing. If setting is not exact, turn crankshaft over two revolutions and stop with flywheel mark at indicator. Then loosen camshaft sprocket mounting capscrews slightly, rotate camshaft until intake valve begins to open, tighten capscrews (capscrew holes are slotted). Check setting.

To Check Exhaust Camshaft:—After checking intake camshaft setting (above) insert adjusting rod in hole of No. 1 exhaust valve cap, turn engine over slowly until added drag on rod when valve is oscillated indicates that valve is beginning to seat. Flywheel mark 'EX.CL.1 & 8' (which is 10° after top dead center mark 'TOP.C. 1 & 8') should be directly opposite indicator on housing. If setting is not correct, turn crankshaft two revolutions and stop with flywheel mark at indicator. Then loosen camshaft sprocket mounting capscrews slightly, turn camshaft until valve closes, tighten mounting screws (capscrew holes are slotted). Check setting.

To Set Valve Timing:—With intake and exhaust camshaft sprockets and automatic idler take-up sprocket off engine. Turn crankshaft until flywheel mark '0' (which is 2½° after top dead center mark 'TOP.C.1 8') is directly opposite indicator on housing with distributor rotor pointed toward rear of car (if rotor points toward front of car turn engine over one complete revolution). Turn intake camshaft until No. 1 intake valve is about to open and turn exhaust camshaft until No. 1 exhaust valve is about to close. Mesh intake camshaft sprocket in chain, turn sprocket counterclockwise to take up all slack in driving side of chain (between sprocket and transfer sprocket), see if lines indicating center of slotted holes in sprocket line up with lines on camshaft flange indicating center of capscrew holes without disturbing position of camshaft. If they do not, slip sprocket on chain one tooth at a time to left until sprocket can be mounted on flange with marks in line without disturbing camshaft. This is necessary to provide for later adjustment. Insert capscrews mounting sprocket on flange. Mesh exhaust camshaft sprocket in chain, turn to left to take up slack in driving side of chain between camshaft sprockets, slip sprocket on chain one tooth at a time until sprocket can be mounted on camshaft flange with marks indicating center of slots in sprocket and center of holes in flange in line without disturbing position of camshaft. Mesh automatic take-up idler sprocket in chain, turn eccentric hub to left to take up all slack in chain, wind up eccentric spring one and one half turns, insert end of spring in nearest slot, assemble washer and cotter. Check valve timing as directed above for both camshafts and make any adjustment necessary by shifting sprockets on camshafts until exact settings are secured.

CARBURETION:—Stromberg Downdraft Carburetor, Model EE-3 (see Carburetor Section for complete data). Stromberg Automatic Choke is standard equipment.

Fuel Pump:—Stewart-Warner mechanical type fuel pump is mounted on valve cover at left rear of engine (see Carburetion Section).

Gasoline Gauge:—Stewart-Warner electric type.

STARTER:—**Model 726-C ('31-32), 727-C ('33-34).** Starter drive—manual pinion shift operated by pedal on toeboard (1931-32), or by solenoid starting switch Type 1501 (1933-34). See article in Electrical Equipment Section for complete data on this solenoid switch. Rotation counter-clockwise at commutator end. Brush spring tension 24-28 ounces.

Starter Data

Torque	R.P.M.	Volts	Amperes
0 lb. ft.	5500	5.0	65
15 "	Lock	3.0	600

Mounting:—Starter flange mounted left front face flywheel housing. To remove, disconnect cable, disconnect starting pedal linkage, take out 3 flange mounting screws, pull starter forward to clear pinion housing, lift out.

GENERATOR:—**Model 391.** Third brush regulation, thermostat control. Thermostat operates at 160° F. (contacts open, cuts in resistance) reducing output approximately 40%. Rotation is counter-clockwise at commutator end. Maximum charging rate is 12 amperes at 7.3 volts (hot) reached at 1600 R.P.M. or 32 M.P.H.

Charging Rate Adjustment. Take off commutator cover band, shift third brush by means of a screwdriver inserted in slot in brush mounting plate, counter-clockwise to increase, or clockwise to decrease charging rate. Brush mounting plate is held in position by friction.

Generator Data

Cold Test			Hot Test		
Amperes	Volts	R.P.M.	Amperes	Volts	R.P.M.
22-24	8.2-8.6	1400	10-12	7.3-7.6	1600

Brush Spring Tension:—20-28 ounces on each brush.

Field Current:—1.8-2.3 amperes at 6 volts across field terminals.

Mounting:—Generator flange mounted on rear face of accessory bracket at right of engine. To remove, disconnect water pump drive coupling, disconnect lead, take out 3 flange screws, pull generator to rear to disengage drive coupling, lift out.

RELAY:—**Model 266-N.** Relay mounted on generator. Contacts close at 600 R.P.M. of generator or 7 M.P.H. with generator voltage of 7-7.5 volts and open with discharge current of 0-2.5 amperes. Relay contact gap limits .015-.025 inch. Air gap limits .012-.017 inch (contacts closed).

LIGHTING:—**Delco-Remy Switch, Model 486-G.** Lighting switch mounted at the lower end of steering column controlled by lower lever on steering wheel. Headlamps dimmed by resistance on switch (1931-32). On 1933-34 models, double filament bulbs used for 'depressed beam' dimming and are controlled by lighting switch.

Lamp Sizes

Position	Voltage	Candlepower	Base	Mazda No
Headlights	6-8	32-32	D.C.	1000
Parking Lights	6-8	3	S.C.	63
Dash and Tail Lights	6-8	3	S.C.	63
Stop Lights	6-8	15	S.C.	87
Dome, Corner Lights	6-8	15	S.C.	87

NOTE—Headlamp bulbs for 1931-32 models 32 cp. SC., Mazda No. 1133.

CURRENT LIMIT RELAY:—**Model 410-C, N, F.** Vibrating circuit breaker mounted on back of instrument panel at extreme left. Circuit breaker begins to vibrate with current load of 35-40 amperes (410-N), 30-35 amperes (410-F), limiting load to 5-22 amperes with direct short-circuit.

Contact Gap:—.012-.030". **Air Gap:**—.015-.025" with contacts closed.

Spring Tension:—5 ounces minimum measured at brass button with spring scale at right angles to contact arm.

HORNS:—Klaxon Model K-26, Type 1509 (low note), Type 1510 (high note), matched tone twin horns. Current draw 6.0-8.5 amperes at 6.0 volts (Type 1509), 5.0-6.5 amperes at 6.0 volts (Type 1510).

SERIAL NUMBER:—First number (K) 373,000, (KU) 21,500, (KS) 396,727. On plate on engine side of dash under hood.

COMPRESSION:—Ratio—Std. 5.75-1 hd. Optl. 6.25-1 hd. **Pressure**—(Std. head) 80 lbs. at 125 R.P.M.

VACUUM READING:—Gauge should show steady reading of 18-19" with engine idling.

IGNITION:—Coil Model IG-4311. Lock coil type. Resistor mounted on distributor.
Ignition Current—2.5 amperes (idling), 4.5 amperes (stopped).
Distributor Model IGB-4301-A. Single breaker, 6 lobe cam, full automatic advance type.
Breaker Gap—Set gap at .020". Limits, .018-.020".
Breaker Arm Spring Tension—16-22 ounces.
Cam Angles—Closed 40°. Open 20° (distributor).

Automatic Advance

Distributor Degrees	R.P.M.	Engine Degrees	R.P.M.
Start	400	0	800
3	720	6	1440
6	1040	12	2080
9	1360	18	2720
12	1680	24	3360
15	2000	30	4000

IGNITION TIMING:— Flywheel Degs. Piston Position Initial Setting (all engines) at TDC. ..... .0000" TDC.
Timing (Initial Setting):—With #1 piston on compression, turn engine over until piston reaches top dead center, stop when flywheel mark 'UDC.1-6/' registers with pointer in inspection hole (left hand front face of flywheel housing above starter), loosen hold-down screw in advance arm, rotate distributor clockwise to limit of advance arm slot, then rotate distributor slowly counter-clockwise until contacts begin to open, tighten hold-down screw, check rotor position and spark plug connections (see diagram). This top dead center setting should be checked by road-testing car and spark advanced as much as operating conditions and fuel rating will allow (see below).
Timing (Final Setting):—With engine at normal operating temperature and running at 8 M.P.H. in high gear on level road, accelerate engine rapidly and note performance from 10 to 15 M.P.H. With correct setting a slight spark knock should be noted under these conditions. If no knock is heard, loosen hold-down screw in advance arm and rotate distributor one graduation counter-clockwise (advance). If knock is too severe, rotate distributor one graduation colckwise (retard). Repeat test until satisfactory setting is secured. Final setting must not be beyond maximum advance mark on flywheel (¾" before top dead center mark 'UDC.1-6/').
Motor Gauge—Weidenhoff Adapter #114, Rod #43.

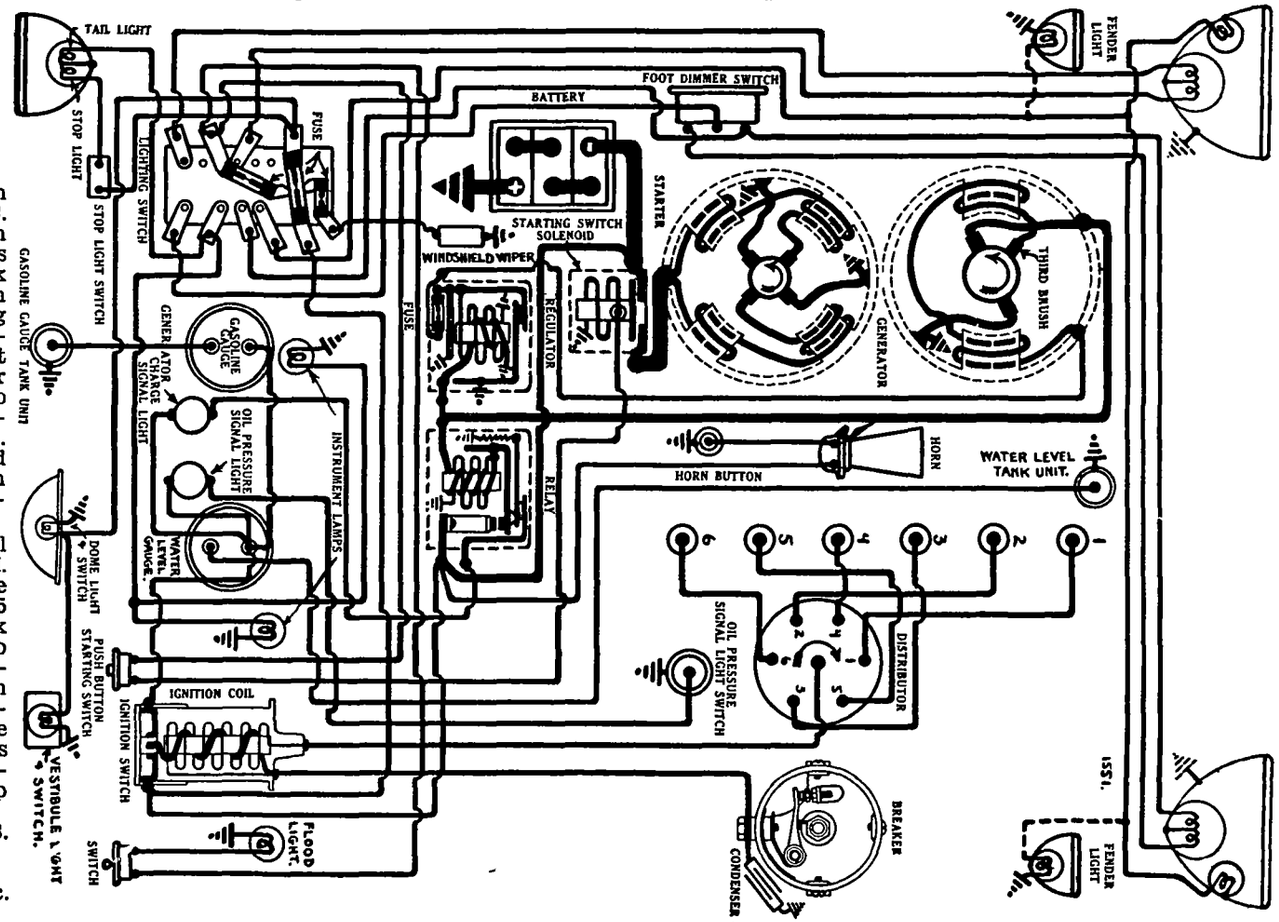
Firing Order:—1-5-3-6-2-4 (see diagram).

Spark Plugs:—Champion, Type J-7. 14 MM. Metric.
Spark Plug Gaps—.022".

CARBURETION: — (Fuel System). See Carburetion Section for complete data on Carburetor, Automatic Choke (Climatic Control), Fuel Pump, and Gasoline and Oil Level Gauge.
Carburetor:—Carter, Model 281-S (K, KU), 295-S (KS), 1¼" plain tube, downdraft type.
Automatic Choke—Carter Climatic Control (281-only).
Fuel Pump:—A.C., Type R.
See 'Servicing AC Fuel Pumps' in Carburetion Equipment Section for recommended replacement pumps.
Gasoline Gauge:—Motometer, electric type.

VALVE TIMING:—To Check Timing—Set tappet clearance #1 intake valve at .010". This valve should open with piston 10°40' or .0562" before top dead center when a point on the flywheel approximately 3.17 teeth before top dead center mark 'UDC.1-6' lines up with indicator. Reset tappet clearance at .006" with engine warm and running.
Motor Gauge—Weidenhoff Adapter #114, Rod #43.
Tappet Clearance:—.006" Int., .008" Exh., engine hot and running.
Valve Spring Pressure:—44 lbs. at 2" (valve closed). 102 lbs. at 1 21/32" (valve open).

LUBRICATION:—Duo-flow (splash) system with positive pump feed to oil troughs and timing gears by oscillating plunger type pump. Pump mounted on right hand side of crankcase.
Normal Oil Pressure—3 pounds.
Oil Pressure Relief Valve—Operates at 3 lbs. Located on right hand side of crankcase at rear (combined with oil pressure signal light switch). See Signal Lights article in Equipment Section.
Capacity and Oil—7 qts. (dry), 6 qts. (refill). Use SAE #30 (above 40°F.), #20-W (40° to 0°F.).



BATTERY:—National, Type ST-3-17X, 6 volt, 17 plate, 100 ampere hour capacity.
Starting Capacity—122 amperes for 20 minutes.
Grounded Terminal—Positive (+) terminal.
Location—Left hand side under front floor boards.

STARTER:—Model MAB-4060. Armature No. MAB-2114. Starter drive—Inboard Bendix.
Rotation—Counter-Clockwise at commutator end.
Brush Spring Tension—44-56 ozs. (new brushes).
Cranking Engine—125-150 amperes at 5 volts.

Performance Data

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	3700	5.5	60
.6 "	1910	5.5	100
3.4 "	1100	5.0	200
6.6 "	695	4.5	300
10.15 "	420	4.0	400
15.8 "	Lock	3.0	582
22.5 "	Lock	4.0	775

NOTE:—Lock torque figures correct without switch.

Starting Switch:—Type SS-4001. Solenoid type switch mounted on starter field frame and controlled by pushbutton switch on instrument panel.

Mounting:—Flange mounted on left hand front face of flywheel housing. To remove, take out two flange mounting bolts.

GENERATOR:—Model GBK-4602. Armature No. GBK-2055. Ventilated, third brush control type with external voltage regulator. See Equipment Section for complete data on Voltage Regulator.

Charging Rate Adjustment:—Use test meters to check generator output. Short out voltage regulator by connecting short jumper wire from 'F' terminal on generator to ground. Take off commutator cover band, shift third brush by hand counter-clockwise to increase, or clockwise to decrease charging rate. Remove jumper wire.

Maximum Charging Rate—22 amperes (cold), 8.0 volts, 2400 R.P.M. or 28 M.P.H.

Performance Data
Cold—Regulator Inoperative—Hot

Amperes	Volts	R.P.M.	Amperes	Volts	R.P.M.
0	6.4	800	0	6.4	840
4	6.7	980	4	6.8	1025
8	7.0	1110	8	7.15	1200
12	7.3	1300	12	7.5	1450
16	7.55	1500	16	7.85	1760
22	8.0	2200	18	8.0	2400

Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—18-22 ounces.
Field Current—3.75-4.15 amperes at 6.0 volts.
Motoring—4.46-4.94 amperes at 6.0 volts.
Field Fuse—7½ ampere capacity in knurled cup under regulator case.

Mounting:—Pivot mounted at left front of engine. Driven by fan belt. To remove, take out two pivot bolts and one clamp bolt.
Belt Adjustment—Loosen pivot bolts and clamp bolt, swing generator out or away from engine until slight pull is felt on belt, tighten clamp bolt before slacking off on generator, tighten pivot bolts.

CUT-OUT RELAY:—Model CBA-4002. Mounted on dash. Relay has extra set of contacts above armature for charge tell-tale light control.
Cuts in—6.4 volts, 750 R.P.M. or 8 M.P.H.
Cuts out—.5-2.5 ampere discharge.

VOLTAGE REGULATOR:—Model TC-4102A. Two Charge Regulator mounted on engine side of dash. See article in Electrical Equipment Section for complete data.
Contacts Open—7.86-8.27 volts at 70° F.
Contacts Close—6.46-6.86 volts at 70° F.
Contact Gap—.005" minimum.
Core Gap—.030" plus or minus .001" with contacts closed.

LIGHTING:—Soreng-Manegold Switch, Model 5640-A, C-5640-A (without windshield wiper fuse). Soreng-Manegold Foot Control Switch. Foot control switch provides asymmetric 'meeting' beam (lower beam right hand headlight, upper beam left hand headlight). Headlight beams are crossed (left hand headlight lights right side of road). Operative only with lighting switch in 'Country Driving' position. Headlight bulbs are pre-focused type.

Bulb Specifications

Lamp	Candlepower	Mazda No.
Headlights	32-21	2320-C
Parking, Instrument, Flood	3	63
Dome, Vestibule	15	87
Stop and Tail	21-2	1158
Signal	3	64 (DC.)

SIGNAL LIGHTS:—Battery charge tell-tale and oil pressure tell-tale light mounted on instrument panel. Light bulbs are standard 3 cp. DC. bulbs.

Battery Charge Tell-tale. At left of instrument cluster. Tell-tale should light with ignition turned on and should go out when gentrator begins to charge battery (relay contacts closed). If tell-tale does not burn when ignition turned on, check bulb by grounding tell-tale terminal on relay to generator field frame. If tell-tale does not light, replace bulb. If lamp lights, check auxiliary contact spring, contacts and ground resistor. See that auxiliary contacts are closed with main contacts open. If tell-tale lights at speeds above idling (8 M.P.H.), generator or relay is defective.

Oil Pressure Tell-tale. At right of instrument cluster. Tell-tale should light with ignition turned on but should go out when engine is operated (light should flash at idling speeds). Tell-tale should not light or flash at speeds above idling. If tell-tale does not light when ignition is turned on, check bulb by grounding terminal on oil pressure check valve (right side of crankcase) to engine. If tell-tale does not light, replace bulb. See special article on Hudson Signal Lights in Equipment Section for complete data.

FUSES:—Lighting—Two 20 ampere capacity fuses on back of lighting switch.
Windshield Wiper—7½ ampere capacity fuse on lighting switch (not used on all cars).
Generator Field—7½ ampere capacity.

SERIAL NUMBERS:—First number — 51-101. On plate on engine side of dash. All cars have this prefix '51'.

COMPRESSION:—Ratio—6.0-1 std. (cast-iron) head, 7.0-1 optl. (composite aluminum-iron) head.
Pressure—111 lbs. at 215 R.P.M. (6.0-1 head), 127 lbs. (7.0-1 head) with all spark plugs removed and throttle wide open.

VACUUM READING:—Gauge should show steady reading of 18-19" with engine idling at 350 R.P.M. or 7 M.P.H.

AUTOMATIC SHIFT (ELECTRIC HAND):—Bendix electro-pneumatic type optional on this car. See article in Mechanical Equipment Sect. for complete description, wiring diagram, and trouble shooting.

IGNITION:—Coil Model IG-4616. Resistance unit mounted on distributor connected in primary.
Ignition Current—2.5 amperes idling, 4.5 stopped.
Ignition Switch—Mitchellock Mod. 24-B, Type 6509.
Distributor Model IGB-4301-A (first 25076 cars), IGB-4301-B (after Eng. No. 128077). Single breaker, 6 lobe cam, full automatic advance type.
Breaker Gap—Set at .020". Limits .018-.020".
Breaker Arm Spring Tension—16-22 ounces.
Cam Angles—Closed 40°. Open 20° (distributor).

Automatic Advance—IGB-4301-A

Distributor Degrees	R.P.M.	Engine Degrees	R.P.M.
Start	400	0	800
3	720	6	1440
6	1040	12	2080
9	1360	18	2720
12	1680	24	3360
15	2000	30	4000

Automatic Advance—IGB-4301-B

Start	300	0	600
3	400	6	800
5	615	10	1230
10	1150	20	2300
14	1580	28	3160

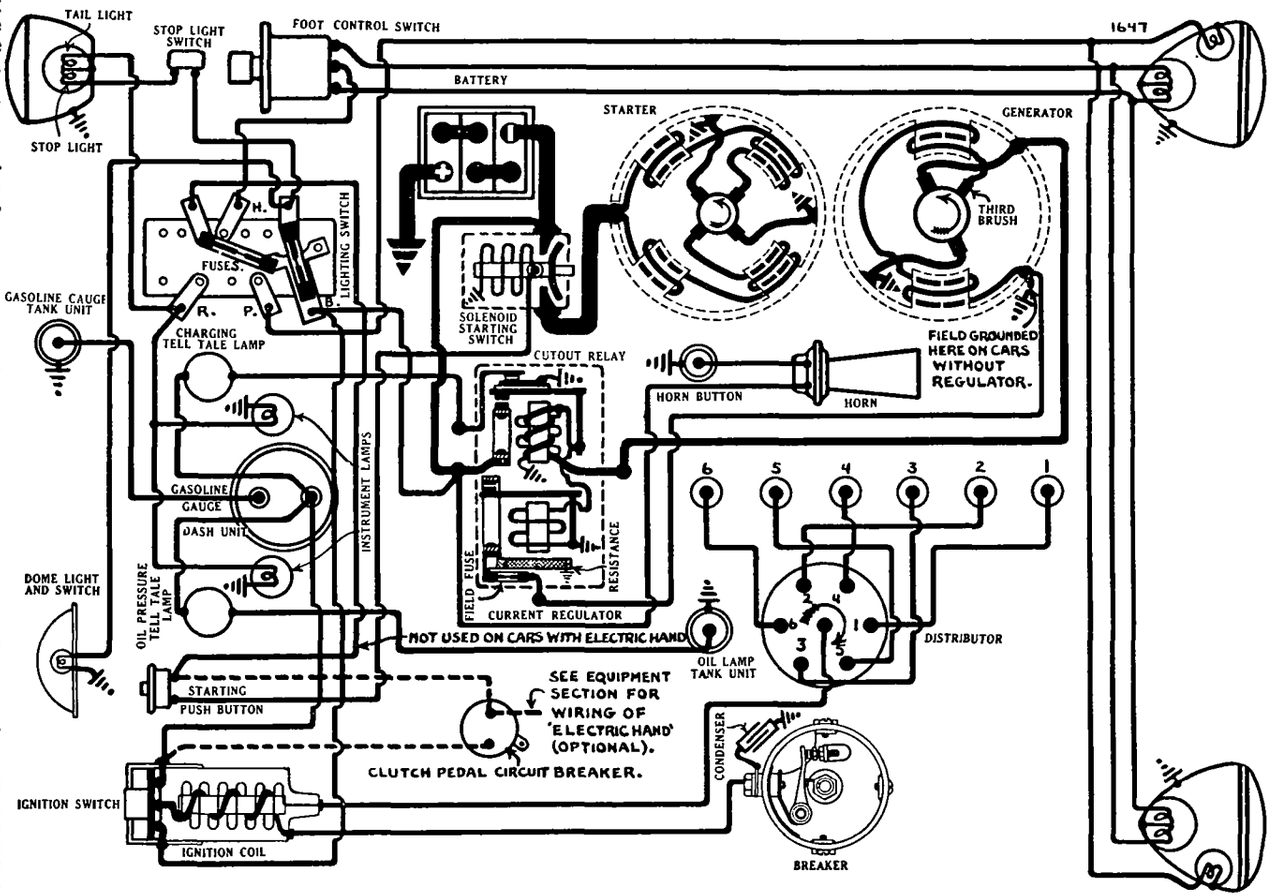
Removal:—Mounted on right side of crankcase. To remove, take out hold-down screw in advance arm.

IGNITION TIMING:— Flywheel Degs. Piston Posi.
First 25076 cars 4½° or ½" BTDC. ..... 0101" BTDC.
Eng. No. 128077 up.....At TDC. ..... .0000" TDC.
Timing (Initial Setting)—With #1 piston on compression, turn engine over until piston reaches top dead center, stop when flywheel mark 'UDC. 1-6' lines up with pointer on edge of inspection hole in left front face of flywheel housing above starter (after 25076 cars or ½" before this point on first cars). Loosen hold-down screw in advance arm, turn distributor clockwise to limit of advance arm slot, then turn distributor slowly counter-clockwise until contacts just open, tighten hold-down screw, see that rotor is opposite #1 segment in distributor cap. Car should then be road-tested and spark advanced as much as operating conditions and fuel will allow.

Timing (Final Setting)—With engine at normal operating temperature, and running at 8 M.P.H. in high gear on level road, accelerate engine rapidly and note performance from 10-15 M.P.H. A slight spark knock should be noticed. If no knock is heard, loosen hold-down screw and advance distributor one graduation on scale (turn distributor counter-clockwise) If knock is too severe, retard distributor one graduation (clockwise). Repeat test until satisfactory setting is secured. Final setting must not be beyond maximum advance mark on flywheel (¾" before mark 'UDC.1-6').
Motor Gauge—Weidenhoff Adapter #114, Rod #43.

Firing Order:—1-5-3-6-2-4. See diagram.

Spark Plugs—Champion Type J-7-S. 14 MM. Metric.
Spark Plug Gaps—Set at .022".



CARBURETION:—See Carburetion Section for data.
Carburetor: — Carter Model 311-S, 1¼" downdraft type.
Fuel Pump:—AC. Type R-1521540 diaphragm type. See 'Servicing AC Fuel Pumps' in Carburetion Equipment Section for recommended replacement pumps.
Gasoline Gauge:—King-Seeley Electric. K-S No. 5240 (dash unit), No. 5582 (tank unit).
See article in Carburetion Equipment Section.

VALVE TIMING:—**To Check Timing**—Set tappet clearance #1 intake valve at .010". This valve should open with piston 10°40' or .0562" before top dead center when a point on the flywheel approximately 3.17 teeth before top dead center mark 'UDC.1-6' lines up with indicator. Reset tappet clearance at .006" with engine warm and running.
Motor Gauge—Weidenhoff Adapter #114, Rod #43.
Tappet Clearance:—.006" Int., .008" Exh., engine hot and running.
Valve Spring Pressure:—44 lbs. at 2" (valve closed). 102 lbs. at 1 21/32" (valve open).

LUBRICATION:—**Crankcase Capacity**—5 qts. (refill).
Normal Oil Pressure—3 pounds.

BATTERY:—**National, Type ST-3-17X.** 6 volt 17 plate, 96 A.H. capacity (20 hour rate).
Starting Capacity—120 amperes for 20 minutes.
Grounded Terminal—Positive (+) terminal.
Location—On left hand side under front floor.

STARTER:—**Model MAB-4060, MAB-4074 after Engine No. 143134. Armature No. MAB-2114.**
Starter Drive—Inboard Bendix, Type A-1588.
Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—44-56 ozs. (new brushes).
Cranking Engine—150 R.P.M., 125 amperes, 5 volts.

Performance Data

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	3700	5.5	60
3.4 "	1100	5.0	200
6.6 "	695	4.5	300
10.15 "	420	4.0	400
15.8 "	Lock	3.0	582
22.5 "	Lock	4.0	775

Lock torque figures correct without switch.

Starting Switch:—Type SS-4001. Solenoid type switch mounted on starter field frame controlled by pushbutton switch. See Equipment Section.

Removal:—Starter flange mounted on left front face of flywheel housing. To remove, take out flange mounting bolts.

GENERATOR:—**Model GBK-4601-2. Armature No. GBK-2055.** Air-cooled. Third brush control type. Current Regulator (two-rate charging control) used on some models. See Equipment Section for complete data on Regulator.
Charging Rate Adjustment—Use test meters to check generator output. On cars with Current Regulator, short out regulator by connecting jumper wire from 'F' terminal on generator to ground on generator frame. Take off commutator cover band, shift third brush by hand counter-clockwise to increase charging rate, or clockwise to decrease charging rate. Third brush held in position by friction. Remove jumper wire.
Maximum Charging Rate—17 amperes (cold) or 13 amperes (hot) cars without regulator or 22 amperes (cold), 17 amperes (hot) cars with regulator, 8.0 volts, 2200 R.P.M., 28 M.P.H.
NOTE—On generators used without the regulator, the field terminal on the generator frame is grounded by a grounding cup assembled on the terminal. This ground cup must be removed when a regulator is installed.

Performance Data—No Regulator

Cold			Hot		
Amps.	Volts	R.P.M.	Amps.	Volts	R.P.M.
0	6.4	800	0	6.4	840
4	6.8	1000	4	6.85	1050
8	7.2	1200	8	7.3	1260
12	7.6	1400	12	7.7	1560
16.5	8.0	2200	14.8	8.0	2250

Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—18-22 ozs. (new brushes).
Field Current—4.08-4.52 amperes at 6.0 volts.
Field Fuse—5 ampere in knurled cup on side of regulator case (no fuse when regulator not used).
Motoring Current—4.18-4.62 amperes at 6.0 volts.

Removal:—Pivot mounted at left front of engine with fan belt drive. To remove, take out two pivot bolts and one clamp bolt.

Belt Adjustment:—Loosen pivot bolts and clamp bolt, pull generator out from engine until slack on belt midway between crankshaft and generator pulleys is 1¼" (measure from straightedge across pulleys), tighten mounting bolts.

CUTOUT RELAY:—**Model CBA-4002.** Used on cars without regulator. Mounted on dash. See Equipment Section for complete data.
Cuts In—6.4 volts, 8 M.P.H.
Cuts Out—.5-2.5 amperes discharge current.
Contact Gap—.025-.035". With upper or ground contacts closed.
Air Gap—.010-.030" with contacts closed.

RELAY-REGULATOR:—**Model TC-4304-A.** Used on some cars. Mounted on dash. Consists of Cutout Relay and Current Regulator in a single case. See Equipment Section for data on these units.

Cutout Relay

Cuts In—6.5-7.25 volts.
All other data same as for CBA-4002 above.

Current Regulator

Contacts Open—8.0-8.50 volts at 70°F.
Contacts Close—1.2-1.4 volts below opening point.
Contact Gap—.005" minimum.
Air Gap—.045" with contacts closed.

LIGHTING:—**Soreng-Manegold Switch Model F-5640-A. R.B.M. Foot Control Switch Model 1076, A.** Foot switch used to control Country Driving (high) and City (low) beams with lighting switch in second or driving position. Headlamp bulbs are pre-focused type.

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps	32-21	2320-C
Parking, Instrument	3	63
Stop and Tail	21-2	1158
Dome	15	87
Signal lights	3	64 (DC)

SIGNAL LIGHTS:—Battery Charge Tell-tale and Oil Pressure Tell-tale lights mounted in instrument cluster. See Equipment Section for complete data.

HORNS:—**Auto-Lite Type HA-4003, 4004 Std. Klaxon Model K-26-M Type 1716 (high note), 1717 (low note) Optional.** All horns are vibrator type. Optional horns are matched tone, twin horns.

FUSES:—**Lighting**—Two 20 ampere on back of switch.
Generator Field—5 ampere in knurled plug on regulator case—not used without regulator.

SERIAL NUMBER:—First number, 52-101. On plate on engine side of dash. All serial numbers have this prefix '52'.

COMPRESSION:—**Ratio**—6.0-1 Std. (cast-iron) head. 7.0-1 Optl. (composite aluminum-iron) head. **Pressure**—111 lbs. at 215 R.P.M. (std. head), 127 lbs. at 207 R.P.M. (optl. head) with all spark plugs removed and throttle wide open.

VACUUM READING:—Gauge should show steady reading of 18-19" with engine idling at 350 R.P.M. or 7 M.P.H.

AUTOMATIC SHIFT (ELECTRIC HAND):—Bendix electro-pneumatic type optional on this car. See article in Mechanical Equipment Sect. for complete description, wiring diagram, and trouble shooting.

IGNITION:—**Coil Model IG-4616.** Resistance unit mounted on distributor connected in primary circuit.
Ignition Current—2.5 amperes idling, 4.5 stopped.
Ignition Switch—Mitchellock Mod. 24-B, Type 6509.
Distributor Model IGB-4301-A (first 25076 cars), IGB-4301-B (Eng. No. 128077 up). Single breaker, 6 lobe cam, full automatic advance type.
Breaker Gap—Set at .020". Limits .018-.020".
Breaker Arm Spring Tension—16-22 ounces.
Cam Angles—Closed 40°. Open 20° (distributor).

Automatic Advance—IGB-4301-A

Distributor Degrees	R.P.M.	Engine Degrees	R.P.M.
Start	400	0	800
3	720	6	1440
6	1040	12	2080
9	1360	18	2720
12	1680	24	3360
15	2000	30	4000

Automatic Advance—IGB-4301-B

Start	300	0	600
3	400	6	800
5	615	10	1230
10	1150	20	2300
14	1580	28	3160

Removal:—Mounted on right side of crankcase. To remove, take out hold-down screw in advance arm, lift out.

IGNITION TIMING:—

	Flywheel Degs.	Piston Pos.
First 25076 cars	4½° or ½" BTDC.	.0101" BTDC.
Eng. No. 128077 up	At TDC.	.0000" TDC.

Timing (Initial Setting)—With #1 piston on compression, turn engine over until piston reaches top dead center, stop when flywheel mark 'UDC. 1-6/' lines up with pointer on edge of inspection hole in left front face of flywheel housing above starter (after 25076 cars or ½" before this point on first cars). Loosen hold-down screw in advance arm, turn distributor clockwise to limit of advance arm slot then turn distributor slowly counter-clockwise until contacts just open, tighten hold-down screw, see that rotor is opposite #1 segment in distributor cap. Car should be road-tested and spark advanced as much as operating conditions and fuel will allow.

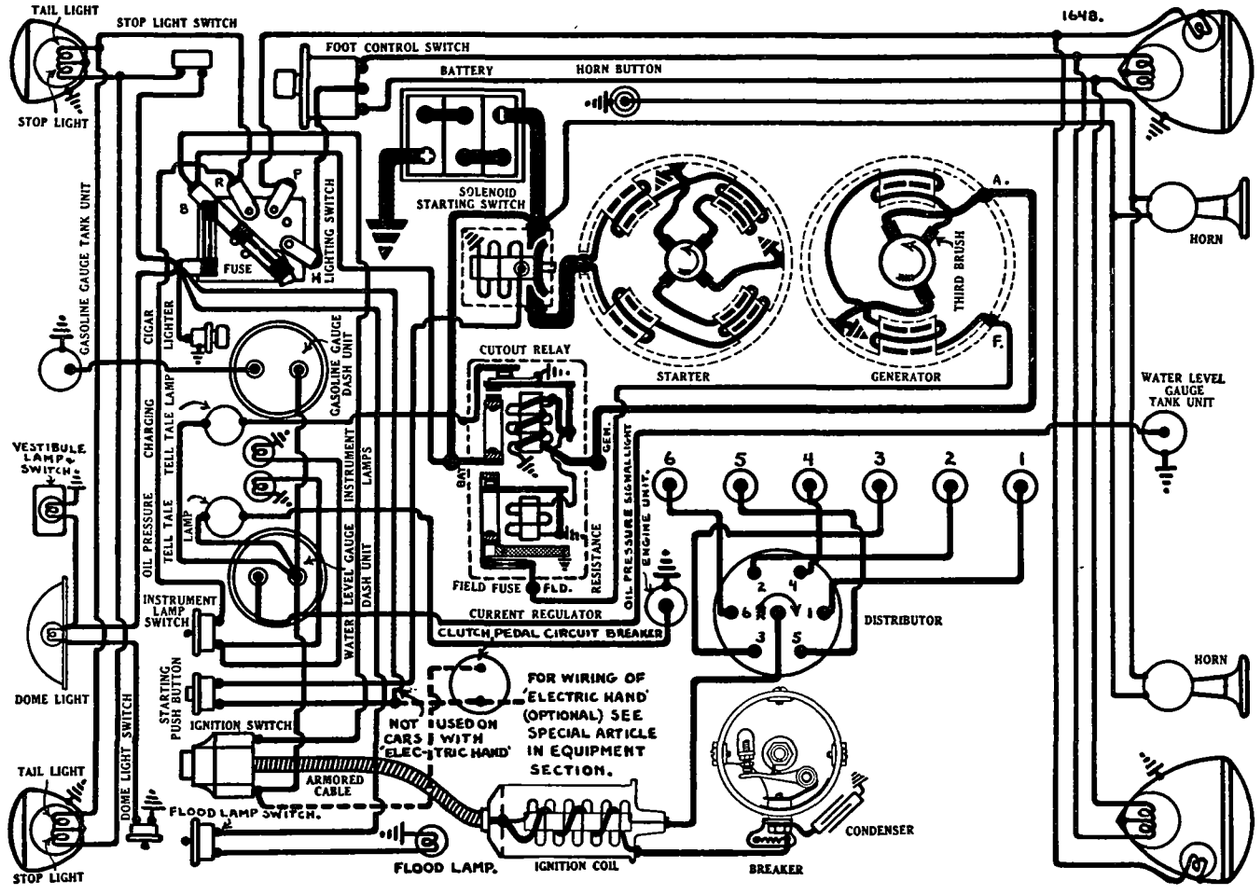
Timing (Final Setting)—With engine at normal operating temperature, and running at 8 M.P.H. in high gear on level road, accelerate engine rapidly and note performance from 10-15 M.P.H. A slight spark knock should be noticed. If no knock is heard, loosen hold-down screw and advance distributor one graduation on scale (turn distributor counter-clockwise). If knock is too severe, retard distributor one graduation (clockwise). Repeat test until satisfactory setting is secured. Fnal setting must not be beyond maximum advance mark on flywheel (¾" before mark 'UDC.1-6/).

Motor Gauge—Weidenhoff Adapter #114, Rod #43.

Firing Order:—1-5-3-6-2-4. See diagram.

Spark Plugs:—Champion Type J-7-S. 14 MM. Metric.
Spark Plug Gaps—Set at .022".

CARBURETION:—See Carburetion Section for complete data on Carburetor, Automatic Choke, Fuel Pump, and Gasoline Gauge.



Carburetor:—Carter, Model 309-S, 1¼", downdraft type with drop-bar type Fast Idle.
Automatic Choke—Carter Climatic Control integral with carburetor.

Fuel Pump:—AC. Type R-1521540 diaphragm type. **See 'Servicing AC Fuel Pumps' in Carburetion Equipment Section for recommended replacement pumps.**

Gasoline Gauge:—King-Seeley Electric. K-S No. 5200 (dash unit), No. 5582 (tank unit).
See article in Carburetion Equipment Section.

VALVE TIMING:—To Check Timing—Set tappet clearance #1 intake valve at .010". This valve should open with piston 10°40' or .0562" before top dead center when a point on the flywheel approximately 3.17 teeth before top dead center mark 'UDC.1-6' lines up with the indicator. Reset tappet clearance at .006" with engine warm and running.
Motor Gauge—Weidenhoff Adapter #114, Rod #43.

Tappet Clearance:—.006" Int., .008" Exh., engine hot and running.

Valve Spring Pressure:—44 lbs. at 2" (valve closed). 102 lbs. at 1 21/32" (valve open).

LUBRICATION:—Crankcase Capacity—5 qts. (refill).
Normal Oil Pressure—3 pounds.

BATTERY:—National, Type ST-3-17X. 6 volt, 17 plate, 96 A.H. capacity (20 hour rate).
Starting Capacity—120 amperes for 20 minutes.
Grounded Terminal—Positive (+) terminal.
Location—On left hand side under front floor.

STARTER:—Model MAB-4060, MAB-4074 after Engine No. 143134. Armature No. MAB-2114.
Starter Drive—Inboard Bendix, Type A-1588.
Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—44-56 ozs. (new brushes).
Cranking Engine—150 R.P.M., 125 amperes, 5 volts.

Performance Data

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	3700	5.5	60
.6 "	1910	5.5	100
3.4 "	1100	5.0	200
6.6 "	695	4.5	300
10.15 "	420	4.0	400
15.8 "	Lock	3.0	582
22.5 "	Lock	4.0	775

Lock torque figures correct without switch.

Starting Switch:—Type SS-4001. Solenoid type switch mounted on starter field frame controlled by pushbutton switch on instrument panel. See Equipment Section.

Removal:—Starter flange mounted on left front face of flywheel housing. To remove, take out flange mounting bolts.

GENERATOR:—Model GBK-4602-1. Armature No. GBK-2055. Ventilated, third brush control type with external current regulation (two-step charging rate). See Equipment Section for complete data on Regulator.
Charging Rate Adjustment—Use test meters to check generator output. Short out current regulator by connecting jumper wire from 'F' terminal on generator to ground. Take off commutator cover band, shift third brush by hand, counter-clockwise to increase, or clockwise to decrease charging rate. Remove jumper wire.
Maximum Charging Rate—22 amperes (cold) or 18 amperes (hot), 8.0 volts, 2400 R.P.M., 28 M.P.H.

Performance Data

Cold—Regulator Inoperative—Hot					
Amperes	Volts	R.P.M.	Amperes	Volts	R.P.M.
0	6.4	800	0	6.4	840
4	6.7	980	4	6.8	1025
8	7.0	1110	8	7.15	1200
12	7.3	1300	12	7.5	1450
16	7.55	1500	16	7.85	1760
22	8.0	2200	18	8.0	2400

Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—18-22 ozs. (new brushes).
Motoring—4.46-4.94 amperes at 6.0 volts.
Field Current—3.75-4.15 amperes at 6.0 volts.
Field Fuse—5 amperes in knurled cup on side of regulator case.

Removal:—Pivot mounted at left front of engine with fan belt drive. To remove, take out two pivot bolts, one clamp bolt.

Belt Adjustment—Loosen pivot bolts and clamp bolt, pull generator out from engine until slack on belt midway between crankshaft and generator pulleys is 1¼" (measure from straightedge across pulleys), tighten mounting bolts.

REGULATOR:—Model TC-4304-A. Consists of Cutout Relay and Current Regulator (two-rate relay) in a single case on the dash. See Equipment Section for complete article on these units. Cutout relay has extra set of ground contacts for generator charging tell-tale signal light control.

Cutout Relay

Cuts In—6.5-7.25 volts.
Cuts Out—.5-2.5 ampere discharge current.
Relay Contact Gap—.015-.045" (with upper or ground contacts closed—ground contacts must be open with main contacts closed).
Air Gap—.010-.030" with contacts closed.

Current Regulator

Contacts Open—8.0-8.50 volts at 70° F.
Contacts Close—1.2-1.4 volts below opening point.
Contact Gap—.005" minimum.
Air Gap—.045" with contacts closed.

LIGHTING:—Soreng-Manegold Switch Model 5770-A. R.B.M. Foot Control Switch Model 1076, A. Foot switch used to control Country Driving (high) and City (low) beams with lighting switch in driving or second position. Headlight bulbs are pre-focused type.

Bulb Specifications

Position	Candlepower	Mazda No.
Headlights	32-21	2320-C
Parking, Instrument	3	63
Signal Lights	3	64(DC)
Stop & Tail	21-2	1158
Dome	15	87

SIGNAL LIGHTS:—Battery Charge Tell-tale and Oil Pressure Tell-tale lights mounted on instrument panel. See Equipment Section for complete data.

HORNS:—Auto-Lite HA-4003, 4004 (Std), Klaxon Model K-26-M, Type 1716 (high note), 1717 (low note) matched tone, twin horns (optl.).

FUSES:—Lighting—Two 20 ampere on switch.
Generator Field—5 ampere in regulator.

NOTE:—'Electric Hand' Bendix electro-pneumatic type gear shift optional on all models.
See article in Mechanical Equipment Section for complete data.

SERIAL NUMBER:—First number—(61) 61101 (U.S.), 61C101 (Canada); (62) 62101 (U.S.), 62C101 (Canada). Stamped on plate on dash under hood.

COMPRESSION:—Ratio 6.0-1 Std. cast-iron head, 7.0-1 Optl. high compression aluminum head. Check compression pressure by removing all spark plugs and cranking engine with throttle wide open.

Cylinder Head	Compression Pressure
Std. 6.0-1	111 lbs. at 215 R.P.M.
Optl. 7.0-1	127 lbs. at 207 R.P.M.

VACUUM READING:—Gauge should show steady reading of 18-20" of HG. with engine idling at 350 R.P.M.

IGNITION:—**Coil Model IG-4633.** Resistor unit mounted on distributor terminal is connected in series with coil primary.
Resistance Unit—Part No. SP-4008.
Coil Draw—2.5 amperes idling, 4.5 stopped.

Ignition Switch:—Mitchellock Model 24-B, Type 6696. Connected to coil by armored cable.
Ignition Lock—Briggs & Stratton No. 50184, Mitchell No. 6095.

Distributor Model IGB-4301B. Single breaker, 6 lobe cam, full automatic advance type.
Breaker Gap—Set at .020". Limits .018-.020".
Cam Angle or Dwell—38° closed, 22° open (distr.).
Breaker Arm Spring Tension—16-20 ounces.
Condenser—Part No. IGB-1025J. Capacity .20-.25 mfds.

Automatic Advance

Distributor Degrees	Distributor R.P.M.	Engine Degrees	Engine R.P.M.
Start	300	0	600
3	400	6	800
5	615	10	1230
10	1150	20	2300
14	1580	28	3160

Distributor Removal:—Mounted on right side of crank case. To remove, take out hold-down screw in advance arm.

IGNITION TIMING:—Initial setting for all engines as shown. See Final Setting Section for adjustment in accordance with octane rating of fuel used.

Flywheel Degrees	Piston Position
At TDC.	.000" TDC.

NOTE—High octane type fuel must be used in engines with high compresion 7.0-1 aluminum head.

To Set Timing (Initial Setting)—With #1 piston on compression, turn engine over until flywheel mark 'UDC.1-6/' lines up with pointer in inspection hole in left front face of flywheel housing above starter. Loosen hold-down screw in advance arm, rotate distributor clockwise to limit of advance arm slot, then slowly rotate distributor counter-clockwise until contacts begin to open, tighten hold-down screw.

Final Setting—Check ignition setting by road testing car. With engine warm and running in high gear on level road, a slight spark knock should be evident when car is accelerated from 10-15 M.P.H. with wide open throttle. Adjust by loosening hold-down screw in advance arm and rotating distributor one graduation on scale counter-clockwise (if no knock evident) or clockwise (if knock too severe). Repeat test until slight knock is evident. Final setting must not be more than ¾" on flywheel before 'UDC.1-6/' mark.

Timing (Motor Gauge)—Weidenhoff #114 Adapter, #44 Rod.

Firing Order:—1-5-3-6-2-4. See diagram.

Spark Plugs:—Champion Type J-8 (Std. 6.25-1 engines), J-9 (Optl. 7.0-1 engines). 14 MM. Metric type.
Spark Plug Gaps—.025" (Std. engine), .022" (Optl. H. C. engine).

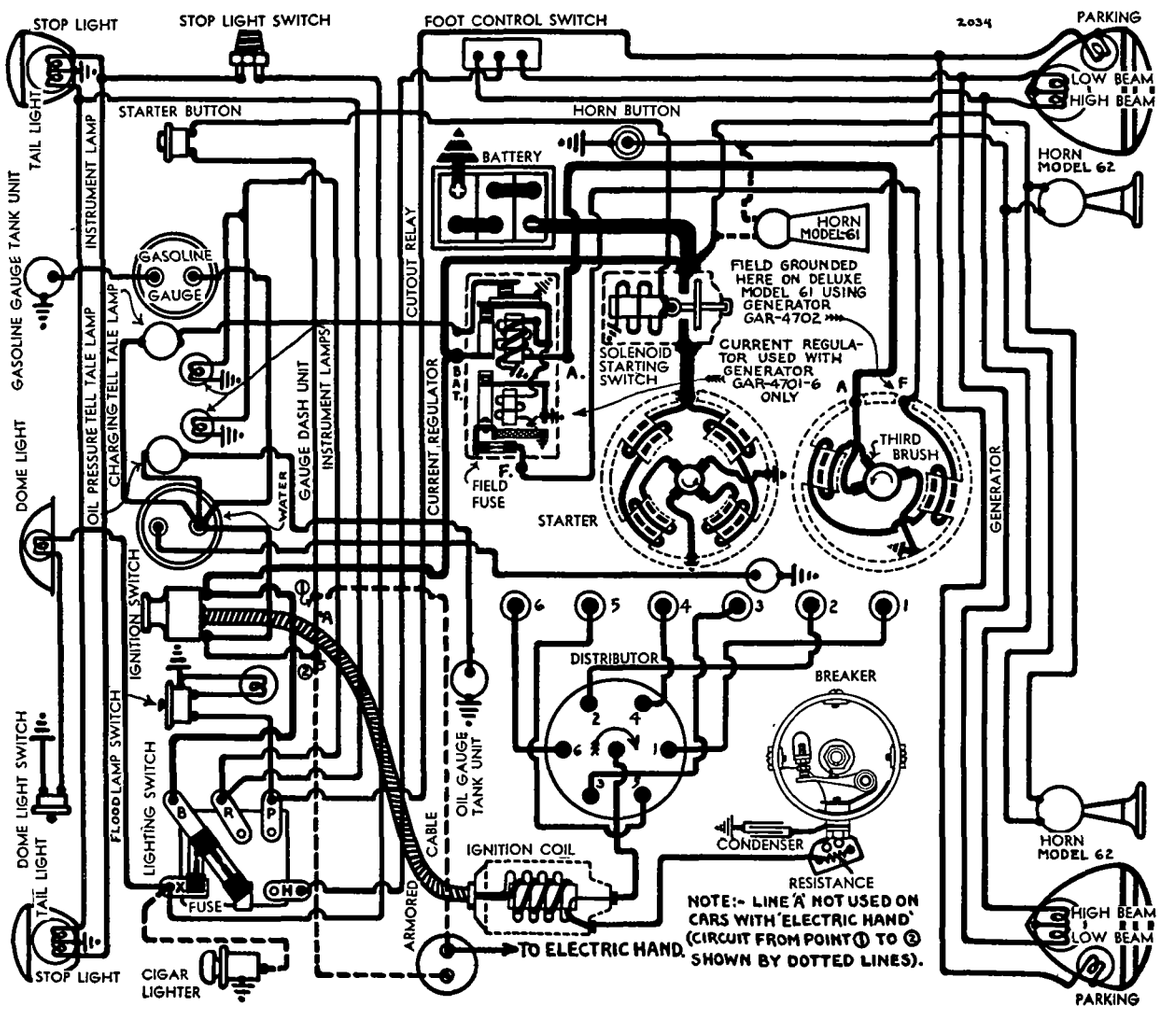
CARBURETION:—**Carburetor**—(61) Carter Mod. 331-S, (62) Carter Model 329-S. 1¼" downdraft types. See Carburetion Section for complete adjustment, overhaul and Jet Specifications.
NOTE—Do not adjust carburetor until engine is warmed up so that choke valve is wide open and engine idling at slow or hot idling speed.

Idle Adjustment—Adjust throttle stopscrew so that speed is 350 R.P.M. or 7 M.P.H. Turn idle adjusting screw in until engine begins to miss, then turn screw out until engine begins to roll, finally turn screw in slowly until engine fires smoothly. Final setting should be ¼-1 (331-S), ½-1 (329-S) turn open from seated position. Readjust throttle stopscrew for correct idling speed.

Accelerating Pump Setting—Pump lever (under dust cover at top of carburetor) has three holes for pump link engagement. Change for seasonal requirements as follows:
Center Hole—Normal summer temperatures.
Inner Hole (Min. stroke)—Extreme hot weather.
Upper Hole (Max. stroke)—Extreme cold weather.

Throttle Cracking (331-S only):—Opens throttle valve .036-.040" with choke fully closed. No adjustment.

Fast Idle (329-S only):—Integral with carburetor. No adjustment required. See article on Carter Fast Idle in Carburetion Section.



Automatic Choke (329-S only):—Carter Climatic Control. See article in Carburetion Section.

Air Cleaner:—AC. #1526650 Std., #1526651 on cars with Electric Hand. Heavy duty oil-bath type optl.

Fuel Pump:—AC. Type R #1521450. Diaphragm type. See article in Carburetion Section.
See 'Servicing AC Fuel Pumps' in Carburetion Equipment Section for recommended replacement pumps.

Gasoline Gauge:—King-Seeley Electric. K-S No. 6190 (dash unit), No. 5835 (tank unit).
See article in Carburetion Equipment Section.

VALVE TIMING:—Tappet Clearance—.006" Int., .008" Exh., with engine hot.

Valve Spring Pressure—44 lbs. at 2" (valve closed), 102 lbs. at 1 21/32" (valve open).

To Check Valve Timing—Set tappet clearance #1 intake valve at .010". This valve should open with piston 10°40' or .0562" before top dead center when point on flywheel approximately 3.94 teeth before dead center mark 'UDC.1-6/' lines up with pointer in inspection hole in left front face of housing. Reset tappet clearance at .006" with engine hot.

Motor Gauge—Weidenhoff #114 Adapter, #44 Rod.

LUBRICATION:—Crankcase Capacity—5 qts. refill.

Normal Oil Pressure—3 lbs. (no gauge).

Oil Pressure Signal Light—Used instead of pressure gauge. Controlled by oil pressure regulator valve. See complete article in Equipment Section.

BATTERY:—National, Type ST-317X. 6 volt, 17 plate, 96 ampere hour capacity (20 hour rate).

Starting Capacity—120 amperes for 20 minutes.

Zero Capacity—300 amperes for 3.2 minutes.

Grounded Terminal—Positive (+) terminal.

Location—On left hand side under front floor.

STARTER:—Model MAB-4075. Armature MAB-2113.

Drive—Inboard Bendix (barrel), Type A-1673.

Cranking Engine—150 R.P.M., 120-125 amps. at 5 vs.

Rotation—Counter-clockwise at commutator end.

Brush Spring Tension—42-53 ozs. (new brushes).

Performance Data

Torque		R.P.M.	Volts	Amperes
0	ft. lbs.	3700	5.5	60
.6	"	1910	5.5	100
3.4	"	1100	5.0	200
6.6	"	695	4.5	300
10.15	"	420	4.0	400
15.8	"	Lock	3.	582
22.5	"	Lock	4.	775

NOTE—Lock Torque figures correct without switch.

Removal:—Flange mounted on left front face of flywheel housing. To remove, take out flange mounting bolts.

Starting Switch:—Solenoid Type SS-4001. Controlled by pushbutton switch (R.B.M. Model 1800) on dash. Operative with switch turned on. On cars with Electric Hand clutch must be disengaged to operate switch.

Solenoid Switch

Closes with terminal voltage of 4 volts or less and will remain closed until voltage drops to .75-2.0 volts. Current draw 3 amperes at 6 volts.

GENERATOR:—(61) Model GAR-4702, (62) GAR-4701-6 Armature No. GAR-2077. Ventilated, third brush control type. Current Regulator (two-rate charging control) on GAR-4701-6.

Charging Rate Adjustment—Use test meters to check generator output. On Mod. GAR-4701-6, short out regulator by connecting jumper wire from 'F' terminal on generator to ground. Take off commutator cover band, shift third brush by hand counter-clockwise to increase, or clockwise to decrease charging rate. Third brush held in position by friction. Remove jumper wire.

NOTE—Model GAR-4702 generator field terminal on generator frame is grounded by a grounding cup assembled on the terminal. If regulator is installed, this ground cup must be removed.

Performance Data—GAR-4701-6

Cold—Regulator Inoperative—Hot					
Amperes	Volts	R.P.M.	Amperes	Volts	R.P.M.
0	6.4	780	0	6.4	820
4	6.7	930	4	6.8	1000
8	6.95	1060	8	7.1	1180
12	7.25	1210	12	7.35	1400
16	7.6	1440	16	7.8	1790
22.8	8.0	2400	18.4	8.0	2700

Model GAR-4702

Cold — No Regulator — Hot					
Amperes	Volts	R.P.M.	Amperes	Volts	R.P.M.
0	6.4	860	0	6.4	830
4	6.8	1000	4	6.85	1040
8	7.2	1200	8	7.3	1300
12	7.6	1460	12	7.75	1550
16	8.0	2150	14.5	8.0	2200

Rotation—Counter-clockwise at commutator end.

Brush Spring Tension—18-22 ozs. (new brushes).

Field Current—3.51-4.89 amperes (GAR-4702), 3.51-3.89 amperes (GAR-4701-6) at 6.0 volts.

Motoring Current—4.84-5.36 amperes (GAR-4702), 5.32-5.88 amperes (GAR-4701-6) at 6.0 volts.

Field Fuse—5 ampere in knurled cup on side of regulator case (GAR-4701-6 only).

Removal:—Pivot mounted at left front of engine, with fan belt drive. To remove, take out two pivot bolts and one clamp bolt.

Belt Adjustment:—Swing generator away from engine until slack in belt midway between fan pulley and generator pulley is 1¼" (measure from straight edge across pulleys).

CUTOUT RELAY:—Model CBA-4003 (GAR-4702). Mounted on dash. Extra set of ground contacts provided for generator charging tell-tale signal light control. See article in Equipment Section for complete data.

Cuts In—6.75-7.5 volts.

Cuts Out—.5-2.5 amperes discharge current.

Contact Gap—.025-.035" (with upper or ground contacts closed—ground contacts must be open with main contacts closed).

Air Gap—.010-.030" with contacts closed.

RELAY-REGULATOR:—Mod. TC-4304A (GAR-4701-6). Mounted on engine side of dash. Consists of Cutout Relay and Current Regulator (two-rate charging control). See Equipment Section for complete data. Cutout Relay has extra set of ground contacts for generator charging tell-tale signal light control.

Cutout Relay

Cuts In—6.5-7.25 volts. All other data same as for Model CBA-4003 (see above).

Current Regulator

Contacts Open—8.0-8.50 volts at 70° F.

Contacts Close—1.2-1.4 volts below opening point.

Contact Gap—.005" minimum.

Air Gap—.045" with contacts closed.

LIGHTING:—Headlamps—Hall, Pre-focused type. Head lamps aimed straight ahead (upper beams with lenses in place). Upper and lower beams controlled by foot selector switch.

Switches

Lighting—R.B.M. Model 1650.

Foot Selector—R.B.M. Model 1082.

Instrument Lights—Soreng-Manegold Mod K2060A.

Stop Light—Motometer Model 58012-C. Hydraulic type mounted in brake line at left frame side rail in channel at rear.

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps	32-32	2331
Parking, Instrument	1	55
Signal Lights	1	51
Stop and Tail	21-3	1158
Dome	15	87

SIGNAL LIGHTS:—Battery Charge Tell-tale and Oil Pressure Tell-tale lights mounted on instrument panel. See Equipment Section for complete data.

FUSES:—Lighting—Two 20 ampere capacity on switch.
Generator Field—5 ampere in regulator (on GAR-4701-6 only).

HORNS:—E. A. Vibrator type. Twin horns on Model 62

NOTE:—Electric Hand (Bendix type Electro-pneumatic gear shift optional on all models.
See article in Mechanical Equipment Section for complete data.

SERIAL NUMBER:—First number 70-101 (Commercial Model 70), 71-101 (Deluxe Model 71). Stamped on plate on right front door hinge pillar above top hinge.

COMPRESSION:—Ratio—6.25-1 Std. cast-iron head. 7.0-1 Optl. 'Super Power Dome' aluminum alloy hd. NOTE—High octane fuel must be used with this hd.
Pressure—Check pressure by removing all spark plugs and cranking engine with throttle wide open.

Cylinder Head	Compression Pressure
6.25-1	103 lbs., 170 R.P.M.
7.0-1	119 lbs., 170 R.P.M.

VACUUM READING:—18-20" steady reading with engine idling at 350 R.P.M. or 6 M.P.H.

IGNITION:—Coil Model IG-4644. Service winding (coil less switch and cable) IG-3224S. Resistor unit mounted on distributor terminal connected in primary circuit. NOTE—This resistor not used when Regulator (VRD-4003A, B) used. Resistor should be removed when regulator installed.
Ignition Current—2.5 amperes idling, 4.5 stopped.
Ignition Switch:—Michellock Model 24-B, Type 7063. Connected to coil by armored cable.
Ignition Lock—Briggs & Stratton, Mitchell No. 6095.
Distributor Model IGW-4012-A. Single breaker, 6 lobe cam, full automatic advance type.
Breaker Gap—Set at .020".
Cam Angle or Dwell—35° (closed), 25° (open).
Breaker Arm Spring Tension—16-20 ounces.
Condenser—No. IGB-1025J. Capacity .20-.25 mfd.

Automatic Advance

Distributor Degrees	Distributor R.P.M.	Engine Degrees	Engine R.P.M.
Start	300	0	600
3	400	6	800
5	520	10	1040
10	1150	20	2300
14	1575	28	3150

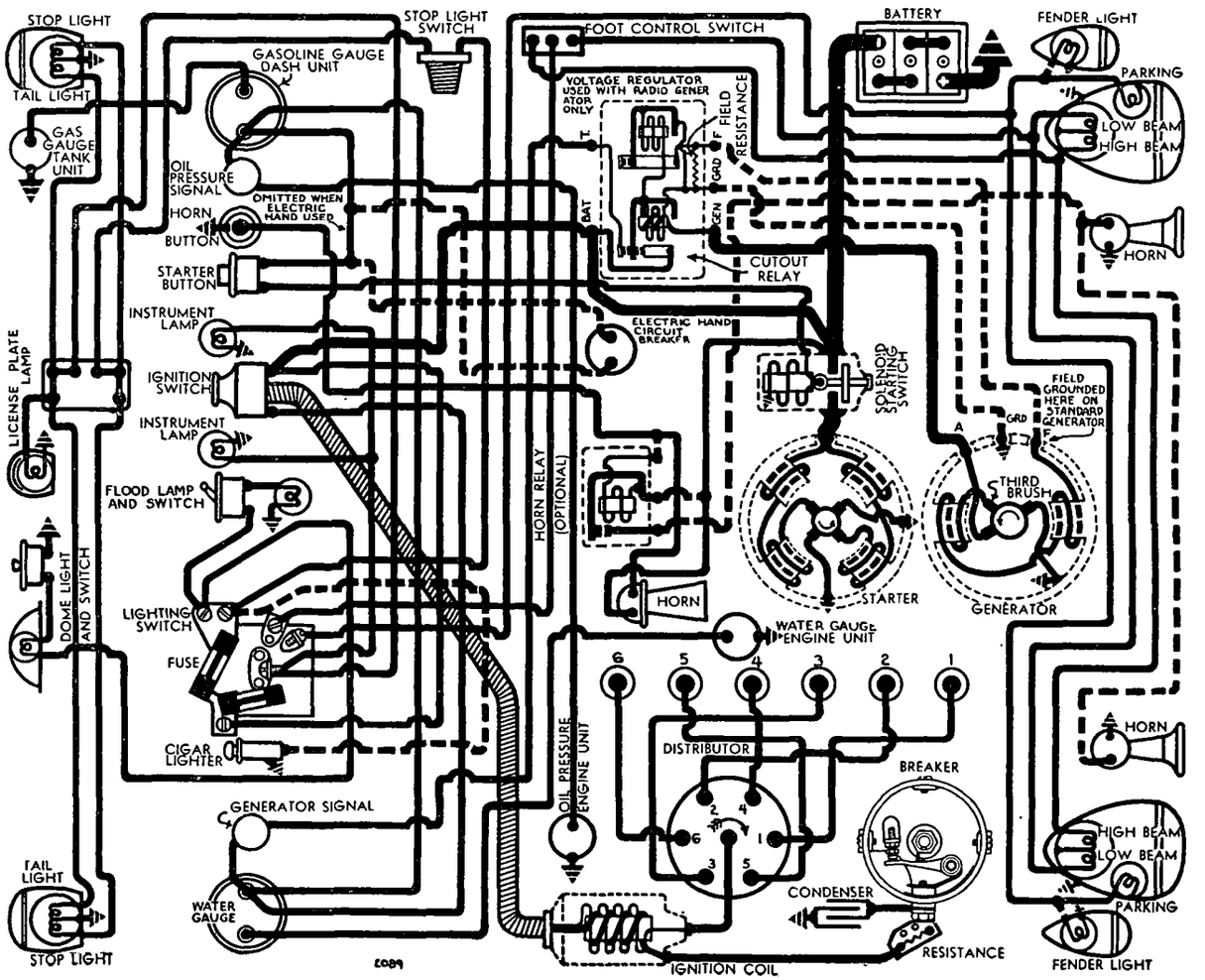
Distributor Removal:—Mounted on right side of crankcase. To remove, take out hold-down screw in advance arm.

IGNITION TIMING:—Initial setting for all engines as shown. See Final Setting for adjustment dependent on Octane rating of fuel used.

Flywheel Degrees	Piston Position
At TDC.	.0000" TDC.

NOTE—High Octane fuel must be used in engines with 7.0-1 high compression aluminum head.
To Set Timing (Initial Setting)—With #1 piston on compression, crank engine over until flywheel mark 'UDC.1-6/' lines up with pointer in left front face of flywheel housing. Loosen hold-down screw in advance arm, rotate distributor clockwise to limit of slot, then slowly rotate distributor counter-clockwise until contacts begin to open, tighten hold-down screw.
Final Ignition Setting—Road test car and note performance when accelerating from 10-15 M.P.H. with wide open throttle on level road (engine must be warm), slight spark knock should be evident. Adjust by loosening hold-down screw and rotating distributor one graduation on scale counter-clockwise (if no knock), clockwise (if knock too severe). Repeat test. Final setting must not be advanced more than ¾" before 'UDC.1-6/' mark on flywheel.
Timing (Motor Gauge)—Weidenhoff Adapter #114, Rod #43.
Firing Order:—1-5-3-6-2-4. See diagram.
Spark Plugs:—Champion Type J-8 (Std. 6.25-1 hd.), H-10 (Optl. 7.0-1 hd.). 14 MM. Metric type.
Spark Plug Gaps—.025".

CARBURETION:—Carburetor—Carter Model W1 Type 348-S. Single barrel, downdraft type.
See Article in Carburetion Section for data.
Idle Adjustment—Engine must be warm so that choke valve wide open and throttle cracker inoperative. Set throttle lever stopscrew so that idling speed is 6 M.P.H. Turn idle adjusting screw in until engine begins to miss, then out until engine begins to roll, finally turn screw in slowly until engine fires smoothly. Final setting should be ¼-1 turn open from inner seated position. Readjust throttle stopscrew for correct idling speed.
Accelerating Pump Setting—Pump lever (under dust cover at top of carburetor) has three holes for pump link connection. Change for seasonal requirements as follows:
Center Hole—Normal summer temperatures.
Inner (Min. stroke)—Extreme hot weather.
Upper (Max. stroke)—Extreme cold weather.
Throttle Cracker:—Open throttle valve .036-.040" with choke valve fully closed. No adjustment.
Air Cleaner:—AC. #1528159 (Std.), #1528158 (cars with Electric Hand), oil-wetted type. Heavy duty oil-bath type optional.
Fuel Pump:—AC. Type AK #1523289. Diaphragm type std., Type AB #1523290 combination fuel-and-vacuum type optl.
NOTE—**See 'AC Fuel Pump Servicing' in Carburetion Equipment Section for special pump gasket data.**
Gasoline Gauge:—King-Seeley Electric Type. K-S No. 6190 (dash unit), 5835 (tank unit).



VALVE TIMING:—To Check—Set tappet clearance #1 intake valve at .010". This valve should open with piston 10°40' or .0562" before top dead center when a point on the flywheel approximately 3.94 teeth before top dead center mark 'UDC.1-6/' lines up with indicator on left front face on flywheel housing. Reset tappet clearance at .006" hot.

Motor Gauge—Weidenhoff Adapter #114, Rod #43.

Tappet Clearance:—.006" Int., .008" Exh. engine hot.

Valve Spring Pressure:—44 lbs. at 2" (valve closed), 102 lbs. at 1 21/32" (valve open).

LUBRICATION:—Crankcase Capacity—5 qts. (refill).

Normal Oil Pressure—3 lbs. (no gauge).

Oil Pressure Signal—Used instead of press. gauge. Controlled by oil pressure regulator valve.

See Article in Mechanical Equipment Section.

BATTERY:—National, Type ST-317X. 6 volt, 17 plate, 96 ampere hour capacity (20 hour rate).

Starting Capacity—120 amperes for 20 minutes.

Zero Capacity—300 amperes for 3.2 minutes.

Grounded Terminal—Positive (+) terminal.

Location—In left front fender. Accessible from engine compartment by taking out 3 slotted screws in cover flange (2 top, 1 rear) and removing cover.

STARTER:—Model MAB-4075. Armature MAB-2113.

Drive—Inboard Barrel type Bendix No. A-1673.

Rotation—Counter-clokwise at commutator end.

Brush Spring Tension—42-53 ozs. (new brushes).

Cranking Engine—150 RPM., 120-125 amps., 5 volts.

Performance Data

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	3700	5.5	60
.6 "	1910	5.5	100
3.4 "	1100	5.0	200
6.6 "	695	4.5	300
10.15 "	420	4.0	400
15.8 "	Lock	3.0	582
22.5 "	Lock	4.0	775

NOTE—Lock torque figures correct without switch.

Removal:—Starter flange mounted on left front face of flywheel housing. To remove, take out flange mounting screws.

Starting Switch:—Type SS-4001. Magnetic solenoid type mounted on starter field frame. Controlled by pushbutton (R.B.M. Model 1815) on instrument panel. Operative only with ignition on (and clutch disengaged on cars with Electric Hand).

GENERATOR:—Mod GCJ-4804A-1. Armature GCJ-2006. Third brush control type. Ventilated by fan on drive pulley. Vibrating voltage regulator used on cars with radio only.

NOTE—On standard cars (without Voltage Regulator) field terminal on generator frame is grounded by ground cup assembled on terminal stud. This ground cap must be removed if regulator installed.

Maximum Charging Rate—16 amperes (cold), 12.4 amperes (hot) without regulator, 25 amperes (cold) 22 amperes (hot) with regulator.

Charging Rate Adjustment—Remove commutator cover band, shift third brush by hand, counter-clockwise to increase or clockwise to decrease charging rate. Third brush held in position by friction. Do not exceed maximum rate as given above. Actual charging rate, on cars with regulator, determined by regulator setting and dependent upon battery condition (see Regulator Section below).

Performance Data

Cold Without Regulator			Hot		
Amps.	Volts	R.P.M.	Amps.	Volts	R.P.M.
0	6.4	835	0	6.4	920
4	6.6	1025	4	6.9	1100
8	7.2	1225	8	7.4	1325
12	7.6	1460	12.4	8.0	2400
16	8.0	2250			

Performance Data

Cold Cars with Regulator			Hot		
Amps.	Volts	R.P.M.	Amps.	Volts	R.P.M.
0	6.4	760	0	6.4	850
4	6.65	920	4	6.7	1020
8	6.9	1080	8	7.0	1240
12	7.2	1240	12	7.3	1400
16	7.45	1400	16	7.6	1650
20	7.7	1580	20	7.9	2100
25	8.0	2500	22	8.0	2700

Rotation—Counter-clockwise at commutator end.

Brush Spring Tension—53 ozs. max. (new brushes).

Field Current—1.9-2.1 amperes at 6.0 volts.

Motoring Current—4.0-4.4 amperes at 6.0 volts.

Removal:—Generator pivot mounted at left front of engine. To remove, take out clamp bolt and pivot bolts.

Belt Adjustment:—Loosen pivot bolts and clamp bolt, swing generator out until total sideplay or deflection midway between generator and fan pulleys is ¾-1¼".

CUTOUT RELAY:—Model CBA-4003 (Std.). Mounted on the dash. Has extra set of ground contacts for Generator Charge Signal control. See Electrical Equipment Section for complete data.

Cuts In—6.75-7.5 volts.

Cuts Out—.5-2.5 ampere discharge current.

Contact Gap—.025-.035" with upper ground contacts closed (upper contacts must open when main contacts close).

Air Gap—.010-.030" with contacts closed.

REGULATOR:—Models VRD-4003A, B, Voltage Type. (Cars with Radio only). Consists of Cutout Relay and Vibrating Voltage Regulator in case on dash. Cutout Relay has extra set of contacts for Generator Charge Signal control.

See Article in Electrical Equipment Section.

NOTE—Regulator cover is sealed. Serviced on exchange basis if seals unbroken. Cover must be removed to make adjustments.

Cutout Relay

Cuts In—6.4-7.0 volts Cold.

Cuts Out—.5 ampere Min., 3.0 amperes Max. Cold.

Contact Gap—.015" minimum (with ground contacts closed—ground contacts must be open with main contacts closed).

Air Gap—.034" Min., .038" Max. with contacts open. Measure at hinge end of core.

Voltage Regulator

Setting (VRD-4003-A)—7.5-7.8 volts at 70°F. (Before #8R-000001), 7.35-7.65 volts at 70°F (After #8R-000001).

Setting (VRD-4003-B)—7.8-8.1 volts at 70°F (Before #8R-000001), 7.35-7.65 volts at 70°F (After #8R-000001).

See Electrical Equipment Section for complete settings and changes on these Regulator models.

To Check—Connect ammeter in charging line at 'B' terminal on regulator (use short heavy leads), connect voltmeter between regulator 'B' and 'GD' terminals. Operate generator, charging fully charged battery, at speed equivalent to 30 M.P.H. car speed until voltage is steady. Voltmeter reading should be within limits of 7.4-7.9 volts (VRD-4003-A before #8R-000001), 7.8-8.1 volts (VRD-4003-B before #8R-000001), 7.1-7.8 volts (all models after #8R-000001). If outside these limits, regulator is defective.

To Adjust—Change regulator armature spring tension by bending lower spring hanger. See Electrical Equipment Section for complete instructions.

Contact Gap—.010" Min., .020" Max. with armature against stop pin.

Air Gap—.0595-.0625" with contacts just opening.

LIGHTING:—Headlamps. Hall, pre-focused type. Lenses interchangeable. Aim headlamps straight ahead with top of beam 39" above floor level at 25' (car unloaded, upper beam lighted). Upper and lower beams controlled by foot selector switch with lighting switch in driving (right hand) position.

Switches

Lighting—R.B.M.

Foot Selector—R.B.M. No. 1076.

Dome Light—R.B.M. No. 1220.

Stop Light—R.B.M. No. 965.

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps	32-32	2331
Headlamps (export)	50-21	2520
Park, Instrument	1½	55
Signals, Service	1	51
Fender (Optl.) License	3	63
Stop-Tail	21-3	1158
Dome	15	87

SIGNAL LIGHTS:—Oil Pressure Indicator and Generator Charge Indicator mounted on instrument board. Similar to design used previously except that bulb lights up word 'Not' on dials. See article in Electrical Equipment Section.

FUSES:—Lighting—Two 20 ampere type on back of lighting switch.

HORNS:—Delco-Remy Klaxon, Model K16 Type 2010. Vibrator type. Current draw 6.5-8.5 amperes at 6.0 volts. **Air Gap**—.025-.029".

NOTE—See Terraplane Model 72 for optional horns.

NOTE:—Electric Hand (Bendix type Electro-pneumatic gear shift optional on all models.
See article in Mechanical Equipment Section for complete data.

SERIAL NUMBER:—First number 72-101. Stamped on plate on right front door hinge pillar above top hinge.

COMPRESSION:—Ratio—6.25-1 Standard cast-iron hd. 7.0-1 Optl. 'Super Power Dome' aluminum alloy head.
NOTE—High octane fuel must be used with this hd.
Pressure—Check presure by removing all spark plugs and cranking engine with throttle wide open.

Cylinder Head	Compression Pressure
6.25-1	103 lbs., 170 R.P.M.
7.0-1	119 lbs., 170 R.P.M.

VACUUM READING:—18-20" steady reading with engine idling at 350 R.P.M. or 6 M.P.H.

IGNITION:—Coil Model IG-4644. Service winding (coil less switch and cable) IG-3224-S.
Ignition Current—2.5 amperes idling, 4.5 stopped.
Ignition Switch:—Mitchellock Model 24-B, Type 7063. Connected to coil by armored cable.
Ignition Lock—Briggs & Stratton, Mitchell No. 6095. B. & S. #50184. **Key Series**—H601-H1100.
Distributor Model IGW-4013-A. Single breaker, 6 lobe cam, full automatic advance type.
Breaker Gap—Set at .020".
Cam Angle or Dwell—35° (closed), 25° (open).
Breaker Arm Spring Tension—16-20 ounces.
Condenser—No. IGB-1025-J. Capacity .20-.25 mfd.

Automatic Advance

Distributor Degrees	Distributor R.P.M.	Engine Degrees	Engine R.P.M.
Start	300	0	600
3	400	6	800
5	520	10	1040
10	1150	20	2300
14	1575	28	3150

Distributor Removal:—Mounted on right side of crankcase. To remove, take out hold-down screw in advance arm.

IGNITION TIMING:—Initial setting for all engines as shown. See Final Setting for adjustment dependent on Octane rating of fuel used.

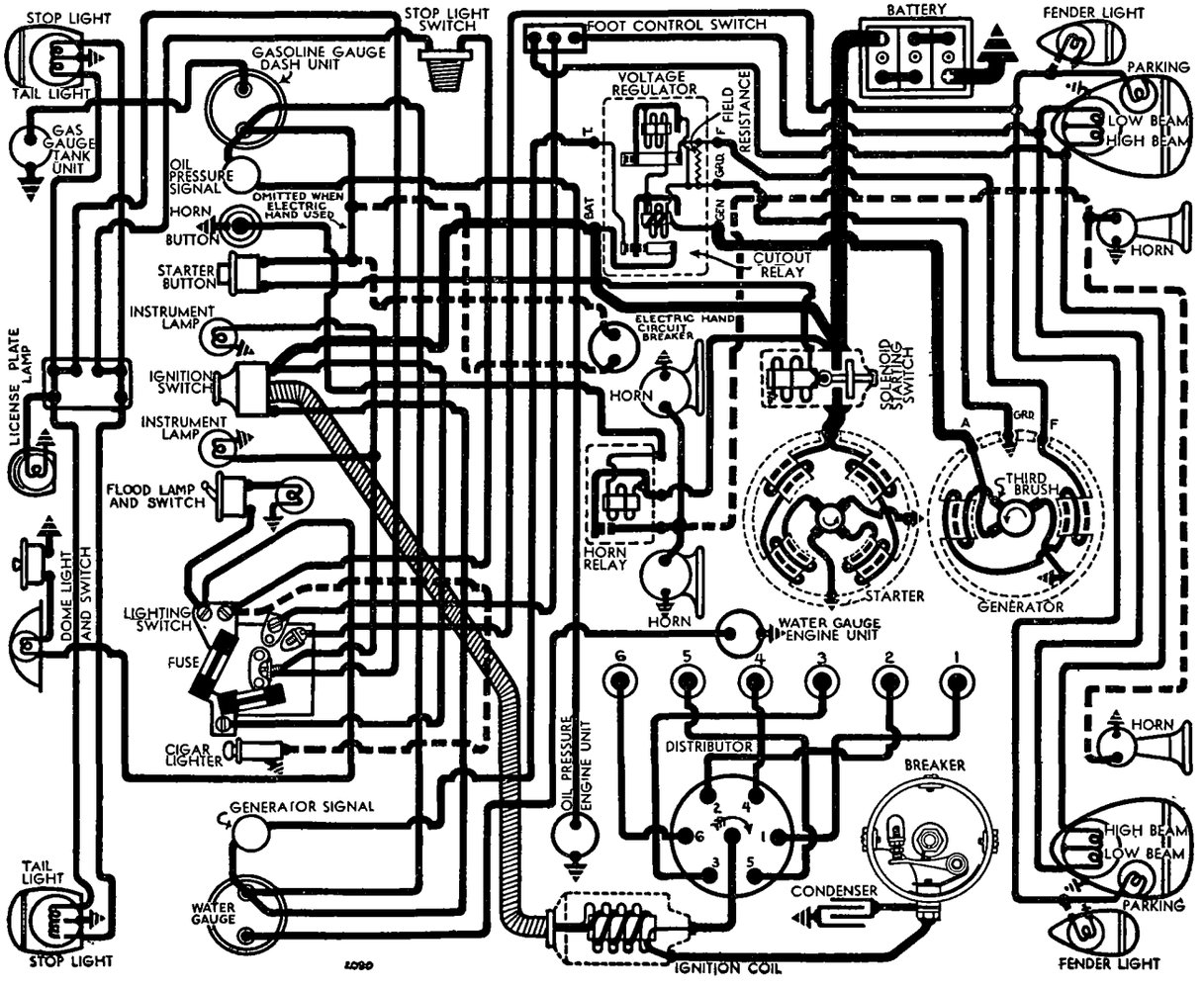
Flywheel Degrees	Piston Position
At TDC	.0000" TDC.

NOTE—High Octane fuel must be used in engines with 7.0-1 high compression aluminum head.
To Set Timing (Initial Setting)—With #1 piston on compression, crank engine over until flywheel mark 'UDC.1-6/' lines up with pointer in left front face of flywheel housing. Loosen hold-down screw in advance arm, rotate distributor clockwise to limit of slot, then slowly rotate distributor counter-clockwise until contacts begin to open, tighten hold-down screw.
Final Ignition Setting—Road test car and note performance when accelerating from 10-15 M.P.H. with wide open throttle on level road (engine must be warm). Slight spark knock should be evident. Adjust by loosening hold-down screw and rotating distributor one graduation on scale counter-clockwise (if no knock), clockwise (if knock too severe). Repeat test. Final setting must not be advanced beyond ¾" before 'UDC.1-6/' mark on flywheel.
Timing (Motor Gauge)—Weidenhoff Adapter #114, Rod #43.

Firing Order:—1-5-3-6-2-4. See diagram.

Spark Plugs:—Champion Type J-8 (Std. 6.25-1 head), H-10 (Optl. 7.0-1 head), 14 MM. Metric type.
Spark Plug Gaps—.025".

CARBURETION:—Carburetor—Carter, Mod. WDO Type 344-S. Duplex or dual downdraft type.
See Article in Carburetion Section.
Idle Adjustment—Engine must be warm so that fast idle and automatic choke control inoperative. Set throttle lever stopscrew so that idling speed is 6 M.P.H. Turn each idle adjusting screw, in succession, in until engine begins to miss, then slowly out until engine fires smoothly. Final setting should be ¼-¾ turn out from inner seated position and screws must be adjusted equally so that engine fires smoothly on all cylinders. Readjust throttle stopscrew if necessary.
Accelerating Pump Setting—Adjustable for minimum and maximum stroke. Requires partial dismantling of carburetor to change setting (see article in Carburetion Section for complete directions).
Fast Idle:—Integral with carburetor. See Carburetion Section for checking and adjusting directions.
Automatic Choke:—Carter Climatic Control mounted on carburetor. See article in Carburetion Equipment Section.
Air Cleaner:—AC. #1528161 (Std.), #1528160 (Cars with Electric Hand), oil-wetted type. Oil-bath type optional.
Fuel Pump:—AC. Type AK #1523289 diaphragm type std., Type AB #1523290 combination fuel-and-vacuum type optional. See article in Carburetion Equip. Section.
NOTE—**See 'AC Fuel Pump Servicing' in Carburetion Equipment Section for special pump gasket data.**
Gasoline Gauge:—King-Seeley Electric type. K-S No. 6190 (dash unit), 5835 (tank unit). See article in Carburetion Equipment Section.



VALVE TIMING:—To Check—Set tappet clearance #1 intake valve at .010". This valve should open with piston 10°40' or .0562" before top dead center when a point on the flywheel approximately 3.94 teeth before top dead center mark 'UDC.1-6/' lines up with indicator on left front face of flywheel housing. Reset tappet clearance at .006" hot.

Motor Gauge—Weidenhoff Adapter #114, Rod #43.

Tappet Clearance:—.006" Int., .008" Exh., hot.

Valve Spring Pressure:—44 lbs. at 2" (valve closed), 102 lbs. at 1 21/32" (valve open).

LUBRICATION:—Crankcase Capacity—5 qts. (refill).

Normal Oil Pressure—3 lbs. (no gauge).

Oil Pressure Signal—Used instead of pressure gauge. Controlled by oil pressure regulator valve. See article in Electrical Equipment Section.

BATTERY:—National, Type ST-317X. 6 volt, 17 plate, 96 ampere hour capacity (20 hour rate).

Starting Capacity—120 amperes for 20 minutes.

Zero Capacity—300 amperes for 3.2 minutes.

Grounded Terminal—Positive (+) terminal.

Location—In left front fender. Accessible from engine compartment by taking out 3 slotted screws in cover flange (2 top, 1 rear) and removing cover.

STARTER:—Model MAB-4075. Armature MAB-2113.

Drive—Inboard Barrel Type Bendix No. A-1673.

Rotation—Counter-clockwise at commutator end.

Brush Spring Tension—42-53 ozs. (new brushes).

Cranking Engine—150 R.P.M., 120-125 amps., 5 volts.

Performance Data

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	3700	5.5	60
.6 "	1910	5.5	100
3.4 "	1100	5.0	200
6.6 "	695	4.5	300
10.15 "	420	4.0	400
15.8 "	Lock	3.	582
22.5 "	Lock	4.	775

NOTE—Lock torque figures correct without switch.

Removal:—Starter flange mounted on left front face of flywheel housing. To remove, take out flange mounting screws.

Starting Switch:—Type SS-4001. Magnetic solenoid type mounted on starter. Controlled by pushbutton on instrument board (RBM Model 1815). Operative only with ignition on (and clutch disengaged on cars with Electric Hand).

Switch Specifications

Closes with terminal voltage of 4.0 volts or less. Remains closed until voltage drops to .75-2.0 volts. Current draw, 3 amperes at 6.0 volts.

GENERATOR:—Mod. GCJ-4803-A. Armature GCJ-2006. Third brush control type with external voltage regulation. Ventilated by fan on drive pulley.

Maximum Charging Rate—25 amperes (cold), 22 amperes (hot), 8.0 volts, 2500 R.P.M. Actual charging rate controlled by Voltage Regulator and dependent on battery condition.

Charging Rate Adjustment—Maximum output controlled by third brush. Do not adjust third brush for output greater than shown in table below (with field terminal grounded to render regulator inoperative). Actual charging rate controlled by regulator setting. See Regulator Section below.

Cold Performance Data			Hot Performance Data		
Amps.	Volts	R.P.M.	Amps.	Volts	R.P.M.
0	6.4	760	0	6.4	850
4	6.65	920	4	6.7	1020
8	6.9	1080	8	7.0	1240
12	7.2	1240	12	7.3	1400
16	7.45	1400	16	7.6	1650
20	7.7	1580	20	7.9	2100
25	8.0	2500	22	8.0	2700

Rotation—Counter-clockwise at commutator end.

Brush Spring Tension—53 ozs. max. (new brushes).

Field Current—1.9-2.1 amperes at 6.0 volts.

Motoring Current—4.0-4.4 amperes at 6 volts.

Removal:—Generator pivot mounted at left front of engine with fan belt drive. To remove, take out clamp bolt and two pivot bolts.

Belt Adjustment:—Loosen clamp bolt and pivot bolts, swing generator out until slack in belt midway between generator and fan pulleys is ¾-1¼" (measured from straightedge across pulleys).

REGULATOR:—Models VRD-4003A, B. Voltage Type. Consists of Cutout Relay and Vibrating Voltage Regulator in case on dash. Cutout Relay has extra set of contacts for generator charge signal control.

See Article in Electrical Equipment Section.

NOTE—Regulator case cover is sealed. Serviced on exchange basis if seals not broken. Cover must be removed to make adjustments.

Cutout Relay

Cuts In—6.4-7.0 volts Cold.

Cuts Out—.5 ampere Min., 3.0 amperes Max. Cold.

Contact Gap—.015" minimum (with ground contacts closed—ground contacts must be open with main contacts closed).

Air Gap—.034" Min., .038" Max. with contacts open. Measure at hinge end of core.

Voltage Regulator

Setting (VRD-4003-A)—7.5-7.8 volts at 70°F. (Before #8R-000001), 7.35-7.65 volts at 70°F (After #8R-000001).

Setting (VRD-4003-B)—7.8-8.1 volts at 70°F (Before #8R-000001), 7.35-7.65 volts at 70°F (After #8R-000001).

See Electrical Equipment Section for complete settings and changes on these Regulator models.

To Check—Connect ammeter in charging line at 'B' terminal on regulator (use short heavy leads), connect voltmeter between regulator 'B' and 'GD' terminals. Operate generator, charging fully charged battery, at speed equivalent to 30 M.P.H. car speed until voltage is steady. Voltmeter reading should be within limits of 7.4-7.9 volts (VRD-4003-A before #8R-000001), 7.8-8.1 volts (VRD-4003-B before #8R-000001), 7.1-7.8 volts (all models after #8R-000001). If outside these limits, regulator is defective.

To Adjust—Change regulator armature spring tension by bending lower spring hanger. See Electrical Equipment Section for complete instructions.

Contact Gap—.010" Min., .020" Max. with armature against stop pin.

Air Gap—.0595-.0625" with contacts just opening.

LIGHTING:—Headlamps—Hall, Pre-focused type. Lenses interchangeable. Aim headlamps straight ahead with top of beam 39" above floor level at 25' (car unloaded, upper beams lighted). Upper and lower beams controlled by foot selector switch with lighting switch in driving (right hand) position.

Switches

Lighting—R.B.M.

Foot Selector—R.B.M. No. 1076.

Dome Light—R.B.M. No. 1220

Stop Light—R.B.M. No. 965.

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps	32-32	2331
Headlamps (export)	50-21	2520
Park, Dash	1½	55
Dash Signal, Service	1	51
Fender (Optional)	3	63
Stop-Tail	21-3	1158
License Plate	3	63
Dome	15	87

SIGNAL LIGHTS:—Battery Charge Indicator and Oil Pressure Indicator mounted on instrument board. Similar to design used previously except that bulb lights up word 'Not' on dials. See article in Electrical Equipment Section for complete data.

FUSES:—Lighting—Two 20 ampere capacity on back of lighting switch.

HORNS:—Delco-Remy Model K-33-S Std., K-33-F Optl. Blended tone, twin horns operated by relay.

Horn	Current (6 volts)	Air Gap
K-33-S, 2051 (low note)	11-13 amps.	.042-.046"
K-33-S, 2052 (high note)	10-12 "	.032-.036"
K-33-F, 2117 (low note)	11-13 "	.040-.044"
K-33-F, 2118 (high note)	9-11 "	.032-.036"

Horn Relay Model 271-A:—Contacts close at 2.7-4.0 volts.

Contact Gap—.015-.030". **Air Gap**—.010-.025".

NOTE:—Electric Hand (Bendix type Electro-pneumatic gear shift) optional equipment.
See article in Mechanical Equipment Section.

SERIAL NUMBER:—First number 80101 (80), 88101 (88), 81101 (81). Stamped on plate on right front door hinge pillar post.

ENGINE NUMBER:—First number 80101 (80), 88101 (88), 81101 (81). On boss on left side of block near top front or on top of block between #1 and #2 exhaust manifold flanges.

COMPRESSION:—Ratio and pressure as follows:

Ratio	Compression Pressure
6.25-1 std. C. I. hd.....	.....103 lbs. @ 170 R.P.M.
7.0-1 Optl. Al hd.	119 lbs @ 170 R.P.M.

NOTE—7.0-1 aluminum head—Super Power Dome.

VACUUM READING:—Gauge should show steady reading of 18-21" with engine idling at 350 R.P.M. or 7 M P.H.

IGNITION:—Coil Model IG-4650. Service winding (coil less switch and cable) IG-3224JS.
Ignition Current—5-6 amperes stopped.
Ignition Switch:—Mitchellock Model 24-B, Type 7642.
Ignition Lock—Briggs & Stratton, Mitchell No. 6095.
Distributor Model IGW-4104A, IGW-4103A (Cars with radio). Single breaker, 6 lobe cam, full automatic advance type.
NOTE—Resistor unit used on IGW-4104A (mounted on distributor terminal connected in primary circuit). When voltage regulator is installed (for cars with radio), resistor should be removed or IGW-4103A type distributor installed.
Breaker Gap—Set at .020".
Cam Angle or Dwell—35° (closed), 25° (open).
Breaker Arm Spring Tension—16-20 ounces.
Rotation—Clockwise viewed from the top
Condenser—Part IGB-1025J. Capacity .20-.25 mfd.

Automatic Advance

Distributor		Engine	
Degrees	R.P.M.	Degrees	R.P.M.
Start	300	0	600
3	400	6	800
4	500	8	1000
9	1040	18	2080
14	1580	28	3160

Fuel Compensator—Provides manual adjustment at distributor for octane rating of fuel used. See Fuel Compensator Setting (following).
Distributor Removal:—Mounted on right side of crankcase. To remove, take out hold-down screw in advance arm.

IGNITION TIMING:—Initial Setting as shown. See Fuel Compensator Setting following.

	Flywheel Degrees	Piston Position
All engines	0° TDC.	.000" TDC.

NOTE—High octane fuel must be used in engines with 7.0-1 'Super Power Dome' head.
To Set Timing—With #1 piston on compression, turn engine over until flywheel mark 'UDC.1-6/', lines up with pointer in left front face of flywheel housing. Loosen hold-down screw in advance arm, rotate distributor clockwise to limit of slot, then slowly rotate distributor counter-clockwise until contacts begin to open, tighten hold-down screw.
To Set Timing (Using Synchroscope)—Car manufacturer recommends this method. Clip lead to #6 spark plug, fill in timing mark with white chalk and direct light on flywheel through hole in housing.
See article in Electrical Equipment Section.
Motor Gauge—Weidenhoff Adapter #114, Rod #44.
Fuel Compensator Setting—Road test car and note performance when accelerating from 10-15 M.P.H. with wide open throttle on level road (engine must be warm). Slight spark knock should be evident. Adjust by loosening hold-down screw and rotating distributor one graduation on scale counter-clockwise (if no knock), clockwise (if knock too severe). Repeat test. Final setting must not be advanced beyond ¾" before 'UDC.1-6/' mark on flywheel.

Firing Order:—1-5-3-6-2-4. See diagram.

Spark Plugs:—Champion Type J-8A (std. 6.25-1 head), H-10 (optl. 7.0-1 head). 14 MM. Metric type.
Spark Plug Gap—Set at .032".

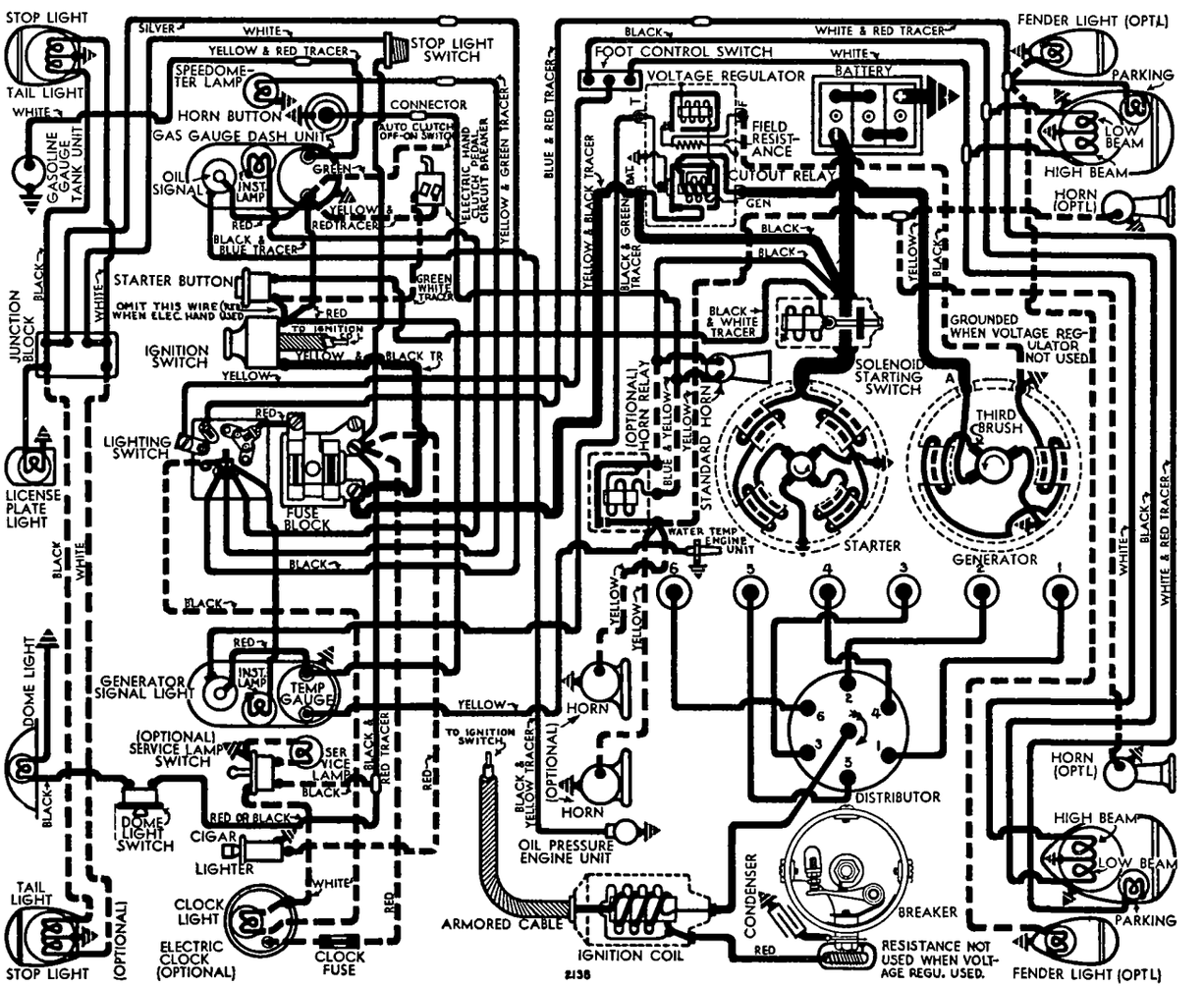
CARBURETION:—Carburetor—Carter Model W1, Type 397-S. 1¼" single barrel downdraft, vacumeter type.
See article in Carburetor Section for data.
Idle Adjustment—Engine must be warm so that choke valve is wide open and throttle cracker inoperative. Set throttle lever stopscrew to idle engine at 7 M P.H. Turn idle adjusting screw in until engine begins to miss, then out until engine begins to roll, finally turn screw in slowly until engine fires smoothly. Final setting should be ¼-1 turn open from inner seated position. Readjust throttle stopscrew for correct idling speed.
Accelerating Pump Setting—Pump lever (under dust cover at top of carburetor) has three holes for pump link engagement. Set as follows:
Lower Hole (medium stroke)—Normal setting.
Inner Hole (min. stroke)—Hot temp., hi-test fuel.
Outer Hole (max. stroke)—Cold temp., low-test fuel.

Throttle Cracker:—With choke valve closed, throttle opening should be .036-.040".

Air Cleaner—AC. #1528159 (std.), #1528158 (with Electric Hand) oil-wetted type. United (oil-bath type) optional.

Fuel Pump:—AC. Type AK #1523289 (LHD), #1523313 (RHD), diaphragm type, standard. Type AB #1523290 (LHD), #1523314 (RHD), combination fuel-and-vacuum pump optional.
See article in Carburetion Equipment Section.

Gasoline Gauge:—King-Seeley Electric type. K-S No. 6783 (dash unit), No. 5835 (tank unit).
See article in Carburetion Equipment Section.



MANIFOLD HEAT CONTROL:—Manual adjustment type located at center of exhaust manifold behind carburetor. Setting should be changed for seasonal requirements.

Setting—To adjust, loosen nuts on strut bar on face of valve cover, turn cover so that pointer is in line with 'W' mark on manifold (Winter temperatures), straight up (Normal Summer temperatures), toward front in line with 'S' mark (Extremely hot temperatures).

VALVE TIMING:—To Check—Set tappet clearance #1 intake valve at .010". This valve should open with piston 10° 40' or .0562" before top dead center when a point on the flywheel approximately 3.94 teeth before top dead center mark 'UDC.1-6/' lines up with indicator on left front face of flywheel housing. Reset tappet clearance at .006" hot.

Motor Gauge—Weidenhoff Adapter #114. Rod #44.

Tappet Clearance:—.006" Int., .008" Exh., Hot.

Valve Spring Pressure—44 lbs. at 2" (valve closed), 102 lbs. at 1 21/32" (valve open).

LUBRICATION:—Crankcase Capacity—6 quarts (dry), 5 quarts (refill).

Normal Oil Pressure—3 lbs. (no gauge).

Oil Pressure Signal—Used instead of pressure gauge. Controlled by oil pressure regulator valve.

See article in Electrical Equipment Section.

BATTERY:—National, Type HT-17 (Original equipment), L-17-1F (Replacement). 6 volt, 17 plate, 100 ampere hour capacity (20 hour rate).

Starting Capacity—120 amperes for 20 minutes.

Zero Capacity—300 amperes for 3.5 minutes.

Grounded Terminal—Positive (+) terminal. Grounded to left front fender support bracket. Engine grounded to frame by ground strap at bell housing.

Dimensions—Length 10 9/16". Width 7¼". Height 7 15/16".

Location—In left front fender under hood. Accessible from engine compartment by taking out 3 slotted screws in cover flange (2 top, 1 rear) and removing cover.

STARTER:—Model MAB-4075. Armature MAB-2113.

Drive—Inboard Barrel Type Bendix No. A-1673.

Rotation—Counter-clockwise at commutator end.

Brush Spring Tension—42-53 ozs. (new brushes).

Cranking Engine—150 RPM., 120-125 amperes, 5 v.

Performance Data

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	3700	5.5	60
.6 "	1910	5.5	100
3.4 "	1100	5.0	200
6.6 "	695	4.5	300
10.15 "	420	4.0	400
15.8 "	Lock	3.	582
22.5 "	Lock	4.	775

NOTE—Lock torque figures correct without switch.

Removal:—Starter flange mounted on left front face of flywheel housing. To remove, take out flange mounting screws.

Starting Switch:—Type SS-4001. Magnetic solenoid type mounted on starter. Controlled by pushbutton on instrument board (RBM Model 1815). Operative only with ignition on (and clutch disengaged on cars with Electric Hand).

Switch Specifications

Closes with terminal voltage of 4.0 volts or less. Remains closed until voltage drops to .75-2.0 volts. Current draw, 3 amperes at 6.0 volts.

GENERATOR:—Model GDF-4803A-1. Armature GDF-2006. Third brush control type. Ventilated by fan on drive pulley. Vibrating voltage regulator used on cars with radio only.

NOTE—Generator field terminal grounded by ground cup assembled on terminal stud (on cars without regulator). This cup must be removed when regulator installed.

Maximum Charging Rate—16-18 amperes (hot), 17-19 amperes (cold) without regulator. 26.5-29.5 amperes (hot), 29-32 amperes (cold) with regulator. Use test meter connected to battery terminal on regulator.

Charging Rate Adjustment—Remove commutator cover band, shift third brush by hand, counter-clockwise to increase, clockwise to decrease charging rate. Third brush held in position by friction. Do not exceed maximum rate given above. On cars with regulator, actual charging rate determined by regulator setting and dependent upon battery condition (see Regulator).

NOTE—Standard 3rd brush setting 3¾-4 (without regulator), 2⅛ (with regulator) commutator bars from insulated (nearest) main brush.

Performance Data—without Regulator

Cold			Hot		
Amperes	Volts	R.P.M.	Amperes	Volts	R.P.M.
0	6.4	860	0	6.4	1020
4	6.75	1200	4	6.8	1260
8	7.1	1450	8	7.15	1500
12	7.45	1680	12	7.55	1740
16	7.8	2020	16	7.9	2240
18	8.0	2800	17	8.0	2800

Performance Data—with Regulator

0	6.4	920	0	6.4	1000
4	6.6	1030	4	6.6	1140
8	6.8	1140	8	6.85	1280
12	7.0	1300	12	7.1	1440
16	7.25	1460	16	7.3	1640
20	7.45	1650	20	7.55	1840
24	7.65	1880	24	7.75	2220
28	7.9	2220	28.3	8.0	3200
32	8.0	3100			

Rotation—Counter-clockwise at commutator end.

Brush Spring Tension—53 ozs. max. (new brushes).

Field Current—1.90-2.10 amperes at 6.0 volts.

Motoring Current—4.6-5.2 amperes (without regulator), 5.3-5.9 (with regulator) at 6 volts.

Removal:—Generator pivot mounted at left front of engine with fan belt drive. To remove, take out clamp and pivot bolts.

Belt Adjustment:—Loosen clamp and pivot bolts, swing generator out until slack in belt midway between generator and fan pulleys is ¾" (measured with straightedge across pulleys).

CUTOUT RELAY (CARS WITHOUT RADIO):—Model CBA-4003. Mounted on engine side of dash. Relay has extra set of contacts for Teleflash Generator Charging Indicator.

See article in Electrical Equipment Section.

Cuts In—6.75-7.5 volts. Approx. 10 M.P.H.

Cuts Out—.5-2.5 ampere discharge current.

Contact Gap—.025-.035" with upper ground contacts closed (upper contacts must open when main contacts close).

Air Gap—.010-.030" with contacts closed.

REGULATOR (CARS WITH RADIO):—Model VRD-4008A. Voltage Type. Consists of Cutout Relay and vibrating Voltage Regulator in case on dash. Cutout Relay has extra set of contacts for Teleflash Generator Charging Indicator.

NOTE—See distributor and generator notes for changes to be made when this unit installed in field.

See article in Electrical Equipment Section.

NOTE—Regulator case cover is sealed. Serviced on exchange basis if seals not broken.

Cutout Relay

Cuts In—6.4-7.0 volts Cold. Approx. 10 M.P.H.

Cuts Out—.5 ampere min., 3.0 amperes max. cold.

Contact Gap—.015" minimum (with ground contacts closed—ground contacts must be open with main contacts closed).

Air Gap—.034" min., .038" max. with contacts open. Measure at hinge end of core.

Voltage Regulator

Setting—7.35-7.65 volts at 70°F. (after 15 minutes operation charging at 10 amperes).

To Check (without breaking seal)—Connect ammeter in charging line at 'BAT' terminal on regulator, connect voltmeter between 'BAT' terminal and ground. Operate generator at speed equivalent to 30 MPH., charging fully charged battery until voltage is constant. Voltmeter reading should be within 7.1-7.8 volts (high limit cold, low limit hot). If outside these limits regulator is defective.

To Adjust (with cover removed)—Change regulator armature spring tension slightly by bending lower spring hanger. Check setting as directed above. See Electrical Equipment Section for complete directions.

Contact Gap—.010-.020" (armature against stop).

Air Gap—.0595-.0625" with contacts just opening.

LIGHTING:—Headlamps—Hall, pre-focused type with interchangeable lenses. Upper and lower beams (lower beam deflected slightly to right) controlled by foot selector switch with lighting switch in driving (right hand) position.

Headlamp Adjustment—Aim headlamps straight ahead with top of beam 35¼" above floor level at 25' (car unloaded, upper beams lighted). Headlamps aimed by means of two screws on underside of headlamp body. Vertical movement obtained by turning both screws equally in or out, horizontal movement by turning one screw in until half desired movement obtained and completing movement by turning opposite screw out an equal amount.

Switches

Lighting—R.B.M. #1725.

Beam Selector—R.B.M. #1076.

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps	32-32	2331
Headlamps (export)	21-50	2520D
Park, Instrument, Service	1½	55
License, Fender	3	63
Stop-Tail	21-3	1158
Dash Signals	1	51
Dome	15	87

SIGNAL LIGHTS:—Teleflash Generator Charging Indicator and Oil Pressure Indicator mounted on instrument panel.

See article in Electrical Equipment Section.

FUSES:—Lighting—Two 20 ampere capacity mounted on fuse block on lower flange of instrument panel on left side.

HORNS:—Single horn standard. Sparton twin horns with R.B.M. relay (optl.—dash mounted).

Klaxon Model K-33-F—Type 2117 (left—low note), 2118 (right—high note), twin horns, blended tone with Delco-Remy horn relay (optional—outside mounting).

NOTE—Data below for Delco-Remy equipment.

Horn Type	Current at 6 volts	Air Gap
2117 (low note)	11-13	.040-.044"
2118 (high note)	9-11	.032-.036'

Horn Relay:—Model 271-A (with Klaxon horns' Contacts close 2.7-4.0 volts.

Contact Gap—.020". **Air Gap**—.015".

NOTE—R.B.M. #780 relay also used.

NOTE:—Electric Hand (Bendix type Electro-pneumatic gear shift) optional equipment.
See article in Mechanical Equipment Section.

SERIAL NUMBER:—First number 82101. On plate on right front door hinge pillar post.

ENGINE NUMBER:—First number 82101. On boss on left side of block near top front or on top of block between #1 and #2 exhaust manifold flanges.

COMPRESSION:—Ratio and pressures as follows:

Ratio	Compression Pressure
6.25-1 std. CI. hd.	103 lbs. @ 170 R.P.M.
7.0-1 Optl. Al. hd.	119 lbs. @ 170 R.P.M.

NOTE—7.0-1 aluminum head—Super Power Dome.

VACUUM READING:—Gauge should show steady reading of 18-21" with engine idling at 350 R.P.M. or 6 M.P.H.

IGNITION:—**Coil Model IG-4650.** Service winding (coil less switch and cable) IG-3224JS. On dash.
Ignition Current—5-6 amperes (stopped).

Ignition Switch:—Mitchellock Model 24-B, Type 7642. Connected to coil by armored cable.
Ignition Lock—Briggs & Stratton, Mitchell No. 6095.

Distributor Model IGW-4103A. Single breaker, 6 lobe cam, full automatic advance type.
Breaker Gap—Set at .020".
Cam Angle or Dwell—35° (closed), 25° (open).
Breaker Arm Spring Tension—16-20 ounces.
Rotation—Clockwise viewed from the top.
Condenser—Part No. IGB-1025J. Capacity .20-.25 mfds.

Automatic Advance

Distributor Degrees	R.P.M.	Engine Degrees	R.P.M.
Start	300	0	600
3	400	6	800
4	500	8	1000
9	1040	18	2080
14	1580	28	3160

Fuel Compensator—Provides manual adjustment at distributor for octane rating of fuel used. See Fuel Compensator Setting (following).

Distributor Removal:—Mounted on right side of crankcase. To remove, take out hold-down screw in advance arm.

IGNITION TIMING:—Initial Setting as shown. See Fuel Compensator Setting following.

	Flywheel Degrees	Piston Position
All engines	0° TDC	.000" TDC.

NOTE—High octane fuel must be used in engines with 7.0-1 'Super Power Dome' head.

To Set Timing—With #1 piston on compression, turn engine over until flywheel mark 'UDC.1-6/', lines up with pointer in left front face of flywheel housing. Loosen hold-down screw in advance arm, rotate distributor clockwise to limit of slot, then slowly rotate distributor counter-clockwise until contacts begin to open, tighten hold-down screw.

To Set Timing (Using Synchroscope)—Car manufacturer recommends this method. Clip lead to #6 spark plug, fill in timing mark with white chalk and direct light on flywheel through hole in housing.
See article in Electrical Equipment Section.

Motor Gauge—Weldenhoff Adapter #114, Rod #44.

Fuel Compensator Setting—Road test car and note performance when accelerating from 10-15 M.P.H. with wide open throttle on level road (engine must be warm). Slight spark knock should be evident. Adjust by loosening hold-down screw and rotating distributor one graduation on scale counter-clockwise (if no knock), clockwise (if knock too severe). Repeat test. Final setting must not be advanced beyond ¾" before 'UDC.1-6/' mark on flywheel.

Firing Order:—1-5-3-6-2-4. See diagram.

Spark Plugs:—Champion Type J-8A (std. 6.25-1 hd.), H-10 (optl. 7.0-1 hd.). 14 MM. Metric type.
Spark Plug Gap—Set to .032".

CARBURETION:—**Carburetor**—Carter Model 402-S. 1" dual downdraft type.
See article in Carburetor Section.

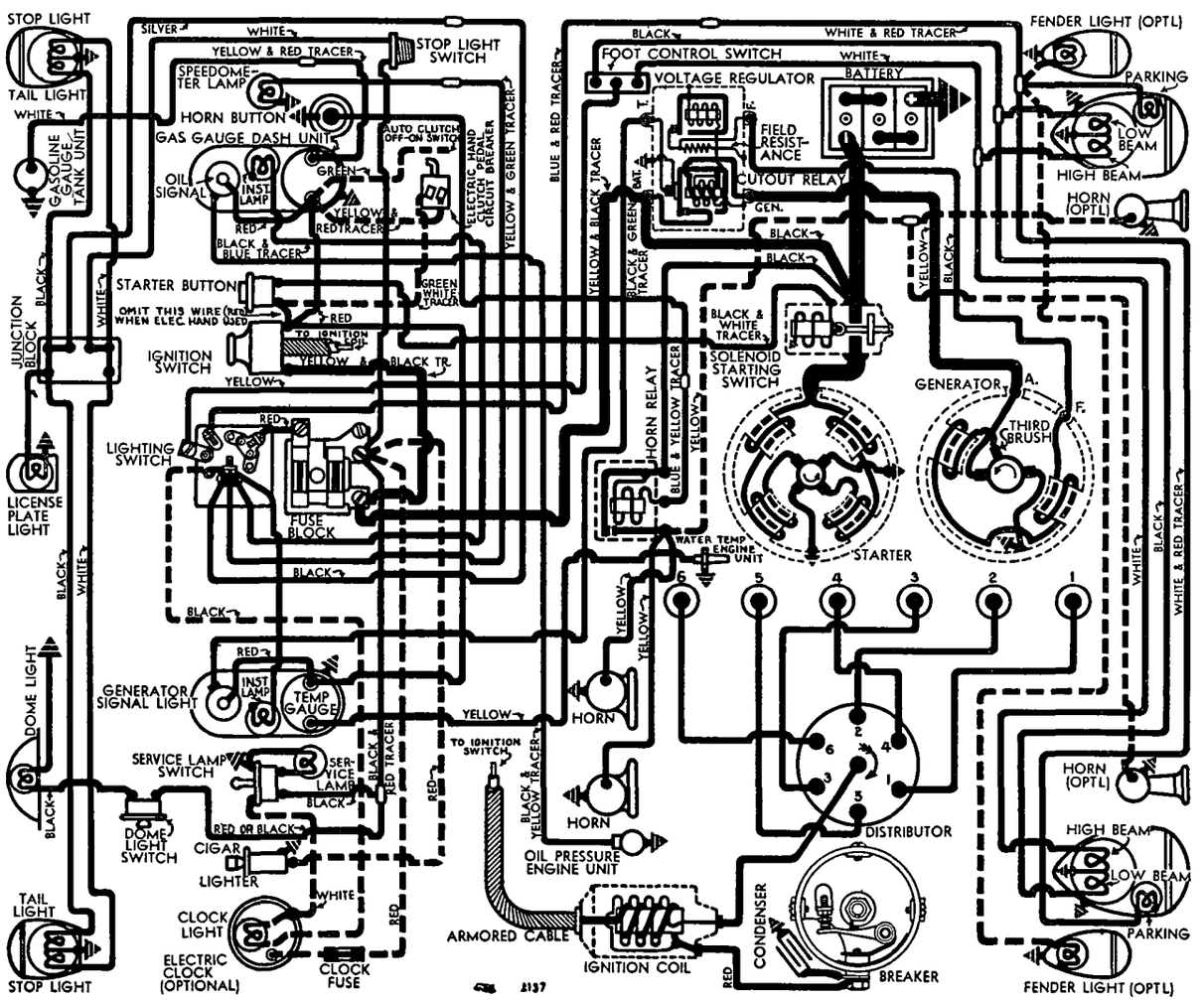
Idle Adjustment—Engine must be warm so that fast idle and automatic choke control inoperative. Set throttle lever stopscrew so that idling speed is 6 M.P.H. Turn each idle adjusting screw, in succession, in until engine begins to miss, then slowly out until engine fires smoothly. Final setting should be ¼-¾ turn out from inner seated position and screws must be adjusted equally so that engine fires smoothly on all cylinders. Readjust throttle stopscrew if necessary.

Accelerating Pump Setting—Adjustable for minimum and maximum stroke as follows:
Short stroke (inner hole)—Hot temperatures.
Long stroke (outer hole)—Cold temperatures.

Fast Idle:—Three step type cam used.
See article in Carburetion Equipment Section.

Air Cleaner:—AC. #1528161 (std.), #1528160 (with Electric Hand) oil-wetted type. United (oil-bath type) optional.

Fuel Pump:—AC. Type AK #1523289 (LHD), #1523313 (RHD), diaphragm type, standard. Type AB #1523290 (LHD), #1523314 (RHD), combination fuel-and-vacuum pump optional.
See article in Carburetion Equipment Section.



Gasoline Gauge:—King-Seeley Electric type. K-S No. 6756 (dash unit), No. 5835 (tank unit).

See article in Carburetion Equipment Section.

MANIFOLD HEAT CONTROL:—Thermostatic coil type (located within exhaust manifold housing behind carburetor). No adjustment required.

VALVE TIMING:—To Check—Set tappet clearance #1 intake valve at .010". This valve should open with piston 10°40' or .0562" before top dead center when a point on the flywheel approximately 3.94 teeth before top dead center mark 'UDC.1-6/' lines up with indicator on left front face of flywheel housing. Reset tappet clearance at .006" hot.

Motor Gauge—Weidenhoff Adapter #114, Rod #44.

Tappet Clearance:—.006" Int., .008" Exh., Hot.

Valve Spring Pressure—44 lbs. at 2" (valve closed), 102 lbs. at 1 21/32" (valve open).

LUBRICATION:—Crankcase Capacity—6 quarts (dry), 5 quarts (refill).

Normal Oil Pressure—3 lbs. (no gauge).

Oil Pressure Signal—Used instead of pressure gauge. Controlled by oil pressure regulator valve.

See article in Electrical Equipment Section.

BATTERY:—National, Type HT-17 (Original equipment), L-17-1F (Replacement). 6 volt, 17 plate, 100 ampere hour capacity (20 hr. rate).

Starting Capacity—120 amperes for 20 minutes.

Zero Capacity—300 amperes for 3.5 minutes.

Grounded Terminal—Positive (+) terminal. Grounded to left front fender support bracket. Engine grounded to frame by ground strap at bell housing.

Dimensions—Length 10 9/16". Width 7¼". Height 7 15/16".

Location—In left front fender under hood. Accessible from engine compartment by taking out 3 slotted screws in cover flange (2 top, 1 rear) and removing cover.

STARTER:—Model MAB-4075. Armature MAB-2113.

Drive—Inboard Barrel Type Bendix No. A-1673.

Rotation—Counter-clockwise at commutator end.

Brush Spring Tension—42-53 ozs. (new brushes).

Cranking Engine—150 RPM., 120-125 amperes, 5 v.

Performance Data

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	3700	5.5	60
.6 "	1910	5.5	100
3.4 "	1100	5.0	200
6.6 "	695	4.5	300
10.15 "	420	4.0	400
15.8 "	Lock	3.	582
22.5 "	Lock	4.	775

NOTE—Lock torque figures correct without switch.

Removal:—Starter flange mounted on left front face of flywheel housing. To remove, take out flange mounting screws.

Starting Switch:—Type SS-4001. Magnetic solenoid type mounted on starter. Controlled by pushbutton on instrument board (RBM Model 1815). Operative only with ignition on (and clutch disengaged on cars with Electric Hand).

Switch Specifications

Closes with terminal voltage of 4.0 volts or less. Remains closed until voltage drops to .75-2.0 volts. Current draw, 3 amperes at 6.0 volts.

GENERATOR:—Model GDF-4802A. Armature No. GDF-2006. Third brush control type with external voltage regulation. Ventilated by fan on drive pulley.

Maximum Charging Rate—32.0 amperes (cold), 29.5 amperes (hot), 8.0 volts, 3100 R.P.M., 30-35 M.P.H. Actual charging rate controlled by Voltage Regulator and dependent on battery condition.

Charging Rate Adjustment—Maximum output controlled by third brush. Do not adjust third brush for out put greater than shown in table below (with field terminal grounded to render regulator inoperative). See Regulator Section below.

NOTE—Standard third brush setting 2⅛ commutator bars from nearest main brush.

Performance Data

Cold			Hot		
Amperes	Volts	R.P.M.	Amperes	Volts	R.P.M.
0	6.4	920	0	6.4	1000
4	6.6	1030	4	6.6	1140
8	6.8	1140	8	6.85	1280
12	7.0	1300	12	7.1	1440
16	7.25	1460	16	7.3	1640
20	7.45	1650	20	7.55	1840
24	7.65	1880	24	7.75	2220
28	7.9	2220	28.2	8.0	3200
32	8.0	3100			

Rotation—Counter-clockwise at commutator end.

Brush Spring Tension—53 ozs. max. (new brushes).

Field Current—1.90-2.10 amperes at 6.0 volts.

Motoring Current—4.6-5.2 amperes at 6.0 volts.

Removal:—Generator pivot mounted at left front of engine with fan belt drive. To remove, take out clamp bolt and two pivot bolts.

Belt Adjustment:—Loosen clamp bolt and pivot bolts, swing generator out until slack in belt midway between generator and fan pulleys is ¾-1¼" (measured with straightedge across pulleys).

REGULATOR:—Model VRD-4008A. Voltage Type. Consists of Cutout Relay and Vibrating Voltage Regulator in case on dash. Cutout Relay has extra set of contacts for generator charge signal control.

See article in Electrical Equipment Section.

NOTE—Regulator case cover is sealed. Serviced on exchange basis if seals not broken. Cover must be removed to make adjustments.

Cutout Relay

Cuts In—6.4-7.0 volts Cold. Approx. 10 M.P.H.

Cuts Out—.5 ampere Min., 3.0 amperes Max. Cold.

Contact Gap—.015" minimum (with ground contacts closed—ground contacts must be open with main contacts closed).

Air Gap—.034" Min., .038" Max. with contacts open. Measure at hinge end of core.

Voltage Regulator

Setting—7.35-7.65 volts at 70° F. (after 15 minutes operation charging at 10 amperes).

To Check (without breaking seal)—Connect ammeter in charging line at 'BAT' terminal on regulator, connect voltmeter between 'BAT' terminal and ground. Operate generator at speed equivalent to 30 M.P.H., charging fully charged battery until voltage is constant. Voltmeter reading should be within 7.1-7.8 volts (high limit cold, low limit hot). If outside these limits regulator is defective.

To Adjust (with cover removed)—Change regulator armature spring tension slightly by bending lower spring hanger. Check setting as directed above. See Electrical Equipment Section for complete directions.

Contact Gap—.010" Min., .020" Max. with armature against stop pin.

Air Gap—.0595-.0625" with contacts just opening.

LIGHTING:—Headlamps—Hall, pre-focused type with interchangeable lenses. Upper and lower beams (lower beam deflected slightly to right) controlled by foot selector switch with lighting switch in driving (right hand) position.

Headlamp Adjustment—Aim headlamps straight ahead with top of beam 35¼" above floor level at 25' (car unloaded, upper beams lighted). Headlamps aimed by means of two screws on underside of headlamp body. Vertical movement obtained by turning both screws equally in or out, horizontal movement by turning one screw in until half desired movement obtained and completing movement by turning opposite screw out an equal amount.

Switches

Lighting—R.B.M. #1725.

Beam Selector—R.B.M. #1076.

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps	32-32	2331
Headlamps (export)	21-50	2520D
Park, Instrument, Service	1½	55
License, Fender	3	63
Stop-Tail	21-3	1158
Dash Signals	1	51
Dome	15	87

SIGNAL LIGHTS:—Teleflash Generator Charging Indicator and Oil Pressure Indicator mounted on Instrument panel.

See article in Electrical Equipment Section.

FUSES:—Lighting—Two 20 ampere capacity mounted on fuse block on lower flange of instrument panel on left side.

HORNS:—Sparton—Twin horns with R.B.M. #780 horn relay (standard dash mounted horns).

Klaxon Model K-33-F—Type 2117 (left—low note) 2118 (right—high note), twin horns, blended tone with Delco-Remy horn relay (optional—outside mounting).

NOTE—Data below for Delco-Remy equipment.

Horn Type	Current at 6 volts	Air Gap
2117 (low note)	11-13	.040-.044"
2118 (high note)	9-11	.032-.036"

Horn Relay:—Model 271-A (with Klaxon horns). Contacts close 2.7-4.0 volts.

Contact Gap—.020". **Air Gap**—.015".

CAR SERIAL NUMBER:—Stamped on plate on left hand frame side rail in front of left front spring rear shackle and on plate under driver's seat cushion. First number 1001 (6-90), 14,201 (6-90A).

ENGINE NUMBER:—Stamped on left hand upper front of engine block.

ENGINE:—Six cylinder, 'L' head type, 3¼x3⅞" bore and stroke, 193 cubic inch displacement, rated at 25.35 H.P., develops 65 H.P. at 3400 R.P.M. Standard compression ratio—5.26-1.

BATTERY:—U.S.L., Type XY-13X-7A, 6 volt, 13 plate, 87.5 ampere hour capacity (5 ampere rate). Starting capacity 102 amperes for 20 minutes.

Grounded Terminal:—Negative (—) terminal grounded to frame.

Mounting:—On left hand frame side rail under front floor boards.

Dimensions:—Width, 7¼". Length, 9". Height, 8⅝".

IGNITION:—Coil Model IG-4305 (Std.), IG-4602 (Clsd. Cars), IG-4502 (Sport Rdstr.), IG-4501 (Std. Rdstr.). IG-4035, 4501, 4502 are coil lock types mounted on back of instrument board (switch in base). IG-4602 mounted on dash and connected to special Mitchellock by armored cable (see Electrical Equipment Section for Mitchellock data).

Ignition Current:—1½ amperes at 6 volts (engine running), 3.4-5 amperes at 6 volts (engine stopped).

Distributor Model IGB-4032. Single breaker arm, 6 lobe cam, semi-automatic advance type. Manual advance controlled by button on dash. Distributor is retarded by pulling out button for hand cranking or heavy pulling. Pushing button in toward dash advances distributor 20° (engine).

Breaker Gap:—Set contact at .018". Hold within limits of .018-.020".

Breaker Arm Spring Tension:—16-22 ounces (measured at tip of breaker arm with spring scale centered on arm and at right angles to breaker arm.

Cam Angles—Closed 34°. Open 26° (distributor degrees).

Automatic Advance

Degrees	Distributor	R.P.M.	Degrees	Engine	R.P.M.
Start		300	0		600
3		640	6		1280
6		1010	12		2040
9		1350	18		2700
11		1600	22		3200

Mounting:—Distributor mounted at left center of engine and driven by an inclined shaft from the camshaft. To remove, disconnect primary lead, disconnect manual spark control, take off distributor cap, take out hold-down screw in advance arm, lift out.

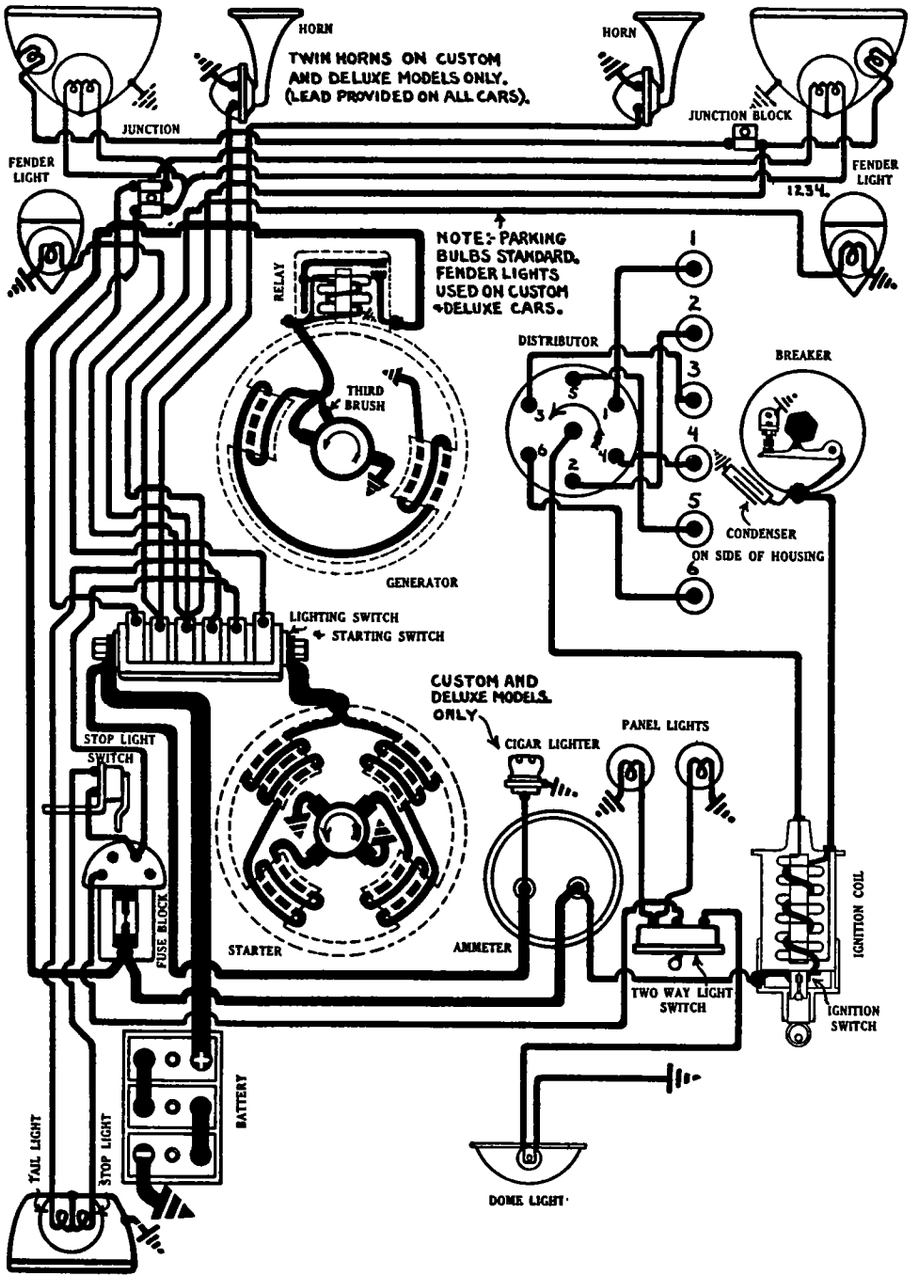
Oiling:—250 Miles. Put 6 drops SAE. #20 engine oil in oiler on side of shaft. Take off distributor cap and rotor, put 6 drops oil in wick oiler in center of shaft.

5000 Miles. Apply thin film vaseline to face of breaker cam.

IGNITION TIMING:—Standard Setting—top dead center with manual control advanced.

To Set Ignition Timing:—Take off cover plate over inspection hole in left hand front face of flywheel housing, advance manual spark control (push button in toward dash), see that distributor is rotated clockwise to end of advance arm slot. With No. 1 piston on compression turn engine over until piston reaches top dead center with flywheel mark '1-6 CYL./IGN.TC' directly opposite indicator on housing, loosen advance arm clam bolt, rotate distributor until contacts begin to open, tighten clamp bolt, see that rotor is opposite No. 1 terminal in distribuor cap (see diatgram), connect spark plugs as indicated.

Note on Cars with Startix:—The Electrolock ignition switch used on all cars with Startix automatic starting switch has two 'On' positions. The first 'On' position (approximately ⅛ turn from the vertical 'Off' position) turns on ignition and gasoline gauge circuit but does not connect Startix. This switch position should be used in checking ignition to avoid automatic



cranking. The second 'On' position (approximately ¼ turn of switch key) is the normal operating position of the switch with Startix operative.

Firing Order:—1-5-3-6-2-4. No. 1 cylinder nearest radiator.

Spark Plugs:—18 MM. Metric. Champion Type C-7. Set spark plug gaps at .027".

VALVE TIMING:—Camshaft Setting:—Camshaft at right of engine is driven from crankshaft by two-sprocket non-adjustable chain drive. Sprockets are marked. Mesh chain with sprockets turned so that punch marks are adjacent and in line with straightedge across shaft centers. With correct setting, mark on rim of camshaft sprocket should be in line with mark on edge of front engine support with piston No. 1 on top dead center and flywheel mark 'IGN.TC./CYL.1-6' at indicator.

To Check Valve Timing:—Set tappet clearance No. 1 intake valve at .008", No. 1 exhaust valve at .009" (cold). With No. 6 piston on compression turn engine over until flywheel mark 'IO/' is opposite pointed screw on edge of inspection hole in left front face of flywheel housing. No. 1 intake valve should begin to open at this point. Turn engine over 5° to point where flywheel mark 'EC./' registers with pointer. No. 1 exhaust valve should close at this point. Reset tappet clearance at .004" (intake), .006" (exhaust) with engine hot.

Valve Specifications

Valve	Head Diameter	Stem Diameter	Seat Angle	Lift
Intake	1⅝"	.372"	45°	5/16"
Exhaust	1 15/32"	.371"	45°	5/16"

Tappet Clearance (Operating Timing)		Valve Springs	
Intake	.004" (hot) .008" (cold)	Closed	46 pounds—2¼"
Exhaust	.006" (hot) .009" (cold)	Open	85½ pounds—1 15/16"

Timing

Intake Valve	Exhaust Valves
Open—7° before top dead center.	Open—49° before lower dead center.
Close—39° after lower dead center.	Close—2° before top dead center.

CARBURETION:—Tillotson Updraft Carburetor, Model J1B. See Carburetor Section for complete data. Intake manifold heat control automatic.

Fuel Pump:—A.C. Mechanical Fuel Pump mounted on right side of crankcase (see Carburetion Section for complete data). Remove glass sediment bowl when necessary, empty water and sediment, clean filter screen (located above bowl) before reassembling.

Gasoline Gauge:—K-S Telegauge hydrostatic type gauge (see Carburetion Section).

STARTER:—Model MZ-4030 (Custom and Sport Models), (MZ-4024 Standard Models). Starter drive—inboard Bendix with Startix automatic starting switch on Custom models and Pines 'Finger Tip Control' switch on Standard models. See Equipment Section for complete data on Startix and Pines switches. Rotation counter-clockwise at commutator end. Brush spring tension 44-56 ounces.

Starter Data

Torque	R.P.M.	Volts	Amperes
0 lb. ft.	4902	5.5	47 (with Bendix)
.65 "	2500	5.5	100
2.55 "	1325	5.0	200
4.95 "	750	4.5	300
7.65 "	220	4.0	400
10.1 "	Lock	3.5	470
12.25 "	Lock	4.0	545

Mounting:—Flange mounted on left hand front face of flywheel housing. To remove, disconnect cable, take out 3 flange mounting screws, pull starter forward to clear Bendix, lift out.

Oiling:—500 Miles. Put 6 drops SAE. No. 20 engine oil in oiler at each end.

GENERATOR:—Model GAL-4331. Third brush regulation. Rotation counter-clockwise at commutator end. Maximum charging rate (standard setting) is 17.2 amperes (cold) at 8.0 volts reached at 1900 R.P.M.

Charging Rate Adjustment:—Take off commutator cover band, shift third brush by prying on brush mounting stud counter-clockwise to increase, or clockwise to decrease charging rate. Brush held in position by friction.

Generator Data

Cold Test			Hot Test		
Amperes	Volts	R.P.M.	Amperes	Volts	R.P.M.
0	6.3	600	0	6.4	700
4	6.7	740	4	6.9	900
8	7.1	900	8	7.4	1150
12	7.4	1120	10	7.7	1340
17	8.0	1900	12.4	8.0	2150
12	7.4	3200	9.5	7.7	3200

Brush Spring Tension:—8-13 ounces on each brush.

Field Current:—4.08-4.52 amperes at 6 volts across field terminals.

Motoring:—4.27-4.73 amperes at 6.0 volts.

Mounting:—Pivot mounting on bracket at left front of engine with fan belt drive. To remove, disconnect lead, loosen adjustment clamp bolt, swing generator toward engine and slip off drive belt, take out bolt forming bracket hinge, lift generator out.

Belt Adjustment:—Loosen adjustment clamp bolt and mounting bolt, pull generator away from engine until fan can just be turned with belt held stationary, tighten adjustment bolt and mounting bolt before slacking off on generator.

Oiling:—250 Miles. Put 6 drops SAE. No. 20 engine oil in oiler at each end. **1000 Miles.** Remove grease cup under bearing retainer on commutator end, clean out old grease, fill cup with vaseline, dip wick in oil and replace.

RELAY:—Model CB-4014, 4021 (With Startix terminal). Mounted on generator field frame. Relay contacts close at 675 R.P.M. with generator voltage of 7-7.5 volts and charging current of approximately 2 amperes and open with discharge current of .5-2.5 amperes.

Contact Gap:—.025-.035 inch. **Air Gap:**—.010-.030 inch (contacts closed).

LIGHTING:—Pines Switch, Model A-805 (Standard Models), 6700 (Custom and Sport Models). Lighting switch 'Finger Tip Control' type mounted at lower end of steering column and controlled by knob on steering wheel. Type A-805 on Standard models includes starting switch. Type 6700 on Custom models is used with Startix and does not include starting switch. See Equipment Section for complete data. Lighting system 'depressed beam' dimming with standard double filament headlight bulbs.

Lamp Sizes

Position	Voltage	Candlepower	Base	Mazda No.
Headlights	6-8	21-21	D.C.	1110
Parking Lights	6-8	3	S.C.	63
Instrument Lights	6-8	3	S.C.	63
Stop and Tail Lights	6-8	21-2	D.C.	1158

Custom and Sport models have parking lights mounted on fenders. Standard models have parking bulbs in headlights. Stop and tail light has special double filament bulb and tail light lead must be connected to 2 cp. filament.

FUSES:—One 20-ampere capacity fuse mounted on left front of dash.

CAR SERIAL NUMBER:—Stamped on plate on right hand frame side rail above right front spring rear shackle and also under driver's seat. First number 1001 (8-88), 2,401 (8-88A).

ENGINE NUMBER:—Stamped on left side cylinder block opposite No. 1 cylinder.

BATTERY:—U.S.L., Type 3-HVX-7X-6A, 6 volt, 15 plate, 142 ampere hour capacity (5 ampere rate). Starting capacity 148.5 amperes for 20 minutes.
Grounded Terminal:—Negative (—) terminal grounded to frame.
Mounting:—Mounted on left hand frame side rail under front floor boards.
Dimensions:—Width, 7 7/16". Length, 11¾". Height, 9¾".

IGNITION:—Coil Model IG-4305, 4501 (8-88), IG-4602 (8-88A). IG-4305 and IG-4501 are coil lock types mounted on back of instrument board with switch in base of coil. IG-4602 mounted on dash and connected to special Mitchellock by armored cable. See Electrical Equipment Section for Mitchellock data.
Ignition Current:—1-3 amperes at 6 volts (engine running), 3-4.5 amperes at 6 volts with engine stopped.
Ignition Switch—Type 16-S Mitchellock integral with coil. Switch has two 'On' positions. First on position (⅛ turn from 'Off' or vertical) does not connect Startix and should be used for timing. Second 'On' position (approximately ¼ turn to right) is regular running position with Startix operative.

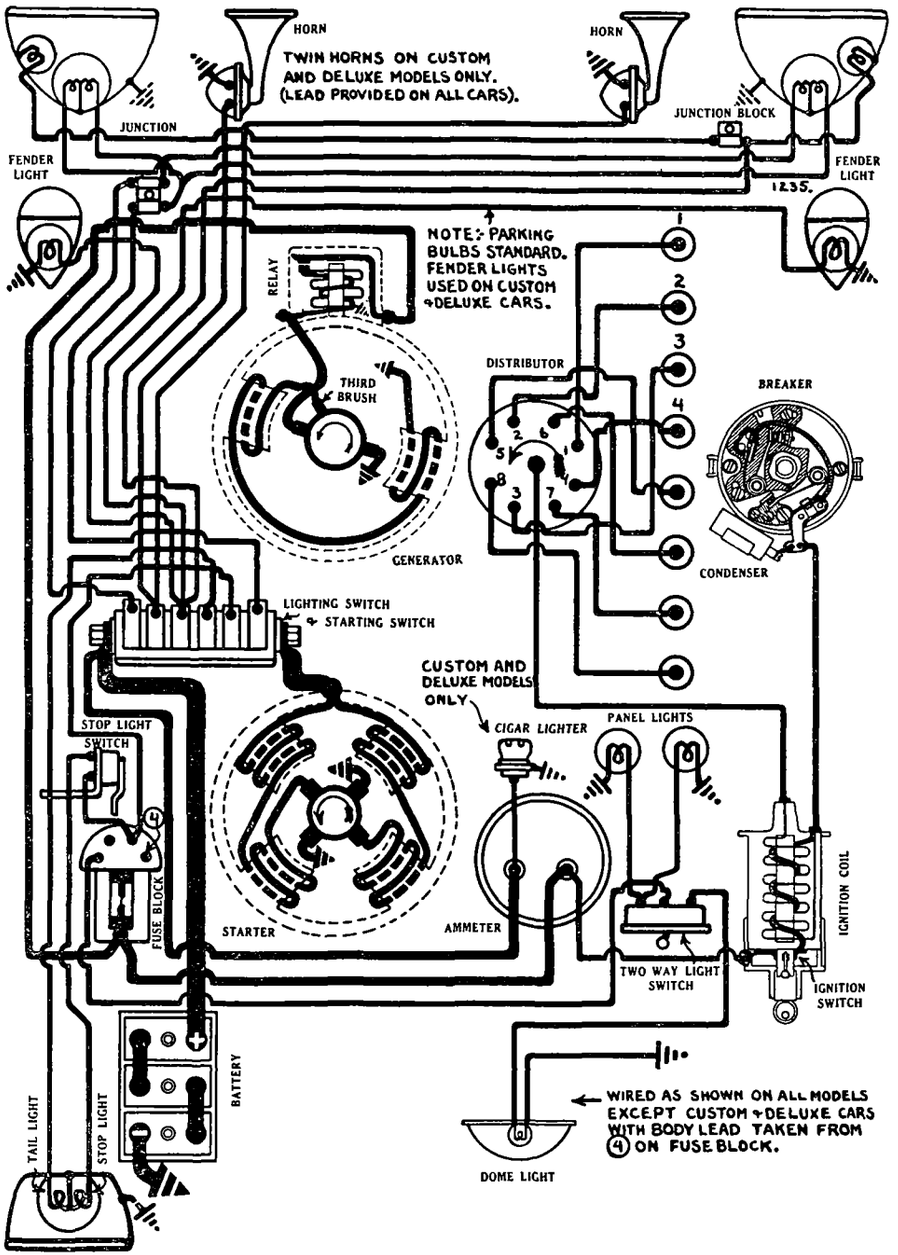
Distributor Model IGH-4013. Two-breaker arm, 4-lobe cam, semi-automatic advance type. Distributor is retarded by pulling out spark control button for hand cranking and operation at low speeds or heavy pulling. Pushing in button advances distributor 20° (engine). Breaker contacts open alternately at 45° intervals corresponding to 90° firing interval of engine. Contacts must be synchronized (see Ignition Timing).
Breaker Gap:—Set contact gap at .018". Hold within limits of .018-.020".
Breaker Arm Spring Tension:—16-22 ounces (measured at tip of breaker arm with spring scale centered and at right angles to arm).
Cam Angles—Closed 32°. Open 13° (distributor) when synchronized.

Automatic Advance					
Degrees	Distributor	R.P.M.	Degrees	Engine	R.P.M.
Start		200	0		400
3		600	6		1200
6		1015	12		2030
9		1430	18		2860
11		1700	22		3400

Mounting:—Mounted at left center of crankcase and driven by inclined shaft from crankshaft. To remove, disconnect primary lead, disconnect manual spark control, take off distributor cap, take out hold-down screw in advance arm, lift distributor out.

Oiling:—250 Miles. Put 6 drops SAE. No. 20 engine oil in oiler on side of shaft. Take off distributor cap and rotor, oil wick oiler in center of shaft. Put one drop oil on breaker arm pivot pins.
5000 Miles. Apply thin film vaseline to face of breaker cam.

IGNITION TIMING:—Standard Setting—6° (flywheel) or .0136" (piston travel) before top dead center with manual spark control advanced.
To Set Ignition Timing. Take off cover plate on inspection hole in right front face of flywheel housing, advance manual spark control (push button in toward dash) with No. 1 piston on compression, turn engine over by hand until flywheel mark 'IGN./' (which is 6° before top dead center mark '1&8.TC./I.O.') registers with pointed end of inspection cover plate screw. Loosen advance arm clamp bolt, rotate distributor until first set of breaker contacts (mounted directly on breaker plate) begin to open, tighten clamp bolt. If ignition is turned on to check opening of contacts on Custom models equipped with Startix, use first 'On' position of switch (key turned approximately ⅛ turn to right) to avoid automatic cranking. See that rotor is directly opposite No. 1 terminal in distributor cap (see diagram) and connect spark plugs as indicated. Then synchronize contacts.
Synchronization of Contacts. No flywheel marks provided to synchronize



contacts on engine. It will be necessary to use a rotary spark gap or special Auto-Lite synchronizing tool. See Equipment Section for complete data on synchronization. If timing gause is used, shift gauge to No. 6 cylinder and repeat timing. Do not loosen clamp bolt but loosen lock screws on movable sub-plate (carrying second set of contacts), shift plate until contacts begin to open, tighten lock screws.

Firing Order:—1-6-2-5-8-3-7-4. No. 1 cylinder nearest radiator.

Spark Plugs:—18 MM. Metric. Champion Type #8. Set gaps at .027 inch.

VALVE TIMING:—Camshaft Setting. Camshaft at right of engine and driven from crankshaft by two-sprocket non-adjustable chain drive. Sprockets are marked. Mesh chain so that marks are adjacent and in line with straight-edge across shaft centers. With correct setting, mark on rim of camshaft sprocket should be in line with mark on edge of front engine support with piston No. 1 on top dead center and flywheel mark '1&8.T.C./I.O.' registering with pointer in inspection hole.

To Check Valve Timing. Set tappet clearance No. 1 intake and exhaust valves at .010" cold. With No. 8 piston on compression turn engine over until piston reaches top dead center with flywheel mark '1&8.T.C./I.O' at indicator. No. 1 intake valve should open at this point. Turn engine over 4° until flywheel mark 'E.C/' registers with pointer. No. 1 exhaust valve should close. Reset tappet clearance at .006" (intake), .008" (exhaust) with engine warm.

Valve Specifications

Valve	Head Diameter	Stem Diameter	Seat Angle	Lift
Intake	1 17/32"	.372"	45°	21/64"
Exhaust	1 15/32"	.371"	45°	21/64"

Tappet Clearance	Operating	Timing	Valve Springs
Intake	.006" (hot)	.010" (cold)	92-100 pounds—1 15/16"
Exhaust	.008" (hot)	.010" (cold)	

Intake Valves	Timing	Exhaust Valves
Open—At top dead center	Open—34° before lower dead center.	
Close—38° after lower dead center.	Close—4° after top dead center.	

CARBURETION:—Tillotson Updraft Carburetor, Model W5D. See Carburetor Section for complete data. Intake manifold heat control automatic.

Fuel Pump:—A.C. Mechanical Fuel Pump mounted on right side of crankcase (see Carburetion Section). Remove glass sediment bowl when necessary empty water and sediment, clean filter screen (located directly above bowl) before reassembling.

Gasoline Gauge:—K-S Telegauge hydrostatic type (see Carburetion Section).

STARTER:—**Model MAB-4035, 4048.** Drive—Inboard Bendix with Startix automatic starting switch on Custom models and Pines 'Finger Tip Control' switch on Standard models. See Equipment Section for complete data on Startix and Pines 'Finger Tip Control' switches. Rotation counter-clockwise at commutator end. Brush spring tension 44-56 ounces.

Starter Data

Torque	R.P.M.	Volts	Amperes
0 lb. ft.	4020	5.5	46
0.6 "	1910	5.5	100
3.4 "	1100	5.0	200
6.6 "	695	4.5	300
10.15 "	420	4.0	400
17.0 "	Lock	3.0	525
24.0 "	Lock	4.0	720

Mounting:—Flange mounted on left hand front face of flywheel housing. To remove, disconnect cable, take out 3 flange mounting bolts, pull starter forward to clear Bendix, lift out.

Oiling:—**500 Miles.** Put 6 drops SAE. No. 20 engine oil in oiler at each end.

GENERATOR:—**Model GAL-4331.** Third brush regulation. Rotation counter-clockwise at commutator end. Maximum charging rate (standard setting) is 17.2 amperes (cold) at 8.0 volts reached at 1900 R.P.M.

Charging Rate Adjustment:—Take off commutator cover band, shift third brush by prying on brush mounting stud counter-clockwise to increase, or clockwise to decrease charging rate. Brush held in position by friction.

Generator Data

Cold Test			Hot Test		
Amperes	Volts	R.P.M.	Amperes	Volts	R.P.M.
0	6.3	600	0	6.4	700
4	6.7	740	4	6.9	900
8	7.1	900	8	7.4	1150
12	7.4	1120	10	7.7	1340
17	8.0	1900	12.4	8.0	2150
12	7.4	3200	9.5	7.7	3200

Brush Spring Tension:—8-13 ounces on each brush.

Field Current:—4.08-4.52 amperes at 6 volts across field terminals.

Motoring:—4.27-4.73 amperes at 6.0 volts.

Mounting:—Pivot mounting on bracket at left front of engine with fan belt drive. To remove, disconnect lead, loosen adjustment clamp bolt, swing generator toward engine and slip off drive belt, take out bolt forming bracket hinge, lift generator out.

Belt Adjustment:—Loosen adjustment clamp bolt and mounting bolt, pull generator away from engine until fan can just be turned with belt held stationary, tighten adjustment bolt and mounting bolt before slacking off on generator.

Oiling:—**250 Miles.** Put 6 drops SAE. No. 20 engine oil in oiler at each end.

1000 Miles. Remove grease cup under bearing retainer on commutator end, clean out old grease, fill cup with vaseline, dip wick in oil and replace.

RELAY:—**Model CB-4014, 4021 (With terminal for Startix).** Mounted on generator field frame. Relay contacts close at 675 R.P.M. with generator voltage of 7-7.5 volts and charging current of approximately 2 amperes and open with discharge current of .5-2.5 amperes.

Contact Gap:—.025-.035 inch. **Air Gap:**—.010-.030 inch (contacts closed).

LIGHTING:—**Pines Switch, Model A-805 (Standard Models), 6700 (Custom and Sport Models).** Lighting switch 'Finger Tip Control' type mounted at lower end of steering column and controlled by knob on steering wheel. Type A-805 on Standard models includes starting switch. Type 6700 on Custom models is used with Startix and does not include starting switch. See Equipment Section for complete data. Lighting system 'depressed beam' dimming with standard double filament headlight bulbs.

Lamp Sizes

Position	Voltage	Candlepower	Base	Mazda No.
Headlights	6-8	21-21	D.C.	1110
Parking Lights	6-8	3	S.C.	63
Instrument Lights	6-8	3	S.C.	63
Stop and Tail Lights	6-8	21-2	D.C.	1158

Custom and Sport models have parking lights mounted on fenders. Standard models have parking bulbs in headlights. Stop and tail light has special double filament bulb and tail light lead must be connected to 2 cp. filament.

FUSES:—One 20-ampere capacity fuse mounted on left front of dash.

SERIAL NUMBER:—First number 1001 ('33), 13820 ('34), 27001 ('35), 42000 ('36). On left hand frame member near rear shackle of left front spring and on body sill at left front door opening.

COMPRESSION:—

Ratio	Pressure
1933-34-35 ... 5.13-1	83 lbs. at 120 R.P.M.
1936 ... 5.7-1	87 lbs. at 216 R.P.M.

NOTE—Cylinder heads are cast-iron.

VACUUM READING:—Gauge should show steady reading of 18½" with engine idling at 7 M.P.H.

IGNITION:—**Coil Model IG-4406 ('33-35), IG-4090 ('36).** Mounted on right side of engine. Service coil IG-4044 ('33-35), IG-4070 ('36).

Ignition Current—Idling—3 1 amperes ('33-35), 2.5 amperes ('36), at 6.0 volts. Stopped—4.98 amperes ('33-35), 4 amperes ('36).

Ignition Switch:—Mitchellock 17-A, Type 5159. Coil connection not armored.

Ignition Lock—Independent Lock Co. No. 4044-H, Mitchell No. 4759.

Distributor Model IGB-4078 ('33-35), IGS-4007 ('36). Single breaker, 4 lobe cam, full automatic advance type. Auxiliary vacuum spark control used on IGS model.

Breaker Gap—Set at .018". Limits, .018-.020"

Breaker Arm Spring Tension—16-20 ounces.

Cam Angles—(IGB)—46° (closed), 44° (open).
(IGS)—47° (closed), 43° (open).

Condenser—Part No. IGB-1025 (IGB), IG-2671 (IGS).
Capacity .20-.25 microfarads.

Automatic Advance—IGB-4078

Distributor Degrees	R.P.M.	Engine Degrees	R.P.M.
Start	300	0	600
2	510	4	1020
4	750	8	1500
6	970	12	1940
8	1190	16	2380
10	1415	20	2830
12½	1700	25	3400

Automatic Advance—IGS-4007

Start	300	0	600
4.4	420	8.8	840
7	770	14	1540
10	1165	20	2330
14	1700	28	3400

Vacuum Spark Control (IGS-4007)—Integral with distributor. Mounted on distributor housing and linked directly to breaker plate. Provides additional advance for all speeds above idling except when engine is accelerated or operated with wide open throttle when spark is retarded by return spring within unit.

Vacuum Advance—IGS-4007

Distr. Degrees	Eng. Degrees	Vacuum (" of HG)
Start	0°	3½"
2°	4°	5¾"
5°	10°	9¼"
8°	16°	12¾"
10°	20°	15"

IGNITION TIMING:—

Flywheel Degs.	Piston Position
'33-35 engines ... 4° BTDC.	.0066" BTDC.
'36 engines ... 5° ATDC.	.0103" ATDC.

Timing—Take off cover plate over inspection hole (top surface left hand side flywheel housing). Turn engine over with #1 piston on compression, stop when flywheel mark IGN lines up with pointed end of inspection plate screw, loosen advance arm clamp bolt, rotate distributor until contacts begin to open, tighten clamp bolt, see that rotor is opposite #1 segment in distributor cap, check spark plug connections (see diagram).

Motor Gauge—Weidenhoff Adapter #104, Rod #2.

Firing Order:—1-3-4-2 (see diagram).

Spark Plugs:—Champion, Type C-7. 18 MM. Metric type.

Spark Plug Gaps—.025".

CARBURETION:—**Carburetor.** Tillotson Model D-1A ('33-34), D-1D ('35), D-1E ('36). 1⅛" downdraft type with manual choke control.

See article in Carburetion Section for complete data.

Adjust as follows:

NOTE—High Speed Adjustment applies to Model D-1E (1936) only.

High Speed Adjustment—With engine warm set throttle for 25-30 M.P.H. speed. Turn idle adjusting screw in until it is closed. Then turn High Speed Adjusting Screw (screw with cross bar) in until engine misses, turn screw out until engine begins to roll, finally turn screw in (approximately ¾ turn) until engine fires smoothly. Then set Idle Adjustment as outlined below.

Idle Speed Adjustment—Open idle screw 1-1¼ turns and close throttle. Set throttle stopscrew for idling speed of 7 M.P.H., turn idle adjusting screw out or left until engine misses, then turn screw in until engine fires smoothly. Reset throttle stop screw if necessary for correct idling speed.

Air Cleaner:—AC #1525088 ('33-34), Monroe ('35-36) oil-wetted types.

Fuel Pump:—A.C. Type P-1521390.

NOTE—P-1521010 used on early 1933 models.

See article in Carburetion Equipment Section.

Gasoline Gauge:—National, Electric type.

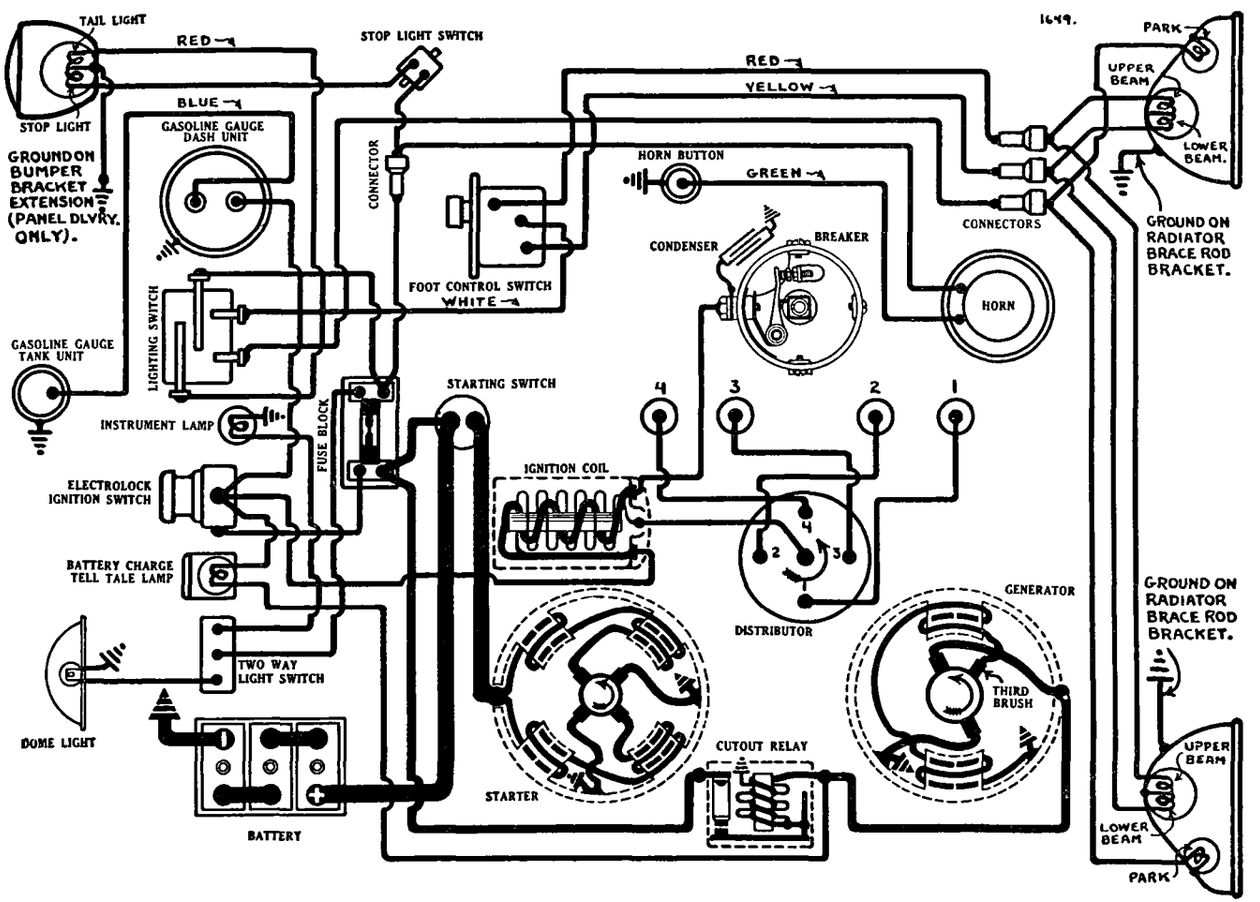
See article in Carburetion Equipment Section.

VALVE TIMING:—To Check Timing—Set tappet clearance #1 intake and exhaust valves at .010". Intake valve opens with piston on top dead center when flywheel mark 'T.C.I.O.1-4' lines up with pointed end of inspection hole cover screw (top of flywheel housing on left hand side). Exhaust valve closes with piston 5° or .0103" down on intake stroke when flywheel mark 'E.C.' lines up with indicator. Reset tappet clearance at .004" Int., .006" Exh., with engine hot.

Motor Gauge—Weidenhoff Adapter #104, Rod #2.

Tappet Clearance:—.004" Int., .006" Exh., with engine hot.

Valve Spring Pressure:—46½ lbs. at 2¼" (valve closed). 85½ lbs. at 1 15/16" (valve open).



LUBRICATION:—Crankcase Capacity—4 quarts.
Normal Oil Pressure—30 lbs. at 30 MPH. (warm oil).

BATTERY ('33-34):—U.S.L., Type CW-11. 6 volt, 11 plate, 84AH. capacity (5 amp. rate).
Starting Capacity—96 amperes for 20 minutes.
Grounded Terminal—Negative (—) terminal.
Location—On 'X' member under right front seat.

BATTERY ('35-36):—U.S.L., A-13-A. 6 volt, 13 plate, 78 A.H. capacity (20 hour rate).
Starting Capacity—90 amperes for 20 minutes.
Grounded Terminal & Location—As above.

STARTER:—Model MZ-4033. Armature No. MZ-2089.
Starter Drive—Special outboard Bendix RC10HD.
Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—42-53 ozs. (new brushes).
Cranking Engine—120 R.P.M., 200 amperes, 5 volts.

Performance Data

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	4300	5.5	70
.65 " "	2500	5.5	100
2.55 " "	1325	5.0	200
4.95 " "	750	4.5	300
7.65 " "	220	4.0	400
7.8 " "	Lock	3.0	420
11.8 " "	Lock	4.0	560

Starting Switch:—Model SW-4001. Foot plunger type mounted on toeboard.
Mounting:—Flange mounted on right hand front face of flywheel housing. To remove, take out two flange cap screws and one cap screw in bracket on commutator end.

GENERATOR:—Model GAM-4504. Armature No. GAM-2055. Third brush control type.
Charging Rate Adjustment—Take off commutator cover band, shift third brush by hand by prying on brush mounting stud, counter-clockwise to increase, or clockwise to decrease charging rate. Third brush is held in position by friction.
Maximum Charging Rate—17 amperes (cold), 8.0 volts, 1950 R.P.M.

Performance Data

Cold			Hot		
Amps.	Volts	R.P.M.	Amps	Volts	R.P.M.
0	6.4	700	0	6.4	720
4	6.8	880	4	6.9	920
8	7.2	1075	8	7.35	1160
12	7.6	1280	12	7.8	1460
16.5	8.0	1950	13.8	8.0	2000

Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—18-22 ozs. (new brushes).
Field Current—3.89-4.31 amperes at 6.0 volts.
Motoring Current—4.08-5.32 amperes at 6.0 volts.

Mounting:—Pivot mounted at right front of engine. Fan belt drive. To remove, take out two pivot bolts, one clamp bolt.

Belt Adjustment—Loosen two pivot bolts and adjustment clamp bolt, pull generator away from engine until fan can just be turned with belt held stationary, tighten clamp bolt and pivot bolts.

GENERATOR CHARGE INDICATOR (1935 ONLY):—Consists of signal light on instrument board connected between generator side of Cutout Relay and ignition coil terminal of Ignition Switch. Lamp should light when ignition is turned on and will go out when generator begins to charge battery (cutout relay contacts close). If lamp does not light with ignition on and engine not running, replace bulb. Signal light bulb is standard 6-8 volt, 3 cp. S.C., Mazda 63.

RELAY:—Model CB-4008. Mounted on top of right hand frame side rail near generator.
See article in Electrical Equipment Section.
Cuts in—7.0-7.5 volts, 700-800 R.P.M. of generator.
Cuts out—.5-2.5 amperes discharge.
Relay Contact Gap—.025-.035".
Air Gap—.010-.030" (contacts closed).

LIGHTING:—Headlamps—Corcoran-Brown. Fixed focus type. Headlamps aimed straight ahead (upper beam with lenses in place). Upper and lower beams controlled by foot selector switch.

Switches

Lighting—Culver-Stearns.
Foot Selector—Clum Model 9579.

Bulb Specifications

Lamp	Candlepower	Mazda No.
Headlights	21-21	1110
Stop and Tail Light	21-2	1158
All others	3	63

FUSES:—20 ampere capacity lighting fuse mounted on engine side of dash ('33-35), back side of dash under cowl ('36).

HORNS:—Schwartze vibrator type disc horn.

SERIAL NUMBER:—First number 37-1001. Stamped on plate located on right side of cowl under the engine hood and on plate above crank opening on front frame cross-member.

ENGINE NUMBER:—Stamped on right front upper corner of block. First number—37-1001 (37).

COMPRESSION:—Ratio—5.7-1 Std. cast-iron head. No optl. ratios. **Pressure**—87 lbs. at 216 R.P.M.

VACUUM READING:—Gauge should show steady reading of 18½" with engine idling at 7 M.P.H.

IGNITION:—Coil Model IG-4090. Mounted on right side of engine block. Service coil IG-4070.

Ignition Current—2.5 amps. idling, 4 stopped (cold).

Ignition Switch:—Douglas. Coil connection nct armored.

Distributor Model IGS-4007, A. Single breaker, 4 lobe cam, full automatic advance type with auxiliary vacuum spark control.
See Electrical Equipment Section for special Distributor Servicing data.
Breaker Gap—Set at .020".
Cam Angle or Dwell—47.0° (closed), 43.0° (open).
Breaker Arm Spring Tension—16-20 ounces.
Rotation—Counter-clockwise viewed from top.
Condenser—Part No. IG-2671G. Capacity .20-.25 mfds.

Automatic Advance

Distributor		Engine	
Degrees	R.P.M.	Degrees	R.P.M.
Start	300	0.	600
4.4	420	8.8	840
7	770	14.	1540
10	1165	20.	2330
14	1700	28	3400

Vacuum Spark Control—Integral with distributor. Mounted on distributor housing and linked directly to breaker plate. Provides additional advance for all speeds above idling except when engine is accelerated or operated with wide open throttle when spark is retarded by return spring within unit.

Vacuum Advance

Distr. Degrees	Eng. Degrees	Vacuum (" of HG)
Start	0°	3½"
2°	4°	5¾"
5°	10°	9¼"
8°	16°	12¾"
10°	20°	15"

Distributor Removal:—Mounted on right side of engine. To remove, disconnect vacuum line, take out hold-down screw in plate.

IGNITION TIMING:—Flywheel Degrees Piston Position
All engines .....5° ATDC..... .0103" ATDC

To Check Timing—Take off inspection hole cover plate (top surface left hand side of flywheel housing). Turn engine over with #1 piston on compression, stop with piston 5° or .0103" after top dead center when flywheel mark 'IGN' lines up with pointed end of inspection plate screw, loosen advance arm clamp bolt, rotate distributor until contacts begin to open, tighten clamp bolt, see that rotor is opposite #1 segment in distributor cap, check spark plug connections (see diagram).
NOTE—This check must be made with all back lash eliminated in distributor drive and vacuum spark control should be in a fully released position.
Motor Gauge—Weidenhoff Adapter #104, Rod #2.
Firing Order:—1-3-4-2. See diagram.

Spark Plugs:—Champion Type C-7. 18 MM. Metric.
Spark Plug Gap—Set at .025". Limits .024-.025".

CARBURETION:—Carburetor—Tillotson Model U-1A 1⅛" downdraft type with manual choke control.
See Article in Carburetion Section.

Adjust as follows:

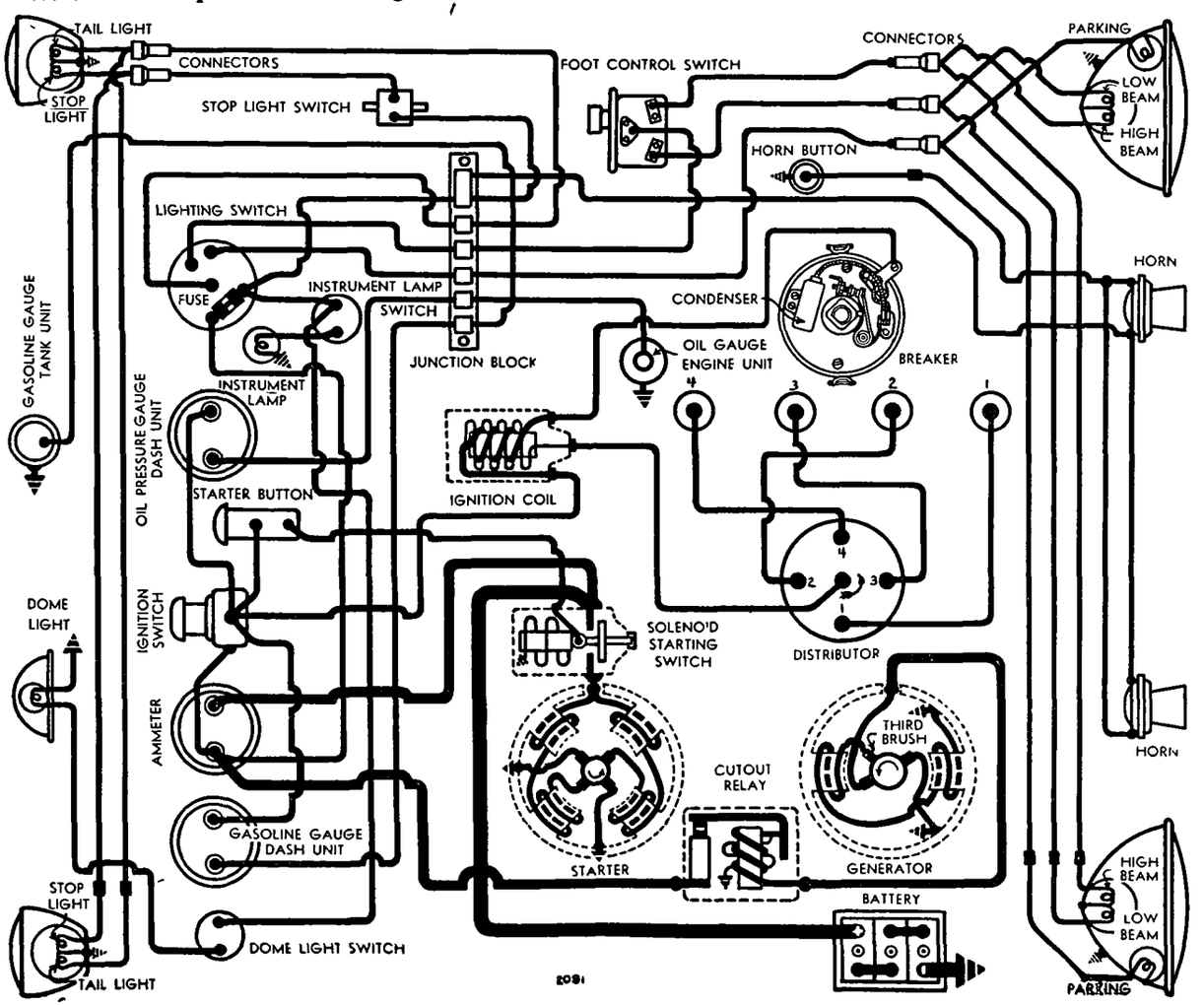
High Speed Adjustment—Set idle adjusting screw ¾ turn open from inner seated position. With engine warm set throttle for 25 M.P.H. Turn High Speed Adjusting Screw (screw with cross bar) in until engine misses, then turn screw out until engine begins to roll, finally screw in (approximately ⅜ turn) until engine fires smoothly. Then set Idle Adjustment as outlined below.

Idle Speed Adjustment—Close throttle, set throttle stopscrew to idle slightly faster than normal, turn idle adjusting screw out or left, until engine misses, then turn screw in until engine fires smoothly. Reset throttle stopscrew to idle engine at 7 M.P.H.

Air Cleaner:—AC. #1528326 oil-wetted type standard. #1528608 heavy duty (oil-bath type) optl.
Fuel Pump:—AC. Type AF #1523306. Diaphragm type.
See Article in Carburetion Equipment Section.

Gasoline Gauge:—King-Seeley Electric. Part No. 6270 (dash unit), 6280 (tank unit). See separate article in Carburetion Equipment Section for complete data.

VALVE TIMING:—To Check Timing—Set tappet clearance #1 intake valve at .010". This valve should open when piston reaches top dead center and flywheel mark 'T.C.I.O.1-4' lines up with pointed end of inspection hole cover plate screw (top of flywheel housing left hand side). Reset tappet clearance at .004" with engine hot.
Motor Gauge—Weidenhoff Adapter #104, Rod #2.
Tappet Clearance:—.004" Int., .006" Exh., hot.
Valve Spring Pressure:—46½ lbs. at 2¼" (valve closed), 85½ lbs. at 1 15/16" valve open).



LUBRICATION:—Crankcase Capacity—4 qts. (refill).
Normal Oil Pressure—30 lbs. at 30 M.P.H.

BATTERY:—U.S.L., Type A-13A. 6 volt, 13 plate, 78 ampere hour capacity (20 hour rate).

Starting Capacity—96 amperes for 20 minutes.

Zero Capacity—300 amperes for 1.9 minutes.

Grounded Terminal—Negative (—) terminal. Grounded to right end of frame front cross-member.
Dimensions—Length 8⅞". Width 7". Height 8⅝".

Location—In recess in right front fender skirt under hood.

STARTER:—Model MZ-4049. Armature No. MZ-2089.
Drive—Special outboard Bendix No. RC10HD.
Cranking Engine—120 R.P.M., 200 amps., at 5 volts.
Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—42-53 ozs. (new brushes).

Performance Data

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	4300	5.5	70
.65 "	2500	5.5	100
2.55 "	1325	5.0	200
4.95 "	750	4.5	300
7.65 "	220	4.0	400
7.8 "	Lock	3.	420
11.8 "	Lock	4.	560

Removal:—Flange mounted on right hand front face of flywheel housing. To remove, take out two flange capscrews and one capscrew in bracket on commutator end.

Starting Switch:—Solenoid Type SS-4001. Controlled by push-button switch on instrument panel.
See Article in Electrical Equipment Section.

Switch Specifications

Closes with terminal voltage of 4 volts or less and will remain closed until voltage drops to .75-2.0 volts. Current draw 3 amperes at 6 volts.

GENERATOR:—Model GAM-4504. Armature No. GAM-2055. Third brush control type.

Charging Rate Adjustment—Take off commutator cover band, shift third brush by hand by prying on brush mounting stud, counter-clockwise to increase, or clockwise to decrease charging rate. Third brush is held in position by friction.

Maximum Charging Rate—17 amperes (cold), 12.5 amperes (hot), 8.0 volts, at 22 MPH. Use test ammeter connected in charging line at Cutout Relay to check generator output.

Performance Data

Cold Amperes	Cold Volts	Cold R.P.M.	Hot Ampere	Hot Volts	Hot R.P.M.
0	6.4	720	0	6.4	720
4	6.8	880	4	6.9	900
8	7.2	1050	8	7.4	1160
12	7.6	1280	12	7.95	1700
16.4	8.0	1950	12.5	8.0	2000

Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—18-22 ozs. (new brushes).
Field Current—3.89-4.31 amperes at 6.0 volts.
Motoring Current—4.08-4.52 amperes at 6.0 volts.

Removal:—Pivot mounted at right front of engine. To remove, take out two pivot bolts, one clamp bolt.

Belt Adjustment:—Loosen two pivot bolts and adjustment clamp bolt, swing generator away from engine until fan can just be turned with belt held stationary, tighten clamp bolt and pivot bolts.

CUTOUT RELAY:—Model CB-4025. Mounted on top of right hand frame side rail near generator.
Cuts In—6.75-7.5 volts, 995 RPM, 12 MPH.
Cuts Out—.5-2.5 amperes discharge current.
Contact Gap—.025-.035".
Air Gap—.010-.030" with contacts closed.

LIGHTING:—Headlamps—Corcoran Brown. Fixed focus type. Headlamps aimed straight ahead (upper beam with lenses in place). Upper and lower beams controlled by foot selector switch.

Switches

Lighting—Douglas Model 5400-B.

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps	32-32	2320
Stop-Tail	21-3	1158
All others	3	63

FUSES:—Lighting—Mounted on lighting switch. 20 ampere capacity.

HORNS:—Schwarze vibrator type disc horn.

SERIAL NUMBER:—First number 65,001 (1938), 91,751 (1939—see Note following). Stamped on front center of front frame cross-member and on right side of cowl under engine hood.
NOTE—Cars manufactured after beginning of fiscal year (Sept. 1, 1938), Serial No. 89001 and up, are 1939 cars.

ENGINE NUMBER:—First number 91751 (1939). Stamped on boss on right front upper corner of block.

COMPRESSION:—Ratio—5.7-1. **Pressure**—87 lbs. at cranking speed of 216 R.P.M.

VACUUM READING:—Steady 18½" idling at 7 M.P.H.

IGNITION:—Coil Model IG-4090, 4090A (48 Truck). On right hand side of engine. Service Coil #IG-4070.
Ignition Current—2.5 amperes idling, 4 stopped.
Ignition Switch:—Douglas. Coil connection is not armored.
Distributor Model IGS-4007A, IGW-4129A (some 48 cars). Single breaker, 4 lobe cam, full automatic advance type with auxiliary vacuum spark control. NOTE—Vacuum unit integral type (IGS-4007A), separate VC-4007 or VC-4010 (IGW-4129A).
Breaker Plate Identification (IGS-4007A)—Maximum vacuum advance limited by slot and marked by number #10 stamped on plate.
Breaker Gap—.020".
Cam Angle (IGS-4007A)—47° closed 43° open.
Cam Angle (IGW-4129A)—41° closed, 49° open.
Breaker Arm Spring Tension—16-20 ozs.
Rotation—Counter-clockwise viewed from top.
Condenser—No. IG-2671G (IGS-4007A), No. IGB-1025 (IGW-4129A). Capacity .20-.25 microfarads.

Automatic Advance—IGS-4007A

Distributor Degrees	R.P.M.	Engine Degrees	R.P.M.
Start	300	0	600
4.4	420	8.8	840
7	770	14	1540
10	1165	20	2330
14	1700	28	3400

Automatic Advance—IGW-4129A

Start	300	0	600
4	400	8	800
7	790	14	1580
11	1310	22	2620
14	1700	28	3400

Vacuum Spark Control (IGS-4007A)—Mounted on distributor cup and linked to breaker plate. Provides additional advance at speeds above idling except when engine accelerated or operated with wide open throttle when spark retarded by return spring within unit.

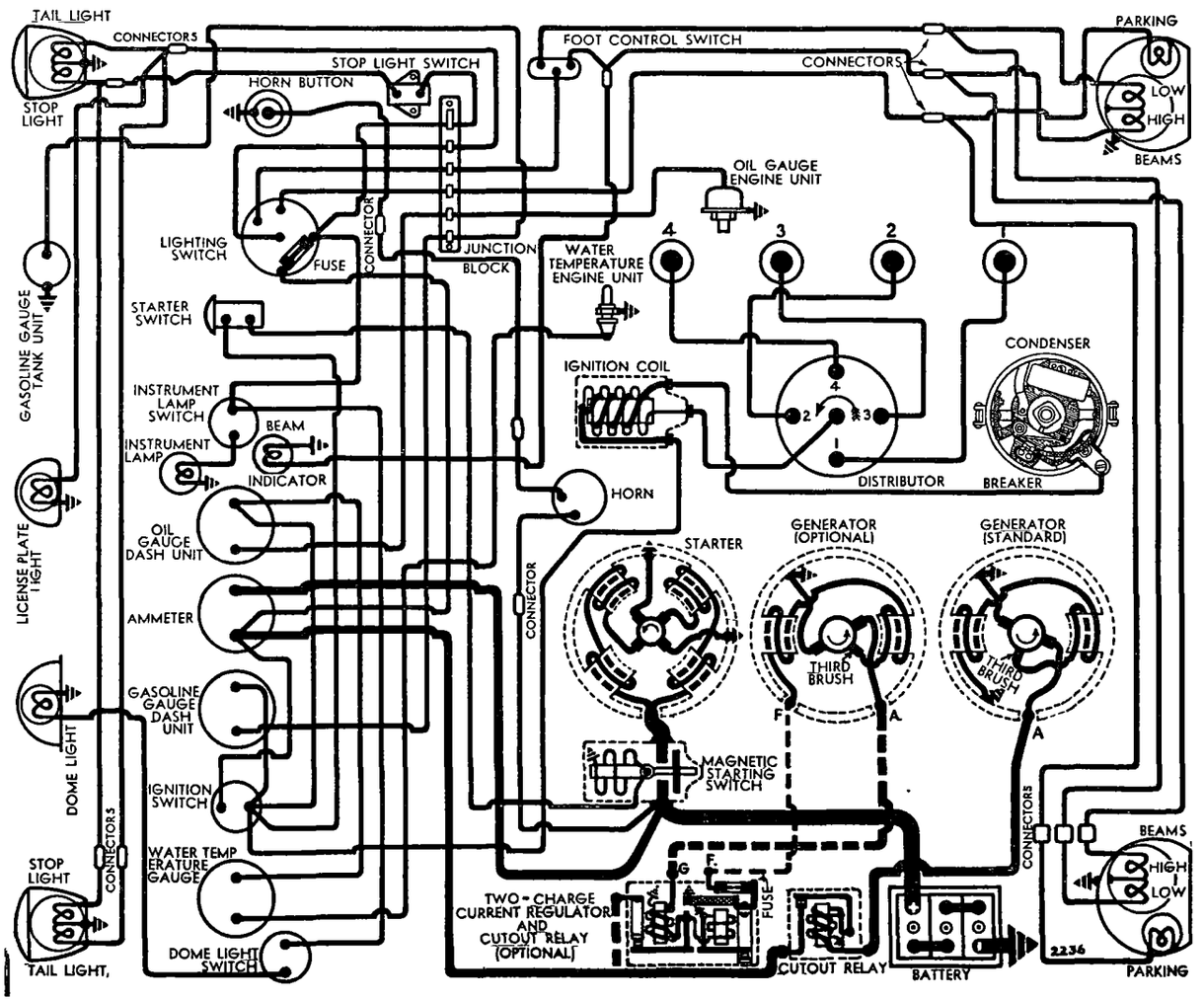
Vacuum Advance—IGS-4007A

Distr. Degrees	Eng. Degrees	Vacuum (" of HG)
Start	0°	3½"
2°	4°	5¾"
5°	10°	9¼"
8°	16°	12¾"
10°	20°	15"

Vacuum Spark Control (IGW-4129A). Type VC-4007 or VC-4010. Mounted on bracket under distributor cup and linked to advance arm. Operates in same manner as IGS-4007A type.
Distributor Removal:—Mounted on right side of engine. To remove, disconnect vacuum line and take out hold-down screw in advance arm. To remove IGW-4129A without disturbing vacuum unit, loosen advance arm clamp bolt.

IGNITION TIMING: Flywheel Degrees Piston Position
All Engines .....5° ATDC.....0103" ATDC.
To Set Timing—Remove inspection hole cover plate in left top face of flywheel housing. With #1 piston on compression, turn engine over until piston reaches firing position when flywheel mark 'IGN' lines up with pointed end of inspection plate screw. Loosen advance arm clamp bolt, rotate distributor until contacts begin to open, tighten clamp bolt, see that rotor opposite #1 segment in distributor cap, check spark plug connections (see diagram).
Motor Gauge—Weidenhoff Adapter #104. Rod #2.
Firing Order:—1-3-4-2. See diagram.
Spark Plugs:—Champion Type C7. 18 MM. Metric.
Spark Plug Gaps—.025".

CARBURETION:—Carburetor—Tillotson Model U-1A. 1⅛" single barrel, downdraft type.
See article in Carburetor Section for data.
Preliminary Adjustment (If carburetor out of adjustment so that engine cannot be warmed up)—Turn main adjustment (high speed) needle valve clockwise or in until it is seated, then back off exactly 3 turns. Turn idle adjustment screw in or clockwise until seated, then back off ¾ turn. Start engine and run until warm. Then adjust as follows:
High Speed Adjustment—Set throttle so that engine runs at 25 MPH., turn main adjustment needle valve in or clockwise slowly until engine begins to slow down, then turn needle valve out until maximum speed is secured, finally turn needle valve in ⅜ turn. This final setting should be approximately 2⅜ turns open from inner seated position. Then set idle adjustment.
Idle Adjustment—Close throttle, set throttle stopscrew to idle engine slightly faster than normal, turn idle adjusting screw counter-clockwise or out until engine begins to miss, then turn screw in slowly until engine fires smoothly. Open throttle momentarily to clear manifold, close throttle, recheck idle adjustment. Final setting should be approximately 1 turn open from inner seated position. Then set throttle lever stopscrew for correct 7 M.P.H. idling speed.



Air Cleaner: AC #1528326 oil-wetted type Std., #1528608 ('38), #1529167 ('39) oil bath type optl.
Fuel Pump:—AC Type AF #1523306. Diaphragm type. *See article in Carburetion Equipment Section.*
Gasoline Gauge:—King-Seeley Electric. K-S No. 6270 (dash unit), No. 6280 (tank unit). *See article in Carburetion Equipment Section.*

MANIFOLD HEAT CONTROL:—Manual type with three settings (depressions for valve lever setscrew engagement) as follows: 'Heatoff'—Summer operation (left hand), 'Midway'—Mild Winter operation (middle position), 'Heaton'—Extreme Winter operation (right hand). To adjust, loosen locknut, back off setscrew, move heat valve lever toward right (in direction of arrow) for more heat, opposite direction for less heat. Make certain that setscrew engages depression in manifold and tighten locknut.

VALVE TIMING:—To Check—Set tappet clearance #1 intake valve at .010". This valve should open with piston on top dead center when flywheel mark 'I.O. T.C.1-4' lines up with pointed end of inspection plate screw in inspection hole on left top face of flywheel housing (permissible variation ¼" either way from mark). Reset tappet clearance at .004" with engine warm.
Tappet Clearance:—.004" Int., .006" Exh. Warm.
Valve Spring Pressure:—46½ lbs. at 2¼" (valve closed), 85½ lbs. at 1 15/16" (valve open). Free length 2 11/16".

LUBRICATION:—Crankcase Capacity—4 qts.
Normal Oil Pressure—30 lbs. at 30 M.P.H.
Oil Pressure Gauge:—King-Seeley Electric. K-S No. 6275 (dash unit), No. 6425 (engine unit). *See article in Mechanical Equipment Section for data.*

COOLING SYSTEM:—Capacity—11 qts.
Thermostat—None. NOTE—Accessory thermostat available.
Temperature Gauge:—King-Seeley Electric type. **Dash Unit**—K-S No. 6628 ('38 Std., Economy & Comm'l.), No. 6632 ('38 Deluxe, '39 Comm'l). NOTE—'39 passenger cars use dash signal light. **Engine Unit**—K-S No. 5700 (All except '39 passenger cars), No. 7205 ('39 passenger cars). *See article in Mechanical Equipment Section for data.*

BATTERY:—USL Type A-13. 6 volt, 13 plate, 78 ampere hour capacity (20 hour rate).
Starting Capacity—96 amperes for 20 minutes.
Zero Capacity—300 amperes for 1.9 minutes.
Grounded Terminal—Negative (—) grounded to right side of front cross-member. **Engine Ground**—Strap connector at left front engine mounting.
Dimensions—Length 8⅞". Width 7". Height 8⅝".
Location—Right hand side under engine hood.

STARTER:—Model MZ-4049. Armature No. MZ-2089.
Drive—Special Bendix No. RC10HD.
Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—42-53 ozs. (new brushes).
Cranking Engine—216 RPM., 135-150 amperes, 5.35 volts.

Performance Data

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	4300	5.5	70
.65 "	2500	5.5	100
2.55 "	1325	5.0	200
4.95 "	750	4.5	300
7.65 "	220	4.0	400
7.8 "	Lock	3.0	420
11.8 "	Lock	4.0	560

Removal:—Starter flange mounted on right front face of flywheel housing. To remove, take out two flange capscrews and one capscrew in bracket at commutator end, remove starter and switch as an assembly.

Starting Switch:—Model SS-4001. Magnetic type. Mounted on starter and controlled by pushbutton switch on instrument panel. *See article in Electrical Equipment Section.*

GENERATOR (STD.):—Models GAM-4504-A, B. Armature No. GAM-2055. Third brush control type.
Charging Rate Adjustment—Remove commutator cover band, shift third brush by hand, counter-clockwise to increase charging rate, clockwise to decrease charging rate. Brush held in position by friction.
Maximum Charging Rate—16 amperes (cold), 12.5 amperes (hot), 8.0 volts, 1950 R.P.M.

Performance Data

Cold			Hot		
Amperes	Volts	R.P.M.	Amperes	Volts	R.P.M.
0	6.4	720	0	6.4	720
4	6.8	880	4	6.9	900
8	7.2	1050	8	7.4	1160
12	7.6	1280	12	7.95	1700
16.4	8.0	1950	12.5	8.0	2000

Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—18-22 ozs. (new brushes).
Field Current—3.89-4.31 amperes at 6.0 volts.
Motoring Current—4.08-4.52 amperes at 6.0 volts.

Removal:—Pivot mounted at right front of engine. To remove, take out two pivot bolts, one clamp bolt.

Belt Adjustment:—Loosen pivot and clamp bolts, swing generator out from engine until fan can just be turned with belt held stationary, tighten bolts.

GENERATOR (STD. 48 TRUCK, OPTL. 38):—Model GCS-4809A5. Arm. GCS-2049F. 3rd brush type in conjunction with non-vibrating type Two-Charge (Current) Regulator. Ventilated by fan on drive pulley.
Charging Rate Adjustment—Use test meters to check output, connect jumper between fuse cup on regulator and ground to eliminate regulator action. Shift third brush by hand counter-clockwise to increase, or clockwise to decrease output. Brush held in position by friction. **Do not exceed maximum rated output** (secured with third brush set 1⅔ commutator bars minimum, or this distance less 1 mica strip maximum, from nearest or insulated main brush). Remove jumper after completing adjustment.
Maximum Charging Rate—20 amperes (cold), 16.5 amperes (hot), 8.0 volts, 2000 R.P.M. with regulator inoperative.

Performance Data

Cold—Regulator Inoperative			Hot		
Amperes	Volts	R.P.M.	Amperes	Volts	R.P.M.
0	6.4	500	0	6.4	550
4	6.75	620	4	6.8	700
8	7.1	750	8	7.2	915
12	7.4	925	12	7.6	1200
16	7.7	1200	16.5	8.0	2150
20	8.0	2000			

Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—53 ozs. maximum.
Field Current—3.56-3.94 amperes at 6.0 volts.
Field Fuse—5 ampere (in knurled cup on regulator)
Motoring Current—4.99-5.51 amperes at 6.0 volts. NOTE—Main brushes should be set 2-2½ commutator bars ahead of neutral point.
Removal & Belt Adjustment:—Same as Std. Generator.

CUTOUT RELAY (GAM-4504A, B GEN.):—Model CB-4025. Mounted separately. *See article in Electrical Equipment Section.*
Cuts In—6.75-7.5 volts.
Cuts Out—.5-2.5 ampere discharge current.
Contact Gap—.025-.035".
Air Gap—.010-.030" with contacts closed.

TWO-CHARGE REGULATOR (GCS-4809A-5 GEN.):—Model TC-4317A. Mounted separately. Consists of Cutout Relay and Two-Charge (Current) Regulator in single case. *See article in Electrical Equipment Section.*

Cutout Relay

Cuts In—6.5-7.25 volts.
Cuts Out—.5-2.5 ampere discharge current.
Contact Gap—.015-.045".
Air Gap—.010-.030" with contacts closed.

Regulator

Contact Opening Voltage—8.25-8.75 volts at 70°F. NOTE—Unit compensated for temperature (voltage different at other temperatures—see Electrical Equipment Section for complete performance table).
Contact Closing Voltage—1.2-1.4 volts below opening voltage at same temperature.
Contact Gap—.005" minimum.
Air Gap—.045" with contacts closed.

LIGHTING:—Headlamps—Corcoran-Brown Stabilite with pre-focused bulbs. Upper and lower beams controlled by Beam Selector Switch on toeboard.
Headlamp Adjustment—With car fully loaded, 25' from screen, and with upper beams lighted, aim each headlamp so that hot spot centered on vertical lamp center-line and upper edge at horizontal lamp centerline. To adjust, loosen clampscrew (below lamp at center) three full turns, rotate entire lamp in the socket.
Beam Indicator—At center of instrument panel. Lighted whenever upper beams in use.

Switches

Lighting—Douglas. **Beam Selector**—Douglas.
Instrument—Douglas.

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps	32-21	2320
Parking	1.5	55
Instrument, Beam Indicator	1	51
Stop & Tail	21-3	1158
Dome, License Plate ('39)	3	63

FUSES:—Lighting—20 ampere. On Lighting Switch.
Generator Field Fuse (GCS-4809A-5 Generator only)—5 ampere. In knurled cup on side of regulator.

HORNS:—Schwarze. Vibrator, disc type. One horn Std., Twin horns Optl.
Horn Current—10 amperes (each).

SERIAL NUMBER:—First number 39-1001. Stamped on plate on right side of cowl under engine hood and on center of front frame cross-member.

ENGINE NUMBER:—First number 39-1001. Stamped on right front corner of engine block.

COMPRESSION:—Ratio—6.35-1 (Std.), 6.81-1 (High Alt.) cast-iron heads; 7.0-1 (Optl. HC) aluminum head.

Pressure—105 lbs. at 185 RPM. (Std. head).

VACUUM READING:—Steady 21-23" at 7 MPH. idling speed.

IGNITION:—**Coil Model IG-4090-A.** On the right side of engine block. Service Coil No. IG-4070.

Ignition Current—2.5 amperes idling, 4 stopped.

Ignition Switch:—Douglas. Coil connection not armored.

Distributor Model IGS-4007B, IGW-4129. Single breaker, 4 lobe cam, full automatic advance type with auxiliary vacum spark control. NOTE—Vacuum unit integral type (IGS-4007B), separate VC-4007 unit (IGW-4129).

Breaker Plate Identification (IGS-4007B)—Maximum vacuum advance limited by slot and marked by number (#7) stamped on plate.

Breaker Gap—.020".

Cam Angle (IGS-4007B)—47° closed, 43° open.

Cam Angle (IGW-4129)—41° closed, 49° open.

Breaker Arm Spring Tension—16-20 ounces.

Rotation—Counter-clockwise viewed from top.

Condenser—No. IG-2671K (IGS-4007B), No. IGB-1025 (IGW-4129). Capacity .20-.25 mfd.

Automatic Advance

Distributor Degrees	R.P.M.	Engine Degrees	R.P.M.
Start	300	0	600
2	550	4	1100
4	800	8	1600
6	1050	12	2100
8	1200	16	2400
9.5	1500	19	3000

Vacuum Spark Control (IGS-4007B)—Mounted on distributor cup and linked directly to breaker plate. Provides additional advance at all speeds above idling except when engine accelerated or operated with wide open throttle when spark retarded by return spring within unit.

Vacuum Advance

Distr. Degrees	Eng. Degrees	Vacuum (" of HG)
Start	0°	5"
2.5	5	9"
5	10	12.2"
7	14	15"

Vacuum Spark Control (IGW-4129)—Type VC-4007 or VC-4010. On bracket under distributor cup and linked to advance arm. Operates in same manner as IGS-4007B type above. Maximum vacuum advance 7° Dist., 14° Eng. (VC-4007).

Distributor Removal:—Mounted on right side of engine. To remove, disconnect vacuum line and take out hold-down screw in advance arm. To remove IGW-4129 without disturbing vacuum unit, loosen advance arm clamp bolt.

IGNITION TIMING:— Flywheel Degrees Pist. Position
All Engines .....0° At TDC.....0000" TDC

Timing—Remove inspection hole cover on top left hand side of flywheel housing. With #1 piston on compression, turn engine over until piston reaches top dead center, stop when flywheel mark 'TC-IGN' lines up with pointed end of indicator screw. Loosen advance arm clamp bolt, rotate distributor until contacts begin to open, tighten clamp bolt and see that rotor is in line with #1 segment in distributor cap, check spark plug connections (see diagram). NOTE—Eliminate backlash in drive gears by pressing rotor clockwise when checking timing.

Firing Order:—1-3-4-2. See diagram.

Spark Plugs:—Champion Type J8. 14 MM. Metric.

Spark Plug Gaps—.025".

CARBURETION:—Carburetor—Tillotson Model U-1B, 1⅛" downdraft type with manual choke control.

NOTE—No high speed adjustment provided on this model.

See article in Carburetor Section for data.

Idle Adjustment—If preliminary adjustment required (to warm up engine), turn idle adjusting screw in until just seated, then turn screw out ¾ turn. Warm up engine. With engine warm, adjust throttle lever stopscrew for slightly faster-than-normal idling speed, then turn idle adjusting screw out until engine begins to miss, finally turn screw in slowly until engine fires evenly. Set throttle lever stopscrew for 7 M.P.H. idling speed.

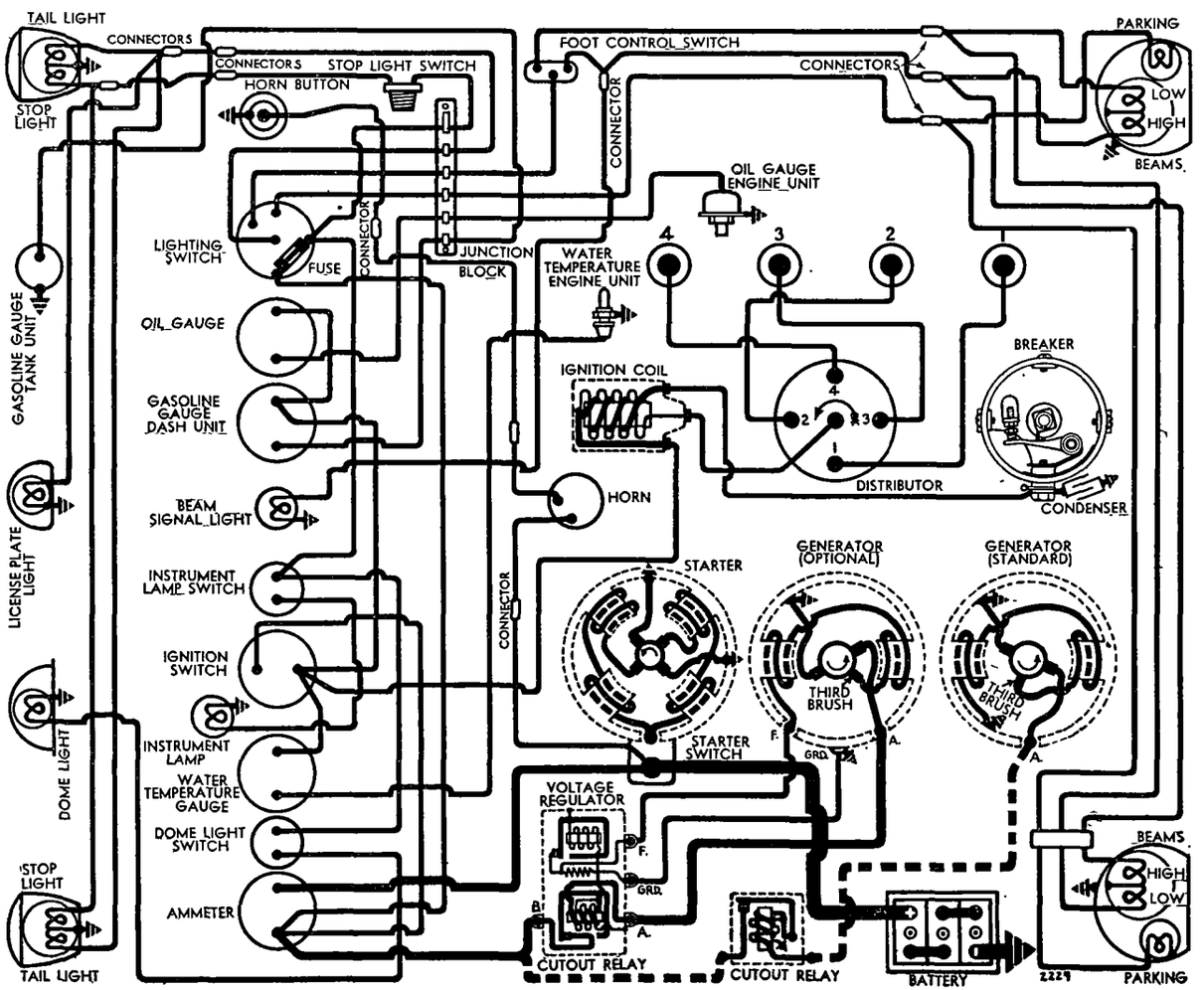
Air Cleaner:—AC #1528326 oil-wetted type Std., #1529167 heavy-duty oil-bath type Optl.

Fuel Pump:—AC Model AF #1523306. Diaphragm type.
See article in Carburetion Equipment Section.

Gasoline Gauge:—King-Seeley Electric. K-S No. 7044 (dash unit), No. 6280 (tank unit).
See article in Carburetion Equipment Section.

MANIFOLD HEAT CONTROL:—Automatic thermostatic type. No adjustment required.

VALVE TIMING:—To Check Timing—Set tappet clearance #1 intake valve at .020". This valve should open with the piston 9° or .039" before top dead



center when flywheel mark 'I.O.' lines up with pointed end of indicator screw in inspection hole in top left surface of flywheel housing. Reset tappet clearance at .014" (engine cold).

Tappet Clearance:—.014" all valves, engine cold.

Valve Spring Pressure:—59.5 lbs. at 2.165" (valve closed), 100 lbs. at 1.814" (valve open). Free length 2.684".

LUBRICATION:—Crankcase Capacity—4 qts.

Normal Oil Pressure—30 lbs. at 30 M.P.H.

Oil Pressure Gauge:—King-Seeley Electric. K-S No. 7047 (dash unit), No. 6425 (engine unit).
See article in Mechanical Equipment Section.

COOLING SYSTEM:—Capacity—11¾ qts.

Thermostat—Harrison. In outlet elbow on cylinder head. Starts to open 140-147°F. Fully open 170°F.

Temperature Gauge:—King-Seeley Electric. K-S No. 7041 (dash unit), No. 7000 (engine unit).
See article in Mechanical Equipment Section for data.

BATTERY:—USL Type A-13. 6 volt, 13 plate, 78 Ampere Hour capacity (20 hour rate).

Starting Capacity—96 amperes for 20 minutes.

Zero Capacity—300 amperes for 1.9 minutes.

Grounded Terminal—Negative (—) terminal grounded to right end of front frame cross-member.

Engine Ground—Strap connector at front mounting.

Dimensions—Length 8⅞". Width 7". Height 8⅝".

Location—In engine compartment on right side.

STARTER:—Model MZ-4064. Armature No. MZ-2089.

Drive—Special Outboard Bendix No. RC10HD.

Cranking Engine—185 RPM. 150-175 amperes, 5 volts.

Rotation—Counter-clockwise at commutator end.

Brush Spring Tension—42-53 ozs. (new brushes).

Performance Data

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	4300	5.5	70
.65 "	2500	5.5	100
2.55 "	1325	5.0	200
4.95 "	750	4.5	300
7.65 "	220	4.0	400
7.8 "	Lock	3.0	420
11.8 "	Lock	4.0	560

Removal:—Flange mounted on right front face of flywheel housing. To remove, take out 2 flange mounting capscrews and capscrew in bracket on commutator end.

Starting Switch:—No. SW-3737S. On starter. Cable-operated by pull button on instrument panel. Pull required to close switch should be 2.3 lbs. minimum (measured at extreme end and at right angles to lever).

GENERATOR (STD.):—Model GBM-4612-A. Armature No. GBM-2065. Third brush control type. Ventilated by fan on drive pulley.

Maximum Charging Rate—18 amperes (cold), 8 volts, 2150 R.P.M. (generator).

Charging Rate Adjustment—Remove commutator cover band, shift third brush by hand, counter-clockwise to increase, or clockwise to decrease output. Brush held in position by friction.

Performance Data

Cold Amperes	Volts	R.P.M.	Hot Amperes	Volts	R.P.M.
0	6.4	760	0	6.4	800
4	6.8	920	4	6.9	960
8	7.25	1050	8	7.35	1150
12	7.65	1240	12	7.8	1360
16	8.1	1450	16	8.3	1750
20	8.5	2150	18	8.5	2450

Rotation—Counter-clockwise at commutator end.

Brush Spring Tension—50-60 ozs. (new brushes).

Field Current—3.80-4.20 amperes at 6.0 volts.

Motoring Current—5.7-6.3 amperes at 6.0 volts.

GENERATOR (DELUXE):—Model GCJ-4811-A. Armature No. GCJ-2006F. Third brush control in conjunction with external vibrating type voltage regulator. Ventilated by fan on driven pulley.

Maximum Charging Rate—25 amperes (cold), 22 amperes (hot), 8.0 volts, 2500 R.P.M. Actual charging rate controlled by regulator and dependent on battery condition. See Regulator data below.

Charging Rate Adjustment—See Regulator data below. Maximum output controlled by third brush and adjustable by removing commutator cover band and shifting third brush counter-clockwise to increase, clockwise to decrease output (brush held in position by friction). When checking output, ground 'F' terminal (to eliminate regulator action). Do not set generator for greater amount than maximum given above.

Performance Data

Cold Amperes	Volts	R.P.M.	Hot Amperes	Volts	R.P.M.
0	6.4	760	0	6.4	850
4	6.65	920	4	6.7	1020
8	6.9	1080	8	7.0	1240
12	7.2	1240	12	7.3	1400
16	7.45	1400	16	7.6	1650
20	7.7	1580	20	7.9	2100
25	8.0	2500	22	8.0	2700

Rotation—Counter-clockwise at commutator end.

Brush Spring Tension—53 ozs. max. (new brushes).

Field Current—1.9-2.1 amperes at 6.0 volts.

Motoring Current—4.0-4.4 amperes at 6.0 volts.

Removal:—Conventional pivot mounting at right front of engine. To remove, take out pivot and clamp bolts.

Belt Adjustment:—Loosen pivot and clamp bolts, swing generator out until fan can just be rotated with belt stationary.

CUTOUT RELAY (STD. GENERATOR):—Model CB-4025. Mounted separately on dash.
See article in Electrical Equipment Section.

Cuts In—6.75-7.5 volts.

Cuts Out—.5-2.5 amperes discharge current.

Contact Gap—.010-.030".

Air Gap—.025-.035" with contacts closed.

REGULATOR (DELUXE GENERATOR):—Model VRD-4004A. Consists of Cutout Relay and vibrating type Voltage Regulator in case mounted on the dash.
NOTE—Regulator cover sealed. Serviced on exchange basis if seals not broken.
See article in Electrical Equipment Section.

Cutout Relay

Cuts In—6.4-7.0 volts cold.

Cuts Out—.5 ampere min., 3.0 amperes max. cold.

Contact Gap—.015" minimum.

Air Gap—.034-.038" (hinge end of core—contacts open).

Voltage Regulator

Setting—7.3-7.6 volts at 70°F.

To Check (Without Breaking Seals)—Connect ammeter in charging line at regulator 'BAT' terminal, voltmeter between 'BAT' terminal and ground. Operate generator at speed of 30 M.P.H. charging fully charged battery until voltage is constant. Voltmeter reading should be within limits of 7.3-7.6 volts (cold—70°F.), 7.1-7.4 volts (hot—140°F.). See article in Electrical Equipment Section for voltages at other temperatures.

To Adjust (With cover removed)—Change regulator armature spring tension by bending lower spring hanger slightly. Check setting as directed above. See Electrical Equipment Section for complete instructions.

Contact Gap—.010-.020" (armature against stop pin).

Air Gap—.0595-.0625" with contacts just opening.

LIGHTING:—Headlamps—Corcoran - Brown Stabilite, Pre-focused type. Upper and lower beams controlled by beam selector switch on toeboard.

Headlamp Adjustment—Adjust by loosening clamp-screw at lower end of mounting band (on back of lense body below lamp, under fender) 3 full turns and turning lamp in socket by grasping adjusting pin at rear. Aim upper beam of each lamp straight ahead so that hot spot centered on vertical line directly ahead of lamp center with upper edge on horizontal line at lamp-center height at 25 feet.

Beam Indicator—In upper rim of speedometer dial. Lighted whenever upper or high beams in use.

Switches

Lighting—Douglas. **Beam Control**—Douglas.
Instrument—Douglas.

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps	32-21	2320
Parking	1.5	55
Instrument, Beam Indicator	1	51
Stop and Tail	21-3	1158
Dome, License Plate	3	63

FUSES:—Lighting—20 amperes. On lighting switch.

HORN:—Schwarze. Vibrator type.

Horn Current—10 amperes.

CAR SERIAL NUMBER:—On plate on right frame member above front spring *rear hanger and under driver's seat cushion. First number 1001 (66-D), 7601* (66-E).

ENGINE NUMBER:—On plate on left side of crankcase.

BATTERY:—U.S.L., Type HW-17A (Models 66-D and 66-E). 6 volt, 17 plate, 166 ampere hour capacity (5 ampere rate). Starting capacity 170 amperes for 20 minutes.

Grounded Terminal:—Negative (—) terminal grounded to frame.

Mounting:—On left hand side of frame under front floor boards.

Dimensions:—Width, 7⅛". Length, 13 7/16". Height, 9⅛".

IGNITION:—**Coil Model IG-4202, 4303 (66-D) IG-4602 or North East No. 22636** (66-E). Lock coil type mounted on back of instrument board with switch in base (except North East coil mounted on side of engine block, and IG-4602 used with special Mitchellock Model 16-S).

Ignition Current:—2 amperes at 6 volts (engine running), 4 amperes at 6 volts (engine stopped).

Ignition Switch—Electrolock Type 5-B (N. E. distributor—see Equip. Section for complete data). Switch is assembled as unit with distributor and must be taken off the car whenever distributor is removed. No provision is made to turn ignition on with Startix being inoperative and it will be necessary to disconnect lead on 'IGN' terminal of Startix case to avoid automatic cranking when ignition is turned on to check timing.

Distributor North-East Type 10877 or Auto-Lite Model IGC-4052. Single breaker, 6 lobe cam, semi-automatic advance type.

Manual Advance:—20 degrees (engine) maximum.

Breaker Gap:—Set contact gap at .020 inch.

Breaker Arm Spring Tension:—16-20 ounces.

Cam Angles—(IGC-4052). Closed 41°. Open 19° (distributor degrees).

Automatic Advance—Type 10877

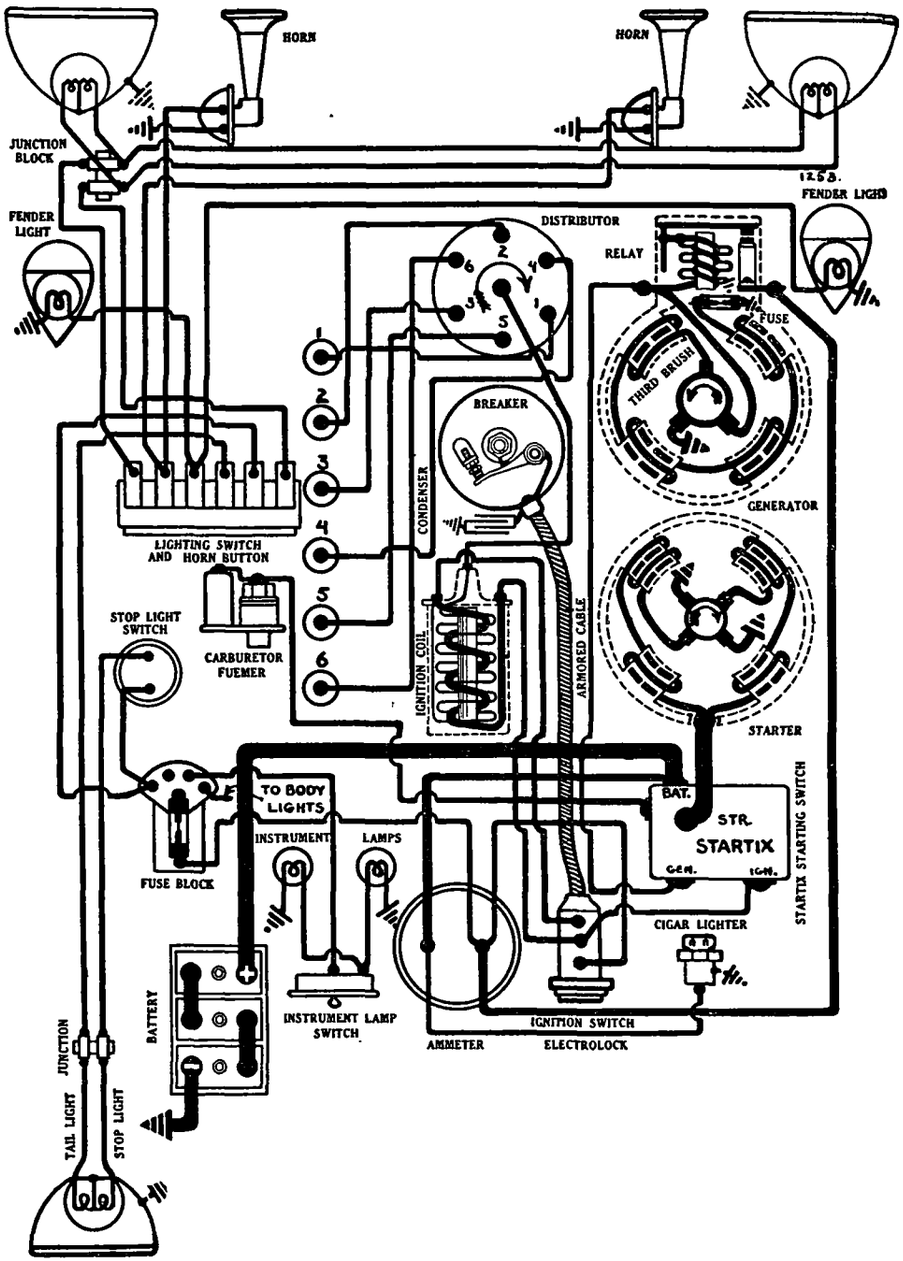
Degrees	Distributor R.P.M.	Degrees	Engine R.P.M.
Start	200	2	400
12	1000	24	2000

Automatic Advance—Model IGC-4052

Start	200	0	400
3	610	6	1220
6	1050	12	2100
9	1480	18	2960
10.5	1700	21	3400

Mounting:—Distributor is mounted on top of oil pump housing at right of engine. To remove distributor, take out hold-down screw in advance arm and lift distributor from place.

Timing:—Breaker contacts begin to open when the piston entering power stroke reaches a position .112 inch (actual piston travel) or 16 degrees (on the flywheel) before top dead center with the manual spark control fully advanced. To set timing, crank engine over until piston No. 1 enters compression stroke. This can be determined by taking out No. 1 spark plug and turning the engine over until the air compressed in the cylinder is felt escaping through the spark plug port. Fully advance the manual spark control (push the spark button all the way in toward the dash) and see that the distributor is turned counter-clockwise as far as possible. Turn engine over until the ignition mark on the flywheel, 'IGN', which is 16 degrees before the top dead center mark 'T.C.' is directly opposite the



indicator in the inspection hole in the flywheel housing. Take up all backlash in distributor gears by turning distributor shaft counter-clockwise. Then loosen advance arm clamp screw and rotate distributor until contacts begin to open. Tighten the clamp screw and connect spark plugs as shown on the diagram.

Firing Order:—The firing order is 1-5-3-6-2-4.

Spark Plugs:—⅞-18 S.A.E. Champion Type C-4. Gaps are .020 inch.

VALVE TIMING:—The Willys-Knight engine is of the sleeve valve type. To time sleeve valves with eccentric shaft sprocket removed, remove pipe plug in exhaust manifold directly opposite No. 1 exhaust port and scrape carbon from edges of sleeve ports so that closing of ports can be checked. Remove inspection hole cover in flywheel housing and turn engine over until piston No. 1 reaches top dead center with the flywheel mark 'T.C.' directly opposite the indicator. Remove the spark plug in cylinder No. 1 and place a test lamp in the spark plug port so that the light can be seen through the exhaust port. Then turn eccentric shaft in direction of rotation until the upper edge of the port in the outer sleeve just passes the lower edge of the port in the cylinder block when the light will be cut off. Assemble eccentric shaft sprocket and timing chain, being careful not to disturb relative positions of eccentric shaft and crankshaft.

Intake Ports	Timing—1931	Exhaust Ports
Open—5° after top dead center.		Open—50° before lower dead center.
Close—46° after lower dead center.		Close—At top dead center.

Timing—1932

Open—10° before top dead center.	Open—45° before lower dead center.
Close—36° after lower dead center.	Close—At top dead center.

STARTER:—Model MAB-4018, MAB-4036 R.H.D. Starter drives engine through a Bendix drive. The direction of rotation is clockwise, viewed from the commutator end. Brush spring tension is 44-56 ounces. The starting switch is mounted at the lower end of the steering column and is operated by pulling up on the knob on the steering wheel.

Starter Data

Torque	R.P.M.	Volts	Amperes
.6 lb. ft.	1910	5.5	100
3.4 "	1100	5.0	200
6.6 "	695	4.5	300
10.15 "	420	4.0	400
24 "	Lock	4.0	725

Mounting:—Starter is sleeve mounted at the right of the transmission on the rear face of the flywheel housing. To remove starter, disconnect cable and take out two dowel screws in flywheel housing directly above starter sleeve. Then pull starter to the rear to clear drive and lift from place.

GENERATOR:—Model GAG-4130, 4134. Direction of rotation is counter-clockwise at commutator end. Third brush regulation. With standard car setting, maximum charging rate is 17 amperes at 8 volts (cold) reached at 1500 R.P.M.

Charging Rate Adjustment. Take off commutator cover band, shift third brush by prying on brush mounting stud, counter-clockwise to increase, or clockwise to decrease charging rate. Third brush mounting plate is held in position by friction.

Generator Data

Cold Test			Hot Test		
Amperes	Volts	R.P.M.	Amperes	Volts	R.P.M.
0	6.4	550	0	6.4	640
4	6.7	660	4	6.9	800
8	7.0	760	8	7.3	980
12	7.4	900	10	7.6	1110
16	7.8	1120	12	7.8	1280
19	8.0	1500	14.2	8.0	1680
13	7.4	2400	11.5	7.7	2400

Brush Spring Tension:—22-27 ounces on each brush.

Field Current:—4.08-4.52 amperes at 6.0 volts across field terminals.

Field Fuse:—7½ ampere capacity fuse mounted on brush ring.

Motoring:—4.18-4.62 amperes at 6.0 volts.

Mounting:—Generator is cradle mounted at the right of the engine and is driven through a flexible coupling from the chain case. To remove generator, disconnect lead and drive coupling. Then loosen mounting strap and slide generator from place.

RELAY:—Model CB-4014, 4021. Mounted on the generator field frame. Relay contacts close at 575 R.P.M. when the voltage of the generator reaches 7-7.5 volts and open with a discharge current of .5-2.5 amperes. Charging current at closing of contacts is approximately 2 amperes. Relay contact gap is .025-.035 inch. Air gap is .010-.030 inch with contacts closed.

LIGHTING:—Finger Tip Control Switch, Model A-805. Switch is mounted at the lower end of the steering column and is controlled by a button on the steering wheel. The starting switch, lighting switch and horn button are all incorporated in the single unit. Dimmer system 'depressed beam' double filament headlight bulbs controlled by lighting switch. See Equipment Section for complete article on Finger Tip Control.

Lamp Sizes

Position	Voltage	Candlepower	Base	Mazda No.
Headlights	6-8	21-21	D.C.	1110
Fender lights	6-8	3	S.C.	63
Dash lights	6-8	3	S.C.	63
Stop and tail light	6-8	21-2	D.C.	1158
Dome and corner lights	6-8	3	S.C.	63

FUSES:—Generator field fuse is 7.5 ampere capacity. Lighting fuse mounted on fuse block on lower left front side of dash is 20 ampere capacity.

NATIONAL SERVICE MANUAL

1940 SUPPLEMENTS

FIELD & PRODUCTION CHANGES
NEW TYPE UNITS—SPECIAL SERVICE NOTES

BANTAM

1940 MODELS

New Carburetor—New Zenith model—does not have High Speed Adjustment. See Bantam 'T&E' page and Zenith 61A5 Carburetor in 'C' Section.

New Crankshaft Bearings—New 3 bearing crankshaft with new type center main bearing. See Bantam 'M' page.

New Shock Absorbers—Monroe Hydraulic type now used on Passenger Car models. See Monroe Shock Absorbers in 'ME' Section.

New Clutch Facing—After Eng. No. 65-500, front facing not riveted on flywheel (floats between flywheel and driven member).

Oil Pump Screen Location—After Eng. No. 65-500, screen mounted on pump inside oil pan (was on side of crankcase on previous models).

1939 & PREVIOUS MODELS

Excessive Oil Gauge Pointer Fluctuation—Correct by removing oil gauge line, blowing out oil and restricting lower end of line to pin hole size. Install later type high-pressure oil gauge.

Oil Leakage at rear end of Crankshaft—Has been corrected by use of new solid washer, No. 8700, under head of flywheel bolt.

Front Shock Absorber Squeaks—Correct by cleaning or replacing discs and oiling center bolt. See Bantam 'M' page for directions.

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BUICK

1940 MODELS

Hard Shifting Complaints (50, 70)—Lubricate shift control idler lever on side of transmission case (see Buick Transmission Control in 'ME' Section). This lever not used on other models.

New Axle Torque Tube & Carrier (40, 50, 60, 70)—New two-piece bolted type. Torque tube should not be disconnected from carrier (except for gasket installation to correct oil leaks) or original alignment will be disturbed (parts not furnished separately).

New Pistons—New type with deeper top compression ring groove and new ring with heavier wall section to prevent ring and land failure. See Pistons & Replacement Piston Ring data in Buick Shop Notes ('M' Section).

Transmission—New type Synchronizer Cones and Second Speed Gears. Must be matched on each transmission model and must not be confused with previous types. See Buick Transmission in 'ME' Section.

New Ignition Lock (not Steering Column Lock)—Has two different 'off' positions (locked in one position only). See Ignition Switch on Buick 'T&E' page.

Carter & Stromberg Carburetors—Both makes used on each model (2 different Carter models on 40, 50). See Buick 'T&E' page and Carter 'WDO' and Stromberg 'AAV' carburetors in 'C' Section.

Starter Controls (2 Types)—Different type vacuum switch (on carburetor) on each carburetor make. See Buick 'T&E' page and complete data in 'EE' Section.

Horn Relay Sticking—See Note under Horn Relay on Buick 'T&E' page for special tested service relays to correct sticking complaints.

New Direction Signal—1940 Type has Direction Signal built in steering wheel hub. Switch must be turned 'off' whenever steering wheel removed or replaced. See Direction Signals in 'EE' Section.

1939 & PREVIOUS MODELS

1939 40 & 60 Engine & Axle Alignment Caution—See special caution note under Rear Axle Removal on 1939 'M' page to maintain alignment of Axle and Engine on these cars with frame-mounted universal joint ball. See also Engine & Rear Axle Alignment instructions on Buick Shop Note page in 1939 Supplement 'M' Section.

CADILLAC—LA SALLE

1940 MODELS

Clutches (2 Makes used)—Borg & Beck 11A6 type used on first Cadillac V8 & La Salle cars, Long 11CF and 10CF on later cars. See Borg & Beck and Long 'CF' Clutches in 'ME' Section.

CONTINUED ON NEXT PAGE

FIELD & PRODUCTION CHANGES, NEW TYPE UNITS, SPECIAL SERVICE NOTES

CONTINUED FROM PRECEDING PAGE

Replacement Clutch Caution—Service clutches furnished with locking pin blocking each release lever. Pins must be removed when clutches installed in car or they will drop down in clutch housing and may cause damage.

Clutch Balancing—Clutches must be balanced when installed in car for smooth operation. See Balancing data in Cadillac Shop Notes in 'M' Section.

Rear Axle Pinion Bearing Caution—Do not loosen rear universal joint companion flange nut (controls pinion bearing 'pre-load').

Direction Signal Bulb Change—Two different bulbs used in rear signal. Flasher will not operate if wrong type installed. See Cadillac & La Salle 'T&E' page Bulb Specifications.

New Steering Gear (72)—New Recirculating Ball Type. See Saginaw Recirculating Ball type Steering Gear in 'ME' Section for special servicing caution to avoid damage to nut and ball return channels.

1939 & PREVIOUS MODELS

Replacement Clutch Caution—See caution note for '40 Models (above) for locking pin or block removal.

Steering Gear Chuckle or Noise on V8 & V16 Cars with offset steering shaft & Universals—See Special Service Note on Universal Joints in 'Saginaw Steering Gears' in 'ME' Section for recommended correction.

1939 Rear Axle Pinion Bearing Caution—Rear universal joint companion flange nut must not be loosened (controls pinion bearing 'pre-load').

CHEVROLET

1940 MODELS

Gearshift Flutter Complaints—See Chevrolet Transmission Control in 'ME' Section for recommended procedure to correct this complaint.

Carburetor 'Popping-back' & Rich or Lean Complaints—See Carter W1 (Chevrolet) Carburetor in 'C' Section for recommended correction.

Engine Running Backward when turned off—See Carter W1 (Chevrolet) Carburetor in 'C' Section for recommended correction.

1940 Carburetors—1940 cars use same models as 1939 but specifications and jets changed. See Carter W1 Carburetor and Carter Jet Specifications in 'C' Section for new data.

New Adjustable Throttle-cracker—See Chevrolet 'T&E' page for adjustment directions.

New Oil Distributor Caution—See 'Oil Distributor' in Chevrolet Shop Notes in 'M' Section for Important gasket installation data.

New Crankshaft Rear Oil Seal—See Oil Seal data in Chevrolet Shop Notes in 'M' Section for servicing instructions.

New Valve Timing (New Crankshaft Gear)—See 'Timing Gear' and 'Valve Timing' sections on Chevrolet 'M' page. *CAUTION*—Old type gear must not be used on '40 cars.

Tight Rear Spring Shackle Correction—See Chevrolet Shop Notes in 'M' Section for recommended correction.

Brake Adjustment Change—Not necessary to remove front wheels for brake adjustment on '40 models (slots now provided in front wheels).

New Truck Axles—All Truck Axles now Hypoid type (Semi-floating & Full-floating types). See Chevrolet Axles in 'ME' Section.

Transmission Control Changes—On Passenger cars, new type shifter mechanism and vacuum power cylinder linkage used. See Chevrolet Transmission Control in 'ME' Section for new adjustment data.

1939 & PREVIOUS MODELS

Engine Running Backward when turned off—See Carter W1 Carburetor in 1939 Supplement 'C' Section for recommended correction.

1939 Carburetor Stalling, Loading, Pinging, or Poor Mileage Complaints—See Carter W1 Carburetor in 1939 Supplement 'C' Section for recommended corrections.

Main Bearing Dimensions (1937-38)—See 1939 Supplement Chevrolet 'M' page for Crankshaft Journal data. Correct 1937 & 1938 Supplement pages to read same as 1939 data.

Transmission Front Bearing Retainer (New Type to correct Oil Leaks caused by cracked retainer)—Can be installed on '38-39 Cars and '38-39-40 Trucks for heavy duty service. See Chevrolet 1940 Transmission in 'ME' Section for data.

Manifold Heat Control Valve Rattle Correction—See Note under Manifold Heat Control on Chevrolet 'T&E' page for installation of special anti-rattle spring.

CHRYSLER—DE SOTO—DODGE PLYMOUTH

1940 MODELS

Carburetor Changes (Chrysler 6 & De Soto)—Two carburetor models used on each with different jet calibrations. See Carter (B&B) Carburetor & Jet Specifications in 'C' Section for data. IMPORTANT CHRYSLER NOTE—First Type Carburetor can be brought up to later type performance by installing new jets. See Carter (B&B) Carburetor in 'C' Section for directions.

- **Throttle Guard on Fluid Drive Cars**—See Chrysler 'T&E' page or Chrysler Throttle Guard in 'CE' Section for adjustment directions.

New Toe-in Adjustment—Now adjusted by turning both rods on all models. See Chrysler Independent Suspension in 'ME' Section for instructions.

New Windshield Wiper & Circuit Breaker—New two-speed type wiper with circuit breaker on switch instead of fuses. See Auto-Lite Electric Windshield Wiper in 'ME' Section.

New Rear Axle (C27)—Has barrel type differential case. See Chrysler C27 Axle in 'ME' Section for special important differential cover lockpin data.

Overdrive Transmission (Chrysler, De Soto)—Adapter plate fastened to overdrive case by concealed screws. See Warner Overdrive in 'ME' Section for Adapter Removal Note (Servicing Section).

CROSLEY

1939-40 MODEL

Important Service Note—Engine must be removed from chassis for service work. See Crosley Shop Notes in 'M' Section for instructions.

Rear Axle Service Caution—See Axle & Transmission Removal instructions on Crosley 'M' page for caution when removing axle or shaft and torque tube from car.

FORD—MERCURY

1940 MODELS

Cylinder Sleeves & Special Piston Servicing Data—New dry cylinder sleeves used on all models (part production). See Ford Shop Notes in 'M' Section for engine markings and special piston servicing data when sleeves used.

1940 '60' Crankshaft—New type with larger main and connecting rod journals. See new bearing data in Ford Shop Notes in 'M' Section.

1940 '60' Clutch—New larger semi-centrifugal clutch on Passenger Cars. See Ford '60' 'M' page and Long 'CF' Clutch in 'ME' Section.

New Timing Gear—New aluminum alloy bolted-on type Camshaft Gear used (part production). See Ford Shop Notes in 'M' Section for servicing data.

New Transmission Control—New gearshift lever mounted on steering column used on all models. See Ford Transmission Control in 'ME' Section for adjustments.

New Rear Axles (Trucks)—All Trucks now Hotchkiss drive. See Ford Truck Rear Axle in 'ME' Section and also Ford 'M' pages for new propeller shaft and universal joint data.

1939 & PREVIOUS MODELS

Starter Support Brace Installation (1938 cars & earlier) to correct Engine Pound—See Ford Shop Note page in 'M' Section (1938 Supplement or manual) for instructions.

1939 Shock Absorber Change—New spring-loaded automatic type packing gland used on late 1939 cars. No packing gland adjustment (to prevent leaks) required on these cars.

HUDSON

1940 MODELS

New Distributor & Drive 6—New type distributor & vacuum spark control. Rotation reversed from 1939. New type distributor mounting at rear of engine. See Distributor section of Hudson 6 'T&E' page.

Carburetor Changes (41, 43)—Two different Carter carburetors used. See Hudson 8 'T&E' page and Carter 'WDO' Carburetor in 'C' Section.

Regulator Changes—Auto-Lite 'VRD' used on first cars, 'VRR' with different specifications on later cars. See Hudson 'T&E' pages and Auto-Lite Regulators in 'EE' Section.

Special Carburetor Mounting—8 gaskets used. See Carter 'WA1' and 'WDO' Carburetors in 'C' Section for gasket and heat deflector installation data.

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New Rear Camshaft Bearing (6)—Bearing has cut-out for distributor drive gear clearance. See special installation instructions on Hudson Shop Note page in 'M' Section.

Vibration Dampener Removal—Can be removed from under car without removing radiator. See instructions on Hudson Shop Note page in 'M' Section.

New Overdrive with 'kick-down' Control—See Warner Overdrive & Warner Overdrive Control in 'ME' Section for servicing & adjustment data.

New Front Suspension—New Independent Suspension used on all models. See Hudson Independent Suspension in 'ME' Section.

1939 & PREVIOUS MODELS

1939 Water Pump Change—New Impeller and seal spring washer used on late cars, can be installed on earlier cars. See Hudson Water Pump in 1940 Supplement 'ME' Section.

1939 Shock Absorber Change—New Monroe '3 tube' type used on late cars. See Monroe Shock Absorbers in 1940 Supplement 'ME' Section for data.

LINCOLN-ZEPHYR

1940 MODELS

1940 Engine Changes—Larger engine with increased bore and higher compression ratio. See Engine Specifications on Lincoln-Zephyr 'M' page and new Piston & Ring data on Lincoln-Zephyr Shop Note page in 'M' Section.

New Timing Gear—New aluminum alloy bolted-on type Camshaft Gear. Can be replaced without removing camshaft. See Lincoln-Zephyr Shop Note page in 'M' Section for instructions.

New Larger Carburetor—Carburetor size increased and new larger jets used. See Chandler-Groves Carburetor and Jet Specifications in 'C' Section.

1939 & PREVIOUS MODELS

Connecting Rod Bearing Correction—Bearing shells on all Lincoln-Zephyr engines are clamped in rod (not floating) and have small tangs which engage notches in rod and cap. Make this notation on Lincoln-Zephyr 1936-37-38 'M' pages. Bearing dimensions are correct as shown.

1939 Firing Order—On 1939 Lincoln-Zephyr 'T&E' page, firing order should be 1-4-9 etc. Change second figure from '3' to '4'.

1939 Shock Absorber Change—New spring-loaded automatic type packing gland used on late 1939 cars. No packing gland adjustment (to correct leaks) required on these cars.

NASH & NASH-LAFAYETTE

1940 MODELS

Warming up Complaints—On Nash 6 & 8, see Carter 'WA1' and 'WDO' Carburetor in 'C' Section for directions on checking hot air tube. On Nash-Lafayette, see Climatic Control change following.

Climatic Control Change (Nash-Lafayette)—New type Climatic Control (automatic choke) with different setting and other changes made to correct warming up complaints. See Carburetor section on Nash-Lafayette 'T&E' page and Carter 'WDO' Carburetor in 'C' Section for data.

Torquematic Spark Control (Nash 6 & 8)—See Ignition Timing on Nash 'T&E' pages for adjustments.

Crankshaft Chain Sprocket Installation—Sprocket should be heated. See Nash Shop Note page in 'M' Section for instructions.

1940 Clutch Changes—Clutch type changed in production and new 'Borglite' driven member used with later types (requires different lever setting). See Nash 'M' pages and Borg & Beck Clutch in 'ME' Section.

New Independent Suspension—Used on all 1940 models. See Nash Independent Suspension in 'ME' Section.

New Brake Adjustment (Nash 6 & Nash Lafayette)—Do not have Eccentric adjustment and must be adjusted differently than previous models. See Bendix Hydraulic Brakes (No Eccentric) in 'ME' Section for instructions.

New 'kick-down' type Overdrive—Electrical control not same as used on other car models. See Warner Overdrive & Warner Overdrive Control in 'ME' Section for servicing and adjustment.

Transmission Shifter Fork & Overshift Stop Adjustments—Must be adjusted when cover installed. See Nash Transmission in 'ME' Section.

Hypoid Rear Axles—All models now have Hypoid Axles. See Nash Rear Axle in 'ME' Section for complete overhaul and adjustment data.

1939 & PREVIOUS MODELS

Piston Removal on 8 Cylinder Cars—Pistons should be removed from below. Make this correction on Nash 8 'M' pages.

OLDSMOBILE

1940 MODELS

Ignition Timing Change (8)—Flywheel mark now indicates #1 firing point (not #6 as on previous cars). See Oldsmobile 8 'T&E' page.

New Carburetors on Hydra-matic Drive Cars—Different carburetors used on each model when cars equipped with Hydra-matic Drive. See Oldsmobile 'T&E' pages and Carter 'WA1' and 'WDO' Carburetors in 'C' Section for special settings on these models.

Carburetor Float Level Change (8)—Float level changed to 3/8" (supersedes all former settings on Std. & Hydra-matic Car Carburetor models). See Oldsmobile 'T&E' page & Carter 'WDO' Carburetor in 'C' Section for complete data.

Connecting Rod Bolt Change—New type bolt (no cotter pin) used on later cars. Must be tightened to different tension. See Oldsmobile Shop Note page in 'M' Section for data.

Special Main Bearing Bolts (6)—Special bolts used on #3 main bearing cap on all Sixes. See Crankshaft Note on Oldsmobile 6 'M' page.

New Self-locking Tappet Screws—Used on all 1940 cars. See Tappet Clearance Note on Oldsmobile 'T&E' and 'M' pages.

New Brake Adjustment (8)—Brakes do not have eccentric adjustment. See Bendix Hydraulic Brakes (No Eccentric) in 'ME' Section for new adjustment directions.

Hydra-matic Drive—New type Fluid Coupling and automatic transmission optional on all 1940 cars. No clutch used with this drive. See Oldsmobile Hydra-matic Transmission in 'ME' Section.

Propeller Shaft Slip-joint Caution—See note under Rear Axle Removal on Oldsmobile 'M' pages (slip-joint formed in transmission ahead of front universal and entire shaft assembly free to pull out unless care taken to prevent this).

1939 & PREVIOUS MODELS

1939 Water Pump Change—Neoprene bearing seal used on pumps on late cars. See Oldsmobile Water Pump in 1940 Supplement 'ME' Section for data.

1939 Propeller Shaft & Slip-joint Caution—When disconnecting shaft, use care not to allow shaft to pull out of transmission (slip-joint formed in transmission ahead of front universal and entire shaft free to pull out).

New 1937-38 Valve Guides—New shorter 1939-40 type Valve Guide can be installed on 1937-38 cars to correct valve sticking. See Oldsmobile 1939 or 1940 'M' pages for Valve Guide data.

New 1939 Clutch Throw-out Bearing—New improved 1940 type bearing may be installed on 1939 cars.

New 1939 Transmission Oil Seal—New 1940 type may be used. This seal has locating shoulder to insure correct installation.

Distributor Ground Leads—New 1940 ground lead can be installed on previous 6 cylinder distributors. Special longer type (as used on first 1250 1940 8 cylinder cars) can be installed on previous 8 cylinder distributors.

PACKARD

1940 MODELS

Distributor Change (6 & 8)—Two different distributors used on each model (production change). Condenser also changed on 6 (new type has different capacity). See Packard 6 & 8 'T&E' pages.

New Carburetor (6)—1940 Six equipped with new type Stromberg Carburetor. See Stromberg 'BXOV' Carburetor in 'C' Section.

New Electric Windshield Wiper (6 & 8)—See Stewart-Warner Electric Windshield Wiper in 'ME' Section.

Regulator Change (6 & 8)—Auto-Lite 'VRB' type used on first cars, new 'VRP' type on later cars. See Packard 6 & 8 'T&E' pages and Auto-Lite Regulators in 'EE' Section.

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FIELD & PRODUCTION CHANGES, NEW TYPE UNITS, SPECIAL SERVICE NOTES

CONTINUED FROM PRECEDING PAGE

Clutch Change (All Models)—Both Borg & Beck (10A7 & 11A6) and Long (CF) Clutches used on 1940 cars. See Packard 'M' pages and Borg & Beck and Long 'CF' & 'CFS' Clutches in 'ME' Section.

Self-locking Tappet Screws (6 & 8)—See Packard 6 & 8 'T&E' or 'M' pages for data.

New Super 8 Engine—Entirely new design. See Packard Super 8 'M' page.

New Electrically Controlled Overdrive—Not like previous type or overdrive on any other car. Control entirely electrical (solenoid action reversed from 1939 type). See Warner (Packard) Overdrive, and Overdrive Control, in 'ME' Section.

New Brake Adjustment—Brakes on 6, 8, Super 8 (1803, 6 only) do not have eccentric adjustment and adjusted differently than previous models. See Bendix Hydraulic Brakes (No Eccentric) in 'ME' Section for adjustment instructions.

New Shock Absorbers (6 & 8)—Delco or Monroe Direct Acting type used. See Delco and Monroe Shock Absorbers in 'ME' Section.

Rear Axle Pinion Bearing Caution—Pinion bearings must be adjusted whenever rear universal joint companion flange nut loosened or removed. See Packard Rear Axle in 1940 Supplement 'ME' Section for directions and specified 'pre-load'.

1939 & PREVIOUS MODELS

1938 Valve Guide Change to prevent sticking (6 & 8)—See 1939 Packard Shop Notes in 'M' Section for recommended change on first cars with longer guides.

1938 Camshaft & Lifter Change (6 & 8)—See 1939 Packard Shop Notes in 'M' Section for change in camshaft and lifter type used with each shaft.

1939 Econo-drive Rear Bearing Caution—Bearings must be adjusted if universal joint companion flange nut loosened (controls bearing 'pre-load') on cars with first type bearing. See Packard Transmission and Warner Overdrive in 1939 Supplement for Bearing Adjustment and installation of recommended later type bearing (with automatic spring-washer bearing adjuster). NOTE—On cars with later type bearing, rear nut must be kept tight—on first cars tighten nut only enough to secure correct bearing pre-load.

Rear Axle Pinion Bearing Caution (6, 8, 1939 Super 8)—Bearing must be adjusted whenever rear universal joint companion flange nut loosened or removed. See Packard Rear Axle in 'ME' Section for directions.

PONTIAC

1940 MODELS

Carburetor Changes (6 & 8)—See Carter 'WA1' Carburetor in 'C' Section for changes on new 'SP' type and recommended correction for 'hesitating' when starting in 2nd gear on first types.

Carburetor Changes (Torpedo 8)—Metering Rod and Climatic Control changed on later 'SM' type. See Carter 'WDO' Carburetor in 'C' Section for different settings on each type and recommended correction for poor warming up on first type.

New Light Switch & Stop Light Fuse—See Lighting Switch Note on Pontiac 'T&E' pages. New switch used on later cars and Stop Light fuse added.

Grounded Generator Field Coils—See Generator Note on Pontiac 6 'T&E' page.

Generator Open-circuits (Torpedo 8)—See correction note under Regulator on Pontiac 8 'T&E' page.

Timing Gear Cover Noise Correction—See Pontiac Shop Notes in 'M' Section for recommended change.

Engine Rear Support Insulator Loosening from Frame (First Cars)—See Pontiac Shop Notes in 'M' Section for installation of special Re-inforcement Plate (as used on later cars).

Clutch Slippage Correction (8)—See Inland Clutch in 'ME' Section for new heavier clutch assembly recommended to correct slipping when starting in second gear on first cars (used on later cars).

Rear Axle Oil Leakage—See Pontiac Shop Note page in 'M' Section for recommended correction.

Gearshift Stiffness Correction—See Pontiac Transmission Control in 'ME' Section for recommended correction.

Clutch Poor Release, Noise, Roughness Correction—See Anti-rattle Spring data for Inland Clutch in 'ME' Section for recommended correction.

Propeller Shaft Slip-joint Caution—See note under Rear Axle Removal on Pontiac 'M' pages (slip-joint formed in transmission and entire shaft assembly free to pull out unless care taken to prevent this).

1939 & PREVIOUS MODELS

1939 Water Pump Change—Neoprene bearing seal used on later cars. See Pontiac Water Pump in 1940 Supplement 'ME' Section.

1939 Easier Shifting Correction—See Pontiac Transmission in 1940 Supplement 'ME' Section for installation of 1940 type shifter shaft.

Clutch Poor Release, Noise, Roughness—See Anti-rattle spring data for Inland Clutch in 1940 Supplement 'ME' Section for correction.

1939 Propeller Shaft & Slip-joint Caution—When disconnecting shaft, use care not to allow shaft to pull out of transmission (slip-joint located in transmission ahead of front universal).

STUDEBAKER

1940 MODELS

Carter & Stromberg Carburetors (Comm. & Pres.)—Both makes used on each model. See Carter 'WA1' & 'WDO' and Stromberg 'BXO' & 'AAO' Carburetors in 'C' Section.

Manifold Heater Valve Noise Correction (Champion early cars)—See Note under Manifold Heat Control on Champion 'T&E' page for recommended correction on first cars.

New Drive Shaft Slip Joint (Champion)—Located on rear of transmission (solid shaft). See Note under Transmission on Champion 'M' page for data.

New Gearshift (Commander & President)—Now use new type similar to Champion. See Studebaker Transmission Control in 'ME' Section for directions on reworking 1939 adjusting gauge for 1940 models.

Champion Carburetor Float Level Caution—See important note under Float Level for Carter 'WO' Carburetors in 'C' Section.

1939 & PREVIOUS MODELS

1939 Champion Carburetor Change—Special spring loaded float valve used on late cars. See Carter 'WO' Carburetor in 1940 Supplement 'C' Section for special caution when checking float level.

1939 Champion Clutch Facing Change—New grooved facings used after Engine No. 17804.

1939 Champion Insulated Steering Arm—Used on late cars. See Ross Cam-and-Twin Lever Steering Gear in 1940 Supplement 'ME' Section for servicing data.

1939 Commander Compression Ring Change—New sealed power type compression ring used after Engine No. H-81539.

1939 Commander Suspension & Camber Adjustment—New type and different adjustment after Serial No. 4112701. See Studebaker Independent Suspension in 1940 Supplement 'ME' Section for directions.

1935 Dictator Valve Timing & Tappet Clearance Change—After Eng. No. D-47576, tappet clearance changed to .016" Cold (All Valves) and Valve Timing changed to same Opening & Closing points as 1935 Commander & President. Make this change on 'T&E' & 'M' pages in early editions where not shown.

1935 Commander & President Tappet Clearance Change—On engines so marked on plate on valve cover plate, tappet clearance should be set at .016" Cold for all valves (instead of .004" Int., .006" Exh. Hot). Make this change on Studebaker 1935 'T&E' & 'M' pages in early editions where not shown.

WILLYS

1940 MODELS

New Carburetor (Pass. Cars) & Float Level Caution—See Carter 'WO' Carburetor in 'C' Section and important note under Float Level when checking float level.

New Clutch (Passenger Cars)—See Atwood Clutch in 'ME' Section.

Engine Change on Panel Delivery Model—Two different engines used (changed at Eng. No. 35129). See Willys 'M' pages for both types.

New Gearshift & Rattle Correction (Pass. Cars)—See Willys Transmission Control in 'ME' Section and note special Trouble Shooting data and Control Shaft Dampener Adjustment to correct rattles.

New Shock Absorbers—Both Monroe and Gabriel Direct Acting types used. See Monroe and Gabriel Shock Absorbers in 'ME' Section.

1939 & PREVIOUS MODELS

1939 Shock Absorber Change—New Monroe '3 tube' type used on late cars. See Monroe Shock Absorbers in 1940 Supplement 'ME' Section for data.

1940 TUNE UP & ELECTRICAL CAR MODEL INDEX

Car	Model	Year	Electrical System	Page No.
BANTAM	65 Super 4	1940	Auto-Lite	T&E-1730
BUICK	40-40, 50, 60, 70, 80, 90	1940	Delco-Remy	T&E-1732
CADILLAC	60S, 62, 72, 75 V8	1940	Delco-Remy	T&E-1734
CADILLAC	90 V16	1940	Delco-Remy	T&E-1736
CHEVROLET	KA, KB, KH Mstr.	1940	Delco-Remy	T&E-1738
CHEVROLET	KC, KD, KE, W Trucks	1940	Delco-Remy	T&E-1738
CHRYSLER	C25 Royal & Windsor 6	1940	Auto-Lite	T&E-1740
CHRYSLER	C26, C27 Eights	1940	Auto-Lite	T&E-1742
CROSLEY	A	1939-40	Auto-Lite	T&E-1744
DE SOTO	S7 Cust. & Deluxe	1940	Auto-Lite	T&E-1746
DODGE	D14 Del., D17 Spec.	1940	Auto-Lite	T&E-1748
FORD	022A '60', 01A '85'	1940	Ford	T&E-1750
FORD	Comm. & Trucks (all)	1940	Ford	T&E-1750
GRAHAM	107, 108, 109	1940	Delco-Remy	See Note
HUDSON	40P, 40T Six	1940	Auto-Lite	T&E-1752
HUDSON	40, 48 Business Cars	1940	Auto-Lite	T&E-1752
HUDSON	41, 43 Six	1940	Auto-Lite	T&E-1752
HUDSON	44, 45, 47 Eight	1940	Auto-Lite	T&E-1754
LA SALLE	40-50, 52 V8	1940	Delco-Remy	T&E-1756
HUPMOBILE	R Skylark	1940	Auto-Lite	See Note
LINCOLN	V12	1940	Auto-Lite	See Note
LINC.-ZEPHYR	06H V12	1940	Ford	T&E-1758
MERCURY	09A '95' V8	1940	Ford	T&E-1760
NASH	4020 Ambass. 6	1940	Auto-Lite	T&E-1762
NASH	4080 Ambass. 8	1940	Auto-Lite	T&E-1764
NASH-LAFAYETTE	4010	1940	Auto-Lite	T&E-1766
OLDSMOBILE	F-40 '60', G-40 '70'	1940	Delco-Remy	T&E-1768
OLDSMOBILE	L-40 '90' Eight	1940	Delco-Remy	T&E-1770
PACKARD	1800 '110' Six	1940	Auto-Lite	T&E-1772
PACKARD	1801, 1A '120' Eight	1940	Auto-Lite	T&E-1774
PACKARD	1803,3A,4,5'160' Super 8	1940	Auto-Lite	T&E-1776
PACKARD	1806, 7, 8 '180' Super 8	1940	Auto-Lite	T&E-1776
PLYMOUTH	P9 R'dking & Econ.	1940	Auto-Lite	T&E-1778
PLYMOUTH	P10 Deluxe & Econ.	1940	Auto-Lite	T&E-1778
PONTIAC	40-25, 40-26 Sixes	1940	Delco-Remy	T&E-1780
PONTIAC	40-28 Deluxe Eight	1940	Delco-Remy	T&E-1782
PONTIAC	40-29 Torpedo Eight	1940	Delco-Remy	T&E-1782
STUDEBAKER	2G Champion	1940	Auto-Lite	T&E-1784
STUDEBAKER	10A Commander	1940	Auto-Lite	T&E-1786
STUDEBAKER	6C President	1940	Delco-Remy	T&E-1788
WILLYS	440 Pass. & Pick Up	1940	Auto-Lite	T&E-1790
WILLYS	440P Panel Delivery	1940	Auto-Lite	T&E-1790

NOTE:—All Specifications and Service Data for car models listed below are same as for corresponding 1939 model except as noted.

GRAHAM MODEL 108, SUPERCHARGER MODEL 107, HOLLYWOOD SUPERCHARGER 109

MODEL 109 NOTE:—This is a new model. All specifications and equipment on this model same as for 107 Supercharger (except Carburetor—see below).

SERIAL NUMBER:—First 1940 Number—505001 (107), 605001 (108), 700001 (109).

ENGINE NUMBER:—First 1940 Number—515001 (107), 615001 (108), 710001 (109).

COMPRESSION:—Ratio—6.65-1 Std., 7.0-1 & 7.25-1 Optl. (on all models).
Pressure—125 lbs. (108), 130 lbs. (107 & 109) at cranking speed (std. hd.).

SPARK PLUGS:—Champion Type J-10. 14 MM. Metric type. **Gap**—Set at .025".

CARBURETION:—Carburetor. Carter Type WA-1, Model 472-S (108), 473-S (107); Type WDO, Model 488-S (109), single barrel (107,8), dual (109) downdraft types with Carter Climatic Control.
See Carter WA-1 and WDO carburetor articles in Carburetor Section for data.
Idl Adjustment—Adjust only with engine warmed up so Automatic Choke and Fast Idle inoperative. Turn idle adjusting screw (2 used on 488-S—adjust in succession) in for leaner mixture, out for richer mixture, adjust so engine fires smoothly. Adjust throttle lever stopscrew for 7-8 MPH idle speed.
Float Level (WA-1)—⅜" from top of machined projection on bowl cover to top of soldered seam at free end of float (invert to check).
Float Level (WDO)—3/16" from top of float to gasket seat on cover with needle valve seated (remove bowl cover assembly—invert cover to check).
Automatic Choke:—Carter Climatic Control.
See article in Carburetion Equipment Section for complete data.
Choke Setting—Center coil housing (108), 1 Notch Rich (107, 109).

VALVE TIMING:—New valve timing. *See Graham Model 107, 108, 109 (1940) 'M' page.*

BATTERY:—Model 109—Willard Type SWB-100, 17 Plate (Std.); Type HWB-110, 19 Plate (Radio).
Capacity (20 Hour Rate)—100 (SWB-100), 110 (HWB-110) ampere hours.
Dimensions (Std. & Radio)—Length 10½". Width 7⅛". Height 8 7/16".
Models 107, 108—Same batteries used as on corresponding 1939 model.

GENERATOR:—Delco-Remy Model 1100007 (same as for 1939 Model 97). This generator used on all 1940 models (no Lamp Load Type generator used in 1940).

REGULATOR:—Delco-Remy Model 1118204 'Single Core' type. Cutout Relay and vibrating Voltage Regulator in a single case on engine side of dash.
NOTE—This regulator does not have 'IGN' terminal.
See 'Single Core' Regulator article in Electrical Equipment Section.

Cutout Relay

Cuts In—6.2-6.7 volts hot. **Cuts Out**—0-4.0 amperes discharge.
Contact Gap—.020" (same for both sets). **Air Gap**—.020" (points just closed).

Voltage Regulator

Setting—7.4-7.8 volts (70° F.), 7.2-7.4 volts (hot—operating temp.). This Voltage Regulator is over-compensated for temperature.
Checking & Adjustment—*See Delco-Remy Single Core Regulator article in Electrical Equipment Section for complete instructions.*
Air Gap—.070" between center of core and armature (contacts just closed).

LIGHTING SWITCH:—Delco-Remy Model 478-H (for all models).
For all other data see Graham Model 96, 97 (1939) 'T&E' page.

HUPMOBILE SKYLARK MODEL R (1940)

DISTRIBUTOR:—Auto-Lite IGC-4277 (Early '39), IGW-4141 (Late '39 & '40). All data same for both distributors except Cam Angle as follows:
Cam Angle—IGC: 40° closed, 20° open. IGW: 35° closed, 25° open (dist. °).

REGULATOR:—Auto-Lite VRR-4005A (Late '40). All data same as for VRD-4009A except as follows:

Cutout Relay

Cuts Out—6.0 amperes maximum discharge current.

Voltage Regulator

Contact Gap—.012" minimum (with armature against stop pin).
Air Gap—.048-.052" with contacts just opening.
For all other data see Hupmobile Skylark Model R (1939) 'T&E' page.

LINCOLN V12 MODEL (1940)

For all data see Lincoln V12 Model (1938) 'T&E' page.

Cam Angles for Delco-Remy distributors are correct with breaker gap set midway between limits and breaker arm fibre bumper worn in (1000 miles).

Cam Angles for Auto-Lite distributors correct with gap specified by car manufacturer except in instances where special gap specified under 'Cam Angle.'

HOOD LATCH NOTE:—Hood latch handles located in driver's compartment on extreme right and left sides and must be released before hood can be raised.

SERIAL NUMBER:—First number 65-343. Stamped on plate on left side of cowl under engine hood. On Export Cars, Serial Number also stamped on left frame side rail below engine oil level gauge.

ENGINE NUMBER:—First number 65-501. Stamped on left side of crankcase above Starter Bendix.

COMPRESSION:—**Ratio**—7.4-1 Std. cast-iron head.
Pressure—135 lbs. at cranking speed (200 RPM).

VACUUM READING:—18-20" steady reading at idling speed of 7 MPH.

IGNITION:—**Auto-Lite Coil Model IG-4065.** Service coil IG-4070. Mounted on dash.

Ignition Current—2.5 amperes idling, 4.5 stopped.

Ignition Switch:—Douglas #2980 Ignition Lock Assembly. Coil connection not armored.
Ignition Lock—Douglas.

Distributor Auto-Lite IGW-4105C. Single breaker, 4 lobe cam, full automatic advance type.

Breaker Gap—.018" (.022" for new set of points).

Cam Angle or Dwell—41° closed, 49° open (distributor degrees with .020" gap).)

Breaker Arm Spring Tension—17-20 ounces.

Rotation—Clockwise viewed from the top.
Condenser—No. IGB-1025. Capacity .20-.25 mfd.

Automatic Advance

Distributor		Engine	
Degrees	R.P.M.	Degrees	R.P.M.
Start	400	0	800
2	800	4	1600
5	1400	10	2800
8	2000	16	4000
10	2400	20	4800

Removal:—Distributor mounted on bracket at front of engine. To remove, loosen clampscrew in mounting bracket, lift distributor out.

IGNITION TIMING:— **Flywheel Degrees** **Piston Pos.**
All Engines..... 4° BTDC.....0048" BTDC

To Set Timing—With #1 piston on compression, turn engine over until piston is 4° or .0048" BTDC, stop when point 3/8" before '/' flywheel mark lines up with indicator under pit cover on flywheel housing. Loosen distributor clampscrew, rotate distributor until contacts begin to open, tighten clampscrew.

Firing Order:—1-3-4-2.

Spark Plugs:—Champion Type H-10. 14 MM. Metric.
Spark Plug Gaps—Set at .025".

CARBURETION:—**Carburetor**—Zenith Model 61A5. 13/16" single barrel updraft type.
See article in Carburetor Section for complete data.

NOTE—This carburetor has Idle (low speed) adjustment only. No high speed adjustment used.

Idle Adjustment—With engine warm and idling, set idle adjusting screw so that engine fires smoothly. Idle screw should be set approximately 1½ turns out from inner seated position and setting should be varied only slightly. Set throttle stopscrew for idle speed of 7 MPH.

Float Level—Bottom of float at free end should be 1 5/32" from gasket seat of throttle body with needle valve closed (invert throttle body to check).

Air Cleaner:—AC #A1529203. Oil-wetted type Std.

Gasoline Gauge:—Stewart (Stewart-Warner) Electric. Dash Unit—No. 99166 (Instrument Cluster), Tank Unit—No. 97550.
See article in Carburetion Equipment Section.

VALVE TIMING:—**To Check**—Check tappet clearance #1 intake valve (.011" warm). This valve should open with piston 19° or .115" before top dead center when point on flywheel 1 5/32" before '/' mark lines up with indicator under pit cover on flywheel housing.

Tappet Clearance:—.011" Int., .012" Exh. Warm.

Valve Spring Pressure:—28 lbs. at 1¼" (valve closed), 44 lbs. at 1" (valve open). Spring free length 1.6875".

LUBRICATION:—**Crankcase Capacity**—6 pints (3 qts.).

Normal Oil Pressure—30 lbs. at 50 MPH.

COOLING SYSTEM:—Thermo-syphon type water circulation (no pump used).

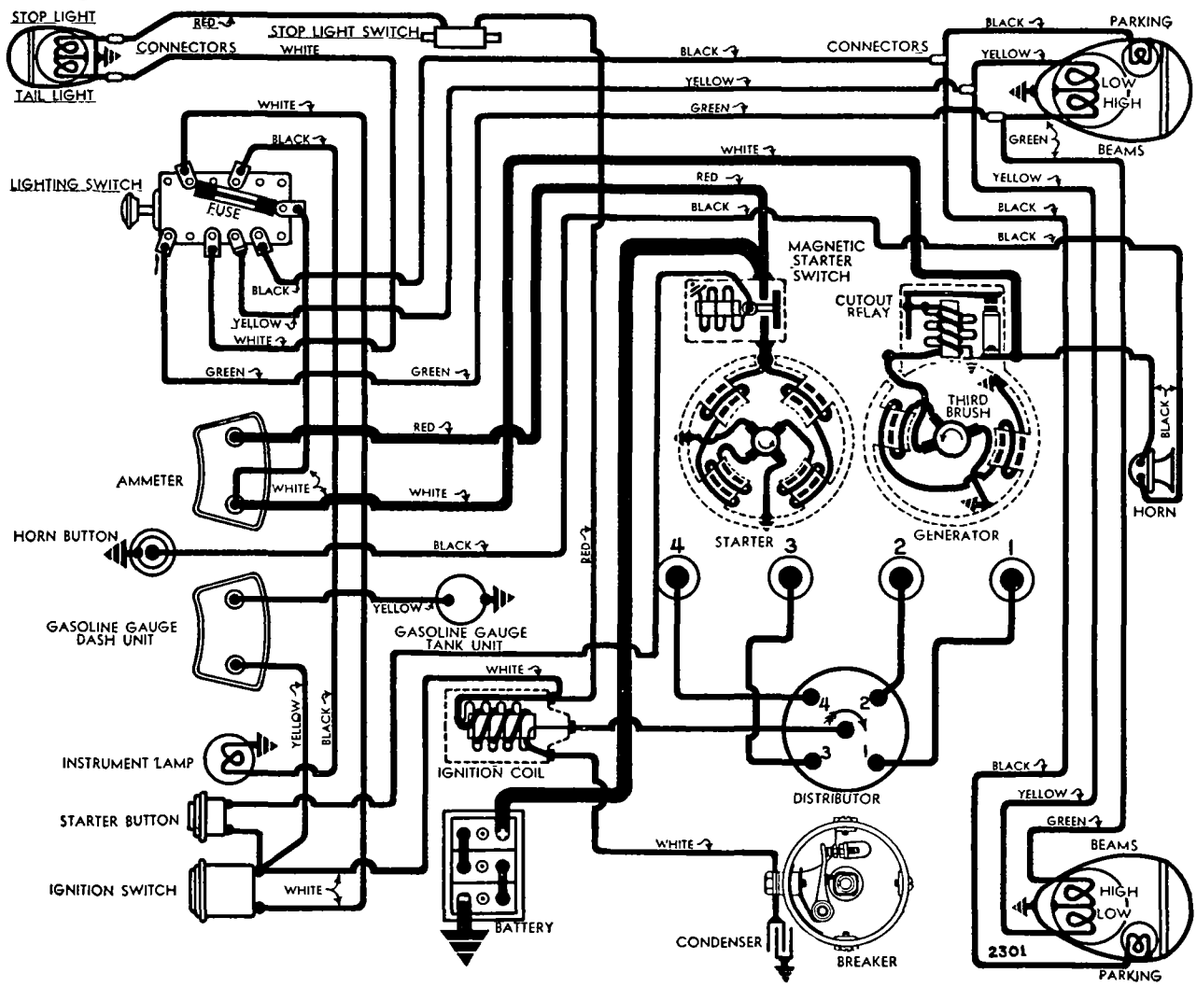
Capacity—6 quarts.

BATTERY:—**Auto-Lite Type PN-11F.** 6 volt, 11 plate, 67 ampere hour capacity (20 hr. rate).

Grounded Terminal—Negative (—) terminal grounded to dash. No separate engine ground used.

Dimensions—6 15/16" long. 7" wide. 8⅝" high.

Location—Battery mounted on right side of cowl under engine hood.



STARTER:—Auto-Lite MAK-4001. Armature MAK-2006.

Drive—Special Inboard Bendix Type RCE11-10.

Rotation—Counter-clockwise at commutator end.

Brush Spring Tension—38-61 ozs. (new brushes).

Performance Data

Torque		R.P.M.	Volts	Amperes
0	ft. lbs.	5000	5.5	70
.3	"	3240	5.5	100
1.35	"	1880	5.0	200
3.1	"	1000	4.5	300
4.8	"	220	4.0	400
4.5	"	Lock	3.0	380
7.0	"	Lock	4.0	520

Removal:—Starter flange mounted on left front face of flywheel housing. To remove, take out flange mounting screws, remove starter and switch as an assembly.

Starting Switch:—Magnetic type mounted on dash and controlled by pushbutton on left side of instrument panel.

GENERATOR:—Auto-Lite GAS-4139A. Armature GAS-2076. Third brush control type. Not ventilated.

Maximum Output—10 amperes (cold), 8 amperes (hot), 8.0 volts, 2600 RPM, 40 MPH. with standard car setting.

Charging Rate Adjustment—Remove commutator cover band, shift third brush by hand counter-clockwise to increase, clockwise to decrease charging rate. Third brush held in position by friction.

Performance Data

Cold			Hot		
Amperes	Volts	R.P.M.	Amperes	Volts	R.P.M.
0	6.4	880	0	6.4	975
2	6.6	985	2	6.8	1135
4	6.9	1100	4	7.0	1310
6	7.2	1230	6	7.35	1540
8	7.3	1420	8	7.7	1860
10	7.6	1650	10.2	8.0	2900
12	7.8	2000			
14	8.0	2800			

Rotation—Counter-clockwise at commutator end.

Brush Spring Tension—15-20 ozs. (new brushes).

Field Current—3.80-4.20 amperes at 6.0 volts.

Motoring Current—4.64-4.94 amperes at 6.0 volts.

Removal:—Generator cradle mounted at left front of engine with fan belt drive. To remove, loosen drive belt, take out clamp bolt in mounting clamp band, lift generator out.

Belt Adjustment:—Loosen fan shaft clamp nut, raise fan until belt can be pulled out of vertical line (midway between pulleys) not more than 1" with single finger pull, tighten clamp nut.

CUTOUT RELAY:—Auto-Lite CB-4014. Mounted on generator.

See article in Electrical Equipment Section.

Cuts In—6.5-7.25 volts, 5 MPH.

Cuts Out—.5-2.5 ampere discharge current (after charging at 15 amperes).

Contact Gap—.015-.045".

Air Gap—.010-.030" with contacts closed.

LIGHTING:—Headlamps—Corcoran-Brown. Pre-focused type. Upper and lower beams controlled by lighting switch.

Headlamp Adjustment—Aim headlamp upper beam straight ahead at lamp center height.

Switches

Lighting—H.A. Douglas No. 5794.

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps	32-21	2320
Parking	1.5	55
Instrument	3	63
Stop & Tail	21-3	1158

FUSES:—Lighting—20 ampere. Mounted on lighting switch.

HORN:—Schwartze No. 93. Vibrator type.

Horn Current—7 amperes.

SERIAL NUMBER:—First number (all series) 13596807 (Flint), 23601856 (Calif.), 33611856 (Linden). On right frame side rail at dash under hood.

ENGINE NUMBER:—First number (40,50) 3786214, (60, 70,80,90) 3812000 with prefix 4- (40), 5- (50), 6- (60), 7- (70), 8- (80), 9- (90). Stamped on boss on right side of crankcase to rear of fuel pump.

COMPRESSION:—

Model	Compression Ratio	Pressure 1000 RPM.	Cranking Spd.
40-40, 50	6.1-1	126 lbs.	112 lbs.
40-60, 70, 80, 90	6.25-1	130 lbs.	114 lbs.

VACUUM READING:—Steady 18-20" idling at 7-8 MPH.

IGNITION:—Coil Model 1115024, 1115026 (with radio). Mounted on engine side of dash. NOTE—Radio type coil has condenser installed under end cover.

Ignition Current—2½ amperes idling, 4½ stopped.

Ignition Switch:—Delco-Remy Model 1116276 (40, 50, 60, 70), 1116277 (40, 50, 60, 70—RHD), 1116280 (80, 90), 1116281 (80, 90—RHD). Coil connection armored. NOTE—Ignition switch has 3 positions as follows: 1) 60° to right—Ign. OFF also LOCKED with key removed. 2) Vertical—Ign. ON with or without key in place. 3) 40° to left—Ign. OFF also UNLOCKED with or without key in place.

Ignition Lock—Briggs & Stratton No. 85253. Key Series—8000 to 9499. Groove—No. 15.

Distributor Delco-Remy 1110801 (40,50), 1110805 (60,70, 80, 90). Full automatic advance type with auxiliary vacuum spark control.

Breaker Gap—.015". Limits .0125-.0175".

Cam Angle or Dwell—31° (closed), 14° (open).

Breaker Arm Spring Tension—19-23 ounces.

Rotation—Counter-clockwise viewed from above.

Condenser—Part No. 1869704. Capacity .18-.25 mfd.

Automatic Advance—1110801

Distributor Degrees	R.P.M.	Engine Degrees	R.P.M.
Start	250	3.5	500
7	400	14	800
13	1500	26	3000

Automatic Advance—1110805

Start	250	2	500
8	600	16	1200
13	1500	26	3000

Vacuum Spark Control 681-H—Integral type (on distributor, linked to breaker plate). Provides additional advance at speeds above 18 M.P.H. except when engine accelerated or operated with wide open throttle when spark retarded by return spring in unit. Plunger travel ⅛" maximum.

Vacuum Advance

Distr. Degrees	Eng. Degrees	Vacuum (" of HG).
Start	0	5-7"
5-6½	10-12	10-13"

Distributor Removal:—Mounted on right side of crankcase. To remove, disconnect vacuum line, take out two hold-down screws in advance arm, lift out. NOTE—Oil pump driven by tongue on lower end of distributor shaft. When installing distributor, mesh drive gear so that rotor at #1 segment in cap and normal timing secured with mounting screws approximately centered in slots.

IGNITION TIMING:—Initial setting (regular fuel 40, 50, Ethyl fuel 60, 70, 80, 90) given below. See 'Final Ignition Setting' (following) for correction dependent on operating conditions and fuel used.

	Flywheel Degrees	Piston Position
40-40, 50	4° BTDC	.0063" BTDC.
40-60, 70, 80, 90	6° BTDC	.0149" BTDC.

Timing (With Synchroscope)—Connect synchroscope in #1 spark plug lead, direct light on flywheel through inspection hole in right front face of flywheel housing above starter. Idle engine at 400 RPM. maximum. Loosen two distributor hold-down screws, rotate distributor until 'ADV' mark lines up with indicator on flywheel housing, tighten screws (screws should be approximately centered in slots). See Final Ignition Setting below.

Timing (Without Synchroscope)—With #1 piston on compression, turn engine over until 'ADV' mark on flywheel lines up with reference mark on housing (inspection hole in right front face of housing above starter). Adjust distributor as above.

Final Ignition Setting—Should be adjusted for fuel used so that light 'ping' secured when engine accelerated with wide open throttle between 10 & 20 MPH. To adjust, loosen two distributor hold-down screws, move distributor in small steps counter-clockwise (if ping too severe), clockwise (if no ping).

Firing Order:—1-6-2-5-8-3-7-4.

Spark Plugs:—AC No. 46. 14 MM. Metric type.

Spark Plug Gaps—.025".

CARBURETION:—Carburetor—Stromberg or Carter, 1" (40, 50), 1¼" (others) dual downdraft types.

	Carter	Stromberg
40, 50	440-S or 474-S	AAV-16
60, 70, 80, 90	448-S	AAV-26

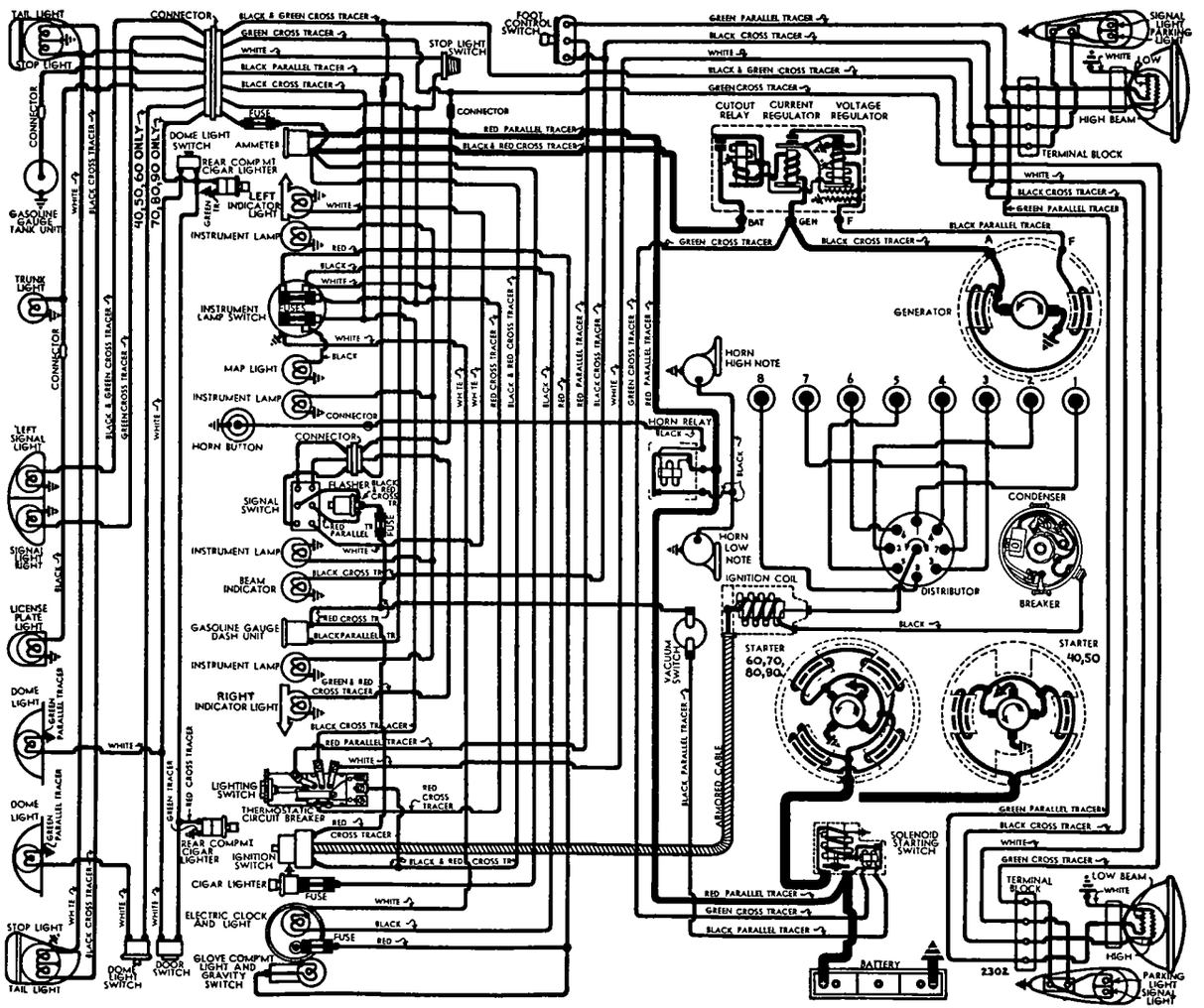
See articles on each type in Carburetor Section.

Idle Adjustment—With engine warm and running at slow idle speed (choke valve wide open, fast idle inoperative), set throttle stopscrew for 7-8 MPH. idling speed. Adjust idle adjusting screw for each barrel (in succession) until engine fires smoothly (approximately 1¼ turns—Stromberg, ½-1¼ turns —Carter, from inner seated position. Readjust idle speed.

NOTE—If vacuum gauge used for idling adjustment, turn screws evenly in 'rich' direction until gauge reading is 1" less than obtainable maximum.

Float Level (Carter)—3/16" from top of float to cover (gasket removed with needle valve seated.

Float Level (Stromberg)—Fuel level 19/32" below top edge of bowl with engine idling.



Accelerating Pump Setting—Three holes are provided in pump arm (Carter—remove dust cover), throttle lever (Stromberg) for pump rod connection. Recommended settings are as follows:
#1 (Inner—Min.) Hot weather, high-test gasoline.
#2 (Center)—Std. normal all-year setting.
#3 (Outer—Max.) Cold weather, low-test gasoline.

Fast Idle:—Integral type built-in each carburetor.
See articles in Carburetion Equipment Section.
Setting (Carter)—Adjust fast idle screw for .018" (440-S, 474-S), .012" (448-S) throttle opening with choke valve fully closed.
Setting (Stromberg)—Non-adjustable type.

Automatic Choke:—Carter Climatic Control (Carter), AAV-16, AAV-26 type (Stromberg).
See articles in Carburetion Equipment Section.
Setting (Carter)—1 Notch Lean (440-S, 474-S), 3 Notches Rich (448-S).
Setting (Stromberg)—Inverted 'V' mark on cover should line up with reference mark on housing.

Air Cleaner:—AC #1529294 (40, 50), #1529307 (60, 70, 80, 90) oil-wetted type Std. Heavy duty oil-bath type optional.

Fuel Pump:—AC Type AJ #1537100 (40, 50), #1523992 (60, 70, 80, 90). Combination fuel-and-vacuum pump.
See articles in Carburetion Equipment Section.

Gasoline Gauge:—AC Electric type. Dash unit—#1515367 (all). Tank unit—#1516167 (40, 50, 60, 70), #1516176 (80, 90).
See article in Carburetion Equipment Section.

MANIFOLD HEAT CONTROL:—Thermostatic coil type.
Setting—Coil wind-up ¼ turn at 70° F. With coil engaged on heat valve shaft, wind up outer end ¼ turn and engage prong on anchor stud.

VALVE TIMING:—#2 or #7 exhaust valve should be .145" open (40, 50), .155" (60, 70, 80, 90) with #1 & 8 pistons at TDC. Flywheel mark 'TDC/1-8' at indicator hole above starter.
Tappet Clearance—.015" all valves—engine hot.
Valve Spring Pressure—Total (inner and outer springs) 42-52 lbs. (closed), 112-124 lbs. (open).

LUBRICATION:—Crankcase Capacity 40, 50 8 qts. (dry), 6 qts. (refill). **60,70,80,90** 10 qts. (dry), 8 qts. (refill).
Normal Oil Pressure—45 lbs. at 35 M.P.H.

COOLING:—Capacity 13¼ qts. (40,50), 17 (60,70,80,90).
Thermostat—Harrison. In cylinder head outlet. Starts to open at 148-155° F. Fully open 173° F.

BATTERY:—Delco Model 17E-1. 6 volt, 17 plate, 115 ampere hour capacity (20 hour rate).
Starting Capacity—137 amperes for 20 minutes.
Zero Capacity—300 amperes for 4.3 minutes. Five second voltage—4.4 volts.
Grounded Terminal—Negative (—) grounded to bolt on engine block.
Dimensions—Width 4". Length 19 5/16". Height 9".
Location—Under engine hood on right side.
Taxicab Battery—Delco Model 19E-1. 6 volt, 19 plate, 130 ampere hour capacity (20 hour rate).
Grounded Terminal & Location—Same as 17E-1.

STARTER:—Delco-Remy 1107005 (40,50), 1107018 (40,50 RHD), 1107908 (60 to 90), 1107909 (60 to 90 RHD).
Armature 1867897 (1107005), 820158 (1107908, 9), 810601 (1107018).
Drive—Overrunning clutch (solenoid pinion shift).
Brush Spring Tension—24-28 ounces.
Rotation—Counter-clockwise at commutator end.
Cranking Engine—(40, 50) 135 RPM., 150 amp., 4.5 volts. (60, 70, 80, 90) 115 RPM., 175 amperes, 5 volts.

Performance Data—1107005, 1107018

Torque	R.P.M.	Volts	Amperes
0 ft. lbs	5000	5.0	65
12 "	Lock	3.37	525

Performance Data—1107908, 1107909

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	5500.	5.0	65
16 "	Lock	3.0	600

Removal:—Flange mounted on right front face of flywheel housing. To remove, take out capscrews.

Starting Switch:—Solenoid Switch No. 1542 (1107005, 1107908), 1545 (1107018, 1107909). Vacuum Switch D-R. No. 1990127 (Stromberg Carb.), Carter Car Starter No. 192-10U (Carter Carb.). Mounted on carburetor. *See articles in Electrical Equipment Section.*

Solenoid Switch Specifications

Closes against 70 lb. pull with ½" air gap drawing 65-71 amperes at 5 volts. Holds switch closed drawing 12-14 amperes (hold-in coil only).

Solenoid Relay

Contacts Close—1.9 volts Max. **Contact Gap**—.035".
Contacts Open—1.0-1.2 volts. **Air Gap**—.012".

GENERATOR:—

Car Model	Delco-Remy Model	Pulley Diameter	Groove Width
40, 50	1102662	3 13/16"	13/16"
40 (3.9 Axle)	1102663	3 17/32"	13/16"
60, 70, 80	1102668	3 17/32"	15/16"
90	1102669	3 13/16"	15/16"

NOTE—Interchangeable when correct pulley installed. Two brush (shunt) type with current-voltage control.
Armature No.—1879002 (all models).
Charging Rate Adjustment—No adjustment at generator. Charging rate controlled by Voltage Regulator and maximum output by Current Regulator.
Maximum Charging Rate—32-34 amperes, 8.0 volts, 2000 RPM. (cold), 2400 RPM (hot), or approx. 20 MPH. and above with load or discharged battery (Current Regulator setting). Actual charging rate controlled by Voltage Regulator and dependent on battery condition.

Performance Data

	Amperes	Volts	R.P.M.
Cold	30*	8.0	1800

*—Not maximum output—See Current Regulator.
Brush Spring Tension—25 ounces each.
Field Current—1.76-1.88 amperes at 6.0 volts.
Rotation—Counter-clockwise at commutator end.

Removal—Pivot mounted at left front of engine. To remove, take out pivot and clamp bolts.

Belt Adjustment:—Loosen pivot and clamp bolts, pull generator up and out until belt deflection midway between fan and generator is ½".

REGULATOR:—Model 1118201. 'Single Core' type. Vibrating Voltage & Current regulator on dash.
CAUTION—Check generator for grounded fields before changing regulator settings.
See article in Electrical Equipment Section for data.

Cutout Relay

Cuts In—6.2-6.7 volts, hot, 880 RPM, 8-10 MPH.
Cuts Out—0-4.0 amperes discharge current.
Contact Gap—.020" (same for both sets).
Air Gap—.020" (with points just closed).

Voltage Regulator

Setting—7.4-7.8 volts (70° F.), 7.2-7.4 volts (hot). Regulator over-compensated for temperature.
To Check—Connect ammeter in charging line at 'BAT' regulator terminal, voltmeter between 'BAT' terminal and ground. Operate generator at 2800 RPM., adjust charging rate to 8-10 amperes (use variable rheostat or 'AVR' set). With regulator hot (150° F.), retard generator speed until cut-out relay points open, then increase generator speed to 2800 RPM. and check hot voltage setting (above).
To Adjust—Change regulator armature spring tension slightly by bending lower spring hanger for **light (left) spring (or one spring if both alike) only.** If further adjustment required, see Single Core Regulator article in Electrical Equipment Section for Heavy (or other spring) adjustment.
Air Gap—.070" between center of core and armature with contacts just closed.

Current Regulator

Setting—32-34 amperes (hot).
To Check—Remove cover, connect short jumper from voltage regulator frame to upper contact support bracket (shorting out Voltage Regulator). Connect ammeter in charging line at 'BAT" regulator terminal. Turn on lights and accessories, operate generator and increase speed until output remains stationary (run until hot). Check setting with regulator at operating temperature.
To Adjust—Change regulator armature spring tension slightly by bending lower spring hanger for **one spring.** If further adjustment required see Single Core Regulator article in Electrical Equipment Section for adjustment of other spring.
Air Gap—.075" (check same as Voltage Regulator).

LIGHTING:—Headlamps—Guide 'Sealed Beam' type.
See article in Electrical Equipment Section for data.
Headlamp Adjustment—Aim upper beam straight ahead with center of hot spot 3" below lamp center height.
Beam Indicator—In speedometer dial. Lighted when upper beams in use.
Direction Signal—*See Electrical Equipment Section.*

Switches

Lighting—Delco-Remy 1995008.
Beam Selector—Delco-Remy 1997002.
Direction Signal—Delco-Remy 1995501 (All—LHD), 1995502 (40, 50, 60, 70—RHD).

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps		Sealed Beam
Front Dir. Sig. & Park.	21-3	1154
Instrument, Map, Clock	1.5	55
Radio, Trunk	1.5	55
Beam Indicator, Glove Compt.	1	51
Direction Signal Indicators	1	51
Stop & Tail	21-3	1154
License Plate	3	63
Rear Direction Signal	32	1133
Dome (except 46C & 66C)	6	81
Dome (46C & 66C only)	1.5	55

THERMOSTATIC RELAY:—Delco-Remy. On lighting switch. Contacts remain closed with 30 amperes, open in 3 minutes with 42 amps. @ 70°. Not adj.

FUSES:—Dome Light & Rear Cigar Lighters (70,80,90) —30 ampere in feed wire at charge indicator.
Direction Signal—14 ampere in connector back of instrument panel.
Instrument Lamp Switch—Two 10 amperes. #1 protects Instrument Lights & Clock. #2, Map Light & License.
Clock—2 ampere under red button on back of clock.

HORNS:—Delco-Remy Model K-33-H. No. 1999501, 519 (low note, right horn), 1999502, 520 (high note, left horn). Vibrator type, blended tone, operated by horn relay. No. 1999501 & 502 on early cars.

Type	Current (at 6 volts)	Air Gap
1999501 (Low)	16-18 amperes.	.044-.049"
1999502 (High)	15-17 amperes.	.034-.039"
1999519 (Low)	19-21 amperes.	.044-.049"
1999520 (High)	18-20 amperes.	.034-.039"

Horn Relay:—Delco-Remy Model 1116775.
Contact Gap—.020". **Air Gap**—.015" (closed).
Contacts Close—2.75-4.0 volts.
NOTE—Use relays marked by bar over last 3 figures of part number to correct relay sticking.

ENGINE HOOD & SIDE PANELS:—Alligator type. To raise hood, tilt radiator ornament back to release catch and safety latch. Side panels removed by taking out 2 screws on upper edge and 3 screws along lower edge of panel.

SERIAL & ENGINE NUMBER:—First number (60S) 6320001, (62) 8320001, (72) 7320001, (75) 3320001. On crankcase at rear of left cylinder block and on left frame side member opposite steering gear.

COMPRESSION:—**Ratio** 6.25-1 (60S, 62), 6.7-1 (72, 75).

Pressure:—	At 1000 RPM.	At Cranking Speed
6.25-1	155 lbs.	Approx. 105-110 lbs.
6.70-1	170 lbs.	Approx. 110-115 lbs.

VACUUM READING:—Steady 20-21" idling 7-8 MPH.

IGNITION:—**Coil Model 1115128.** Mounted on dash.

Ignition Current—2.2 amperes idling, 4.4 stopped.

Ignition Switch:—Delco-Remy Model 1116282 (62, 72), 1116275 (60S, 75). Armored cable coil connection.

Ignition Lock—Briggs & Stratton No. 45792. Key Series—8000 to 9499. Groove—No. 15.

Distributor Model 1110806. Single breaker, 8 lobe cam, full automatic advance with vacuum spark control and manual adjustment.

Breaker Gap—.0125-.0175".

Cam Angle or Dwell—31° closed, 14° open (distr.).

Breaker Arm Spring Tension—19-23 ounces.

Rotation—Clockwise viewed from above.

Condenser—Part No. 1869704. Capacity .18-.25 mfd.

Automatic Advance

Distributor Degrees	Distributor R.P.M.	Engine Degrees	Engine R.P.M.
Start	500	1	1000
12	2000	24	4000

Vacuum Spark Control 1116020. Integral type (on distributor, linked to breaker plate). Provides additional advance at speeds above idling except when engine accelerated or operated with wide open throttle when spark retarded by return spring within unit. Plunger travel 13/64" maximum.

Vacuum Advance

Distr. Degrees	Eng. Degrees	Vacuum (" of HG)
Start	0°	5.5-7.5"
9°	18°	15-18"

Manual Adjustment—Permits 10° advance or retard from center position. See Ignition Timing for adjustment.

Removal:—Distributor mounted between cylinder banks at rear of engine. To remove, disconnect vacuum line, take out two hold-down screws in advance arm, lift out. NOTE—When installing distributor, turn crankshaft to firing position for #1 cylinder, mesh distributor drive gear with slot in upper end of drive shaft offset toward left-hand or rear side of engine (narrow portion of coupling toward rear).

IGNITION TIMING:—Setting for 72 octane fuel (60S, 62), premium 'Ethyl' fuel (72, 75). See Manual Adjustment (following) for correction dependent on operating conditions and fuel regularly used.

Flywheel Degrees	Piston Position
5° BTDC	.0114" BTDC

Timing (With Synchroscope)—This method recommended by manufacturer. Clip synchroscope lead to #1 spark plug, direct light on crankshaft pulley, idle engine. Loosen hold-down screw in advance arm, rotate distributor until 'IG/A' mark on pulley (5° before dead center Mark 'C.1/6) appears in line with pointer on chain case cover, tighten hold-down screw. Adjust for fuel (see Manual Adjustment).

Timing (Without Synchroscope)—Turn engine over to firing position for #1 piston (front piston, left bank) with crankshaft pulley mark 'IG/A' (5° before dead center mark 'C.1/6') lined up with pointer on chain case cover. Loosen hold-down screw in advance arm, center pointer on scale, tighten screw. Loosen advance arm clamp bolt, rotate distributor until contacts begin to open, tighten clamp bolt, check Manual Adjustment.

Manual Adjustment—Should be set for slight ping when accelerating engine with wide open throttle at speeds below 15 M.P.H. To adjust, loosen hold-down screw in advance arm, rotate distributor clockwise (if ping too severe), counter-clockwise (if no ping noted) one graduation at a time until correct performance secured.

NOTE—Check engine for faulty spark plugs, excessive carbon deposits, localized hot spots, lean carburetor setting before changing adjustment to correct pinging.

Firing Order:—1-8-7-3-6-5-4-2.

Spark Plugs:—AC No. 104. 10 MM. Metric type.

NOTE—These plugs are new small type. Do not tighten excessively (7-10 ft. lbs. tension).

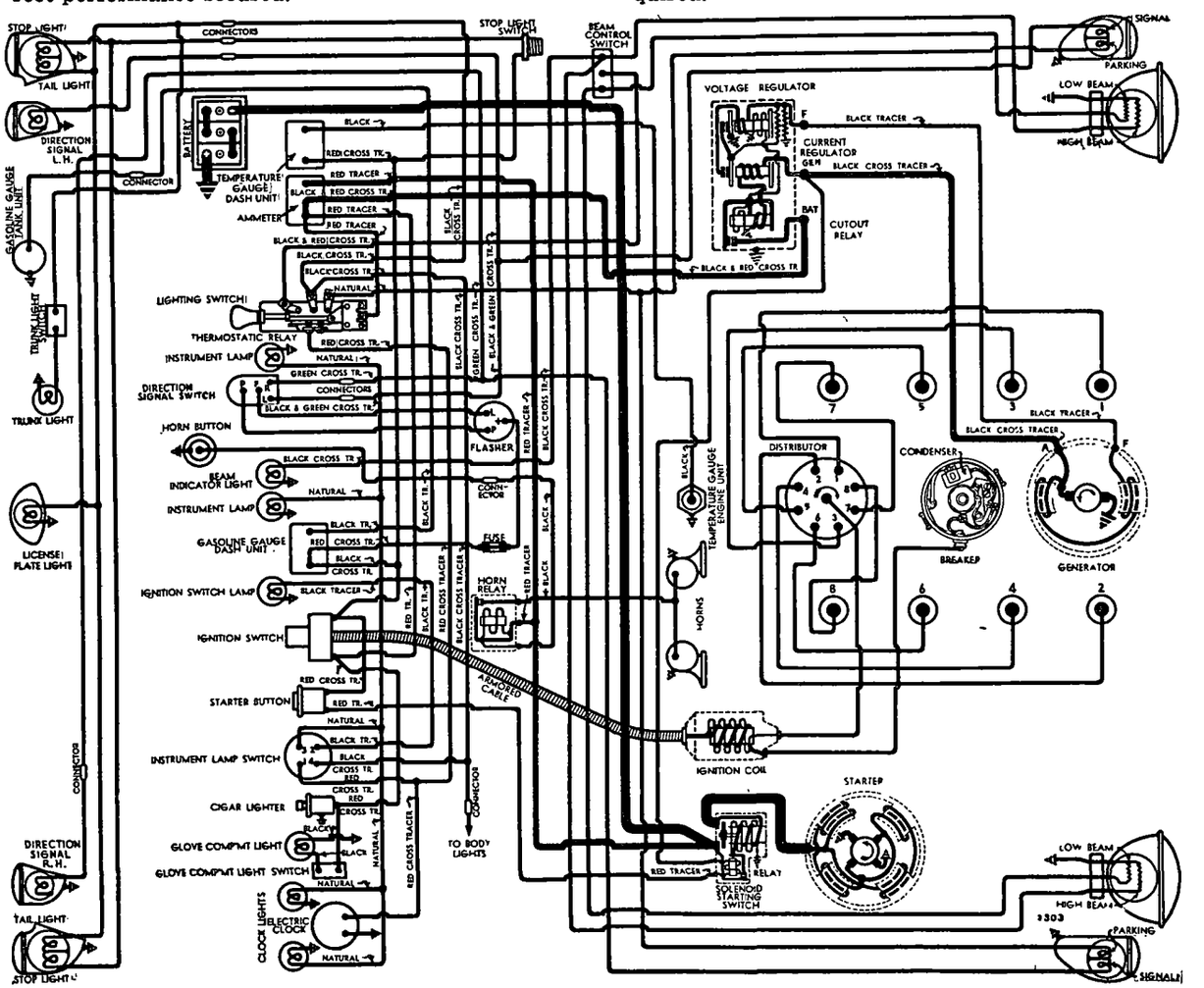
Spark Plug Gaps—.025-.030".

CARBURETION:—**Carburetor**—Stromberg Model AAV-26. 1¼" dual downdraft type.

See article in Carburetor Section for data.

Idle Adjustment—With engine warm and running at slow idle speed (choke valve wide open, fast idle inoperative), set throttle stopscrew for 7-8 MPH idling speed. Adjust idle adjusting screw for each barrel until engine fires smoothly (turn screws in for leaner mixture.) Readjust idle speed.

Accelerating Pump Setting—Throttle lever has two holes for pump link engagement. Connect as follows: Inner Hole (Min. Stroke)—Normal setting. Outer Hole (Max. Stroke)—When richer charge required.



Float Level—Fuel level 5/8" below top edge of bowl.
Fast Idle:—Integral (built-in carburetor). Non-adjustable. *See article in Carburetion Equipment Section.*
Fast Idle Setting—Not adjustable.
Automatic Choke:—Integral type built-in carburetor. *See article in Carburetion Equipment Section.*
Choke Setting—Center '0' mark on scale opposite mark on housing.
Air Cleaner:—AC #1529298 (60S,62,72), #1528980 (75) heavy duty oil-bath type.
Fuel Pump:—AC Type AX #1537088 Diaphragm type combination fuel-and-vacuum pump. *See article in Carburetion Equipment Section.*
Gasoline Gauge:—AC Electric type. #1515368 (dash unit), #1516155 (tank unit—60S,62), #1516190 (tank unit—72), #1516156 (tank unit—75). *See article in Carburetion Equipment Section.*

VALVE TIMING:—Intake valve (#1 cylinder, front—left bank) opens with piston at TDC. with mark 'C.1/6' behind crankshaft pulley aligned with pointer on chain case cover (right side).
Tappet Clearance—None (hydraulic take-up used). *See article in Mechanical Equipment Section for data.*
Valve Spring Pressure—66 lbs. at 1 59/64" (valve closed). 145 lbs. at 1 37/64" (valve open).

LUBRICATION:—**Crankcase Capacity**—7 quarts.
Normal Oil Pressure—25 lbs. at 30 MPH., 15 lbs. idling.

COOLING SYSTEM:—**Capacity**—24½ quarts.
Thermostat:—In radiator top tank (operates shutters). Starts to open 153-158°F., fully open 175°. High Reading Thermostat for use with heater (starts to open 168-175°F., fully open 190°).
Temperature Gauge:—AC Electric. #1510773 (dash unit), #1510774 (engine unit). *See article in Mechanical Equipment Section for data.*

BATTERY:—**Delco 17K-2.** 17 plate, 115 AH. capacity.
Starting Capacity—135 amperes for 20 minutes.
Zero Capacity—300 amperes for 4.3 minutes. Five second voltage—4.38 volts.
Grounded Terminal—Positive (+) terminal.
Engine Ground—Strap connector at right front engine support.
Dimensions—Length 10⅜". Width 7". Height 8⅝".
Location—Under left front floor (62, 72), under right side of engine hood outside frame (60S, 75).
Commercial Battery—Delco Model 19Q-1. 6 volt, 19 plate, 122 A H. Capacity (20 hour rate).
Starting Capacity—140 amperes for 20 minutes.
Zero Capacity—300 amperes for 4.8 minutes. Five second voltage 4.5 volts.
Dimensions—Same as 17K-2 except Height 8 9/16".
Grounded Terminal, Location—See 17K-2 above.

STARTER:—**Model 1107912 (A11 LHD—72, 75 RHD) 1107911 (60S, 62 RHD). Armature No. 820158 (all models).**
Drive—Overrunning clutch (solenoid pinion shift).
Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—24-28 ounces.

Performance Data

Torque	R P.M.	Volts	Amperes
0 ft. lbs.	5500	5.0	60
16 "	Lock	3.0	600

Removal:—Flange mounted on right front face of flywheel housing. To remove, take out flange mounting screws, pull starter forward and remove from below.
Starting Switch:—Solenoid Switch Type 1542 (all). Mounted on starter, controlled through relay (in switch) by Control Switch Type 1996005 on instrument panel. *See article in Electrical Equipment Section for data.*

Solenoid Switch Specifications

Closes against 70 lb. pull with ½" air gap drawing 65-71 amperes at 5 volts. Holds switch closed with current draw of 12-14 amperes (hold-in coil only).

Solenoid Relay Specifications

Contacts Close—1.9 volts max. **Open**—1.0-1.2 volts.
Contact Gap—.035". **Air Gap**—.012".

GENERATOR:—**Delco-Remy 1102661. Armature 1878211.** Two brush with current-voltage control.
Charging Rate Adjustment—No adjustment at generator. Charging rate controlled by Voltage Regulator and maximum output by Current Regulator. *See Regulator data following.*
Maximum Charging Rate—32 amperes min. (hot), 8 0 volts, 2450 RPM, 27 MPH (60S,62), 24.5 MPH (72, 75) and above with load or discharged battery (Current Regulator setting). Actual charging rate controlled by Voltage Regulator and dependent on battery condition.

Performance Data

	Amperes	Volts	R.P.M.
Cold	30*	8.0	1800

*—Not maximum output—See Current Regulator.
Rotation—Counter-clockwise at commutator end
Brush Spring Tension—25 ounces each.
Field Current—1.76-1.88 amperes at 6.0 volts.
Removal:—Flange mounted between cylinder banks at front of engine, belt driven in tandem with water pump (separate belt for fan). To remove, take out flange mounting bolts.
IMPORTANT AIR SCOOP NOTE—When installing air scoop on generator, make certain that raised portion provides clearance at terminals and that scoop does not cover drive end oil cup.
Belt Adjustment:—Loosen generator mounting bolts, lift generator up until only slight slack evident in belt (belt engages bottom of pulley groove not sides), tighten bolts. Generator pivots on left hand bolt, right bolt hole slotted. NOTE—Fan belt adjustment provided at fan bracket.

REGULATOR:—**Model 1118202. 'Single Core' type.** Vibrating Voltage & Current regulator on dash.
CAUTION—Check generator for grounded fields before changing regulator settings. *See article in Electrical Equipment Section for data.*

Cutout Relay

Cuts In—6.2-6 7 volts (hot).
Cuts Out—0-4.0 amperes discharge current.
Contact Gap— *020" (same for both sets).*
Air Gap—.020" (with points just closed).

Voltage Regulator

Setting—7.4-7.8 volts (70° F.), 7.2-7.4 volts (hot). Regulator over-compensated for temperature.
To Check—Connect ammeter in charging line at 'BAT' regulator terminal, voltmeter between 'BAT' terminal and ground. Operate generator at 2450 RPM, adjust charging rate to 8-10 amperes (use variable rheostat or 'AVR' set). With regulator at hot operating temperature, retard generator speed until cut-out relay points open, then increase generator speed to 2450 RPM and check hot voltage setting (above).
To Adjust—Change regulator armature spring tension slightly by bending lower spring hanger for **light (left) spring (or one spring if both alike) only.** If further adjustment required, see Single Core Regulator article in Electrical Equipment Section for Heavy (or other spring) adjustment.
Air Gap—.070" between center of core and armature with contacts just closed.

Current Regulator

Setting—32-34 amperes (hot).
To Check—Remove cover, connect short jumper from voltage regulator frame to upper contact support bracket (shorting out Voltage Regulator). Connect ammeter in charging line at 'BAT' regulator terminal. Turn on lights and accessories, operate generator and increase speed until output remains stationary (run until hot). Check setting with regulator at operating temperature.
To Adjust—Change regulator armature spring tension slightly by bending lower spring hanger for **one spring.** If further adjustment required see Single Core Regulator article in Electrical Equipment Section for adjustment of other spring.
Air Gap—.075" (check same as Voltage Regulator).

LIGHTING:—**Headlamps**—Guide 'Sealed Beam' type. *See article in Electrical Equipment Section for data.*
Headlamp Adjustment—Aim upper beam straight ahead with center of hot spot 3" below lamp center height.
Beam Indicator—On speedometer face. Lighted whenever Country (upper) beam in use.
Direction Signal—*See Electrical Equipment Section.*

Switches

Lighting—Delco-Remy 1995010.
Beam Selector—D-R 1997002, 471-U (60, 75 RHD).

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps		Sealed Beam
Front Indic. & Park	21-3	1154
Instr., Clock, Radio	1.5	55
Glove & Trunk Comp't	1.5	55
Beam Indicator, Ign. Lock	1	51
Stop & Tail	21-3	1154
*Rear Indicator (Early)	21-3	1154
*Rear Indicator (Later)	32	1133
License Plate	3	63
Dome & Quarter	15	87

*—When replacing Rear Indicator Bulb use same type bulb as formerly used (1154 double contact—1133 single contact) in order for circuit to function properly.

THERMOSTATIC RELAY:—**Delco-Remy.** On lighting switch. Contacts remain closed with 30 amperes, open in 3 minutes with 42 amps. @ 70°. Not adj.

FUSES:—**Direction Signal**—9 ampere. In Flasher lead under instrument panel.
Fog Lights—20 ampere. On switch.
Radio & Under Seat Heater—14 amperes each.

HORNS:—**Delco-Remy Model K-33-H.** No. 1999501, 519 (low note), 1999502, 520 (high note). Vibrator type, blended tone, operated by horn relay. Horn set 1999501 & 502 used on early cars.

Type	Current (at 6 volts)	Air Gap
1999501 (Low)	16-18 amperes	.044-.049"
1999502 (High)	15-17 amperes	.034-.039"
1999519 (Low)	19-21 amperes	.044-.049"
1999520 (High)	18-20 amperes	.034-.039"

Horn Relay:—Delco-Remy Model 1116775.
Contact Gap—.020". **Air Gap**—.015" (closed).
Contacts Close—2.75-4.0 volts.

ENGINE HOOD & SIDE PANELS:—Alligator type. To raise hood, tilt radiator ornament, raise hood slightly and release safety catch (under edge of hood). Side panels secured by screw at each upper corner and clips along lower edge.

SERIAL & ENGINE NUMBER:—First number 5320001. On upper rear corner of left hand cylinder block below head and on frame opposite steering gear.

COMPRESSION:—**Ratio**—6.75-1 (requires Ethyl fuel). 6.08-1 optional.

Pressure—180 lbs. at 1000 RPM for standard head or approximately 110-115 lbs. at cranking speed.

VACUUM READING:—Steady 20-21" idling at 7-8 MPH.

IGNITION:—**Coil Model 553-E.** Two coil unit mounted on bracket at radiator top. Coil Cover No. 1854013.

Current—2.2 amperes idling, 4.4 stopped (each).

Ignition Switch:—Delco-Remy No. 1116283 (switch and cable). Connected to coil unit by armored cable.

Ignition Lock—Briggs & Stratton No. 45792. Key Series—8000 to 9499. Groove—No. 15.

Distributor Nos. 1110601 (L.H.), 1110602 (R.H.). Two distributors used (left hand distributor times ignition for entire engine, right hand distributor distributes high tension current to spark plugs of right hand cylinder bank only and has no breaker mechanism. Same design as used on 39-90.

Type—Double breaker, 8 lobe cam, full automatic advance with manual adjustment at distributor.

Firing Interval—Movable contacts open 22½° (distr.) after fixed set. Must be synchronized (see Timing).

Breaker Gap—.0125-.0175".

Cam Angle or Dwell—31° closed, 14° open (distr.). Each set operates independently.

Breaker Arm Spring Tension—19-23 ounces.

Rotation—Clockwise viewed from top (L.H. No. 1110601), counter-clockwise (R.H. No. 1110602).

Condenser—No. 1869707 (2 used, both mounted in L.H. No. 1110601 distributor). Capacity .18-.25 mfd.

Automatic Advance

Distributor		Engine	
Degrees	R.P.M.	Degrees	R.P.M.
Start	800	1½	1600
10	2000	20	4000

Manual Adjustment—Permits 10° advance or retard from center position. See Ignition Timing for adjustment.

Removal:—Distributor for each bank mounted at right and left hand side at front of engine. To remove, take out hold-down screw in advance arm, lift up to disengage coupling (does not disturb drive gear).

Distributor Installation Note—Drive slot not offset and distributors must be installed as follows: With crankshaft turned to #1 firing position (IG/A mark on dampener at front of engine lined up with pointer), install both distributors with rotors pointing forward and to left (L. H.—33° to left from straight ahead position, R. H.—60° to left).

Distributor Drive Shaft Installation—Distributor cannot be timed unless shafts correctly installed as follows: With crankshaft and timing gear marks lined up, install special Distributor Shaft Setting Gauge #J-1212 in distributor support dowel holes, note pointer positions. Remove gauge, install distributor drive shafts, check with gauge (slots must line up with pointer).

IGNITION TIMING:—Standard setting (Ethyl fuel): See Manual adjustment for correction dependent on fuel regularly used.

Flywheel Degrees	Piston Position
6° BTDC.	.0112" BTDC.

Timing (Stationary Contacts)—Loosen thumbscrew on pointer arm, center pointer on scale, tighten thumbscrew. With #1 piston on compression (front cylinder, left bank), turn engine over until mark 'IG/A' on vibration dampener (which is 6° before TDC mark 'C/1-15') lines up with pointer on chain case cover. Loosen advance arm clampscrew on left hand distributor, rotate distributor until stationary contacts (mounted directly on breaker plate) begin to open, tighten clampscrew. Then synchronize.

Synchronization (Timing Movable Contacts)—Manufacturer recommends distributor removal and synchronization on test fixture (set movable contacts to open 22½° (distr.) after fixed set. To synchronize on engine, turn engine over 45° or ⅛ revolution to firing position for #4 cylinder with 'IG/A' mark on dampener lined up with pointer. Remove distributor cap and rotor, loosen two lockscrews on movable sub-plate (on which movable contacts mounted), turn eccentric adjusting screw until contacts begin to open ,tighten lockscrews. Check Manual Adjustment setting.

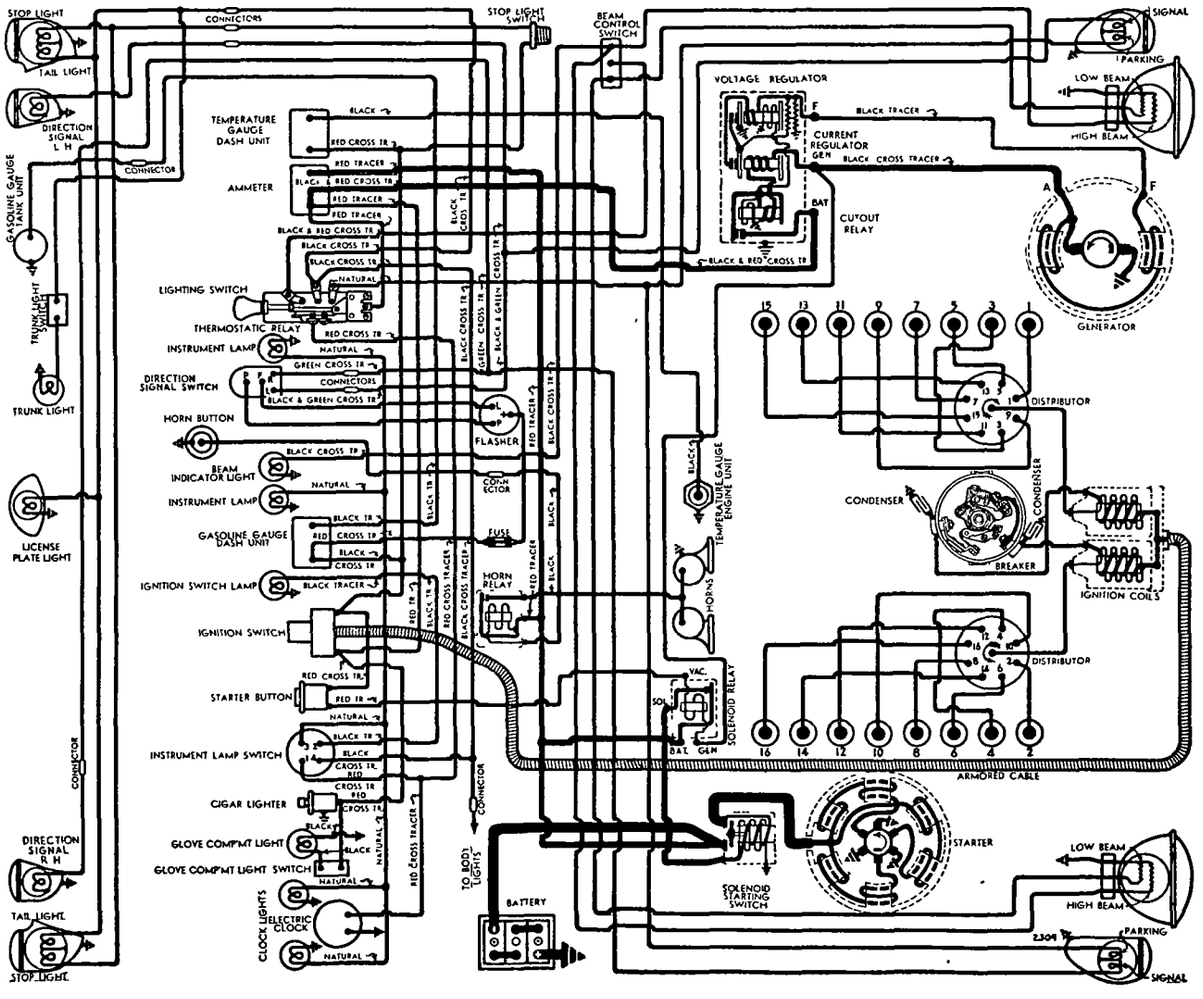
Manual Adjustment—Should be set for slight ping when accelerating engine with wide open throttle at speeds below 15 M.P.H. To adjust, loosen pointer thumbscrew, rotate distributor clockwise (if ping too severe), counter-clockwise (if no ping noted) one graduation on scale at a time until satisfactory performance secured. NOTE—Before changing manual adjustment, accelerate engine up to at least 60 MPH (critical point is 50 MPH.). If engine pings, check for fuel being used, faulty spark plugs, carbon deposits, lean carburetor setting which will cause pre-ignition.

Firing Order:—1-4-9-12-3-16-11-8-15-14-7-6-13-2-5-10. See diagram for cylinder numbering and spark plug connections.

Spark Plugs:—AC No. 104. 10 MM. Metric. NOTE—These plugs are new small type. Do not tighten excessively (7-10 ft. lbs. tension).

Spark Plug Gaps—.032". Limits .030-.035".

CARBURETION:—**Carburetors**—Carter WDO Type 407-S (Left hand), 408-S (Right hand). 1⅛" dual,



downdraft type. One carburetor used for each cylinder bank with interconnected throttle controls.
See article in Carburetor Section for data.
NOTE—Carburetors must be synchronized or equalized at both idle and part throttle position.
Idle Adjustment—With engine warmed up so that Automatic Chokes and Fast Idles inoperative, adjust each carburetor as follows: Set throttle lever stopscrew for 7-8 MPH. idling speed. Turn each idle adjusting screw (one for each barrel, two per carburetor) in until engine begins to lag or miss, then turn screw out slowly until engine fires smoothly. Readjust throttle stopscrew for correct idling speed of 300 R.P.M. After adjusting both carburetors, equalize as follows:
Equalizing Carburetors—Use mercury column 'U' tube connected to ⅛" pipe plug openings in long leg of each intake manifold (do not connect gauge to vacuum balancing tube between carburetors). Disconnect throttle rods, idle engine, note mercury levels in tube. Adjust throttle stopscrew at each carburetor so that engine idles at 7-8 MPH. and mercury level is equal in each tube. Adjust right throttle rod length (trunnion with fine threads on rod near carburetor) so that rod can be connected without disturbing throttles or unbalancing mercury levels. Open throttle to 1000 RPM. engine speed (use foot throttle, not hand throttle), make any necessary re-adjustment to secure equal mercury column levels. If adjustment made recheck idle setting (idle speed equalization more important).
Accelerating Pump Setting—Not adjustable.
Float Level—13/64" from top of float to cover (gasket removed) with needle seated.

Fast Idle—Integral type. Built-in each carburetor.
See article in Carburetion Equipment Section.
Fast Idle Setting—Adjust fast idle screw for .026" throttle opening with choke valve fully closed.

Automatic Choke:—Integral. Built-in each carburetor. *See article in Carburetion Equipment Section.*
Choke Setting—Set center index mark to coincide with mark on carburetor flange.

Air Cleaner:—AC #1528718 heavy duty oil-bath type (one cleaner used for each carburetor). NOTE—Crankcase ventilator air cleaner is AC #1528732.

Fuel Pump:—AC Type AU (2 used). #1523695 (R.H.), #1523696 (L.H.). Diaphragm type. One pump used for each carburetor. NOTE—Fuel lines inter-connected, one pump only may operate at idling speed.
See article in Carburetion Equipment Section.
Vacuum Pump—AC Type K #1523906 (separate unit) mounted between cylinder banks at rear.

Gasoline Gauge:—AC Electric type. #1515368 (dash unit), #1515461 (tank unit).
See article in Carburetion Equipment Section.

VALVE TIMING:—Intake valve (#1 cylinder, front—left bank) opens with piston 6° BTDC. Mark 'IG/A' behind crankshaft pulley aligned with pointer on chain case cover.
Tappet Clearance—None (hydraulic take-up used).
See article in Mechanical Equipment Section for data.
Valve Spring Pressure—50 lbs. at 1 25/32" (valve closed). 100 lbs. at 1 15/32" (valve open).

LUBRICATION:—**Crankcase Capacity**—11 quarts.
Normal Oil Pressure—25 lbs.@30 MPH, 15 lbs. idling.

COOLING SYSTEM:—**Capacity**—30 quarts.

Thermostat:—Harrison. In radiator top tank. Operates shutters. Starts to open 153-158°F. Fully open 175°F. (Std.); Starts to open 168-173°. Fully open 190°F (High Reading type for use with heaters).

Temperature Gauge:—AC Electric #1510773 (dash unit), #1510774 (engine unit).
See article in Mechanical Equipment Section for data.

BATTERY:—**Delco 19Q-1.** 19 plate, 122 AH. capacity.
Starting Capacity—140 amperes for 20 minutes.
Zero Capacity—300 amperes for 4.8 minutes. Five second voltage—4.5 volts.
Dimensions—10⅜" long, 7" wide, 8 9/16" high.
Grounded Terminal—Positive (+) terminal.
Engine Ground—Strap connector at right front engine support.
Location—Under hood on right side outside frame.

STARTER:—**Delco-Remy 783. Armature No. 1868165.**
Drive—Overrunning clutch (solenoid pinion shift).
Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—36-40 ounces each.

Performance Data

Torque	R.P.M.	Volts	Amperes
0 ft. lb.	3000	5.0	70
19	Lock	3.0	500

Removal:—Flange mounted on right front face of flywheel housing. To remove, take off cover in right side pan, take out flange mounting screws, remove starter and switch assembly from below.

Starting Switch:—Solenoid No. 1555 (on starter). Solenoid Relay No. 268-M (mounted separately on dash). Solenoid switch controlled through relay by pushbutton No. 1996005 on instrument panel.
See article in Electrical Equipment Section for data.

Solenoid Switch Specifications

Closes against 70 lb. pull with ½" air gap drawing 65-71 amperes at 5 volts. Holds switch closed with current draw of 12-14 amperes (hold-in coil only).

Solenoid Relay Specifications

Contacts Close—3.2 volts max. **Open**—1.6-2.0 volts.
Contact Gap—.035". **Air Gap** .010" (contacts closed).

GENERATOR:—**Delco-Remy 1102666. Armature 1878429.**
Two brush type with current-voltage control.
Charging Rate Adjustment—No adjustment at generator. Charging rate controlled by Voltage Regulator and maximum output by Current Regulator.
Maximum Charging Rate—32 amperes min. (hot), 8 0 volts, 2450 RPM, 25 MPH and above with load or discharged battery (Current Regulator setting). Actual charging rate controlled by Voltage Regulator and dependent on battery condition.

Performance Data

	Amperes	Volts	R.P.M.
Cold	30*	8.0	1800

*—Not maximum output—see Current Regulator.
Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—25 ounces each.
Field Current—1.76-1.88 amperes at 6.0 volts.

Removal:—Mounted on slide on fan bracket at front of engine between cylinder banks. To remove, take out mounting bolt in slot on slide mounting.

Belt Adjustment:—Loosen mounting bolt on slide mounting under generator, lift generator up to remove slack from belt, tighten mounting bolt.

REGULATOR:—**Model 1118202. 'Single Core' type.** Vibrating Voltage & Current regulator on dash.
CAUTION—Check generator for grounded fields before changing regulator settings.
See article in Electrical Equipment Section for data.

Cutout Relay

Cuts In—6.2-6.7 volts (hot).
Cuts Out—0-4.0 amperes discharge current.
Contact Gap—.020" (same for both sets).
Air Gap—.020" (with points just closed).

Voltage Regulator

Setting—7.4-7.8 volts (70° F.), 7.2-7.4 volts (hot). Regulator over-compensated for temperature.
To Check—Connect ammeter in charging line at 'BAT' regulator terminal, voltmeter between 'BAT' terminal and ground. Operate generator at 2450 RPM., adjust charging rate to 8-10 amperes (use variable rheostat or 'AVR' set). With regulator at hot operating temperature, retard generator speed until cutout relay points open, then increase generator speed to 2450 RPM and check hot voltage setting (above).
To Adjust—Change regulator armature spring tension by bending lower spring hanger for **light (left) spring (or one spring if both alike) only.** If further adjustment required, see Single Core Regulator article in Electrical Equipment Section for heavy (or other) spring adjustment.
Air Gap—.070" between center of core and armature with contacts just closed.

Current Regulator

Setting—32-34 amperes (hot).
To Check—Remove cover, connect short jumper from voltage regulator frame to upper contact support bracket (shorting out Voltage Regulator). Connect ammeter in charging line at 'BAT' regulator terminal. Turn on lights and accessories, operate generator and increase speed until output remains stationary (run until hot). Check setting with regulator at operating temperature.
To Adjust—Change regulator armature spring tension slightly by bending lower spring hanger for **one spring.** If further adjustment required see Single Core Regulator article in Electrical Equipment Section for adjustment of other spring.
Air Gap—.075" (check same as Voltage Regulator).

LIGHTING:—**Headlamps**—Guide 'Sealed Beam' type.
See article in Electrical Equipment Section for data.
Headlamp Adjustment—Aim upper beam straight ahead with center of hot spot 3" below lamp center
Beam Indicator—On speedometer face. Lighted whenever Country (upper) beam in use.
Direction Signal—*See Electrical Equipment Section.*

Switches

Lighting—Delco-Remy 1995010.
Beam Selector—Delco-Remy 1997002.

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps		Sealed Beam
Front Indi. & Park.	21-3	1154
Instr., Clock, Radio	1.5	55
Glove & Trunk Comp't	1.5	55
Beam Indicator, Ign. Lock	1	51
Stop & Tail	21-3	1154
*Rear Indicator (Early)	21-3	1154
*Rear Indicator (Later)	32	1133
License Plate	3	63
Dome & Quarter	15	87

*—When replacing Rear Indicator Bulb use same type bulb as formerly used (1154 double contact—1133 single contact) in order for circuit to function

THERMOSTATIC RELAY:—**Delco-Remy.** On lighting switch. Contacts remain closed with 30 amperes, open in 3 minutes with 42 amps. @ 70°. Not adj.

FUSES:—**Direction Signal**—9 ampere. In Flasher lead under instrument panel.
Fog Lights—20 ampere. On switch.
Radio & Under Seat Heater—14 amperes each.

HORNS:—**Klaxon.** D-R. Model K-33D Type 1967 (low note—left hand), 1968 (high note—right hand). Vibrator type, blended tone, twin horns operated by relay. NOTE—Horns mounted vertically behind radiator grille with horn relay on left front fender dust shield. Remove grille for horn service.

Horn Type	Current (at 6 volts)	Air Gap
1967 Low Note	12-14 amperes	.045-.050"
1968 High Note	11-13 amperes	.036-.040"

Horn Relay:—D-R. Model 1116775.
Contact Gap—.020". **Air Gap**—.015" (closed).
Contacts Close—2.75-4.0 volts.

ENGINE HOOD NOTE:—Alligator type with control knob under left side of instrument panel. Pull control knob out (hood will lift silghtly), reach under front edge of hood and press up on safety catch **Side Panels**—To remove, take out attaching screws (fastened to radiator grille at forward end).

FLEET MODEL NOTE:—Special Economy Engine available on all models. Identify by Tune Up Specification Plate on push rod cover listing special settings for this model. Special carburetor (434-S) has stop-pin limiting throttle opening to half-throttle.

SERIAL NUMBER:—First number 1001 with model prefix as follows: KA(Special Deluxe), KH(Master Deluxe), KB(Master), KC(½ Ton), KD(¾ Ton), KE (¾ Ton Special), WA, WB (1½ Ton), WC (School Bus), WD, WE, WF (1½ Ton Cab-over-Engine). On plate on right front floor (pass. cars), on right side of cowl under hood (Trucks except Cab-over-Engine), on plate on rear side of dash (Cab-over-Engine Trucks).

ENGINE NUMBER:—First No. 2697268 (Flint), B-105462 (Buffalo) with special prefix for each model as follows: Pass. Cars—None (Flint), B (Buffalo); Half Ton—K (Flint), KB (Buffalo); ¾ & ¾ Ton Special—AT (Flint), ATB (Buffalo); 1½ Ton—T (Flint), TB (Buffalo); 1½ Ton Cab-over-engine—H (Flint only), Dubl Duti Panel—E (Flint only). Stamped on right side of block to rear of distributor.

COMPRESSION:—**Ratio**—6.25-1 Std. cast-iron head. **Pressure**—112 lbs. at 65 RPM cranking speed. Minimum pressure 90 lbs. (cylinders even with 5-10 lbs.).

VACUUM READING:—Steady 18-21" with engine idling.

IGNITION:—**Coil Model 536-D.** On right side of engine above distributor. Switch connection armored.

Ignition Current—2.5 amperes idling, 4.8 stopped.

Ignition Switch:—Delco-Remy No. 1116272 (Pass. Cars), 1116287 (Pass. Cars—Canada), 1116278 (Trucks), 1116263 (Trucks with flat cowl), 1116279 (Cab-over-engine). 1116291, 1116292 (Trucks, Can.).

Ignition Lock—Briggs & Stratton No. 45792.

Key Series—8000 to 9499. **Groove**—No. 15.

Distributor Delco-Remy 1110052 with Vacuum Spark Control 1116011. Full automatic advance with auxiliary vacuum spark control & Octane Selector.

Breaker Gap—.018". Limits .018-.024".

Cam Angle or Dwell—35° closed, 25° open (distr.).

Breaker Arm Spring Tension—17-21 ounces.

Rotation—Clockwise viewed from above.

Condenser—Part No. 1869704. Capacity .18-.25 mfd.

Automatic Advance

Distributor Degrees	R.P.M.	Engine Degrees	R.P.M.
Start	400	4	800
5½	600	11	1200
18½	1550	37	3100

Vacuum Spark Control No. 1116011—Mounted on Octane Selector, linked to advance arm. Provides additional advance except when engine accelerated (spark retarded by return spring in unit) or at high speed with wide open throttle (vacuum port cut off by throttle valve shaft). Plunger travel 7/32".

Vacuum Advance

Distr. Degrees	Eng. Degrees	Vacuum (" of HG)
Start	0	6" Min.
8	16	12-15"

Octane Selector—Adjustment at distributor provides 10° advance or retard from center 'O' position. See Ignition Timing for adjustment instructions.

Removal:—On right side of crankcase. To remove, loosen advance arm clamp bolt (does not disturb Octane Selector).

IGNITION TIMING:—Initial setting as follows (see Octane Selector for final setting dependent on fuel used):

	Flywheel Degrees	Piston Position
All Engines	5° BTDC	.0091" BTDC.

Timing (Neon Light)—This method recommended. Attach Neon Timing Light to #1 spark plug, direct light on flywheel through inspection hole in right front face of housing. Set Octane Selector pointer at 'O' on scale. Idle engine, loosen advance arm clamp bolt, rotate distributor until steel ball timing mark on flywheel appears in line with pointer. Tighten clamp bolt and check Octane Selector.

Timing (Without Neon Light)—With #1 piston on compression, turn engine over until piston is 5° or .0091" BTDC. when steel ball mark on flywheel lines up with pointer in inspection hole in right front face of housing. Adjust distributor as above.

Octane Selector Setting—Road test car and set Octane Selector for slight ping when accelerating engine with wide open throttle to secure maximum performance and economy with fuel regularly used. To adjust, loosen hold-down screw, move distributor and scale counter-clockwise to advance spark, clockwise to retard spark, tighten hold-down screw.

Firing Order:—1-5-3-6-2-4. See diagram.

Spark Plugs:—AC No. 44. 14 MM. Metric type.

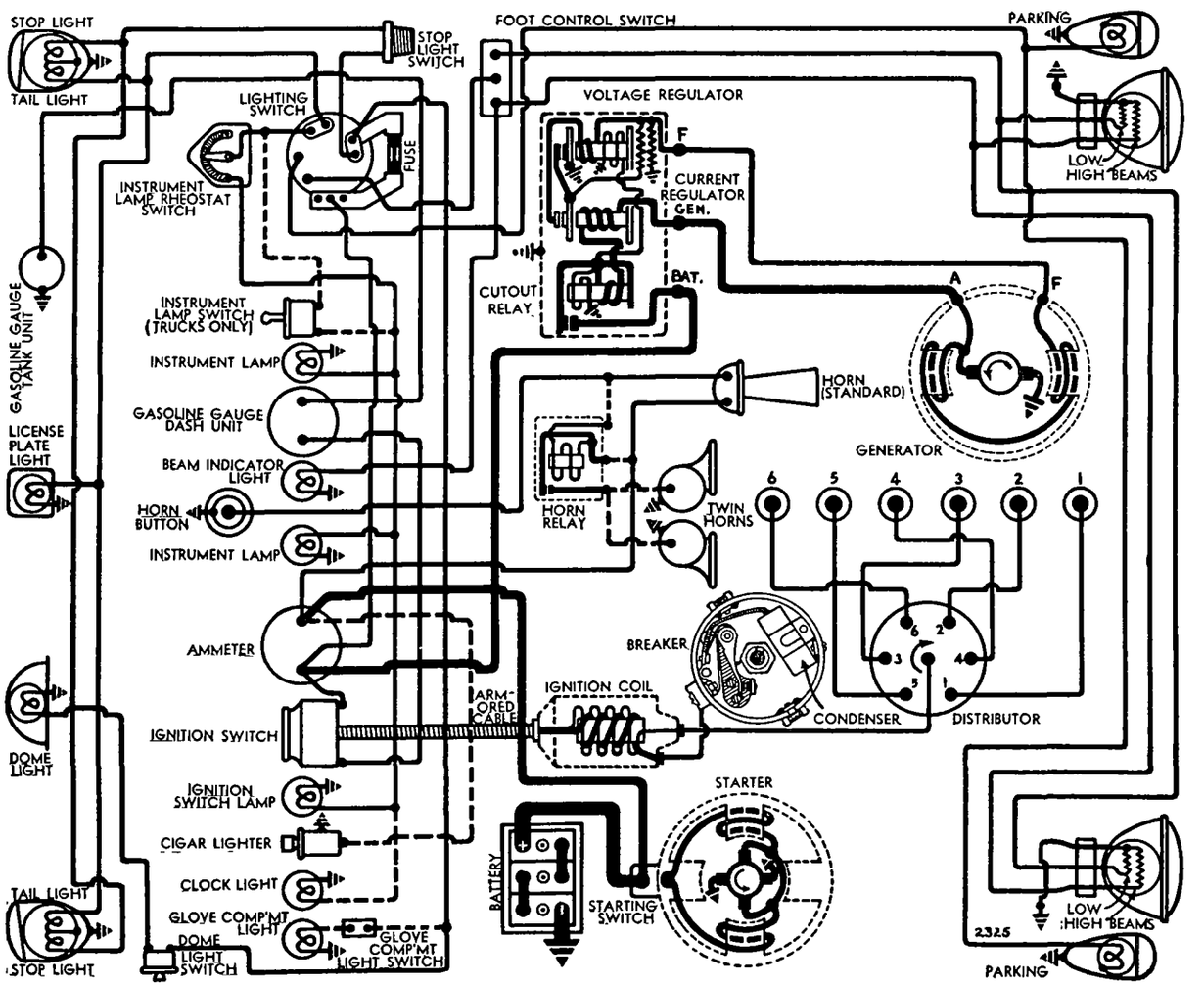
Spark Plug Gaps—.040".

CARBURETION:—**Carburetor**—Carter Model W1, No. 420-S (Std.), 434-S (Econ. Engines). 1¼" single barrel downdraft type. 420-S carburetor painted Black and marked '365' on flange, 434-S painted Brown and marked '373'. NOTE—These carburetors same models as used on 1939 but have new specifications. ***See article in Carburetor Section for complete data and directions to correct 'pop-back' in carburetor.***

Cab-over-Engine & Dubl Duti Panel—Carter BB1, Model 447-S, 1¼" single barrel, updraft type. ***See article in Carburetor Section for data.***

Idle Adjustment—With engine warm and choke valve wide open, set throttle stopscrew so engine idles at 450-500 RPM. (except Cab-over-Engine), 300-375 RPM. (Cab-over-Engine Truck). Turn idle adjusting screw in (leaner mixture), out (richer mixture) until engine fires smoothly. Final setting should be 1-2 turns (420-S, 434-S), ½-1¼ turns (447-S) out from inner seated position. Readjust throttle stopscrew for correct idling speed.

NOTE—Special metering rods (420-S, 434-S), me-



tering jets (447-S) available for special service. See Carter and Carter (B&B) Jet Specification Tables in Carburetor Section for complete data.

Accelerating Pump Setting—Pump lever under dust cover on bowl has 3 holes for pump link connection (420-S, 434-S), throttle lever has 2 holes for pump link (447-S). Connect link as follows (Med. stroke position not provided on 447-S).

Lower (Med. stroke)—Normal temp. Std. fuel.

Inner (Min. stroke)—Hot weather or high-test fuel.

Upper (Max. stroke)—Extremely cold weather.

Float Level (420-S, 434-S)—½" from top of float at free end to gasket seat on cover with valve closed

Float Level (447-S)—Top of float 1/32-1/16" below top edge of bowl (gasket removed) with valve closed.

Throttle Cracker:—New adjustable type. Opens throttle 1/3 when starter pedal depressed.

Adjustment—Set carburetor idle speed at 450-500 RPM. Loosen locknut, turn adjusting screw on accelerator rod bellcrank (left side of engine) until clearance between end of screw and throttle control bellcrank is .030" (use feeler gauge), tighten locknut. Loosen locknut and adjust bolt in accelerator rod for 1/16" clearance between head of bolt and lug on starter cross-shaft.

Air Cleaner:—AC #1528524 (Pass. Cars without Governor), #1529264 (Pass. Cars with Governor), #1525978 (Trucks) oil-wetted type Std. Heavy duty oil-bath type Air Cleaner Optl. on all models except Pass. Cars with Governor.

Fuel Pump:—AC Type AF. #1523089 Diaphragm type Std. Type AM #1523271 fuel & Vacuum type Optl. ***See article in Carburetion Equipment Section.***

Gasoline Gauge:—AC Electric. Dash Unit No. 1515369 (first—medium brown dial), 1516221 (later—light brown dial). Tank Unit No. 1516182 (Pass. Cars except—#1516183 Coupe & Sedan Delivery only). ***See article in Carburetion Equipment Section.***

MANIFOLD HEAT CONTROL:—Thermostatic type. Check coil wind-up when tuning engine. Spring should be wound up just enough to slip end over manifold pin (approximately ½ turn). NOTE—Excessive tension may cause sticking of valve, detonation and poor performance.

Anti-rattle Spring—To correct rattles, install No. 602799 anti-rattle spring (do not increase thermostatic coil tension). With valve rotated to heat off position, insert spring in slot in valve shaft, hold shaft counterbalance weight 3/16" above Heat On position, bend spring until it just touches stop pin

VALVE TIMING:—To Check—With #1 intake valve tappet clearance set at .006", valve should open with piston 3° or .0032" BTDC. when point on flywheel approximately 1.158 teeth before 'U/C' mark in line with indicator in inspection hole in right front face of flywheel housing.

Tappet Clearance:—.006-.008" Int., .013-.015" Exh. Hot (engine 'Normalized'). Use lower figure for ordinary service, higher figure for severe truck service. ***See Chevrolet Shop Notes in 'M' section for engine normalizing instructions.***

Fleet Econ. Engines—.010" Int., .016" Exh. Hot.

Valve Spring Pressure:—49-56 lbs. at 1 13/16" (valve closed), 131-133 lbs. at 1½" (valve open).

LUBRICATION:—Crankcase Capacity—5 qts. (refill). **Normal Oil Pressure**—15 lbs. (all models) at 40 MPH. (KA, KH, KC, KE), 43 MPH. (KB), 36 MPH. (KD), 30 MPH. (WC Bus), 32 MPH. (Other Trucks).

COOLING SYSTEM:—Capacity—14 qts. (except Cab-over-Engine), 16½ qts. (Cab-over-Engine Trucks). **Thermostat**—Harrison. In cylinder head outlet. Starts to open at 142°F. (Std.), 150°F (for Alcohol Anti-freeze), 160° (Perm. anti-freeze & Econ. Eng.).

BATTERY (STD):—Delco Model 15X1. 6 volt, 15 plate, 94 ampere hour capacity (20 hour rate).

Starting Capacity—115 amperes for 20 minutes.

Zero Capacity—300 amperes for 3.3 minutes.

Dimensions—Lgth. 8 15/16". Width 7". Hgt. 8 11/16".

Grounded Terminal—Negative (—) grounded to clutch housing below starter pedal pull-back spring (Pass. Cars), to rear of transmission (Trucks).

Location—In engine compartment on right side (Pass. Cars), under right front floor (Trucks), under right cab seat (Cab-over-Engine Trucks).

Special Battery—Delco Model 19Q1. 6 volt, 19 plate, 122 ampere hour capacity (20 hour rate).

Grounded Terminal & Location—See above.

STARTER:—Delco-Remy Model 1107009, Armature 1867897 (Std); 1107023, Arm. 810601 (RHD Cars).

Drive—Manual pinion shift (1107009), Solenoid pinion shift (1107023) with overrunning clutch.

Rotation—Counter-clockwise at commutator end.

Brush Spring Tension—24-28 ounces each.

Cranking Engine—65 RPM., 150 amperes, 5.5 volts.

Performance Data

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	5000	5.0	65
12 " "	Lock	3.37	525

Removal:—Flange mounted on right front face of flywheel housing. To remove, disconnect cable take out capscrews, remove starter and switch.

Starting Switch (1107009):—No. 820052. Mounted on starter and operated by starting pedal.

(1107023)—Solenoid No. 1546 mounted on starter controlled by Pushbutton Switch D-R 1996006. ***See article in Electrical Equipment Section for data.***

GENERATOR:—Delco-Remy Model 1102667, Armature 1879002 (Std); Model 1106403 (City Police & U. S. Govt.). Two brush (shunt) type with vibrating type voltage and current regulation.

Charging Rate Adjustment—No adjustment at generator. Charging rate controlled by Voltage Regulator, maximum output by Current Regulator.

Maximum Charging Rate—38-40 amperes, 7 55-7.85 volts, 1900 RPM. Cold; 34-36 amperes, 7.45-7.55 volts, 2300 RPM. Hot. Reached at 25 MPH (KA, KH, KC), 27 MPH. (KB, KE), 23 MPH. (KD), 22 MPH. (WA, B, D, E, F), 19 MPH. (WC Bus). Actual charging rate controlled by Regulator and dependent on battery

Performance Data Cold.

	Amperes	Volts	R.P.M.
1102667	30*	8.0	1700
1106403	35*	8.0	1040

*—Not maximum output—See Current Regulator.

Brush Spring Tension—25 ounces each.

Rotation—Counter-clockwise at commutator end.

Field Current—1.76-1.88 amperes (1102667), 1.77-2.0 amperes (1106403) at 6.0 volts.

Removal:—Generator pivot mounted at left front of engine. To remove, take out pivot and clamp bolts.

Belt Adjustment:—Swing generator away from engine until belt sideplay at point midway between generator & fan pulleys is 1½" (light pressure).

REGULATOR:—Model 1118201 (1102667 Gen.), 1118229 or 1118232 (1106403 Gen.) 'Single Core' Type. Vibrating Voltage and Current Regulators in case on dash. NOTE—1118229 Regulator used with Negative battery ground, 1118232 with Positive ground. ***See article in Electrical Equipment Section for data.***

CAUTION—Check generator for grounded fields before changing regulator settings.

Cutout Relay

Cuts In—6.2-6.7 volts (hot), 800 RPM., 8.7 MPH. (KA, KH), 9.5 MPH. (KB), 8 5 MPH. (KC). 8 MPH. (KD, KE), 7.5 MPH. (WA, B, D, E, F), 7 MPH. (WC).

Cuts Out—0-4.0 amperes discharge current.

Contact Gap—.020" (same for both sets).

Air Gap—.020" (with points just closed).

Voltage Regulator

Setting (1118201)—7.4-7.8 volts (70°), 7.2-7.4 volts (Hot). **(1118229 & 1118232)**—7.0-7.4 volts (70° F.), 7.0-7.2 volts (Hot).

To Check—Connect ammeter in charging line at regulator 'BAT' terminal, voltmeter between 'BAT' terminal and ground. Operate generator at 2800 RPM., adjust charging rate to 8-10 amperes (use variable rheostat or 'AVR' set). With regulator hot (150° F.), slow generator speed until cutout relay points open, then increase speed to 2800 RPM. and check hot voltage setting (above).

To Adjust—Change regulator armature spring tension slightly by bending lower spring hanger for **light (left) spring (or one spring if both alike) only.** If further adjustment required, see Single Core Regulator article in Electrical Equipment Section for Heavy (or other) spring adjustment.

Air Gap—.070" between center of core and armature with contacts just closed.

Current Regulator

Setting—32-34 amperes (1118201), 34-36 amperes (1118229 & 1118232).

To Check—Remove cover, connect short jumper from voltage regulator frame to upper contact support bracket (to short out Voltage Regulator). Connect ammeter in charging line at regulator 'BAT' terminal. Turn on lights and accessories, operate generator and increase speed until output remains stationary (run until hot). Check setting with regulator at operating temperature.

To Adjust—Change regulator armature spring tension slightly by bending lower spring hanger for **one spring** only. If further adjustment required, see Single Core Regulator article in Electrical Equipment Section for adjustment of other spring.

Air Gap—.075" (check same as Voltage Regulator).

LIGHTING:—Headlamps—Guide 'Sealed Beam' type. ***See article in Electrical Equipment Section for data.***

Headlamp Adjustment—Aim upper beam straight ahead with center of hot spot 3" below lamp center

Beam Indicator—On face of speedometer dial. Lighted when upper beams in use.

Switches.

Lighting—Delco-Remy No. 1994014 (Pass. Cars—Instr. lamp rheostat in handle), 1994015 (Trucks).

Instrument—Delco-Remy 1404 (Trucks only).

Beam Selector—Delco-Remy 1997003.

Glove Compt. Light—D-R. 1997721 (Spec. Del.).

Stop Light—Delco-Remy 476-U (hydraulic type).

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps		Sealed Beam
Parking, License Plate	3	63
Instr., Glove Compt., Ign. (1½ Ton)	1½	55
Beam Ind. (all), Ign. (exc. 1½ Ton)	1	51
Stop & Tail (exc. 1½ Ton)	21-3	1154
Stop, Tail (1½ Ton)	3	63
Dome	6	81

NOTE—Dome lamp 15 cp. on Carryall only.

FUSES:—Lighting—30 ampere. On switch.

Clock—2 ampere. On clock.

HORNS:—Pass. Cars—Delco-Remy No. 1999509 (Low Note), 1999510 (High Note), 1999519 (Low Note—Canada), 1999520 (High Note—Canada). Twin horns

Trucks—No. 1999801 Vibrator type single horn.

	Current (at 6 volts)	Air Gap
1999509, 1999519	19-21 amperes	.044-.049"
1999510, 1999520	18-20 amperes	.034-.039"
1999801	7-9 amperes	.027-.033"

Horn Relay:—Delco-Remy 1116775. Used with twin horns on Pass. Car models.

Contacts Close—2.75-4.0 volts.

Contact Gap—.020". **Air Gap**—.015" (closed).

SERIAL NUMBER:—On right front door hinge post. First number: Detroit—7,625,001 (Royal), 6,955,201 (Windsor). Canada—9,714,601 (Royal).

ENGINE NUMBER:—First number C25-1001. Stamped on left side of block between #1 and #2 cylinders.

COMPRESSION:—Ratio and pressure as follows:

Ratio	Pressure at 1000 RPM	At 100 RPM
6.5-1 cast-iron hd.	140-150 lbs.	Approx. 115 lbs.
*7.0-1 aluminum hd.	150-160 lbs.	Approx. 120 lbs.

*—This head standard equip. on 7 passenger sedan.

VACUUM READING:—Steady 18-21" idling at 6 MPH.

IGNITION:—Coil Model IG-4661. Service winding (less switch and cable) IG-3224JS. Mounted on dash.
Ignition Current—2.25 amperes idling, 5.5 stopped.
Ignition Switch:—Mitchellock Model 24-R, No. 8197.
Ignition Lock—Yale & Towne or Briggs & Stratton. B&S No. 80651. Key Series 1BP to 1000BP. Groove #24.
Distributor Model IGS-4108A-1. Single breaker, 6 lobe cam, full automatic advance type auxiliary vacuum spark control and manual (octane selector) adjustment.
Breaker Plate Identification—Maximum vacuum advance limited by slot and marked with number (#11) stamped on plate.
Breaker Gap—Set at .020". Limits .018-.022".
Cam Angle or Dwell—38° closed, 22° open (distr.).
Breaker Arm Spring Tension—17-20 ounces.
Rotation—Clockwise viewed from the top.
Condenser—No. IG-3927A. Capacity .25-.28 mfd.

Automatic Advance

Distributor Degrees	Distributor R.P.M.	Engine Degrees	Engine R.P.M.
Start	350	0	700
3	400	6	800
6	850	12	1700
9	1300	18	2600
12	1750	24	3500

Vacuum Spark Control—Integral type (on distributor, linked directly to breaker plate). Provides additional advance at speeds above idling except when engine accelerated or operated with wide open throttle (spark retarded by return spring in unit).

Vacuum Advance

Distr. Degrees	Eng. Degrees	Vacuum (" of HG)
Start	0°	5"
2°	4°	7¼"
5°	10°	10½"
8°	16°	13¾"
11°	22°	17"

Manual Adjustment—At distributor. Provides 10° advance or retard from center '0' position. See Ignition Timing for adjustment.
Distributor Removal:—Mounted on left side of crankcase. To remove, disconnect vacuum line, take out hold-down screw in lock plate.

IGNITION TIMING:—Initial setting (correct for fuel of 70 octane rating at low altitudes for both cast-iron and aluminum heads) shown below. See Manual adjustment (following) for correction (not to exceed 4° either way) dependent on fuel regularly used and operating conditions.

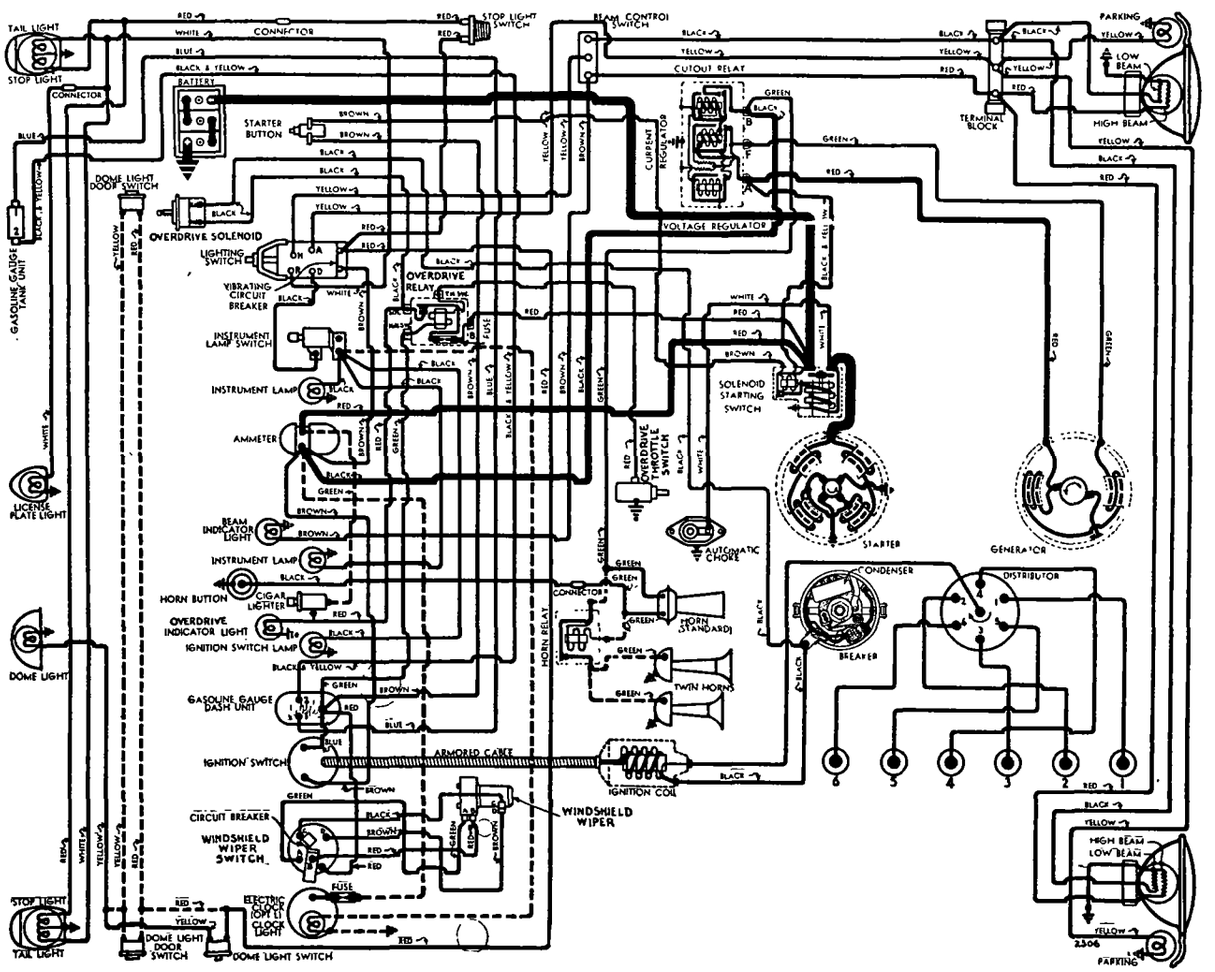
	Flywheel Degrees	Piston Position
6.5-1 cast-iron hd.	0° at TDC	.0000" at TDC
7.0-1 aluminum hd.	2° ATDC	.002" ATDC

NOTE—Impulse neutralizer marked 'DC' at TDC point with 15 (1°) graduations on either side.
Timing (Using Timing Light)—Connect timing light between distributor and battery terminal on the generator regulator. With #6 piston on compression, turn engine over until piston reaches firing position (see Initial Setting above), stop when correct mark on impulse neutralizer lines up with pointer on chain case cover. Loosen lock-plate hold-down screw, center pointer on scale, tighten screw. Loosen lock-plate clamp bolt, rotate distributor until timing light just goes out, tighten clamp bolt. Check Manual Adjustment as directed below.

Timing (Using Synchroscope)—Tool C-374. Clip lead to #1 spark plug, direct light on impulse neutralizer (fill in correct mark on impulse neutralizer with chalk or paint), idle engine and adjust distributor as directed above.

Manual Adjustment—Initial ignition setting (listed above) should be varied not more than 4° (Cast-iron head from 4° or .007" BTDC to 4° or .007" ATDC. Aluminum head from 2° or .002" BTDC to 6° or .016" ATDC) so that slight ping noticeable between 10 and 30 MPH when accelerating with wide open throttle for best performance. To adjust, loosen lock-plate hold-down screw, rotate distributor counter-clockwise to advance spark (if no ping noted), clockwise to retard spark (if ping too severe) not more than 4°. Scale graduated in engine degrees.
Firing Order:—1-5-3-6-2-4. See diagram.
Spark Plugs:—Auto-Lite Type A-7B (cast-iron head), Type AL-7A (aluminum head). 14 MM Metric type.
Spark Plug Gaps—Set at .025".

CARBURETION:—Carburetor—Carter (Ball & Ball) Model E6S1 (early cars), E6S2 (later cars). 1½" single barrel, downdraft type.
See article in Carburetor Section for complete data.
E6S1 Note—Can be changed to E6S2 specifications by changing parts (carburetors marked E6S1* on bowl cover factory equipped to E6S2 specifications).
See article in Carburetor Section for part changes.
Idle Adjustment—With engine warm and running at slow idle speed (choke valve wide open, fast idle inoperative), set throttle stopscrew for 6 MPH idle speed. Adjust idle adjusting screw until engine fires smoothly (½-1½ turns open—turn screw in for leaner mixture). Readjust idle speed. NOTE—Car manufacturer recommends use of vacuum gauge. Set idle screw for highest reading on gauge.



Accelerating Pump Setting—Pump lever has three holes for pump link engagement. Set as follows: Inner Hole (min. stroke)—Extreme hot temperatures or altitudes above 3000 feet.
Center Hole (med. stroke)—Normal setting.
Outer Hole (max. stroke)—Winter temperatures.
NOTE—If lean metering jets (High Alt. calibration) used at lower altitudes for increased economy, reduced speed and power will result (not recommended by manufacturer). See Carter (B&B) Jet Table in Carburetor Section for complete jet data.
Float Level—5/64" from top of float (not soldered seam) to top edge of float bowl.

Fast Idle:—Not adjustable (built-in type).

Automatic Choke:—Sisson Type AC-758B.
See article in Carburetion Equipment Section.

Air Cleaner:—AC #1529041 oil-wetted type standard.

Fuel Pump:—AC Type AT #1523912 diaphragm type. Type AS #1523913 combination fuel-and-vacuum pump used on cars with swinging windshield.
See articles in Carburetion Equipment Section.

Gasoline Gauge:—Auto-Lite electric. No. NG-9356D (dash unit), No. NG-9329T (tank unit).
See article in Carburetion Equipment Section.

MANIFOLD HEAT CONTROL:—Thermostatic coil type. See that shaft and valve rotate freely. When installing coil, wind free end approximately 1 turn counter-clockwise and hook end over stop stud.

VALVE TIMING:—To Check—With .014" (cold) tappet clearance #6 intake valve should open with #6 piston 12° or .063" BTDC with 12th graduation before DC mark on impulse neutralizer aligned with pointer. Reset tappet clearance at .008" hot.

Tappet Clearance:—.008" Int., .010" Exh. (hot & idling). .002" add'tl exh. clearance desirable for sustained high speeds. NOTE—Tappet screws self-locking (no locknuts). Remove right front wheel, lower housing panel and fuel pump shield for access to valves.

Valve Spring Pressure:—40-45 lbs. at 1¾" (valve closed). 107-115 lbs. at 1⅜" (valve open).

LUBRICATION:—Crankcase Capacity—5 qts. (refill).
Normal Oil Pressure—30-45 lbs. at 30 MPH, 15 idling.

COOLING SYSTEM:—Capacity—18 quarts.
Thermostat—Bishop & Babcock or Fulton. In outlet on head. Starts to open 157-162°. Fully open 183°
Temperature Gauge—Motometer (Auto-Lite) Vapor tension type. A-L Part No. H-9355.
See article in Mechanical Equipment Section for data.

TRANSMISSION OVERDRIVE CONTROL:—Electric type with accelerator pedal 'kick-down' switch. Optional on Windsor only (not available on Royal).
See article in Mechanical Equipment Section for data.
Overdrive Solenoid—Auto-Lite SSB-4001.
Throttle Switch Setting—3/32" gap between switch plunger & contact screw (throttle just wide open).
Control Relay—Auto-Lite HR-4201. Use only 20 ampere fuse on relay (on left side of engine dash).
Overdrive Indicator Light—In upper right corner of speedometer dial. Lights when 'kick-down' direct drive operating.

BATTERY:—Willard Type SW-2-119. 6 volt, 15 plate, 119 ampere hour capacity (20 hour rate).
Starting Capacity—140 amperes for 20 minutes.
Zero Capacity—300 amperes for 4.3 minutes. Five second voltage—4.3 volts.
Grounded Terminal—Positive (+) grounded to the transmission case.
Dimensions—Lgth 10 5/16". Width 7". Hght 9 5/16".
Location—Left side under front seat.

STARTER:—Model MAX-4020A. Armature MAW-2030.
Drive—Solenoid operated pinion shift type. Drive through overrunning clutch.
Cranking Engine—Approx. 160 amperes, 5 volts.
Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—42-53 ozs. (new brushes).

Performance Data

Torque			R.P.M.	Volts	Amperes
0	ft.	lbs.	5300	5.5	65
.65	"	"	3300	5.5	100
2.75	"	"	1630	5.0	200
5.5	"	"	970	4.5	300
8.7	"	"	600	4.0	400
12.0	"	"	300	3.5	500
16.5	"	"	Lock	3.0	640
25.0	"	"	Lock	4.0	880

Removal:—Flange mounted on left front face of flywheel housing. Disconnect wire connections (tape battery lead) and oil filter lines. Remove two fastening bolts and withdraw unit.

Starting Switch:—Solenoid Switch Type SS-4206. Controlled through relay by pushbutton on instrument panel. Operative with ignition 'on'.
See article in Electrical Equipment Section for data.

GENERATOR:—Models GDZ-4801A (Std.), GEB-4801A (Police). Armature No. GDZ-2006F (GDZ-4801A) GEB-2006F (GEB-4801A). Two brush type with current-voltage control. Air cooled.
Charging Rate Adjustment—No adjustment at generator. Charging rate controlled by Voltage Regulator and maximum output by Current Regulator.
Maximum Charging Rate—35 amperes (Std.), 32 amperes (Police), 8.0 volts, 2200 gen. RPM (Std.), 1400 (Police), approx. 24 MPH (Std.) and above with load or discharged battery (Current Regulator setting). Actual charging rate controlled by Voltage Regulator and dependent on battery condition.

Performance Data—GDZ-4801A

Cold			Hot		
Amperes	Volts	R.P.M.	Amperes	Volts	R.P.M.
0	6.4	925	0	6.4	1000
4	6.6	1035	4	6.6	1120
8	6.75	1140	8	6.75	1235
12	6.95	1250	12	6.95	1350
16	7.15	1370	16	7.15	1460
20	7.3	1480	20	7.3	1590
24	7.5	1590	24	7.5	1730
28	7.7	1710	28	7.7	1900
32	7.9	1820	32	7.9	2090
*35	8.0	1900	35	8.0	2250

Performance Data—GEB-4801A

0	6.4	560	0	6.4	600
4	6.6	630	4	6.6	675
8	6.8	700	8	6.8	750
12	7.0	775	12	7.0	840
16	7.2	845	16	7.2	930
20	7.4	920	20	7.4	1030
24	7.6	1000	24	7.6	1140
28	7.8	1075	28	7.8	1260
*32	8.0	1150	32	8.0	1400

*—Current regulator setting.

Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—53 ozs. max. (new brushes).
Field Current—1.60-1.78 amperes at 6 volts (GDZ).
Motoring Current—4.16-4.60 amperes at 6 v. (GDZ).

Removal:—Pivot mounted at left side of engine at front. To remove, take out pivot and clamp bolts.

Belt Adjustment:—Loosen clamp and pivot bolts, swing generator out until scale (attached to field frame) reads 40-50 lbs., tighten bolts.

REGULATOR:—Model VRP-4001A (Std.), B (Police). Current-Voltage type. In single case on dash.
See article in Electrical Equipment Section for data.
NOTE—Regulator case cover is sealed. Serviced on exchange basis if seals not broken.

Cutout Relay

Cuts In—6.4-6.6 volts at approximately 1000 generator RPM (Std.), approx. 600 gen. RPM (Police).
Cuts Out—4.8-5.6 volts (approx. 7-8 amps. disch.).
Contact Gap—.015" minimum.
Air Gap—.034" min., .038" max. with contacts open. Measure at hinge end of core.

Voltage Regulator

Setting—7.3-7.6 volts at 70° F.
To Check (without breaking seals)—Connect ammeter in charging line at regulator 'B' terminal, voltmeter between 'B' terminal and ground. Operate generator at speed equivalent to 30 MPH charging battery until voltage is steady. Voltage reading should be 7.3-7.6 volts (room temperature), 7.1-7.4 volts (hot operating conditions).
To Adjust (with cover removed)—Change regulator armature spring tension by bending lower spring hanger slightly. See Electrical Equipment Section.
Contact Gap—.012" Min. (armature against stop pin).
Air Gap—.048-.052" with contacts just opening.

Current Regulator

Setting—Std: 34-36 amperes (marked '35' on cover), Police: 31-33 amperes (marked '32' on cover).
To Check (without breaking seals)—Connect test meters as for Voltage check (above). Operate generator at speed equivalent to 30 MPH charging battery, turn on car lights and accessories so that generator charges at peak rate and Current Regulator operates. Charging current should not exceed 34-36 amperes (Std.), 31-33 amperes (Police). If more than slight excess noted, regulator is defective.
Adjustment & Contact Gap—Same as for Voltage Regulator (above).
Air Gap—.034-.038" with contacts just opening.

LIGHTING:—Headlamps—Corcoran-Brown 'Sealed Beam' type. *See article in Electrical Equipment Section.*
Headlamp Adjustment—Aim upper beam for each lamp straight ahead with center of hot spot 3" below lamp center height.
Beam Indicator—Red light in upper left corner of speedometer dial. Lighted with upper beams on.

Switches

Lighting—Chrysler No. 854794, 857380 Optl.
Beam Selector—Chrysler No. 859974.
Instrument—Chrysler No. 853371.
Stop Light—Chrysler No. 677112 hydraulic type.

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps		Sealed Beam
Parking, Instrument	1½	55
Beam Indicator, Ign. Sw.	1	51
Stop and Tail	21-3	1158
Rear License	3	63
Dome or Reading	15	87
Overdrive Indicator	1	51

LIGHTING CIRCUIT BREAKER:—Vibrating, thermostatic type. Mounted on lighting switch.

FUSES:—**Clock**—2 ampere. In connector behind clock.
Transmission Overdrive Control—20 amp. On relay.
Horns & Windshield Wiper—No fuse used.
Radio—14 amp. In feed wire behind instr. panel.

HORNS:—Single—Delco-Remy No. 1999911 standard.
Dual—Auto-Lite HO-5001 horn set. HL-4001 (low pitch), HL-4002 (high pitch) operated by horn relay.
Current Draw—Approx. 7 amps. single, 35-40 dual.

Horn Relay:—Auto-Lite Model HRC-4001 (no fuse).
Contacts Close—1.5-3.0 volts. **Open**—.5 volt.
Contact Gap—.026". **Air Gap**—.016-.020" (closed).

WINDSHIELD WIPER:—Auto-Lite Model EBW-4001. Electric type with circuit-breaker on back of switch.
See article in Mechanical Equipment Section for data.
Circuit Breaker—Vibrating, thermostatic type. Starts to operate with current of 12 amperes.

SERIAL NUMBER:—6750101 Up (Traveler), 6673501 (Saratoga), 6613401 (New Yorker), 7806551 (Crown Imperial). On right front door hinge pillar post.

ENGINE NUMBER:—C26-1001 Up (C26), C27-1001 (C27). Left side of block between #2 and #3 cylinders.

COMPRESSION:—**Ratio**—6.8-1 CI (Std. C26), 6.8-1 AL (Std. C27). 7.45-1 aluminum (Optl. C26 & C27).

Ratio	Pressure at 1000 RPM	At 100 RPM
6.8-1 CI or AL hd.	150-160 lbs.	Approx. 118 lbs.
7.45-1 aluminum hd.	160-170 lbs.	Approx. 124 lbs.

VACUUM READING:—Steady 18-21" idling at 6 MPH.

IGNITION:—**Coil Model CE-4640.** Service coil (less switch and cable CE-3224JS). Mounted on dash.

Ignition Current—2.25 amperes idling, 5.5 stopped.

Ignition Switch:—Mitchellock Model 24-R. Type 8197.

Ignition Lock—Yale & Towne or Briggs & Stratton. B&S No. 80651. Key Series 1BP to 1000BP. Groove #24.

Distributor Model IGT-4101A-2 (C26), IGT-4101B-2 (C27). Single breaker, 8 lobe cam, full automatic advance type with auxiliary vacuum spark control and manual (octane selector) adjustment.

Breaker Plate Identification—Maximum vacuum advance limited by slot and marked by number (#8—IGT-4101A-2, #6—IGT-4101B-2) on plate

Breaker Gap—Set at .018".

Cam Angle—27° closed, 18° open (.017" gap).

Breaker Arm Spring Tension—17-20 ounces.

Rotation—Clockwise viewed from above.

Condenser—No. IG-3927A. Capacity .25-.28 mfd.

Automatic Advance

Distributor Degrees	Distributor R.P.M.	Engine Degrees	Engine R.P.M.
Start	350	0	700
3	400	6	800
6	850	12	1700
9	1300	18	2600
12	1750	24	3500

Vacuum Spark Control—Integral type (on distributor, linked directly to breaker plate). Provides additional advance at speeds above idling except when engine accelerated or operated with wide open throttle (spark retarded by return spring in unit).

Vacuum Advance—IGT-4101A-2

Distr. Degrees	Eng. Degrees	Vacuum (" of HG)
Start	0°	5"
2°	4°	8"
4°	8°	11"
6°	12°	14"
8°	16°	17"

Vacuum Advance—IGT-4101B-2

Start	0°	5"
1°	2°	7"
3°	6°	11"
5°	10°	15"
6°	12°	17"

Manual Adjustment—Provides 10° advance or retard from center '0' position on scale (at distributor). See Ignition Timing for adjustment.

Distributor Removal:—Mounted on left side of crankcase. To remove, disconnect vacuum line, take out hold-down screw in lock plate.

IGNITION TIMING:—Initial setting (correct for fuel of 70 octane rating at low altitudes for 6.8-1, Ethyl fuel 7.45-1 head) shown below. See Manual Adjustment (following) for recommended corrections (not to exceed 4° either way) dependent on fuel regularly used and operating conditions.

	Flywheel Degrees	Piston Position
C26—6 8-1 CI hd.	0° at TDC.	.0000" TDC.
C27—6.8-1 AL hd.	3° BTDC.	.0038" BTDC.
**All—7.45-1 AL hd.	0° at TDC.	.0000" TDC.

**—Ethyl gasoline setting.

NOTE—Impulse neutralizer marked DC at TDC with 15 (1°) graduations on either side.

Timing (Using Timing Light)—Connect timing light between distributor and battery terminal on generator regulator. With #8 piston on compression, turn engine over until piston reaches firing position (see Initial Setting above), stop when correct mark on impulse neutralizer lines up with pointer on chain cover. Loosen lock-plate hold-down screw, center pointer on scale, tighten screw. Loosen lock plate clamp bolt, rotate distributor until timing light just goes out, tighten clamp bolt. Check Manual Adjustment setting (following).

Timing (Using Synchroscope)—Tool C-374. Clip lead to #1 spark plug, direct light on impulse neutralizer (correct mark filled in with paint or chalk), idle engine and adjust distributor as directed above).

Manual Adjustment—Initial ignition setting listed above should be varied not more than 4° (.007") retard or advance so that slight ping noticeable between 10 and 30 MPH when accelerating with wide open throttle for best performance. To adjust, loosen lock plate hold-down screw, rotate distributor counter-clockwise (if no ping noted), clockwise to retard (if ping too severe) not more than 4°. Scale graduated in engine degrees.

Firing Order:—1-6-2-5-8-3-7-4. See diagram.

Spark Plugs:—Auto-Lite Type A-7B (cast-iron hd.). AL-7A (aluminum heads). 14 MM Metric.

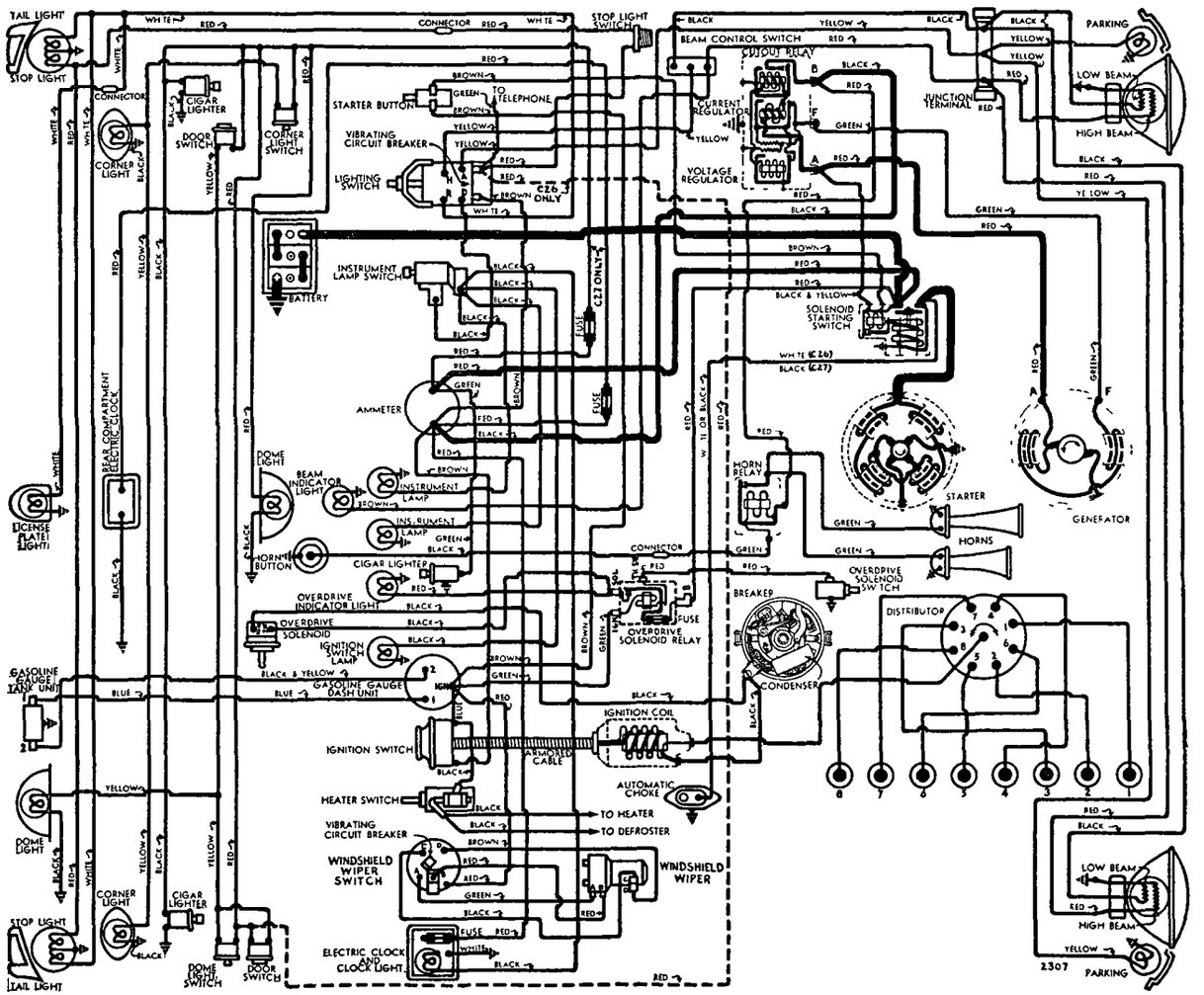
Spark Plug Gaps—Set at .025".

CARBURETION:—**Carburetor**—Stromberg Model AAV-2. No. A-18792. Aircraft, duplex, 1¼" downdraft type.

See article in Carburetor Section for complete data.

Idle Adjustment—With engine warm and running at slow idle speed (choke valve wide open, fast idle inoperative), set throttle stopscrew for 6 MPH idle speed. Adjust idle adjusting screw for each barrel equally until engine fires smoothly (turn screws in for leaner mixture). Readjust idle speed. NOTE—Car manufacturer recommends use of vacuum gauge. Set idle adjusting screw for highest reading on gauge.

Accelerating Pump Setting—Throttle lever has two holes for pump link engagement. Set as follows:
Inner Hole (short stroke)—Extreme hot weather.
Outer Hole (long stroke)—Winter temperatures.



Float Level—Fuel level 5/8" below top edge of bowl.
Fast Idle Setting—Adjust choke connector link length so that choke valve opening is 1/8" with fast idle screw (throttle stopscrew) against first step of fast idle cam.

Automatic Choke:—Sisson Type AC-600.
See article in Carburetion Equipment Section.

Throttle Guard (Cars with Fluid Drive):—Vacuum operated throttle kicker to prevent engine stalling when accelerator pedal released quickly.
See article in Carburetion Equipment Section.

Air Cleaner:—AC #1528334 oil-wetted type standard.

Fuel Pump:—AC Type AW #1523869 diaphragm type.
See article in Carburetion Equipment Section.

Gasoline Gauge:—Auto-Lite electric. No. NG-9356D (dash unit), No. NG-9330T (tank unit).
See article in Carburetion Equipment Section.

MANIFOLD HEAT CONTROL:—Thermostatic coil type. See that shaft and valve rotate freely. When installing coil, wind up free end 1 turn counter-clockwise and hook end over stop stud.

VALVE TIMING:—To Check—With .011" (cold) tappet clearance #8 intake valve should open with #8 piston 6° or .0170" BTDC with 8th graduation before DC mark on impulse neutralizer aligned with pointer on chain cover. Reset tappet cl. at .008" (hot).

Tappet Clearance:—.008" Int., .010" Exh. (hot & idling). .002" add'tl exh. clearance desireable for high speeds. NOTE—Tappet screws self-locking (no locknuts). Remove right front wheel, lower housing panel and fuel pump shield for access to valves.

Valve Spring Pressure:—52-58 lbs. at 2 1/32" (valve closed). 129-137 lbs. at 1 21/32" (valve open).

LUBRICATION:—Crankcase Capacity—6 qts. (refill).
Normal Oil Pressure—30-45 lbs. @ 30 MPH, 15 idling.

COOLING SYSTEM:—**Capacity**—24 quarts.
Thermostat—Bishop & Babcock or Fulton. In outlet on head. Starts to open 157-162°. Fully open 183°
Temperature Gauge—Motometer (Auto-Lite) Vapor tension type. A-L Part No. H-9355.
See article in Mechanical Equipment Section for data.

TRANSMISSION OVERDRIVE CONTROL:—Electric type with accelerator pedal 'kick-down' switch. Standard on C27, Optl. on C26 (except Traveler).
See article in Mechanical Equipment Section for data.
Overdrive Solenoid—Auto-Lite SSB-4001.
Throttle Switch Setting—3/32" gap between switch plunger & contact screw (throttle just wide open).
Control Relay—Auto-Lite HR-4201. Use only 20 ampere fuse on relay (on left side of engine dash).
Overdrive Indicator Light—In upper right corner speedometer dial. Lights when 'kick-down' direct drive operating.

BATTERY:—Willard Type MW-2-135. 6 volt, 17 plate, 135 ampere hour capacity (20 hour rate).
Starting Capacity—171 amperes for 20 minutes.
Zero Capacity—300 amperes for 5.9 minutes. Five second voltage—4.5 volts.
Grounded Terminal—Positive (+) grounded to the transmission case.
Dimensions—Lgth. 10 5/16". Wid. 6 13/16". Hgt. 9".
Location—On left side under front seat.

STARTER:—Auto-Lite MAX-4037 (C26), MAX-4020A (C27, C26 Fluid Drive). Armature MAW-2030 (all).
Drive—Overrunning clutch (solenoid pinion shift).
Cranking Engine—Approx. 160-170 amps. 5 volts.
Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—42-53 ozs. (new brushes).

Performance Data

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	5300	5.5	65
.65 " "	3300	5.5	100
2.75 " "	1630	5.0	200
5.5 " "	970	4.5	300
8.7 " "	600	4.0	400
12.0 " "	300	3.5	500
16.5 " "	Lock	3.	640
25.0 " "	Lock	4.	880

Removal:—Flange mounted on left front face of flywheel housing. Disconnect wire connections (tape battery lead) and oil filter lines. Remove two fastening bolts and withdraw unit.
Starting Switch:—Solenoid Pinion Shift type SS-4206. Controlled through relay by pushbutton on instrument panel. *See article in Electrical Equip. Section.*

GENERATOR:—Models GDZ-4801A (Std.), GEB-4801A (Police). Armature No. GDZ-2006F (GDZ-4801A) GEB-2006F (GEB-4801A). Two brush type with current-voltage control. Air cooled.
Charging Rate Adjustment—No adjustment at generator. Charging rate controlled by Voltage Regulator and maximum output by Current Regulator.
See Regulator data following.
Maximum Charging Rate—35 amperes (Std.), 32 amperes (Police), 8.0 volts, 2200 gen. RPM (Std.), 1400 (Police), approx. 24 MPH (Std.) and above with load or discharged battery (Current Regulator setting). Actual charging rate controlled by Voltage Regulator and dependent on battery condition.

Performance Data—GDZ-4801A

Cold			Hot		
Amperes	Volts	R.P.M.	Amperes	Volts	R.P.M.
0	6.4	925	0	6.4	1000
4	6.6	1035	4	6.6	1120
8	6.75	1140	8	6.75	1235
12	6.95	1250	12	6.95	1350
16	7.15	1370	16	7.15	1460
20	7.3	1480	20	7.3	1590
24	7.5	1590	24	7.5	1730
28	7.7	1710	28	7.7	1900
32	7.9	1820	32	7.9	2090
*35	8.0	1900	35	8.0	2250

Performance Data—GEB-4801A

0	6.4	560	0	6.4	600
4	6.6	630	4	6.6	675
8	6.8	700	8	6.8	750
12	7.0	775	12	7.0	840
16	7.2	845	16	7.2	930
20	7.4	920	20	7.4	1030
24	7.6	1000	24	7.6	1140
28	7.8	1075	28	7.8	1260
*32	8.0	1150	32	8.0	1400

*—Current regulator setting.
Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—53 ozs. max. (new brushes).
Field Current—1.60-1.78 amperes at 6 volts (GDZ).
Motoring Current—4.16-4.60 amperes at 6 v. (GDZ).
Removal:—Pivot mounted at left side of engine at front. To remove, take out pivot and clamp bolts.
Belt Adjustment:—Loosen clamp and pivot bolts, swing generator out until scale (attached to field frame) reads 40-50 lbs., tighten bolts.

REGULATOR:—Model VRP-4001A (Std.), B (Police). Current-Voltage type. In single case on dash.
See article in Electrical Equipment Section for data.
NOTE—Regulator case cover is sealed. Serviced on exchange basis if seals not broken.

Cutout Relay
Cuts In—6.4-6.6 volts at approximately 1000 generator RPM (Std.), approx. 600 gen. RPM (Police).
Cuts Out—4.8-5.6 volts (approx. 7-8 amps. disch.).
Contact Gap—.015" minimum.
Air Gap—.034" min., .038" max. with contacts open. Measure at hinge end of core.

Voltage Regulator
Setting—7.3-7.6 volts at 70° F.
To Check (without breaking seals)—Connect ammeter in charging line at regulator 'B' terminal, voltmeter between 'B' terminal and ground. Operate generator at speed equivalent to 30 MPH charging battery until voltage is steady. Voltage reading should be 7.3-7.6 volts (room temperature), 7.1-7.4 volts (hot operating conditions).
To Adjust (with cover removed)—Change regulator armature spring tension by bending lower spring hanger slightly. See Electrical Equipment Section.
Contact Gap—.012" Min. (armature against stop pin).
Air Gap—.048-.052" with contacts just opening.

Current Regulator
Setting—Std: 34-36 amperes (marked '35' on cover), Police: 31-33 amperes (marked '32' on cover).
To Check (without breaking seals)—Connect test meters as for Voltage check (above). Operate generator at speed equivalent to 30 MPH charging battery, turn on car lights and accessories so that generator charges at peak rate and Current Regulator operates. Charging current should not exceed 34-36 amperes (Std.), 31-33 amperes (Police). If more than slight excess noted, regulator is defective.
Adjustment & Contact Gap—Same as for Voltage Regulator (above).
Air Gap—.034-.038" with contacts just opening.

LIGHTING:—Headlamps—Corcoran-Brown 'Sealed Beam' type. *See article in Electrical Equipment Section.*
Headlamp Adjustment—Aim upper beam for each lamp straight ahead with center of hot spot 3" below lamp center height.
Beam Indicator—Red light in upper left corner of speedometer dial. Lighted when upper beam on.

Switches
Lighting—Chrysler No. 854794, 857380 Optl.
Beam Selector—Chrysler No. 859974.
Instrument—Chrysler No. 853371.
Stop Light—Chrysler No. 677112 hydraulic type.

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps		Sealed Beam
Parking Instrument	1½	55
Beam Indicator, Ign. Sw.	1	51
Overdrive Indicator	1	51
Stop and Tail	21-3	1158
Rear License	3	63
Dome or Reading	15	87

LIGHTING CIRCUIT BREAKER:—Vibrating, thermostatic type. Mounted on lighting switch.

FUSES:—Clock—2 ampere. In connector behind clock.
Rear Clock (C27 only)—2 ampere. In connector near back of ammeter.
Body Wiring (C27 only)—30 ampere. In connector back of ammeter.
Transmission Overdrive Control—20 amp. On relay.
Radio—14 amp. In feed wire behind instr. panel.
Horns & Windshield Wiper—No fuse used.

HORNS:—Auto-Lite HC-5107, HO-5001 Horn Set. HL-4001 (low pitch), HL-4002 (high pitch), dual horns.
Current Draw—Approx. 35-40 amperes.
Horn Relay:—Auto-Lite Model HRC-4001 (no fuse).
Contacts Close—1.5-3.0 volts. **Open**—.5 volt.
Contact Gap—.026". **Air Gap**—.016-.020" (closed).

WINDSHIELD WIPER:—Auto-Lite Model EBW-4001. Electric type with circuit-breaker on back of switch.
See article in Mechanical Equipment Section for data.
Circuit Breaker—Vibrating, thermostatic type. Starts to operate with current of 12 amperes.

ENGINE NOTE:—Engine is two cylinder, horizontally opposed type with connecting rods on individual crankpins so that both pistons move in and out together. Cylinders fire alternately at 360° intervals (one complete revolution between firing points).

SERIAL NUMBER:—First number 390-10000. Stamped on front face of cowl below battery shelf (in engine compartment).

ENGINE NUMBER:—First number C-10000. Stamped on top center of engine block at rear of carburetor.

COMPRESSION:—**Ratio**—5.5-1. **Pressure**—90 lbs. at cranking speed.

VACUUM READING:—No means of connecting gauge.

IGNITION:—**Coil Model IG-4065.** Mounted on battery shelf between battery and gasoline tank. Service Coil IG-4070.

Ignition Current—2 amperes idling, 5 stopped.

Ignition Switch:—Douglas No. 2980.

Distributor Model IGW-4142-A. Single breaker, two lobe cam, full automatic advance type.

Breaker Gap—.020".

Rotation—Clockwise viewed from the top.

Cam Angle or Dwell—46° closed, 134° open.

Breaker Arm Spring Tension—17-20 ozs.

Condenser—No. IGB-1025. Capacity .20-.25 mfds.

Automatic Advance

Distributor		Engine	
Degrees	R.P.M.	Degrees	R.P.M.
Start	300	0	600
3	480	6	960
6	650	12	1300
10	1475	20	2950
14	2300	28	2600

Removal:—Distributor mounted on top of engine on left side. To remove, take out hold-down screw in advance arm, lift distributor out.

IGNITION TIMING:—Standard setting below correct for fuel of 70 Octane Rating. See Final Adjustment (following) for correction dependent on fuel used.

	Flywheel Degrees	Piston Position
All Engines	0° At TDC	.000" TDC

To Set Timing—Turn engine over until piston reaches top dead center when half-round notch in rim of flywheel lines up with small rib cast on top center of crankcase. Loosen advance arm clamp screw, rotate distributor until contacts just begin to open, tighten clamp screw. See that distributor cap terminal which is in line with rotor is connected to spark plug in cylinder entering power stroke (flywheel mark will be at indicator at firing point for each cylinder on alternate revolutions of the crankshaft).

Final Adjustment—If Ethyl fuel, or fuel of better than 70 Octane Rating used, loosen advance arm clampscrew and rotate distributor so as to advance timing until slight 'ping' secured when engine pulling under load.

Firing Order:—1-2 (cylinders fire alternately at intervals of 360° or one complete revolution of the crankshaft).

Spark Plugs:—Auto-Lite Type A5. 14MM. Metric.

Spark Plug Gaps—.025".

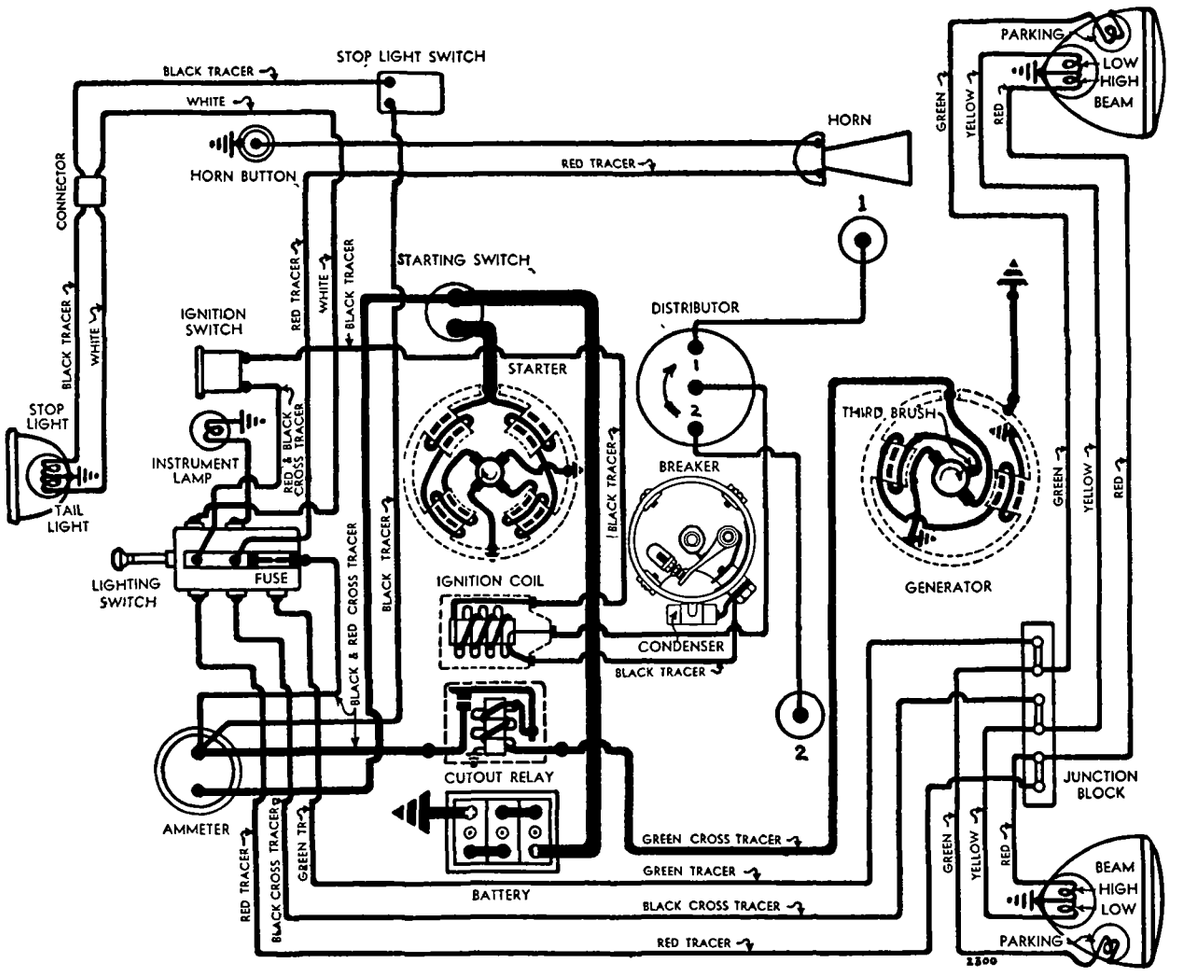
CARBURETION:—**Carburetor**—Tillotson Model DY-1A. 1", plain tube, single barrel downdraft type with low and high speed adjustments.

See article in Carburetor Section for data.

ADJUSTMENT NOTE—If carburetor out of adjustment so that engine can not be warmed up, make preliminary adjustment as given below, then run engine until warm before making adjustments.

Preliminary Adjustment—Turn main (high speed) adjusting screw in or clockwise lightly until it is seated, then back adjusting screw out exactly two full turns. Turn idle (low speed) adjusting screw in or clockwise lightly until seated, then back adjusting screw out exactly one full turn. Start engine and run until thoroughly warm, then adjust as follows:

High Speed (Main) Adjustment—Open throttle so that engine runs at speed of 30-35 M.P.H. Turn main adjusting screw in or clockwise slowly (¼ turn at a time) until engine slows down due to lack of fuel, then turn adjusting screw out very slowly (⅛ turn at a time) until maximum speed is secured. Correct setting is approximately 1½-1¾ turns of the screw from the inner seated position.



Low Speed (Idle) Adjustment—Close throttle, set throttle lever stopscrew so that engine idles faster than normal. Turn idle adjusting screw in or clockwise slowly until engine begins to miss, then turn screw out until engine fires smoothly. Open throttle momentarily to clear manifold, recheck idle adjustment. Correct setting is approximately ¾-1¼ turns of the screw from the inner seated position. Adjust throttle lever stopscrew for high gear idling speed of 7 M.P.H.

Air Cleaner:—Oil-wetted type.

Fuel Pump:—None used (gravity feed).

MANIFOLD HEAT CONTROL:—No adjustment.

VALVE TIMING:—**To Check Timing**—Intake valve should open when point on flywheel 5.5 teeth before TDC mark (half-round notch in flywheel rim) lines up with small rib cast on top center of crankcase. Exhaust closing point is 5.5 teeth past TDC mark.

Tappet Clearance:—.006-.0065" Intake, .007-.0075" Exhaust (Cold). No adjustment.

Valve Spring Pressure:—20 lbs. at 1½" (closed), 41 lbs. at 1 15/64" (open). Free length 1 27/32".

LUBRICATION:—**Crankcase Capacity**—2 qts.
Normal Oil Pressure—30-45 lbs. (warm oil).

COOLING SYSTEM:—Air-cooled by suction fan built in flywheel. Fan capacity 700 cu. ft. per minute at 3600 R.P.M.

BATTERY:—**Auto-Lite Model AB-13L.** 6 volt, 13 plate, 80 ampere hour capacity (20 hour rate).
Starting Capacity—96 amperes for 20 minutes.
Zero Capacity—300 amperes for 2.0 minutes.
Grounded Terminal—Positive (+) terminal grounded to right hand side of cowl. **Engine Ground**—Strap between engine and frame cross-member at front engine mounting on right hand side.
Location—On shelf on front of cowl in engine compartment on right hand side.
Dimensions—Length 9". Width 7". Height 8⅝".

STARTER:—**Model MZ-4077. Armature No. MZ-2085.**
Drive—Compression Type Bendix No. RCBX11-10.
Rotation—Clockwise at commutator end.
Brush Spring Tension—42-53 ozs. (new brushes).

Performance Data

Torque		R.P.M.	Volts	Amperes
0	ft. lbs.	4300	5.5	70
.65	"	2500	5.5	100
2.55	"	1325	5.0	200
4.95	"	750	4.5	300
7.65	"	220	4.0	400
7.80	"	Lock	3.0	420
11.80	"	Lock	4.0	560

Removal:—Starter cradle mounted on top of flywheel housing. To remove, take out starting motor top plate (in driver's compartment), disconnect cable, take out two bolts in starter clamp band, lift starter out.

Starting Switch:—Model SW-4001. Manual 'type mounted on toeboard.

GENERATOR:—**Model GBM-4619-5. Armature GBM-2066.** Third brush control type. No ventilation.
Charging Rate Adjustment—Remove commutator cover band, shift third brush by hand clockwise to increase, or counter-clockwise to decrease, charging rate. Brush held in position by friction.
Maximum Charging Rate—12 amperes, 8.0 volts.

Performance Data

Cold			Hot		
Amperes	Volts.	R.P.M'	Amperes	Volts	R.P.M.
0	6.4	850	0	6.4	900
2	6.6	960	2	6.65	1040
4	6.75	1030	4	6.9	1180
6	7.05	1160	6	7.2	1330
8	7.25	1265	8	7.4	1500
10	7.45	1380	10	7.7	1720
12	7.7	1510	12	7.9	2080
14	7.9	1740	12.45	8.0	2400
15	8.0	2300			

Rotation—Clockwise at commutator end.
Brush Spring Tension—50-60 ozs.
Field Current—3.8-4.2 amperes at 6.0 volts.
Motoring Current—5.3-5.9 amperes at 6.0 volts.

Removal:—Generator flange mounted on timing gear cover and driven directly from front end of crankshaft. To remove, disconnect lead, take out two flange mounting capscrews, remove generator from below.

CUTOUT RELAY:—**Model CB-4025.** Mounted on shelf on front of cowl between battery and gasoline tank. *See article in Electrical Equipment Section for data.*
Cuts In—6.5-7.25 volts.
Cuts Out—.5-2.5 ampere discharge current (after charging at 15 amperes).
Contact Gap—.015-.045".
Air Gap—.010-.030" with contacts closed.

LIGHTING:—**Headlamps**—Moto-lamp type with upper and lower beams controlled by lighting switch.
Headlamp Adjustment—Aim each headlamp so that hot spot centered on vertical line directly ahead of each lamp center and upper edge of hot spot on horizontal line at lamp center height.

Switches

Lighting—Douglas No. 5731.

Bulb Specfications

Position	Candlepower	Mazda No.
Headlights	32-21	2320C
Parking, Instrument	1.5	55
Stop & Tail	21-3	1158

FUSES:—**Lighting**—10 ampere. On switch.

HORN:—**Sparton.** Disc type vibrator horn.
Current—5 amperes.

SERIAL NUMBER:—On right front door hinge post, First number: Detroit—5,688,001 (Custom), 6,064,301 (Deluxe), 5,096,701 (Taxi). Canada—9,393,281.

ENGINE NUMBER:—First number S7-1001. Stamped on left side of block between #1 and #2 cylinders.

COMPRESSION:—Ratio and pressure as follows:

Ratio	Pressure at 1000 RPM	At 100 RPM
6.5-1 cast-iron hd.	145-155 lbs.	Approx. 115 lbs.
*7.0-1 aluminum hd.	150-160 lbs.	Approx. 120 lbs.

NOTE—7.0-1 Head Std. on 7 Pass. Sedans.

IGNITION:—**Coil Model IG-4661.** Service winding (less switch and cable) IG-3224JS. Mounted on dash.
Ignition Current—2.25 amperes idling, 5.5 stopped.

Ignition Switch:—Mitchellock Model 24-R, No. 8197.
Ignition Lock—Yale & Towne or Briggs & Stratton. B&S No. 80651. Key Series 1BP to 1000BP. Groove #24.

Distributor Model IGS-4108-1. Single breaker, 6 lobe cam, full automatic advance type with auxiliary vacuum spark control and manual (octane selector) adjustment.
Breaker Plate Identification—Maximum vacuum advance limited by slot and marked with number (#7) stamped on plate.
Breaker Gap—Set at .020". Limits .018-.022".
Cam Angle or Dwell—38° closed, 22° open (distr.).
Breaker Arm Spring Tension—17-20 ounces.
Rotation—Clockwise viewed from the top.
Condenser—No. IG-3927A. Capacity .25-.28 mfd.

Automatic Advance

Distributor Degrees	Distributor R.P.M.	Engine Degrees	Engine R.P.M.
Start	350	0	700
3	400	6	800
6	850	12	1700
9	1300	18	2600
12	1750	24	3500

Vacuum Spark Control—Integral type (on distributor, linked directly to breaker plate). Provides additional advance at speeds above idling except when engine accelerated or operated with wide open throttle (spark retarded by return spring in unit).

Vacuum Advance

Distr. Degrees	Eng. Degrees	Vacuum (" of HG)
Start	0°	5"
1°	2°	6½"
3°	6°	9¼"
5°	10°	12⅛"
7°	14°	15"

Manual Adjustment—At distributor. Provides 10° advance or retard from center '0' position. See Ignition Timing for adjustment.

Distributor Removal:—Mounted on left side of crankcase To remove, disconnect vacuum line, take out hold-down screw in lock plate.

IGNITION TIMING:—Initial setting (correct for fuel of 70 octane rating at low altitudes for both cast-iron and aluminum heads) shown below. See Manual adjustment (following) for correction (not to exceed 4° either way) dependent on fuel regularly used and operating conditions.

	Flywheel Degrees	Piston Position
6.5-1 cast-iron hd.	2° BTDC.	.002" BTDC.
7.0-1 aluminum hd.	2° ATDC.	.002" ATDC.

NOTE—Impulse neutralizer marked 'DC' at TDC point with 15 (1°) graduations on either side.
Timing (Using Timing Light)—Connect timing light between distributor and battery terminal on the generator regulator. With #6 piston on compression, turn engine over until piston reaches firing position (see Initial Setting above), stop when correct mark on impulse neutralizer lines up with pointer on chain case cover. Loosen lock-plate hold-down screw, center pointer on scale, tighten screw. Loosen lock-plate clamp bolt, rotate distributor until timing light just goes out, tighten clamp bolt. Check Manual Adjustment as directed below.

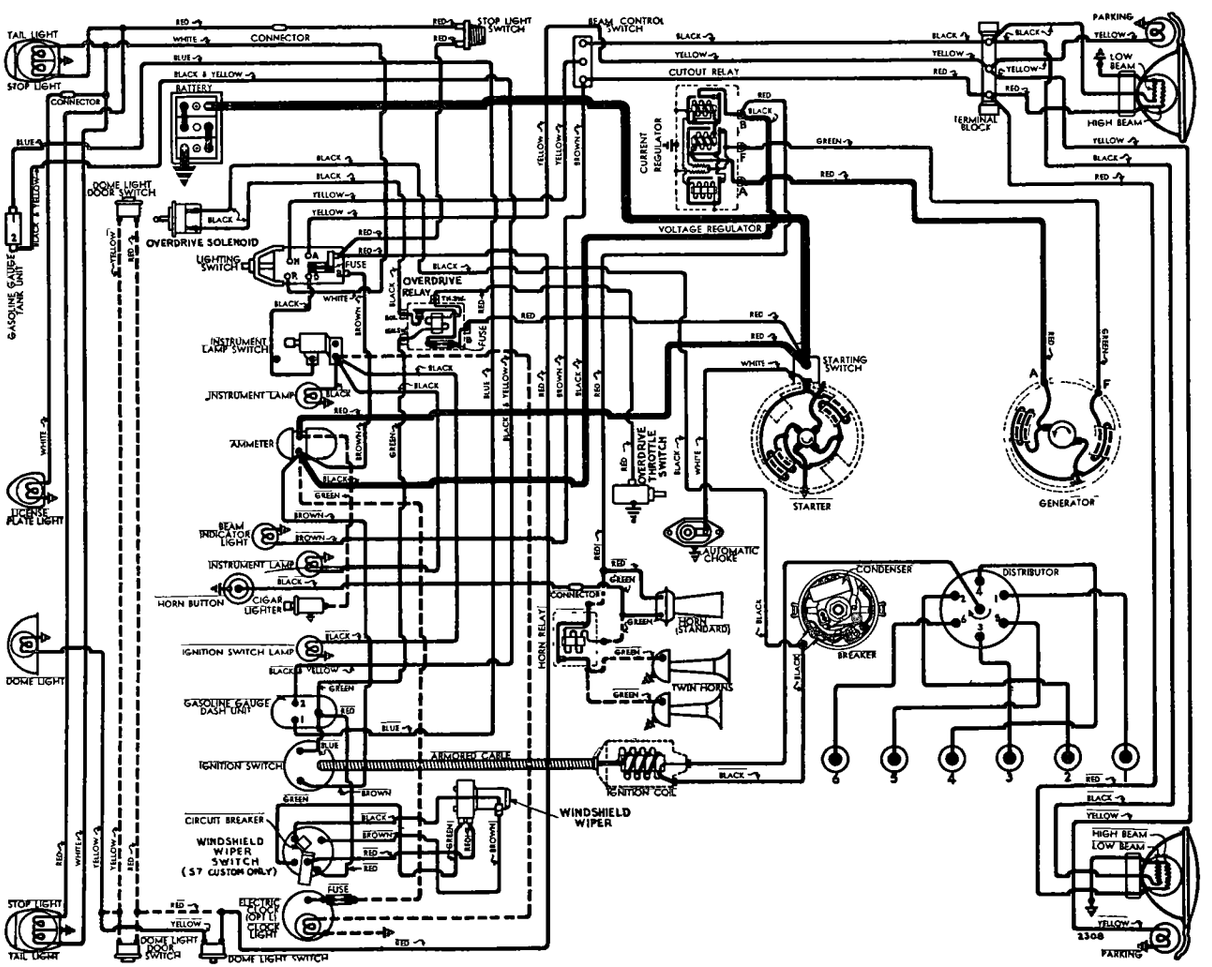
Timing (Using Synchroscope)—Tool C-374. Clip lead to #1 spark plug, direct light on impulse neutralizer (fill in correct mark on impulse neutralizer with chalk or paint), idle engine and adjust distributor as directed above.

Manual Adjustment—Standard ignition setting should be varied not more than 4° (cast-iron head —6° or .015" BTDC to 2° or .002" ATDC. Aluminum head—2° or .002" BTDC to 6° or .015" ATDC) so that slight ping noticeable between 10 and 30 M.P.H. when accelerating with wide open throttle for best performance. To adjust, loosen hold-down screw, rotate distributor counter-clockwise to advance spark (if no ping noted), clockwise to retard spark (if ping too severe) not more than 4°. Scale graduated in engine degrees.

Firing Order:—1-5-3-6-2-4. See diagram.

Spark Plugs:—Auto-Lite Type A-7B (cast-iron head), Type AL-7A (aluminum head). 14 MM Metric type.
Spark Plug Gaps—Set at .025".

CARBURETION:—**Carburetor**—Carter (Ball & Ball) Model E6N2 (early cars), E6N3 (later cars). 1½" single barrel, downdraft type.
See article in Carburetor Section for complete data.
NOTE—Carburetor jets changed (new metering jet used on E6N3). ***See Carter (B&B) carburetor article and Jet Table in Carburetor Section for complete data.***
Idle Adjustment—With engine warm and running at slow idle speed (choke valve wide open, fast idle inoperative), set throttle stopscrew for 6 MPH idle speed. Adjust idle adjusting screw until engine fires smoothly (½-1¼ turns open—turn screw in for leaner mixture). Readjust idle speed. NOTE—Car manufacturer recommends use of vacuum gauge. Idle screw should be set to give highest reading on gauge.



Accelerating Pump Setting—Pump lever has three holes for pump link engagement. Set as follows: Inner Hole (min. stroke)—Extreme hot temperatures or altitudes above 3000 feet.
Center Hole (med. stroke)—Normal setting.
Outer Hole (max stroke)—Winter temperatures.
NOTE—If lean metering jets (High Alt calibration) used at lower altitudes for increased economy, reduced speed and power will result (not recommended by manufacturer). See Carter (B&B) Jet Table in Carburetor Section for complete jet data
Float Level—5/64" from top of float (not soldered seam) to top edge of float bowl.

Fast Idle:—Not adjustable (built-in type).

Automatic Choke:—Sisson Type AC-758B.
See article in Carburetion Equipment Section.

Air Cleaner:—AC #1529041 oil-wetted type standard.

Fuel Pump:—AC Type AT #1523912 diaphragm type Type AS #1523913 combination fuel-and-vacuum pump used on cars with swinging windshield.
See articles in Carburetion Equipment Section.

Gasoline Gauge:—Auto-Lite electric. No. NG-9349-D (dash unit), No NG-9329T (tank unit).
See article in Carburetion Equipment Section.

MANIFOLD HEAT CONTROL:—Thermostatic coil type See that shaft and valve rotate freely. When installing coil, wind up free end ½ turn counterclockwise and hook end over stop stud
CAUTION—Do not wind coil up more than ½ turn

VALVE TIMING:—To Check—With .014" (cold) tappet clearance #6 intake valve should open with #6 piston 12° or 063" BTDC with 12th graduation before DC mark on impulse neutralizer aligned with pointer on chain case cover. Reset tappet clearance at .008" (hot).

Tappet Clearance:— 008" Int, 010" Exh (hot & idling). 002" add'tl exh clearance desirable for sustained high speeds NOTE—Tappet screws self-locking (no locknuts). Remove right front wheel, lower housing panel and fuel pump shield for access to valves.

Valve Spring Pressure:—40-45 lbs at 1¾" (valve closed). 107-115 lbs. at 1⅜" (valve open).

LUBRICATION:—Crankcase Capacity—5 qts (refill).
Normal Oil Pressure—30-45 lbs at 30 MPH, 15 idling

COOLING SYSTEM:—Capacity—17 quarts.
Thermostat—Bishop & Babcock or Fulton In outlet on head Starts to open 157-162° Fully open 183°
Temperature Gauge—Motometer (Auto-Lite) Vapor tension type. A-L Part No H-9348.
See article in Mechanical Equipment Section for data.

TRANSMISSION OVERDRIVE CONTROL:—Electric type with accelerator pedal 'kick-down' switch Optl.
See article in Mechanical Equipment Section for data.
Overdrive Solenoid—Auto-Lite SSB-4001
Throttle Switch Setting—3/32" gap between switch plunger & contact screw (throttle just wide open).
Control Relay—Auto-Lite HR-4201 Use only 20 ampere fuse on relay (on left side of engine dash).

BATTERY:—Willard Type SW-2-105. 6 volt, 15 plate, 105 ampere hour capacity (20 hour rate)
Starting Capacity—133 amperes for 20 minutes
Zero Capacity—300 amperes for 3 9 minutes. Five second voltage—4 3 volts
Grounded Terminal—Positive (+) grounded to transmission.
Dimensions—Length 10¼". Width 7". Height 9".
Location—On left side under front seat.

STARTER:—Model MAW-4016. Armature MAW-2030.
Drive—Overrunning clutch, manual pinion shift.
Rotation—Counter-clockwise at commutator end.
Cranking Engine—150-175 amperes, 5.1 volts.
Brush Spring Tension—42-53 ozs (new brushes).

Performance Data

Torque	R P M.	Volts	Amperes
0 ft. lbs.	4900	5 5	65
60 " "	3300	5 5	100
2 75 " "	1480	5 0	200
5 45 " "	820	4 5	300
8 50 " "	400	4 0	400
11 55 " "	110	3 5	500
11 5 " "	Lock	3 0	505
18 0 " "	Lock	4 0	670

Removal:—Flange mounted on left front face of flywheel housing, Remove cables, 2 clips on starter linkage, oil filter lines, 2 mounting bolts Lift off.
Starting Switch:—Model SW-2813 On starter Manually operated by starter (pinion shift) pedal.

GENERATOR:—Models GDZ-4801A (Std.), GEB-4801A (Police). Armature No. GDZ-2006F (GDZ-4801A) GEB-2006F (GEB-4801A). Two brush type with current-voltage control Air cooled.
Charging Rate Adjustment—No adjustment at generator. Charging rate controlled by Voltage Regulator and maximum output by Current Regulator.
See Regulator data following.
Maximum Charging Rate—35 amperes (Std), 32 amperes (Police), 8 0 volts, 2200 gen RPM (Std), 1400 (Police), approx 24 MPH (Std) and above with load or discharged battery (Current Regulator setting). Actual charging rate controlled by Voltage Regulator and dependent on battery condition.

Performance Data—GDZ-4801A

Cold			Hot		
Amperes	Volts	R P M.	Amperes	Volts	R P M
0	6 4	925	0	6 4	1000
4	6 6	1035	4	6 6	1120
8	6 75	1140	8	6 75	1235
12	6 95	1250	12	6 95	1350
16	7 15	1370	16	7 15	1460
20	7 3	1480	20	7 3	1590
24	7 5	1590	24	7 5	1730
28	7 7	1710	28	7 7	1900
32	7 9	1820	32	7 9	2090
*35	8 0	1900	35	8 0	2250

Performance Data—GEB-4801A

0	6 4	560	0	6 4	600
4	6 6	630	4	6 6	675
8	6 8	700	8	6 8	750
12	7 0	775	12	7 0	840
16	7 2	845	16	7 2	930
20	7 4	920	20	7 4	1030
24	7 6	1000	24	7 6	1140
28	7 8	1075	28	7 8	1260
*32	8 0	1150	32	8 0	1400

*—Current regulator setting.

Rotation—Counter-clockwise at commutator end
Brush Spring Tension—53 ozs max (new brushes)
Field Current—1 60-1 78 amperes at 6 volts (GDZ).
Motoring Current—4 16-4 60 amperes at 6 v (GDZ).
Removal:—Pivot mounted at left side of engine at front To remove, take out pivot and clamp bolts.
Belt Adjustment:—Loosen clamp and pivot bolts, swing generator out until scale (attached to field frame) reads 40-50 lbs , tighten bolts

REGULATOR:—Model VRP-4001A (Std.), B (Police).
Current-Voltage type. In single case on dash
See article in Electrical Equipment Section for data.
NOTE—Regulator case cover is sealed Serviced on exchange basis if seals not broken.

Cutout Relay
Cuts In—6 4-6 6 volts at approximately 1000 generator RPM (Std), approx. 600 gen RPM (Police).
Cuts Out—4 8-5 6 volts (approx 7-8 amps disch).
Contact Gap— 015" minimum.
Air Gap— 034" min , 038" max with contacts open. Measure at hinge end of core.

Voltage Regulator
Setting—7 3-7 6 volts at 70° F.
To Check (without breaking seals)—Connect ammeter in charging line at regulator 'B' terminal, voltmeter between 'B' terminal and ground Operate generator at speed equivalent to 30 MPH charging battery until voltage is steady Voltage reading should be 7 3-7 6 volts (room temperature), 7 1-7.4 volts (hot operating conditions).
To Adjust (with cover removed)—Change regulator armature spring tension by bending lower spring hanger slightly See Electrical Equipment Section
Contact Gap— 012" Min (armature against stop pin).
Air Gap— 048- 052" with contacts just opening

Current Regulator
Setting—Std 34-36 amperes (marked '35' on cover), Police 31-33 amperes (marked '32' on cover)
To Check (without breaking seals)—Connect test meters as for Voltage check (above) Operate generator at speed equivalent to 30 MPH charging battery, turn on car lights and accessories so that generator charges at peak rate and Current Regulator operates Charging current should not exceed 34-36 amperes (Std), 31-33 amperes (Police). If more than slight excess noted, regulator is defective
Adjustment & Contact Gap—Same as for Voltage Regulator (above)
Air Gap— 034- 038" with contacts just opening.

LIGHTING:—Headlamps—Hall 'Sealed Beam' type
See article in Electrical Equipment Section for data.
Headlamp Adjustment—Aim upper beam for each lamp straight ahead with center of hot spot 3" below lamp center height
Beam Indicator—Red light on panel above instrument cluster Lighted with upper beam on.

Switches
Lighting—Chrysler No 854756, 854757 Optl.
Beam Selector—Chrysler No 859974.
Instrument—Chrysler No 853371
Stop Light—Chrysler No 677112

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps		Sealed Beam
Parking, Instrument	1½	55
Beam Indicator, Ign Sw	1	51
Stop and Tail	21-3	1158
Rear License	3	63
Dome or Reading	15	87

FUSES:—Lighting—30 amp. On back of light switch
Clock—2 ampere In connector behind clock
Transmission Overdrive Control—20 amp On relay
Horns & Windshield Wiper—No fuse used
Radio—14 amp In feed wire behind instr panel.
HORNS:—Single—Delco-Remy No 1999911 standard
Dual—Auto-Lite HO-5001 horn set HL-4001 (low pitch), HL-4002 (high pitch) operated by horn relay
Current Draw—Approx 7 amps single, 35-40 dual
Horn Relay:—Auto-Lite Model HRC-4001 (no fuse)
Contacts Close—1 5-3 0 volts **Open**— 5 volt
Contact Gap— 026" **Air Gap**— 016- 020" (closed)
WINDSHIELD WIPER:—Auto-Lite Model EBW-4001 (S7 Custom cars only). Electric type with circuit-breaker on back of switch
See article in Mechanical Equipment Section for data.
Circuit Breaker—Vibrating, thermostatic type Starts to operate with current of 12 amperes

SERIAL NUMBER:—On right front door hinge post.

	Detroit	Canada
D14 Deluxe	30,216,001	9,420,231
D17 Special	4,349,001	9,494,721

ENGINE NUMBER:—First number D14-1001. Stamped on left side of block between #1 and #2 cylinders.

COMPRESSION:—Ratio and pressure as follows:

Ratio	Pressure at 1000 RPM	At 100 RPM
6.5-1 cast-iron hd.	140-150 lbs.	Approx. 113 lbs.
7.0-1 aluminum hd.	150-160 lbs.	Approx. 120 lbs.

IGNITION:—**Coil Model IG-4661.** Service winding (less switch and cable) IG-3224JS. Mounted on dash.
Ignition Current—2.25 amperes idling, 5.5 stopped.
Ignition Switch:—Mitchellock Model 24-R, No. 8197.
Ignition Lock—Yale & Towne or Briggs & Stratton. B&S No. 80651. Key Series 1BP to 1000BP. Groove #24.
Distributor IGS-4107-1, IGS-4108B-1 (D14 Canada). Single breaker, 6 lobe cam, full automatic advance type with auxiliary vacuum spark control and manual (octane selector) adjustment.
Breaker Plate Identification—Maximum vacuum advance limited by slot and marked with number (#8—IGS-4107-1, #10—IGS-4108B-1) stamped on plate.
Breaker Gap—Set at .020". Limits .018-.022".
Cam Angle or Dwell—38° closed, 22° open (distr.).
Breaker Arm Spring Tension—17-20 ounces.
Rotation—Clockwise viewed from the top.
Condenser—No. IG-3927A. Capacity .25-.28 mfd.

Automatic Advance

Distributor Degrees	R.P.M.	Engine Degrees	R.P.M.
Start	350	0	700
3	400	6	800
6	850	12	1700
9	1300	18	2600
12	1750	24	3500

Vacuum Spark Control—Integral type (on distributor, linked directly to breaker plate). Provides additional advance at speeds above idling except when engine accelerated or operated with wide open throttle (spark retarded by return spring in unit).

Vacuum Advance—IGS-4107-1

Distr. Degrees	Eng. Degrees	Vacuum (" of HG)
Start	0°	5"
2°	4°	7¾"
4°	8°	10½"
6°	12°	13¼"
8°	16°	16"

Vacuum Advance—IGS-4108B-1

Start	0°	4¾"
2°	4°	6¼"
5°	10°	8⅜"
8°	16°	10½"
10°	20°	12"

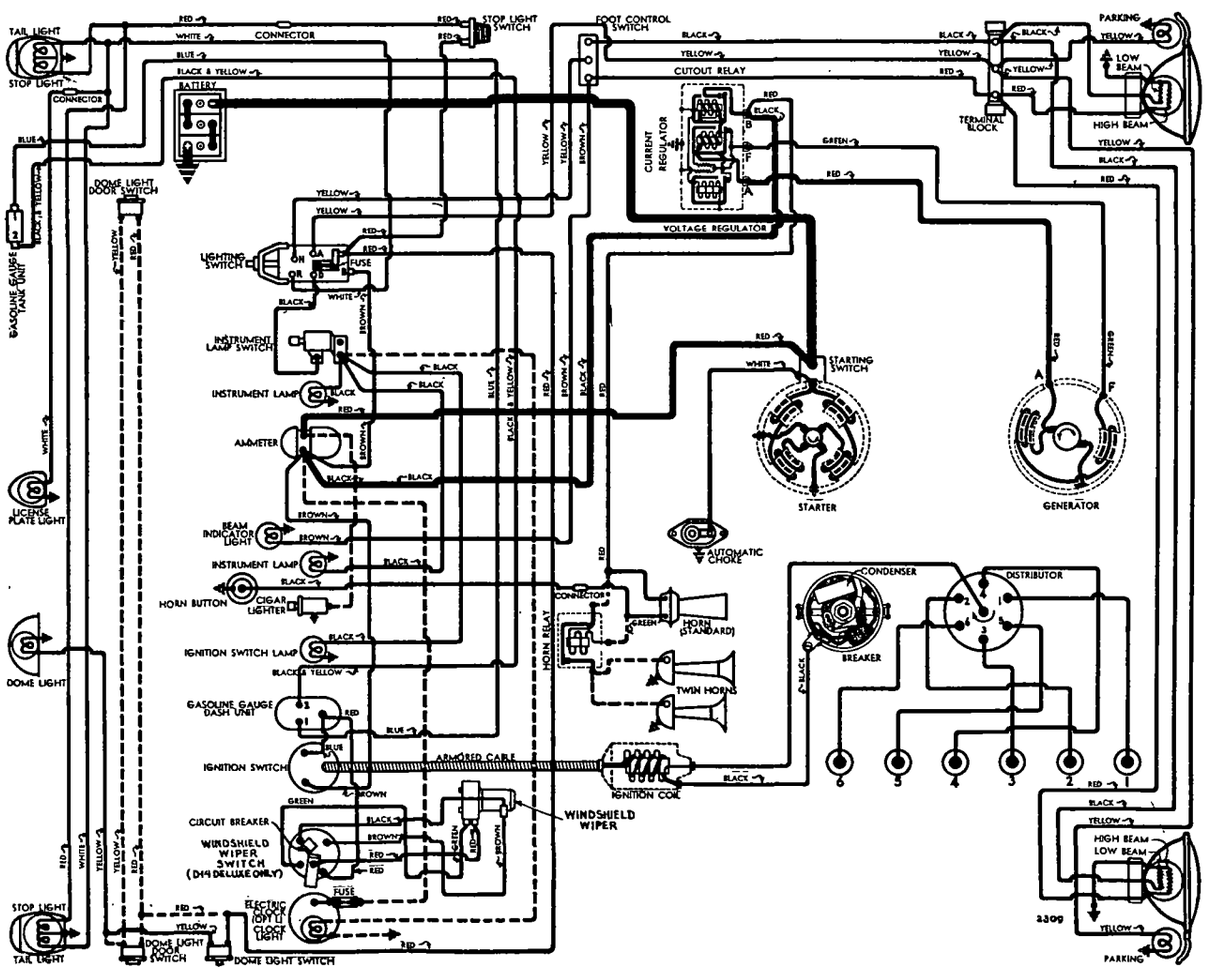
Manual Adjustment—At distributor. Provides 10° advance or retard from center '0' position. See Ignition Timing for adjustment.
Distributor Removal:—Mounted on left side of crankcase. To remove, disconnect vacuum line, take out hold-down screw in lock plate.

IGNITION TIMING:—Initial setting (correct for fuel of 70 octane rating at low altitudes for both cast-iron and aluminum heads) shown below. See Manual adjustment (following) for correction (not to exceed 4° either way) dependent on fuel regularly used and operating conditions.

Flywheel Degrees	Piston Position
6.5 & 7.0-1 heads 0° at TDC	0000" at TDC.

NOTE—Impulse neutralizer (D14), crankshaft pulley (D17) marked 'DC' at top dead center with 15 (1°) graduations on either side.
Timing (Using Timing Light)—Connect timing light between distributor and battery terminal on the generator regulator. With #6 piston on compression, turn engine over until piston reaches firing position (see Initial Setting above), stop when correct mark on impulse neutralizer lines up with pointer on chain case cover. Loosen lock-plate hold-down screw, center pointer on scale, tighten screw. Loosen lock-plate clamp bolt, rotate distributor until timing light just goes out, tighten clamp bolt. Check Manual Adjustment as directed below.
Timing (Using Synchroscope)—Tool C-374. Clip lead to #1 spark plug, direct light on impulse neutralizer (fill in correct mark on impulse neutralizer with chalk or paint), idle engine and adjust distributor as directed above.
Manual Adjustment—Standard ignition setting should be varied not more than 4° (piston 4° or .0068" before or after top dead center) so that slight ping noticeable between 10 and 30 M.P.H. when accelerating with wide open throttle for best performance. To adjust, loosen hold-down screw, rotate distributor counter-clockwise to advance spark (if no ping noted), counter-clockwise to retard spark (if ping too severe) not more than 4°. Scale graduated in engine degrees.
Firing Order:—1-5-3-6-2-4. See diagram.
Spark Plugs:—Auto-Lite Type A-7B (cast-iron head), Type AL-7A (aluminum head). 14 MM Metric type.
Spark Plug Gaps—Set at .025".

CARBURETION:—**Carburetor**—Stromberg Model BXV-3. Single barrel, 1½" special downdaft type.
See article in Carburetor Section for complete data.
Idle Adjustment—With engine warm and running at slow idle speed (choke valve wide open, fast idle inoperative), set throttle stopscrew for 6 MPH idle speed. Adjust idle adjusting screw until engine fires smoothly (turn screw in for leaner mixture). Re-



adjust idle speed. NOTE—Car manufacturer recommends use of vacuum gauge. Idle screw should be set to give highest reading on gauge.
Accelerating Pump Setting—Pump lever has three holes for pump link engagement. Set as follows:
Inner Hole (min. stroke)—Extreme hot temperatures or altitudes above 3000 feet.
Center Hole (med. stroke)—Normal setting.
Outer Hole (max. stroke)—Winter temperatures.
NOTE—If lean metering jets (High Alt. calibration) used at lower altitudes for increased economy, reduced speed and power will result (not recommended by manufacturer). See Stromberg Jet Table in Carburetor Section for complete jet data.
Float Level—Fuel level 5/8" below top edge of bowl.

Fast Idle:—Not adjustable. Throttle stopscrew should rest on high point of cam (choke valve closed).

Throttle Cracker:—Interconnector between starting pedal and accelerator rod which opens throttle approximately one-third when pedal depressed for starting. Adjust by loosening throttle pickup clamp bolt (above starter switch), shift clamp on rod.

Automatic Choke:—Sisson Type AC-758B.
See article in Carburetion Equipment Section.

Air Cleaner:—AC #1528200 oil-wetted type standard.

Fuel Pump:—AC Type AT #1523647 diaphragm type.
See article in Carburetion Equipment Section.

Gasoline Gauge:—Auto-Lite electric. No. NG-9342D (dash unit), No. NG-9329T (tank unit).
See article in Carburetion Equipment Section.

MANIFOLD HEAT CONTROL:—Thermostatic coil type. See that shaft and valve rotate freely. When installing coil, wind up free end ½ turn counter-clockwise and hook end over stop stud.
CAUTION—Do not wind coil up more than ½ turn.

VALVE TIMING:—To Check—With .011" (cold) tappet clearance, #6 intake valve should open with #6 piston 6° or .0153" ATDC with 6th graduation after DC mark on impulse neutralizer or crankshaft pulley aligned with pointer on chain case cover. Reset tappet clearance at .006" (hot and idling).

Tappet Clearance:—.006" Int., .008" Exh. (hot&idling). .002" add'tl exh. clearance desirable for sustained high speeds. NOTE—Tappet screws self-locking (no locknuts). Remove right front wheel, lower housing panel and fuel pump shield for access to valves.

Valve Spring Pressure:—34-38 lbs. at 1¾" (valve closed), 77-83 lbs. at 1 7/16" (valve open).

LUBRICATION:—Crankcase Capacity—5 qts. (refill).
Normal Oil Pressure—30-45 lbs. at 30 MPH, 15 idling.

COOLING SYSTEM:—Capacity—15 quarts.
Thermostat—Bishop & Babcock or Fulton. In outlet on head. Starts to open 157-162°. Fully open 183°
Temperature Gauge—Motometer (Auto-Lite) Vapor tension type. A-L Part No. H-9341.
See article in Mechanical Equipment Section for data.

BATTERY:—Auto-Lite type PN-15A. 6 volt, 15 plate, 95 ampere hour capacity (20 hour rate).
Starting Capacity—117 amperes for 20 minutes.
Zero Capacity—300 amperes for 3.1 minutes.
Grounded Terminal—Positive (+) grounded to the transmission case.
Dimensions—Length 8⅞". Width 7". Height 8⅝".
Location—Left side under front seat.

STARTER:—Model MZ-4062. Armature No. MZ-2108. MAW-4016 (D14 Canada). Armature No. MAW-2030.
See 1940 De Soto S7 'T&E' page for MAW-4016 data.
Drive—Overrunning clutch, manual pinion shift.
Rotation—Counter-clockwise at commutator end.
Cranking Engine—150-175 amperes, 5.1 volts.
Brush Spring Tension—42-53 ozs. (new brushes).

Performance Data

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	4300	5.5	70
.65 " "	2500	5.5	100
2.55 " "	1325	5.0	200
4.95 " "	750	4.5	300
7.65 " "	220	4.0	400
7.8 " "	Lock	3.0	420
11.8 " "	Lock	4.0	560

Removal:—Flange mounted on left front face of flywheel housing, Remove cables, 2 clips on starter linkage, oil filter lines, 2 mounting bolts. Lift off.
Starting Switch:—Model SW-2813. On starter. Manually operated by starter (pinion shift) pedal.

GENERATOR:—Models GDZ-4801A (Std.), GEB-4801A (Police). Armature No. GDZ-2006F (GDZ-4801A) GEB-2006F (GEB-4801A). Two brush type with current-voltage control. Air cooled.
Charging Rate Adjustment—No adjustment at generator. Charging rate controlled by Voltage Regulator and maximum output by Current Regulator.
See Regulator data following.
Maximum Charging Rate—35 amperes (Std.), 32 amperes (Police), 8.0 volts, 2200 gen. RPM (Std.), 1400 (Police), approx. 24 MPH (Std.) and above with load or discharged battery (Current Regulator setting). Actual charging rate controlled by Voltage Regulator and dependent on battery condition.

Performance Data—GDZ-4801A

Cold			Hot		
Amperes	Volts	R.P.M.	Amperes	Volts	R.P.M.
0	6.4	925	0	6.4	1000
4	6.6	1035	4	6.6	1120
8	6.75	1140	8	6.75	1235
12	6.95	1250	12	6.95	1350
16	7.15	1370	16	7.15	1460
20	7.3	1480	20	7.3	1590
24	7.5	1590	24	7.5	1730
28	7.7	1710	28	7.7	1900
32	7.9	1820	32	7.9	2090
*35	8.0	1900	35	8.0	2250

Performance Data—GEB-4801A

0	6.4	560	0	6.4	600
4	6.6	630	4	6.6	675
8	6.8	700	8	6.8	750
12	7.0	775	12	7.0	840
16	7.2	845	16	7.2	930
20	7.4	920	20	7.4	1030
24	7.6	1000	24	7.6	1140
28	7.8	1075	28	7.8	1260
*32	8.0	1150	32	8.0	1400

*—Current regulator setting.

Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—53 ozs. max. (new brushes).
Field Current—1.60-1.78 amperes at 6 volts (GDZ).
Motoring Current—4.16-4.60 amperes at 6 v. (GDZ).

Removal:—Pivot mounted at left side of engine at front. To remove, take out pivot and clamp bolts.

Belt Adjustment:—Loosen clamp and pivot bolts, swing generator out until scale (attached to field frame) reads 40-50 lbs., tighten bolts.

REGULATOR:—Model VRP-4001A (Std.), B (Police). Current-Voltage type. In single case on dash.
See article in Electrical Equipment Section for data.
NOTE—Regulator case cover is sealed. Serviced on exchange basis if seals not broken.

Cutout Relay
Cuts In—6.4-6.6 volts at approximately 1000 generator RPM (Std.), approx. 600 gen. RPM (Police).
Cuts Out—4.8-5.6 volts (approx. 7-8 amps. disch.).
Contact Gap—.015" minimum.
Air Gap—.034" min., .038" max. with contacts open. Measure at hinge end of core.

Voltage Regulator
Setting—7.3-7.6 volts at 70° F.
To Check (without breaking seals)—Connect ammeter in charging line at regulator 'B' terminal, voltmeter between 'B' terminal and ground. Operate generator at speed equivalent to 30 MPH charging battery until voltage is steady. Voltage reading should be 7.3-7.6 volts (room temperature), 7.1-7.4 volts (hot operating conditions).
To Adjust (with cover removed)—Change regulator armature spring tension by bending lower spring hanger slightly. See Electrical Equipment Section.
Contact Gap—.012" Min. (armature against stop pin).
Air Gap—.048-.052" with contacts just opening.

Current Regulator
Setting—Std: 34-36 amperes (marked '35' on cover), Police: 31-33 amperes (marked '32' on cover).
To Check (without breaking seals)—Connect test meters as for Voltage check (above). Operate generator at speed equivalent to 30 MPH charging battery, turn on car lights and accessories so that generator charges at peak rate and Current Regulator operates. Charging current should not exceed 34-36 amperes (Std.), 31-33 amperes (Police). If more than slight excess noted, regulator is defective.
Adjustment & Contact Gap—Same as for Voltage Regulator (above).
Air Gap—.034-.038" with contacts just opening.

LIGHTING:—Headlamps—Corcoran-Brown 'Sealed Beam' type. *See article in Electrical Equipment Section.*
Headlamp Adjustment—Aim upper beam for each lamp straight ahead with center of hot spot 3" below lamp center height.
Beam Indicator—Red light on panel above instrument cluster. Lighted with upper beam on.

Switches
Lighting—Chrysler No. 858050, 858052 Optl.
Beam Selector—Chrysler No. 859974.
Instrument—Chrysler No. 853371.
Stop Light—Chrysler No. 862556.

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps		Sealed Beam
Parking, Instrument	1½	55
Beam Indicator, Ign. Sw.	1	51
Stop and Tail	21-3	1158
Rear License	3	63
Dome or Reading	15	87

FUSES:—Lighting—30 amp. On back of light switch.
Clock—2 ampere. In connector behind clock.
Radio—14 amp. In feed wire behind instr. panel.
Horns & Windshield Wiper—No fuse used.

HORNS:—Single—Delco-Remy No. 1999911 standard.
Dual—Auto-Lite HO-5001 horn set. HL-4001 (low pitch), HL-4002 (high pitch) operated by horn relay.
Current Draw—Approx. 7 amps. single, 35-40 dual.
Horn Relay:—Auto-Lite Model HRC-4001 (no fuse).
Contacts Close—1.5-3.0 volts. **Open**—.5 volt.
Contact Gap—.026". **Air Gap**—.016-.020" (closed).

WINDSHIELD WIPER:—Auto-Lite Model EBW-4001 (used on D14 cars only). Electric type with circuit-breaker on back of switch.
See article in Mechanical Equipment Section for data.
Circuit Breaker—Vibrating, thermostatic type. Starts to operate with current of 12 amperes.

MODEL DESIGNATION:—Model number indicates Engine size—022 or 02 (60 Engine); 01, 011, 014, 018 (85 Engine); 09, 091, 094, 098 (95 Engine)—with suffix letter indicating body type as follows:
'A'—112" Wheelbase Passenger Cars.
'C'—112" Wheelbase Commercial Chassis.
'D'—122" Wheelbase ¾ Ton Truck Chassis.
'Y'—122" Wheelbase 1 Ton Truck Chassis.
'W'—101", 134", 158" W.B. Cab-over-Engine Trucks.
'T' & 'U'—134", 158" W.B. Trucks and 194" W.B. School Bus.

ENGINE HOOD NOTE:—To raise hood, release latch by pulling up on latch handle on front of hood at center, press in on button in upper edge of grille to release secondary (safety) catch. Safety catch button concealed by latch handle in closed position.

SERIAL & ENGINE NUMBER:—Stamped on top of clutch housing and on left frame side member near generator.

COMPRESSION:—**Ratio**—6.6-1 (All 60 Engines), 6.2-1 (85 & 95 Engines—Pass. Cars, Comm'l., ¾ & 1 Ton), 5.9-1 (85 & 95 Engines—Other Trucks).
Pressure—105 lbs. (60 Engine), 100 lbs. (85 & 95 Engines) at cranking speed of 100 RPM.

VACUUM READING:—Steady 18-20" at 5-7 MPH.

IGNITION:—**Coil Model 78-12024-A** (part of ignition unit assembly). Mounted on top of distributor.
Resistor Unit—Connected in coil primary circuit. Mounted on Circuit Breaker Assembly No. 01A-12250.
Ignition Current—4½-6 amperes (engine stopped). Ignition primary circuit resistance 1-1⅓ ohms.
Ignition Switch:—Oakes Steering Column & Ignition Lock Assembly No. 302110, Ford No. 01A-3676A (Std. Pass. Car); 302126, Ford No. 01A-3676B (Deluxe Pass. Car); 302120, Ford No. 01C-3676 (Comm'l, ¾ & 1 Ton); Ford No. 81W-3676 (Cab-over-Engine), 302122, Ford No. 01T-3676 (Other Trucks). Ignition Switch No. 301683 (all models).
Lock Cylinder—Hurd or Briggs & Stratton No. 80935, Ford No. 91A-3686A (with keys).
Key Series—FK000 to FK999. **Groove**—No. 17.
Distributor Model 78-12127. (Less coil, distributor caps, and distributor plates). Double breaker, 8 lobe cam, full automatic advance type with Vacuum Brake Control (see Ignition Timing for adjustment). Same design as used on preceding V8 models.
Breaker Gap—.014-.016" (both sets). Use special two step feeler—.014" step 'go', .016 step 'no go'.
Cam Angle—36° closed, 9° open. For both sets operating together with correct coil-loading lead.
Breaker Arm Spring Tension—20-24 ozs.
Rotation—Clockwise viewed from drive end.
Condenser—No. 78-12300. Capacity .33-.36 mfd.

Automatic Advance
(High Vacuum or Vacuum Brake Inoperative)

Distributor		Engine	
Degrees	R.P.M.	Degrees	R.P.M.
Start	200	0	400
2	325	4	650
3	425	6	850
5	825	10	1650
8	1500	16	3000

Removal:—Ignition unit mounted on front of engine. To remove, disconnect vacuum line, take off caps, take out screws in mounting flange.

IGNITION TIMING:—For each engine as follows (see Vacuum Brake Setting below for adjustment depending on type of service and fuel used).

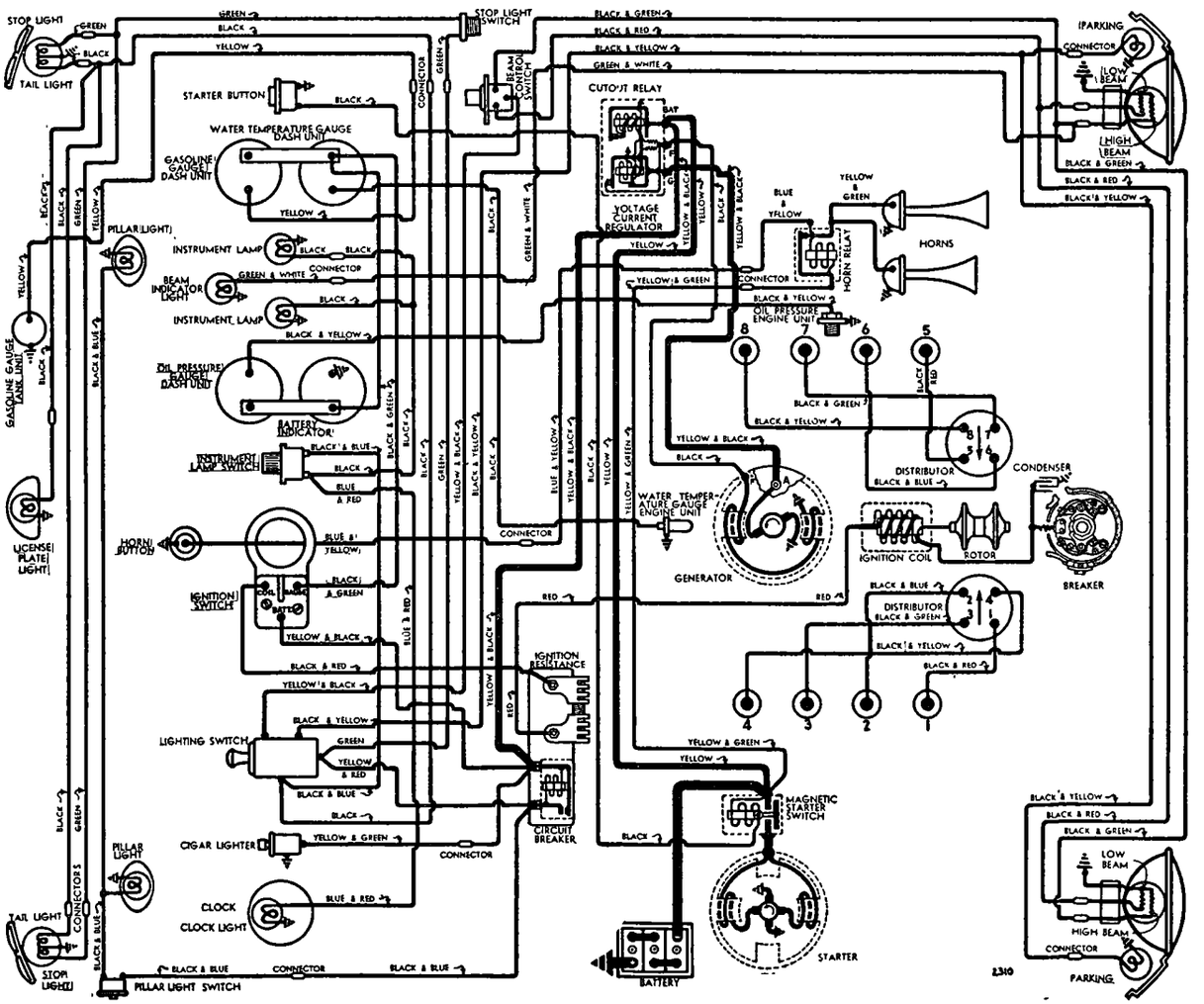
	Flywheel Degrees	Piston Position
'60' Engines	4° BTDC	.0048" BTDC.
'85' & '95' Engines	4° BTDC	.0058" BTDC.

Timing Note—Manufacturer recommends use of Laboratory Test Set with Stroboscope attachment or V-126 Timing Fixture for all ignition settings.
Timing (On Engine)—No flywheel marks provided and timing should be set with piston on top dead center. With #1 piston on top dead center entering power stroke, loosen timing adjusting screw on left hand side of ignition unit housing, place screw in retard position at lower end of slot, move screw slowly up until timing contacts begin to open, note graduation on plate under screw head which is in line with reference mark on housing, move screw up exactly one additional graduation, tighten screw. NOTE—Dead center position can be determined by inserting gauge rod in cylinder or by measuring to tops of #2 and #3 pistons (should be equal).

Vacuum Brake Setting:—Should be adjusted to eliminate pinging when engine operated with load. To adjust, loosen locknut, back off adjusting screw until engine pings with load, turn screw in just enough to eliminate ping, tighten locknut. When adjusted on Stroboscope, vacuum brake should retard spark so that automatic advance is 2° (distr.) at 950 R.P.M. or 38 M.P.H. with no vacuum.

Firing Order:—1-5-4-8-6-3-7-2. See diagram.
Spark Plugs:—Champion Type H-10. 14 MM. Metric.
Spark Plug Gaps—.025".

CARBURETION:—**Carburetor**—Chandler-Groves Model AA-⅞ Ford No. 922A-9510A (60 Engine); AA-1, Ford No. 91A-9510-A (85 & 95 Engine). Dual, downdraft type.
See article in Carburetor Section for data.
Idle Adjustment—With engine warm, choke valve wide open, and Fast Idle inoperative, set throttle lever stopscrew for 5-7 MPH. idling speed, turn each idle adjusting screw (one for each barrel, adjust in succession) in until engine begins to miss, then out until engine begins to roll, finally turn screw in until engine fires smoothly. Final setting should be approximately ⅝-⅞ turn of screw from inner seated position. Readjust stopscrew for correct idling speed of 5-7 MPH. or 350 RPM.
NOTE—Vacuum gauge recommended for idling adjustment. Set for highest steady gauge reading.
Float Level—1⅜-1 11/32" from bottom of float to face of cover with valve seated (invert to check). Fuel level 21/32-23/32" below top edge of bowl.



Accelerating Pump Setting—Three holes provided for pump link connection as follows:
Inner (#1)—Min. stroke, Summer Temperatures.
Center (#2)—Med. stroke, Winter Temperatures.
Outer (#3)—Max. stroke, Extreme Cold Weather.
NOTE—Link locked in pump rod by snap-lock. Pull link shaft out of pump rod to disengage this lock.

Fast Idle:—Integral with carburetor. Operated by choke valve lever. No adjustment required.

Air Cleaner:—AC #1529224, Ford No. 91A-9600-A oil-wetted type Std. Heavy duty oil-bath type Optl.

Gasoline Gauge:—King-Seeley Electric. Ford No. Dash Unit—01A-9280A (Std.), 01A-9280B (Deluxe). Tank Unit—01A-9275A (All Pass. Cars & Comm'l.), 01A-9275B (Deluxe Sedan Delivery), 01Y-9275 (122" Panel Delivery), 01W-9275 (Cab - over - Engine Trucks), 01T-9275 (Other Trucks).
See article in Carburetion Equipment Section.

Fuel Pump:—AC Type R. #1523257, Ford No. 52-9350B (60 Engine); #1523307, Ford No. 68-9350 (85 & 95 Engines). Diaphragm type.
See article in Carburetion Equipment Section.

VALVE TIMING:—To Check Timing. No flywheel marks or other means provided to check timing. If dead center position for piston #1 is established on flywheel, intake opening for this cylinder should occur with piston .0270" BTDC. with flywheel mark 3.22 teeth before dead cented point (60 Engine) or with piston on top dead center and flywheel mark at dead center point (85, 95 Engines).

Tappet Clearance:—.0125-.0135" all valves. Not adj.

Valve Spring Pressure:

	(Valve Closed)	(Open)
60 Engine	26-30 lbs., 2.05"	48-52 lbs., 1.80"
85, 95 Engines	37-40 lbs., 2.13"	76-80 lbs., 1.84"

LUBRICATION:—Crankcase Capacity—4 qts. (60 Engine), 5 qts. (85, 95 Engines).

Normal Oil Pressure:—30 lbs. at 2000 R.P.M. (all).

Oil Pressure Gauge:—King-Seeley Electric. Ford No. Dash Unit—01A-9273A (Std.), 01A-9273B (Deluxe). Engine Unit—Ford No. 48-9278 (all models).
See article in Mechanical Equipment Section for data.

COOLING SYSTEM:—Capacity—13 qts. (60 Pass. Car & Comm'l.), 16 qts. (60 ¾&1Ton), 20 qts. (85 Comm'l), 22 qts. (85 Pass. Car & Trucks except Cab-over-Engine), 23 qts. (Cab-over-Engine Trucks).

Thermostat:—In each cylinder head outlet (2 used). Starts to open at 145° F. Fully open at 180° F.

Temperature Gauge:—King-Seeley Electric. Ford No. Dash Unit—01A-10883A (Std.), 01A-10883B (Deluxe). Engine Unit—99A-10884 (all models).
See article in Mechanical Equipment Section for data.
NOTE—Gauge reads 212 (Hot) with ignition off.

BATTERY:—Ford No. 01A-10655-A. 6 volt, 17 plate, 120 ampere hour capacity (20 hour rate).
Starting Capacity—150 amperes for 20 minutes.
Zero Capacity—300 amperes for 4.0 minutes.
Grounded Terminal—Positive (+) grounded to dash.
Engine Ground—Strap connector between right rear cylinder head and dash (connected to battery ground strap bolt on Deluxe cars).
Dimensions—Length 10.6". Width 7.3". Height 9.2".
Location—On right side in engine compartment.

Battery Indicator:—King-Seeley. Voltmeter type. Ford No. 01A-10844A (Std.), 01A-10844B (Deluxe).
See article in Electrical Equipment Section.

STARTER:—No. 52-11002 (60 Eng.), 18-11002 (85, 95).
Armature—52-11005 (52-11002), 18-11005 (18-11002).
Drive—Barrel Type Bendix No. A-1806. Ford No. 52-11350-C (52-11002), Inboard Bendix No. L11FX-10, Ford No. B-11350 (18-11002).
See Electrical Equipment Section for data on Special Ford Barrel Type Bendix Drive servicing.
Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—2 lbs. each.
Cranking Engine—100 RPM., 190-215 amperes.

Torque	R.P.M.	Volts	Amperes
4 ft. lbs.	1070	4.6	200
8 "	660	4.3	340
12 "	300	3.65	465
14 "	Lock	3.5	500

Starting Switch:—R-B-M Model 5604, Ford No. 78-11450 Magnetic Switch mounted on dash and controlled by pushbutton on instrument panel R-B-M Model 3237, Ford No. 01A-11500A (Std), R-B-M Model 3238, Ford No. 01A-11500B (Deluxe).

Removal:—Starter mounted on right front face of flywheel housing. To remove, take off pan at right of engine, free starter-to-oil pan support bracket, take out through-bolts on commutator end plate.

GENERATOR:—Ford No. 01A-10000 (All Cars & Trucks except Cab-over-Engine), 81T-10000A or 81T-10000B Cab-over-Engine Trucks). Two brush (shunt) type with vibrating type voltage and current regulation. Ventilated by fan on drive pulley.
Armature—Ford No. 01A-10005 (01A-10000 Gen.), 78-10005-A or C (81T-10000A Gen.), 78-10005-B or D (81T-10000B Gen.).
Charging Rate Adjustment—No adjustment. See Regulator data below.
Maximum Charging Rate—Controlled by regulator and dependent on battery condition and load. To check generator output, disconnect generator field lead at generator, connect both generator terminals together (use short insulated wire). Use 'BRS' set or rheostat connected across battery terminals and apply load until voltage is exactly 6 volts. Connect ammeter in charging line, run engine at approximately 1000 RPM, check output at 3 speeds given in performance table below. Restore original connections after completing test. **Do not operate generator in service with both terminals connected together. This eliminates all regulator action and will damage generator.**

Performance Data

Amperes	01A-10000	Engine R.P.M.
Start		400
32		1100
32		3000
	81T-10000A	
Start		550
28		1300
28		3000
	81T-10000B	
Start		350
20		1050
20		3000

Rotation—Counter-clockwise at commutator end.
Field Current—2.86 amperes at 6 volts (01A-10000—field resistance 2.1 ohms at 70°), 2.22 amperes at 6 volts (81T-10000A & B—field resistance 2.7 ohms at 70°).
Brush Spring Tension—Approximately 28 ozs.

Removal:—Generator mounted on bracket between cylinder banks at front of engine, driven in tandem with water pumps by Vee belt (on Cab-over-engine Trucks, fan mounted on generator shaft and double belts used). To remove, loosen nut on bracket stud.

Belt Adjustment:—Loosen nut on bracket mounting stud, raise generator up until side movement on belt midway between generator and water pump pulley is 1" (thumb and finger pressure).

REGULATOR:—Ford No. 01A-10505-A. Vibrating type Voltage-Current regulator with Cutout Relay in case on dash. NOTE—Regulator mounted on rubber cushions and grounded through separate ground wire attached to case. Regulator case is sealed and no adjustments can be made.

Cutout Relay

Cuts In—6.2-6.5 volts (Cold or 60-80°), 400 Eng. RPM. (01A-10000), 500 Eng. RPM. (81T-10000A), 350 Eng. RPM. (81T-10000B).
Cuts Out—5.5 amperes max. (Cold 60°), 1.7 amperes (Hot 180°)—*see Regulator article in Electrical Equipment Section for specifications at other temperatures.*

Voltage-Current Regulator

Voltage Setting—7.2-7.65 volts (Cold 60°), 6.825-7.2375 volts (Hot 180°). Over-compensated for temperature.
Current Setting—32 amperes (01A-10000 Gen.), 28 amperes (81T-10000A Gen.), 20 amperes (81T-10000B Gen.).
Regulator Checking & Adjustment—*See Ford Regulator article in Electrical Equipment Section for complete testing directions.* No adjustments can be made as regulator case is sealed.

LIGHTING:—Headlamps—Ford Sealed Beam type. Controlled by switch on instrument panel and Beam Selector switch on toeboard.
See article in Electrical Equipment Section.
Headlamp Adjustment—Aim upper beam of each headlamp straight ahead with hot spot centered on horizontal line 3" below lamp center height (lamp center height 30½" Pass. Cars, 42" Trucks).
Beam Indicator—Red jewel on instrument panel directly above speedometer. Lighted when upper beams in use.

Switches

Lighting—R-B-M Model 6425. Ford No. 01A-11654 (this switch now mounted in instrument panel). Switch & Wiring Assembly Ford No. 01A-11653 (Pass. Cars), 01T-11653 (Commercial & Trucks), 01W-11653 (Cab-over-engine Trucks).
Beam Selector—R-B-M Model 2480. Ford No. 81A-13532.
Instrument—Ford No. 01A-13740A (Std.), 01A-13740B (Deluxe).
Stop Light—Ford No. 91A-13480.

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps		Sealed Beam
Parking (Pass. Cars)	1.5	55
Parking (Comm'l., Trks.)	3	63
Instrument (Pass. Cars)	1	51
Instrmt. (Comm'l., Trks.)	3	63
Beam Indicator	1	51
Stop & Tail	21-3	1158
Pillar (Pass. Cars)	3	63

LIGHTING CIRCUIT BREAKER:—R-B-M Model 6700, Ford No. 01A-12250. Combined with Ignition Resistor on block on dash under cowl. Combination thermostatic and wound-coil type. Contacts open with current of 50 amperes. Current continues to flow through winding which is connected across the contacts resulting in rapid vibrating action.

HORNS:—Air Electric dual horns (Pass. Cars), Vibrator type single horn (Comm'l. & Trucks). Horn relay used with dual horns.
Horn Current—24-28 amperes (total—dual horns), 6-8 amperes (single horn).

Horn Relay:—R-B-M Model 4700, Ford No. 91A-13842.
Contact Closing Voltage—3.5-4.5 volts.
Current Draw—Approximately ¾ ampere.

NOTE:—New Traveler & Deluxe Six replace former "112" models and have the 3"x4⅛" Engine. Super Six and Country Club Six have the 3"x5" engine.

ENGINE HOOD (BONNET) LOCK:—*See 1940 Hudson 8 'T&E' page following for complete data.*

SERIAL NUMBER:—First number 40101 (40), 41101 (41), 43101 (43), 48101 (48). Stamped on plate on right front door hinge pillar post.

ENGINE NUMBER:—Same as Serial No. On top of cylinder block between #1 and 2 exhaust flanges.

COMPRESSION:—**Ratio**—7.0-1(40),6.5-1(others),CIhds. **Pressure:**—125 lbs. (40),120 lbs. (others) at 125 RPM.

VACUUM READING:—Steady 18-21" idling at 7 MPH.

IGNITION:—**Coil Model IG-4662.** Mounted on dash. Service Coil (less switch and cable) IG-3224JS.

Ignition Current—2.5 amperes idling, 4.5 stopped.

Ignition Switch:—Mitchellock Model 24-B, Type 8273. Connected to coil by armored cable.

Ignition Lock—Briggs & Stratton. B & S No. 50184.

Key Series—H601 to H1100. **Groove**—No. 1.

Distributor Auto-Lite IGW-4203. Full automatic advance type with separate vacuum spark control unit and manual adjustment (octane selector).

NOTE—Distributor now mounted at top of cylinder block at rear and driven through offset tongue-and-slot coupling by intermediate shaft. Rotation is now counter-clockwise (reversed from 1939 models).

Breaker Gap—.020".

Cam Angle or Dwell—35° closed, 25° open (dist.).

Breaker Arm Spring Tension—17-20 ounces.

Rotation—Counter-clockwise viewed from above.

Condenser—No. IGW-3075C. Capacity .20-.25 mfd.

Automatic Advance

Distributor Degrees	R.P.M.	Engine Degrees	R.P.M.
Start	300	0	600
3	400	6	800
7	825	14	1650
11	1255	22	2510
14	1580	28	3160

Vacuum Spark Control—Mounted on distributor hold-down plate and linked to quadrant scale on side of distributor. Provides additional advance at speeds above idling (vacuum port in carburetor above throttle) except when engine is accelerated or operated with wide open throttle when spark is retarded by return spring within unit.

Vacuum Advance

Distr. Degrees	Eng. Degrees	Vacuum (" of HG)
Start	0°	6¾"
2°	4°	7⅝"
4°	8°	8½"
6°	12°	9⅜"
7.5°	15°	10"

Fuel Compensator—Manual adjustment for octane rating of fuel used. See Ignition Timing.

Distributor Removal:—Mounted at top rear of cylinder block. To remove, disconnect vacuum line, take out cyl. head stud nuts on hold-down plate.

IGNITION TIMING:—Initial setting (for 70 octane fuel). See Fuel Compensator Setting following.

	Flywheel Degrees	Piston Position
All engines	0° at TDC	.0000" TDC

Timing—With #1 piston on compression, turn engine over until piston reaches top dead center, when flywheel mark 'UDC.1-6/' lines up with pointer in left front face of rear motor support above starter. Loosen advance diaphragm screw (at rear end of link), rotate distributor counter-clockwise to limit of slot, then slowly rotate clockwise until contacts begin to open, tighten diaphragm screw securely. Check Fuel Compensator Setting below.

Timing (Using Synchroscope)—Recommended by manufacturer. Mark flywheel with white chalk or paint, connect at #6 spark plug. Idle engine and adjust distributor as directed above.

Fuel Compensator Setting—Road test car with engine at normal operating temperature. With car running at 7 MPH slight ping should occur between 10-15 MPH when accelerating with wide open throttle. To adjust, loosen advance diaphragm screw, rotate distributor one graduation on quadrant scale clockwise (if no ping), counter-clockwise (if ping too severe), repeat test. Final setting not more than ¾" before 'UDC.1-6/' mark.

Firing Order:—1-5-3-6-2-4. NOTE—Distributor rotation now clockwise (reversed over 1939 models). See diagram for spark plug wiring sequence.

Spark Plugs:—Champion Type J-8. 14 MM. Metric.

Spark Plug Gaps—.032".

CARBURETION:—**Carburetor—(40, 48)** Carter Type WA-1 Model 454-S (No. 298 cast on face of flange). 1¼" single barrel, downdraft type.

See article in Carburetor Section for complete data.

Flange Gasket Note—8 gaskets now used (was 2).

Carburetor (41, 43):—Carter dual type. *See 1940 Hudson 8 'T&E' page following for all carburetor data.*

Idle Adjustment—With engine warm and running at slow idle speed (choke valve wide open, fast idle inoperative), set throttle stopscrew for 7 MPH idle speed. Adjust idle adjusting screw until engine fires smoothly (¾-1½ turns open—turn screw in for leaner mixture. Readjust idle speed. NOTE—If vacuum gauge used, set for highest steady reading.

Accelerating Pump Setting—Pump arm has 3 holes for pump link. Set as follows:
Lower Hole (med. stroke)—Normal setting.
Inner Hole (min.)—Hot weather, high-test fuel.
Lower Hole (max.)—Cold weather, low-test fuel.

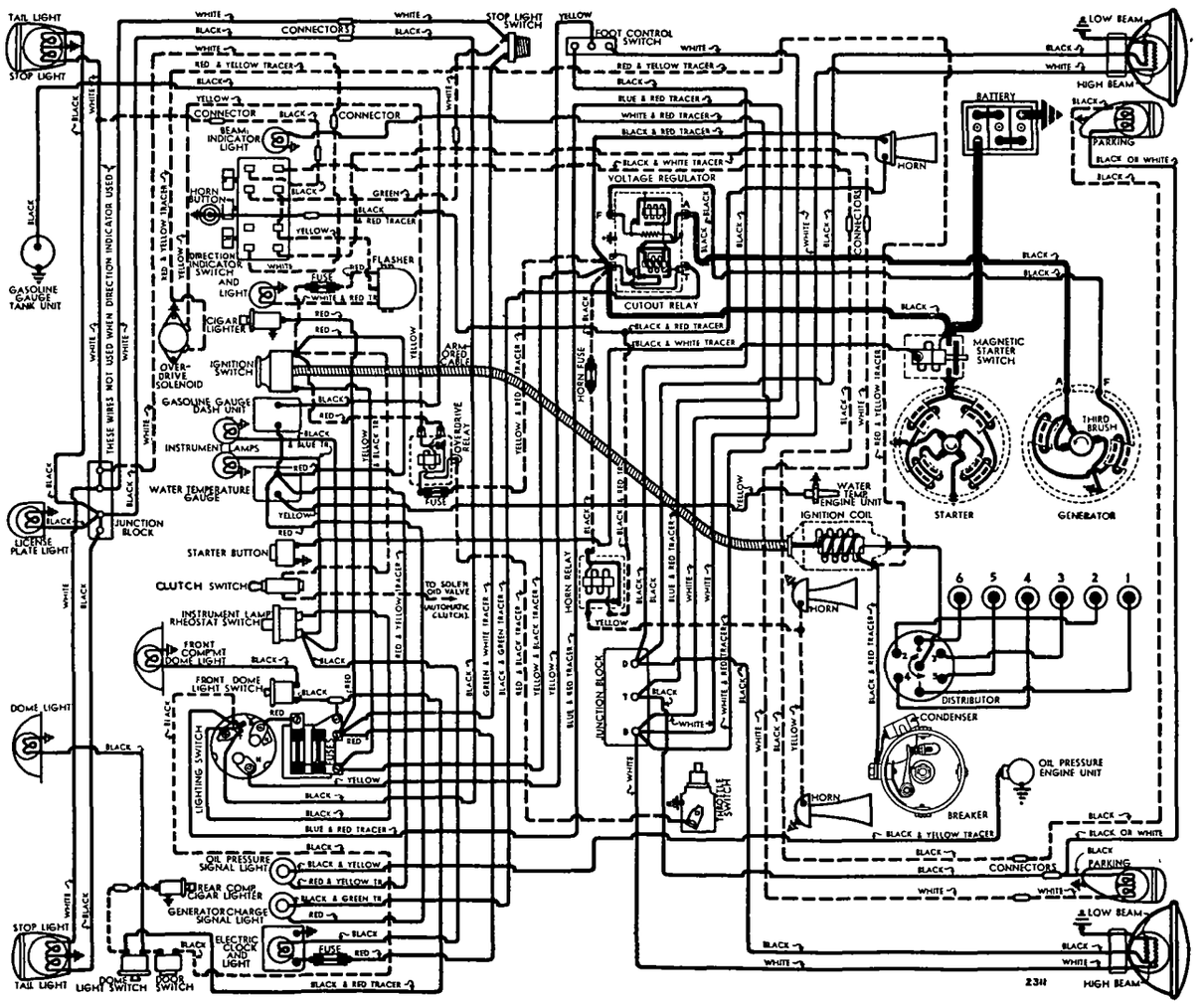
Float Level—⅜" from top of machined projection on bowl cover to top of soldered seam at free end of float (invert to check).

Fast Idle:—Integral type (part of carburetor).

See article in Carburetion Equipment Section.

Setting—Adjust by bending connecting link offset for ⅝" choke valve opening with stopscrew against (not on) first step of fast idle cam.

NOTE—With choke valve fully closed and pin on fast idle cam at bottom of slot in fast idle link,



clearance between top of fast idle cam (behind link) and trip lever should be .010". To adjust, bend trip lever stop (on engine side of link).

Automatic Choke:—Carter Climatic Control.
See article in Carburetion Equipment Section.
Setting—Center thermostatic coil housing.

Air Cleaner:—AC #1528159 (40, 48), #1528161 (41, 43) oil-wetted type std. United oil-bath type optl.

Fuel Pump:—AC Type AF #1523753 (40, 48). Type AK #1523289 (41, 43) diaphragm types standard.
See article in Carburetion Equipment Section.

Gasoline Gauge:—King-Seeley Electric. K-S Nos. Dash Unit—8118 (early—white lines), 7752 (later—white diamonds). Tank Unit—7550.
See article in Carburetion Equipment Section.

MANIFOLD HEAT CONTROL:—40, 48—Manual adjustment type on center of manifold behind carburetor.
Setting—Valve is set at factory to 'W' position (pointer sloping to rear) which is correct setting for all seasons' operation.
41, 43:—Automatic thermostatic coil type. No adj'mt.

VALVE TIMING:—**To Check**—With .010" tappet clearance, #1 intake valve should open with #1 piston 10°40' or .0441" (40), .0562" (41, 43, 48) BTDC when a point on the flywheel approx. 3.95 teeth before 'UDC.1-6/' lines up with indicator in inspection hole above starter. Reset tappet clearance .006" (hot).
Tappet Clearance:—.006" Int., .008" Exh. (hot&idling). Remove right front fender plate for access to valves.
See Hudson Shop Notes ('M' Section) for removal data.
Valve Spring Pressure:—40 lbs. at 2" (valve closed), 80 lbs. at 1 21/32" (valve open). Free length 2 17/64".

LUBRICATION:—**Crankcase Capacity**—4½ quarts (refill), 5½ quarts (dry). NOTE—When pan installed, place 1½ qts. in upper tray, 4 qts. through filler.
Normal Oil Pressure—3 lbs. (no gauge).
Oil Pressure Indicator:—Hudson Teleflash indicator.
See article in Electrical Equipment Section for data.

COOLING SYSTEM:—**Capacity**—13 quarts.
Thermostat—Fulton. In cylinder head outlet. Starts to open 150-155° F. Fully open 185° F.
Temperature Gauge:—King-Seeley Electric. K-S Nos. Dash Unit—8120 (early—white lines), 7755 (later—white diamonds). Engine Unit—7000. NOTE—Gauge inoperative with ignition Off (reads 'H').
See article in Mechanical Equipment Section for data.

AUTOMATIC CLUTCH CONTROL:—Electric type. Optl.
See article in Mechanical Equipment Section for data.

TRANSMISSION OVERDRIVE CONTROL:—Electric type with accelerator pedal operated 'kick-down' switch. *See article in Mechanical Equipment Section.*
Overdrive Solenoid—Delco-Remy No. 1569.
Throttle Control Switch—R-B-M Model 6013. Adjust so contact washer on accelerator linkage just contacts switch plunger with throttle valve in wide open position.
Control Relay—Auto-Lite HR-4201. 20 ampere fuse on relay (on left side of engine dash).

BATTERY:—**National, Type HT-17.** 6 volt, 17 plate, 96 ampere hour capacity (20 hour rate).
Starting Capacity—120 amperes for 20 minutes.
Zero Capacity—300 amperes for 3.5 minutes. Five second voltage—4.24 volts.
Grounded Terminal—Positive (+) grounded to frame. **Engine Ground**—Strap connector from rear motor support to frame.
Dimensions—Length 10½". Width 7⅛". Hght. 7 11/16".
Location—Left side of engine comp't. (under hood).

STARTER:—**Auto-Lite MZ-4079. Armature MZ-2138.**
Drive—Inboard Barrel type Bendix No. A-1684.
Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—42-53 ozs. (new brushes).
Cranking Engine—150 RPM., 125 amperes, 5.4 volts.

Performance Data

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	4300	5.5	70
.65 " "	2500	5.5	100
2.55 " "	1325	5.0	200
4.95 " "	750	4.5	300
7.65 " "	220	4.0	400
7.8 " "	Lock	3.0	420
11.8 " "	Lock	4.0	560

Removal:—Flange (new heavier casting) mounted on left front face of rear motor support. To remove, take out flange mounting screws.
Starting Switch:—R.B.M. Model 5607. Magnetic type. On starter, controlled by pushbutton on instrument panel Douglas #5751. NOTE—Switch is new type.

GENERATOR:—**Auto-Lite GDS-4801A (40, 48), GEC-4801A (41, 43).** Third brush control with external vibrating voltage regulation. Ventilated type.
Armature—GDF-2006F (GDS), GDZ-2006F (GEC).
Maximum Charging Rate—GDS—32-34 amperes (cold), 8.0 volts, 2900 RPM or approx. 35 MPH. GEC—39-44 amperes (cold), 8.0 volts, 3350 RPM or approx. 43 MPH. Actual charging rate controlled by Voltage Regulator and dependent on battery condition. See Regulator data following. To check generator output, ground 'F' terminal to eliminate regulator action.
Charging Rate Adjustment—See Regulator data. Third brush setting: GDS—1 commutator bar minus 1 mica strip minimum, 1 commutator bar maximum from insulated (nearest) main brush. GEC—1 commutator bar Min., 1 comm. bar plus 1 mica strip Max. Setting adjustable by shifting third brush.

Performance Data—GDS-4801A

Cold			Hot		
Amperes	Volts	R.P.M.	Amperes	Volts	R.P.M.
0	6.4	920	0	6.4	960
4	6.6	1050	4	6.65	1120
8	6.8	1175	8	6.9	1280
12	7.0	1300	12	7.1	1430
16	7.2	1450	16	7.35	1640
20	7.4	1600	20	7.6	1900
24	7.6	1820	24	7.8	2320
28	7.8	2075	27.5	8.0	3400
33	8.0	2900			

Performance Data—GEC-4801A

0	6.4	960	0	6.4	1040
4	6.55	1060	4	6.6	1140
8	6.7	1160	8	6.8	1280
12	6.85	1280	12	6.95	1440
16	7.0	1400	16	7.15	1600
20	7.15	1550	20	7.35	1820
24	7.25	1700	24	7.55	2090
28	7.5	1890	28	7.75	2440
32	7.65	2100	32	7.9	3000
36	7.8	2375	34	8.0	3800
41	8.0	3350			

Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—53 ozs. max. (new brushes).
Field Current—1.65-1.82 amperes (GDS), 1.60-1.78 amperes (GEC) at 6.0 volts.
Motoring Current—5.10-5.45 (GDS), 4.85-5.4 (GEC) amperes at 6.0 volts.
Removal:—Pivot mounted at left front of engine. To remove, take out pivot and clamp bolts.
Belt Adjustment:—Swing generator out until possible belt deflection midway between generator and fan pulleys is ¾" (use straightedge across pulleys).

REGULATOR:—**Auto-Lite VRD-4008B (early cars), VRR-4001A (later).** Cutout Relay and vibrating Voltage Regulator in case on dash. Cutout Relay has extra set of contacts for Generator Teleflash Indicator control.
See article in Electrical Equipment Section for data.
NOTE—Regulator case cover is sealed. Serviced on exchange basis if seals not broken.

Cutout Relay

Cuts In—6.4-7.0 volts, 825 RPM., 9.4 MPH.
Cuts Out—1.5-4.5 amperes (VRD), 6.0 amperes (VRR) maximum discharge current.
Contact Gap—.015" minimum with ground contacts closed (ground contacts must open when main contacts close).
Air Gap—.034-.038" at hinge end of core with contacts open (ground contacts closed).

Voltage Regulator

Setting—7.35-7.65 volts (VRD), 7.1-7.4 volts (VRR) Cold (70°F).
To Check (without breaking seals)—Connect ammeter in charging line at regulator 'B' terminal, voltmeter between this terminal and ground. Operate generator at speed of 30 MPH charging battery until voltage is constant. Voltmeter reading should be within limits of 7.35-7.65 volts (VRD), 7.1-7.4 volts (VRR) at 70°F. See Electrical Equipment Section articles for voltages at other temperatures.
To Adjust (with cover removed)—Change regulator armature spring tension by bending lower spring hanger slightly. See Electrical Equipment Section.
Contact Gap—.010-.020" (VRD), .012" Min. (VRR) (armature against stop pin).
Air Gap—.0595-.0625" (VRD), .048-.052" (VRR) with contacts just opening.

LIGHTING:—**Headlamps**—Hall 'Sealed Beam' type.
See article in Electrical Equipment Section for data.
Headlamp Adjustment—Aim upper beam of each headlamp straight ahead with hot spot centered on horizontal line 3" below lamp center height.
Beam Indicator—Red pilot bulb on speedometer dial. Lighted with Country (upper) beam in use.
Direction Indicator—Standard equipment on 43, Optl. on 40, 41, 48. *See Electrical Equipment Section.*

Switches

Lighting—Cole-Hersee.
Instrument (43 only)—R-B-M Model 5203.
Beam Selector—R-B-M Model 2467.

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps		Sealed Beam
Side Panel (Parking—see Note)	1½	55
Front Dir. Sig. (see Note)	21-3	1154
Speedometer only (40, 41, 48)		51
Instrument & Spdmtr (43)	1½	55
All Indicators	1	51
Electric Clock	1½	55
Stop & Tail (see Note)	21-3	1154
Rear License	3	63
Dome	15	87

NOTE—Direction Indicator (Std. on 43) front bulb replaces Parking bulb in Bonnet Side Panel—rear indicator flashes Stop lamp filament.

SIGNAL LIGHTS:—Generator Charge and Oil Pressure Indicators. Hudson Teleflash Electric type.
See article in Electrical Equipment Section for data.

FUSES:—**Lighting**—20 ampere. Lower fuse on fuse block on lower edge of instrument panel to right of steering column. **Accessory**—20 amperes. Top fuse on fuse block. NOTE—Silver-plated fuses used.
Twin Horns—30 ampere on block on engine dash.
Transmission Overdrive Control—20 amp. On Relay.
Direction Indicator—10 ampere. In case on back of instrument panel near speedometer.
Electric Clock—2 ampere on back of clock.

HORNS:—**Single**—Schwarze, electric. Std. on 40T, 48.
Twin—Sparton, vibrator, trumpet type operated by relay. Standard equip. on 40P, 41, 43.
Horn Relay:—R-B-M Model 4790. On horn bracket.
Contacts Close—3.5-4.5 volts. **Current Draw** ¾ amp.

ENGINE HOOD (BONNET) LOCK:—Alligator type hood (hinged at front) with integral side panels and instrument panel lock. To raise hood, push forward on handle located under edge of instrument panel to left of steering column and lift on rear edge of hood.

SERIAL NUMBER:—44101 (Eight 44), 47101 (Country Club Eight 47). On right front door hinge pillar post.

ENGINE NUMBER:—Same as Serial No. On top of engine block between #1 & 2 exhaust flanges.

COMPRESSION:—Ratio—6.5-1 Std. No Optl. ratios. **Pressure**—120 lbs. at 125 RPM. cranking speed.

VACUUM READING:—18-21" steady idling at 7 MPH.

IGNITION:—Coil Model CE-4641. Mounted on dash. Service Coil (less switch & cable) CE-3224JS.
Ignition Current—2.5 amperes idling, 4.5 stopped.
Ignition Switch:—Mitchellock Model 24-B, Type 8273. Connected to coil by armored cable.
Ignition Lock—Briggs & Stratton. B & S No. 50184.
Key Series—H601 to H1100. **Groove**—No. 1.
Distributor Auto-Lite Model IGP-4008A. Full automatic advance type with manual (octane selector) adjustment. No vacuum spark control.
Breaker Gap—.017".
Cam Angle or Dwell—31° closed, 14° open (dist.).
Breaker Arm Spring Tension—17-20 ounces.
Rotation—Clockwise viewed from above.
Condenser—No. IG-2671. Capacity .20-.25 mfd.

Automatic Advance

Distributor		Engine	
Degrees	R.P.M.	Degrees	R.P.M.
Start	300	0	600
3	400	6	800
8	850	17	1700
13	1300	26	2600
17.5	1700	35	3400

Fuel Compensator Adjustment—Manual adjustment for octane rating of fuel. See Ignition Timing.
Removal:—Mounted on right side of crankcase. To remove take out hold-down screw in advance arm.

IGNITION TIMING:—Initial Setting (for 70 octane rating fuel). See Fuel Compensator setting following.

	Flywheel Degrees	Piston Position
All Engines	0° at TDC	.0000" TDC

Timing—With #1 piston on compression, turn engine over until piston reaches top dead center when flywheel mark 'UDC.1-8/' lines up with pointer in left front face of rear motor support. Loosen hold-down screw in advance arm, rotate distributor clockwise to limit of advance arm slot, then slowly rotate distributor counter-clockwise until contacts begin to open, tighten hold-down screw. Check Fuel Compensator setting.
Timing (Using Synchroscope)—Recommended by manufacturer. Mark flywheel with white chalk or paint, connect at #8 spark plug. Idle engine and adjust distributor as directed above.
Motor Gauge—Weidenhoff Adapter #114, Rod #44.
Fuel Compensator Setting—Road test car and note performance when accelerating from 10-15 M.P.H. with wide open throttle on level road (warm engine). Slight ping should be evident. To adjust, loosen hold-down screw, rotate distributor one graduation on scale counter-clockwise (if no ping), clockwise (if ping too severe), repeat test. Final setting should not be more than ¾" before 'UDC. 1-8/' mark on flywheel.
Firing Order:—1-6-2-5-8-3-7-4.

Spark Plugs:—Champion Type J-8. 14 MM. Metric. **Spark Plug Gaps**—.032".

CARBURETION:—Carburetor (Eight—44, 47). Carter Type WDO, Model 455-S (#279 cast on face of flange). 1¼" dual downdraft type.
See article in Carburetor Section for complete data.

Carburetor (Six—41,43—before Eng. No. 3116):—Carter Type WDO, Model 430-SV (#199 cast on flange). 1" dual downdraft type. NOTE—This carburetor same as used on 1939 models (late 92, all 93 and Eights) except that vacuum spark port added (for new vacuum advance distributor).
See article in Carburetor Section for complete data.

Carburetor (Six—41,43—Eng. No. 3116 & Up):—Carter Type WDO, Model 461-S (#286 cast on flange). 1" dual downdraft type.
See article in Carburetor Section for complete data.

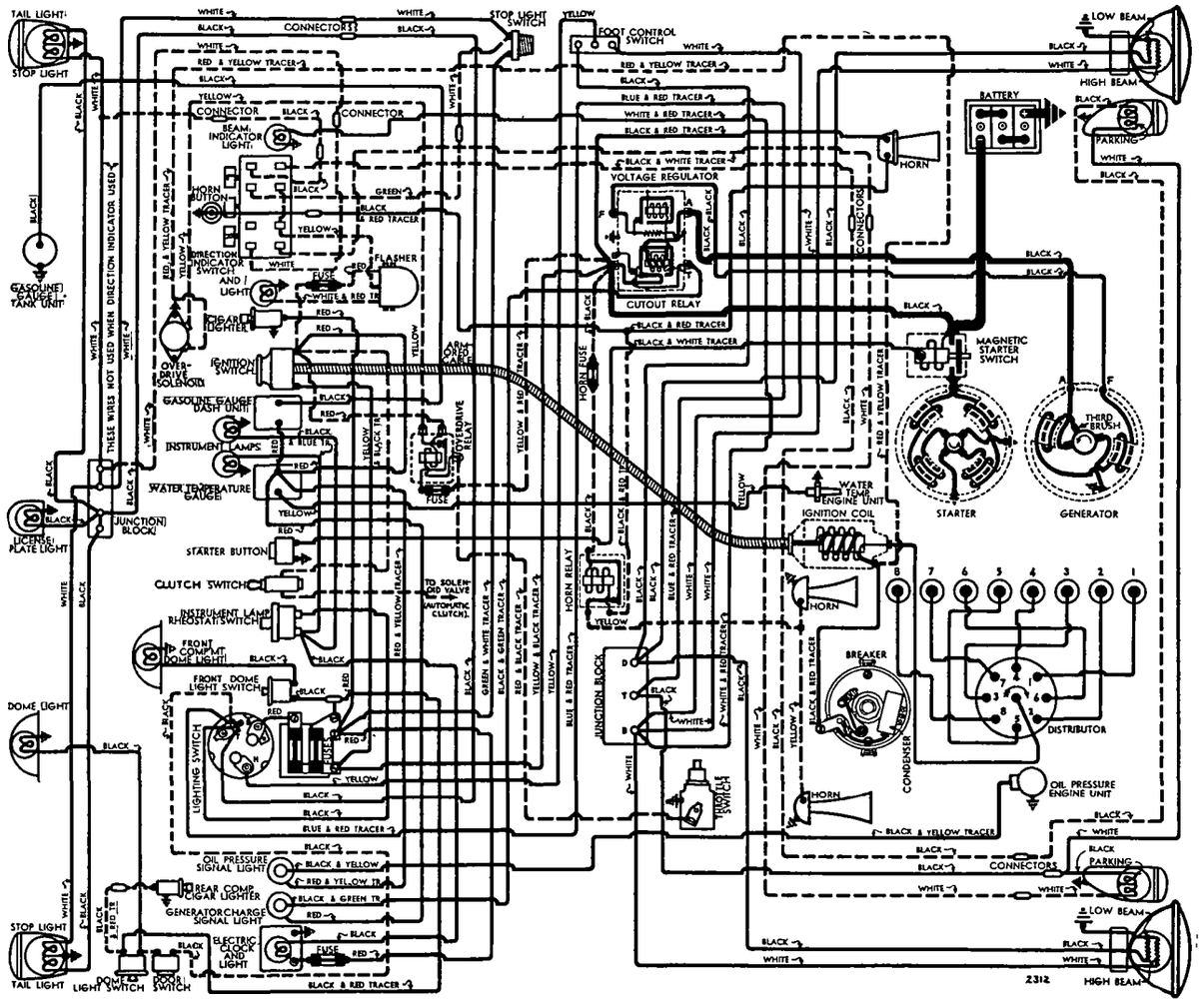
Flange Gasket Note—Eight gaskets now used (was two in 1939) on all carburetors.
Idle Adjustment—With engine warm and running at slow idle speed (choke valve wide open, fast idle inoperative), set throttle stopscrew for 7 MPH idle speed. Adjust idle adjusting screws (2 used, 1 for each barrel) in succession until engine fires smoothly. Final setting should be ¾-1 (430-SV), ½-1½ (455-S), ¼-1¼ (461-S) turns open for each screw. Readjust idle speed. NOTE—Car manufacturer recommends use of vacuum gauge. Adjust one screw for maximum reading, then adjust other screw for maximum steady reading.

Accelerating Pump Setting—Pump lever (under dust cover at top of carburetor) has 2 holes for pump link engagement. Adjust as follows:
Outer Hole (Max. stroke)—Normal setting.
Inner Hole (Min. stroke)—If less charge required.

Float Level—3/32" from top of float to gasket seat on cover (invert to check).

Fast Idle:—Integral type (built-in carburetor).
See article in Carburetion Equipment Section.

Fast Idle Setting—Turn fast idle adjusting screw in to secure .018" throttle opening with choke valve tightly closed.



Automatic Choke:—Carter Climatic Control.
See article in Carburetion Equipment Section.
Choke Setting—Thermostatic coil housing centered on piston plate housing reference mark.

Air Cleaner:—AC #1528161 oil-wetted type Std. United heavy duty oil-bath type Optl.

Fuel Pump:—AC Type AK #1523289 diaphragm type Std. Type AJ #1523936 combination fuel-and-vacuum pump Optl.
See article in Carburetion Equipment Section.

Gasoline Gauge:—King-Seeley Electric. K-S Nos. Dash Unit—8118 (early—white lines), 7752 (later—white diamonds). Tank Unit—7550.
See article in Carburetion Equipment Section.

MANIFOLD HEAT CONTROL:—Automatic thermostatic coil type. No adjustment required.

VALVE TIMING:—**To Check**—With .010" tappet clearance, #1 intake valve should open with #1 piston 10°40' or .0494" BTDC when a point on the flywheel approx. 3.94 teeth before 'UDC.1-8/' mark lines up with indicator in inspection hole above starter (left side). Reset tappet clearance .006" (hot and idling).

Tappet Clearance:—.006" Intake, .008" Exhaust (with engine hot and idling). Remove right front fender plate for access to valves. *See Hudson Shop Notes ('M' Section) for fender plate removal.*

Valve Spring Pressure:—40 lbs. at 2" (valve closed). 80 lbs at 1 21/32" (valve open). Free length 2 17/64".

LUBRICATION:—**Crankcase Capacity**—7 qts. (refill), 9 qts. (dry). NOTE—When pan installed, place 2 qts. in upper tray, 7 qts. through filler.
Normal Oil Pressure—3 lbs. (no gauge).

Oil Pressure Indicator:—Hudson Teleflash indicator.
See article in Electrical Equipment Section for data.

COOLING SYSTEM:—**Capacity**—18 quarts.
Thermostat—Fulton In cylinder head outlet. Starts to open 150-155° F. Fully open 185° F.

Temperature Gauge:—King-Seeley Electric. K-S Nos. Dash Unit—8120 (early—white lines), 7755 (later—white diamonds). Engine Unit—7000. NOTE—Gauge inoperative with ignition Off (reads 'H').
See article in Mechanical Equipment Section for data.

AUTOMATIC CLUTCH CONTROL:—Electric type. Optl.
See article in Mechanical Equipment Section for data.

TRANSMISSION OVERDRIVE CONTROL:—Electric type with accelerator pedal operated 'kick-down' switch. *See article in Mechanical Equipment Section.*
Overdrive Solenoid—Delco-Remy No. 1569.
Throttle Control Switch—R-B-M Model 6013. Adjust so contact washer on accelerator linkage just contacts switch plunger with throttle valve in wide open position.
Control Relay—Auto-Lite HR-4201. 20 ampere fuse on relay (on left side of engine dash).

BATTERY:—**National Type HT-19.** 6 volt, 19 plate, 108 ampere hour capacity (20 hour rate).
Starting Capacity—135 amperes for 20 minutes.
Zero Capacity—300 amperes for 4.0 minutes. Five second voltage—4.43 volts.
Grounded Terminal—Positive (+) grounded to frame. **Engine Ground**—Strap connector from rear motor support to frame.
Dimensions—Length 11¾". Width 7¼". Height 7 11/16".
Location—In engine compartment on left side.

STARTER:—**Auto-Lite MAB-4103. Armature MAB-2113.**
Drive—Inboard Barrel type Bendix No. A-1684.
Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—42-53 ozs. (new brushes).
Cranking Engine—150 RPM, 120-125 amperes, 5 v.

Performance Data

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	3700	5.5	60
.6 "	1910	5.5	100
3.4 "	1100	5.0	200
6.6 "	695	4.5	300
10.15 "	420	4 0	400
15.8 "	Lock	3.0	582
22.5 "	Lock	4.0	775

NOTE—Lock torque figures correct without switch.
Removal:—Flange (new heavier casting) mounted on left front face of rear motor support. To remove, take out flange mounting screws.
Starting Switch:—R.B.M Model 5607. Magnetic type. On starter, controlled by pushbutton on instrument panel Douglas #5751. NOTE—Switch is new type.

GENERATOR:—**Auto-Lite GEC-4801A. Armature GDZ-2006F.** Third brush control with voltage regulation. Ventilated.
Maximum Charging Rate—39-44 amperes (cold), 3350 RPM or approx. 43 MPH. Actual charging rate controlled by Voltage Regulator and dependent on battery condition. See Regulator data. When checking generator output, ground 'F' terminal to eliminate regulator action.
Charging Rate Adjustment—See Regulator data. Third brush setting 1 commutator bar minimum, 1 commutator bar plus 1 mica strip maximum, from nearest (insulated) main brush. Setting adjustable by shifting third brush.

Performance Data

Cold			Hot		
Amperes	Volts	R.P.M.	Amperes	Volts	R.P.M.
0	6.4	960	0	6.4	1040
4	6.55	1060	4	6.6	1140
8	6.7	1160	8	6.8	1280
12	6.85	1280	12	6.95	1440
16	7.0	1400	16	7.15	1600
20	7.15	1550	20	7.35	1820
24	7.25	1700	24	7.55	2090
28	7.5	1890	28	7.75	2440
32	7.65	2100	32	7.9	3000
36	7.8	2375	34	8.0	3800
41	8 0	3350			

Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—53 ozs max. (new brushes).
Field Current—1.60-1.78 amperes at 6.0 volts.
Motoring Current—4.85-5 4 amperes at 6.0 volts.
Removal:—Pivot mounted at left front of engine. To remove, take out pivot and clamp bolts.
Belt Adjustment:—Swing generator out until possible belt deflection midway between generator and fan pulleys is ¾" (use straightedge across pulleys).

REGULATOR:—**Auto-Lite VRD-4008B (early cars), VRR-4001A (later).** Cutout Relay and vibrating Voltage Regulator in case on dash. Cutout Relay has extra set of contacts for Generator Teleflash Indicator control.
See article in Electrical Equipment Section for data.
NOTE—Regulator case cover is sealed. Serviced on exchange basis if seals not broken.

Cutout Relay

Cuts In—6.4-7 0 volts, 825 RPM., 9.4 MPH.
Cuts Out—1.5-4.5 amperes (VRD), 6.0 amperes (VRR) maximum discharge current.
Contact Gap—.015" minimum with ground contacts closed (ground contacts must open when main contacts close).
Air Gap—.034-.038" at hinge end of core with contacts open (ground contacts closed).

Voltage Regulator

Setting—7.35-7.65 volts (VRD), 7.1-7.4 volts (VRR) Cold (70°F).

To Check (without breaking seals)—Connect ammeter in charging line at regulator 'B' terminal, voltmeter between this terminal and ground. Operate generator at speed of 30 MPH charging battery until voltage is constant. Voltmeter reading should be within limits of 7.35-7.65 volts (VRD), 7.1-7.4 volts (VRR) at 70°F. See Electrical Equipment Section articles for voltages at other temperatures.

To Adjust (with cover removed)—Change regulator armature spring tension by bending lower spring hanger slightly. See Electrical Equipment Section.

Contact Gap—.010-.020" (VRD), .012" Min. (VRR) (armature against stop pin).

Air Gap—.048-.052" with contacts just opening.

LIGHTING:—**Headlamps**—Hall 'Sealed Beam' type.
See article in Electrical Equipment Section for data.
Headlamp Adjustment—Aim upper beam of each headlamp straight ahead with hot spot centered on horizontal line 3" below lamp center height.
Beam Indicator—Red pilot bulb on speedometer dial. Lighted with Country (upper) beam in use.
Direction Indicator—Std. on 47, Optl. on 44.
See article in Electrical Equipment Section for data.

Switches

Lighting—Cole-Hersee.
Beam Selector—R-B-M Model 2467.
Instrument (47 only)—R-B-M Model 5203.

Bulb Specifications

Position	Candlepower	Mazda No. Sealed Beam
Headlamps		
Side Panel (Parking—see Note)	1½	55
Front Dir. Sig. (see Note)	21-3	1154
Speedometer only (44, 45)	1	51
Instrument & Spdmtr (47)	1½	55
All Indicators	1	51
Electric Clock	1½	55
Stop & Tail (see Note)	21-3	1154
Rear License	3	63
Dome	15	87

NOTE—Direction Indicator (Std. on 47) front bulb replaces Parking bulb in Bonnet Side Panel—rear indicator flashes Stop Lamp filament.

SIGNAL LIGHTS:—Generator Charge and Oil Pressure Indicators Hudson Teleflash Electric type.
See article in Electrical Equipment Section for data.

FUSES:—**Lighting**—20 ampere. Lower fuse on fuse block on lower edge of instrument panel to right of steering column. **Accessory**—20 amperes. Top fuse on fuse block. NOTE—Silver-plated fuses used.
Twin Horns—30 ampere on block on engine dash.
Transmission Overdrive Control—20 amp. On Relay.
Direction Indicator—10 ampere. In case on back of instrument panel near speedometer.
Electric Clock—2 ampere on back of clock.

HORNS:—**Sparton**—Twin, vibrator type, air trumpet horns standard. Operated by relay.
Horn Relay:—R-B-M Model 4790. On horn bracket. **Contacts Close**—3.5-4.5 volts. **Current Draw** ¾ amp.

ENGINE HOOD & SIDE PANELS:—Alligator type. To raise hood, tilt radiator ornament back to release catch and safety latch. Side panels removed by taking out 2 screws on upper edge and 3 screws along lower edge of panel.

SERIAL & ENGINE NUMBER:—First number (50) 2320001, (52) 4320001. Stamped on crankcase at rear of left cylinder block and on left frame side member opposite steering gear.

COMPRESSION:—**Ratio**—6.25-1 Std., 5.75-1 Optl.
Pressure—155 lbs .at 1000 RPM or approximately 105-110 lbs. at cranking speed for Std. head.

VACUUM READING:—Steady 20-21" idling at 7-8 MPH.

IGNITION:—**Coil Model 1115128.** Mounted on dash.
Ignition Current—2.2 amperes idling, 4.4 stopped.
Ignition Switch:—Delco-Remy Model 1116282. Connected to coil by armored cable.
Ignition Lock—Briggs & Stratton No. 45792. Key Series—8000 to 9499. Groove—No. 15.
Distributor Model 1110806. Single breaker, 8 lobe cam, full automatic advance type with vacuum spark control and manual adjustment.
Breaker Gap—.0125-.0175".
Cam Angle or Dwell—31° closed, 14° open (distr.).
Breaker Arm Spring Tension—19-23 ounces.
Rotation—Clockwise viewed from above.
Condenser—Part No. 1869704. Capacity .18-.25 mfd.

Automatic Advance

Distributor		Engine	
Degrees	R.P.M.	Degrees	R.P.M.
Start	500	1	1000
12	2000	24	4000

Vacuum Spark Control 1116020. Integral type (on distributor, linked to breaker plate). Provides additional advance at speeds above idling except when engine accelerated or operated with wide open throttle when spark retarded by return spring within unit. Plunger travel 13/64" maximum

Vacuum Advance

Distr. Degrees	Eng. Degrees	Vacuum (" of HG)
Start	0°	5.5-7.5"
9°	18°	15-18"

Manual Adjustment—Permits 10° advance or retard from center position. See Ignition Timing for adjustment.
Removal:—Distributor mounted between cylinder banks at rear of engine. To remove, disconnect vacuum line, take out two hold-down screws in advance arm, lift out. NOTE—When installing distributor, turn crankshaft to firing position for #1 cylinder, mesh distributor drive gear with slot in upper end of drive shaft offset toward left-hand or rear side of engine (narrow portion of coupling to rear).

IGNITION TIMING:—Setting for 72 octane fuel. See Manual Adjustment (following) for correction dependent on operating conditions and fuel regularly used.

Flywheel Degrees	Piston Position
5° BTDC	.0114" BTDC

Timing (With Synchroscope)—This method recommended by manufacturer. Clip synchroscope lead to #1 sparkplug, direct light on crankshaft pulley, idle engine. Loosen hold-down screw in advance arm, rotate distributor until 'IG/A' mark on pulley (5° before dead center mark 'C.1/6') appears in line with pointer on chain case cover, tighten hold-down screw. Adjust for fuel (see Manual Adjustment).

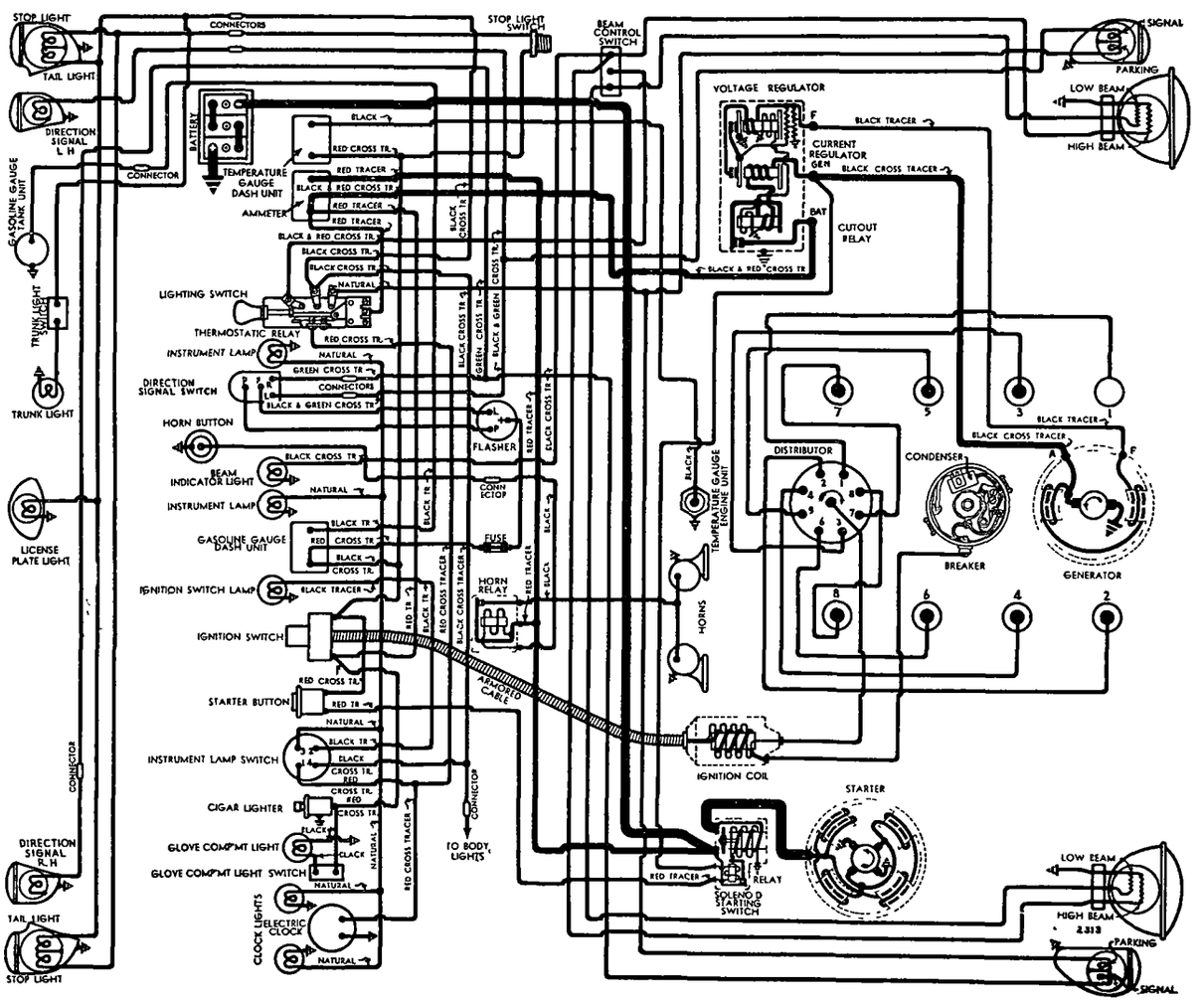
Timing (Without Synchroscope)—Turn engine over to firing position for #1 piston (front piston, left bank) with crankshaft pulley mark 'IG/A' (5° before dead center mark 'C.1/6') lined up with pointer on chain case cover. Loosen hold-down screw in advance arm, center pointer on scale, tighten screw. Loosen advance arm clamp bolt, rotate distributor until contacts begin to open, tighten clamp bolt, check Manual Adjustment.

Manual Adjustment—Should be set for slight ping when accelerating engine with wide open throttle at speeds below 15 M.P.H. To adjust, loosen hold-down screw in advance arm, rotate distributor clockwise (if ping too severe), counter-clockwise (if no ping noted) one graduation at a time until correct performance secured. NOTE—Check engine for faulty spark plugs, excessive carbon deposits, localized hot spots, lean carburetor setting before changing adjustment to correct pinging.

Firing Order:—1-8-7-3-6-5-4-2. See diagram for numbers.

Spark Plugs:—AC No. 104. 10 MM. Metric type. NOTE—These plugs are new small type. Do not tighten excessively (7-10 ft. lbs. tension).
Spark Plug Gaps—.025-.030".

CARBURETION:—**Carburetor**—Carter Model W D O Type 460-S (marked 277 on face of flange). 1¼" dual downdraft type with Carter Climatic Control. *See article in Carburetor Section for data.*
Idle Adjustment—With engine warm and running at slow idle speed (choke valve wide open, fast idle inoperative), set throttle stopscrew for 7-8 MPH idle speed. Adjust idle adjusting screw for each barrel until engine fires smoothly (½-1½ turns out from inner seated position—turn screws in for leaner mixture). Readjust idle speed.
Accelerating Pump—Non-adjustable.
Float Level—⅛" from top of float to gasket seat on cover with needle valve seated (invert to check).
Fast Idle:—Integral type (part of carburetor). *See article in Carburetion Equipment Section.*
Setting—Adjust fast idle screw for .023" throttle opening with choke valve fully closed.



Automatic Choke:—Carter Climatic Control.
See article in Carburetion Equipment Section.
Choke Setting—Set center index mark to coincide with mark on carburetor flange.

Air Cleaner:—AC #1529297 heavy duty oil-bath type.

Fuel Pump:—AC Type AX #1537083. Diaphragm type combination fuel-and-vacuum pump.
See article in Carburetion Equipment Section.

Gasoline Gauge:—AC Electric type. #1515368 (dash unit), #1516155 (tank unit).
See article in Carburetion Equipment Section.

VALVE TIMING:—**To Check**—Intake valve for #1 cylinder (front—left bank) should open with piston on top dead center and mark 'C.1/6' behind crankshaft pulley aligned with pointer on chain case cover.

Tappet Clearance:—None (hydraulic take-up used).
See article in Mechanical Equipment Section for data.

Valve Spring Pressure:—66 lbs. at 1 59/64" (valve closed). 145 lbs. at 1 37/64" (valve open).

LUBRICATION:—**Crankcase Capacity**—7 quarts.
Normal Oil Pressure—25 lbs. at 30 MPH, 15 lbs. idling.

COOLING SYSTEM:—**Capacity**—25 quarts.

Thermostat:—In radiator top tank (operates shutters). Starts to open 153-158° F., fully open 175°. High Reading Thermostat for use with heaters (starts to open 168-173°., fully open 190°).

Temperature Gauge:—AC Electric. #1510773 (dash unit), #1510774 (engine unit).
See article in Mechanical Equipment Section for data.

BATTERY:—**Delco Model 17K-2.** 6 volt, 17 plate, 115 ampere hour capacity (20 hour rate).
Starting Capacity—135 amperes for 20 minutes.
Zero Capacity—300 amperes for 4.3 minutes. Five second voltage—4.38 volts.
Grounded Terminal—Positive (+) terminal.
Engine Ground—Strap connector at right front engine support.
Dimensions—Length 10⅜". Width 7". Height 8⅝".
Location—Under left front floor boards.

Commercial Battery—Delco Model 19Q-1. 6 volt, 19 plate, 122 A.H. Capacity (20 hour rate).
Starting Capacity—140 amperes for 20 minutes.
Zero Capacity—300 amperes for 4.8 minutes. Five second voltage 4.5 volts.
Dimensions—Same as 17K-2 except Height 8 9/16".
Grounded Terminal, Location—See 17K-2 above.

STARTER:—**Model 1107912, 1107913 RHD. Armature No. 820158 (all models).**
Drive—Solenoid pinion shift (overrunning clutch).
Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—24-28 ounces.

Performance Data

Torque	R.P.M.	Volts	Amperes
0 ft. lbs	5500	5.0	60
16 "	Lock	3.0	600

Removal:—Flange mounted on right front face of flywheel housing. To remove, take out flange mounting screws, pull starter forward and remove from below.

Starting Switch:—Solenoid Switch Type 1542 (all). Mounted on starter, controlled through relay (in switch) by Control Switch Type 1996005 on instrument panel.
See article in Electrical Equipment Section for data.

Solenoid Switch Specifications

Closes against 70 lb. pull with ½" air gap drawing 65-71 amperes at 5 volts. Holds switch closed with current draw of 12-14 amperes (hold-in coil only).

Solenoid Relay Specifications

Contacts Close—1.9 volts max. **Open**—1.0-1.2 volts. **Contact Gap**—.035". **Air Gap**—.012".

GENERATOR:—**Model 1102661. Armature No. 1878211.** Two brush type with current-voltage coltrol.
Charging Rate Adjustment—No adjustment at generator. Charging rate controlled by Voltage Regulator and maximum output by Current Regulator.
See Regulator data following.
Maximum Charging Rate—32 amperes min. (hot), 8.0 volts, 2450 RPM, 27 MPH and above with load or discharged battery (Current Regulator setting). Actual charging rate controlled by Voltage Regulator and dependent on battery condition.

Performance Data

	Amperes	Volts	R.P.M.
Cold	30*	8.0	1800

*—Not maximum output—See Current Regulator.
Rotation—Counter-clockwise at commutator end.
Field Current—1.76-1.88 amperes at 6.0 volts.
Brush Spring Tension—25 ounces each.

Removal:—Flange mounted between cylinder banks at front of engine, belt driven in tandem with water pump (separate belt for fan). To remove, take out flange mounting bolts.
IMPORTANT AIR SCOOP NOTE—When installing air scoop on generator, make certain that raised portion provides clearance at terminals and that scoop does not cover drive end oil cup.

Belt Adjustment:—Loosen generator mounting bolts, lift generator up until only slight slack evident in belt (new type belt engages bottom of pulley groove not sides), tighten bolts. Generator pivots on left hand bolt, right bolt hole slotted. NOTE—Fan belt adjustment provided at fan bracket.

REGULATOR:—**Model 1118202. 'Single Core' type.** Vibrating Voltage & Current regulator on dash.
CAUTION—Check generator for grounded fields before changing regulator settings.
See article in Electrical Equipment Section for data.

Cutout Relay

Cuts In—6.2-6.7 volts (hot).
Cuts Out—0-4.0 amperes discharge current.
Contact Gap—.020" (same for both sets).
Air Gap—.020" (with points just closed).

Voltage Regulator

Setting—7.4-7.8 volts (70° F.), 7.2-7.4 volts (hot). Regulator over-compensated for temperature.
To Check—Connect ammeter in charging line at 'BAT' regulator terminal, voltmeter between 'BAT' terminal and ground. Operate generator at 2450 RPM, adjust charging rate to 8-10 amperes (use variable rheostat or 'AVR' set). With regulator at hot operating temperature, retard generator speed until cut-out relay points open, then increase generator speed to 2450 RPM and check hot voltage setting (above).
To Adjust—Change regulator armature spring tension slightly by bending lower spring hanger for **light (left) spring (or one spring if both alike) only.** If further adjustment required, see Single Core Regulator article in Electrical Equipment Section for Heavy (or other spring) adjustment.
Air Gap—.070" between center of core and armature with contacts just closed.

Current Regulator

Setting—32-34 amperes (hot).
To Check—Remove cover, connect short jumper from voltage regulator frame to upper contact support bracket (shorting out Voltage Regulator). Connect ammeter in charging line at 'BAT' regulator terminal. Turn on lights and accessories, operate generator and increase speed until output remains stationary (run until hot). Check setting with regulator at operating temperature.
To Adjust—Change regulator armature spring tension slightly by bending lower spring hanger for **one spring.** If further adjustment required see Single Core Regulator article in Electrical Equipment Section for adjustment of other spring.
Air Gap—.075" (check same as Voltage Regulator).

LIGHTING:—**Headlamps**—Guide 'Sealed Beam' type.
See article in Electrical Equipment Section for data.
Headlamp Adjustment—Aim upper beam straight ahead with center of hot spot 3" below lamp center height.
Beam Indicator—On speedometer face. Lighted whenever Country (upper) beam in use.
Direction Signal—*See Electrical Equipment Section.*

Switches

Lighting—Delco-Remy 1995010.
Beam Selector—Delco-Remy 1997002.

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps		Sealed Beam
Front Indic. & Park	21-3	1154
Instr., Clock, Radio	1.5	55
Glove & Trunk Comp't	1.5	55
Beam Indicator, Ign. Lock	1	51
Stop & Tail	21-3	1154
*Rear Indicator (Early)	21-3	1154
*Rear Indicator (Later)	32	1133
License Plate	3	63
Dome & Quarter	15	87

*—When replacing Rear Indicator Bulb use same type bulb as formerly used (1154 double contact—1133 single contact) in order for circuit to function properly.

THERMOSTATIC RELAY:—**Delco-Remy.** On lighting switch. Contacts remain closed with 30 amperes, open in 3 minutes with 42 ampere load at 70° F. Non-adjustable type.

FUSES:—**Direction Signal**—9 ampere. In Flasher lead under instrument panel.
Fog Lights—20 ampere. On switch.
Radio & Under Seat Heater—14 amperes each.

HORNS:—**Delco-Remy Model K-33-H.** No. 1999501, 519 (low note), 1999502, 520 (high note). Vibrator type, blended tone, operated by horn relay. Horn set 1999501 & 502 used on early cars.

Type	Current (at 6 volts)	Air Gap
1999501 (Low)	16-18 amperes	.044-.049"
1999502 (High)	15-17 amperes	.034-.039"
1999519 (Low)	19-21 amperes	.044-.049"
1999520 (High)	18-20 amperes	.034-.039"

Horn Relay:—Delco-Remy Model 1116775.
Contact Gap—.020". **Air Gap**—.015" (closed).
Contacts Close—2.75-4.0 volts.

ENGINE HOOD NOTE:—Latch is same type used on previous models (turn radiator ornament to free latch).

SERIAL & ENGINE NUMBER:—Stamped on top of clutch housing and on left side of front frame cross-member.

COMPRESSION:—**Ratio**—7.2-1 aluminum alloy head. **Pressure**—110 lbs. at cranking speed of 100 RPM.

VACUUM READING:—18-20" steady idling at 6 MPH.

IGNITION:—**Coil No. H-12024.** (2 coils in single case, part of ignition unit assembly). Mounted on distributor.

Ignition Current—Approx. 3.2 amperes idling, 4.2 stopped (per coil). Ignition primary circuit resistance 1.0-1.33 ohms.

Resistor Unit—One unit connected in each coil primary circuit (2 used). Mounted on Lighting Circuit Breaker Assembly No. 06H-11624.

Ignition Switch:—Oakes Steering Column & Ignition Lock Assembly No. 302099, Ford No. 06H-3676A (Std.); 302131, Ford No. 06H-3676B (Custom); 302180, Ford No. 06H-3676C (Contl. Cabr.). Ignition Switch No. 302136 (Std.), 302137 (Custom), 302182 (Contl. Cabr.).

Lock Cylinder—Hurd. Ford No. 91A-3686A (Std.), 06H-3686 (Custom & Contl. Cabr.) with keys.

Key Series—H000 to H999.

Distributor Model No. H-12127 (less coil, distributor caps and plates). Double breaker, 6 lobe cam, full automatic advance type with Vacuum Brake control (see Ignition Timing). Same design as used on previous Lincoln-Zephyr models.

Firing Interval—Movable contacts open 37½° after fixed set. Unequal 37½° and 22½° intervals (corresponding to 75° and 45° of crankshaft rotation) caused by 75° included angle between banks.

Breaker Gap—.014-.016" (both sets equal).

Cam Angle or Dwell—36.5° closed, 23.5° open (each set—operate independently).

Breaker Arm Spring Tension—20-24 ozs.

Rotation—Clockwise viewed from drive end.

Condenser—No. H-12300 (2 used). Cap. .30-.34 mfd.

Automatic Advance
(High Vacuum or Vacuum Brake Inoperative)

Distributor Degrees	R.P.M.	Engine Degrees	R.P.M.
Start	200	0	400
2	300	4	600
3	375	6	750
4	480	8	960
6	720	12	1440
8	950	16	1900

Distributor Removal:—Mounted on front of engine. Remove generator, disconnect vacuum line and primary leads, remove distributor cap, take out 3 capscrews in mounting flange.

IGNITION TIMING:—See Vacuum Brake Setting below.

	Flywheel Degrees	Piston Position
All Engines	4° BTDC	.0058" BDTC

Timing & Synchronizing Note—Manufacturer recommends use of Stroboscope or V-126 Timing Fixture for both operations. See 1937 Lincoln-Zephyr 'T&E' page for Timing Fixture data. No flywheel marks of other means provided to synchronize distributor on engine.

Timing (On Engine)—With #2 piston on top dead center (starting power stroke), loosen adjusting screw on right side of ignition unit housing, move screw down to bottom of slot, then move screw up slowly until left hand (fixed contacts) begin to open, note graduation on plate under screw head in line with reference mark on housing, move screw up one additional graduation and tighten (this provides 4° BTDC. timing).

Synchronization (Movable Contacts)—No means provided for synchronization on engine (see note above). If Stroboscope, Timing Fixture, etc. used, set movable contacts to open exactly 37½° (distributor rotation) after fixed set. To adjust, remove timing adjusting screw and plate on side of housing, turn eccentric adjusting screw (visible in slot).

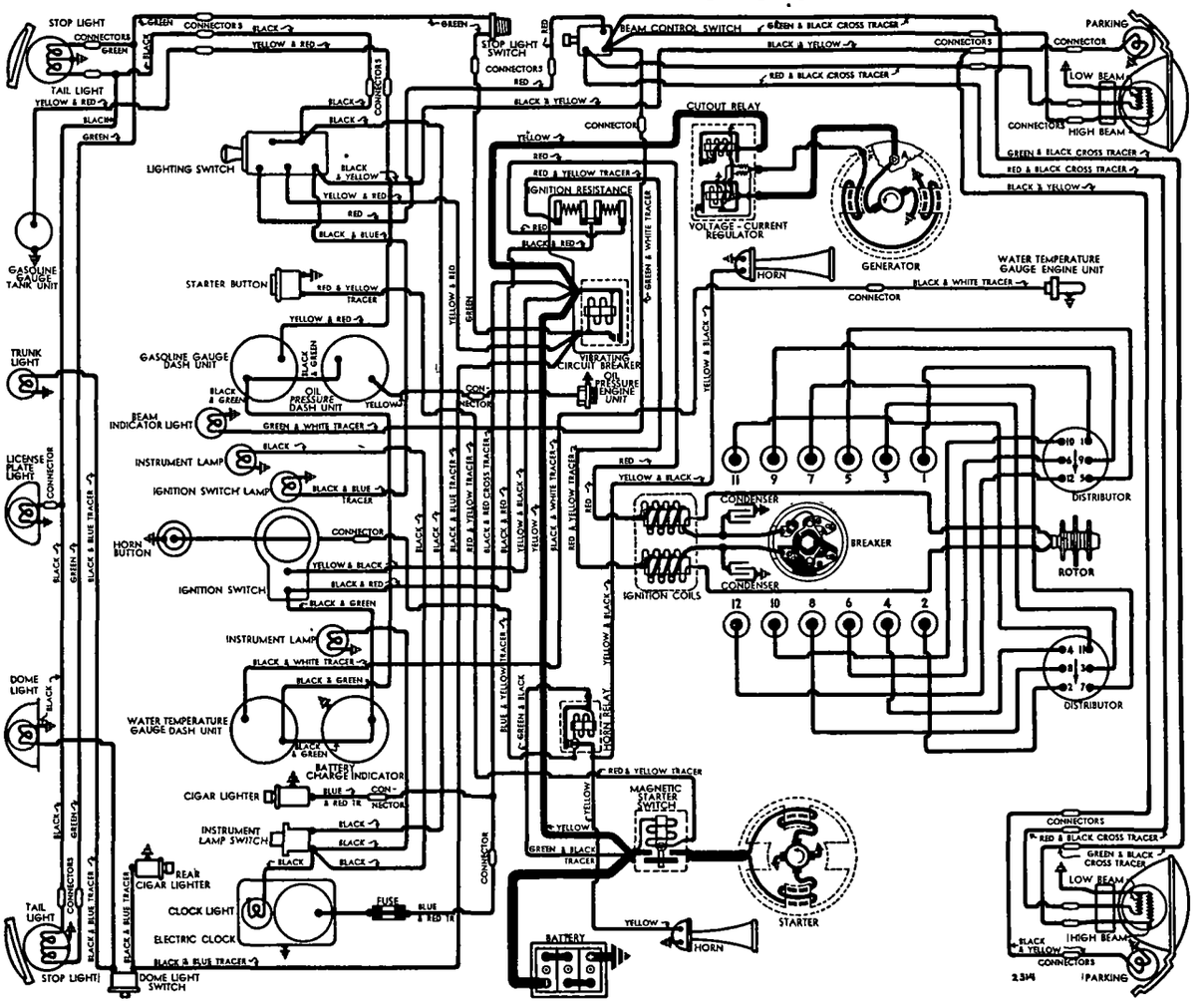
Vacuum Brake Setting:—Should be set for best performance with particular fuel and operating conditions. To adjust, loosen locknut and back off adjusting screw until engine pings when accelerated, then turn screw in just enough to eliminate this ping, tighten locknut. When adjusted on Stroboscope, vacuum brake should retard spark so that automatic advance is 2° (distr.) at 950 RPM. or 38 MPH. with no vacuum to release brake.

Firing Order:—1-4-9-8-5-2-11-10-3-6-7-12. See diagram for cylinder numbering and spark plug distributor connections.

Spark Plugs:—Champion Type H-10. 14 MM. Metric. **Spark Plug Gaps**—.028-.030".

CARBURETION:—**Carburetor**—Chandler-Groves Model AA-1, Ford No. 06H-9510. New larger (1") dual, downdraft type.
See article in Carburetor Section for data.

Idle Adjustment—With engine warm, choke valve wide open and Fast Idle inoperative, set throttle lever stopscrew for 6 M.P.H. idle speed. Turn each idle adjusting screw (one for each barrel, adjust in succession) in until engine begins to miss, then out until engine begins to roll, finally turn screw in slowly until engine fires smoothly. Final setting should be approximately ⅞ turn out from the inner seated position. Re-adjust throttle stopscrew for correct idle speed.
NOTE—Manufacturer recommends use of vacuum gauge for idling adjustment. Set for highest steady reading of gauge.



Accelerating Pump Adjustment—Three holes provided in throttle lever for pump link connection. Adjust for seasonal requirements as follows:
Inner (#1)—Min. stroke, Summer temperatures.
Center (#2)—Med. stroke, Winter temperatures.
Outer (#3)—Max. stroke, Extreme cold weather.
NOTE—Pump link locked in pump rod by snap lock. Pull link shaft out of pump rod to disengage lock.

Fast Idle:—Integral with carburetor. Operated by choke lever. No adjustment required.

Air Cleaner:—Oil-wetted type Std., Heavy duty oil-bath type Optl.

Gasoline Gauge:—King-Seeley Electric. Ford No. Dash Unit—06H-9280-A (except Contl.), 06H-9280-B (Contl.). Tank Unit—No. 01T-9275 (all models).
See article in Carburetion Equipment Section.

Fuel Pump:—AC Type R. #1523307. Ford No. 68-9350.
See article in Carburetion Equipment Section.

VALVE TIMING:—To Check. No flywheel marks provided. If dead center position for any cylinder established on flywheel, intake valve for this cylinder should open approximately 3.24 teeth before this point with piston .0389" before top dead center.

Tappet Clearance:—None (hydraulic type lifters).

Valve Spring Pressure:—51-57 lbs. at 2.13" (valve closed), 111-121 lbs. at 1.84" (valve open).

LUBRICATION:—Crankcase Capacity—5 quarts.

Normal Oil Pressure—40-45 lbs. at 2000 RPM.

Oil Pressure Gauge:—King-Seeley Electric. Ford No. Dash Unit—06H-9273-A (except Contl.), 06H-9273-B (Contl.), Engine Unit—No. 48-9278 (all models).
See article in Mechanical Equipment Section for data.

COOLING SYSTEM:—Capacity—27 quarts.

Thermostat:—In outlet hose for each bank (2 used). Starts to open at 145° F. Fully open at 180° F.

Temperature Gauge:—King-Seeley Electric. Ford No. Dash Unit—06H-10883-A (except Contl.), 06H-10883-B (Contl.). Engine Unit—No. 99A-10884 (all models).
See article in Mechanical Equipment Section for data.
NOTE—Gauge reads 212° (hot) when turned off.

BATTERY:—Ford No. 06H-10655-A. 6 volt, 17 plate, 120 ampere hour capacity (20 hour rate).

Starting Capacity—150 amperes for 20 minutes.

Zero Capacity—300 amperes for 4.0 minutes.

Grounded Terminal—Positive (+) grounded to cylinder head stud of right hand bank.

Location—On right side in engine compartment.

Dimensions—Length 10.6". Width 7.3". Height 9.2".

Battery Indicator:—King-Seeley. Voltmeter type. Ford No. 06H-10844-A (except Contl.), 06H-10844-B (Contl.).
See article in Electrical Equipment Section for data.

STARTER:—Ford No. 18-11002. Armature No. 18-11005.

Drive—Inboard Bendix No. L11FX-10. Ford No. B-11350.

Rotation—Counter-clockwise at commutator end.

Brush Spring Tension—2 lbs. each.

Cranking Engine—100 RPM., 190-215 amperes.

Performance Data

Torque	R.P.M.	Volts	Amperes
4 ft. lbs.	1070	4.6	200
8 "	660	4.3	340
12 "	300	3.65	465
14 "	Lock	3.5	500

Starting Switch:—R-B-M Model 5604, Ford No. 78-11450 magnetic switch mounted on dash and controlled by pushbutton on instrument panel, R-B-M 3243, Ford No. 06H-11500-A (Std.); 3244, Ford No. 06H-11500-B (Custom).

Removal:—Starter mounted on right front face of flywheel housing. To remove, take off pan at right of engine, take out through-bolts on commutator end plate.

GENERATOR:—Ford No. 01A-10000. Armature No. 01A-10005. Two brush (shunt) type with vibrating type voltage and current regulation. Ventilated by fan on drive pulley.

Charging Rate Adjustment—No adjustment. See Regulator data below.

Maximum Charging Rate—Controlled by regulator and dependent on battery condition and load. To check generator output, disconnect generator field lead at generator, connect both generator terminals together (use short insulated wire). Use 'BRS' set or rheostat connected across battery terminals and apply load until voltage is exactly 6 volts. Connect ammeter in charging line, run engine at approximately 1000 RPM., check output at 3 speeds given in performance table below. Restore original connections after completing test. **Do not operate generator in service with both terminals connected together. This eliminates all regulator action and will damage generator.**

Performance Data

Amperes	Engine R.P.M.
Start	400
32	1100
32	3000

Rotation—Counter-clockwise at commutator end.

Field Current—2.86 amperes at 6.0 volts (field resistance 2.1 ohms at 70° F.).

Brush Spring Tension—Approximately 28 ozs.

Removal:—Generator mounted on bracket between cylinder banks at front of engine, driven in tandem with water pumps by Vee belt. To remove, loosen nut on bracket stud.

Belt Adjustment:—Loosen nut on bracket mounting stud, raise generator up until side movement on belt midway between generator and water pump pulleys is 1" (thumb and finger pressure).

REGULATOR:—Ford No. 01A-10505-A3. Vibrating type Voltage-Current Regulator with Cutout Relay in case on dash. NOTE—Regulator mounted on rubber cushions and grounded through separate ground wire attached to case. Regulator case is sealed and no adjustments can be made.

Cutout Relay

Cuts In—6.2-6.5 volts (Cold or 60-80°), 400 Eng. RPM.

Cuts Out—5.5 amperes max. (Cold 60°), 1.7 amperes (Hot 180°)—*see Regulator article in Electrical Equipment Section for specifications at other temperatures.*

Voltage-Current Regulator

Voltage Setting—7.2-7.65 volts (Cold 60°), 6.825-7.2375 volts (Hot 180°). Over-compensated for temperature.

Current Setting—32 amperes.

Regulator Checking & Adjustment—*See Ford Regulator article in Electrical Equipment Section for complete testing directions.* No adjustments can be made as regulator case is sealed.

LIGHTING:—Headlamps—Ford Sealed Beam type. Controlled by switch on instrument panel and Beam Selector switch on toeboard.
See article in Electrical Equipment Section.

Headlamp Adjustment—Aim upper beam of each headlamp straight ahead with hot spot centered on horizontal line 3" below lamp center height.

Beam Indicator—Red jewel on instrument panel directly above speedometer. Lighted when upper beams in use.

Switches

Lighting—R-B-M Model 2440, Ford No. 06H-11654 (all models). Light Switch Knob Ford No. 06H-11661-A (Std.), 06H-11661-B (Custom).

Beam Selector—R-B-M Model 2480, Ford No. 06H-11653 (with Horn Wiring), 06H-13532 (switch only).

Instrument—Ford No. 06H-13740-A (Std.), 06H-13740-B (Custom).

Dome Light—Ford No. B-13752-A.

Stop Light—Ford No. 91A-13480 (hydraulic type).

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps	...	Sealed Beam
Parking	1.5	55
Instrument	1 5	55
Beam Indicator	1	51
Stop & Tail	21-3	1158
License Plate	3	63
Dome	6	81

LIGHTING CIRCUIT BREAKER:—R-B-M Model 6720, Ford No. 06H-11624. Combined with Ignition Resistor assembly on block on dash under left side of cowl. Combination thermostatic and wound-coil type. Contacts open with current of 50 amperes and current continues to flow through winding, which is connected across the contacts, resulting in rapid vibrating action.

FUSES:—Clock—3 amperes. In clock lead.

HORNS:—Air electric type dual horns. Ford No. 06H-13832 (Right Hand—high note), 06H-13833 (Left Hand—low note). Horns operated by horn relay

Horn Current—24-28 amperes (total).

Horn Relay:—R-B-M Model 4750, Ford No. 96H-13842.
Contact Closing Voltage—3.5-4 5 volts.
Current Draw—Approximately ¾ ampere.

ENGINE HOOD NOTE:—To raise hood, release latch by pulling up on latch handle on front of hood at center, press in on button in upper edge of grille to release secondary (safety) catch. Safety catch button concealed by latch handle in closed position.

SERIAL & ENGINE NUMBER:—Stamped on top of clutch housing and on left frame side member near generator.

COMPRESSION:—**Ratio**—6.3-1 Std. Cast iron hd.
Pressure—100 lbs. at cranking speed of 100 RPM.

VACUUM READING:—Steady 18-20" at 5-7 MPH.

IGNITION:—**Coil Model 78-12024-A** (part of ignition unit assembly). Mounted on top of distributor.
Resistor Unit—Connected in coil primary circuit. Mounted on Circuit Breaker Assembly No. 01A-12250.
Ignition Current—4½-6 amperes (engine stopped). Ignition primary circuit resistance 1-1⅓ ohms.

Ignition Switch:—Oakes Steering Column & Ignition Lock Assembly No. 302142, Ford No. 09A-3676. Ignition Switch No. 302159.
Lock Cylinder—Hurd or Briggs & Stratton No. 8500, Ford No. 99A-3686 (with keys).
Key Series—FK000 to FK999. **Groove**—No. 17.

Distributor Model 78-12127. (Less coil, distributor caps, and distributor plates). Double breaker, 8 lobe cam, full automatic advance type with Vacuum Brake Control (see Ignition Timing for adjustment). Same design as used on preceding V8 models.
Breaker Gap—.014-.016" (both sets). Use special two step feeler—.014" step 'go', .016" step 'no go'.
Cam Angle—36° closed, 9° open. For both sets operating together with correct coil-loading lead.
Breaker Arm Spring Tension—20-24 ozs.
Rotation—Clockwise viewed from drive end.
Condenser—No. 78-12300. Capacity .33-.36 mfd.

Automatic Advance
(High Vacuum or Vacuum Brake Inoperative)

Distributor Degrees	R.P.M.	Engine Degrees	R.P.M.
Start	200	0	400
2	325	4	650
3	425	6	850
5	825	10	1650
8	1500	16	3000

Removal:—Ignition unit mounted on front of engine. To remove, disconnect vacuum line, take off caps, take out screws in mounting flange.

IGNITION TIMING:—For each engine as follows (see Vacuum Brake Setting below for adjustment depending on type of service and fuel used).

	Flywheel Degrees	Piston Position
All Engines	4° BTDC	.0058" BTDC.

Timing Note—Manufacturer recommends use of Laboratory Test Set with Stroboscope attachment or V-126 Timing Fixture for all ignition settings.
Timing (On Engine)—No flywheel marks provided and timing should be set with piston on top dead center. With #1 piston on top dead center entering power stroke, loosen timing adjusting screw on left hand side of ignition unit housing, place screw in retard position at lower end of slot, move screw slowly up until timing contacts begin to open, note graduation on plate under screw head which is in line with reference mark on housing, move screw up exactly one additional graduation, tighten screw. NOTE—Dead center position can be determined by inserting gauge rod in cylinder or by measuring to tops of #2 and #3 pistons (should be equal).

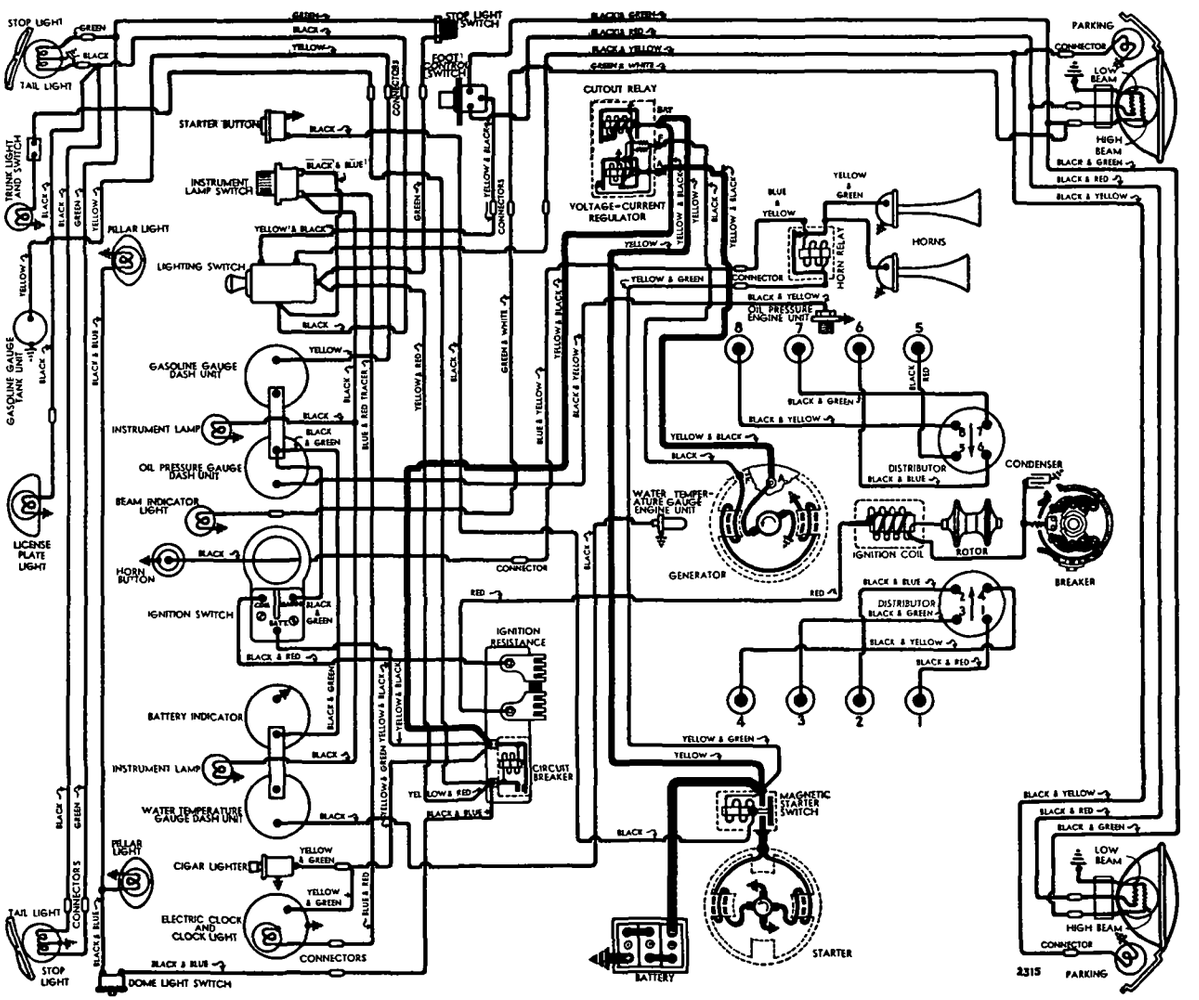
Vacuum Brake Setting:—Should be adjusted to eliminate pinging when engine operated with load. To adjust, loosen locknut, back of adjusting screw until engine pings with load, turn screw in just enough to eliminate ping, tighten locknut. When adjusted on Stroboscope, vacuum brake should retard spark so that automatic advance is 2° (distr.) at 950 R.P.M. or 38 M.P.H. with no vacuum.

Firing Order:—1-5-4-8-6-3-7-2. See diagram.

Spark Plugs:—Champion Type H-10. 14 MM. Metric.
Spark Plug Gaps—.025".

CARBURETION:—**Carburetor**—Chandler-Groves Model AA-1, Ford No. 91A-9510-A. Dual, downdraft type.
See article in Carburetor Section for data.

Idle Adjustment—With engine warm, choke valve wide open, and Fast Idle inoperative, set throttle lever stopscrew for 5-7 MPH. idling speed, turn each idle adjusting screw (one for each barrel, adjust in succession) in until engine begins to miss, then out until engine begins to roll, finally turn screw in until engine fires smoothly. Final setting should be approximately ⅝-⅞ turn of screw from inner seated position. Readjust stopscrew for correct idling speed of 5-7 MPH. or 350 RPM.
NOTE—Vacuum gauge recommended for idling adjustment. Set for highest steady gauge reading.
Float Level—1 3/32-1 11/32" from bottom of float to face of cover with valve seated (invert to check). Fuel level 21/32-23/32" below top edge of bowl.
Accelerating Pump Setting—Three holes provided for pump link connection as follows:
Inner (#1)—Min. stroke, Summer Temperatures.
Center (#2)—Med. stroke, Winter Temperatures.
Outer (#3)—Max. stroke, Extreme Cold Weather.
NOTE—Link locked in pump rod by snap-lock. Pull link shaft out of pump rod to disengage this lock.



Fast Idle:—Integral with carburetor. Operated by choke valve lever. No adjustment required.

Air Cleaner:—AC #1529224, Ford No. 91A-9600-A oil-wetted type Std. Heavy Duty oil-bath type Optl.

Gasoline Gauge:—King-Seeley Electric. Ford No. 09A-9280 (Dash Unit), No. 99A-9275-B (Tank Unit).
See article in Carburetion Equipment Section.

Fuel Pump:—AC Type R. #1523307, Ford No. 68-9350. Diaphragm type.
See article in Carburetion Equipment Section.

VALVE TIMING:—To Check Timing. No flywheel marks or other means provided to check timing. If dead center position for piston #1 is established on flywheel, intake opening for this cylinder should occur with piston on top dead center and flywheel mark at dead center point.

Tappet Clearance:—.0125-.0135" all valves. Not adj.

Valve Spring Pressure:—37-40 lbs. at 2.13" (valve closed), 76-80 lbs. at 1.84" (valve open).

LUBRICATION:—Crankcase Capacity—5 quarts.

Normal Oil Pressure—30 lbs. at 2000 RPM.

Oil Pressure Gauge:—King-Seeley Electric. Ford No. 09A-9273 (Dash Unit), No. 48-9278 (Engine Unit).
See article in Mechanical Equipment Section for data.

COOLING SYSTEM:—Capacity—22 quarts.

Thermostat:—In each cylinder head outlet (2 used). Starts to open at 145° F. Fully open at 180° F.

Temperature Gauge:—King-Seeley Electric. Ford No. 09A-10883 (Dash Unit), No. 99A-10884 (Eng. Unit).
See article in Mechanical Equipment Section for data.
NOTE—Gauge reads 212 (Hot) with ignition off.

BATTERY:—Ford No. 01A-10655-A. 6 volt, 17 plate, 120 ampere hour capacity (20 hour rate).

Starting Capacity—150 amperes for 20 minutes.

Zero Capacity—300 amperes for 4.0 minutes.

Grounded Terminal—Positive (+) grounded to dash.

Engine Ground—Strap connector between right rear cylinder head and dash.

Dimensions—Length 10.6". Width 7.3". Height 9.2".

Location—On right side in engine compartment.

Battery Indicator:—King-Seeley. Voltmeter type. Ford No. 09A-10844.
See article in Electrical Equipment Section for data.

STARTER:—Ford No. 18-11002. Armature No. 18-11005.

Drive—Inboard Bendix No. L11FX-10. Ford No. B-11350.

Rotation—Counter-clockwise at commutator end.

Brush Spring Tension—2 lbs. each.

Cranking Engine—100 RPM., 190-215 amperes.

Performance Data

Torque	R.P.M.	Volts	Amperes
4 ft. lbs.	1070	4.6	200
8 "	660	4.3	340
12 "	300	3.65	465
14 "	Lock	3.5	500

Starting Switch:—R-B-M Model 5604, Ford No. 78-11450. Magnetic Switch mounted on dash and controlled by pushbutton on instrument panel R-B-M No. 3239, Ford No. 09A-11500.

Removal:—Starter mounted on right front face of flywheel housing. To remove, take off pan at right of engine, free starter-to-oil pan support bracket, take out through-bolts on commutator end plate.

GENERATOR:—Ford No. 01A-10000. Armature No. 01A-10005. Two brush (shunt) type with vibrating type voltage and current regulation. Ventilated by fan on drive pulley.

Charging Rate Adjustment—No adjustment. See Regulator data below.

Maximum Charging Rate—Controlled by regulator and dependent on battery condition and load. To check generator output, disconnect generator field lead at generator, connect both generator terminals together (use short insulated wire). Use 'BRS' set or rheostat connected across battery terminals and apply load until voltage is exactly 6 volts. Connect ammeter in charging line, run engine at approximately 1000 RPM., check output at 3 speeds given in performance table below. Restore original connections after completing test. **Do not operate generator in service with both terminals connected together. This eliminates all regulator action and will damage generator.**

Performance Data

Amperes	Engine R.P.M.
Start	400
32	1100
32	3000

Rotation—Counter-clockwise at commutator end.

Field Current—2.86 amperes at 6.0 volts (field resistance 2.1 ohms at 70° F.).

Brush Spring Tension—Approximately 28 ozs.

Removal:—Generator mounted on bracket between cylinder banks at front of engine, driven in tandem with water pumps by Vee belt. To remove, loosen nut on bracket stud.

Belt Adjustment:—Loosen nut on bracket mounting stud, raise generator up until side movement on belt midway between generator and water pump pulleys is 1" (thumb and finger pressure).

REGULATOR:—Ford No. 01A-10505-A. Vibrating type Voltage-Current regulator with Cutout Relay in case on dash. NOTE—Regulator mounted on rubber cushions and grounded through separate ground wire attached to case. Regulator case is sealed and no adjustments can be made.

Cutout Relay

Cuts In—6.2-6.5 volts (Cold or 60-80°), 400 Eng. RPM.

Cuts Out—5.5 amperes max. (Cold 60°), 1.7 amperes (Hot 180°)—*see Regulator article in Electrical Equipment Section for specifications at other temperatures.*

Voltage-Current Regulator

Voltage Setting—7.2-7.65 volts (Cold 60°), 6.825-7.2375 volts (Hot 180°). Over-compensated for temperature.

Current Setting—32 amperes.

Regulator Checking & Adjustment—*See Ford Regulator article in Electrical Equipment Section for complete testing directions.* No adjustments can be made as regulator case is sealed.

LIGHTING:—Headlamps—Ford Sealed Beam type. Controlled by switch on instrument panel and Beam Selector switch on toeboard.
See article in Electrical Equipment Section.

Headlamp Adjustment—Aim upper beam of each headlamp straight ahead with hot spot centered on horizontal line 3" below lamp center height.

Beam Indicator—Red jewel on instrument panel directly above speedometer. Lighted when upper beams in use.

Switches

Lighting—R-B-M Model 6425. Ford No. 01A-11654 (this switch now mounted on instrument panel). Light Switch Knob & Insert Ford No. 09A-11661.

Beam Selector—R-B-M Model 2480. Ford No. 81A-13532.

Instrument—Ford No. 09A-13740-A.

Stop Light—Ford No. 91A-13480.

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps	Sealed Beam	
Parking	1.5	55
Instrmt., Beam Ind.	1	51
Stop & Tail	21-3	1158
Pillar	3	63
License Plate	3	63

LIGHTING CIRCUIT BREAKER:—R-B-M Model 6700, Ford No. 01A-12250. Combined with Ignition Resistor on block on dash under cowl. Combination thermostatic and wound-coil type. Contacts open with current of 50 amperes. Current continues to flow through winding which is connected across the contacts resulting in rapid vibrating action.

HORNS:—Air Eletcric type dual horns. Ford No. 91A-13832 (high note), 91A-13833 (low note).

Horn Current—24-28 amperes (total).

Horn Relay:—R-B-M Model 4700, Ford No. 91A-13842.

Contact Closing Voltage—3.5-4.5 volts.

Current Draw—Approximately ¾ ampere.

NOTE:—Engine hood hinged at cowl and lifts from forward end. Hood latch handle located at lower edge of radiator grille (safety catch at top of grille).

SERIAL NUMBER:—First number R-340000. Stamped on plate on right frame side member under hood.

SERVICE SERIAL NUMBER:—First number N6-31500. On 'Caution Plate' on left front door hinge post.

ENGINE NUMBER:—First number E-339500. On engine block on right side at front. NOTE—Engine Number is 500 less than Serial Number on same car.

COMPRESSION:—Ratio—6.0-1 std. cast-iron head.
Pressure—125 lbs. at 350 RPM or approx. 100 lbs. at cranking speed of 160 RPM.

VACUUM READING:—Steady 18-20" idling at 7-8 MPH.

IGNITION:—Coil Model CE-4025-A (2 used). Coils mounted on right side of engine.
Ignition Current—2 amperes idling, 4 amperes stopped (for each coil).

Ignition Switch:—Oakes Steering Column and Ignition Lock No. 302074. Ignition Switch No. 301538.
Ignition Lock—Briggs & Stratton. B & S No. 80207. Key Digits—5 digits. Groove—No. 1.

Distributor Model IGE-4019A. 'Twin Ignition' double breaker, 6 lobe cam, full automatic advance type with Torquematic Spark Control. Contacts open simultaneously to fire both spark plugs in each cylinder at the same instant and must be synchronized (see Ignition Timing).
Breaker Gap—Set at .020".
Cam Angle or Dwell—35° closed, 25° open (distr.). For each set of contacts (operate independently).
Breaker Arm Spring Tension—17-20 ounces.
Rotation—Counter-clockwise viewed from above.
Condenser—No. IG-2671 (2 used). Cap. .20-.25 mfd.

Automatic Advance

Distributor Degrees	Distributor R.P.M.	Engine Degrees	Engine R.P.M.
Start	275	0	550
3	370	6	740
7	500	14	1000
9	665	18	1330
11.5	875	23	1750

Torquematic Spark Control—Consists of cable anchored at dash and connected to distributor body by a travel limiting spring. Retards distributor through engine movement caused by torque action. Maximum retard 2½° (engine movement in excess of of 2½° taken up by travel limiting spring). See Ignition Timing for setting.

Removal:—Mounted on right side of engine. To remove, take out hold-down screw in advance arm, disconnect torquematic control, lift distributor off.

IGNITION TIMING:—Setting for all engines as follows:

Flywheel Degrees	Piston Position
6° BTDC	.0150" BTDC

To Set Timing—Car manufacturer recommends use of Nash Timing Light SE-569. Synchronize breaker points (see Synchronization following). With Timing Light connected as for Synchronization (see below), slacken torquematic cable by loosening locknuts on anchor bracket at dash. With #1 piston on compression, turn engine over until piston is 6° or .0150" BTDC, stop when 'IGN' mark on vibration dampener lines up with pointer on chain case cover (this mark is 6° or 23/64" before top dead center mark 'DC'). Loosen advance arm clamp bolt, rotate distributor until points just break (lights go on) with stop pin (hold-down bolt and nut) in advance position in slot in advance arm, tighten clamp bolt. Adjust cable locknuts at anchor bracket on dash to leave torquematic cable without slack or tension and stop pin in advance position in slot.

Synchronization—Use Nash Timing Light SE-569 (consists of two lights—one for each set of contacts) connected between each primary terminal and ground. Turn on ignition, turn engine over until fixed points just open (light for stationary contacts on). If both lights go on, synchronization correct. If not, loosen 3 lockscrews on movable subplate, shift plate by prying with screwdriver in notch on edge of plate until this set of contacts begin to open (both lights on), tighten sub-plate lockscrews, and set Ignition Timing as directed above. If other methods used, set contacts to open simultaneously at 60° (distributor) intervals.

Torquematic Spark Control Check—Distributor must be free in bracket and cable pulleys positioned to prevent cable interference with engine. Advance spring and cable take-up spring must be properly located and spring resistance centralized. Car manufacturer recommends use of Nash Synchro Light SE-417 to check torquematic retard by means of dead center mark on vibration dampener.

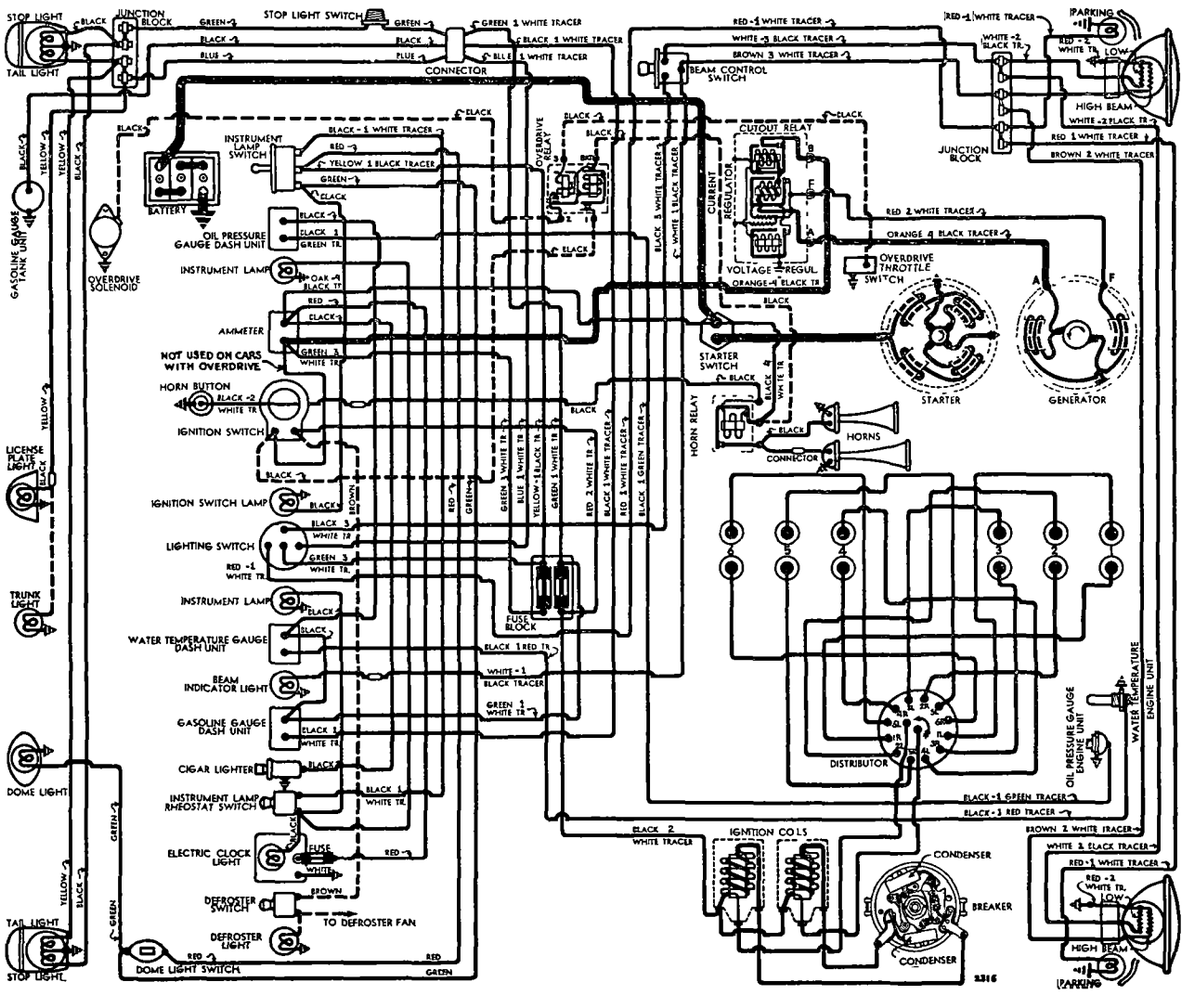
Motor Gauge—Weidenhoff Adapter #113, Rod #37.

Firing Order:—1-5-3-6-2-4. See diagram for spark plug cable connections on distributor cap.

Spark Plugs:—AC No. 45. 14 MM Metric type.
Spark Plug Gaps—Set at .025". Limits .023-.027".

CARBURETION:—Carburetor—Carter Type WA-1, Model 435-S (#253 cast on face of flange). Single barrel, 1¼" downdraft type.
See article in Carburetor Section for data.

Idle Adjustment—With engine warm and running at slow idle speed (choke valve wide open, fast idle inoperative), set throttle stopscrew for 7-8 MPH idle speed. Adjust idle adjusting screw until engine fires smoothly (¾-1½ turns open—turn screw in for leaner mixture). Readjust idle speed.



Accelerating Pump Setting—Pump arm under dust cover at top of carburetor has three holes for pump link engagement. Set as follows
Upper Hole (max stroke)—Cold weather
Lower Hole (med stroke)—Moderate weather.
Inner Hole (min stroke)—Hot weather.
Float Level—3/8" from projection on cover to top of soldered seam at front end of float with needle valve seated (invert to check).

Fast Idle:—Integral type (built-in carburetor).
See article in Carburetion Equipment Section.

Fast Idle Setting—Part of Climatic Control Adjust by bending connecting link offset for 5/8" choke valve opening with stopscrew against (not on) first step of fast idle cam.

Automatic Choke:—Carter Climatic Control.
See article in Carburetion Equipment Section.

Choke Setting—Set thermostatic coil housing 2 Notches Rich.

Air Cleaner:—AC #1529112 oil-wetted type std.

Fuel Pump:—AC Type W #1523642 diaphragm type std. Type AD #1523643 combination fuel-and-vacuum pump optional.
See articles in Carburetion Equipment Section.

Gasoline Gauge:—King-Seeley Electric type. K-S No 7680 (dash unit), No 7780 (tank unit).
See article in Carburetion Equipment Section.

VALVE TIMING:—**To Check**—With regular running tappet clearance of .015", exhaust valve should close with piston 5° or 0104" after top dead center.

Motor Gauge—Weidenhoff Adapter #113, Rod #37

Valve Spring Pressure:—Total for inner and outer springs 59 lbs (closed), 146 lbs. (open). See 'M' page for data on each spring.

Tappet Clearance:— 015" all valves—engine warm and idling NOTE—For high speed driving, .018" maximum tappet clearance may be used

LUBRICATION:—**Crankcase Capacity**—6 qts. (dry or refill).

Normal Oil Pressure—30 lbs at 20 MPH.

Oil Pressure Gauge:—King-Seeley Electric type K-S No 7665 (dash unit), No. 6125 (engine unit).
See article in Mechanical Equipment Section for data.

COOLING SYSTEM:—**Capacity**—16 qts (add 1 qt. for heater).

Thermostat—Dole In cylinder head water outlet. Starts to open 160°F.

Temperature Gauge—King-Seeley electric type. K-S No 7670 (dash unit), No. 7000 (engine unit).
See article in Mechanical Equipment Section for data.
NOTE—Gauge inoperative with ignition 'Off' (reads to '212' in this position).

TRANSMISSION OVERDRIVE CONTROL:—Electric type with accelerator pedal operated 'kick-down' switch *See article in Mechanical Equipment Section.*
Overdrive Solenoid—Delco-Remy Model 1118004.
Throttle Switch—Adjust switch to close with throttle wide open and carburetor throttle shaft pulley spring just starting to compress
Control Relay—Delco-Remy Model 1116798.

BATTERY:—**USL Type HTL-1-15 or Auto-Lite Type CTL-1-15.** 6 volt, 15 plate, 105 ampere hour capacity (20 hour rate).
Starting Capacity—133 amperes for 20 minutes.
Zero Capacity—300 amperes for 3 8 minutes
Grounded Terminal—Positive (+) grounded to transmission. Separate ground strap from transmission to frame.
Dimensions—Length & Height 9 1/16". Width 7⅛".
Location—Under front seat.

STARTER:—**Model MAB-4076. Armature MAB-2057.**
Drive—Inboard Bendix Type LCD11FX-10
Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—42-53 ozs. (new brushes).
Cranking Engine—160 RPM, 150-160 amps, 5.2 v.

Performance Data

Torque	R P.M.	Volts	Amperes
0 ft lbs	3700	5 5	60
6 " "	1910	5 5	100
3.4 " "	1100	5 0	200
6 6 " "	695	4 5	300
10 15 " "	420	4 0	400
15 8 " "	Lock	3 0	582
22 5 " "	Lock	4 0	775

Removal:—Starter flange mounted on left front face of flywheel housing. To remove, take out flange mounting screws.

Starting Switch:—A-L #SW-4005. Mounted on body floor below clutch pedal Operated by depressing clutch pedal fully. No adjustment required.

GENERATOR:—**Model GDZ-4803A. Armature GDZ-2079-F.** Two brush type with current-voltage control.
Charging Rate Adjustment—No adjustment at generator. Charging rate controlled by Voltage Regulator and maximum output by Current Regulator. *See Regulator data following.*
Maximum Charging Rate—35 amperes (hot or cold), 8.0 volts, 1900 RPM (generator) and above with load or discharged battery (Current Regulator setting). Actual charging rate controlled by Voltage Regulator and dependent on battery condition.

Performance Data

Cold			Hot		
Amperes	Volts	R.P.M	Amperes	Volts	R.P M.
0	6.4	925	0	6.4	1000
4	6 6 .	1035	4	6.6 .	1120
8	6 75	1140	8	6 75	1235
12	6 95	1250	12	6.95	1350
16	7 15	1370	16	7 15	1460
20	7 3	1480	20	7 3	1590
24	7 5	1590	24	7 5	1730
28	7.7	1710	28	7.7 .	1900
32	7 9	1820	32	7 9	2090
35	8 0	1900	35	8 0	2250

Rotation—Counter-clockwise at commutator end
Brush Spring Tension—53 ozs. max. (new brushes).
Field Current—1 60-1 78 amperes at 6 0 volts.
Motoring Current—4 16-4 60 amperes at 6 0 volts.

Removal:—Generator cradle mounted at left side of engine with fan belt drive Water pump driven by generator shaft extension. To remove, disconnect water pump, loosen fan belt, remove generator clamp band and lift generator off.

Belt Adjustment:—Adjust whenever belt deflection is over 1½" (when pressed lightly midway between generator and fan pulleys). To adjust, loosen two capscrews on fan bracket, lift fan up (one screw hole slotted) for 1" belt deflection, tighten screws.

REGULATOR:—**Model VRP-4004A. Current-Voltage.** Mounted in single case on dash.
See article in Electrical Equipment Section for data.
NOTE—Regulator case cover is sealed Serviced on exchange basis if seals not broken.

Cutout Relay

Cuts In—6 4-6 6 volts.
Cuts Out—4 8-5 6 volts (approx. 7-8 amps. disch.).
Contact Gap— 015" minimum.
Air Gap— 034" min, 038" max. with contacts open. Measure at hinge end of core.

Voltage Regulator

Setting—7 3-7.6 volts at 70° F.
To Check (without breaking seals)—Connect ammeter in charging line at regulator 'B' terminal, voltmeter between 'B' terminal and ground Operate generator at speed equivalent to 30 MPH, charging battery until voltage is steady Voltage reading should be 7 2 volts min, and 7 7 volts max. at standard operating temperature
To Adjust (with cover removed)—Change regulator armature spring tension by bending lower spring hanger slightly *See Electrical Equipment Section.*
Contact Gap— 012" Min (armature against stop pin).
Air Gap— 048- 052" with contacts just opening.

Current Regulator

Setting—34-36 amperes (marked '35' on cover).
To Check (without breaking seals)—Connect test meters as for Voltage check (above) Operate generator at 30 MPH, charging battery, add load (use bank of headlamp bulbs, or turn on car lights and accessories and discharge battery) so that generator charges at peak rate and Current Regulator operates Charging current should not exceed 34-36 amperes If more than slight excess noted, regulator is defective.
Adjustment & Contact Gap—Same as for Voltage Regulator (above)
Air Gap— 034- 038" with contacts just opening.

LIGHTING:—**Headlamps**—General Electric 'Sealed Beam'.
See article in Electrical Equipment Section for data.
Headlamp Adjustment—Aim upper beam for each lamp straight ahead with center of hot spot 3" below lamp center height
Beam Indicator—Red light on speedometer face. Lighted whenever Country (upper) beam in use.

Switches

Lighting—Douglas No 5754
Beam Selector—Douglas No 5733
Instrument—Douglas No 5653

Bulb Specifications

Position	Candlepower	Mazda No
Headlamps		Sealed Beam
Parking, Rear License	3	63
Instrum., Beam Indic	1½	55
Stop & Tail	21-3	1154
Dome	6	81

FUSES:—**Lighting**—30 ampere (SFE type) mounted on fuse block on back of instrument panel toward left.
Accessory—30 ampere (SFE type) on fuse block.

HORNS:—**Delco-Remy.** No 1999565 (low note), No 1999566 (high note) Vibrator type, blended tone, operated by horn relay

Type	Current (at 6 volts)	Air Gap
1999565 (Low Note)	19-21 amperes	.047- 052"
1999566 (High Note)	18-20 amperes	039-.044"

Horn Relay:—Delco-Remy Model 1116775
Contact Gap— 020" **Air Gap**— 015" (closed).
Contacts Close—2 75-4 0 volts.

NOTE:—Engine hood hinged at cowl and lifts from forward end. Hood latch handle located at lower edge of radiator grille (safety catch at top of grille).

SERIAL NUMBER:—First number B-106300. Stamped on plate on right frame side rail under hood.

SERVICE SERIAL NUMBER:—First number N8-13500. On 'Caution Plate' on left front door hinge post.

ENGINE NUMBER:—First number B-105800. On engine block on right side at front. NOTE—Engine Number is 500 less than Serial Number on same car.

COMPRESSION:—**Ratio**—6.0-1 std. cast-iron head.
Pressure—110 lbs. at 350 RPM or approx. 100 lbs. at cranking speed of 160 RPM.

VACUUM READING:—Steady 18-20" idling at 7-8 MPH.

IGNITION:—**Coil Model CE-4025A (2 used).** Coils mounted on right side of engine.
Ignition Current—2 amperes idling, 4 amperes stopped (for each coil).
Ignition Switch:—Oakes Steering Column and Ignition Lock No. 302076. Ignition Switch No. 301538.
Ignition Lock—Briggs & Stratton. B & S No. 80207. Key Series—5 digits. Groove—No. 1.
Distributor Model IGK-4102. 'Twin Ignition' double breaker, 8 lobe cam, full automatic advance type with Torquematic Spark Control. Contacts open simultaneously to fire both spark plugs in each cylinder at the same instant and must be synchronized (see Ignition Timing).
Breaker Gap—Set at .017" (alike for both sets).
Cam Angle or Dwell—28° closed, 17° open (distr.). For each set of contacts (operate independently).
Breaker Arm Spring Tension—17-20 ounces.
Rotation—Clockwise viewed from above.
Condenser—No. IG-2671 (2 used). Cap. .20-.25 mfd.

Automatic Advance

Distributor Degrees	R.P.M.	Engine Degrees	R.P.M.
Start	275	0	550
4	400	8	800
6	575	12	1150
9	840	18	1680
12	1100	24	2200

Torquematic Spark Control—Consists of cable anchored at dash and connected to distributor body by a travel limiting spring. Retards distributor through engine movement caused by torque action. Maximum retard 2½° (engine movement in excess of 2½° taken up by travel limiting spring). See Ignition Timing for setting.
Removal:—Mounted on right side of engine. To remove, take out hold-down screw in advance arm, disconnect torquematic control, lift distributor off.

IGNITION TIMING:—Setting for all engines as follows:

Flywheel Degrees	Piston Position
9° BTDC	.0325" BTDC

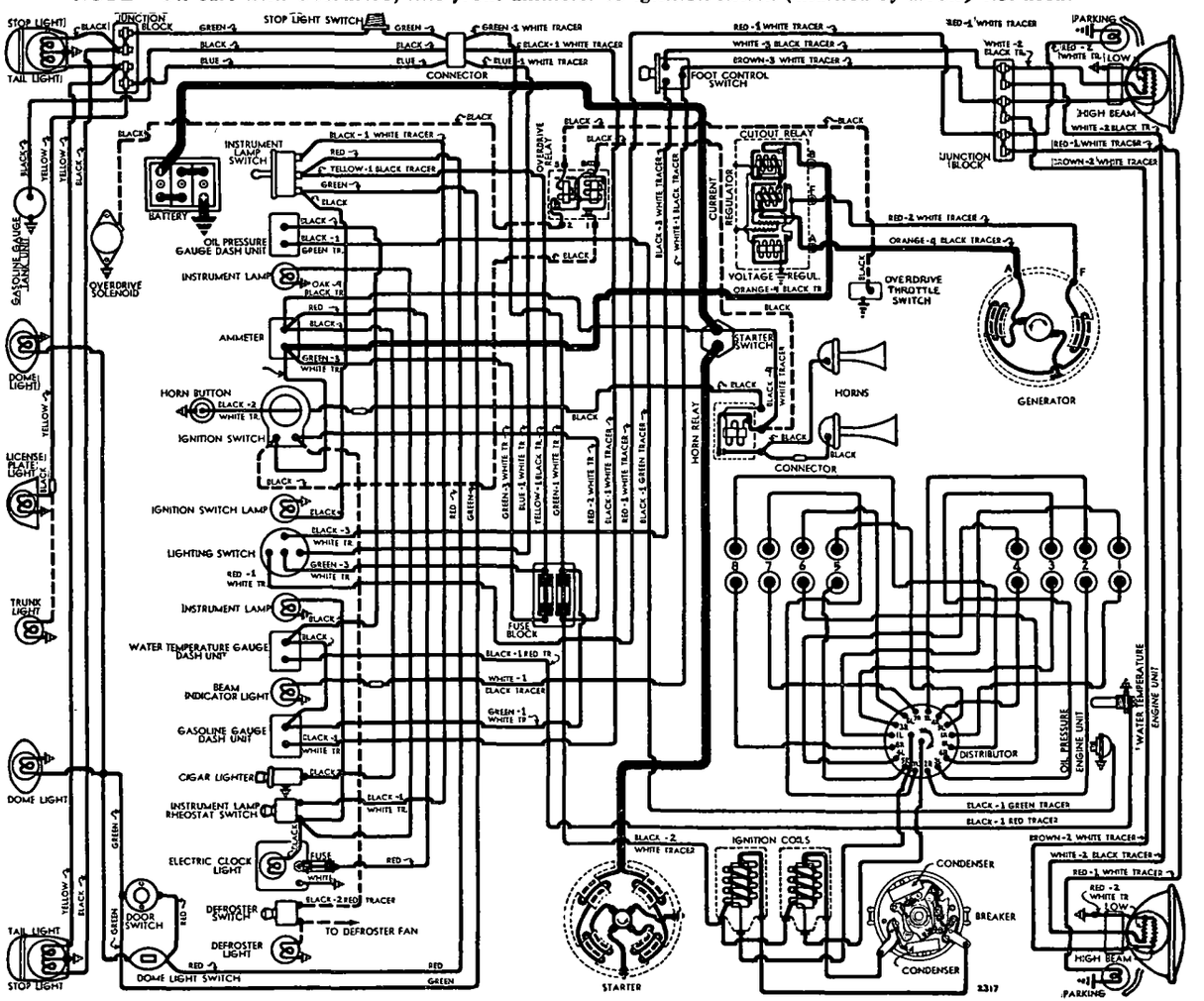
To Set Timing—Car manufacturer recommends use of Nash Timing Light SE-569. Synchronize breaker points (see Synchronization following). With Timing Light connected as for Synchronization (see below), slacken torquematic cable by loosening locknuts on anchor bracket at dash. With #1 piston on compression, turn engine over until piston is 9° or .0325" BTDC, stop when 'IGN' mark on vibration dampener lines up with pointer on chain case cover (this mark is 9° or .725" before top dead center mark 'DC'). Loosen advance arm clamp bolt, rotate distributor until points just break (lights go on) with stop-pin (hold-down bolt and nut) in advance position in slot in advance arm, tighten clamp bolt. Adjust cable locknuts at anchor bracket on dash to leave torquematic cable without slack or tension and stop-pin in advance position in slot.
Synchronization—Use Nash Timing Light SE-569 (consists of two lights—one for each set of contacts) connected between each primary terminal and ground. Turn on ignition, turn engine over until fixed points just open (light for stationary contacts on). If both lights go on synchronization correct. If not, loosen 3 lockscrews on movable subplate, shift plate by prying with screwdriver in notch on edge of plate until this set of contacts begin to open (both lights on), tighten sub-plate lockscrews and set Ignition Timing as directed above. If other methods used, set contacts to open simultaneously at 45° (distributor) intervals.
Torquematic Spark Control Check—Distributor must be free in bracket and cable pulleys positioned to prevent cable interference with engine. Advance spring and cable take-up spring must be properly located and spring resistance centralized. Car manufacturer recommends use of Nash Synchro Light SE-417 to check torquematic retard by means of dead center mark on vibration dampener.
Motor Gauge—Weidenhoff Adapter #113, Rod #37.

Firing Order:—1-6-2-5-8-3-7-4. See diagram for spark plug cable connections on distributor cap.

Spark Plugs:—AC No. 45. 14 MM Metric type.
Spark Plug Gaps—Set at .025".

CARBURETION:—**Carburetor**—Carter Type WDO, Model 465-S (#255 cast on face of flange). 1" dual downdraft type.
See article in Carburetor Section for data.
Idle Adjustment—With engine warm and running at slow idle speed (choke valve wide open, fast idle inoperative), set throttle stopscrew for 7-8 MPH idle speed. Adjust idle adjusting screw for each barrel (in succession) until engine fires smoothly (½-1½ turns open for each screw—turn screws in for leaner mixture). Readjust idle speed.

NOTE—On cars with Overdrive, line from ammeter to ignition switch (marked by arrow) not used.



Accelerating Pump Setting—Pump arm has 2 holes for pump link engagement. Set as follows:
Upper Hole (max. stroke)—Cold weather.
Lower Hole (min. stroke)—Hot weather.

Float Level—3/16" from top of float to gasket seat on cover with needle valve seated (invert to check).

Fast Idle:—Integral type (built-in carburetor).
See article in Carburetion Equipment Section.
Fast Idle Setting—Adjust fast idle screw for .015" throttle opening with choke valve closed.

Automatic Choke:—Carter Climatic Control.
See article in Carburetion Equipment Section.
Choke Setting—Set coil housing 1 Notch Rich.

Air Cleaner:—AC #1529113 oil-wetted type std.

Fuel Pump:—AC Type AD #1523644 combination fuel-and-vacuum type standard.
See article in Carburetion Equipment Section.

Gasoline Gauge:—King-Seeley Electric type. K-S No. 7680 (dash unit), No. 7780 (tank unit).
See article in Carburetion Equipment Section.

VALVE TIMING:—To Check—With regular running tappet clearance of .015" Exhaust valve should close with piston 10° or .0400" after top dead center.

Motor Gauge—Weidenhoff Adapter #113, Rod #37.

Valve Spring Pressure:—Total for inner and outer springs 59 lbs. (closed), 146 lbs. (open). See 'M' page for data on each spring.

Tappet Clearance:—.015" all valves—engine warm and idling. NOTE—For high speed driving, .018" maximum tappet clearance may be used.

LUBRICATION:—Crankcase Capacity—7 qts. (dry or refill).

Normal Oil Pressure—30 lbs. at 20 MPH.

Oil Pressure Gauge:—King-Seeley Electric type. K-S No. 7665 (dash unit), No. 6125 (engine unit).
See article in Mechanical Equipment Section for data.

COOLING SYSTEM:—Capacity 17 qts. (add 1 qt. for heater).
Thermostat—Dole. In cylinder head water outlet. Starts to open 160°F.
Temperature Gauge—King-Seeley electric type. K-S No. 7670 (dash unit), No. 7000 (engine unit).
See article in Mechanical Equipment Section for data.
NOTE—Gauge inoperative with ignition 'Off' (reads to '212' in this position).

TRANSMISSION OVERDRIVE CONTROL:—Electric type with accelerator pedal operated 'kick-down' switch. *See article in Mechanical Equipment Section.*
Overdrive Solenoid—Delco-Remy Model 1118004.
Throttle Switch—Adjust switch to close with throttle wide open and carburetor throttle shaft pulley spring just starting to compress.
Control Relay—Delco-Remy Model 1116798.

BATTERY:—USL Type HTL-2-17 or Auto-Lite Type CTL-2-17. 6 volt, 17 plate, 120 ampere hour capacity (20 hour rate).
Starting Capacity—152 amperes for 20 minutes.
Zero Capacity—300 amperes for 4.9 minutes.
Grounded Terminal—Positive (+) grounded to transmission. Separate ground strap from transmission to frame.
Dimensions—Length 10 5/16". Width 7⅛". Height 9 1/16".
Location—Under front seat.

STARTER:—Model MAB-4104. Armature MAB-2057.
Drive—Inboard Bendix Type LCD11FX-10.
Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—42-53 ozs. (new brushes).
Cranking Engine—160 RPM, 150-160 amps., 5.2 v.

Performance Data

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	3700	5.5	60
.6 " "	1910	5.5	100
3.4 " "	1100	5.0	200
6.6 " "	695	4.5	300
10.15 " "	420	4.0	400
15.8 " "	Lock	3.0	582
22.5 " "	Lock	4.0	775

Removal:—Starter flange mounted on left front face of flywheel housing. To remove, take out flange mounting screws.

Starting Switch:—A-L #SW-4005. Mounted on body floor below clutch pedal. Operated by depressing clutch pedal fully. No adjustment required.

GENERATOR:—Model GDZ-4803B. Armature GDZ-2079F. Two brush type with current-voltage control.

Charging Rate Adjustment—No adjustment at generator. Charging rate controlled by Voltage Regulator and maximum output by Current Regulator. *See Regulator data following.*

Maximum Charging Rate—35 amperes (hot or cold), 8.0 volts, 1900 RPM (generator) and above with load or discharged battery (Current Regulator setting). Actual charging rate controlled by Voltage Regulator and dependent on battery condition.

Performance Data

Cold			Hot		
Amperes	Volts	R.P.M.	Amperes	Volts	R.P.M.
0	6.4	925	0	6.4	1000
4	6.6	1035	4	6.6	1120
8	6.75	1140	8	6.75	1235
12	6.95	1250	12	6.95	1350
16	7.15	1370	16	7.15	1460
20	7.3	1480	20	7.3	1590
24	7.5	1590	24	7.5	1730
28	7.7	1710	28	7.7	1900
32	7.9	1820	32	7.9	2090
35	8.0	1900	35	8.0	2250

Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—53 ozs. max. (new brushes).
Field Current—1.60-1.78 amperes at 6.0 volts.
Motoring Current—4.16-4.60 amperes at 6.0 volts.

Removal:—Generator cradle mounted at left side of engine with fan belt drive. Water pump driven by generator shaft extension. To remove, disconnect water pump, loosen fan belt, remove generator clamp band and lift generator off.

Belt Adjustment:—Adjust whenever belt deflection is over 1½" (when pressed lightly midway between generator and fan pulleys). To adjust, loosen two capscrews on fan bracket, lift fan up (one screw hole slotted) for 1" belt deflection, tighten screws.

REGULATOR:—Model VRP-4004A. Current-Voltage. Mounted in single case on dash.
See article in Electrical Equipment Section for data.
NOTE—Regulator case cover is sealed. Serviced on exchange basis if seals not broken.

Cutout Relay

Cuts In—6.4-6.6 volts.
Cuts Out—4.8-5.6 volts (approx. 7-8 amps. disch.).
Contact Gap—.015" minimum.
Air Gap—.034" min., .038" max. with contacts open. Measure at hinge end of core.

Voltage Regulator

Setting—7.3-7.6 volts at 70° F.
To Check (without breaking seals)—Connect ammeter in charging line at regulator 'B' terminal, voltmeter between 'B' terminal and ground. Operate generator at speed equivalent to 30 MPH, charging battery until voltage is steady. Voltage reading should be 7.2 volts min., and 7.7 volts max. at standard operating temperature.
To Adjust (with cover removed)—Change regulator armature spring tension by bending lower spring hanger slightly. *See Electrical Equipment Section.*
Contact Gap—.012" Min. (armature against stop pin).
Air Gap—.048-.052" with contacts just opening.

Current Regulator

Setting—34-36 amperes (marked '35' on cover).
To Check (without breaking seals)—Connect test meters as for Voltage check (above). Operate generator at 30 MPH, charging battery, add load (use bank of headlamp bulbs, or turn on car lights and accessories and discharge battery) so that generator charges at peak rate and Current Regulator operates. Charging current should not exceed 34-36 amperes. If more than slight excess noted, regulator is defective.
Adjustment & Contact Gap—Same as for Voltage Regulator (above).
Air Gap—.034-.038" with contacts just opening.

LIGHTING:—Headlamps—General Electric 'Sealed Beam'.
See article in Electrical Equipment Section for data.
Headlamp Adjustment—Aim upper beam for each lamp straight ahead with center of hot spot 3" below lamp center height.
Beam Indicator—Red light on speedometer face. Lighted whenever Country (upper) beam in use.

Switches

Lighting—Douglas No. 5754.
Beam Selector—Douglas No. 5733.
Instrument—Douglas No. 5653.

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps		Sealed Beam
Parking, Rear License	3	63
Instrum., Beam Indic.	1½	55
Stop & Tail	21-3	1154
Dome	6	81

FUSES:—Lighting—30 ampere (SFE type) mounted on fuse block on back of instrument panel toward left.
Accessory—30 ampere (SFE type) on fuse block.

HORNS:—Delco-Remy. No. 1999565 (low note), No. 1999566 (high note). Vibrator type, blended tone, operated by horn relay.

Type	Current (at 6 volts)	Air Gap
1999565 (Low Note)	19-21 amperes	.047-.052"
1999566 (High Note)	18-20 amperes	.039-.044"

Horn Relay:—Delco-Remy Model 1116775.
Contact Gap—.020". **Air Gap**—.015" (closed).
Contacts Close—2.75-4.0 volts.

NOTE:—Engine hood hinged at cowl and lifts from forward end. Hood latch handle located at lower edge of radiator grille (safety catch at top of grille).

SERIAL NUMBER:—First number H-57000. Stamped on plate on right frame side member under hood.

SERVICE SERIAL NUMBER:—First number LH-57000. On upper left hand side of engine above front 'Caution Plate' on left front door hinge post.

ENGINE NUMBER:—First number HE-56500. On boss on upper left hand side of engine above front water jacket cover plate. NOTE—Engine No. is 500 less than Serial Number on same car.

COMPRESSION:—**Ratio**—6.3-1 std. cast-iron head.
Pressure—110 lbs. at cranking speed of 160 RPM.

VACUUM READING:—Steady 18-20" idling at 7-8 MPH.

IGNITION:—**Coil Model IG-4095, IG-4096.** Coil is mounted on dash.
Ignition Current—2½ amperes idling, 4 stopped.
Ignition Switch:—Oakes Steering Column and Ignition Lock No. 302072. Ignition Switch No. 301538.
Ignition Lock—Briggs & Stratton. B & S No. 80207. Key Series—5 digits. Groove—No. 1.
Distributor Model IGS-4104 (Std.), IGS-4104X (side outlet type—used with Oil Bath Air Cleaner). Single breaker, 6 lobe cam, full automatic advance type with auxiliary vacuum spark control.
Breaker Plate Identification—Maximum vacuum advance limited by slot and marked by number (#6) stamped on plate.
Breaker Gap—Set at .020".
Cam Angle or Dwell—38° closed, 22° open (distr.).
Breaker Arm Spring Tension—17-20 ounces.
Rotation—Clockwise viewed from above.
Condenser—No. IG-2671F. Capacity .20-.25 mfd.

Automatic Advance

Distributor Degrees	R.P.M.	Engine Degrees	R.P.M.
Start	250	0	500
1	300	2	600
2	440	4	880
4	710	8	1420
5	850	10	1700

Vacuum Spark Control—Integral with distributor. Mounted on distributor housing and linked directly to breaker plate. Provides additional advance at speeds above idling except when engine accelerated or operated with wide open throttle when spark is retarded by return spring within unit.

Vacuum Advance

Distr. Degrees	Eng. Degrees	Vacuum (" of HG)
Start	0°	6"
1°	2°	7"
3°	6°	9¼"
4°	8°	10¾"
5.5°	11°	12"

Removal:—Distributor mounted on cylinder head on right side. To remove, disconnect vacuum line, loosen advance arm clamp bolt.

IGNITION TIMING:—Setting for all engines as follows:

Flywheel Degrees	Piston Position
0° at TDC	.0000" TDC.

To Set Timing—With #1 piston on compression, turn engine over until the piston reaches top dead center, stop when 'IGN-DC' mark on vibration dampener on front of engine is directly under pointer on chain case cover. Loosen advance arm clamp bolt, rotate distributor until contacts begin to open, tighten clamp bolt. NOTE—Manufacturer recommends use of timing light for accurate ignition setting.
Motor Gauge—Weidenhoff Adapter #104, Rod #40.
Firing Order:—1-5-3-6-2-4.
Spark Plugs:—Auto-Lite B-7. 18 MM Metric type.
Spark Plug Gaps—Set at .025".

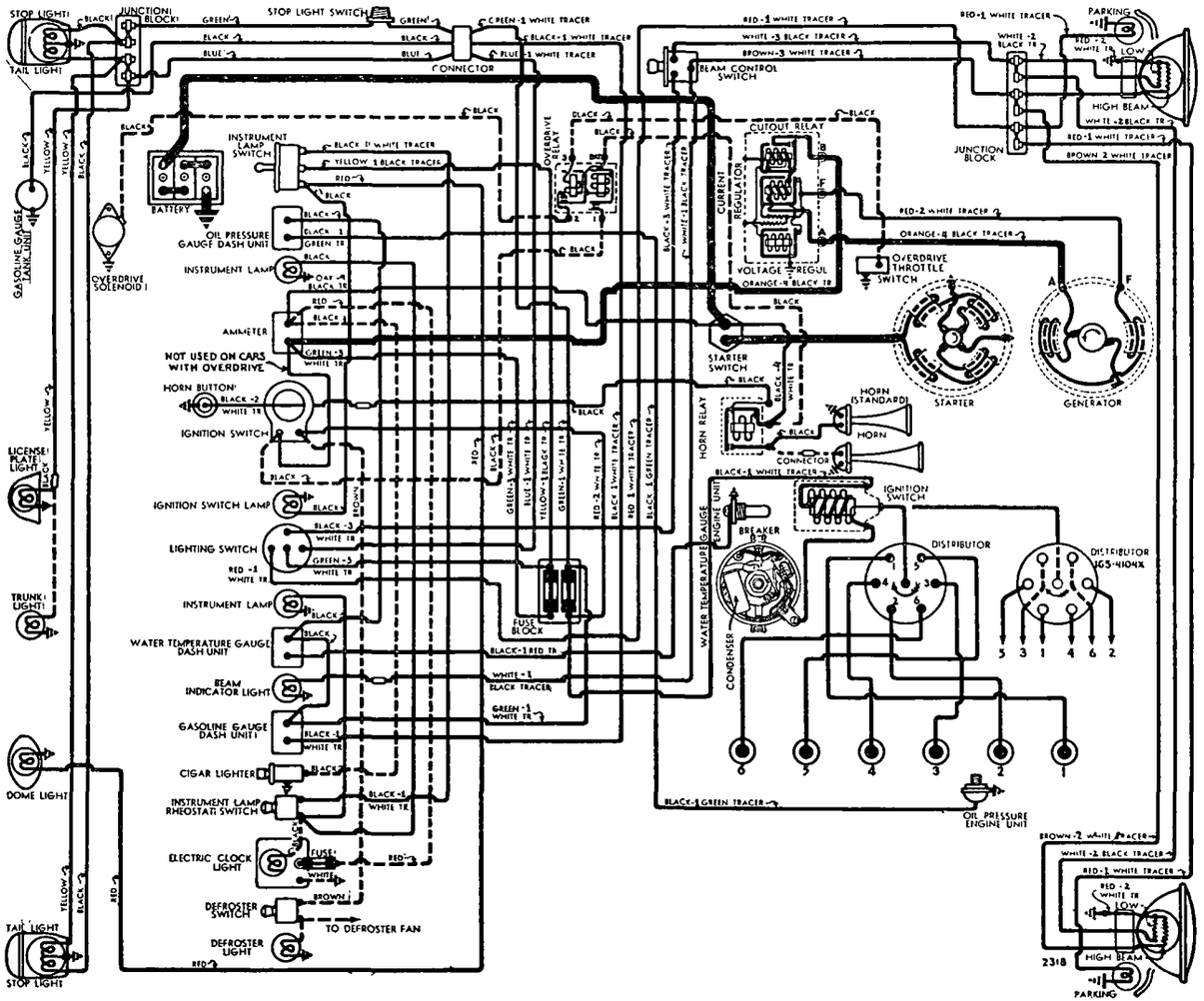
CARBURETION:—**Carburetor**—Carter Type WDO, Model 458-S (#295 cast on face of flange). 1" dual downdraft type.
NOTE—New Air horn, Climatic Control assembly, and Thermostatic Coil & Housing assembly should be installed on first cars to correct warming up complaints.
See article in Carburetor Section for data.
Idle Adjustment—With engine warm and running at slow idle speed (choke valve wide open, fast idle inoperative), set throttle stopscrew for 7-8 MPH idle speed. Adjust idle screw for each barrel (in succession) until engine fires smoothly (¼-1¼ turns open for each screw—turn screws in for leaner mixture). Readjust idle speed.
Accelerating Pump Setting—Pump arm has 2 holes for pump link engagement. Set as follows:
Inner Hole (min. stroke)—Hot weather.
Outer Hole (max. stroke)—Cold weather.
Float Level—3/16" from top of float to gasket seat on cover with needle valve seated (invert to check).

Fast Idle:—Integral type (built-in carburetor).
See article in Carburetion Equipment Section.
Fast Idle Setting—Adjust fast idle screw for .026" throttle opening with choke valve closed.

Automatic Choke:—Carter Climatic Control.
See article in Carburetion Equipment Section.
Choke Setting—1 Notch Rich (with first 170B64S Thermostatic Coil & Housing Assembly), centered (with later 170K64S Thermostatic Coil & Housing Assembly).

Air Cleaner:—AC #1529419 oil-wetted type std.

Fuel Pump:—AC Type W #1523640 diaphragm type Standard. Type AD #1523641 combination fuel-and-vacuum pump optional.
See article in Carburetion Equipment Section.



Gasoline Gauge:—King-Seeley Electric type. K-S No. 7680 (dash unit), No. 7780 (tank unit).
See article in Carburetion Equipment Section.

VALVE TIMING:—To Check—With regular running tappet clearance of .015", Intake valve should open with piston 21½° or .1891" BTDC., and Exhaust valve close with piston 36½° or .5118" ATDC.

Motor Gauge—Weidenhoff Adapter #104, Rod #40.

Valve Spring Pressure:—70 lbs. at 2" (valve closed), 115 lbs at 1 11/16" (valve open).

Tappet Clearance:—.015" all valves—engine warm and idling. NOTE—For high speed driving .018" max. setting may be used. Remove right front fender dust shield for access to valve covers.

LUBRICATION:—Crankcase Capacity 6 qts. (dry or refill).

Normal Oil Pressure—30 lbs. at 20 MPH.

Oil Pressure Gauge:—King-Seeley Electric type. K-S No. 7665 (dash unit), No. 6125 (engine unit).
See article in Mechanical Equipment Section for data.

COOLING SYSTEM:—Capacity 17 qts. (add 1 qt. for heater).

Thermostat—Dole. In cylinder head water outlet. Starts to open 160°F.

Temperature Gauge—King-Seeley electric type. K-S No. 7670 (dash unit), No. 7000 (engine unit).
See article in Mechanical Equipment Section for data.
NOTE—Gauge inoperative with ignition 'Off' (reads to '212' in this position).

TRANSMISSION OVERDRIVE CONTROL:—Electric type with accelerator pedal operated 'kick-down' switch. *See article in Mechanical Equipment Section.*

Overdrive Solenoid—Delco-Remy Model 1118004.

Throttle Switch—Adjust switch to close with throttle wide open and carburetor throttle shaft pulley spring just starting to compress.

Control Relay—Delco-Remy Model 1116798.

BATTERY:—USL Type RN-15 or Auto-Lite Type PN-15. 6 volt, 15 plate, 95 AH. capacity (20 hr. rate).

Starting Capacity—117 amperes for 20 minutes.

Zero Capacity—300 amperes for 3 1 minutes.

Grounded Terminal—Positive (+) grounded to transmission. Separate ground strap from transmission to frame.

Dimensions—Length 8⅞". Width 7". Height 8⅝".

Location—Under front seat.

STARTER:—Model MAB-4076. Armature MAB-2057.

Drive—Inboard Bendix Type LCD11FX-10.

Rotation—Counter-clockwise at commutator end.

Brush Spring Tension—42-53 ozs. (new brushes).

Cranking Engine—160 RPM, 150-160 amps., 5.2 v.

Performance Data

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	3700	5.5	60
.6 " "	1910	5.5	100
3.4 " "	1100	5.0	200
6.6 " "	695	4.5	300
10.15 " "	420	4.0	400
15.8 " "	Lock	3.0	582
22.5 " "	Lock	4.0	775

Removal:—Starter flange mounted on left front face of flywheel housing. To remove, take out flange mounting screws.

Starting Switch:—A-L #SW-4005. Mounted on body floor below clutch pedal. Operated by depressing clutch pedal fully. No adjustment required.

GENERATOR:—Model GDZ-4803A. Armature GDZ-2079F. Two brush type with current-voltage control.

Charging Rate Adjustment—No adjustment at generator. Charging rate controlled by Voltage Regulator and maximum output by Current Regulator. *See Regulator data following.*

Maximum Charging Rate—35 amperes (hot or cold), 8.0 volts, 1900 RPM (generator) and above with load or discharged battery (Current Regulator setting). Actual charging rate controlled by Voltage Regulator and dependent on battery condition.

Performance Data

Cold			Hot		
Amperes	Volts	R.P.M.	Amperes	Volts	R.P.M.
0	6.4	925	0	6.4	1000
4	6.6	1035	4	6.6	1120
8	6 75	1140	8	6.75	1235
12	6.95	1250	12	6 95	1350
16	7 15	1370	16	7.15	1460
20	7.3	1480	20	7.3	1590
24	7.5	1590	24	7.5	1730
28	7.7	1710	28	7.7	1900
32	7 9	1820	32	7.9	2090
35	8 0	1900	35	8.0	2250

Rotation—Counter-clockwise at commutator end.

Brush Spring Tension—53 ozs. max. (new brushes).

Field Current—1.60-1.78 amperes at 6.0 volts.

Motoring Current—4.16-4.60 amperes at 6.0 volts.

Removal:—Generator cradle mounted at left side of engine with fan belt drive. Water pump driven by generator shaft extension. To remove, disconnect water pump, loosen fan belt, remove generator clamp band and lift generator off.

Belt Adjustment:—Adjust whenever belt deflection is over 1½" (when pressed lightly midway between generator and fan pulleys). To adjust, loosen two capscrews on fan bracket, lift fan up (one screw hole slotted) for 1" belt deflection, tighten screws.

REGULATOR:—Model VRP-4004A. Current-Voltage. Mounted in single case on dash.
See article in Electrical Equipment Section for data.
NOTE—Regulator case cover is sealed. Serviced on exchange basis if seals not broken.

Cutout Relay

Cuts In—6.4-6.6 volts.

Cuts Out—4.8-5.6 volts (approx. 7-8 amps. disch.).

Contact Gap—.015" minimum.

Air Gap—.034" min., .038" max. with contacts open. Measure at hinge end of core.

Voltage Regulator

Setting—7.3-7.6 volts at 70° F.

To Check (without breaking seals)—Connect ammeter in charging line at regulator 'B' terminal, voltmeter between 'B' terminal and ground. Operate generator at speed equivalent to 30 MPH, charging battery until voltage is steady. Voltage reading should be 7.2 volts min., and 7 7 volts max. at standard operating temperature.

To Adjust (with cover removed)—Change regulator armature spring tension by bending lower spring hanger slightly. *See Electrical Equipment Section.*

Contact Gap—.012" Min. (armature against stop pin).

Air Gap—.048- 052" with contacts just opening.

Current Regulator

Setting—34-36 amperes (marked '35' on cover).

To Check (without breaking seals)—Connect test meters as for Voltage check (above). Operate generator at 30 MPH, charging battery, add load (use bank of headlamp bulbs, or turn on car lights and accessories and discharge battery) so that generator charges at peak rate and Current Regulator operates. Charging current should not exceed 34-36 amperes. If more than slight excess noted, regulator is defective.

Adjustment & Contact Gap—Same as for Voltage Regulator (above).

Air Gap—.034- 038" with contacts just opening.

LIGHTING:—Headlamps—General Electric 'Sealed Beam'.
See article in Electrical Equipment Section for data.

Headlamp Adjustment—Aim upper beam for each lamp straight ahead with center of hot spot 3" below lamp center height.

Beam Indicator—Red light on speedometer face. Lighted whenever Country (upper) beam in use.

Switches

Lighting—Douglas No. 5754.

Beam Selector—Douglas No. 5733.

Instrument—Douglas No. 5653.

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps		Sealed Beam
Parking, Rear License	3	63
Instrum., Beam Indic.	1½	55
Stop & Tail	21-3	1154
Dome	6	81

FUSES:—Lighting—30 ampere (SFE type) mounted on fuse block on back of instrument panel toward left.

Accessory—30 ampere (SFE type) on fuse block.

HORNS:—Delco-Remy. No. 1999565 (low note), No. 1999566 (high note). Vibrator type, blended tone, operated by horn relay.

Type	Current (at 6 volts)	Air Gap
1999565 (Low Note)	19-21 amperes	.047-.052"
1999566 (High Note)	18-20 amperes	.039-.044"

Horn Relay:—Delco-Remy Model 1116775.

Contact Gap—.020". **Air Gap**—.015" (closed).

Contacts Close—2.75-4.0 volts.

ENGINE HOOD NOTE:—Alligator type hood with integral side panels and instrument panel lock. To raise hood, pull out on control knob at left of steering wheel (hood will raise 1½"), press on safety catch tab under front edge of hood at center.

SERIAL NUMBER:—On left frame side member under hood. 1st No. as follows:

	F-40	G-40
Lansing, Mich.	F-703001	G-355001
Linden, N. J.	LF-556001	LG-108001
South Gate, Calif.	CF-515001	CG- 16001

ENGINE NUMBER:—First number G-79001 (F & G-40), GR-3001 (RHD). On boss on left side of cylinder block behind water pump. NOTE—Cars with Hydra-matic drive carry prefix 'GA' instead of 'G'.

COMPRESSION:—Ratio—6.1-1 Std. 5.61-1 Optl.
Pressure—146 lbs. (Std. Hd.), 120 lbs. (Optl. LC. Hd.) at 1000 RPM. or approximately 102-112 lbs. at cranking speed (100 RPM Summer) for Std. head.

VACUUM READING:—Steady 17" min. at 6 MPH.

IGNITION:—Coil Model 1115129. On engine side of dash.
Ignition Current—2.0 amperes idling, 4.5 stopped.
Ignition Switch:—Delco-Remy No. 1116290 (F-40), 1116273 (G-40), 1116289 (G-40 RHD). Switch connected to coil by armored cable.
Ignition Lock—Briggs & Stratton. B & S No. 85208. Key Series—8000 to 9499. Groove—No. 15.
Distributor Model 647-F. Single breaker, 6 lobe cam, full automatic advance type with auxiliary vacuum spark control and Octane Selector adjustment.
NOTE—Ground lead #1879140 now used between breaker point plate and housing.
Breaker Gap—.020". Limits .018-.024".
Cam Angle or Dwell—35° closed, 25° open (distr.).
Breaker Arm Spring Tension—17-21 ounces.
Rotation—Counter-clockwise viewed from above.
Condenser—No. 1865972. Capacity .18-.25 mfds.

Automatic Advance

Distributor Degrees	Distributor R.P.M.	Engine Degrees	Engine R.P.M.
Start	200	2	400
3	400	6	800
14	1900	28	3800

Vacuum Spark Control Model 681-P—Integral type (mounted on distributor cup, linked to breaker plate). Provides additional advance at speeds above idling except when engine accelerated or operated with wide open throttle when spark retarded by return spring in unit. Plunger travel 3/16" total.

Vacuum Advance

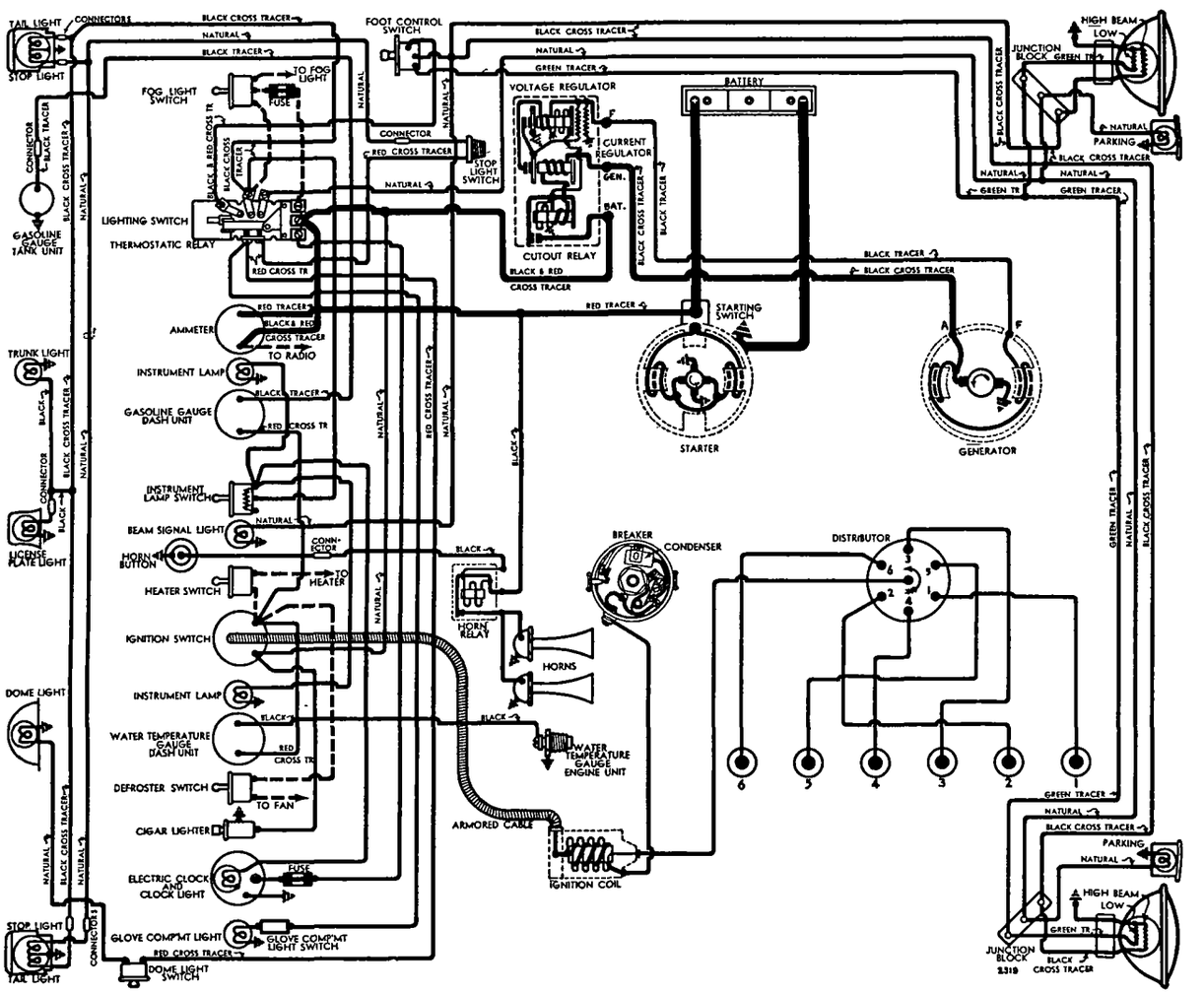
Distr. Degrees	Eng. Degrees	Vacuum (" of HG)
Start	0	5-7"
10	20	15.5-18.5"

Octane Selector—Adjustment at distributor permits 10° advance or retard from center '0' position. See Ignition Timing for adjustment directions.
Removal:—Distributor mounted on left side of engine. To remove, disconnect vacuum line, take out hold-down screw in advance arm.

IGNITION TIMING:—Standard Setting as follows. See Octane Selector for correction dependent on fuel used.

	Flywheel Degrees	Piston Position
All Engines	0° At TDC	.0000" TDC.

Timing (Using Synchroscope)—This method recommended by manufacturer. Clip synchroscope lead to #1 spark plug, direct light on flywheel through inspection hole in left front face of flywheel housing beside starter. Idle engine, loosen hold-down screw, center pointer on scale, tighten hold-down screw. Loosen advance arm clamp bolt, rotate distributor until timing mark (steel ball insert in flywheel) appears in line with pointer in inspection hole, tighten clamp bolt. Check Octane Selector setting.
Timing (Without Synchroscope)—Turn engine over to firing position for #1 piston with steel ball insert in flywheel in line with pointer in inspection hole in left front face of flywheel housing. Loosen hold-down screw in advance arm, center pointer on scale, tighten hold-down screw. Loosen advance arm clamp bolt, rotate distributor until contacts begin to open (use timing light connected between ignition terminal and ground and turn on ignition, light will go on as contacts open), tighten clamp bolt. Check Octane Selector setting.
Octane Selector Setting—Set for slight ping when accelerating engine with wide open throttle at speeds below 15 MPH. To adjust, loosen distributor hold-down screw, rotate distributor clockwise toward 'Adv.' end of scale (if no ping noted), counter-clockwise toward 'Ret' end of scale (if ping too severe). Check performance after making adjustment.
Firing Order:—1-5-3-6-2-4.
Spark Plugs:—AC No. 45. 14 MM. Metric type.
Spark Plug Gaps—.040".
CARBURETION:—Carburetor—Carter Type WA-1, Models 466-S (Std.), 467-S (with Hydra-matic drive). 1¼" single barrel, downdraft type. #194 cast on face of flange.
See article in Carburetor Section for data.
Hydra-matic Drive Car Note—Throttle linkage must be adjusted for correct transmission performance. ***See Hydra-matic Transmission article in Mechanical Equipment Section for adjustments.***
Idle Adjustment—With engine warm and running at slow idle speed (choke valve wide open, fast idle inoperative), set throttle stopscrew for 6 MPH idle speed (high gear—Conv. Trans.), 375 Engine R.P.M. Hydra-matic drive). Adjust idle adjusting screw until engine fires smoothly (½-1½ turns open—turn screw in for leaner mixture). Readjust idle speed.



Accelerator Pump Setting—Pump arm (under dust cover) has three holes for pump connector link engagement. Set as follows:
Lower (med. stroke)—Normal setting.
Inner (short stroke)—Hot temperature or premium fuels.
Outer (max. stroke)—Cold temperature or low-test fuels.

Float Level—3/8" from projection on cover to top of soldered seam at front end of float with needle valve seated (invert to check).

Fast Idle:—Integral type (built-in carburetor).
See article in Carburetion Equipment Section.

Fast Idle Setting—Part of Climatic Control. Adjust by bending connecting link offset for 5/8" choke valve opening with stopscrew against (not on) first step of fast idle cam.

Accelerator Linkage Adjustment:—Must be set for correct 'throttle cracking' action for starting. To adjust, disconnect starter cable (to prevent cranking), fully depress starter switch pedal, loosen eccentric pin locknut, adjust pin to give .030" clearance between throttle stopscrew and high point of fast idle cam, tighten locknut.

Automatic Choke:—Carter Climatic Control.
See article in Carburetion Equipment Section

Choke Setting—Set coil housing 2 notches rich (466-S), center on index mark (467-S). Choke setting may be varied 2 notches.

Air Cleaner:—AC #1528602 oil wetted type std.

Fuel Pump:—AC Type AJ #1537094 diaphragm type combination fuel-and-vacuum pump.
See article in Carburetion Equipment Section.

Gasoline Gauge:—AC Electric type. #1515372 (dash unit), #1516206 (tank unit).
See article in Carburetion Equipment Section.

MANIFOLD HEAT CONTROL:—Automatic thermostatic coil type. See that valve operates freely. When installing thermostatic coil, wind coil up 105° (approx. 1/3 revolution) at room temperature.

VALVE TIMING:—#1 intake valve opens 5° (.0163") BTDC. with .0124" tappet clearance (approx. 2 teeth before steel ball TDC. flywheel mark—housing opening on left side above starter).

Tappet Clearance—.008" Int., .011" Exh. warm.

Valve Springs—50½ lbs. at 2¼" (closed), 95½ lbs. at 1 15/16" (open). Free length 2⅝".

LUBRICATION:—**Crankcase Capacity**—5 quarts.

Normal Oil Pressure—32 lbs.

COOLING SYSTEM:—**Capacity**—18 quarts.

Thermostat:—Harrison. In cyl. head water outlet. Starts to open 152° F. Fully open 173° F.

Temperature Gauge:—AC Electric. #1510918 (dash unit), #1510772 (engine unit).
See article in Mechanical Equipment Section for data.

BATTERY:—**Delco Model 15E-1.** 6 volt, 15 plate, 100 ampere hour capacity (20 hour rate).
Starting Capacity—120 amperes for 20 minutes.
Zero Capacity—300 amperes for 3.5 minutes. Five second voltage—4.25 volts.
Dimensions—Length 19 5/16". Width 4". Height 9".
Grounded Terminal—Negative (—) grounded to starter motor housing.
Location—On left side under hood.

Police Battery:—**Delco Model 19E-1.** 6 volt. 19 plate, 130 ampere hour capacity (20 hour rate).
Starting Capacity—150 amperes for 20 minutes.
Zero Capacity—300 amperes for 5.3 minutes. Five second voltage—4.55 volts.
All other data as given above for 15E-1.

STARTER:—**Model 1107007, 1107019 (RHD).**
Armature No.—1867897 (1107007), 810601 (1107019).
Drive—Overrunning clutch (manual shift on 1107-007, solenoid pinion shift on 1107019).
Rotation—Counter-clockwise at commutator end.
Cranking Engine—125-135 amperes, 5 volts at 100 RPM (summer temperatures) for 1107007.
Brush Spring Tension—24-28 ounces.

Performance Data

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	5000	5.0	65
12 "	Lock	3.37	525

Removal:—Mounted on left front face of flywheel housing. To remove, take out mounting screws.

Starting Switch (1107007):—Mounted on starter. Operated by starting pedal.

Starting Switch (1107019):—Solenoid Switch type 1546 operated by pushbutton switch 1996008.
See article in Electrical Equipment Section for data.

GENERATOR:—**Delco-Remy 1102664. Armature 1879002.** Two brush with current-voltage control.
Charging Rate Adjustment—No adjustment at generator. Charging rate controlled by Voltage Regulator and maximum output by Current Regulator.
See Regulator data following.
Maximum Charging Rate—33 amperes min. (hot or cold), 8.0 volts, 2400 RPM or approx. 20 MPH and above with load or discharged battery (Current Regulator setting). Actual charging rate controlled by Voltage Regulator and dependent on battery condition.

Performance Data

	Amperes	Volts	R.P.M.
Cold	30*	8.0	1700

*—Not maximum output—See Current Regulator.

Field Current—1.76-1.88 amperes at 6.0 volts.
Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—25 ounces each.

Removal:—Pivot mounted at left front of engine. To remove, take out clamp and pivot bolts.

Belt Adjustment:—Swing generator out until belt deflection midway between generator and fan pulley is ¾" with light pressure on belt.

REGULATOR:—**Model 1118201. 'Single Core' type.** Vibrating Voltage & Current regulator on dash.
CAUTION—Check generator for grounded fields before changing regulator settings.
See article in Electrical Equipment Section for data.

Cutout Relay

Cuts In—6.2-6.7 volts (hot), 600 Gen. RPM.
Cuts Out—0-4.0 amperes discharge current.
Contact Gap—.020" (same for both sides).
Air Gap—.020" (with points just closed).

Voltage Regulator

Setting—7.4-7.8 volts (70° F.), 7.2-7.4 volts (hot). Regulator over-compensated for temperature.
To Check—Connect ammeter in charging line at 'BAT' regulator terminal, voltmeter between 'BAT' terminal and ground. Operate generator at approx. 3000 RPM, adjust charging rate to 8-10 amperes (use variable rheostat or 'AVR' set). With regulator hot, retard generator speed until cut-out relay points open, then increase speed to approx. 3000 RPM and check hot voltage setting (above) with cover in place.
To Adjust—Change regulator armature spring tension slightly by bending lower spring hanger for **light (left) spring (or one spring if both alike) only.** If further adjustment required, see Single Core Regulator article in Electrical Equipment Section for Heavy (or other spring) adjustment.
Air Gap—.070" between center of core and armature with contacts just closed.

Current Regulator

Setting—32-34 amperes (hot).
To Check—Remove cover, connect short jumper from voltage regulator frame to upper contact support bracket (shorting out Voltage Regulator). Connect ammeter in charging line at 'BAT' regulator terminal. Turn on lights and accessories, operate generator and increase speed until output remains stationary (run until hot). Check setting with regulator at hot operating temperature.
To Adjust—Change regulator armature spring tension slightly by bending lower spring hanger for **one spring.** If further adjustment required see Single Core Regulator article in Electrical Equipment Section for adjustment of other spring.
Air Gap—.075" (check same as Voltage Regulator).

LIGHTING:—**Headlamps**—Guide 'Sealed Beam' type.
See article in Electrical Equipment Section for data.
Headlamps Adjustment—Aim upper beam straight ahead with center of hot spot 3" below lamp center height.
Beam Indicator—Red light on speedometer face. Lighted whenever Country (upper) beam in use.

Switches

Lighting—Delco-Remy 1995009.
Beam Selector—Delco-Remy 1997002,1997004 (RHD).
Stop Light—Delco-Remy 1997725.

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps		Sealed Beam
Parking, Instrument	1½	55
Glove Comp't., Beam Indic.	1	51
License Plate	3	63
Stop & Tail	21-3	1154
Dome	6	81

THERMOSTATIC RELAY:—**Delco-Remy.** On lighting switch. Contacts remain closed with 30 amperes, open in 3 minutes with 42 amps. at 70°. Not adj.

HORNS:—**Delco-Remy Model K-33-H. No. 1999561** (low note), 1999562 (high note). Vibrator type, blended tone, operated by horn relay.

Type	Current (at 6 volts)	Air Gap
1999561 (Low Note)	19-21 amperes	.047-.052"
1999562 (High Note)	18-20 amperes	.039-.044"

Horn Relay:—Delco-Remy Model 1116775.
Contact Gap—.020". **Air Gap**—.015" (closed).
Contacts Close—2.75-4.0 volts.

ENGINE HOOD NOTE:—Alligator type hood with integral side panels and instrument panel lock. To raise hood, pull out on control knob at left of steering wheel (hood will raise 1½"), press on safety catch tab under front edge of hood at center.

SERIAL NUMBER:—On left frame side member under hood near generator. First number L-242001 (Lansing), CL-190501 (Calif.), LL-202001 (Linden, N.J.).

ENGINE NUMBER:—On boss on left side of cylinder block behind water pump. First number L-334001, LR-1801 (RHD). NOTE—Cars with Hydramatic Drive carry prefix 'LA' instead of 'L'.

COMPRESSION:—**Ratio**—6.2-1 Std. 5.8-1 Optl. **Pressure**—152 lbs. (Std. Hd.), 125 lbs. (Optl. LC. Hd.) at 1000 RPM. or approx. 104-114 lbs. at cranking spd. of 100 R.P.M. (summer temperatures).

VACUUM READING:—Steady 17" min. at 6 MPH.

IGNITION:—**Coil Model 1115129.** On engine side of dash. **Ignition Current**—2.0 amperes idling, 4.5 stopped.

Ignition Switch:—Delco-Remy No. 1116273, 1116289 (RHD). Connected to coil by armored cable. **Ignition Lock**—Briggs & Stratton. B & S No. 85208. Key Series—8000 to 9499. Groove—No. 15.

Distributor Model 1110802. Single breaker, 8 lobe cam, full automatic advance type with auxiliary vacuum spark control and Octane Selector adjustment. NOTE—New ground lead #1879140 used between breaker point plate and housing after first 1250 distributors. This lead cannot be used on earlier cars. For first 1250 distributors and earlier models use longer ground lead #1858574.
Breaker Gap—.015". Limits .0125-.0175".
Cam Angle or Dwell—31° closed, 14° open (distr.).
Breaker Arm Spring Tension—19-23 ounces.
Rotation—Counter-clockwise viewed from above.
Condenser—Part No. 1869704. Capacity .18-.25 mfd.

Automatic Advance

Distributor Degrees	Distributor R.P.M.	Engine Degrees	Engine R.P.M.
Start	300	2.5	600
3.5	500	7	1000
15	2000	30	4000

Vacuum Spark Control Model 681-R—Integral type (mounted on distributor cup, linked to breaker plate). Provides additional advance at speeds above idling except when engine accelerated or operated with wide open throttle when spark retarded by return spring in unit. Plunger travel 11/64" total.

Vacuum Advance

Distr. Degrees	Eng. Degrees	Vacuum (" of HG)
Start	0	5-7"
7.5	15	14-17"

Octane Selector—Adjustment at distributor. Permits 10° advance or retard from center '0' position. See Ignition Timing for adjustment directions.

Removal:—Distributor mounted on left side of engine. To remove, disconnect vacuum line, take out hold-down screw in advance arm.

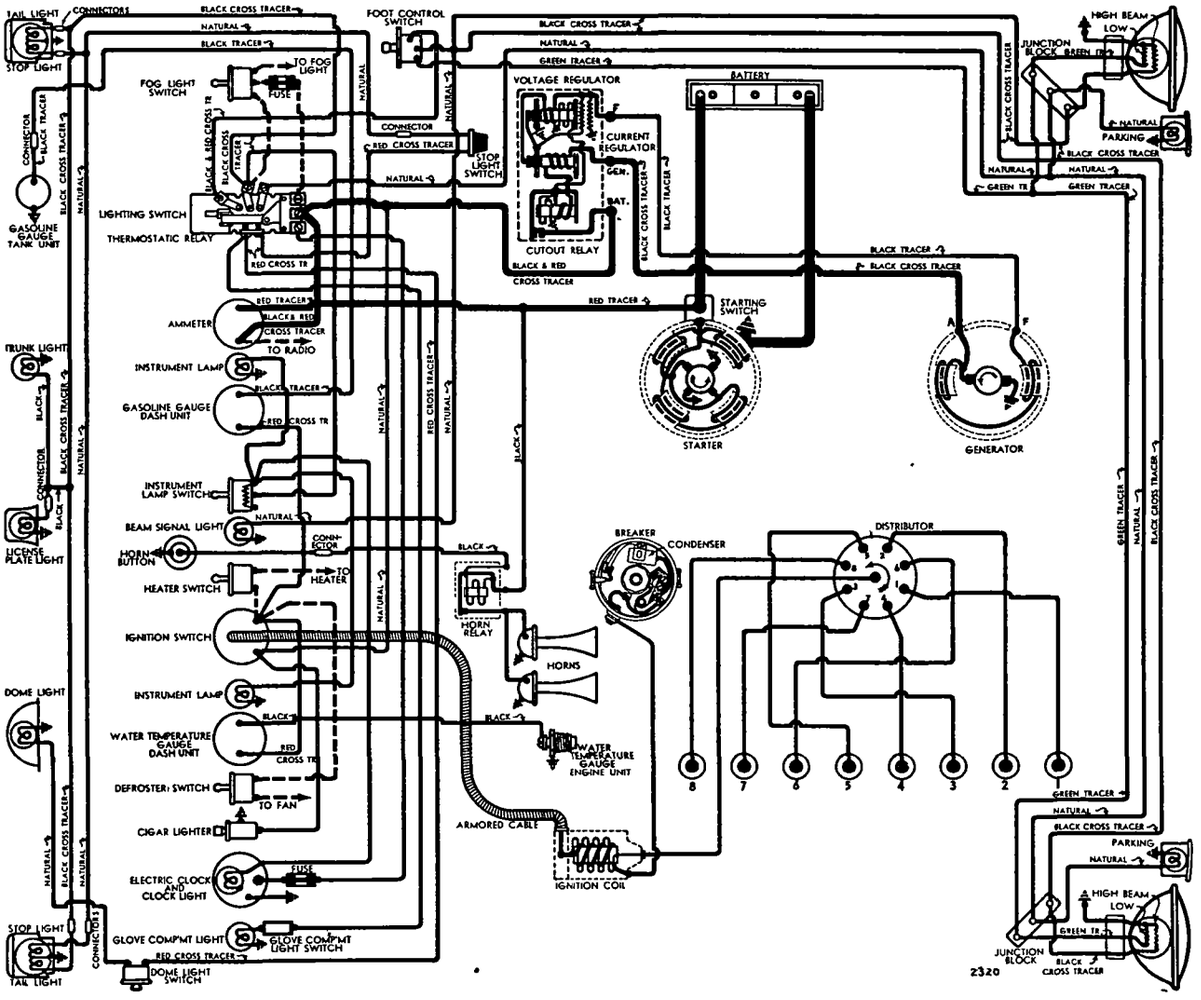
IGNITION TIMING:—Standard setting as follows. See Octane Selector for correction dependent on fuel used.

	Flywheel Degrees	Piston Position
All Engines	2° BTDC	.002" BTDC.

IMPORTANT—Timing mark for #1 cylinder, not #6 cylinder as on previous models.
Timing (Using Synchroscope)—This method recommended by manufacturer. Clip synchroscope lead to #1 spark plug, direct light on flywheel through inspection hole in left front face of flywheel housing beside starter. Idle engine, loosen hold-down screw, center pointer on scale, tighten hold-down screw. Loosen advance arm clamp bolt, rotate distributor until timing mark (steel ball insert in flywheel) appears in line with pointer in inspection hole, tighten clamp bolt. Check Octane Selector setting.

Timing (Without Synchroscope)—Turn engine over to firing position for #1 piston with steel ball insert in flywheel in line with pointer in inspection hole in left front face of flywheel housing. Loosen hold-down screw in advance arm, center pointer on scale, tighten hold-down screw. Loosen advance arm clamp bolt, rotate distributor until contacts begin to open (using timing light connected between ignition terminal and ground and turn on ignition, light will go on as contacts open), tighten clamp bolt. Check Octane Selector setting.

Motor Gauge—Weidenhoff Adapter #114, Rod #40.
Octane Selector Setting—Set for slight ping when accelerating engine with wide open throttle at speeds below 15 MPH. To adjust, loosen distributor hold-down screw, rotate distributor clockwise toward 'Adv' end of scale (if no ping noted), counterclockwise toward 'Ret' end of scale (if ping too severe). Check performance after making adjustment.
Firing Order:—1-6-2-5-8-3-7-4.
Spark Plugs:—AC No. 45. 14 MM. Metric type. **Spark Plug Gaps**—.030".
CARBURETION:—**Carburetor**—Carter Type WDO, Model 389-S (Conventional transmission), Model 471-S (with Hydra-matic drive). 1¼" dual downdraft type. #192 cast on face of flange. ***See article in Carburetor Section for data.***
Hydra-matic Drive Car Note—Throttle linkage must be adjusted for correct transmission performance. ***See Hydra-matic Transmission article in Mechanical Equipment Section for adjustments.***
Idle Adjustment—With engine warm and running at slow idle speed (choke valve wide open, fast idle inoperative), set throttle stopscrew for 6 MPH idle speed (high gear—Conv. Trans.), 375 Engine R.P.M. Hydra-matic drive). Adjust idle adjusting screw for



each barrel (in succession) until engine fires smoothly (½-1¼ turns open—turn screws in for leaner mixture). Readjust idle speed.

Float Level—⅜" from top of float to gasket seat on cover with needle valve seated (invert to check). NOTE—This setting supersedes former setting of 9/32" (also 13/32" setting to correct hard starting).

Accelerator Pump Setting—Not adjustable.

Fast Idle—Integral type (built-in carburetor).
See article in Carburetion Equipment Section.

Fast Idle Setting—Adjust fast idle screw to give .030" clearance between throttle stopscrew and stop (choke valve closed, stopscrew set for 6 MPH idle). NOTE—On cars with Hydra-matic drive, setting should be .025".

Accelerator Linkage Adjustment:—Must be set for correct 'throttle cracking' action for starting. To adjust, disconnect starter cable (to prevent cranking), fully depress starter switch pedal, loosen eccentric pin locknut, adjust pin to give .070" clearance between throttle lever stopscrew and stop on carburetor body (with fast idle screw contacting highest step of fast idle cam—fast idle position), tighten lockscrew.

Automatic Choke:—Carter Climatic Control.
See article in Carburetion Equipment Section.

Choke Setting—Set at center index mark.

Air Cleaner:—AC #1528974 oil wetted type std.

Fuel Pump:—AC Type AJ #1523895 combination fuel-and-vacuum pump mounted on special adapter, AC #1523903, which has additional operating linkage.
See article in Carburetion Equipment Section.

Gasoline Gauge:—AC Electric type. #1515372 (dash unit), #1516206 (tank unit).
See article in Carburetion Equipment Section.

MANIFOLD HEAT CONTROL:—Automatic thermostatic coil type. See that valve operates freely. When installing thermostatic coil, wind coil up 105° (approx. 1/3 revolution) at room temperature.

VALVE TIMING:—#1 intake valve opens at TDC. with .0124" tappet clearance ("TDC/' mark on flywheel at indicator on housing above starter).

Tappet Clearance—.008" Int., .011" Exh. warm.

Valve Springs—50½ lbs. at 2¼" (closed), 95½ lbs. at 1 15/16" (open). Free length 2⅝".

LUBRICATION:—**Crankcase Capacity**—6 quarts.

Normal Oil Pressure—32 lbs.

COOLING SYSTEM:—**Capacity**—21 quarts.

Thermostat:—Harrison. In cyl. head water outlet. Starts to open 152°F. Fully open 173°F.

Temperature Gauge:—AC Electric. #1510918 (dash unit), #1510772 (engine unit).
See article in Mechanical Equipment Section for data.

BATTERY:—**Delco Model 17E-1.** 6 volt, 17 plate, 115 amperes hour capacity (20 hour rate).

Starting Capacity—137 amperes for 20 minutes.

Zero Capacity—300 amperes for 4.3 minutes. Five second voltage—4.40 volts.

Grounded Terminal—Negative (—) terminal grounded to starter motor housing.

Dimensions—Length 19 5/16". Width 4". Height 9".

Location—Left side under engine hood.

Police Battery:—**Delco Model 19E-1.** 6 volt, 19 plate, 130 amperes hour capacity (20 hr. rate).

Starting Capacity—150 amperes for 20 minutes.

Zero Capacity—300 amperes for 5.3 minutes. Five second voltage—4.55 volts.

All other data as given above for 17E-1.

STARTER:—**Delco-Remy 1107907. Armature 1867897.**

Drive—Overrunning clutch (manual pinion shift).

Rotation—Counter-clockwise at commutator end.

Brush Spring Tension—24-28 ounces each.

Cranking Engine—140-150 amperes, 5 volts, 100 RPM (summer temperatures).

Performance Data

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	600	5.0	60
15 " "	Lock	3.0	600

Removal:—Mounted on left front face of flywheel housing. To remove, take out mounting screws.

Starting Switch—No. 820052. Mounted on starter. Operated by starting pedal.

GENERATOR:—**Model 1102664. Armature No. 1879002.** Two brush type with current-voltage control.

Charging Rate Adjustment—No adjustment at generator. Charging rate controlled by Voltage Regulator and maximum output by Current Regulator.
See Regulator data following.

Maximum Charging Rate—33 amperes min. (hot or cold), 8.0 volts, 2400 RPM or approx. 20 MPH and above with load or discharged battery (Current Regulator setting). Actual charging rate controlled by Voltage Regulator and dependent on battery condition.

Performance Data

	Amperes	Volts	R.P.M.
Cold	30*	8.0	1700

*—Not maximum output—See Current Regulator.

Rotation—Counter-clockwise at commutator end.

Brush Spring Tension—25 ounces each.

Field Current—1.76-1.88 amperes at 6.0 volts.

Removal:—Pivot mounted at left front of engine. To remove, take out clamp and pivot bolts.

Belt Adjustment:—Swing generator out until belt deflection midway between generator and fan pulley is ¾" with light pressure on belt.

REGULATOR:—**Model 1118201. 'Single Core' type.** Vibrating Voltage & Current regulator on dash. CAUTION—Check generator for grounded fields before changing regulator settings.
See article in Electrical Equipment Section for data.

Cutout Relay

Cuts In—6.2-6.7 volts (hot), 600 Gen. RPM.

Cuts Out—0-4.0 amperes discharge current.

Contact Gap—.020" (same for both sides).

Air Gap—.020" (with points just closed).

Voltage Regulator

Setting—7.4-7.8 volts (70° F.), 7.2-7.4 volts (hot). Regulator over-compensated for temperature.

To Check—Connect ammeter in charging line at 'BAT' regulator terminal, voltmeter between 'BAT' terminal and ground. Operate generator at approx. 3000 RPM, adjust charging rate to 8-10 amperes (use variable rheostat or 'AVR' set). With regulator hot, retard generator speed until cut-out relay points open, then increase speed to approx. 3000 RPM and check hot voltage setting (above) with cover in place.

To Adjust—Change regulator armature spring tension slightly by bending lower spring hanger for **light (left) spring (or one spring if both alike) only.** If further adjustment required, see Single Core Regulator article in Electrical Equipment Section for Heavy (or other spring) adjustment.

Air Gap—.070" between center of core and armature with contacts just closed.

Current Regulator

Setting—32-34 amperes (hot).

To Check—Remove cover, connect short jumper from voltage regulator frame to upper contact support bracket (shorting out Voltage Regulator). Connect ammeter in charging line at 'BAT' regulator terminal. Turn on lights and accessories, operate generator and increase speed until output remains stationary (run until hot). Check setting with regulator at hot operating temperature.

To Adjust—Change regulator armature spring tension slightly by bending lower spring hanger for **one spring.** If further adjustment required see Single Core Regulator article in Electrical Equipment Section for adjustment of other spring.

Air Gap—.075" (check same as Voltage Regulator).

LIGHTING:—**Headlamps**—Guide 'Sealed Beam' type.
See article in Electrical Equipment Section for data.

Headlamps Adjustment—Aim upper beam straight ahead with center of hot spot 3" below lamp center height.

Beam Indicator—Red light on speedometer face. Lighted whenever Country (upper) beam in use.

Switches

Lighting—Delco-Remy 1995009.

Beam Selector—Delco-Remy 1997002,1997004 (RHD).

Stop Light—Delco-Remy 1997725.

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps		Sealed Beam
Parking, Instrument	1½	55
Glove Comp't., Beam Indic.	1	51
License Plate	3	63
Stop & Tail	21-3	1154
Dome	6	81

THERMOSTATIC RELAY:—**Delco-Remy.** On lighting switch. Contacts remain closed with 30 amperes, but open in 3 minutes with load of 42 amperes at 70°F. Not adjustable.

HORNS:—**Delco-Remy Model K-33-H.** No. 1999561 (low note), 1999562 (high note). Vibrator type, blended tone, operated by horn relay.

Type	Current (at 6 volts)	Air Gap
1999561 (Low Note)	19-21 amperes	.047-.052"
1999562 (High Note)	18-20 amperes	.039-.044"

Horn Relay:—Delco-Remy Model 1116775.

Contact Gap—.020". **Air Gap**—.015" (closed).

Contacts Close—2.75-4.0 volts.

SERIAL NUMBER:—On left side of cowl (use Eng. No.).

ENGINE NUMBER:—First number C-1501. On left side of block between #1 and #2 cylinders.

COMPRESSION:—**Ratio**—6.39-1 Std., 6.71-1 Optl. **Pressure**—110 lbs. (6.39-1 Std. cast-iron hd.), 118 lbs. (6.71-1 Optl. cast-iron hd.) at 125 RPM.

VACUUM READING:—Steady 18-20" idling at 6 MPH.

IGNITION:—**Coil Model CE-4632.** On left hand side of engine near distributor. Service coil CE-3224ES. **Ignition Current**—½ ampere idling, 2½ stopped.

Ignition Switch:—Mitchellock Model 24-B, No. 8058. **Ignition Lock**—Briggs & Stratton. B & S No. 50184. **Key Series**—P1251 to P1500. **Groove**—No. 2.

Distributor Model IGW-4143, IGW-4143A. Single breaker, 6 lobe cam, full automatic advance type with Fuel Compensator adjustment at distributor. NOTE—No vacuum spark control is used.

Breaker Gap—Set at .020".

Cam Angle or Dwell—(IGW-4143) 35° closed, 25° open. (IGW-4143A) 41° closed, 19° open (Dist. °).

Breaker Arm Spring Tension—17-20 ounces.

Rotation—Counter-clockwise viewed from above.

Condenser—No. IGW-3075E, Capacity .20-.25 mfd. (Before 1U-0000); IGW-3128, Capacity .28-.32 mfd. (After 1U-0000—all models).

Automatic Advance—IGW-4143

Distributor Degrees	R.P.M.	Engine Degrees	R.P.M.
Start	300	0	600
2	550	4	1100
4	800	8	1600
6	1300	12	2600
8.75	2000	17.5	4000

Automatic Advance—IGW-4143A

Degrees	R.P.M.	Degrees	R.P.M.
Start	300	0	600
3	590	6	1180
5	780	10	1560
7	1150	14	2300
9.5	1600	19	3200

Fuel Compensator—Manual adjustment at distributor provides 12° advance or retard from center '0' position. See Ignition Timing for setting.

Distributor Removal:—Mounted on left side of crankcase. To remove, take out hold-down screw in advance arm.

IGNITION TIMING:—Standard setting listed below (see Fuel Compensator Setting following):

	Flywheel Degrees	Piston Position
All heads	4½-6° BTDC	.0083-.0149" BTDC.

NOTE—Flywheel marked '1 UP DC' with five 2° graduations before and after this point.

Timing—Remove inspection hole cover (left front face of flywheel housing below starter). Loosen thumbnut, set Fuel Compensator pointer at '0' (center graduation on scale), tighten thumbnut. With #1 piston on compression, turn engine over until piston reaches firing position (see table above), stop when correct graduation on flywheel lines up with pointer. Loosen advance arm clamp bolt, rotate distributor until contacts begin to open, tighten clamp bolt, see that rotor opposite #1 segment in distributor cap, check Fuel Compensator setting.

Timing (Neon Timing Light)—White mark provided on flywheel to indicate timing range (leading edge of mark 6° BTDC). Idle engine and adjust distributor as directed above.

Motor Gauge—Weidenhoff Adapter #104, (with 10 M.M. adapter). Rod #5.

Fuel Compensator Setting—Should be set for slight ping when accelerating with wide open throttle. To adjust, loosen thumbnut, rotate distributor counter-clockwise (if ping too severe), clockwise (if no ping noted), tighten thumbnut and recheck performance.

Firing Order:—1-5-3-6-2-4 (see diagram).

Spark Plugs:—AC No. 104 or Champion Y-4 10 MM. Metric type. NOTE—Do not use more than 50 in. lb. (10 lb. pull on 5" wrench) when tightening these plugs.

CARBURETION:—**Carburetor**—Stromberg Model BXOV-26 (No. A-19162). 1¼" single barrel, down-draft type. Code marked 10-39.

See article in Carburetor Section for complete data.

Idle Adjustment—With engine warm and running at slow idle speed (choke valve wide open, fast idle inoperative), set throttle stopscrew for 6 MPH idle speed. Adjust idle adjusting screw until engine fires smoothly (1-1¼ turns open—turn screw in for leaner mixture). Readjust idle speed.

Accelerating Pump Setting—Three holes provided in pump lever for pump link engagement as follows: Inner (min. stroke)—Hot weather or high-test fuel. Center Hole—Normal temperatures and fuel. Outer (max. stroke)—Cold weather or low test fuel.

Float Level—Fuel level ⅝" below top edge of bowl.

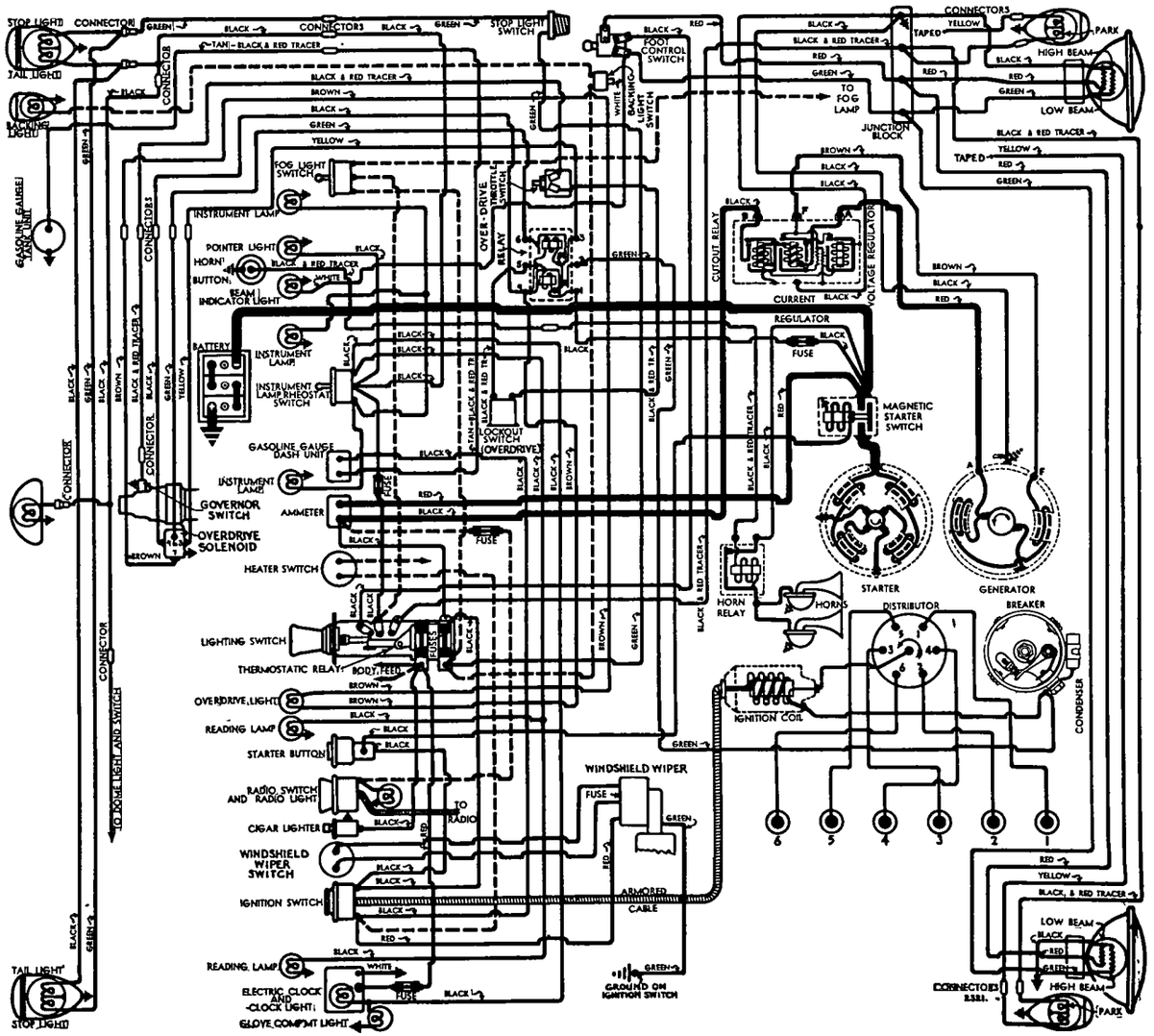
Fast Idle:—Integral type, operated by automatic choke. ***See article in Carburetion Equipment Section.***

Fast Idle Setting—Not adjustable.

Automatic Choke:—Stromberg BXOV-26 carburetor type.

See article in Carburetion Equipment Section.

Choke Setting—5 Notches Rich ('V' on scale centered on mark on housing). May be varied 2 notches.



Throttle Guard (Cars with Econo-Drive):—Vacuum operated throttle kicker to prevent engine stalling when operating below 20 MPH.
See article in Carburetion Equipment Section.

Air Cleaner:—AC #1529340 oil-wetted type standard. Heavy duty oil-bath type optl. Crankcase filler tube cap equipped with copper mesh cleaner.

Fuel Pump:—AC Type AT #1537060 diaphragm type.
See article in Carburetion Equipment Section.

Gasoline Gauge:—Stewart (Stewart-Warner) Electric.
See article in Carburetion Equipment Section.

MANIFOLD HEAT CONTROL:—Thermostatic coil type. Make certain that valve operates freely (valve must not bind or stick). Do not oil control.

VALVE TIMING:—**To Check**—With .0125" tappet clearance #1 intake valve should open with #1 piston 1° or .0004" BTDC when 1° point on flywheel (½ graduation before '1 UP DC' mark) lines up with pointer in inspection hole in flywheel housing below starter (left side). Permissable variation plus or minus 2 graduations. Reset tappet cl. .007" (hot & idling).

Tappet Clearance:—.007" Intake, .010" Exhaust (hot and idling). NOTE—Remove right front fender apron for access to valves.

Valve Spring Pressure:—47-52 lbs. at 1⅝" (valve closed), 114-124 lbs. at 1 5/16" (valve open).

LUBRICATION:—**Crankcase Capacity**—5 quarts.
Normal Oil Pressure—45 lbs. at 45 MPH.

COOLING SYSTEM:—**Capacity**—17 quarts.
Thermostat—Harrison. In cylinder head outlet. Starts to open at 145° F.

TRANSMISSION OVERDRIVE CONTROL:—New electric type with solenoid operated 'kick-down' through accelerator switch and a new governor control switch.
See article in Mechanical Equipment Section for data.

Overdrive Solenoid—Delco Remy Model 1118005.

Overdrive Indicator Light—In light switch knob. Lighted when overdrive is ready to engage (light goes out when accelerator pedal released so that overdrive can engage).

Throttle Switch—Cole-Hersee, Packard No. 347496. Adjust tappet screw on throttle lever to just contact switch plunger with carburetor throttle valve in wide open position.

Lock-out Switch—Ark-less or Soreng-Manegold, Packard No. 354820 or 347641.

Control Relay—Delco-Remy Model 1116801.

Governor Switch—Bendix, Packard No. 347478 Std.
See Warner (Packard) Overdrive Control article in Mechanical Equipment Section for optl. switches.

BATTERY:—**Prest-O-Lite, Type MT1-15.** 6 volt, 15 plate, 95 ampere hour capacity (20 hour rate).
Starting Capacity—300 amperes for 3.1 minutes.
Zero Capacity—300 amperes for 3.1 minutes.
Grounded Terminal—Positive (+) grounded to the frame 'X' member. **Engine Ground**—Strap connector between transmission cover bolt and frame.
Dimensions—Length 9". Width 7". Height 8¾".
Location—Under left front seat.

STARTER:—**Model MZ-4078. Armature MZ-2134.**
Drive—Outboard Barrel Type Bendix No. A-1792.
Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—42-53 ozs. (new brushes).
Cranking Engine—150-175 amperes, 5.1 volts.

Performance Data

Torque			R.P.M.	Volts	Amperes
0	ft. lbs.		4300	5.5	70
.65	"	"	2500	5.5	100
2.55	"	"	1325	5.0	200
4.95	"	"	750	4.5	300
7.65	"	"	220	4.0	400
7.8	"	"	Lock	3.0	420
11.8	"	"	Lock	4.0	560

Removal:—Flange mounted on left front face of flywheel housing. To remove, take out flange mounting screws, lift out starter and switch assembly.
Starting Switch:—Model SS-4001. Magnetic type. Mounted on starter, controlled by switch on instrument panel. *See article in Electrical Equipment Section.*

GENERATOR:—**Model GEA-4801A. Armature GDZ-2006F.** Two brush with current-voltage control.
Charging Rate Adjustment—No adjustment at generator. Charging rate controlled by Voltage Regulator and maximum output by Current Regulator.
See Regulator data following.
Maximum Charging Rate—35 amperes (hot or cold), 8.0 volts, 1570 RPM and above with load or discharged battery (Current Regulator setting). Actual charging rate controlled by Voltage Regulator and dependent on battery condition.

Performance Data

Cold			Hot		
Amperes	Volts	R.P.M.	Amperes	Volts	R.P.M.
0	6.4	780	0	6.4	840
4	6.6	870	4	6.6	935
8	6.8	960	8	6.8	1025
12	6.95	1050	12	6.95	1120
16	7.15	1140	16	7.15	1220
20	7.3	1230	20	7.3	1320
24	7.6	1320	24	7.6	1420
28	7.7	1410	28	7.7	1550
32	7.85	1500	32	7.85	1685
35	8.0	1570	35	8.0	1800

Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—53 ozs. max. (new brushes).
Field Current—1.57-1.75 amperes at 6.0 volts.
Motoring Current—4.45-4.9 amperes at 6.0 volts.
Removal:—Pivot mounted at left front of engine. To remove, take out pivot and clamp bolts.
Belt Adjustment:—Swing generator out until 25 lb. reading secured on scale hooked to clamp bolt lug parallel to clamp link or until belt deflection midway between generator and water pump pulley is ½" with thumb pressure.

REGULATOR:—**Model VRB-4012B-1 (First Cars), VRP-4002A (Later Cars). Current-Voltage Type.** Mounted in single case on engine side of dash.
See article in Electrical Equipment Section for data.
NOTE—Regulator case cover is sealed. Serviced on exchange basis if seals not broken.

Cutout Relay
Cuts In—6.4-7.0 volts (VRB), 6.4-6.6 volts (VRP).
Cuts Out—.5-3.0 ampere discharge (VRB), 4.8-5.6 volts with approx. 7-8 ampere discharge (VRP).
Contact Gap—.015" minimum.
Air Gap—.034" min., .038" max. with contacts open. Measure at hinge end of core.

Voltage Regulator
Setting—7.3-7.6 volts at 70° F.
To Check (without breaking seals)—Connect ammeter in charging line at regulator 'B' terminal, voltmeter between 'B' terminal and ground. Operate generator at speed equivalent to 30 MPH, charging battery until voltage is steady. Voltage reading should be within limits of 7.36 to 7.66 volts.
To Adjust (with cover removed)—Change regulator armature spring tension by bending lower spring hanger slightly. See Electrical Equipment Section.
Contact Gap—.010-.020" (VRB), .012" Min. (VRP) with armature against stop pin.
Air Gap—.0595-.0625" (VRB), .048-.052" (VRP) with contacts just opening.

Current Regulator
Setting—34-36 amperes (marked '35' on cover).
To Check (without breaking seals)—Connect test meters as for Voltage check (above). Operate generator at 30 MPH, charging battery, add load (use bank of headlamp bulbs, or turn on car lights and accessories and discharge battery) so that generator charges at peak rate and Current Regulator operates. Charging current should not exceed 34-36 amperes. If more than slight excess noted, regulator is defective.
Adjustment & Contact Gap—Same as for Voltage Regulator (above).
Air Gap—.0595-.0625" (VRB), .034-.038" (VRP) with contacts just opening.

LIGHTING:—**Headlamps**—Hall 'Sealed Beam' type.
See article in Electrical Equipment Section for data.
Headlamp Adjustment—Aim upper beam for each lamp straight ahead with center of hot spot 3" below lamp center height.
Beam Indicator—Tell-tale light on speedometer face. Lighted when Country (upper) beams in use.

Switches
Lighting—Delco-Remy 1995011.
Beam Selector—R-B-M Model 1050D.

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps		Sealed Beam
Front Turn Indic. & Fender	21-3	1158
Instr., Speed'mtr., Clock	1½	55
Front Reading, Radio, Trunk	1½	55
Glove Comp't., Rear Radio	1	51
Beam, Heater & Defrost Indic.	1	51
Dome and Rear Reading	6	81
Stop & Tail	21-3	1158
Stop (Trunk Rack Equip)	15	87
Tail (Trunk Rack Equip)	3	63
Rear License	3	63
Fog Light	32	1321
Spot Light	32	1323
Backing Light	15	87

THERMOSTATIC RELAY:—**Delco-Remy.** On lighting switch. Contacts remain closed with 30 amperes, open in 3 minutes with 42 amps. @ 70°F. Not adj.
FUSES:—**Dome, Stop Light and Accessories**—Two 20 ampere. Mounted on back of lighting switch.
Instrument and Tail Light—20 ampere. In connector in tail light lead near light switch.
Clock—2 ampere. In feed wire.
Radio—14 ampere. In feed wire.
Overdrive—30 ampere. In relay lead near starter.
Windshield Wiper—14 ampere. On dynamic breaker to right of wiper motor.
HORNS:—**Sparton Model H-32.** Vibrator type, Air tone, Twin horns operated by horn relay.
Air Gap—.032-.035" (low note—long horn), .026-.030" (high note—short air column).
Horn Current—22-25 amperes (total).
Horn Relay:—R-B-M Model 4760.
NOTE—Relay not adjustable (cover welded on).
Closing Voltage—3.5-4.5 volts.
WINDSHIELD WIPER:—**Stewart-Warner Series 645.** Electric type. 14 ampere fuse mounted on dynamic breaker (behind instrument panel to right of wiper motor).
See article in Mechanical Equipment Section for data.

SERIAL NUMBER:—On left side of cowl (use Eng. No.)

ENGINE NUMBER:—First number C-300001. On left side of block between #1 and #2 cylinders.

COMPRESSION:—**Ratio**—6.41-1 Std., 6.85-1 Optl. **Pressure**—110 lbs. (6.41-1 Std. cast-iron hd.), 118 lbs. (6.85-1 Optl. cast-iron hd.) at 125 RPM.

VACUUM READING:—Steady 18-20" idling at 6 MPH.

IGNITION:—**Coil Model CE-4632.** On left hand side of engine near distributor. Service coil CE-3224ES. **Ignition Current**—½ ampere idling, 2½ stopped.

Ignition Switch:—Mitchellock Model 24-B, No. 8058. **Ignition Lock**—Briggs & Stratton. B & S No. 50184. **Key Series**—P1251 to P1500. **Groove**—No. 2.

Distributor Model IGP-4501, IGP-4501A. Single breaker, 8 lobe cam, full automatic advance type with Fuel Compensator adjustment at distributor. NOTE—No vacuum spark control is used.

Breaker Gap—Set at .015".
Cam Angle or Dwell—27° clsd., 18° open (.017" gap).
Breaker Arm Spring Tension—17-20 ounces.
Rotation—Counter-clockwise viewed from the top.
Condenser—No. IG-2671K. Capacity .20-.25 mfd.

Automatic Advance—IGP-4501

Distributor		Engine	
Degrees	R.P.M.	Degrees	R.P.M.
Start	300	0	600
3	400	6	800
4	560	8	1120
6	875	12	1750
8	1200	16	2400

Automatic Advance—IGP-4501A

Degrees	R.P.M.	Degrees	R.P.M.
Start	250	0	500
3	525	6	1050
6	800	12	1600
9	1210	18	2420
11.5	1550	23	3100

Fuel Compensator—Manual adjustment at distributor provides 12° advance or retard from center '0' position. See Ignition Timing for setting.

Distributor Removal:—Mounted on left side of crankcase. To remove, take out hold-down screw in advance arm.

IGNITION TIMING:—Standard setting listed below (see Fuel Compensator Setting following):

	Flywheel Degrees	Piston Position
Std. 6.41-1 head	6½-8° BTDC	.0174-.0262" BTDC
Optl. 6.85-1 HC hd.	5½-7° BTDC	.0124-.0202" BTDC

NOTE—Flywheel marked '1 UP DC' with five 2° graduations before and after this point.

Timing—Remove inspection hole cover (left front face of flywheel housing below starter). Loosen thumbnut, set Fuel Compensator pointer at '0' (center graduation on scale), tighten thumbnut. With #1 piston on compression, turn engine over until piston reaches firing position (see table above), stop when correct graduation on flywheel lines up with pointer. Loosen advance arm clamp bolt, rotate distributor until contacts begin to open, tighten clamp bolt, see that rotor opposite #1 segment in distributor cap, check Fuel Compensator setting.

Timing (Neon Timing Light)—White mark provided on flywheel to indicate timing range (leading edge of mark 8° BTDC). Idle engine and adjust distributor as directed above.

Motor Gauge—Weidenhoff Adapter #104, (with 10 M.M. adapter). Rod #5.
Fuel Compensator Setting—Should be set for slight ping when accelerating with wide open throttle. To adjust, loosen thumbnut, rotate distributor counter-clockwise (if ping too severe), clockwise (if no ping noted), tighten thumbnut and recheck performance.

Firing Order:—1-6-2-5-8-3-7-4 (see diagram).

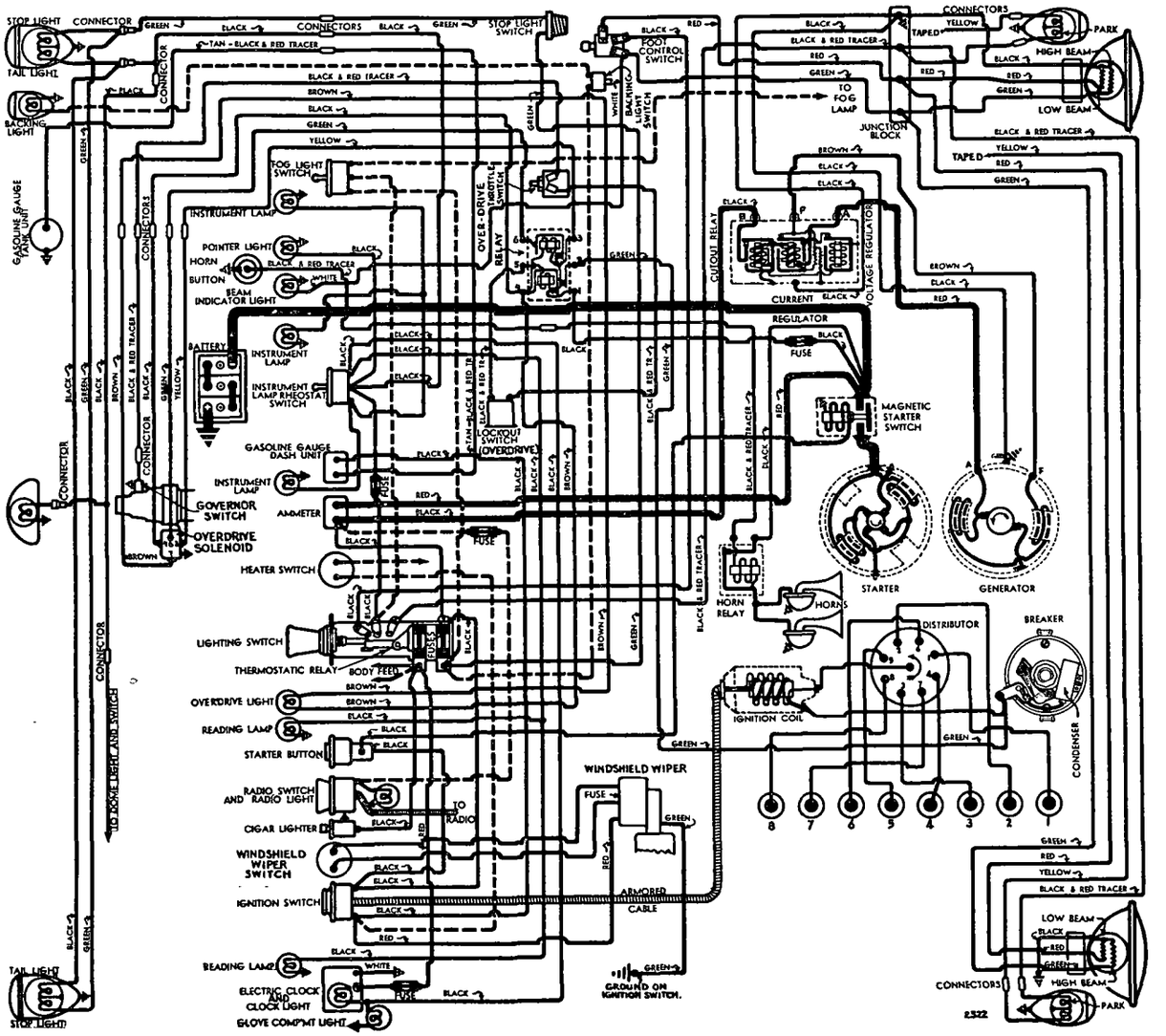
Spark Plugs:—AC No. 104 or Champion Y-4 10 MM. Metric type. NOTE—Do not use more than 50 in. lb. (10 lb. pull on 5" wrench) when tightening these plugs.

CARBURETION:—**Carburetor**—Stromberg EE-16, No. A-18341 (code marked 10-33A on upper main body flange or float bowl cover. 1" Duplex double barrel downdraft type. ***See article in Carburetor Section.***
Idle Adjustment—With engine warm and running at slow idle speed (choke valve wide open, fast idle inoperative), set throttle stopscrew for 6 MPH idle speed. Adjust idle adjusting screw (one for each barrel) in succession until engine fires smoothly (2-2½ turns open for each screw—turn screws in for leaner mixture). Readjust idle speed.
Accelerating Pump—Not adjustable.
Float Level—Fuel level 15/32" below top edge of bowl.

Fast Idle:—Stromberg EE-16 carburetor type. ***See article in Carburetion Equipment Section.***
Fast Idle Setting—Turn screw in to contact lowest step of fast idle cam, then back out ½ turn.

Automatic Choke:—Stromberg EE-16 carburetor type. ***See article in Carburetion Equipment Section.***
Choke Setting—4 Notches Rich ('V' on scale centered on mark on housing). May be varied 2 notches.

Throttle Guard (Cars with Econo-Drive):—Vacuum operated throttle kicker to prevent engine stalling when operating below 20 MPH. ***See article in Carburetion Equipment Section.***



Air Cleaner:—AC # 1529339 oil-wetted type standard. Heavy duty oil-bath type optl. Crankcase filler tube cap equipped with copper mesh cleaner.

Fuel Pump:—AC Type AH #1537067 diaphragm type. *See article in Carburetion Equipment Section.*

Gasoline Gauge:—Stewart (Stewart-Warner) Electric. *See article in Carburetion Equipment Section.*

MANIFOLD HEAT CONTROL:—Thermostatic coil type. Make certain that valve operates freely (valve must not bind or stick). Do not oil control.

VALVE TIMING:—**To Check**—With .0125" tappet clearance #1 intake valve should open with #1 piston 1° or .0004" BTDC when 1° point on flywheel (½ graduation before '1 UP DC' mark) lines up with pointer in inspection hole in flywheel housing below starter (left side). Permissable variation plus or minus 2 graduations. Reset tappet cl. .007" (hot & idling).

Tappet Clearance:—.007" Intake, .010" Exhaust (hot and idling). NOTE—Remove right front fender apron for access to valves.

Valve Spring Pressure:—47-52 lbs. at 1⅝" (valve closed), 114-124 lbs. at 1 5/16" (valve open).

LUBRICATION:—**Crankcase Capacity**—6 quarts.
Normal Oil Pressure—45 lbs. at 45 MPH.

COOLING SYSTEM:—**Capacity**—18 quarts.
Thermostat—Harrison. In cylinder head outlet. Starts to open at 145° F.
NOTE—Thermostatic controlled radiator shutters are used on 1801A instead of cylinder head thermostat.

TRANSMISSION OVERDRIVE CONTROL:—New electric type with solenoid operated 'kick-down' through accelerator switch and a new governor control switch.
See article in Mechanical Equipment Section for data.
Overdrive Solenoid—Delco Remy Model 1118005.
Overdrive Indicator Light—In light switch knob. Lighted when overdrive is ready to engage (light goes out when accelerator pedal released so that overdrive can engage).
Throttle Switch—Cole-Hersee, Packard No. 347496. Adjust tappet screw on throttle lever to just contact switch plunger with carburetor throttle valve in wide open position.
Lock-out Switch—Ark-less or Soreng-Manegold, Packard No. 354820 or 347641.
Control Relay—Delco-Remy Model 1116801.
Governor Switch—Bendix, Packard No. 355075 Std. *See Warner (Packard) Overdrive Control article in Mechanical Equipment Section for optl. switches.*

BATTERY:—**Willard, Type SW-2-113.** 6 volt, 17 plate, 113 ampere hour capacity (20 hour rate).
Starting Capacity—134 amperes for 20 minutes.
Zero Capacity—300 amperes for 4.2 minutes.
Grounded Terminal—Positive (+) grounded to the frame 'X' member. **Engine Ground**—Strap connector between transmission cover bolt and frame.
Dimensions—Length 10 5/16". Width 7 1/16". Height 8 13/16".
Location—Under left front seat.

STARTER:—**Model MAW-4018. Armature MAW-2006.**
Drive—Outboard Barrel Type Bendix No. A-1718.
Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—42-53 ozs. (new brushes).
Cranking Engine—125 RPM, 175 amperes, 5.1 volts.

Performance Data

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	4900	5.5	65
.6 " "	3300	5.5	100
2.75 " "	1480	5.0	200
5.45 " "	820	4.5	300
8 50 " "	400	4.0	400
11.55 " "	110	3.5	500
11.5 " "	Lock	3.0	505
18.0 " "	Lock	4.0	670

Removal:—Flange mounted on left front face of flywheel housing. To remove, take out flange mounting screws, lift out starter and switch assembly.
Starting Switch:—Model SS-4001. Magnetic type. Mounted on starter, controlled by switch on instrument panel. *See article in Electrical Equipment Section.*

GENERATOR:—**Model GEA-4801A. Armature GDZ-2006F.** Two brush with current-voltage control.
Charging Rate Adjustment—No adjustment at generator. Charging rate controlled by Voltage Regulator and maximum output by Current Regulator. *See Regulator data following.*
Maximum Charging Rate—35 amperes (hot or cold), 8.0 volts, 1570 RPM and above with load or discharged battery (Current Regulator setting). Actual charging rate controlled by Voltage Regulator and dependent on battery condition.

Performance Data

Cold			Hot		
Amperes	Volts	R.P.M.	Amperes	Volts	R.P.M.
0	6.4	780	0	6.4	840
4	6.6	870	4	6.6	935
8	6.8	960	8	6.8	1025
12	6.95	1050	12	6.95	1120
16	7.15	1140	16	7.15	1220
20	7.3	1230	20	7.3	1320
24	7.6	1320	24	7.6	1420
28	7.7	1410	28	7.7	1550
32	7.85	1500	32	7.85	1685
35	8.0	1570	35	8.0	1800

Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—53 ozs. max. (new brushes).
Field Current—1.57-1.75 amperes at 6.0 volts.
Motoring Current—4.45-4.9 amperes at 6 0 volts.
Removal:—Pivot mounted at left front of engine. To remove, take out pivot and clamp bolts.
Belt Adjustment:—Swing generator out until 25 lb. reading secured on scale hooked to clamp bolt lug parallel to clamp link or until belt deflection midway between generator and water pump pulley is ½" with thumb pressure.

REGULATOR:—**Model VRB-4012B-1 (First Cars), VRP-4002A (Later Cars). Current-Voltage Type.** Mounted in single case on engine side of dash.
See article in Electrical Equipment Section for data.
NOTE—Regulator case cover is sealed. Serviced on exchange basis if seals not broken

Cutout Relay
Cuts In—6.4-7.0 volts (VRB), 6.4-6.6 volts (VRP).
Cuts Out—.5-3.0 ampere discharge (VRB), 4.8-5.6 volts with approx. 7-8 ampere discharge (VRP).
Contact Gap—.015" minimum.
Air Gap—.034" min., .038" max. with contacts open. Measure at hinge end of core.

Voltage Regulator
Setting—7.3-7.6 volts at 70° F.
To Ch ck (without breaking seals)—Connect ammeter in charging line at regulator 'B' terminal, voltmeter between 'B' terminal and ground. Operate generator at speed equivalent to 30 MPH, charging battery until voltage is steady. Voltage reading should be within limits of 7.36 to 7.66 volts.
To Adjust (with cover removed)—Change regulator armature spring tension by bending lower spring hanger slightly. See Electrical Equipment Section.
Contact Gap—.010-.020" (VRB), .012" Min. (VRP) with armature against stop pin.
Air Gap—.0595-.0625" (VRB), .048-.052" (VRP) with contacts just opening.

Current Regulator
Setting—34-36 amperes (marked '35' on cover).
To Check (without breaking seals)—Connect test meters as for Voltage check (above). Operate generator at 30 MPH, charging battery, add load (use bank of headlamp bulbs, or turn on car lights and accessories and discharge battery) so that generator charges at peak rate and Current Regulator operates. Charging current should not exceed 34-36 amperes. If more than slight excess noted, regulator is defective.
Adjustment & Contact Gap—Same as for Voltage Regulator (above).
Air Gap—.0595-.0625" (VRB), .034-.038" (VRP) with contacts just opening.

LIGHTING:—**Headlamps**—Hall 'Sealed Beam' type.
See article in Electrical Equipment Section for data.
Headlamp Adjustment—Aim upper beam for each lamp straight ahead with center of hot spot 3" below lamp center height.
Beam Indicator—Tell-tale light on speedometer face. Lighted whenever Country (upper) beam in use.

Switches
Lighting—Delco-Remy 1995011.
Beam Selector—R-B-M Model 1050D.

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps		Sealed Beam
Front Turn Indic. & Fender	21-3	1158
Instr., Speed'mtr., Clock	1½	55
Front Reading, Radio, Trunk	1½	55
Glove Comp't., Rear Radio	1	51
Beam, Heater & Defrost Indic.	1	51
Dome and Rear Reading	6	81
Stop & Tail	21-3	1158
Stop (Trunk Rack Equip)	15	87
Tail (Trunk Rack Equip)	3	63
Rear License	3	63
Fog Light	32	1321
Spot Light	32	1323
Backing Light	15	87

THERMOSTATIC RELAY:—**Delco-Remy.** On lighting switch. Contacts remain closed with 30 amperes, open in 3 minutes with 42 amps. @ 70°F. Not adj.
FUSES:—**Dome, Stop Light and Accessories**—Two 20 ampere. Mounted on back of lighting switch.
Instrument and Tail Light—20 ampere. In connector in tail light lead near light switch.
Clock—2 ampere. In feed wire.
Radio—14 ampere. In feed wire.
Overdrive—30 ampere. In relay lead near starter.
Windshield Wiper—14 ampere. On dynamic breaker to right of wiper motor.
HORNS:—**Sparton Model H-32.** Vibrator type, Air tone, Twin horns operated by horn relay.
Air Gap—.032-.035" (low note—long horn), .026-.030" (high note—short air column).
Horn Current—22-25 amperes (total).
Horn Relay:—R-B-M Model 4760.
NOTE—Relay not adjustable (cover welded on).
Closing Voltage—3.5-4 5 volts.
WINDSHIELD WIPER:—**Stewart-Warner Series 645.** Electric type. 14 ampere fuse mounted on dynamic breaker (behind instrument panel to right of wiper motor).
See article in Mechanical Equipment Section for data.

SERIAL NUMBER:—On left side of cowl (use Eng. No.).

ENGINE NUMBER:—First number C-500,051 (1803,4,5), CC-500,051 (1806,7,8). Stamped on left side of cylinder block between #3 and #4 cylinders.

COMPRESSION:—**Ratio**—6.45-1 Std., 6.85-1 Optl. (both heads are cast-iron).
Pressure—118 lbs. at cranking speed.

VACUUM READING:—Steady 18½" idling at 6 MPH.

IGNITION:—**Coil Model CE-4639.** Service Coil CE-3224RS.
Ignition Current—½ ampere idling, 2½ stopped.
Ignition Switch:—Mitchellock Model 24-B, No. 8187.
Ignition Lock—Briggs & Stratton. B & S No. 50184. Key Series—P1251 to P1500. Groove—No. 2.
Distributor Model IGT-4102. Single breaker, 8 lobe cam, full automatic advance type with auxiliary vacuum spark control and Fuel Compensator adj.
Breaker Plate Identification—Maximum vacuum advance limited by slot and marked by number (#5½) on plate.
Breaker Gap—Set at .015".
Cam Angle or Dwell—27° clsd., 18° open (.017" gap).
Breaker Arm Spring Tension—17-20 ounces.
Rotation—Counter-clockwise viewed from the top.
Condenser—No. IG-2671J. Capacity .20-.25 mfd.

Automatic Advance

Distributor		Engine	
Degrees	R.P.M.	Degrees	R.P.M.
Start	250	0	500
3	475	6	950
6	700	12	1400
9	1300	18	2600
11½	1800	23	3600

Vacuum Spark Control—Integral type (on distributor, linked directly to breaker plate). Provides additional advance at speeds above idling except when engine accelerated or operated with wide open throttle (spark retarded by return spring in unit).

Vacuum Advance

Distr. Degrees	Eng. Degrees	Vacuum (" of HG)
Start	0°	7"
1°	2°	8⅝"
3°	6°	12"
4°	8°	13½"
5½°	11°	16"

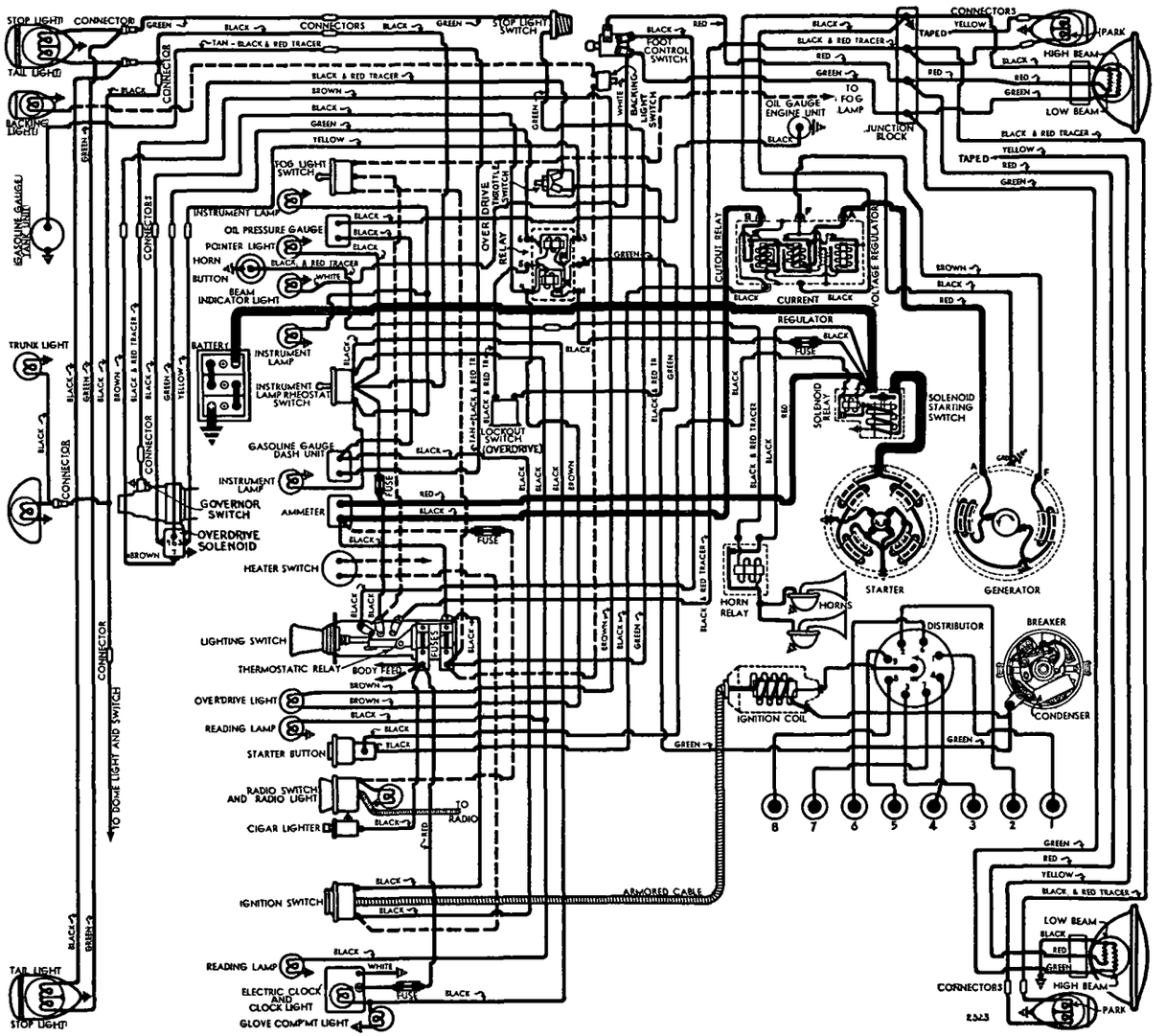
Fuel Compensator—Manual adjustment at distributor providing 10° advance or retard from center '0' position. See Ignition Timing for setting.
Distributor Removal:—Mounted on left side of crankcase. To remove, disconnect vacuum line and take out hold-down screw in advance arm.

IGNITION TIMING:—Standard setting listed below (see Fuel Compensator Setting following):

	Flywheel Degrees	Piston Position
6.45-1 Std. hd.	3½-5° BTDC	.0053-.0110" BTDC
6.85-1 Optl. HC hd.	2½-4° BTDC	.0027-.0040" BTDC

NOTE—Vibration damper marked 'UDC' at TDC with 15 (1°) graduations before this point.
Timing—Loosen thumbnut, set Fuel Compensator pointer at '0', tighten thumbnut. With #1 piston on compression, turn engine over until piston reaches firing position (see table above), stop when correct graduation on vibration dampener at front of engine lines up with pointer on chain case cover. Loosen advance arm clamp bolt, rotate distributor until contacts begin to open, tighten clamp bolt, see that rotor opposite #1 segment in distributor cap, check Fuel Compensator setting.
Timing (Neon Timing Light)—Mark vibration dampener with white paint at proper point, idle engine below 500 RPM, adjust distributor (above).
Motor Gauge—Weidenhoff Adapter #104, (with 10 M.M. adapter). Rod #5.
Fuel Compensator Setting—Should be set for slight ping when accelerating with wide open throttle. To adjust, loosen thumbnut, rotate distributor counter-clockwise (if ping too severe), clockwise (if no ping noted), tighten thumbnut and recheck performance.
Firing Order:—1-6-2-5-8-3-7-4 (see diagram).
Spark Plugs:—AC No. 104 or Champion Y-4 10 MM. Metric type. NOTE—Do not use more than 50 in. lb. (10 lb. pull on 5" wrench) when tightening these plugs.

CARBURETION:—**Carburetor**—Stromberg Model AAV-26. No. A-19172 (Code marked 10-40). 1¼" dual, downdraft type. ***See article in Carburetor Section for data.***
Idle Adjustment—With engine warm and running, at slow idle speed (choke valve wide open, fast idle inoperative), set throttle stopscrew for 6 MPH idle speed. Adjust idle adjusting screw (one for each barrel) in succession until engine fires smoothly: (1½-1¾ turns open for each screw—turn screws in for leaner mixture). Readjust idle speed.
Accelerating Pump Setting—Two holes provided in throttle lever for pump link engagement as follows:
Lower (max. stroke)—Normal setting.
Upper (min. stroke)—If less charge required.
Float Level—Fuel level ⅝" below top edge of bowl.



Fast Idle:—Stromberg AAV-26 carburetor type. Not adjustable.
See article in Carburetion Equipment Section.
Automatic Choke:—Stromberg AAV-26 carburetor type.
See article in Carburetion Equipment Section.
Choke Setting—Aligned 'V' mark on thermostat cover with reference mark on housing. Setting may be varied 2 notches on either side.
Throttle Guard (Cars with Econo-Drive):—Vacuum operated throttle kicker to prevent engine stalling when operating below 20 MPH.
See article in Carburetion Equipment Section.
Air Cleaner:—AC #1529361 oil-wetted type standard. Heavy duty oil-bath type optional. Crankcase filler tube cap equipped with copper mesh cleaner.
Fuel Pump:—AC Type AJ #1523867 combination fuel-and-vacuum pump. Diaphragm type.
See article in Carburetion Equipment Section.
Gasoline Gauge:—Stewart (Stewart-Warner) Electric.
See article in Carburetion Equipment Section.

MANIFOLD HEAT CONTROL:—Thermostatic coil type. Make certain that valve operates freely (valve must not bind or stick). Do not oil control.

VALVE TIMING:—**To Check**—#1 exhaust valve closes 10° or .0438" past top dead center with hydraulic lifter dry (no oil) and built up with shim stock for zero tappet clearance.
Tappet Clearance:—None in service (Wilcox-Rich 'zero lash' hydraulic tappet take-up used).
See article in Mechanical Equipment Section for data.
Valve Spring Pressure:—147-157 lbs. at 1 13/32" (valve open).

LUBRICATION:—**Crankcase Capacity**—7½ quarts.
Normal Oil Pressure—50 lbs. at 45 MPH.

COOLING SYSTEM:—**Capacity**—20 quarts.
Thermostat—Harrison. In radiator top tank (operates radiator shutters). Starts to open at 145° F.
Radiator Filler Cap—Pressure type. Opens at 7 lb. pressure (raises boiling point to 230° F.).

TRANSMISSION OVERDRIVE CONTROL:—New electric type with solenoid operated 'kick-down' through accelerator switch and a new governor control switch.
See article in Mechanical Equipment Section for data.
Overdrive Solenoid—Delco Remy Model 1118005.
Overdrive Indicator Light—In light switch knob. Lighted when overdrive is ready to engage (light goes out when accelerator pedal released so that overdrive can engage).
Throttle Switch—Cole-Hersee, Packard No. 347496. Adjust tappet screw on throttle lever to just contact switch plunger with carburetor throttle valve in wide open position.
Lock-out Switch—Ark-less or Soreng-Manegold, Packard No. 354820 or 347641.
Control Relay—Delco-Remy Model 1116801.
Governor Switch—Bendix, Packard No. 355075 Std.
See Warner (Packard) Overdrive Control article in Mechanical Equipment Section for optl. switches.

BATTERY:—**Willard, Type SW-2-113.** 6 volt, 17 plate, 113 ampere hour capacity (20 hour rate).
Starting Capacity—134 amperes for 20 minutes.
Zero Capacity—300 amperes for 4.2 minutes.
Grounded Terminal—Positive (+) grounded to the frame 'X' member. **Engine Ground**—Strap connector between transmission cover bolt and frame.
Dimensions—Length 10 5/16". Width 7 1/16". Height 8 13/16".
Location—Under left front seat.

STARTER:—**Model MAX-4041. Armature MAW-2069.**
Drive—Overrunning clutch (solenoid pinion shift) through reduction gears.
Rotation—Clockwise at commutator end.
Brush Spring Tension—42-53 ozs. (new brushes).

Performance Data

Torque	**R.P.M.	Volts	Amperes
0 ft. lbs.	2695	5.5	77
33.5 " "	Lock	3.0	652
45.9 " "	Lock	4.0	906

**—Pinion shaft R.P.M.

Removal:—Flange mounted on left front face of flywheel housing. To remove, take out flange mounting screws, lift out starter and switch assembly.
Starting Switch:—Solenoid Switch Type SS-4205. Controlled through relay by pushbutton on instrument panel. *See article in Electrical Equipment Sect'n.*
NOTE—Cutout relay has extra set of contacts ("T" terminal on regulator connected to starter button) which grounds starter circuit at speeds above cut-in point of Cutout Relay.

GENERATOR:—**Model GEA-4802A. Armature GDZ-2006F.** Two brush with current-voltage control.
Charging Rate Adjustment—No adjustment at generator. Charging rate controlled by Voltage Regulator and maximum output by Current Regulator.
See Regulator data following.
Maximum Charging Rate—35 amperes (hot or cold), 8.0 volts, 1570 RPM and above with load or discharged battery (Current Regulator setting). Actual charging rate controlled by Voltage Regulator and dependent on battery condition.

Performance Data

Cold			Hot		
Amperes	Volts	R.P.M.	Amperes	Volts	R.P.M.
0	6.4	780	0	6.4	840
4	6.6	870	4	6.6	935
8	6.8	960	8	6.8	1025
12	6.95	1050	12	6.95	1120
16	7.15	1140	16	7.15	1220
20	7.3	1230	20	7.3	1320
24	7.6	1320	24	7.6	1420
28	7.7	1410	28	7.7	1550
32	7.85	1500	32	7.85	1685
35	8.0	1570	35	8.0	1800

Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—53 ozs. max. (new brushes).
Field Current—1.57-1.75 amperes at 6.0 volts.
Motoring Current—4.45-4.9 amperes at 6.0 volts.
Removal:—Pivot mounted at left front of engine. To remove, take out pivot and clamp bolts.
Belt Adjustment:—Swing generator out until 25 lb. reading secured on scale hooked to clamp bolt lug parallel to clamp link or until belt deflection midway between generator and water pump pulley is ½" with thumb pressure.

REGULATOR:—**Mounted VRP-4003A. Current-Voltage type.** Mounted in single case on engine side of dash. Cutout Relay has extra set of contacts ("T" terminal) for grounding starter circuit.
See article in Electrical Equipment Section for data.
NOTE—Regulator case cover is sealed. Serviced on exchange basis if seals not broken.

Cutout Relay

Cuts In—6.4-6.6 volts, 700 Gen. RPM.
Cuts Out—4.8-5.6 volts (approx. 7-8 amps. disch.).
Contact Gap—.015" minimum with upper ground contacts closed (upper contacts must close when main contacts open).
Air Gap—.034" min., .038" max. with contacts open. Measure at hinge end of core.

Voltage Regulator

Setting—7.3-7.6 volts at 70° F.
To Check (without breaking seals)—Connect ammeter in charging line at regulator 'B' terminal, voltmeter between 'B' terminal and ground. Operate generator at speed equivalent to 30 MPH, charging battery until voltage is steady. Voltage reading should be within limits of 7.36 to 7.66 volts.
To Adjust (with cover removed)—Change regulator armature spring tension by bending lower spring hanger slightly. See Electrical Equipment Section.
Contact Gap—.012" Min. (armature against stop pin).
Air Gap—.048-.052" with contacts just opening.

Current Regulator

Setting—34-36 amperes (marked '35' on cover).
To Check (without breaking seals)—Connect test meters as for Voltage check (above). Operate generator at 30 MPH, charging battery, add load (use bank of headlamp bulbs, or turn on car lights and accessories and discharge battery) so that generator charges at peak rate and Current Regulator operates. Charging current should not exceed 34-36 amperes. If more than slight excess noted, regulator is defective.
Adjustment & Contact Gap—Same as for Voltage Regulator (above).
Air Gap—.034-.038" with contacts just opening.

LIGHTING:—**Headlamps**—Hall 'Sealed Beam' type.
See article in Electrical Equipment Section for data.
Headlamp Adjustment—Aim upper beam for each lamp straight ahead with center of hot spot 3" below lamp center height.
Beam Indicator—Tell-tale light on speedometer face. Lighted whenever Country (upper) beam in use.

Switches

Lighting—Delco-Remy 1995011.
Beam Selector—Delco-Remy 1997001, 2 (RHD).

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps		Sealed Beam
Front Turn Indic. & Fender	21-3	1158
Instr., Speed'mtr., Clock	1½	55
Front Reading, Radio, Trunk	1½	55
Glove Comp't., Rear Radio	1	51
Beam, Heater & Defrost Indic.	1	51
Dome and Rear Reading	6	81
Rear Quarter & Vanity Cabinet	3	63
Stop & Tail	21-3	1158
Stop (Trunk Rack Equip)	15	87
Tail (Trunk Rack Equip)	3	63
Rear License	3	63
Fog Light	32	1321
Spot Light	32	1323
Backing Light	15	87

THERMOSTATIC RELAY:—**Delco-Remy.** On lighting switch. Contacts remain closed with 30 amperes, open in 3 minutes with 42 amps. @ 70°F. Not adj.
FUSES:—**Dome, Stop Light and Accessories**—Two 20 ampere. Mounted on back of lighting switch.
Instrument and Tail Light—20 ampere. In connector in tail light lead near light switch.
Clock—2 ampere. In feed wire.
Radio—14 ampere. In feed wire.
Overdrive—30 ampere. In relay lead near starter.
HORNS:—**Sparton Model H-32.** Vibrator type, Air tone, Twin horns operated by horn relay.
Air Gap—.032-.035" (low note—long horn), .026-.030" (high note—short air column).
Horn Current—22-25 amperes (total).
Horn Relay:—R-B-M Model 4760.
NOTE—Relay not adjustable (cover welded on).
Closing Voltage—3.5-4.5 volts.

SERIAL NUMBER:—On right front door hinge post.

	Detroit	Los Angeles	Evansville	Canada
P9	1,378,001	3,114,801	9,062,201	9,368,516
P10	10,883,001	3,242,501	20,063,001	9,607,611

ENGINE NUMBER:—P9-1001 Up (P9), P10-1001 Up (P10). On left side of block between #1 & #2 cyls.

COMPRESSION:—Ratio and pressure as follows:

Ratio	Pressure at 1000 RPM	At 100 RPM
6.7-1 cast-iron hd.	145-155 lbs.	Approx. 115 lbs.
7.0-1 aluminum hd.	150-160 lbs.	Approx. 120 lbs.

IGNITION:—Coil Model IG-4661. Service winding (less switch and cable) IG-3224JS. Mounted on dash.

Ignition Current—2.25 amperes idling, 5.5 stopped.

Ignition Switch:—Mitchellock Model 24-R, No. 8197.

Ignition Lock—Yale & Towne or Briggs & Stratton. B&S No. 80651. Key Series 1BP to 1000BP. Groove #24.

Distributor Model IGS-4109-1, IGS-4108A-1 or IGS-4108-1 (Canada—see Note). Single breaker, 6 lobe cam, full automatic advance type with auxiliary vacuum spark control and manual (octane selector) adjustment.

Canada Note—IGS-4108A-1 used on P9 before Eng. No. 1375, P10 before Eng. No. 1942. IGS-4108-1 used on cars after these engine numbers.

Breaker Plate Identification—Maximum vacuum advance limited by slot and marked with number (#10—IGS-4109-1, #11—IGS-4108A-1, #7—IGS-4108-1) stamped on breaker plate.

Breaker Gap—Set at .020". Limits .018-.022".

Cam Angle or Dwell—38° closed, 22° open (distr.).

Breaker Arm Spring Tension—17-20 ounces.

Rotation—Clockwise viewed from the top.

Condenser—No. IG-3927A. Capacity .25-.28 mfd.

Automatic Advance—IGS-4108-1, IGS-4801A-1

Distributor Degrees	Distributor R.P.M.	Engine Degrees	Engine R.P.M.
Start	350	0	700
3	400	6	800
6	850	12	1700
9	1300	18	2600
12	1750	24	3500

Automatic Advance—IGS-4109-1

Start	350	0	700
3	400	6	800
6	950	12	1900
9	1500	18	3000
11	1850	22	3700

Vacuum Spark Control—Integral type (on distributor, linked directly to breaker plate). Provides additional advance at speeds above idling except when engine accelerated or operated with wide open throttle (spark retarded by return spring in unit).

Vacuum Advance—IGS-4108-1

Distr. Degrees	Eng. Degrees	Vacuum (" of HG)
Start	0°	5"
1°	2°	6½"
3°	6°	9¼"
5°	10°	12⅛"
7°	14°	15"

Vacuum Advance—IGS-4108A-1

Start	0°	5"
2°	4°	7¼"
5°	10°	10½"
8°	16°	13¾"
11°	22°	17"

Vacuum Advance—IGS-4109-1

Start	0°	5"
2°	4°	7⅜"
5°	10°	11"
8°	16°	14⅝"
10°	20°	17"

Manual Adjustment—At distributor. Provides 10° advance or retard from center '0' position. See Ignition Timing for adjustment.

Distributor Removal:—Mounted on left side of crankcase. To remove, disconnect vacuum line, take out hold-down screw in lock plate.

IGNITION TIMING:—Initial setting (correct for fuel of 70 octane rating at low altitudes for both cast-iron and aluminum heads) shown below. See Manual adjustment (following) for correction (not to exceed 4° either way) dependent on fuel regularly used and operating conditions.

	Flywheel Degrees	Piston Position
6.7 & 7.0-1 heads	.0° at TDC.	.0000" at TDC.

NOTE—Crankshaft pulley marked *'DC'* at *TDC* with 15 (1°) graduations on either side.

Timing (Using Timing Light)—Connect timing light between distributor and battery terminal on generator regulator. With #6 piston on compression, turn engine over until piston reaches firing position (see Initial Setting), stop when correct mark on crankshaft pulley lines up with pointer on chain case cover. Loosen advance arm hold-down screw, center pointer on scale, tighten screw. Loosen advance arm clamp bolt, rotate distributor until timing light just goes out, tighten clamp bolt. Check manual adjustment setting as directed below.

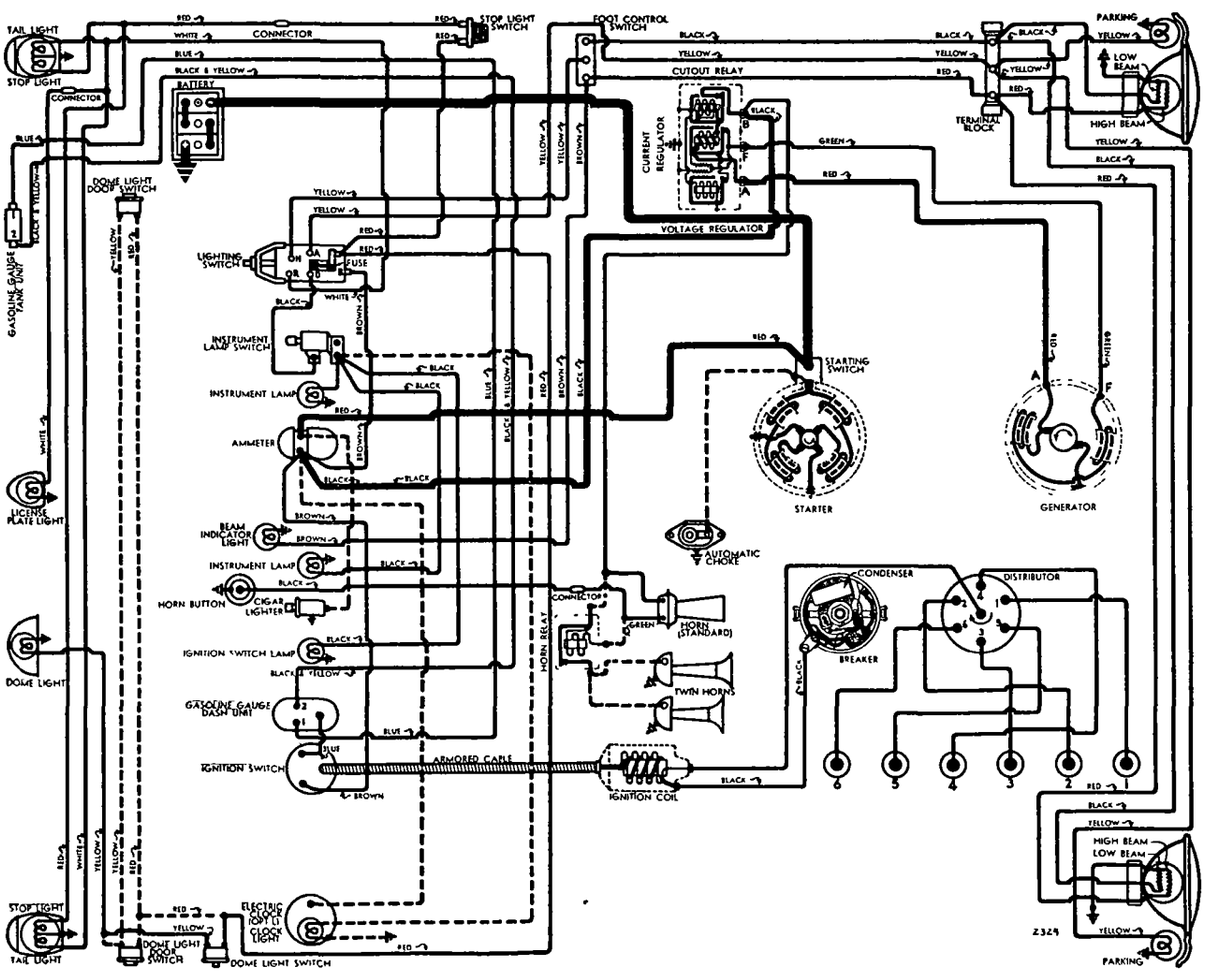
Timing (Using Synchroscope)—Tool No. C-374. Clip lead to #1 spark plug, direct light on crankshaft pulley (correct mark filled in with paint or chalk), idle engine and adjust distributor as directed above.

Manual Adjustment—Initial ignition setting should be varied not more than 4° (piston 4° or .0068" before or after top dead center) so that slight ping noticeable between 10 and 30 MPH. when accelerating with wide open throttle for best performance. To adjust, loosen hold-down screw, rotate distributor counter-clockwise to advance spark (if no ping noted), clockwise to retard spark (if ping too severe) not more than 4°. Scale graduated in engine degrees.

Firing Order:—1-5-3-6-2-4. See diagram.

Spark Plugs:—Champion Type J-8 (P9 Std. head). Auto-Lite Type A-7B (P10 Std. head). Champion Type H-10 or Auto-Lite Type AL-7A (Optl. HC hd.). All are 14 MM Metric type.

Spark Plug Gaps—Set at .025".



CARBURETION:—Carburetor—Carter (Ball & Ball) Model D6A2. 1½" downdraft type. NOTE—Model D6C2 used on cars with automatic choke optl.
Economy Carburetor—Carter (Ball & Ball) Model B6P1. 1¼" single barrel, downdraft type.
See article in Carburetor Section for complete data.
Idle Adjustment—With engine warm and running at slow idle speed (choke valve wide open, fast idle inoperative on D6A2 & D6C2), set throttle stopscrew for 6 MPH idle speed Adjust idle adjusting screw until engine fires smoothly (½-1¼ turns open D6A2 & D6C2, ½-1½ turns open B6P1—turn screw in for leaner mixture). Readjust idle speed. NOTE—Car manufacturer recommends use of vacuum gauge. Set idle screw for highest reading on gauge
Accelerating Pump Setting—Pump lever has three holes for pump link engagement. Set as follows: Inner Hole (min. stroke)—Extreme hot temperatures or altitudes above 3000 feet.
Center Hole (med. stroke)—Normal setting.
Outer Hole (max stroke)—Winter temperatures.
NOTE—If lean metering jets (High Alt. calibration) used at lower altitudes for increased economy, reduced speed and power will result (not recommended by manufacturer). See Carter (B&B) Jet Table in Carburetor Section for complete jet data.
Float Level—5/64" from top of float (not soldered seam) to top edge of float bowl.
Fast Idle:—Used on D6A2 and D6C2 only. Not adjustable
Throttle Cracker:—Interconnector between starting pedal and accelerator rod which opens throttle approximately one-third when pedal depressed for starting Adjust by loosening throttle pickup clamp bolt (above starter switch), shift clamp on rod.
Automatic Choke:—Sisson Type AC-758B. Used on D6C2 optional carburetor
See article in Carburetion Equipment Section.
Air Cleaner:—AC #1528196 oil-wetted type standard.
Fuel Pump:—AC Type AT #1523647 diaphragm type std Type AS #1523648 comb. fuel-and-vacuum pump optl.
See article in Carburetion Equipment Section.
Gasoline Gauge:—Auto-Lite electric. No. NG-9355D (dash unit). No. NG-9329T (tank unit).
See article in Carburetion Equipment Section.

MANIFOLD HEAT CONTROL:—Thermostatic coil type. See that shaft and valve rotate freely. When installing coil, wind up free end ½ turn counterclockwise and hook end over stop stud.
CAUTION—Do not wind coil up more than ½ turn.

VALVE TIMING:—To Check—With .011" (cold) tappet clearance, #6 intake valve should open with #6 piston 6° or 0153" ATDC with 6th graduation after DC mark on crankshaft pulley aligned with pointer on chain cover. Reset tappet clearance .006" (hot).
Tappet Clearance:— 006" Int., .008" Exh. (hot&idling) 002" add'tl exh clearance desirable for sustained high speeds NOTE—Tappet screws self-locking (no locknuts). Remove right front wheel, lower housing panel and fuel pump shield for access to valves.
Valve Spring Pressure:—34-38 lbs. at 1¾" (valve closed), 77-83 lbs. at 1 7/16" (valve open).

LUBRICATION:—Crankcase Capacity—5 qts. (refill).
Normal Oil Pressure—30-45 lbs. at 30 MPH, 15 idling.

COOLING SYSTEM:—Capacity—14 quarts.
Thermostat:—Bishop & Babcock or Fulton (Fulton only on P9) Starts to open 157-162°F. Fully open 183°.
Temperature Gauge—Motometer (Auto-Lite) Vapor tension type. A-L Part No. H-9334.
See article in Mechanical Equipment Section for data.

BATTERY:—Auto-Lite Type CT-1-13. 6 volt, 13 plate, 90 ampere hour capacity (20 hour rate).
Grounded Terminal—Positive (+) grounded to the transmission case
Dimensions—Length 9 1/16". Width 7 1/16". Height 8 15/16".
Location—Left side under front seat

STARTER:—Model MZ-4062. Armature No. MZ-2108. MAW-4016 (Canada). Armature No. MAW-2030.
See 1940 De Soto S7 'T&E' page for MAW-4016 data.
Drive—Overrunning clutch, manual pinion shift
Rotation—Counter-clockwise at commutator end
Cranking Engine—150-175 amperes, 5 1 volts.
Brush Spring Tension—42-53 ozs. (new brushes).

Performance Data

Torque	R P M.	Volts	Amperes
0 ft lbs	4300	5 5	70
65 " "	2500	5 5	100
2 55 " "	1325	5 0	200
4 95 " "	750	4 5	300
7 65 " "	220	4 0	400
7 8 " "	Lock	3 0	420
11 8 " "	Lock	4 0	560

Removal:—Flange mounted on left front face of flywheel housing, Remove cables, 2 clips on starter linkage, oil filter lines, 2 mounting bolts Lift off
Starting Switch:—Model SW-2813 On starter Manually operated by starter (pinion shift) pedal.

GENERATOR:—Models GDZ-4801A (Std.), GEB-4801A (Police). Armature No. GDZ-2006F (GDZ-4801A) GEB-2006F (GEB-4801A). Two brush type with current-voltage control Air cooled
Charging Rate Adjustment—No adjustment at generator Charging rate controlled by Voltage Regulator and maximum output by Current Regulator
See Regulator data following.
Maximum Charging Rate—35 amperes (Std), 32 amperes (Police), 8 0 volts, 2200 gen RPM (Std), 1400 (Police), approx 24 MPH (Std) and above with load or discharged battery (Current Regulator setting) Actual charging rate controlled by Voltage Regulator and dependent on battery condition

Performance Data—GDZ-4801A

Cold			Hot		
Amperes	Volts	R P M	Amperes	Volts	R P M
0	6 4	925	0	6 4	1000
4	6 6	1035	4	6 6	1120
8	6 75	1140	8	6 75	1235
12	6 95	1250	12	6 95	1350
16	7 15	1370	16	7 15	1460
20	7 3	1480	20	7 3	1590
24	7 5	1590	24	7 5	1730
28	7 7	1710	28	7 7	1900
32	7 9	1820	32	7 9	2090
*35	8 0	1900	35	8 0	2250

Performance Data—GEB-4801A

0	6 4	560	0	6 4	600
4	6 6	630	4	6 6	675
8	6 8	700	8	6 8	750
12	7 0	775	12	7 0	840
16	7 2	845	16	7 2	930
20	7 4	920	20	7 4	1030
24	7 6	1000	24	7 6	1140
28	7 8	1075	28	7 8	1260
*32	8 0	1150	32	8 0	1400

*—Current regulator setting.

Rotation—Counter-clockwise at commutator end
Brush Spring Tension—53 ozs max (new brushes)
Field Current—1 60-1 78 amperes at 6 volts (GDZ)
Motoring Current—4 16-4 60 amperes at 6 v. (GDZ).
Removal:—Pivot mounted at left side of engine at front To remove, take out pivot and clamp bolts
Belt Adjustment:—Loosen clamp and pivot bolts, swing generator out until scale (attached to field frame) reads 40-50 lbs , tighten bolts

REGULATOR:—Model VRP-4001A (Std.), B (Police). Current-Voltage type. In single case on dash.
See article in Electrical Equipment Section for data.
NOTE—Regulator case cover is sealed. Serviced on exchange basis if seals not broken

Cutout Relay

Cuts In—6 4-6 6 volts at approximately 1000 generator RPM (Std), approx 600 gen RPM (Police)
Cuts Out—4 8-5 6 volts (approx. 7-8 amps. disch).
Contact Gap— 015" minimum
Air Gap— 034" min , 038" max. with contacts open. Measure at hinge end of core.

Voltage Regulator

Setting—7 3-7.6 volts at 70° F.
To Check (without breaking seals)—Connect ammeter in charging line at regulator 'B' terminal, voltmeter between 'B' terminal and ground Operate generator at speed equivalent to 30 MPH charging battery until voltage is steady. Voltage reading should be 7 3-7 6 volts (room temperature), 7 1-7 4 volts (hot operating conditions).
To Adjust (with cover removed)—Change regulator armature spring tension by bending lower spring hanger slightly See Electrical Equipment Section
Contact Gap— 012" Min (armature against stop pin).
Air Gap—.048- 052" with contacts just opening.

Current Regulator

Setting—Std · 34-36 amperes (marked '35' on cover), Police 31-33 amperes (marked '32' on cover)
To Check (without breaking seals)—Connect test meters as for Voltage check (above) Operate generator at speed equivalent to 30 MPH charging battery, turn on car lights and accessories so that generator operates Charging current should not exceed 34-36 amperes (Std), 31-33 amperes (Police). If more than slight excess noted, regulator is defective
Adjustment & Contact Gap—Same as for Voltage Regulator (above).
Air Gap— 034- 038" with contacts just opening

LIGHTING:—Headlamps—Corcoran-Brown 'Sealed Beam' type *See article in Electrical Equipment Section.*
Headlamp Adjustment—Aim upper beam for each lamp straight ahead with center of hot spot 3" below lamp center height.
Beam Indicator—Red light above speedometer dial Lighted with Country (upper) beam in use.

Switches

Lighting—Chrysler No 854756, 854757 Optl.
Beam Selector—Chrysler No 859974
Instrument—Chrysler No 853371
Stop Light—Chrysler No 677112

Bulb Specifications

Position	Candlepower	Mazda No Sealed Beam
Headlamps		
Parking, Instrument	1½	55
Beam Indicator, Ign Sw.	1	51
Stop and Tail	21-3	1158
Rear License	3	63
Dome or Reading	15	87

FUSES:—Lighting—30 amp On back of light switch.
Clock—2 ampere In connector behind clock
Radio—14 amp. In feed wire behind instr. panel.
Horns—No fuse used on either single or duals
HORNS:—Single—Delco-Remy No *1999911* standard.
Dual—Auto-Lite HO-5001 horn set HL-4001 (low pitch), HL-4002 (high pitch) operated by horn relay
Current Draw—Approx 7 amps single, 35-40 dual.
Horn Relay:—Auto-Lite Model HRC-4001 (no fuse).
Contacts Close—1 5-3 0 volts **Open**— 5 volt
Contact Gap— 026" **Air Gap**—.016- 020" (closed).

SERIAL NUMBER:—First number 6HA-1001 (Special), 6HB-1001 (Deluxe) with prefixes indicating factory as follows: P—Pontiac, Mich., C—South Gate, Calif., L—Linden, N. J. On plate fastened to left end of frame front cross member.

ENGINE NUMBER:—First number 6-595801. Stamped on boss on top left front corner of engine block.

COMPRESSION:—Ratio—6.5-1 Std., 7.2-1 Optl.
Pressure—155-158 lbs. at 1000 RPM, or approximately 118-120 lbs. at cranking speed (Std. head).

VACUUM READING:—Steady 18-20" idling at 7 MPH.

IGNITION:—Coil Model 1115023. Mounted on dash.
Ignition Current—2.5 amperes idling, 4.5 stopped.
Ignition Switch:—Delco-Remy Model 1116284 (40-25), 1116294 (40-25 RHD), 1116285 (40-26). Switch and cable assembly. Connected to coil by armored cable.
Ignition Lock—Briggs & Stratton. B & S No. 45792.
Key Series—8000 to 9499. **Groove**—No. 15.

Distributor:—Delco-Remy 647-D, 1110202 (Taxi)—Single breaker, 6 lobe cam, full automatic advance with vacuum spark control and Gaselector adjustment (for fuel compensation) at distributor.
Breaker Gap—.020". Limits .018-.024".
Cam Angle or Dwell—35° closed, 25° open (distr.).
Breaker Arm Spring Tension—17-21 ounces.
Rotation—Counter-clockwise viewed from top.
Condenser—#1865972 (647-D), #1869704 (1110202). Capacity .18-.25 mfds.

Automatic Advance

Distributor		Engine	
Degrees	R.P.M.	Degrees	R.P.M.
Start	400	4.0	800
8.0	1050	16.0	2100
8.5	1450	17.0	2900
14.25	2000	28.5	4000

Vacuum Spark Control Model 681-M. Integral with distributor. Mounted on housing and linked directly to breaker plate. Provides additional advance at speeds above idling (vacuum port in carburetor above throttle) except when engine accelerated or operated with wide open throttle when spark is retarded by return spring within unit. Total plunger travel 9/64".

Vacuum Advance

Distr. Degrees	Eng. Degrees	Vacuum (" of HG)
Start	0°	7-9"
7.5°	15°	16-18"**

** at .125" travel.

Gaselector—Manual adjustment at distributor providing 10° advance or retard from center '0' position. See Gaselector Setting following.

Distributor Removal:—Mounted on left side of engine. To remove, disconnect vacuum line, take out hold-down screw in Gaselector and lift out.

IGNITION TIMING:—Standard setting given below (regular fuel Std. hd., Ethyl fuel HC hd.). See Gaselector Setting following for final setting.

	Flywheel Degrees	Piston Position
All engines	6° BTDC	.0138" BTDC.

NOTE—The two straight lines of the ignition mark '/IGN.ONE/' indicates allowable timing range of 4° on flywheel. Use first or 6° line in setting ignition. Car manufacturer recommends use of Timing Light (Tool HM-494) or Synchroscope (HMO-161).

To Set Timing (using Timing Light)—Connect timing light between distributor terminal and ground, turn on ignition. With #1 piston on compression, turn engine over until piston is 6° or .0138" before top dead center, stop when first line of ignition mark '/IGN.ONE/' lines up with pointer in inspection hole in left front face of flywheel housing. Loosen Gaselector screw, center pointer on scale, tighten screw, loosen advance arm clamp bolt, rotate distributor until timing lamp lights (contacts opening), tighten clamp bolt.

To Set Timing (using Synchroscope)—Clip one synchroscope lead to #1 spark plug cable, insert other lead in distributor cap terminal from which #1 spark plug wire removed. Fill in first line of flywheel mark '/IGN.ONE/' with white chalk or paint. Direct synchroscope on flywheel through inspection hole in left front face of flywheel housing. Idle engine at 376 R.P.M. or 7 M.P.H., adjust distributor (as directed for Timing Light above) until white line coincides with pointer on housing.

Motor Gauge—Weidenhoff Adapter #114. Rod #42.

Gaselector Setting—Should be set to provide best performance without spark knock or ping for particular operating conditions and octane rating of fuel used. To adjust, loosen screw, move pointer clockwise to advance or counter-clockwise to retard spark.

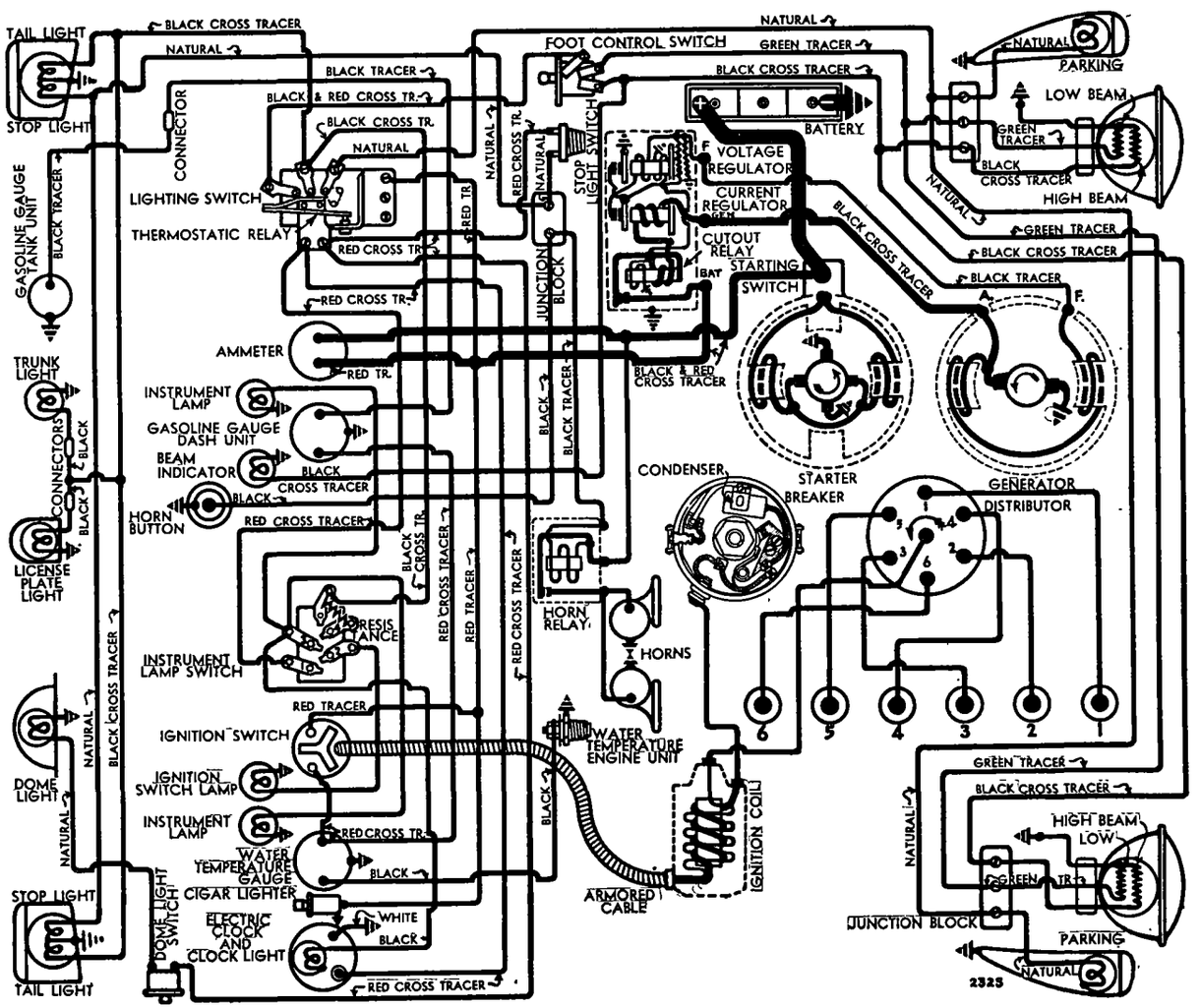
Firing Order:—1-5-3-6-2-4. See diagram.

Spark Plugs:—AC. Type 45. 14 MM. Metric Type.
Spark Plug Gaps—Set at .025".

CARBURETION:—Carburetor—Carter Type WA-1, Model 463-S (first), 463-SP (later). 1¼" downdraft type with Carter Climatic Control.

Production Change—To correct engine hesitating when starting in second gear, a new pump plunger 64-70S used on 463-SP. On 463-S, change pump link to lower hole in arm and plunger shaft to correct this condition.
See article in Carburetor Section for data.

Idle Adjustment—With engine warm and running at slow idle speed (choke valve wide open, fast idle inoperative), set throttle stopscrew for 7 MPH idle speed. Adjust idle adjusting screw until engine fires smoothly (½-1½ turns open—turn screw in for leaner mixture). Readjust idle speed.



Accelerator Pump Setting—Pump arm and plunger under dust cover at top of carburetor have two holes for connector link engagement. Recommended settings as follows:
Upper Holes (short stroke)—Normal setting.
Lower Holes (long stroke)—Cold temperatures or to correct hesitating when starting car in second gear on 463-S carburetors.
Float Level—7/16" from projection on cover to top of soldered seam at front end of float with needle valve seated (invert to check).

Fast Idle:—Integral type, built-in carburetor.
See article in Carburetion Equipment Section.
Fast Idle Setting—Adjust by bending connecting link offset for 5/8" choke valve opening with stop-screw against (not on) first step of fast idle cam.

Accelerator Linkage Adjustment:—Must be maintained to provide correct 'Throttle cracking' action for starting. To adjust, after setting carburetor idle speed at 6-7 MPH, loosen hand throttle wire lock screw, pull button 1/8" out from instrument panel, position hand throttle lever so that no clearance exists between lever and throttle cross shaft, tighten lock screw. Turn throttle stopscrew in 2 turns (with throttle stopscrew on high point of cam or 'cold' position), disconnect battery cable at starting motor to prevent cranking, fully depress starter pedal, adjust throttle cracker lever to take up all clearance on pin. Connect starting motor and reset idle speed.

Automatic Choke:—Carter Climatic Control.
See article in Carburetion Equipment Section.
Choke Setting—Set coil housing 1 notch Rich.

Air Cleaner:—AC #1523985 oil-wetted type Std., #1528944 oil-bath type Optl. with Crankcase Vent Cleaner #502783 Std., #1529288 Optl.

Fuel Pump:—AC Type AH #1523985 standard. Type AJ #1523986 fuel-and-vacuum pump optional.
See article in Carburetion Equipment Section.

Gasoline Gauge:—AC Electric. #1515371 (dash unit), #1515481 (tank unit).
See article in Carburetion Equipment Section.

MANIFOLD HEAT CONTROL:—Themostatic coil type. Non-adjustable (anchor pin fixed). Counter-weight must be tightly clamped to shaft and should be about vertical with valve closed (engine cold).

VALVE TIMING:—#1 intake valve opens 5° (.0096") BTDC. with .015" tappet clearance (first line of flywheel mark "/IGN.ONE/" slightly past indicator.
Tappet Clearance—.011-.013" all valves (warm). .011 "go" and .013" "no go."
NOTE—.013" exhaust setting recommended by car manufacturer for sustained high speeds.
Valve Spring Pressure—56-63 lbs. at 1 29/32" (valve closed). 97-105 lbs. at 1 19/32" (open).

LUBRICATION:—**Crankcase Capacity**—6 quarts.
Normal Oil Pressure—35-40 lbs. above 40 MPH.

COOLING SYSTEM:—**Capacity**—17 quarts.
Thermostat:—Harrison. In cyl. head water outlet. Closed 140° F. Starts to open 145° F. Fully open 172°.
Temperature Gauge:—AC Electric. #1510916 (dash unit), #1510772 (engine unit).
See article in Mechanical Equipment Section for data.

BATTERY:—**Delco Type 15E-1.** 6 volt, 15 plate, 100 A. H. capacity (20 hour rate). End-to-end type.
Starting Capacity—120 amperes for 20 minutes.
Zero Capacity—300 amperes for 3.5 minutes. Five second voltage—4.25 volts.
Grounded Terminal—Negative (—) grounded to lower left side of block. No separate engine ground.
Dimensions—Length 19 5/16". Width 4". Height 9".
Location—Under engine hood on left side.
Police Battery:—**Delco Type 19E-1.** 6 volt, 19 plate, 130 A. H. capacity (20 hr. rate). End-to-end type.
Starting Capacity—150 amperes for 20 minutes.
Zero Capacity—300 amperes for 5.3 minutes. Five second voltage—4.55 volts.
All other date same as for 15E-1 above.

STARTER:—**Delco-Remy 1107022, 727-S (RHD).**
Armature No.—810601 (1107022), 823881 (727-S).
Drive—Overrunning clutch (manual shift on 1107022, solenoid pinion shift on 727-S).
Cranking Engine—200 amperes at 5 volts.
Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—24-28 ounces each.

Performance Data—1107022

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	5000	5.0	65
12 ft. lbs.	Lock	3.37	525

Performance Data—727-S

0 ft. lbs.	5500	5.0	65
15 " "	Lock	3.0	600

Removal:—Mounted on left front face of flywheel housing. To remove take out mounting screws.
Starting Switch (1107022):—Delco-Remy Part #820052. Mounted on starter. Operated by starting pedal.
Starting Switch (727-S):—Solenoid Switch type 1546 operated by pushbutton switch 1996007.
See article in Electrical Equipment Section.

GENERATOR:—**Delco-Remy 1102665 (Std.), 1106403 (Police). Armature No. 1879002 (1102665 Gen.).** Two brush types with voltage & current regulation.
Charging Rate Adjustment—No adjustment at generator. Charging rate controlled by Voltage Regulator and maximum output by Current Regulator.
See Regulator data following.
Maximum Charging Rate—Standard: 32 amperes min. (hot), 8.0 volts, 2450 RPM, 25 MPH; Police: 34 amperes Min. (hot), 8.0 volts, 1040 RPM., 19.0 MPH. with load or discharged battery (Current Regulator setting). Actual charging rate controlled by Voltage Regulator and dependent on battery condition.

Performance Data—1102665

	Amperes	Volts	R.P.M.
Cold	30*	8.0	1700

*—Not maximum output—See Current Regulator.

Performance Data—1106403

Cold	35*	8.0	1040

Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—25 ounces each.
Field Current—1.76-1.88 amperes (Standard), 1.77-2.0 amperes (Police) at 6.0 volts.
Removal:—Pivot mounted at left front of engine. To remove, take out clamp and pivot bolts.
Belt Adjustment:—Loosen pivot and clamp bolts, move generator out or away from engine to take up stretch or slack in belt. Belt play should be 1" between pulleys when belt grasped with fingers.

REGULATOR:—**Delco-Remy 1118201 (Std.), 1118229 (Police). Single Core Type.** Vibrating current and voltage regulator in case on dash.
CAUTION—Check generator for grounded fields before changing regulator settings. If field coils defective, new field coil parts 1877893 and 1878427 should be installed. Also check regulator terminals for clearance at dash.
See article in Electrical Equipment Section for data.

Cutout Relay

Cuts In—6.2-6.7 volts (hot).
Cuts Out—0-4.0 amperes discharge current.
Contact Gap—.020" (same for both sets).
Air Gap—.020" (with points just closed).

Voltage Regulator

Setting (1118201)—7.4-7.8 volts (70° F), 7.2-7.4 volts (hot). **(1118229)**—7.0-7.4 volts (70° F.), 7.0-7.2 volts (hot). Regulator over-compensated for temperature.
To Check—Connect ammeter in charging line at 'BAT' regulator terminal, voltmeter between 'BAT' terminal and ground. Operate generator at approx. 3000 RPM, adjust charging rate to 8-10 amperes (use variable rheostat or 'AVR' set). With regulator at hot operating temperature, retard generator speed until cut-out relay points open, then increase generator speed to 3000 RPM and check hot voltage setting (above). Cover must be in place.
To Adjust—Change regulator armature spring tension slightly by bending lower spring hanger for **light (left) spring (or one spring if both alike) only.** If further adjustment required see Single Core Regulator article in Electrical Equipment Section for Heavy (or other) Spring Adjustment.
Air Gap—.070" between center of core and armature with contacts just closed.

Current Regulator

Setting—32-34 amperes (Std.), 34-36 (Police) hot.
To Check—Remove cover, connect short jumper from voltage regulator frame to upper contact support bracket (shorting out Voltage Regulator). Connect ammeter in charging line at 'BAT' regulator terminal. Turn on lights and accessories, operate generator and increase speed until output remains stationary (run until hot). Check setting with regulator at operating temperature.
To Adjust—Change regulator armature spring tension slightly by bending lower spring hanger for **one spring.** If further adjustment required see Single Core Regulator article in Electrical Equipment Section for adjustment of Other Spring.
Air Gap—.075" (check same as Voltage Regulator).

LIGHTING:—**Headlamps**—Guide 'Sealed Beam' type.
See article in Electrical Equipment Section for data.
Headlamp Adjustment—Aim upper beam for each headlamp straight ahead with center of hot spot on horizontal line 3" below lamp center height.
Beam Indicator—Red light on speedometer dial. Lighted with upper beam in use.

Switches

Lighting—Delco-Remy 1995009. NOTE—New switch with 9 ampere fuse for **Stop Light** circuit used after Serial No. P6HA-40968 (Spec. 6), P6HB-34427 (Del. 6). P8HA-14188 (Del. 8), P8HB-15513 (Torpedo 8). This new switch furnished for service after first type stock exhausted.
Beam Selector—Delco-Remy 1997002, 465-V (RHD).
Instrument Lamp—Delco-Remy 1997719.
Stop Light—Delco-Remy 1997725.

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps		Sealed Beam
Parking, Rear License	3	63
Instrument	1½	55
Ign. Switch, Beam Indic.	1	51
Stop & Tail	21-3	1154
Dome	6	81

THERMOSTATIC RELAY:—**Delco-Remy.** On lighting switch. Contacts remain closed with 30 amperes, but open in 3 minutes with load of 42 amperes at 70°F.

FUSES:—**Stop Light**—9 ampere on lighting switch. Used on later cars only (see Light Switch Note above).

HORNS:—**Delco-Remy Model K-33-H.** No. 1999501, 519 (low note), 1999502, 520 (high note). Vibrator type, blended tone, operated by horn relay. Horn set 1999501 & 502 used on early cars.

Type	Current (at 6 volts)	Air Gap
1999501 (Low)	16-18 amperes	.044-.049"
1999502 (High)	15-17 amperes	.034-.039"
1999519 (Low)	19-21 amperes	.044-.049"
1999520 (High)	18-20 amperes	.034-.039"

Horn Relay:—Delco-Remy Model 1116775.
Contact Gap—.020". **Air Gap**—.015" (closed).
Contacts Close—2.75-4.0 volts.

SERIAL NUMBER:—First number 8HA-1001 (Deluxe), 8HB-1001 (Torpedo) with prefixes indicating factory as follows: P—Pontiac, Mich., C—South Gate, Calif., L—Linden, N. J. On plate fastened to left end of frame front cross member under hood.

ENGINE NUMBER:—First number 8-194401. Stamped on boss on top left front corner of engine block.

COMPRESSION:—**Ratio**—6.5-1 Std., 7.2-1 Optl.

Pressure—155-158 lbs. at 1000 RPM or approximately 118-120 lbs. at cranking speed (Std. head).

VACUUM READING:—Steady 18-20" idling at 7 MPH.

IGNITION:—**Coil Model 1115129.** Mounted on dash.

Ignition Current—2.5 amperes idling, 4.5 stopped.

Ignition Switch:—Delco-Remy Model 1116286 (40-28), 1116285 (40-29). Switch and cable assembly. Connected to coil by armored cable.

Ignition Lock—Briggs & Stratton. B & S No. 45792. Key Series—8000 to 9499. Groove—No. 15.

Distributor Delco-Remy 1110804. Single breaker, 8 lobe cam, full automatic advance type with vacuum spark control and Gaselector adjustment (for fuel compensation) at distributor.

Breaker Gap—.015". Limits .0125-.0175".

Cam Angle or Dwell—31° closed, 14° open (distr.).

Breaker Arm Spring Tension—19-23 ounces.

Rotation—Counter-clockwise viewed from above.

Condenser—Part No. 1869704. Capacity .18-.25 mfd.

Automatic Advance

Distributor		Engine	
Degrees	R.P.M.	Degrees	R.P.M.
Start	400	4.0	800
7.0	1100	14.0	2200
8.5	1500	17.0	3100
13.0	2000	26.0	4000

Vacuum Spark Control Model 1116021. Integral with distributor. Mounted on housing and linked directly to breaker plate. Provides additional advance at speeds above idling (vacuum port in carburetor above throttle) except when engine accelerated or operated with wide open throttle when spark is retarded by return spring within unit. Total plunger travel 7/32".

Vacuum Advance

Distr. Degrees	Eng. Degrees	Vacuum (" of HG)
Start	0°	7-9"
10°	20°	16-21"

Gaselector—Manual adjustment at distributor providing 10° advance or retard from center '0' position. See Gaselector Setting following.

Distributor Removal:—Mounted on left side of engine. To remove, disconnect vacuum line, take out hold-down screw in Gaselector and lift out.

IGNITION TIMING:—Standard setting given below (regular fuel Std. hd., Ethyl fuel HC hd.). See Gaselector following for final setting.

	Flywheel Degrees	Piston Position
All engines	6° BTDC	.0128" BTDC.

NOTE—The two straight lines of the ignition mark '/IGN.ONE/' indicates allowable timing range of 4° on flywheel. Use first or 6° line in setting ignition. Car manufacturer recommends use of Timing Light (Tool HM-494) or Synchroscope (HMO-161).

To Set Timing (using Timing Light)—Connect timing light between distributor terminal and ground, turn on ignition. With #1 piston on compression, turn engine over until piston is 6° or .0128" before top dead center, stop when first line of ignition mark '/IGN.ONE/' lines up with pointer in inspection hole in left front face of flywheel housing. Loosen Gaselector screw, center pointer on scale, tighten screw, loosen advance arm clamp bolt, rotate distributor until timing lamp lights (contacts opening), tighten clamp bolt.

To Set Timing (using Synchroscope)—Clip one synchroscope lead to #1 spark plug cable, insert other lead in distributor cap terminal from which #1 spark plug wire removed. Fill in first line of flywheel mark '/IGN.ONE/' with white chalk or paint. Direct synchroscope on flywheel through inspection hole in left front face of flywheel housing. Idle engine at 376 R.P.M. or 7 M.P.H., adjust distributor (as directed for Timing Light above) until white line coincides with pointer on housing.

Motor Gauge—Weidenhoff Adapter #114. Rod #42.

Gaselector Setting—Should be set to provide best performance without spark knock or ping for particular operating conditions and octane rating of fuel used. To adjust, loosen screw, move pointer clockwise to advance or counter-clockwise to retard spark.

Firing Order:—1-6-2-5-8-3-7-4.

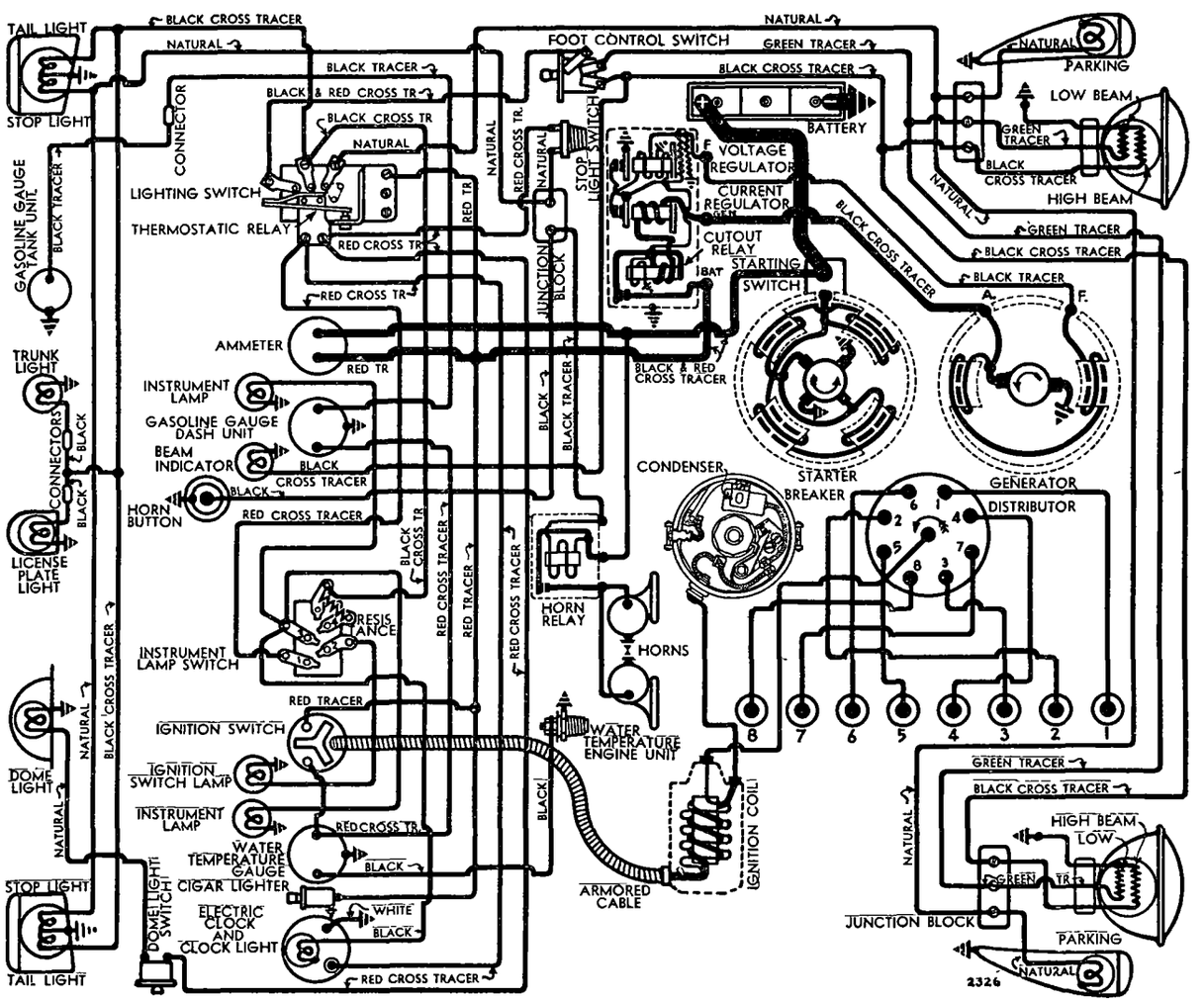
Spark Plugs:—AC No. 45. 14 MM. Metric type.

Spark Plug Gaps—.025".

CARBURETION (DELUXE):—**Caburetor**—Carter Type WA-1, Model 462-S (first), 462-SP (later). 1¼" downdraft type with Carter Climatic Control.

Production Change—To correct engine hesitating when starting in second gear, a new pump plunger 64-70S used on 462-SP. On 462-S, change pump link to lower hole in arm and plunger shaft to correct this condition.

See article in Carburetor Section for data.



Idle Adjustment—With engine warm and running at slow idle speed (choke valve wide open, fast idle inoperative), set throttle stopscrew for 7 MPH idle speed. Adjust idle adjusting screw until engine fires smoothly (½-1¼ turns open—turn screw in for leaner mixture). Readjust idle speed.

Float Level—5/16" from top of float to gasket seat on cover with needle valve seated (invert to check).

Accelerator Pump Setting—Pump arm and plunger under dust cover at top of carburetor have two holes for connector link engagement. Recommended settings as follows:

Upper Holes (short stroke)—Normal setting.

Lower Holes (long stroke)—Cold temperatures or to correct hesitating when starting car in second gear on 462-S carburetors.

Fast Idle:—Integral type, built-in carburetor.
See article in Carburetion Equipment Section.

Fast Idle Setting—Adjust by bending connecting link offset for 5/8" choke valve opening with stopscrew against (not on) first step of fast idle cam.

Accelerator Linkage Adjustment:—Must be maintained to provide correct 'Throttle cracking' action for starting. To adjust, set carburetor idle speed at 6-7 MPH, loosen hand throttle wire lock screw, pull button ⅛" out from instrument panel, position hand throttle lever so that no clearance exists between lever and throttle cross shaft, tighten lockscrew. Turn throttle stopscrew in 2 turns (with throttle stopscrew on high point of cam or 'cold' position), disconnect battery cable at starting motor, to prevent cranking, fully depress starting pedal, adjust throttle cracking pin so that all clearance between pin and cross shaft lever is taken up. Connect starting motor cable and reset idle speed.

Automatic Choke:—Carter Climatic Control.
See article in Carburetion Equipment Section.

Setting—Set coil housing one notch rich.

Air Cleaner:—AC #1528128 oil wetted type with crankcase ventilator #502783 standard. #1529478 oil bath type with #499327 ventilator cleaner optl.

Fuel Pump:—AC Type AH #1523985 standard. Type AJ #1523986 fuel-and-vacuum pump optional.
See article in Carburetion Equipment Section.

Gasoline Gauge:—AC Electric. #1515371 (dash unit), #1515481 (tank unit).
See article in Carburetion Equipment Section.

CARBURETION (TORPEDO): — Carburetor — Carter Type WDO, Model 469-S (first), 469-SM (later). 1 5/16" dual downdraft type with Carter Climatic Control. *See article in Carburetor Section for data.*

Production Change—New metering rods used on 469-SM. *See article in Carburetor Section for data.*

Idle Adjustment—With engine warm and running at slow idle speed (choke valve wide open, fast idle inoperative), set throttle stopscrew for 7 MPH idle speed. Adjust idle adjusting screw for each barrel (in succession) until engine fires smoothly (setting ½-1¼ turns open—turn screws in for leaner mixture). Readjust idle speed. Car manufacturer recommends use of vacuum gauge for this adjustment.

Accelerator Pump Setting—Not adjustable.

Float Level—5/16" from top of float to gasket seat on cover with needle valve seated (invert to check).

Fast Idle:—Integral type, built-in carburetor.
See article in Carburetion Equipment Section.

Fast Idle Setting—Adjust fast idle screw for .010" throttle opening with choke valve fully closed.

Accelerator Linkage Adjustment:—Same as for De-luxe Eight. See instructions listed above.

Automatic Choke:—Carter Climatic Control.
See article in Carburetion Equipment Section.

Choke Setting—1½ Notches Rich (may be set 4 notches rich to correct poor starting or leanness after starting) for first type thermostat marked '170-G-16S' on choke housing. Later type thermostat marked '170-F-16S' set 1½ Notches Rich.

Air Cleaner:—AC #1529478 heavy duty oil bath type standard.

Fuel Pump:—AC Type AJ #1537087 diaphragm type combination fuel-and-vacuum pump standard.
See article in Carburetion Equipment Section.

Gasoline Gauge:—AC Electric. #1515371 (dash unit), #1515481 (tank unit).
See article in Carburetion Equipment Section.

MANIFOLD HEAT CONTROL:—Thermostatic coil type. Counterweight must be tightly clamped to shaft and about vertical with valve closed (engine cold).

Setting—Adjustment provided by shifting anchor pin for following settings: Normal temperatures (center hole). Extremely cold temperatures (inner hole). Extremely hot temperatures (outer hole).

VALVE TIMING:—#1 intake valve opens 5° (.0089") BTDC with .015" tappet clearance (first line of flywheel mark "/IGN.ONE/" just past indicator above starter).

Motor Gauge—Weidenhoff Adapter #114, Rod #42.

Tappet Clearance:—.011-.013" all valves (warm). Use .011" and .013" feelers as 'go' and 'no go' gauges. NOTE—.013" exhaust setting recommended by car manufacturer for sustained high speed driving.

Valve Spring Pressure:—56-63 lbs. at 1 29/32" (valve closed), 97-105 lbs. at 1 19/32" (valve open).

LUBRICATION:—Crankcase Capacity—6 quarts.

Normal Oil Pressure—35-40 lbs. above 40 MPH.

COOLING SYSTEM:—Capacity—19 quarts.

Thermostat:—Harrison. In cyl. head water outlet. Closed 140° F. Starts to open 145° F. Fully open 172°.

Temperature Gauge:—AC Electric. #1510916 (dash unit), #1510772 (engine unit).
See article in Mechanical Equipment Section for data.

BATTERY:—Delco Type 15E-1. 6 volt, 15 plate, 100 A. H. capacity (20 hour rate). End-to-end type.

Starting Capacity—120 amperes for 20 minutes.

Zero Capacity—300 amperes for 3.5 minutes. Five second voltage—4.25 volts.

Grounded Terminal—Negative (—) grounded to lower left side of block. No separate engine ground.

Dimensions—Length 19 5/16". Width 4". Height 9".

Location—Under engine hood on left side.

Police Battery:—Delco Type 19E-1. 6 volt, 19 plate, 130 A. H. capacity (20 hr. rate). End-to-end type.

Starting Capacity—150 amperes for 20 minutes.

Zero Capacity—300 amperes for 5 3 minutes. Five second voltage—4.55 volts.

All other data same as for 15E-1 above.

STARTER:—Delco-Remy 1107914. Armature 1867897.
Drive—Overrunning clutch (manual pinion shift).
Rotation—Counter-clockwise at commutator end.
Cranking Engine—220-225 amperes at 5 volts.
Brush Spring Tension—24-28 ounces.

Performance Data

Torque	R.P M.	Volts	Amperes
0 ft. lbs.	6000	5.0	. .60
15 " "	Lock	3 0	. 600

Removal:—Flange mounted on left front face of flywheel housing. To remove, take out capscrews.
Starting Switch:—Delco-Remy Part #820052. Mounted on starter. Operated by starting pedal.

GENERATOR:—Delco-Remy 1102665 (Std.), 1106403 (Police). Same as used on 40-25,26. *See preceding 1940 Pontiac Six 'T&E' page for complete data.*
Torpedo Note—On some early cars, generator to regulator wire (between generator and wiring harness clip at fender side apron) is tight and may be broken in normal service causing generator to operate on open-circuit. To correct, loosen wiring harness clips at fender side apron and move harness forward to provide slack in this wire.

REGULATOR:—Delco-Remy 1118201 (Std.), 1118229 (Police). Same as used on 40-25,26. *See preceding 1940 Pontiac Six 'T&E' page for complete data.*

LIGHTING:—Headlamps—Guide 'Sealed Beam' type.
See article in Electrical Equipment Section for data.
Headlamp Adjustment—Aim upper beam for each headlamp straight ahead with center of hot spot on horizontal line 3" below lamp center height.
Beam Indicator—Red light on speedometer dial. Lighted with upper beam in use.

Switches

Lighting—Delco-Remy 1995009. NOTE—New switch with 9 ampere fuse for **Stop Light** circuit used after Serial No. P6HA-40968 (Spec. 6), P6HB-34427 (Del. 6). P8HA-14188 (Del. 8), P8HB-15513 (Torpedo 8). This new switch furnished for service after first type stock exhausted.
Beam Selector—Delco-Remy 1997002.
Instrument Lamp—Delco-Remy 1997719.
Stop Light—Delco-Remy 1997725.

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps		Sealed Beam
Parking, Rear License	3	63
Instrument	1½	55
Ign. Switch, Beam Indic.	1	51
Stop & Tail	21-3	1154
Dome	6	81

THERMOSTATIC RELAY:—Delco-Remy. On lighting switch. Contacts remain closed with 30 amperes, but open in 3 minutes with load of 42 amperes at 70°F. Non-adjustable.

FUSES:—Stop Light—9 ampere on lighting switch. Used on later cars only (see Light Switch Note above).

HORNS:—Delco-Remy Model K-33-H. No 1999501, 519 (low note), 1999502, 520 (high note). Vibrator type, blended tone, operated by horn relay. Horn set 1999501 & 502 used on early cars.

Type	Current (at 6 volts)	Air Gap
1999501 (Low)	16-18 amperes	.044-.049"
1999502 (High)	15-17 amperes	.034-.039"
1999519 (Low)	19-21 amperes	.044-.049"
1999520 (High)	18-20 amperes	.034-.039"

Horn Relay:—Delco-Remy Model 1116775.
Contact Gap—.020". **Air Gap**—.015" (closed).
Contacts Close—2.75-4.0 volts.

HOOD LOCK:—Alligator type hood with lock handle in driver's compartment. To raise hood, press down on lock handle at right of steering column (hood will raise slightly) and lift up at forward end.

Hood Side Panels:—Secured by wing nut at radiator, 2 wing nuts at lower edge and one nut at engine dash on upper edge of panel.

SERIAL NUMBER:—First number G-30501 (South Bend), G-803701 (Los Angeles). Stamped on right hand body front hinge pillar.

ENGINE NUMBER:—First number 34101. Stamped on pad on upper left front corner of engine block.

COMPRESSION:—**Ratio**—6.5-1 std. cast-iron head. **Pressure**—105 lbs. at 150 RPM.

VACUUM READING:—Steady 17-18" at 8 MPH idle spd.

IGNITION:—**Coil Model CE-4632.** Service coil (less switch and cable) CE-3224US. Mounted on dash.

Ignition Current—½-1½ amps. idling, 4-5 stopped.

Ignition Switch:—Mitchellock Model 24-R. No. 8271.

Ignition Lock—Yale & Towne. Mitchell No. 6966.

Distributor Model IGW-4131. Single breaker, 6 lobe cam, full automatic advance type with auxiliary vacuum spark control and Octane Selector adjustment (at distributor).

Breaker Gap—Set at .020".

Breaker Arm Spring Tension—17-20 ounces.

Cam Angle or Dwell—35° closed, 25° open (distr.).

Rotation—Counter-clockwise viewed from the top.

Condenser—No. IGB-1025. Capacity .20-.25 mfd.

Automatic Advance

Distributor		Engine	
Degrees	R.P.M.	Degrees	R.P.M.
Start	400	0	800
2	680	4	1360
4	975	8	1950
6	1265	12	2530
7	1400	14	2800

Vacuum Spark Control Model VC-4009—Mounted on hold-down plate and linked to advance plate. Provides additional advance at speeds above idling except when engine accelerated or operated with wide open throttle (spark retarded by return spring in unit).

Vacuum Advance

Distr. Degrees	Eng. Degrees	Vacuum (" of HG)
Start	0°	4"
2°	4°	5½"
5°	10°	7¾"
7°	14°	11¼"
9°	18°	14¾"

Octane Selector—Provides manual adjustment at distributor (hold-down plate marked with scale) for variation in timing depending on fuel regularly used. See Ignition Timing following for adjustment.

Distributor Removal:—Mounted on left side of engine. To remove, disconnect vacuum line, take out screw in hold-down plate and lift distributor off.
NOTE—When installing distributor, insert .016" feeler between hold-down plate and advance plate while tightening advance plate clamp bolt to prevent binding and allow free advance plate motion.

IGNITION TIMING:—Standard setting as follows (see Octane Selector Setting following for correction dependent on fuel regularly used):

Flywheel Degrees	Piston Position
2° BTDC	.0015" BTDC

To Set Timing—Crank engine by engaging gears and rolling car on floor. With #1 piston on compression, turn engine over until 'IGN' mark (approx. 13/16" ahead of U.D.C. 1-6 mark) on flywheel is in line with pointer on engine rear plate on left side of car. Loosen hold-down plate screw and center scale on pointer, tighten screw. Loosen advance arm clamp bolt, rotate distributor until contacts begin to open, insert .016" feeler between advance arm and hold-down plate (to insure clearance for free advance arm movement), tighten clamp bolt, remove feeler gauge. Check Octane Selector Setting (following).

NOTE—Car manufacturer recommends use of Neon Timing Light for setting ignition timing.

Octane Selector Setting—After setting ignition timing, loosen selector (hold-down plate) screw and advance (move selector so that pointer toward 'A' end of scale) until motor 'pings' when it is hot and pulling hard. Then retard (move selector with pointer toward 'R' end of scale) until 'ping' just disappears.

Firing Order:—1-5-3-6-2-4. See diagram.

Spark Plugs:—Champion No. 8. 18 MM Metric.

NOTE—Champion No. 7 or 13 (colder plugs) may be used for extremely fast driving in hot weather.

Spark Plug Gaps—Set at .025".

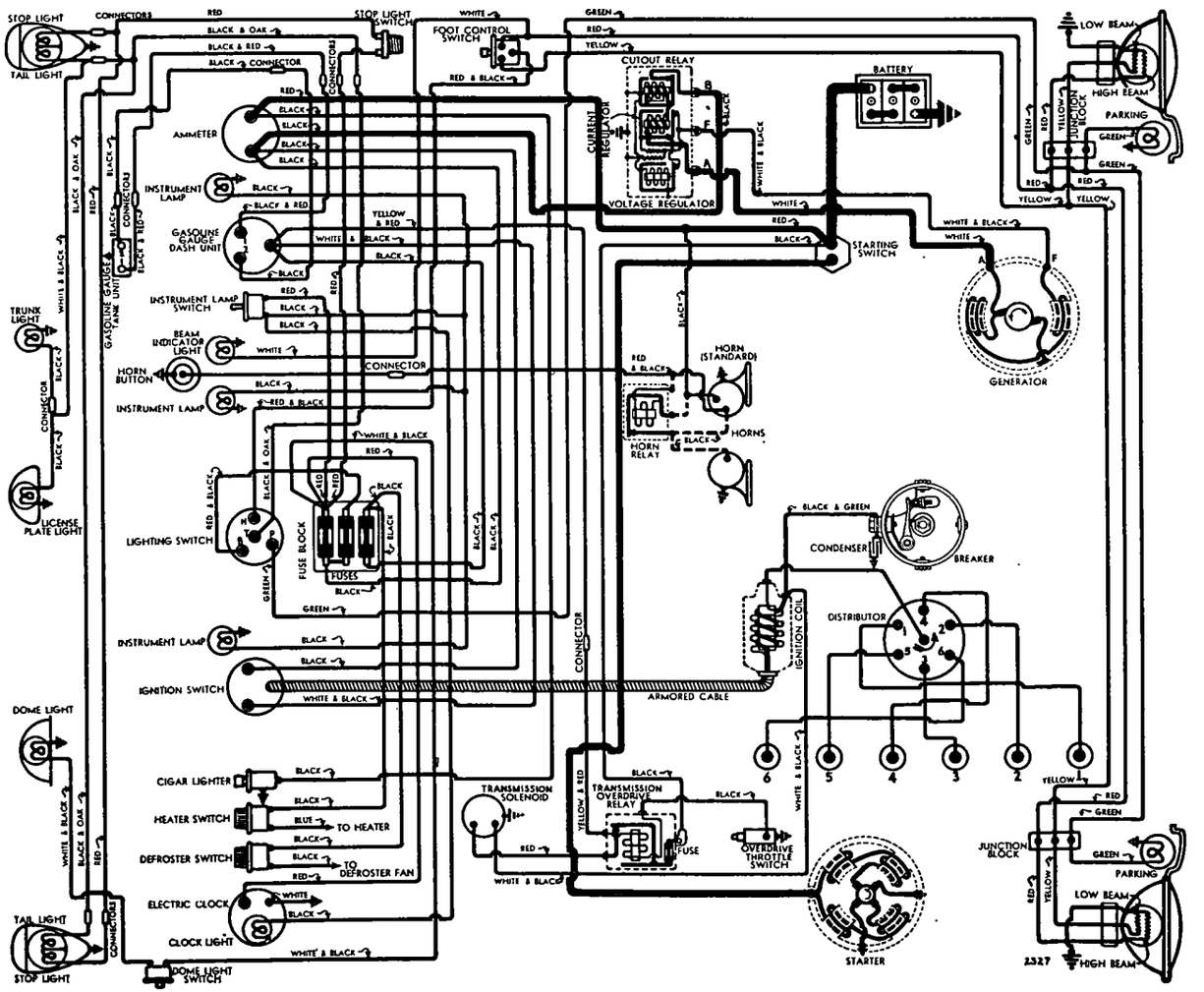
CARBURETION:—**Carburetor**—Carter Type WO Model 468-S (#229 cast on flange). 1¼" single barrel, downdraft type.

See article in Carburetor Section for complete data.

Idle Adjustment—With engine warm and running at slow idle speed (choke valve wide open, fast idle inoperative), set throttle stopscrew for 8 MPH or 600 RPM idle speed. Adjust idle adjusting screw until engine fires smoothly (¾-1¼ turns open—turn screw in for leaner mixture). Readjust idle speed.

Accelerating Pump—Non-adjustable type.

Float Level—¼" from top of float (free end) to gasket seat on cover. Invert to check with float hanging freely and spring in valve stem not compressed.



Fast Idle Setting—Choke connector link opens throttle .018-.022" with choke valve closed. Adjust by bending offset on connector link.

Air Cleaner:—AC #1529210 oil-wetted type std. Heavy duty oil-bath type optional. Oil filler cap equipped with copper mesh cleaner.

Fuel Pump:—AC Type W # 1523957 diaphragm type. *See article in Carburetion Equipment Section.*

Gasoline Gauge:—Auto-Lite electric type. No. NG-9211D (dash unit). *See article in Carburetion Equipment Section.*

MANIFOLD HEAT CONTROL:—Thermostatic coil type. To check, unhook coil from pin (valve in closed position, counterweight up). Hooked end of coil should be ¼ revolution away from pin (replace coil if not within this limit). Car manufacturer recommends application (every 1000 miles) of kerosene and baking soda solution on shaft at coil to insure free operation of valve shaft.

Valve Noise Note—Manifold heater valve (No. 196657) has been changed to prevent rattle or noise by tapering lower (curved portion) of valve where it contacts manifold. Edge has been cut back ⅛" at one edge and tapers out to within ¼" from opposite edge of valve (leaving ¼" straight portion with remainder of edge tapered). If noise develops on early cars, valves should be tapered as above to remedy this condition.

VALVE TIMING:—**To Check.** With .020" tappet clearance #1 intake valve should open with #1 piston 15° or .0835" BTDC with flywheel mark 'IN-OP.1-6/' aligned with pointer on left rear engine plate. Reset tappet clearance at .016" (cold).

Tappet Clearance:—.016" all valves with engine cold. NOTE—Self-locking tappet screws used.

Valve Spring Pressure:—49-53 lbs. at 1 21/32" (valve closed), 90-94 lbs. at 1 11/32" (valve open).

LUBRICATION:—**Crankcase Capacity**—5 quarts.
Normal Oil Pressure—40 lbs. at 25-30 MPH.
Oil Pressure Relief Valve—On right front corner of engine block. Opens at 40 lbs.

COOLING SYSTEM:—**Capacity**—10½ quarts.
Thermostat—Bishop & Babcock. In cylinder head water outlet. Starts to open at 156-160° F.
Temperature Gauge—Auto-Lite (Motometer) Vapor tension type. No. H-9210-A.
See article in Mechanical Equipment Section for data.

TRANSMISSION OVERDRIVE CONTROL:—Electric type with accelerator pedal 'kick-down' switch.
See article in Mechanical Equipment Section for data.
Throttle Switch—Cole-Hersee No. 1687-S. Adjust so that shoe on accelerator linkage just contacts switch plunger with carburetor throttle in wide open position.
Control Relay—Auto-Lite HR-4201S. 14 ampere fuse mounted in holder on relay.

BATTERY:—**Willard, Type SW-1-90.** 6 volt, 13 plate, 90 Ampere Hour capacity (20 hour rate).
Starting Capacity—114 amperes for 20 minutes.
Zero Capacity—300 amperes for 3.0 minutes. Five second voltage—4.1 volts.
Grounded Terminal—Positive (+) grounded to dash.
Engine Ground—Strap connector at right front mounting bolt.
Dimensions—Length & Height 9". Width 7".
Location—In carrier on left front side of dash in engine compartment.

STARTER:—**Model MZ-4074. Armature MZ-2130.**
Drive—Barrel type Bendix No. A-2033 (similar in design to Ford '60' type A-1806).
IMPORTANT—A-2033 drive marked 'D' on pinion barrel. Must not be interchanged with Ford type due to difference in structure of pinion teeth.
Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—42-53 ozs. (new brushes).
Cranking Engine—160 amperes, 5.2 volts, 130 RPM.

Performance Data

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	4300	5.5	70
.65 " "	2500	5.5	100
2.55 " "	1325	5.0	200
4.95 " "	750	4.5	300
7.65 " "	220	4.0	400
7.8 " "	Lock	3.0	420
11.8 " "	Lock	4.0	560

Removal:—Starter flange mounted on right rear engine plate. To remove take out mounting bolts and lift starter off.

Starting Switch:—A-L Model SW-4011. Mounted on left side of car below clutch pedal. Operated by depressing clutch pedal fully.

GENERATOR:—**Model GEA-4804A. Armature No. GDZ-2006F.** Two brush type with current-voltage control.
Charging Rate Adjustment—No adjustment at generator. Charging rate controlled by Voltage Regulator and maximum output by Current Regulator. *See Regulator data following.*
Maximum Charging Rate—35 amperes (hot or cold), 8.0 volts, 1800 gen. RPM or 18.3 MPH and above with load or discharged battery (Current Regulator Setting). Actual charging rate controlled by Voltage Regulator and dependent on battery condition.

Performance Data

Cold			Hot		
Amperes	Volts	R.P.M.	Amperes	Volts	R.P.M.
0	6.4	780	0	6.4	840
4	6.6	870	4	6.6	935
8	6.8	960	8	6.8	1025
12	6.95	1050	12	6.95	1120
16	7.15	1140	16	7.15	1220
20	7.3	1230	20	7.3	1320
24	7.6	1320	24	7.6	1420
28	7.7	1410	28	7.7	1550
32	7.85	1500	32	7.85	1685
35	8.0	1570	35	8.0	1800

Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—53 ozs. max. (new brushes).
Field Current—1.57-1.75 amperes at 6.0 volts.
Motoring Current—4.45-4.9 amperes at 6.0 volts.

Removal:—Pivot mounted at left front of engine. To remove, take out clamp and pivot bolts.

Belt Adjustment:—Loosen pivot and clamp bolts, move generator out away from engine until fan can just be rotated with belt held stationary.

REGULATOR:—**Model VRP-4004A. Current-Voltage type.** In a single case mounted on engine dash.
See article in Electrical Equipment Section for data.
NOTE—Regulator case cover is sealed. Serviced on exchange basis if seals not broken.

Cutout Relay

Cuts In—6.4-6.6 volts, 850 Gen. RPM., 8.6 MPH.
Cuts Out—4.8-5.6 volts (approx. 7-8 amps. disch.).
Contact Gap—.015" minimum.
Air Gap—.034" min., .038" max. with contacts open. Measure at hinge end of core.

Voltage Regulator

Setting—7.3-7.6 volts at 70° F.

To Check (without breaking seals)—Connect ammeter in charging line at regulator 'B' terminal, voltmeter between 'B' terminal and ground. Operate generator at speed equivalent to 30 MPH, charging battery until voltage is steady. Voltage reading should be 7.3-7.6 volts at 70° F.

To Adjust (with cover removed)—Change regulator armature spring tension by bending lower spring hanger slightly. See Electrical Equipment Section.

Contact Gap—.012" Min. (armature against stop pin).

Air Gap—.048-.052" with contacts just opening.

Current Regulator

Setting—34-36 amperes (marked '35' on cover).

To Check (without breaking seals)—Connect test meters as for Voltage Check (above). Operate generator at 30 MPH, charging battery, add load (use bank of headlamp bulbs or turn on car lights and accessories and discharge battery) so that generator charges at peak rate and Current Regulator operates. Charging current should not exceed 34-36 amperes. If more than slight excess noted, regulator is defective.

Adjustment & Contact Gap—Same as for Voltage Regulator (above).

Air Gap—.034-.038" with contacts just opening.

LIGHTING:—**Headlamps**—Own 'Sealed Beam' type.
See article in Electrical Equipment Section for data.

Headlamp Adjustment—Aim upper beam for each lamp straight ahead with center of hot spot 3" below lamp center height.

Beam Indicator—Red light on speedometer face. Lighted whenever Country (upper) beam in use.

Switches

Lighting—Douglas Model 5724.
Beam Selector—Delco-Remy 1997002.
Instrument—Douglas Model 5645.

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps	Sealed Beam	
Parking, Instr., Trunk	1½	55
Beam Indicator	1	51
Stop & Tail	21-3	1158
Rear License	3	63
Dome	15	87

FUSES:—**Lighting**—Three 20 ampere. On fuse block on back of instrument panel at center. Protects circuits as follows: **Top**—Clock, Dome, Stop, Instrument lamps. **Center**—Head and Tail lamps. **Lower**—Accessories.
Transmission Overdrive Control—14 amp. On relay.

HORNS:—**Single**—Delco-Remy 1999805 standard.
Dual—Delco-Remy 1999511 (low note), 1999512 (high note) electric, air tone horns operated by relay.

Type	(Current at 6 volts)	Air Gap
1999805	7-9 amperes	.027-.033"
1999511 (low note)	19-21 amperes	.044-.049"
1999512 (high note)	18-20 amperes	.034-.039"

Horn Relay:—Delco-Remy Model 1116792.
Contact Gap—.020". **Air Gap**—.015" (closed).
Contacts Close—2.75-4.0 volts.

HOOD LOCK:—Alligator type hood with lock handle in driver's compartment. To raise hood, press down on handle at left of steering column (hood will raise slightly) allowing safety latch behind latch bolt and spring to be pressed back which will release hood.

SERIAL NUMBER:—First number 4148501 (South Bend), 4807601 (Los Angeles). Stamped on left hand body front hinge pillar.

ENGINE NUMBER:—First number H-87601. Stamped on boss on left hand side of cylinder block.

COMPRESSION:—**Ratio**—6.0-1 standard cast-iron hd., 7.0-1 optl. high-altitude aluminum head.
Pressure—105 lbs. (6.0-1 head), 110 lbs. (7.0-1 head) at 150 RPM cranking speed.

VACUUM READING:—18-20" at 450 RPM or 8 MPH.

IGNITION:—**Coil Model IG-4663.** Service coil (less switch and cable) IG-3224JS. Mounted on dash.
Ignition Current—½-1½ amps. idling, 4-5 stopped.
Ignition Switch:—Mitchellock Model 24-R, No. 8229.
Ignition Lock—Yale & Towne, Mitchell No. 8078.
Distributor Model IGW-4101. Single breaker, 6 lobe cam, full automatic advance type with auxiliary vacuum spark control and Octane Selector adjustment (at distributor).
Breaker Gap—Set at .020".
Breaker Arm Spring Tension—17-20 ounces.
Cam Angle or Dwell—35° closed, 25° open (distr.).
Rotation—Counter-clockwise viewed from the top.
Condenser—No. IGB-1025. Capacity .20-.25 mfd.

Automatic Advance

Distributor Degrees	R.P.M.	Engine Degrees	R.P.M.
Start	400	0	800
2	600	4	1200
5	900	10	1800
8	1200	16	2400
10	1400	20	2800

Vacuum Spark Control Model VC-4004—Mounted on hold-down plate and linked to advance plate. Provides additional advance at speeds above idling except when engine accelerated or operated with wide open throttle (spark retarded by return spring in unit).

Vacuum Advance

Distr. Degrees	Eng. Degrees	Vacuum (" of HG)
Start	0°	3"
2°	4°	5"
3°	6°	6"
5°	10°	10"
6°	12°	12"

Octane Selector—Provides manual adjustment at distributor (hold-down plate marked with scale) for variation in timing depending on fuel regularly used. See Ignition Timing following for adjustment.
Distributor Removal:—Mounted on left side of engine. To remove, disconnect vacuum line, take out screw in hold-down plate and lift distributor off.
NOTE—When installing distributor, insert .016" feeler between hold-down plate and advance plate while tightening advance plate clamp bolt to prevent binding and allow free advance plate motion.

IGNITION TIMING:—For all engines as follows (see Octane Selector Setting following for correction dependent on fuel regularly used):

Flywheel Degrees	Piston Position
2° BTDC	.0016" BTDC.

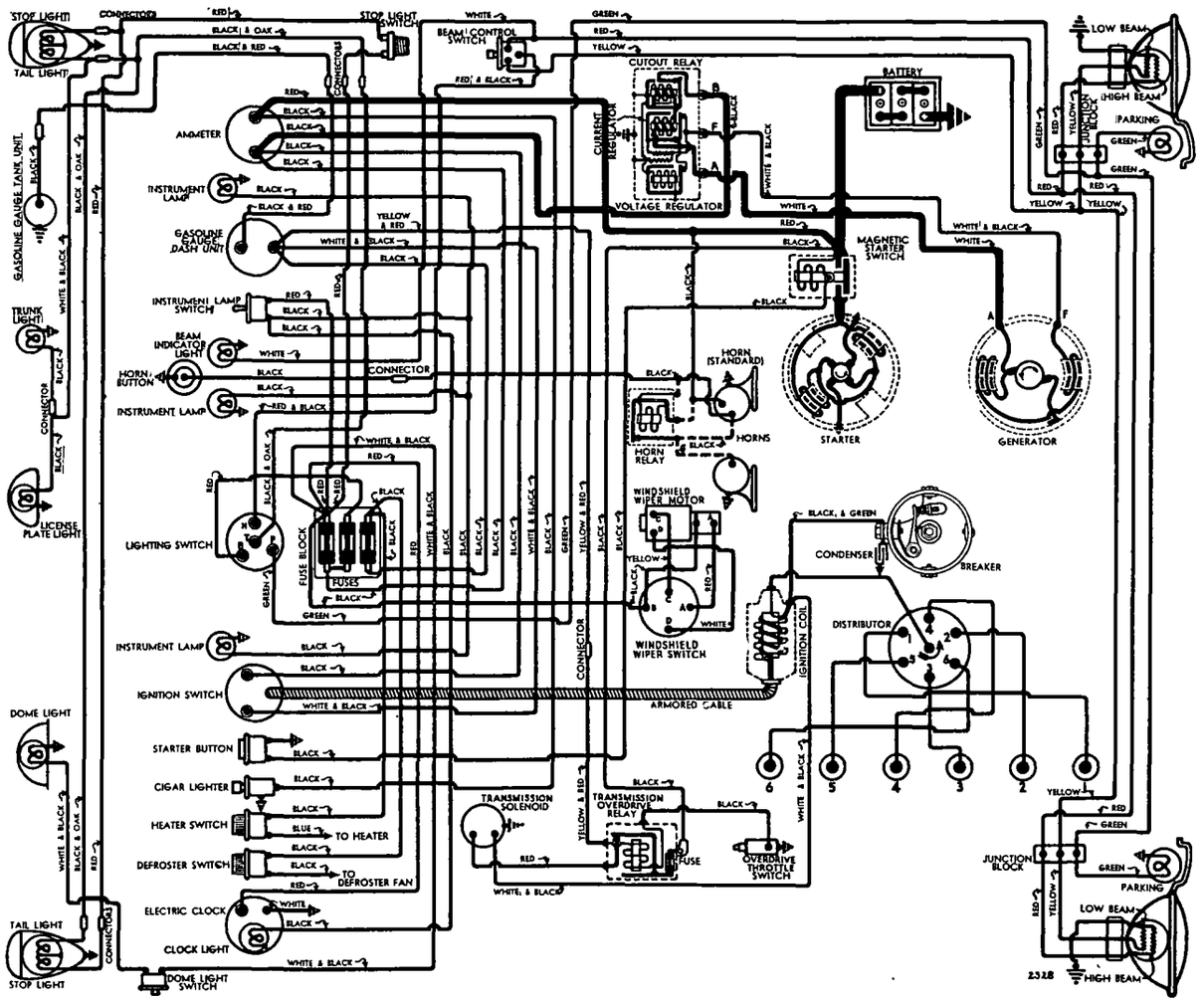
To Set Timing—Crank engine by engaging gears and rolling car on floor. With #1 piston on compression, turn engine over until 'IGN/' mark on vibration dampener at front of engine lines up with pointer on timing gear cover (this mark is 2° or 9/64" before top dead center mark '/UDC.1-6'). Loosen hold-down plate screw and center scale on pointer, tighten screw. Loosen advance arm clamp bolt, rotate distributor until contacts begin to open, insert .016" feeler between advance arm and hold-down plate (to insure clearance for free advance arm movement), tighten clamp bolt, remove feeler gauge.
Motor Gauge—Weidenhoff Adapter #104, Rod #2.
Octane Selector Setting—After setting ignition timing, loosen selector (hold-down plate) screw and advance (move selector so that pointer toward 'A' end of scale) until motor 'pings' when it is hot and pulling hard. Then retard (move selector with pointer toward 'R' end of scale) until 'ping' just disappears.
Firing Order:—1-5-3-6-2-4. See diagram.
Spark Plugs:—Champion No. 8. 18 MM Metric.
NOTE—Champion No. 7 or 13 (colder plugs) may be used for extremely fast driving in hot weather.
Spark Plug Gaps—Set at .025".

CARBURETION:—**Carburetor**—Carter Type WA-1 Model 410-S or Stromberg Model BXO-26 (code marked 6-84 on float chamber). 1¼" single barrel, downdraft types. ***See separate articles in Carburetor Section for data on each model.***

Idle Adjustment—With engine warm and running at slow idle speed (choke valve wide open, fast idle inoperative), set throttle stopscrew for 8 MPH idle speed. Adjust idle adjusting screw until engine fires smoothly (½-1¼ turns open for Carter—turn screw in for leaner mixture). Readjust idle speed.

Accelerating Pump Setting—3 holes provided in pump arm (Carter), throttle lever (Stromberg) for pump link engagement. Set as follows:
Inner Hole (min. stroke)—Extreme warm weather.
Center Hole (Stromberg) or Lower Hole (Carter)—Normal operating conditions.
Outer Hole (Stromberg) or Upper Hole (Carter)—Extreme cold weather.

Float Level (Carter)—¼" from top of machined projection on float bowl cover to top of soldered seam at free end of float (invert to check).



Float Level (Stromberg)—Fuel level 5/8" below top edge of float bowl.

Fast Idle (Carter):—Integral (built-in carburetor). *See article in Carburetion Equipment Section.*
Fast Idle Setting—Part of climatic control. Adjust by bending connector link offset to secure 5/8" choke valve opening with throttle stopscrew against (not on) first step of fast idle cam.

Fast Idle (Stromberg):—Stromberg BXO-26 carburetor type. *See article in Carburetion Equipm't Section.*
Fast Idle Setting—With throttle stopscrew against second step of fast idle cam, choke valve should be 11/32" open. To adjust, bend choke lever.

Automatic Choke (Carter):—Carter Climatic Control. *See article in Carburetion Equipment Section.*
Setting—Set thermostatic coil housing 1 Notch Rich.

Automatic Choke (Stromberg):—Stromberg BXO-26 carburetor type. *See article in Carburetion Equip. Sec.*
Setting—Mark 'R' on thermostatic spring case should line up with projection on housing (ordinary fuel). If setting too rich rotate case to 'M' mark (leaner setting). Use 'H' position only for very volatile fuels.

Air Cleaner:—AC #1528630 oil-wetted type Std. Heavy duty oil-bath type optional. Oil filler cap equipped with copper mesh cleaner.

Fuel Pump:—AC Type W #1522227 diaphragm type. *See article in Carburetion Equipment Section.*

Gasoline Gauge:—Stewart (Stewart-Warner) Electric. Stewart-Warner No. G-102158. *See article in Carburetion Equipment Section for data.*

MANIFOLD HEAT CONTROL:—Thermostatic coil type. To check valve, unlatch thermostatic coil by freeing outer end from bracket on manifold, operate valve by hand and see that valve is free (shaft can be cleaned with emery if necessary). Make certain that coil is properly latched on bracket and that tension spring (from shaft to clip on manifold flange) is in place.

VALVE TIMING:—To Check. With .020" tappet clearance #1 intake valve should open with #1 piston 15° or .0942" BTDC when mark 'IN-OP.1-6/' on vibration damper at front of engine lines up with pointer on gear case cover. Reset tappet clearance at .016" (cold).
Tappet Clearance:—.016" all valves with engine cold.
Valve Spring Pressure:—54-60 lbs. at 2 3/32" (valve closed). 125-135 lbs. at 1¾" (valve open).

LUBRICATION:—Crankcase Capacity—6 quarts.
Normal Oil Pressure—40 lbs. at 25-30 MPH.

COOLING SYSTEM:—Capacity—14½ quarts.
Thermostat—Bishop & Babcock or Fulton. In cylinder head outlet. Starts to open 156-160° F.
Temperature Gauge—Stewart (Stewart-Warner). No. G-102072.

TRANSMISSION OVERDRIVE CONTROL:—Electric type with accelerator pedal 'kick-down' switch. *See article in Mechanical Equipment Section for data.*
Overdrive Solenoid—Delco-Remy Model 1118001.
Throttle Switch—Cole-Hersee No. 1687-S. Adjust so that shoe on accelerator linkage just contacts switch plunger with carburetor throttle in wide open position.
Control Relay—Auto-Lite HR-4201S. 14 ampere fuse mounted in holder on relay.

BATTERY:—Willard Type SW-1-95. 6 volt, 15 plate, 95 A. H. capacity (20 hour rate).
Starting Capacity—117 amperes for 20 minutes.
Zero Capacity—300 amperes for 3.1 minutes. Five second voltage 4.2 volts.
Grounded Terminal—Positive (+) grounded to frame. **Engine Ground**—Separate ground strap.
Dimensions—Length 9". Width 7". Height 8 13/16".
Location—In engine compartment on left side.

STARTER:—Model MAW-4015. Armature MAW-2091.
Drive—Outboard Barrel Type Bendix No. A-1729.
Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—43-52 ozs. (new brushes).
Cranking Engine—130 RPM., approximately 175 amperes at 5.0-5.5 volts.

Performance Data

Torque	R P.M.	Volts	Amperes
0 ft. lbs.	4900	5 5	65
.6 " "	3300	5.5	100
2.75 " "	1480	5.0	200
5.45 " "	820	4 5	300
8.5 " "	400	4.0	400
11.5 " "	Lock	3.0	505
18.0 " "	Lock	4.0	670

Removal:—Starter flange mounted on left front face of flywheel housing. To remove, take out two flange mounting screws, remove starter and switch as assembly.

Starting Switch:—R.B.M. Model 5607. Magnetic type. Mounted on starter and controlled by Douglas #5701 pushbutton switch on instrument panel.

GENERATOR:—Model GEA-4803A. Armature No. GDZ-2006F. Two brush type with current-voltage control. NOTE—If GDA-4804A Generator and VRB-4012A Regulator used, refer to 1939 Commander 'T&E' page for data.
Charging Rate Adjustment—No adjustment at generator. Charging rate controlled by Voltage Regulator and maximum output by Current Regulator. *See Regulator data following.*
Maximum Charging Rate—35 amperes (hot or cold), 8.0 volts, 1600 gen. RPM or 17 MPH and above with load or discharged battery (Current Regulator Setting). Actual charging rate controlled by Voltage Regulator and dependent on battery condition.

Performance Data

Cold			Hot		
Amperes	Volts	R.P.M.	Amperes	Volts	R.P.M.
0	6.4	780	0	6.4	840
4	6.6	870	4	6 6	935
8	6.8	960	8	6.8	1025
12	6.95	1050	12	6.95	1120
16	7.15	1140	16	7.15	1220
20	7.3	1230	20	7.3	1320
24	7.6	1320	24	7.6	1420
28	7.7	1410	28	7.7	1550
32	7.85	1500	32	7.85	1685
35	8.0	1570	35	8.0	1800

Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—53 ozs. max. (new brushes).
Field Current—1.57-1.75 amperes at 6.0 volts.
Motoring Current—4.45-4.9 amperes at 6.0 volts.
Removal:—Pivot mounted at left front of engine. To remove, take out clamp and pivot bolts.
Belt Adjustment:—Loosen pivot and clamp bolts, move generator out away from engine until fan can just be rotated with belt held stationary.

REGULATOR:—Model VRP-4004A. Current-Voltage type. In a single case mounted on engine dash. *See article in Electrical Equipment Section for data.*
NOTE—Regulator case cover is sealed. Serviced on exchange basis if seals not broken.

Cutout Relay

Cuts In—6.4-6.6 volts, 800 Gen. RPM., 6.1 MPH.
Cuts Out—4.8-5.6 volts (approx. 7-8 amps. disch.).
Contact Gap—.015" minimum.
Air Gap—.034" min., .038" max. with contacts open. Measure at hinge end of core.

Voltage Regulator

Setting—7.3-7.6 volts at 70° F.
To Check (without breaking seals)—Connect ammeter in charging line at regulator 'B' terminal, voltmeter between 'B' terminal and ground. Operate generator at speed equivalent to 30 MPH, charging battery until voltage is steady. Voltage reading should be 7 3-7 6 volts at 70° F.
To Adjust (with cover removed)—Change regulator armature spring tension by bending lower spring hanger slightly. See Electrical Equipment Section.
Contact Gap— 012" Min. (armature against stop pin).
Air Gap—.048-.052" with contacts just opening.

Current Regulator

Setting—34-36 amperes (marked '35' on cover).
To Check (without breaking seals)—Connect test meters as for Voltage Check (above). Operate generator at 30 MPH, charging battery, add load (use bank of headlamp bulbs or turn on car lights and accessories and discharge battery) so that generator charges at peak rate and Current Regulator operates. Charging current should not exceed 34-36 amperes If more than slight excess noted, regulator is defective.
Adjustment & Contact Gap—Same as for Voltage Regulator (above).
Air Gap—.034-.038" with contacts just opening.

LIGHTING:—Headlamps—Own 'Sealed Beam' type. *See article in Electrical Equipment Section for data.*
Headlamp Adjustment—Aim upper beam for each lamp straight ahead with center of hot spot 3" below lamp center height.
Beam Indicator—Red light on speedometer face. Lighted whenever Country (upper) beam in use.

Switches

Lighting—Douglas Model 5704.
Beam Selector—Delco-Remy 1997002.
Instrument—Douglas Model 7290.

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps		Sealed Beam
Parking, Instr., Trunk	1½	55
Beam Indicator	1	51
Stop & Tail	21-3	1158
Rear License	3	63
Dome	15	87

FUSES:—Lighting—Three 20 ampere. On fuse block on back of instrument panel at center. Protects circuits as follows: **Top**—Clock, Dome, Stop, Instrument Lamps and Windshield Wiper. **Center**—Head and Tail lamps. **Lower**—Accessories.
Transmission Control—14 ampere. On relay.
Windshield Wiper—No separate fuse (protected by accessory fuse on fuse block).

HORNS:—Single—Delco-Remy 1999512 standard.
Dual—Use Delco-Remy Package #1874459 (horn 1999515) to make matched set. Electric type, air tone horns operated by relay.

Type	Current (at 6 volts)	Air Gap
1999512 (low note)	19-21 amperes	.044-.049"
1999515 (high note)	18-20 amperes	.034-.039"

Horn Relay:—Delco-Remy Model 1116756.
Contact Gap—.020". **Air Gap**—.015" (closed).
Contacts Close—2.75-4.0 volts.

WINDSHIELD WIPER:—Auto-Lite Model EBW-4002. Electric type. NOTE—No separate fuse used. *See article in Mechanical Equipment Section for data.*

HOOD LOCK:—Alligator type hood with lock handle in driver's compartment. To raise hood, press down on handle at left of steering column (hood will raise slightly) allowing safety latch behind latch bolt and spring to be pressed back which will release hood.

SERIAL NUMBER:—On left front body hinge post. First No. 7133101 (South Bend), 7803301 (L.A.).

ENGINE NUMBER:—First number B-38501. Stamped on left rear of cylinder block.

COMPRESSION:—Ratio—6.0-1 Std. CI. Hd. 6.5-1 Optl. **Pressure**—105 lbs. at 150 RPM.

VACUUM READING:—Steady 18" at 450 RPM, 8 MPH.

IGNITION:—Coil Model 1115201. Mounted on dash.
Ignition Current—½-1½ amps. idling, 4-5 stopped.
Ignition Switch:—Mitchellock Model 24-R, No. 8229. Delco-Remy No. 1116274, 1116288 (RHD) switch and cable.
Ignition Lock—Yale & Towne. Mitchell No. 8078.
Distributor Model 662-M:—Double breaker, 4 lobe cam, full automatic advance type with auxiliary vacuum spark control and Octane Selector. NOTE—Contacts must be synchronized (see Timing).
Firing Interval—Movable contacts open 45° (distr.) after fixed set.
Breaker Gap—.020". Limits .018-.024".
Cam Angle or Dwell—33° (closed), 14° (open).
Breaker Arm Spring Tension—19-23 ounces.
Rotation—Clockwise viewed from above.
Condenser—Part No. 1838163. Capacity .18-.25 mfd.

Automatic Advance

Distributor		Engine	
Degrees	R.P.M.	Degrees	R.P.M.
Start	300	2.5	600
14.5	1800	29	3600

Vacuum Spark Control Model 681-S.—Mounted under distributor and linked to advance arm. Provides additional advance at speeds above idling except when engine is accelerated or operated with wide open throttle when spark is retarded by return spring within unit. Total plunger travel ¼".

Vacuum Advance

Distr. Degrees	Eng. Degrees	Vacuum (" of HG)
Start	0°	5-7"
**6°	12°	11-14"

**—at .125" travel.
Octane Selector—Provides manual adjustment at distributor (hold-down plate marked with scale) for variation in timing depending on fuel regularly used. See Ignition Timing following for adjustment.
Distributor Removal:—Mounted on right side of cylinder head. To remove, take out screw in hold-down plate, loosen advance arm clamp bolt (not necessary to disturb vacuum unit or vacuum connections).

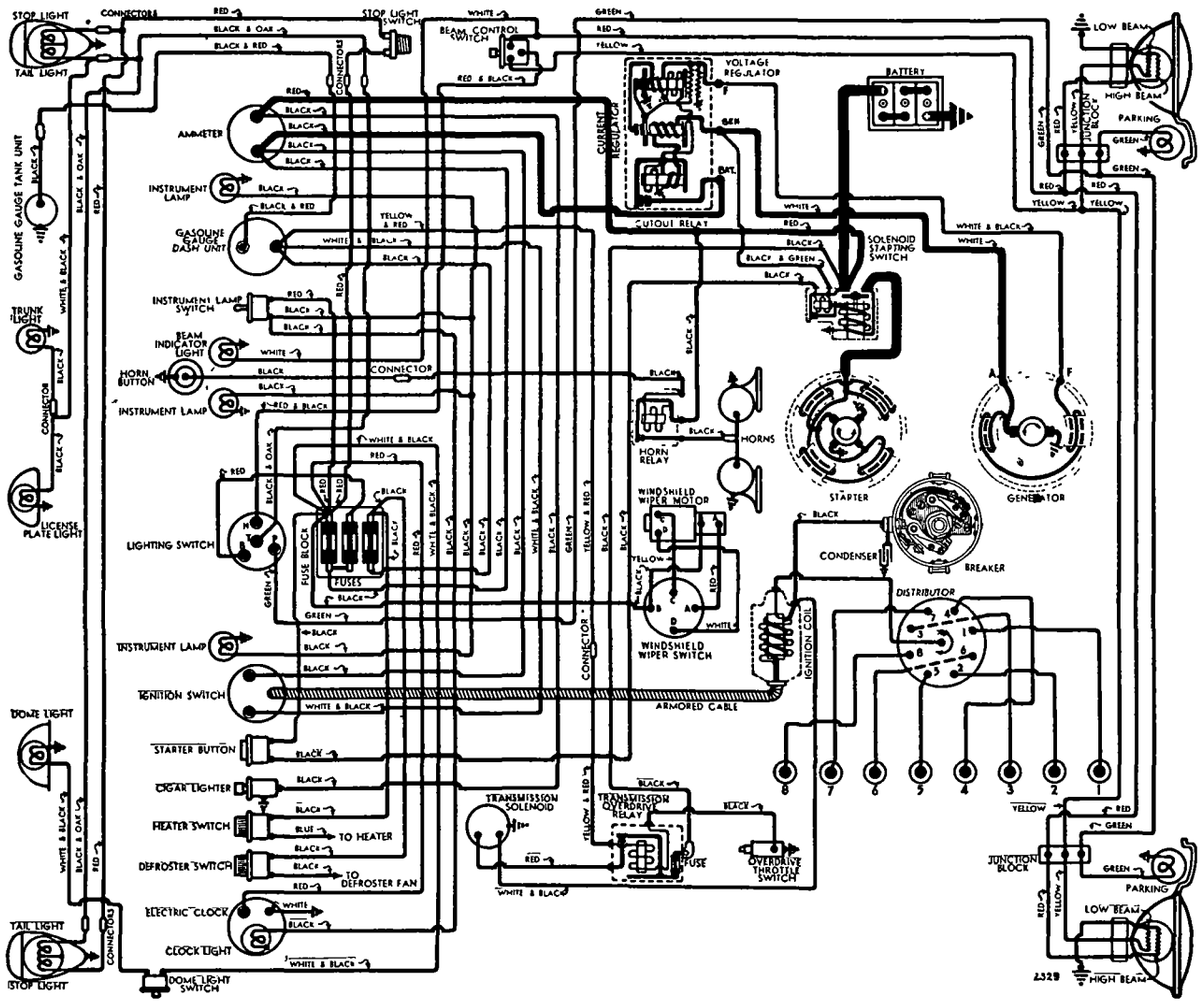
IGNITION TIMING:—Standard setting as follows (see Octane Selector Setting following for correction dependent on fuel regularly used):

Flywheel Degrees	Piston Position
0° (At TDC)	.0000" TDC.

To Set Timing (Stationary Contacts)—Crank engine by engaging gears and rolling car on floor. With #1 piston on compression, turn engine over until piston reaches top dead center, stop when dead center mark 'U.D.C.1-8' on vibration dampener at front of engine lines up with pointer on timing gear cover. Loosen hold-down plate screw, center scale on pointer, tighten screw. Loosen advance arm clamp bolt, rotate distributor until stationary breaker contacts (mounted directly on breaker plate) begin to open, tighten clamp bolt, then synchronize movable contacts.
Synchronization (On Engine)—Turn engine over 90° to #6 firing position with vibration dampener mark 'U.D.C.3-6' lined up with pointer on timing gear cover. Loosen lockscrews on movable sub-plate carrying second set of contacts, turn eccentric adjusting screw until contacts begin to open, tighten lockscrews.
Synchronization (Using Tool)—Use Delco-Remy tool #1838182. See Distributor Synchronization in Electrical Equipment Section for complete instructions. Distributor firing intervals regular 45-45-45°.
Motor Gauge—Weidenhoff Adapter #104. Rod #2.
Octane Selector Setting—After setting ignition timing, loosen selector (hold-down plate) screw and advance (move selector so that pointer toward 'A' end of scale) until motor 'pings' when it is hot and pulling hard. Then retard (move selector with pointer toward 'R' end of scale) until 'ping' just disappears.

Firing Order:—1-6-2-5-8-3-7-4 (see diagram).
Spark Plugs:—Champion No. 8. 18 MM Metric.
NOTE—Champion No. 7 or 13 (colder plugs) may be used for extremely fast driving in hot weather.
Spark Plug Gaps—Set at .025".

CARBURETION:—Carburetor—Carter Type WDO Model 409-S or Stromberg Model AAO-161 (code marked 6-85 on top of float chamber cover). 1¼" (Carter), 1" (Stromberg) dual, downdraft types. ***See separate articles in Carburetor Section for data.***
Idle Adjustment—With engine warm and running at slow idle speed (choke valve wide open, fast idle inoperative), set throttle stopscrew for 8 MPH idle speed. Adjust idle adjusting screw for each barrel (in succession) until engine fires smoothly (¼-1¼ turns open for each screw on Carter—turn screws in for leaner mixture). Readjust idle speed.
Accelerating Pump Setting—2 holes provided in pump arm (Carter), throttle lever (Stromberg) for pump link engagement. Set as follows:
Inner Hole (min. stroke)—Summer temperatures.
Outer Hole (max. stroke)—Winter temperatures.



Float Level (Carter)—3/16" from top of float to gasket seat on cover with needle valve seated (invert float chamber cover to check).

Float Level (Stromberg)—Fuel level 5/8" below top edge of bowl (level sight plug on engine side of carburetor—check with engine idling).

Fast Idle (Carter):—Integral (built-in carburetor). *See article in Carburetion Equipment Section.*

Fast Idle Setting—Adjust fast idle screw for .018" throttle opening with choke valve fully closed.

Fast Idle (Stromberg):—Stromberg AAO-161 carburetor type. *See article in Carburetion Equipm't Section.*

Fast Idle Setting—No adjustment provided.

Automatic Choke (Carter):—Carter Climatic Control. *See article in Carburetion Equipment Section.*

Setting—Set coil housing one Notch Rich.

Automatic Choke (Stromberg):—Stromberg AAO-161 carburetor type. *See Carburetion Equip. Sec. article.*

Setting—Mark 'R' on thermostatic spring case should line up with projection on housing (ordinary fuel). If this setting too rich, rotate case to 'M' mark (leaner setting). Use 'H' setting for high test fuels.

Air Cleaner:—AC #1529440 oil-wetted type Std. Heavy duty oil-bath type optl. Oil filler cap equipped with copper mesh cleaner.

Fuel Pump:—AC Type E #1523926 diaphragm type. *See article in Carburetion Equipment Section.*

Gasoline Gauge:—Stewart (Stewart-Warner) Electric Stewart-Warner No. G-102158. *See article in Carburetion Equipment Section.*

MANIFOLD HEAT CONTROL:—Thermostatic coil type. To check valve, unlatch thermostatic coil (free outer end from bracket on manifold), operate valve by hand and see that shaft is free (shaft can be cleaned with emery if necessary). Make certain that thermostatic coil is properly latched to bracket and that tension spring (from shaft to clip on flange) is in place.

VALVE TIMING:—#1 intake valve opens 15° (.0915") BTDC. with .020" tappet clearance ("IN.OP/1-8" mark on vibration dampener in line with pointer).

Tappet Clearance—.016" (cold) all valves.

Valve Spring Pressure—54-60 lbs. at 2 3/32" (valve closed), 125-135 lbs. at 1¾" (valve open).

LUBRICATION:—Crankcase Capacity—8 quarts.

Normal Oil Pressure—60 lbs. at 25-30 MPH.

COOLING SYSTEM:—Capacity—17 quarts.

Thermostat—Bishop & Babcock or Fulton. In cylinder head outlet. Starts to open 156-160° F.

Temperature Gauge—Stewart (Stewart-Warner). No. G-102072.

TRANSMISSION OVERDRIVE CONTROL:—Electric type with accelerator pedal 'kick-down' switch. *See article in Mechanical Equipment Section for data.*

Overdrive Solenoid—Delco-Remy Model 1118001.

Throttle Switch—Cole-Hersee No. 1687S. Adjust so that end of accelerator rod just contacts switch plunger with throttle valve wide open.

Control Relay—Auto-Lite HR-4201S. 14 ampere fuse mounted in holder on relay.

BATTERY:—Willard Type SW-1-95. 6 volt, 15 plate, 95 A. H. capacity (20 hour rate).

Starting Capacity—117 amperes for 20 minutes.

Zero Capacity—300 amperes for 3.1 minutes. Five second voltage 4.2 volts.

Grounded Terminal—Positive (+) grounded to frame. **Engine Ground**—Separate ground strap.

Dimensions—Length 9". Width 7". Height 8 13/16".

Location—In engine compartment on left side.

STARTER:—Model No. 1107903. Armature No. 820158.
Drive—Solenoid pinion shift & overrunning clutch.
Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—24-28 ozs. each.
Cranking Engine—110 RPM., 150-200 amperes, 5-5.5 volts.

Performance Data

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	6000	5.0	60
16 "	Lock	3.0	600

Removal:—Flange mounted on left front face of flywheel housing. To remove, take out flange mounting screws (remove starter and solenoid switch as an assembly).

Starting Switch:—Solenoid Switch Type 1546. Mounted on starter and controlled through relay (in switch case by pushbutton switch Douglas #5700 on instrument panel. *See article in Electrical Equipment Section.*

GENERATOR:—Delco-Remy Model 1102671. Two-brush (shunt) type with voltage-current regulation.
Charging Rate Adjustment—No adjustment at generator. Charging rate controlled by Voltage Regulator and maximum output by Current Regulator. *See Regulator data following.*
Maximum Charging Rate—33-35 amperes (hot or cold), 8.0 volts, 1850 gen. RPM or 22 MPH and above with load or discharged battery (Current Regulator setting). Actual charging rate controlled by Voltage Regulator and dependent on battery condition.

Performance Data

	Amperes	Volts	R.P.M.
Cold	30*	8.0	1700

*—Not maximum output—See Current Regulator.

Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—25 ounces each.
Field Current—1.76-1.88 amperes at 6.0 volts.

Removal:—Pivot mounted at left front of engine. To remove, take out pivot and clamp bolts.

Belt Adjustment:—Swing generator out until fan can just be turned with belt held stationary.

REGULATOR:—Model 1118202. 'Single Core' type. Vibrating Voltage & Current regulator on dash.
CAUTION—Check generator for grounded fields before changing regulator settings. *See article in Electrical Equipment Section for data.*

Cutout Relay

Cuts In—6.2-6.7 volts (hot), 750 RPM., 8.9 MPH.
Cuts Out—0-4.0 amperes discharge current.
Contact Gap—.020" (same for both sets).
Air Gap—.020" (with points just closed).

Voltage Regulator

Setting—7.4-7.8 volts (70° F.), 7.2-7.4 volts (hot). Regulator over-compensated for temperature.
To Check—Connect ammeter in charging line at 'BAT' regulator terminal, voltmeter between 'BAT' terminal and ground. Operate generator at 3000 RPM, adjust charging rate to 8-10 amperes (use variable rheostat or 'AVR' set). With regulator at hot operating temperature, retard generator speed until cut-out relay points open, then increase generator speed to 3000 RPM and check hot voltage setting (above).
To Adjust—Change regulator armature spring tension slightly by bending lower spring hanger for **light (left) spring (or one spring if both alike) only.** If further adjustment required see Single Core Regulator article in Electrical Equipment Section for Heavy (or Other) Spring adjustment.
Air Gap—.070" between center of core and armature with contacts just closed.

Current Regulator

Setting—32-34 amperes (hot).
To Check—Remove cover, connect short jumper from voltage regulator frame to upper contact support bracket (shorting out Voltage Regulator). Connect ammeter in charging line at 'BAT' regulator terminal. Turn on lights and accessories, operate generator and increase speed until output remains stationary (run until hot). Check setting with regulator at operating temperature.
To Adjust—Change regulator armature spring tension slightly by bending lower spring hanger for **one spring.** If further adjustment required see Single Core Regulator article in Electrical Equipment Section for adjustment of other spring.
Air Gap—.075" (check same as Voltage Regulator).

LIGHTING:—Headlamps—Own 'Sealed Beam' type. *See article in Electrical Equipment Section for data.*
Headlamp Adjustment—Aim upper beam for each lamp straight ahead with center of hot spot 3" below lamp center height.
Beam Indicator—Red light on speedometer face. Lighted whenever Country (upper) beam in use.

Switches

Lighting—Douglas Model 5704.
Beam Selector—Delco-Remy 1997002.
Instrument—Douglas Model 7290.

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps		Sealed Beam
Parking, Instr., Trunk	1½	55
Beam Indicator	1	51
Stop & Tail	21-3	1158
Rear License	3	63
Dome	15	87

FUSES:—Lighting—Three 20 ampere. On fuse block on back of instrument panel at center. Protects circuits as follows: **Top**—Clock, Dome, Stop, Instrument Lamps and Windshield Wiper. **Center**—Head and Tail lamps. **Lower**—Accessories.
Transmission Control—14 ampere. On relay.
Windshield Wiper—No separate fuse (protected by accessory fuse on fuse block).

HORNS:—Delco-Remy. Model 1999511 (low note), 1999512 (high note). Electric type, air tone operated by relay.

Type	Current (at 6 volts)	Air Gap
1999511 (low note)	19-21 amperes	.044-.049"
1999512 (high note)	18-20 amperes	.034-.039"

Horn Relay:—Delco-Remy Model 1116756.
Contact Gap—.020". **Air Gap**—.015" (closed).
Contacts Close—2.75-4.0 volts.

WINDSHIELD WIPER:—Auto-Lite Model EBW-4002. Electric type. NOTE—No separate fuse used. *See article in Mechanical Equipment Section for data.*

PANEL DELIVERY NOTE:—Before Engine No. 35129, Engine used was similar to Model 48 and specifications listed below as 'First' apply. After Engine No. 35129, Model 440 Engine was used (same as Pick-up Model) and specifications marked 'Later' apply.

SERIAL NUMBER:—First No. 440-17001 (all models). Stamped on plate on frame front cross-member (all models), and on right side of cowl under hood (Pass. cars & Pick-up), or on right front door riser (Panel Delivery).

ENGINE NUMBER:—First No. 17001. Stamped on right front upper corner of engine block.

COMPRESSION:—**Note**—All heads are Cast Iron except 7.0-1 H.C. Pass. Car head which is Aluminum.

Model	Ratio	Pressure (Crk. Speed)
Pass. Cars Std.	6.48-1	111 lbs., 185 RPM.
Pass Cars High Alt.	6.81-1	111 lbs., 185 RPM.
Pass. Cars Optl. H.C.	7.0-1	111 lbs., 185 RPM.
Pick-up&Panel (later)	6.1-1	107 lbs., 185 RPM.
Panel Dlvry. (first)	5.7-1	87 lbs., 216 RPM.

VACUUM READING:—Steady 21-23" at 8 MPH. idling speed. NOTE—18½" on First Panel Delivery (5.7-1 Ratio).

IGNITION:—**Coil Model IG-4090A.** Mounted on right side of engine block near distributor. Service Coil No. IG-4070.
Ignition Current—2.5 amperes idling, 4 stopped.
Ignition Switch:—Douglas. Coil connection not armored.
Ignition Lock—Douglas #2975.
Distributor Auto-Lite IGW-4129 (Pass. Car, Pick-up & Later Panel Delivery), IGW-4129A (First Panel Delivery). Full automatic advance type with auxiliary Vacuum Spark Control (VC-4010).
Breaker Gap—.020".
Cam Angle or Dwell—41° closed, 49° open (distr.).
Breaker Arm Spring Tension—17-20 ounces.
Rotation—Counter-clockwise viewed from above.
Condenser—No. IGB-1025. Capacity .20-.25 mfd.

Automatic Advance—IGW-4129

Distributor Degrees	R.P.M.	Engine Degrees	R.P.M.
Start	300	0	600
2	550	4	1100
5	930	10	1860
7	1190	14	2380
9.5	1500	19	3000

Automatic Advance—IGW-4129A

Start	300	0	600
4	400	8	800
7	790	14	1580
11	1310	22	2620
14	1700	28	3400

Vacuum Spark Control—Type VC-4010. Mounted on distributor bracket and linked to advance arm. Provides additional advance at all speeds above idling except when engine accelerated or operated with wide open throttle when spark retarded by return spring within unit.

Vacuum Advance

Distr. Degrees	Eng. Degrees	Vacuum (" of HG)
Start	0°	3½"
2°	4°	5¾"
5°	10°	9¼"
8°	16°	12¾"
10°	20°	15"

Distributor Removal:—Mounted on right side of engine. To remove (without disturbing vacuum unit), loosen advance arm clamp bolt.

Note—If oil pump removed, turn crankshaft so that #1 piston on compression and flywheel mark 'TC-IGN' at indicator on housing, turn distributor shaft so that rotor at #1 terminal in cap, install oil pump and mesh gears so that shaft engages distributor tongue-and-slot coupling without disturbing distributor shaft position. Check ignition timing.

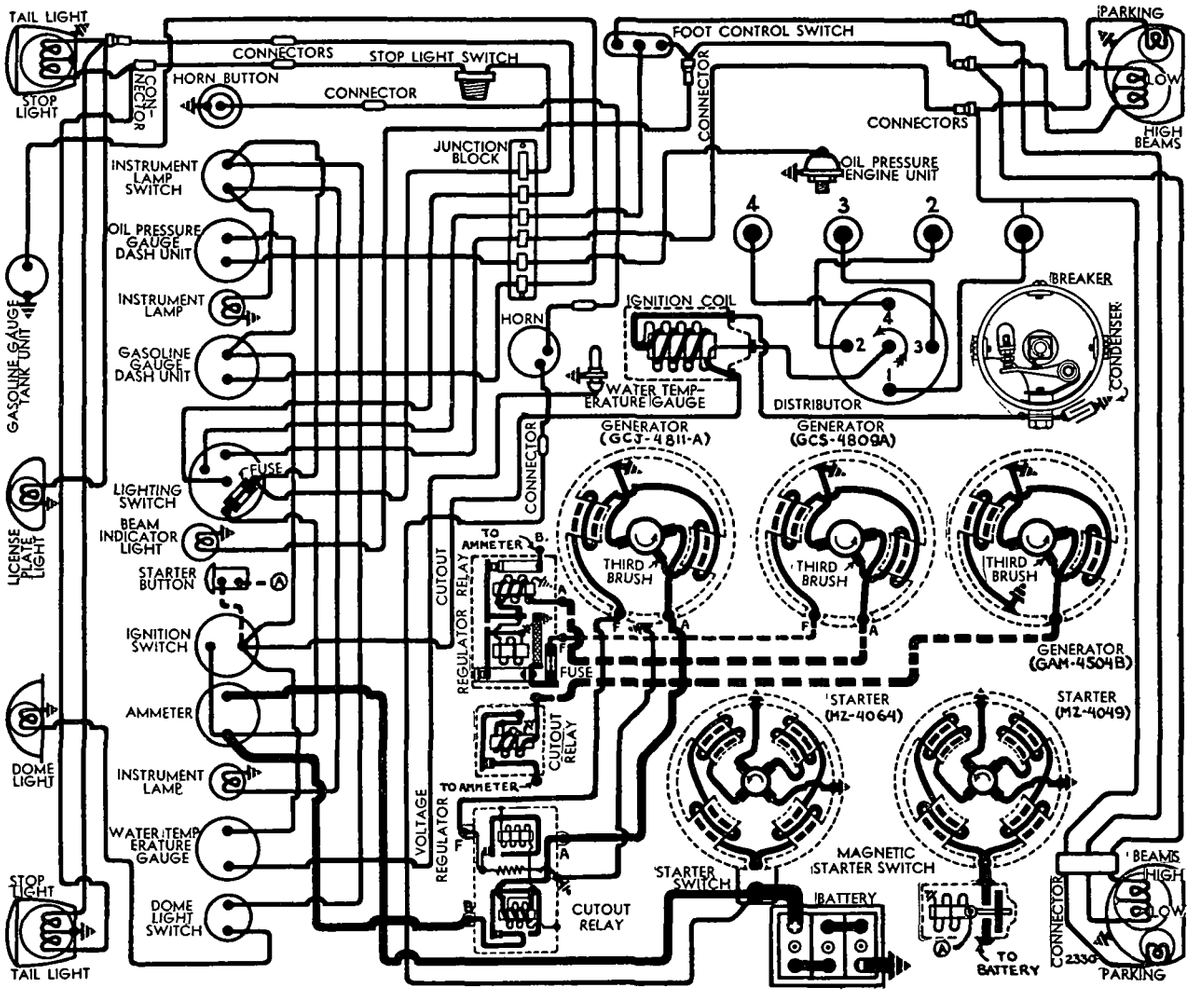
IGNITION TIMING:—

	Flywheel Deg.	Piston Pos.
Pass. Cars (All heads)	At TDC	.0000" TDC
Pick-up & Panel (later)	4° BTDC	.0066" BTDC
Panel Dlvry. (first 5.7-1)	5° ATDC	.0103" ATDC

Timing—With #1 piston on compression, turn engine over until piston reaches firing position (see above) with flywheel mark 'TC-IGN' or 'IGN' centered in inspection hole in front face of engine right rear support. Loosen advance arm clamp bolt, rotate distributor until contacts begin to open (eliminate backlash in drive gears by pressing on rotor in clockwise direction), tighten clamp bolt, see that rotor is at #1 terminal in distributor cap. NOTE—Ignition mark on First Panel Delivery on top left of housing.

Firing Order:—1-3-4-2. See diagram.
Spark Plugs:—Champion Type J8, 14 MM. Metric (Except First Panel Delivery), Type C7, 18 MM. Metric (First Panel Delivery).
Spark Plug Gaps—.030".

CARBURETION:—**Carburetor**—Carter Model WO Type 450-S (Pass. Cars), Tillotson Model U-1B (Pick-up & Panel Delivery). 1⅛" downdraft type.
See articles in Carburetor Section for data.
Idle Adjustment—If preliminary adjustment required (to warm up engine), turn idle adjusting screw in until just seated, then turn screw out 1¼ turns (Carter), ¾ turn (Tillotson); start engine and run until warm. With engine warm, set throttle stopscrew for slightly faster than normal idling speed, turn idle adjusting screw out until engine begins to roll, then turn screw in until engine fires smoothly. Recheck adjustment and set throttle stopscrew for 8 MPH idle speed pulling in high gear.
Float Level (Carter)—⅜" from top of float (free end) to gasket seat on cover with needle valve seated (invert to check—do not compress spring in valve stem).



Float Level (Tillotson)—Fuel level 13/16" below top edge (gasket seat) of bowl with engine running.

Air Cleaner:—AC #1529478 oil-wetted type Std. Heavy duty oil-bath type optional.

Fuel Pump:—AC Type AF #1523306. Diaphragm type. *See article in Carburetion Equipment Section.*

Gasoline Gauge:—King-Seeley Electric. K-S Nos. 7855—first, 8112—later (Dash Unit), No. 7695 (Tank Unit). **Note**—Dials on first dash units have ivory lines, later units have ivory dots. *See article in Carburetion Equipment Section.*

MANIFOLD HEAT CONTROL:—Automatic thermostatic type (no adjustment) on Pass. Cars, Pick-up & Later Panel Delivery. NOTE—On first Panel Delivery, manual type with seasonal adjustment used. See Willys 48 (1939) T&E page for adjustment instructions.

VALVE TIMING:—To Check (Pass. Cars, Pick-up & Later Panel Delivery)—Set tappet clearance #1 intake valve at .020". This valve should open with piston 9° or .039" before top dead center when flywheel mark 'I.O' centered in inspection hole in front face of right rear motor support (¼" variation permissible). Reset tappet clearance at .014" cold.

First Panel Delivery—With .010" tappet clearance, #1 intake valve opens with piston on top dead center and flywheel mark 'I.O-T.C.' at indicator (inspection hole in left top of housing). Reset tappet clearance at .004" warm.

Tappet Clearance:—.014" all valves—engine cold (except First Panel Delivery), .004" Int., .006" Exh. Warm (First Panel Delivery).

Valve Spring Pressure—46 lbs. at 2¼" (valve closed), 85½ lbs. at 1 15/16" (valve open). Spring free length 2 11/16".

LUBRICATION:—Crankcase Capacity—4 quarts.

Normal Oil Pressure—75 lbs. (gauge) at 30 MPH.

Oil Pressure Gauge:—King-Seeley Electric. K-S Nos. 7860—first, 8115—later (Dash Units); No. 6425 (Engine Unit). **Note**—Dial on first dash unit has ivory lines, later unit has ivory dots. *See article in Mechanical Equipment Section for data.*

COOLING SYSTEM:—Capacity—11¾ qts. (except First Panel Delivery), 11 qts. (First Panel Delivery).

Thermostat—Harrison. In outlet elbow on cylinder head. Starts to open 148-155°. Fully open at 173° F. NOTE—Thermostat not used on First Pick-up & Panel Delivery.

Temperature Gauge:—King-Seeley Electric. K-S Nos. 7850—first, 8110—later (Dash Units); No. 7000 (Engine Unit). **Note**—Dial on first dash unit has ivory lines, later unit has ivory dots. *See article in Mechanical Equipment Section for data.*

BATTERY:—National Type HT-13. 6 volt, 13 plate, 77 ampere hour capacity (20 hour rate).
NOTE—When USL battery used, specifications same as for 1939 models (Type A-13).

Starting Capacity—90 amperes for 20 minutes.

Zero Capacity—300 amperes for 1.7 minutes.

Grounded Terminal—Negative (—) grounded to front frame cross-member. **Engine Ground**—Strap connector at front engine mounting on left side.

Location—On right side in engine compartment.

Dimensions—Length 9". Width 7". Hgt. 8 9/16".

(Pick-up Battery) Auto-Lite Type AB-13. 6 volt, 13 plate, 80 AH. Capacity (20 hour rate).

Starting Capacity—96 amperes for 20 minutes.

Zero Capacity—300 amperes for 2.0 minutes.

Dimensions—Length 9". Width 7". Hgt. 8⅝".

Grounded Terminal & Location—See above.

STARTER:—Auto-Lite MZ-4064 (Pass. Car & Pick-up), MZ-4049 (Panel Delivery). Armature MZ-2089.

Drive—Special Outboard Bendix #RC10HD.

Rotation—Counter-clockwise at commutator end.

Brush Spring Tension—42-53 ozs. (new brushes).

Cranking Engine—185 RPM, 150-175 amperes, 5 volts (Pass. Car & Pick-up), 216 RPM. 135-150 amperes, 5.35 volts (Panel Delivery).

Performance Data

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	4300	5.5	70
.65 " "	2500	5.5	100
2.65 " "	1325	5.0	200
4.95 " "	750	4.5	300
7.65 " "	220	4.0	400
7.8 " "	Lock	3.0	420
11.8 " "	Lock	4.0	560

Removal:—Starter flange mounted on right front face of rear motor support. To remove, take out two flange capscrews and one capscrew in bracket at commutator end, remove starter and switch as an assembly.

Starting Switch (MZ-4064):—Type SW-3737S. Mounted on starter, cable operated by button on instrument panel. Pull required to close switch should be 2.3 lbs. min. (at right angles to hole at end of lever).
(MZ-4049)—Type SS-4001. Magnetic switch mounted on starter, controlled by pushbutton on instrument panel. *See article in Electrical Equipm't Section.*

GENERATOR (PASS. CARS):—Auto-Lite GCJ-4811-A. Armature GCJ-2006-F. Third brush control in conjunction with vibrating type voltage regulator. Ventilated by fan on drive pulley.

Maximum Charging Rate—25 amperes (cold), 8.0 volts, 2500 RPM. Actual charging rate controlled by voltage regulator and dependent on battery condition. See Regulator data below. When checking generator output, ground 'F' terminal to eliminate regulator action.

Charging Rate Adjustment—See Regulator data. Third brush setting 2 commutator bars minus 2 mica strips minimum, 2 bars minus 1 mica strip maximum for insulated (nearest) main brush. Setting adjustable by removing commutator cover band and moving third brush by hand counterclockwise to increase, clockwise to decrease output. Maximum output given above must not be exceeded.

Performance Data

Cold			Hot		
Amperes	Volts	R.P.M.	Amperes	Volts	R.P.M.
0	6.4	760	0	6.4	850
4	6.65	920	4	6.7	1020
8	6.9	1080	8	7.0	1240
12	7.2	1240	12	7.3	1400
16	7.45	1400	16	7.6	1650
20	7.7	1580	20	7.9	2100
25	8.0	2500	22	8.0	2700

Rotation—Counter-clockwise at commutator end.

Brush Spring Tension—53 ozs. max. (new brushes).

Field Current—1.9-2.1 amperes at 6.0 volts.

Motoring Current—4.0-4.4 amperes at 6.0 volts.

Removal:—Conventional pivot mounting at right front of engine. To remove, take out pivot and clamp bolts.

Belt Adjustment:—Loosen pivot and clamp bolts, swing generator out until fan can be turned with belt stationary.

GENERATOR (STD. PICK-UP & PANEL DLVRY.):—Auto-Lite GAM-4504-B. Armature GAM-2055. Third brush control.

Maximum Charging Rate—16.5 amperes (cold), 8.0 volts, 1950 RPM.

Charging Rate Adjustment—Remove commutator cover band, shift third brush by hand counterclockwise to increase, clockwise to decrease output. Brush held in position by friction.

Performance Data

Cold			Hot		
Amperes	Volts	R.P.M.	Amperes	Volts	R.P.M.
0	6.4	720	0	6.4	720
4	6.8	880	4	6.9	900
8	7.2	1050	8	7.4	1160
12	7.6	1280	12	7.95	1700
16.5	8.0	1950	12.5	8.0	2000

Rotation—Counter-clockwise at commutator end.

Brush Spring Tension—18-22 ozs. (all brushes).

Field Current—3.89-4.31 amperes at 6.0 volts.

Motoring Current—4.08-4.52 amperes at 6.0 volts.

Removal & Belt Adjustment:—Same as above.

GENERATOR (SPEC. PICK-UP & PANEL DLVRY.):—Auto-Lite GCS-4809-A. Armature GCS-2049F. Third brush control in conjuction with non-vibrating type two-charge (Current) regulator. Ventilated by fan on pulley.

Maximum Charging Rate—20 amperes (cold), 8.0 volts, 2000 RPM. Use test meters to check output, connect jumper between fuse cup on regulator and ground (to eliminate regulator action). Remove jumper after completing test. See Regulator data.

Charging Rate Adjustment—Remove commutator cover band, shift third brush by hand counterclockwise to increase, clockwise to decrease output. Do not exceed rated maximum (secured with third brush 1⅔ commutator bars maximum, 1⅔ bars minus 1 mica strip minimum, from nearest (insulated) main brush).

Performance Data

Cold			Hot		
Amperes	Volts	R.P.M.	Amperes	Volts	R.P.M.
0	6.4	500	0	6.4	550
4	6.75	620	4	6.8	700
8	7.1	750	8	7.2	915
12	7.4	925	12	7.6	1200
16	7.7	1200	16.5	8.0	2150
20	8.0	2000			

Rotation—Counter-clockwise at commutator end.

Brush Spring Tension—53 ozs. max. (new brushes).

Field Current—3.56-3.94 amperes at 6.0 volts.

Field Fuse—5 ampere (in knurled cup on regulator).

Motoring Current—4.99-5.51 amperes at 6.0 volts.

Removal & Belt Adjustment:—Same as above.

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REGULATOR (GCJ-4811A GEN.):—Model VRR-4004A. Vibrating type voltage regulator (with Cutout Relay) in case.

NOTE—Regulator cover is sealed. Serviced on exchange basis if seals not broken.

See article in Electrical Equipment Section for data.

Cutout Relay

Cuts In—6.4-7.0 volts.

Cuts Out—6 amperes discharge (maximum).

Contact Gap—.015" minimum.

Air Gap—.034-.038" (hinge end of core with contacts open).

Voltage Regulator

Setting—7.3-7.6 volts at 70°F.

To Check (without breaking seal)—Connect ammeter in charging line at regulator 'BAT' terminal, voltmeter between this terminal and ground. Operate generator at speed of 30 MPH. charging battery until voltage is constant. Voltmeter reading should be within limits of 7.3-7.6 volts (Cold—70°), 7.19-7.49 volts (Hot—110°). See article in Electrical Equipment Section for voltages at other temperatures.

To Adjust (with cover removed)—Change regulator armature spring tension by bending lower spring hanger slightly. See Electrical Equipment Section.

Contact Gap—.012" min. (armature against stop).

Air Gap—.048-.052" with contacts just opening.

CUTOUT RELAY (GAM-4504B GEN.):—Model CB-4025. ***See article in Electrical Equipment Section for data.***

Cuts In—6.5-7.25 volts.

Cuts Out—.5-2.5 ampere discharge current (after charging at 15 amperes).

Contact Gap—.015-.045".

Air Gap—.010-.030" with contacts closed.

REGULATOR (GCS-4809A GEN.):—Model TC-4317A. Two-charge non-vibrating current regulator (in case with Cutout Relay). ***See article in Electrical Equipment Section.***

Cutout Relay

Cuts In—6.5-7.25 volts.

Cuts Out—.5-2.5 ampere discharge current.

Contact Gap—.015-.045".

Air Gap—.010-.030" with contacts closed.

Regulator

Contact Opening Voltage—8.25-8.75 volts at 70°F. NOTE—Unit over-compensated for temperature. ***See Electrical Equipment Section for complete data.***

Contact Closing Voltage—1.2-1.4 volts below opening voltage at same temperature.

Contact Gap—.005" minimum.

Air Gap—.044-.046" with contacts closed.

LIGHTING:—Headlamps—Corcoran-Brown pre-focused double filament type with upper and lower beams controlled by Beam Selector Switch on toeboard.

Headlamp Adjustment—With upper beam lighted and car 25' from screen, aim each headlamp so that beams centered on vertical line directly ahead of lamp center, and upper edge at horizontal line at lamp-center height, with lamp door and lens in place. To adjust, remove door and lens, turn 3 adjusting screws on reflector rim.

Beam Indicator—Red jewel in upper edge of speedometer dial. Lighted when upper beams in use.

Switches

Lighting—Douglas. **Beam Selector**—Douglas.
Instrument—Douglas.
Stop Light—A-L. #100640A (hydraulic type).

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps	32-21	2320
Parking	1.5	55
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Generator Field—5 ampere (in knurled cup on regulator). Used on GCS-4809A generator only.

HORNS:—Schwarze. Vibrating, disc type.
Horn Current—10 amperes.

ELECTRICAL EQUIPMENT SECTION

'EE' PAGES

The ELECTRICAL EQUIPMENT SECTION contains the *Complete Separate Treatment* of the Performance, Adjustment, Trouble Shooting and Circuit Diagrams of the SPECIAL ELECTRICAL EQUIPMENT that has been adapted for the modern Automobile.

Often SPECIAL EQUIPMENT is found on cars which was *Not Factory Installed*. Such Equipment is *fully covered* in this section so that no trouble will be experienced in Service Work.

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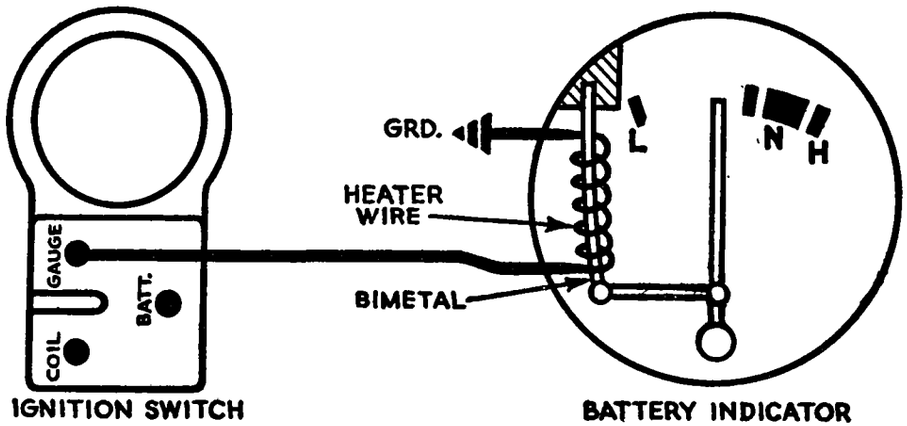
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96H-10844 —LINCOLN-ZEPHYR, MODEL 96H (1939)

DESCRIPTION:—This gauge is a 'hot wire' type voltmeter calibrated to show battery voltage ranges rather than actual volts. It consists of a simple bimetal arm linked to the gauge pointer and wound with a heater wire. The heater wire circuit is controlled by the ignition switch.

OPERATION:—When the ignition switch is turned on, a current flows through the heater wire on the bimetal arm (approximately 1/10 ampere—heater wire resistance is 60 ohms), heating the arm and causing it to bend so that a reading is indicated on the gauge. This gauge reading indicates the line voltage (battery voltage when generator not charging, generator voltage when charging) since the current in the heater wire, and consequent deflection of the bimetal arm, is directly proportional to the voltage at the gauge terminal.

READING THE GAUGE:—See illustration for gauge dial markings. This marking should be interpreted as follows: **Left hand Line Marked 'L'**—2 volts. **Unmarked line to left of 'N' range**—6 volts. If pointer drops below this mark, battery, starter, wiring, and generator should be checked (Performance Test). If pointer is above this 6 volt mark, but below the 'N' range, battery load is greater than generator charging rate and electrical system and generator should be checked. **'N' Range**—This segment indicates the normal line voltage range from 6.75 volts (left hand end) to 8.25 volts (right hand end) and indicates that generator charging rate is in excess of the load. **Right Hand Line Marked 'H'**—9 volts. This voltage is too high and unsafe for lamp bulbs and wiring. Check wiring and generator and correct conditions causing this high voltage.

TESTING & SERVICING:—To check gauge accuracy, connect test voltmeter in parallel with Battery Indicator (connect one test voltmeter lead to battery indicator terminal, ground other voltmeter lead), turn on ignition switch and note if both gauge readings agree (see 'Reading the Gauge' section above for meaning of battery indicator dial markings). Replace defective units.



HUDSON SIGNAL LIGHTS

DESCRIPTION:—These signal lights consist of a Battery Charge Tell-tale and Oil Pressure Tell-tale on the instrument panel which are used instead of gauges to indicate when generator is charging battery and if oil pressure is satisfactory. They are regular lamp bulbs connected to the accessory terminal of the ignition switch (operative only with ignition switch turned 'on') and are controlled by the generator cutout relay and oil line check-valve as described below.

GENERATOR CHARGE TELL-TALE:—The cutout relay is provided with an extra set of ground contacts above the armature and the tell-tale lamp lead is connected to this contact terminal on the relay case. The lamp circuit is completed to ground through these contacts (on some types a resistance is connected between the contacts and ground to protect the contacts and contact spring from damage due to excessive current flow in case the two terminals on the relay case are shorted as this would throw the entire battery voltage across the contacts).

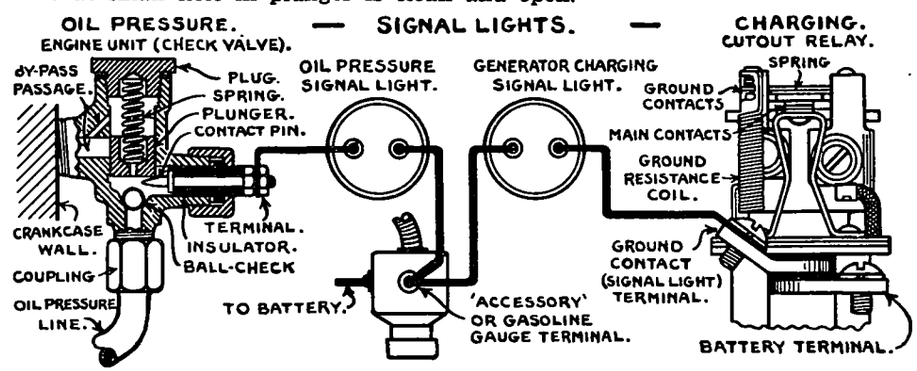
Operation:—The ground contacts are normally closed with the main contacts open and open when the main contacts close. When the ignition is turned on, the tell-tale lamp lights and remains lighted until the main contacts close and the generator begins to charge the battery. The lamp should not remain lighted after the car speed is brought up beyond the cut-in point (8-10 M.P.H.).

Trouble Shooting:—If the tell-tale lamp does not light when ignition is turned on, ground tell-lamp lead terminal on relay case. If lamp does not light, replace bulb. If lamp lights, examine ground contacts and see that they are closed. Check contact mounting spring. If tell-tale lamp does not go out at speeds above cut-in point, examine ground contacts and see that they open when main contacts close. See separate article on Auto-Lite Cut-out Relays. Check generator performance by connecting accurate test ammeter in charging circuit.

OIL PRESSURE TELL-TALE:—The oil line check valve on the right side of the crankcase is provided with an insulated terminal pin which is grounded by the check-valve plunger when no pressure exists in the oil line. The oil pressure tell-tale lamp lead is connected to this terminal. A small hole in the check-valve plunger and a by-pass in the body allow the passage of sufficient oil so that the plunger alternately opens and closes the circuit at idling speeds, causing the tell-tale lamp to flash.

Operation:—The plunger rests normally against the pin when no pressure exists in the oil line so that the tell-tale lamp will light when the ignition is turned on. At idling speeds the plunger alternately opens and closes the circuit so that tell-tale lamp flashes. At speeds above idling (approximately 7 M.P.H.), the oil pressure holds the check-valve plunger off its seat so that the tell-tale lamp does not burn or flash.

Trouble Shooting:—If the tell-tale lamp does not light when the ignition is turned on, ground check-valve terminal to engine. If lamp does not light, replace bulb. If lamp does light, remove terminal pin and see that it is straight and clean. Take off plug on top of check-valve housing, remove plunger and see that it is clean and moves freely up and down. Examine spring above plunger. If tell-tale lamp does not flash at idling speeds, see that small hole in plunger is clean and open.



FINGER TIP CONTROL

DESCRIPTION:—The Pines Type 'Finger Tip Control' consists of a starting switch, lighting switch, and horn button combined in a single unit which is designed to be mounted at the lower end of the steering column and controlled by a button on the steering wheel. The starting switch is operated by lifting the button slightly, the horn circuit is closed by depressing the button, and the various lighting circuits are completed by rotating the button. There is no electrical connection between the starting switch unit and the lighting and horn control unit, which permits an ammeter to be placed in circuit to show the discharge current. The two terminals on the side of the unit are the starting switch terminals and one terminal should be connected to the car battery. The lead for the generating and lighting circuits should be taken from this terminal. The other starting switch terminal should be connected directly to the starting motor. The six lighting switch terminals are grouped on the front of the switch. These terminals should be connected as follows (left to right facing the bottom of the switch):

1. Headlight (High Beam—lower filament).
2. Lead—Connect to ammeter through fuse or circuit breaker.
3. Tail—Tail light. On some cars, the dash light is taken off also.
4. Park—Parking bulbs, fender lights or side lights.
5. Horn—This is the horn feed lead. The other horn terminal is grounded.
6. Headlight (Low or depressed beam—upper filament).

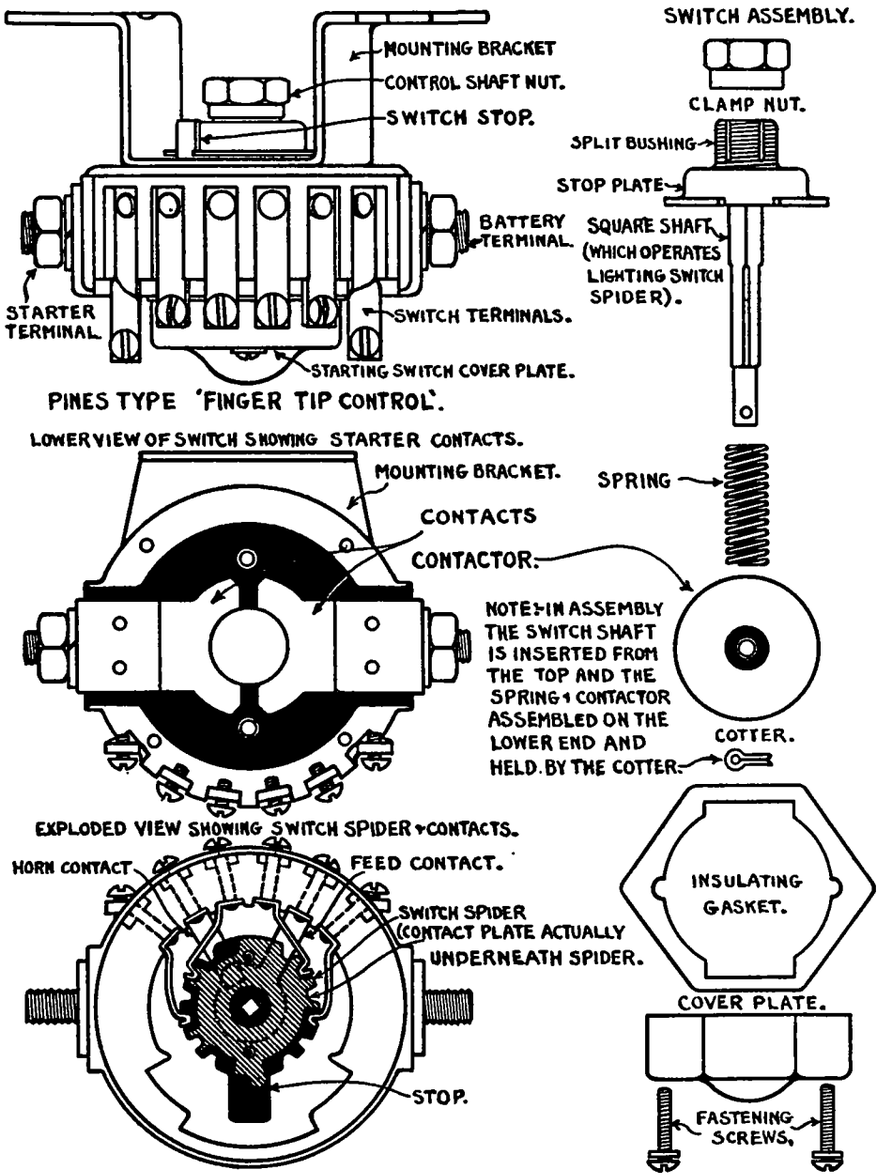
The lighting switch terminals terminate in switch fingers within the switch housing (see exploded view of switch). These switch fingers rest on the notched edge of the switch spider which carries a contact plate on its lower surface. This contact plate bears against the circular plate connected to the 'Lead' terminal and is kept in contact with it by a spring under the plate. The horn terminal contact is directly under this contact plate and they are brought together whenever the control shaft is pushed downward.

The switch control shaft extends through the switch housing to the starting switch housing on the lower end of the switch. The starting switch terminals terminate in two semi-circular copper contacts. A circular contactor is mounted on the lower end of the control shaft below these contacts and is normally separated from them by a spring on the control shaft above the contactor. When the control button is lifted up, this spring is compressed by the upward movement of the control shaft and the contactor completes the circuit between the two starting switch contacts. The contactor is insulated from the control shaft.

MOUNTING:—The switch is fitted with a universal mounting bracket so that it can be mounted on the steering column or on the chassis frame at the lower end of the column. The control shaft upper end is fitted with a slotted bushing and lock nut and grips the control tube in the steering column when the lock nut is tightened. To remove the switch, first disconnect battery cable and tape to prevent short-circuits. Then disconnect starter cable and all lighting lines. Loosen the lock nut on the upper end of the control shaft. Then take out bolts or screws in mounting bracket. The switch can be removed by pulling it straight downward until the control tube slips out of the control shaft bushing.

SERVICING:—The starting switch contacts can be examined by taking off the lower cover plate. To remove cover plate, take out the two screws and lift off the plate and insulating gasket. The contactor on the control shaft can be removed by taking out the cotter pin in the lower end of the shaft. The spring, which will come off with the contactor, must be replaced when the switch is reassembled. If the control shaft is removed, it must be replaced so that the slot in the stop plate is against the stop when the lug on the switch spider is against the stop on the switch body. To secure this result, insert the control shaft and turn the switch spider as far as possible in one direction. Then remove shaft and assemble so that the stop on the top of the switch body prevents the shaft from turning any further in that direction.

The cover plate over the lighting switch spider is riveted in place and it is not practical to attempt any repairs to the lighting switch unit. If tests through the lighting switch with a voltmeter or lamp and test points indicate that the lighting switch is defective, it should be replaced with a new unit.



BUICK TYPE

Std. Equipment On:

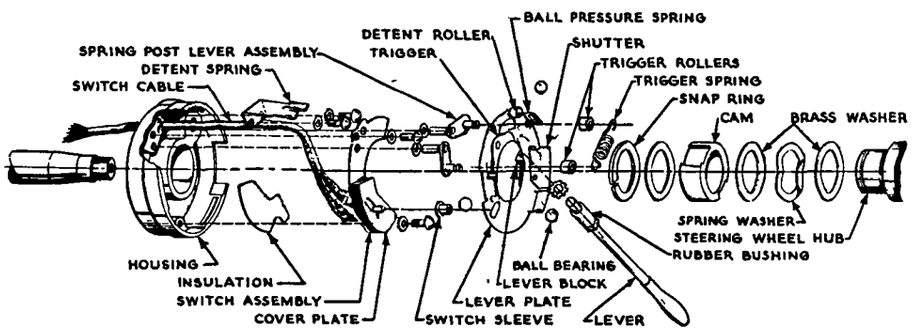
BUICK SERIES 40-40, 50, 60, 70, 80, 90 (1940)

DESCRIPTION:—Direction signals consist of a special 21 cp. filament combined with the parking lamp in the Front Fender Lamps (front of car), separate bulbs illuminating red arrows on trunk cover (rear of car), and pilot bulbs illuminating green arrows on instrument panel. Control switch is built in steering wheel housing with switch handle directly below steering wheel. Flasher unit is mounted in back of instrument panel.

Control Switch—Consists of a bakelite movable member supported on ball bearings, and a lever plate carrying the trigger release and operating handle which is also mounted on ball bearings. This plate is held in one of three positions—'Left', 'Off', 'Right'—by a roller which engages a detent spring in the switch housing. Switch cam is assembled on lower end of steering wheel hub within switch housing (retained by locking ring) with spring washer assembled between brass washers to form a friction clutch for the cam which prevents jamming or locking of the wheel in case of switch failure.

Wiring Diagram—See Buick wiring diagram on 'T&E' page for complete Direction Signal circuit wiring and fuse data.

OPERATION:—Switch is operated manually to indicate a turn, and is turned off automatically by the steering wheel movement when the turn is completed (switch can also be turned off manually if desired). If turn is made in opposite direction than that for which the switch has been set, switch is turned off automatically as the turn is begun. Switch handle should be moved in same direction as wheel is rotated for the intended turn (move handle up for left turn, down for right turn).



Control Switch—When switch is operated to indicate a turn, circuit is completed through flasher unit to right or left Front Signal Light, Rear Signal Light, and Pilot Light. If pilot light on instrument panel does not flash when switch operated, check all bulbs (pilot light will not flash if front or rear signal bulbs burned out). Operation of the switch also presses the spring-loaded pawl or trigger on the lever plate against the notched cam on the steering wheel hub. When the steering wheel is moved in the same direction to turn the car, the trigger ratchets over the notch in the cam, however when the wheel is turned in the opposite direction after the turn has been completed, the trigger engages the cam notch and the switch is carried around to the off position. The trigger is then released so that the switch is ready for further operation.

ADJUSTMENT:—Important Note—Steering wheel must be installed so that lower spoke points straight down with wheels in straight ahead position (see Saginaw Steering Gear article for servicing directions). Whenever steering wheel removed or installed, direction signal switch lever must be placed in 'off' position to prevent damage to switch assembly.

To Adjust Switch—With correct adjustment, automatic release will occur only when wheel returned to center position after being rotated at least one-third revolution. To adjust switch, set switch lever for Right Hand Turn, turn steering wheel to right until first click is heard or slight movement felt in switch lever after right hand spoke on steering wheel has passed lower center position. Hold switch lever down firmly and turn steering wheel back slowly until right hand spoke is approximately 2" past or to right of lower center position, release switch lever and return wheel to straight ahead position which will return switch to off position. This adjustment causes switch cam to shift on steering wheel hub by slipping the friction clutch. No further adjustment is required for left turn switch release (positioning cam for right turn release as above will automatically regulate left return release also).

SERVICING:—Disassembly—Make certain that switch lever set in 'off' position, remove steering wheel. Switch will then be accessible for inspection and servicing. To correct complaints of switch getting out of adjustment (adjustment changing in service), check tension of crimped steel spring washer assembled between two brass washers on steering wheel hub above switch cam). Pressure of 85-100 lbs. should be required to flatten washer to height of ⅛". Replace spring washer if pressure is less than this amount. See illustration for correct assembly of switch cam washers and other switch parts.

DIRECTION SIGNAL LAMPS & FUSE:—See Buick 'T&E' page for complete data.

CADILLAC TYPE

Optional Equipment On:

CADILLAC, V8 SERIES 40-60S, 62, 72, 75; V16 SERIES 40-90 (1940)

LA SALLE, V8 SERIES 40-50, 52 (1940)

IMPORTANT PRODUCTION CHANGE:—Rear Signal bulbs changed. Direction Signals will not operate if wrong type bulb installed. See Signal Lamp & Fuse section below for data.

DESCRIPTION:—Direction Signals consist of a special 21 cp. filament combined with the parking lamp in the front Fender Lamps (front of car), separate bulbs in Rear Lamp (at rear of car), and an indicator lamp on the control switch which flashes while the signal is in operation. Control switch is mounted on left hand side of steering column below steering wheel and flasher unit is mounted in back of instrument panel.

Wiring Diagram—See Cadillac and La Salle wiring diagrams on 'T&E' pages for complete Direction Signal wiring circuits, Lamp Bulb and Fuse data.

OPERATION:—Switch is operated manually and control lever should be pressed 'up' for Right Turn, 'down' for Left Turn. When switch operated, circuit is completed through flasher unit to right or left Front & Rear Signal Lights and pilot light on switch also flashes. If pilot light does not flash, check for burned out or incorrect type bulbs (see Rear Signal Lamp Caution below). Switch must be turned off manually after turn is completed and pilot bulb on switch serves as a warning that signals are operating.

DIRECTION SIGNAL LAMPS & FUSE:—See Cadillac & La Salle 'T&E' pages for data. **Important Rear Signal Lamp Caution**—Two types of bulbs have been used in Rear Signal Lamp as follows: **First Cars**—32 cp. single contact type bulb used in single contact type socket. **Later Cars**—21 cp. filament of a No. 1154 21-3 cp. bulb used in a double contact socket (3 cp. filament not used). CAUTION—Flasher will not operate if any other than correct type bulb used on each car (flasher units specially calibrated for each of the above lamp types and will not operate if bulbs interchanged).

HUDSON TYPE

Optional Equipment On:

MODELS 40T, 40P, 41, 43, 44, 45, 47, 48 (1940)

DESCRIPTION:—Direction Signals consist of a special 21 cp. filament combined with the parking lamp (double filament bulb) in the Bonnet Panel Lamps (front of car), and the Stop Lights at the rear of car (stop light switch is hooked up to Direction Signal Switch so that both stop lights operate in usual manner when brake applied, one lamp only flashes when direction signal switch operated to indicate a turn). The control switch is mounted on the steering column directly below the steering wheel and has three buttons—'L' left turn, 'off' center, 'R' right turn—and an indicator bulb under a jewel below the center button which flashes while the signals are operating.

Wiring Diagram—See Hudson wiring diagrams on 'T&E' pages for complete direction signal circuit wiring and fuse data.

OPERATION:—Control is operated manually and 'L' (left) or 'R' (right) button is pressed to indicate a turn. This completes circuit through flasher, and Front & Rear Signals and indicator bulb on switch flash until the center 'off' button of the switch is pressed which releases the operating button and turns the switch off. If indicator bulb does not flash when switch operated, check for burned out bulbs.

SERVICING:—Indicator Bulb Replacement—Switch cover retained by screws concealed under button on switch case. To remove cover, pull buttons off, remove screws located on flat terminals under buttons, lift switch cover off. Take out mounting screws in switch and lift switch out. Indicator bulb and switch can then be inspected and serviced.

DIRECTION SIGNAL LAMPS & FUSE:—See Hudson 'T&E' pages for data.

SEALED BEAM HEADLAMPS

REPLACEMENT NOTE:—Two types of Sealed Beam Lamp Units are available for replacement: (1) Composite Type with metal reflector and glass lens (has conventional lamp bulb assembled in unit) and (2) All Glass Type with hard glass reflector and lens (no lamp bulb used, filaments mounted directly on reflector). ***Both types and all makes are fully interchangeable on all 1940 car models with Sealed Beam Headlamps.***

DESCRIPTION:—Sealed Beam Headlamps, as used on 1940 car models, consist of a reflector, lens, and lamp filaments assembled as a single sealed unit. This excludes all dirt and moisture so that the original effciency of the lamp is retained throughout the life of the filaments. When replacement is required, the entire sealed beam unit is discarded and a new unit is installed. No attempt should be made to disassemble the sealed beam unit.

NOTE—Sealed Beam Headlamps used on all 1940 cars except Bantam, Crosley, Graham, Hupmobile, and Willys.

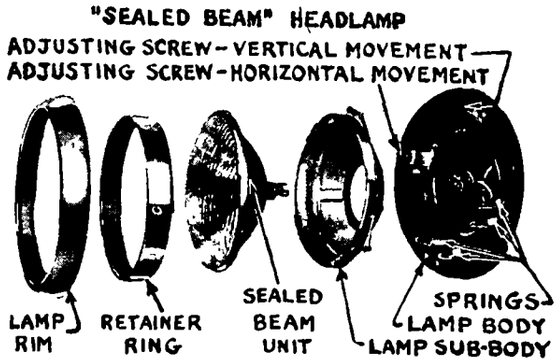
OPERATION:—Sealed Beam lamps have double "bar" type filaments (filaments parallel and slightly offset so that lower "Traffic" beam deflected slightly toward right side of road) with an upper "Country Beam" of 40-45 watts intensity and a lower "Traffic Beam" of 30-35 watts (these lamps not rated by candlepower but upper beam is approximately 50% brighter than former 32 cp. headlamps). Beams are controlled by a Beam Selector Switch on the toeboard in the usual manner.

INSTALLATION & REMOVAL:—On all cars, a sub-body or housing is provided in the headlamp for the sealed beam unit mounting. This sub-body is retained in the headlamp by the two adjusting screws and by two sets of two springs which are hooked to the sub-body diametrically across from each screw. The sealed beam unit seats directly in the sub-body and is positioned by three heavy lugs which fit into slots in the sub-body. A retainer ring is fitted over the outer edge of the sealed beam unit. This retainer ring has three lugs which engage three clamp screws on the sub-body rim so that the retainer ring and sealed beam unit are securely clamped in place when the clamp screws are tightened (on some cars a gasket is used between the retainer ring and the sealed beam unit). A lamp rim which fits over the retainer ring in such a manner as to conceal the clamp screws and adjusting screws completes the assembly.

Removing Sealed Beam Units—Remove headlamp rim (retained by one or more screws and clips). Loosen, but do not remove, three clamp screws which engage retainer ring lugs (use care not to turn adjusting screws located at top and one side of lamp). Rotate retainer ring counter-clockwise until lugs disengage from clamp screws, lift retainer ring off. Pull sealed beam unit out to disengage lugs from slots in sub-body, disconnect cable plug from clips on sealed beam unit.

Installing Sealed Beam Units—Terminal clips on sealed beam units and cable plug are designed so that plug can be connected only in correct position. Plug terminals (facing end of plug) are as follows:

Left Side—Upper Country Beam. **Center (Top)**—Lower Traffic Beam. **Right Side**—Ground wire connected to lamp sub-body or lamp housing. When installing new sealed beam unit, connect plug, see that sealed beam unit lugs properly engage slots in sub-body, install retainer ring and rotate ring clockwise until lugs on ring engage under clamp screw heads on sub-body, tighten clamp screws securely. Then adjust headlamps as directed below.

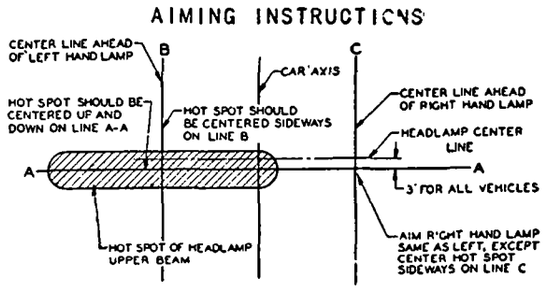


ADJUSTMENT:—All sealed beam lamp units are "prefocused" type so that the only adjustment required is to aim the lamp beam for correct horizontal and vertical position.

Headlamp Adjustment (All Cars)—Use conventional headlamp adjusting screen with vertical lines drawn directly ahead of each lamp center-line and horizontal line drawn 3" below and parallel to lamp center-line. Place car at 25 feet distance from screen, turn on lights and make certain that Upper Country Beam (lower filament) is lighted. Aim each headlamp as follows:

Horizontal Adjustment—With headlamp rim removed, turn adjusting screw at one side of lamp sub-body (do not confuse with retainer ring clamp-screws) until hot spot is centered on vertical line directly ahead of this lamp. Adjust other headlamp in same manner (both lamps aimed straight ahead).

Vertical Adjustment—With headlamp rim removed, turn adjusting screw at top or bottom of lamp sub-body (do not confuse with retainer ring clamp-screws) until hot spot is centered on horizontal line 3" below lamp center height. IMPORTANT—Beam may be directed downward as required by state laws, but should never be aimed higher than 3" below lamp center height.



SERVICING ALL 'IGS' AND 'IGT' TYPES

'POOR IGNITION' COMPLAINTS:—May be caused by breaking of strands within flexible breaker plate leads (these leads flexed by rotation of breaker plate when vacuum unit advances spark). Examine both primary (contact) lead and ground lead carefully for broken strands or replace both leads with new type (see below).

NEW TYPE IGNITION LEADS:—May be identified by color (Red with Black or Yellow Tracer—old leads were Black with red or orange tracer). These leads have several strands of steel piano wire which support the copper strands and distribute flexing action throughout entire length of the lead (this prevents flexing being centered at one point which caused breaking of strands in old type leads). Part Nos. for new leads as follows:

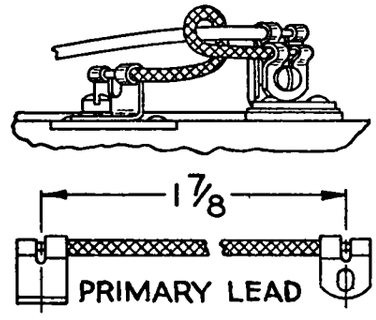
New Type Lead	Replaces Old Lead
IGS-59A	IGS-59
IGT-11A	IGT-11
IGT-14A	IGT-14

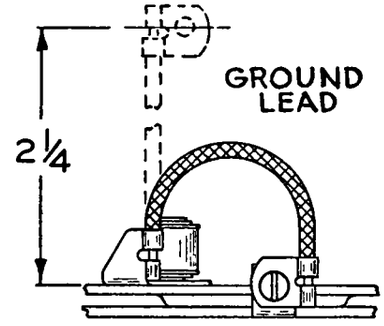
IGNITION LEAD INSTALLATION & CHANGES:—Leads must be properly installed to prevent any contact or close proximity to rotor which may allow secondary current to short-circuit through these leads. See illustration for correct primary and ground lead lengths and installation. This new IGS-59A lead (1⅞" plus ⅛", minus 0") was installed on all distributors after October 1, 1937 (approximate). Earlier distributors with longer lead should be changed as follows:

Primary Lead Changes:—On distributors before Oct. 1, 1937 with IGS-59A (Red with black or yellow tracer) leads which were 2½" (plus ⅛", minus 0") long, these leads should be shortened to 1⅞" by cutting off one terminal and section of wire and securely soldering new terminal in place. See illustration for correct installation of lead.

Ground Lead Changes:—On all distributors with long ground lead (may be identified by right angle clip at breaker arm pivot pin end and vertical mounting of clip on breaker plate at opposite end), this lead should be shortened by cutting off terminal clip and section of wire so that length with new terminal (IGS-56) is 2¼"—see illustration. Make certain that terminal is securely soldered to lead. New type leads (of correct length) have flat terminal at breaker arm pivot pin end and opposite end is mounted horizontally on breaker plate.

CORRECT BREAKER PLATE INSTALLATION:—Maximum vacuum advance is determined by size of hole cut in breaker plate which registers with small tongue on sub-plate. Correct breaker plate can be identified by number stamped on upper side of each breaker plate which indicates maximum vacuum advance in distributor degrees. Refer to Vacuum Advance table on each car model 'T&E' page for maximum vacuum advance (last figure in 'Distributor Degree' column), see that this figure corresponds with figure stamped on breaker plate in distributor used on that particular car model. Some breaker plates are identical except for this vacuum advance limiting slot and it is important that correct breaker plate be installed.





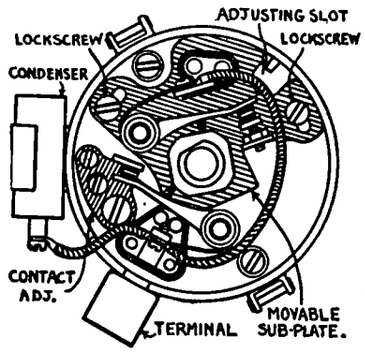
TYPE 'IGH' SYNCHRONIZATION

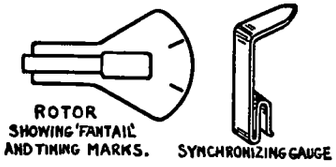
DESCRIPTION:—The two sets of contacts on the Type IGH distributors are connected in parallel to the breaker terminal on the distributor housing. The condenser is mounted on the side of the case. Only one ignition coil is used and the primary circuit is broken by the two sets of contacts alternately. For this reason it will be necessary to use a special synchronizing tool to establish the correct relation between the contacts.

CONTACT ADJUSTMENT:—Breaker contacts separate .020-.024 inch. This gap should be maintained at all times. To set contact gap (fixed contacts mounted on base plate), loosen the two lock screws on the stationary contact mounting plate and turn eccentric adjusting screw until correct gap is secured with breaker arm rubbing block on lobe of cam. Then tighten the lock screws. The other set of contacts (mounted on movable breaker plate) are adjusted by loosening lock nut on stationary contact mounting stud and turning up stud. Tighten the lock nut after making the adjustment. It is important that the contact gap of each set of contacts should be the same. Use a feeler gauge to accurately determine the gap.

TIMING DISTRIBUTOR TO ENGINE:—Distributor is timed to the engine in the usual manner by cranking engine over until piston No. 1 reaches firing position and then loosening the advance arm clamp bolt and rotating the distributor housing and breaker assembly until the contacts open. The correct firing position of the piston and full directions for each installation will be found on the car model pages.

SYNCHRONIZATION OF CONTACTS:—Connect a six volt test lamp between the primary terminal inside the breaker housing and ground (snap the other test lamp lead on the distributor case). Block open the second set of contacts (mounted on movable breaker plate) with a piece of cardboard. Then turn on ignition and slowly crank engine over until the first set of contacts open as indicated by the lighting of the lamp. If this position is accurately determined the backlash in the gears will be sufficient to open and close the contacts and the lamp should go out as the distributor shaft is rocked. Place rotor button on distributor shaft. It will be noted that rotor is built with a 'fantail' marked with two lines. These lines are exactly 45 degrees apart (distributor degrees) and represent the firing interval of the distributor. Clamp the special synchronizing gauge (Auto-Lite Part No. ST-206 on the side of the distributor case so that the pointer of the gauge is directly opposite the leading line (determined by direction of rotation of the distributor) n the fantail. Then carefully crank engine over 90 degrees until the second line on the fantail is directly opposite the synchronizing gauge. Remove the insulation from between the breaker contacts and block open the first set in the same manner. If the lamp lights when the second line on the fantail is opposite the gauge the distributor contacts are correctly synhronized. If it does not, loosen the two lock screws on the movable breaker plate and turn the eccentric adjusting screw until the contacts open and the lamp lights. Tighten the lock screws.





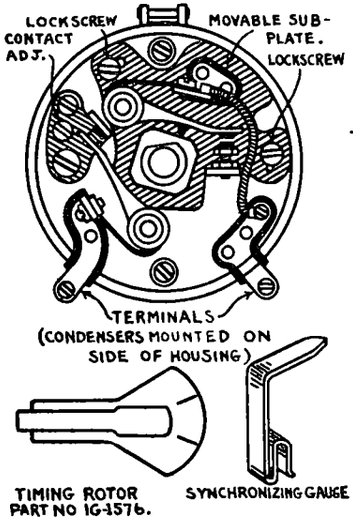
AUTO-LITE

TYPE IGJ

DESCRIPTION:—This type distributor is used in conjunction with two coils, each coil controlled by one set of contacts. There is no electrical connection between the two breakers although they operate on the same cam. It is very important to synchronize these contacts as the ignition of one half the entire number of cylinders will be thrown off if the contacts are allowed to get out of synchronization.

CONTACT ADJUSTMENT:—Breaker contacts separate .020-.024 inch. Set contact gap by loosening lock nut on stationary contact mounting stud and turning up stud until correct gap is secured with breaker arm rubbing block on lobe of cam. The other set of contacts (mounted on fixed base plate) are adjusted by loosening the two lock screws on the stationary contact mounting plate and turning the eccentric screw. Tighten the lock screws. The contact gap should be the same on both sets and a feeler gauge should be used to accurately set contacts.

SYNCHRONIZATION OF CONTACTS:—Connect a six volt test lamp across each set of contacts. It will not be necessary to block open one set of contacts since they are electrically separate. Crank the engine over slowly until the contacts (mounted on stationary base plate) begin to open and the lamp lights with the igniton turned on. Then place the special 'Master Timing Rotor,' Part No. IG-1576, on the shaft and clip the synchronizing gauge, Part No. ST-206, on the edge of the case opposite the leading mark on the fantail of the rotor. Carefully crank the engine over until the second mark is directly opposite the gauge. If the second lamp does not light at this point, indicating that the second set of contacts are opening, loosen the lock screws on the movable breaker plate and turn the eccentric adjusting screw until the contacts begin to open. With the correct adjustment the back lash in the gears will be sufficient to open and close the contacts and the lamp should light and go out as the distributor shaft is rocked. The regular production rotor used on these distributors will be equipped with timing marks and it will only be necessary to use the special master timing rotor on the early equipment.



NOTE:—All production rotors furnished as car equipment will be equipped with the fantail and timing marks. However, rotors have been used without these marks. It is possible to secure special rotors to use in timing these distributors from the Auto-Lite Company. These are known as "Special Master Timing Rotors" and carry the regular production rotor part number IG-1576.

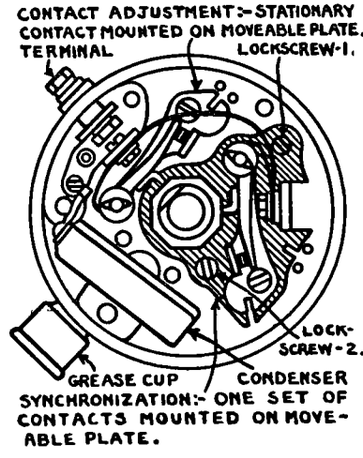
NORTH EAST

PACKARD TYPES

DESCRIPTION:—These distributors are designed for eight cylinder engines and have two sets of contacts operating on an eight lobe cam. Contacts must be synchronized so as to open at the same instant in order to distribute the ignition load equally. If one set of contacts opens early, it will have no effect on the timing, which will be determined by the second set of contacts, but this second set will carry all the ignition load and will consequently wear more rapidly than would be the case if the contacts were properly synchronized. Contacts should be synchronized whenever the contacts are resurfaced and synchronization should be checked whenever the ignition timing is checked or set.

CONTACT ADJUSTMENT:—Contact gap should be set at .020 inch. Set contact gap by loosening the lock nut on the stationary contact mounting stud and turning up the stud until the gap is .020 inch with breaker arm rubbing block on lobe of cam. On the new type distributor (new Packard equipment) the stationary contact is carried on a moveable sub-plate. The lock screw on this plate should be loosened and the plate shifted by inserting the point of a screwdriver in the slot in the end of the plate and prying sideways on the screwdriver. Tighten the lock screw after making the adjustment.

SYNCHRONIZATION OF CONTACTS:—**First Type.** Distributors of this type were constructed with both breaker arms and contact assemblies mounted on a plate which was constructed with .020 inch clearance in the distributor cup. To synchronize contacts, loosen the lock screws on the breaker plate and shift the entire plate within the distributor cup until both contacts open simultaneously.



Second Type. Distributors of this type were constructed with one set of contacts mounted on a movable sub-plate. To synchronize contacts, loosen the two lock screws on the sub-plate, insert the point of a screwdriver in the slot in the plate and pry the plate to one side. Two small pins in the base-plate are designed to be used as fulcrums for the screwdriver. Tighten the lock screws after making the adjustment. The synchronization can be checked as part of the timing operation (see next paragraph.

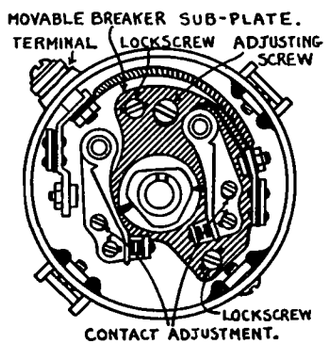
TIMING DISTRIBUTOR TO ENGINE:—The synchronization can be accurately and easily checked while the distributor is being timed to the engine by using one set of contacts at a time. First block open the second set of contacts (mounted on the movable sub-plate) with a piece of cardboard or fiber insulator and proceed with the timing operation, using a test lamp to check the contact opening. Then change the insulator to the first set of contacts and repeat the timing operation except that the distributor advance plate clamping screw should be loosened and the plate shifted until the second set of contacts begin ot open. Check the contact gap after synchronization has been completed.

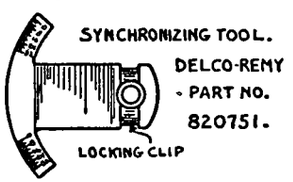
TYPES 650, 656, 659

DESCRIPTION:—These types are designed for use n six cylinder engines. They are fitted with two sets of contacts operating on a three sided cam. Contacts open alternately (one set opening an instant before the other set closes) at intervals of 60 degrees which corresponds with the 120 degree firing interval of the engines on which they are designed to be used. The two sets of contacts control the same coil and are connected in parallel in the primary circuit of the ignition system. All these types are identical in principle and are synchronized in the same manner although they differ in constructional details.

CONTACT ADJUSTMENT:—Contacts should be set at .022 inch and must be held within limits of .018-.024 inch at all times. Set contact gap by loosening lock screw on stationary contact mounting plate (located directly behind breaker arm) and turning eccentric adjusting screw until correct gap is secured with breaker arm rubbing block on lobe of cam. This must be done before attempting to synchronize contacts. If the synchronizing operation affects the setting sufficiently to throw the gap outside the limit of .018-.024 inch it must be reset at .022 inch and the synchronization repeated.

SYNCHRONIZATION OF CONTACTS:—A special tool has been developed to synchronize contacts. This is Delco-Remy Part No. 820751. To synchronize contacts, remove distributor head and rotor. Set contact gaps. Then place the synchronizing tool on shaft so that the 'A' side of the spring rests in the slot on the shaft (clockwise distributors) or the 'B' side of the spring rests in the slot (counter-clockwise distributors). Rotate the distributor shaft until the graduations on the leading tool scale approach the slot in the distributor housing. Connect a six volt test lamp in series with the coil primary and turn on the ignition. Continue to turn the shaft until the lamp goes out, indicating that the contacts have opened. Note the scale graduation which is in line with the edge of the slot. Then continue to turn shaft until the same figure on the other scale is opposite the same edge of the slot. This will indicate that the distributor has been turned through 60 degrees and the lamp should go out at this point, indicating that the second set of contacts has opened. If it does not, loosen the lock screws on the movable breaker plate on which this set of contacts is mounted and turn the eccentric adjusting screw until the contacts begin to open. Tighten the lock screws and check the contact opening. It must be within limits of .018-.024 inch. If outside these limits, reset at .022 inch and repeat synchronization. If the slot cannot be used as a reference mark, a mark may be made on the edge of the distributor housing opposite the '0' mark on the scale when the first set of contacts open. The tool is graduated in engine degrees. Contacts must be synchronized within two degrees or one graduation on the tool.



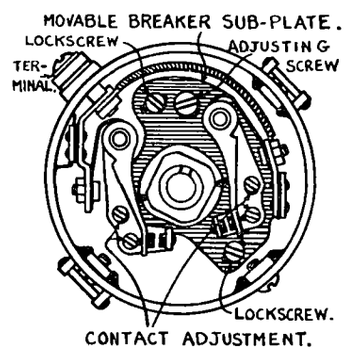


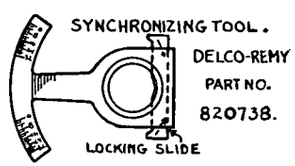
TYPES 651, 652, 657, 658

DESCRIPTION:—These types are designed for use on eight cylinder engines. They are fitted with two sets of contacts on a four sided cam. The contacts open alternately at intervals of 45 degrees corresponding to the 90 degree firing interval of the engines on which they are used. Both sets of contacts control the same coil and they are connected in parallel in the primary circuit of the ignition system. Both contacts must be open to secure a spark at the spark plug. This is accomplished by designing one set of contacts to close immediately after the other set opens. All these types operate on the same principle although they differ in constructional details.

CONTACT ADJUSTMENT:—Contacts should be set at .022 inch and must be held within limits of .018-.024 inch. Set contact gap by loosening lock screw on stationary contact mounting plate (directly behind breaker arm) and turning eccentric adjusting screw until correct gap is secured with breaker arm rubbing block on lobe of cam. Tighten the lock screw. This must be checked before the contacts are synchronized.

SYNCHRONIZATION OF CONTACTS:—A special Delco-Remy synchronizing tool, Part No. 820738, has been developed for this purpose. To synchronize contacts, remove distributor head and rotor and check contact gap. Then place synchronizing tool on shaft and lock it in place by pushing the slide through from the side. The slide is marked with an arrow at each end. One arrow will be visible when the tool is locked on the shaft and the slide should be locked so that the visible arrow points in the direction of distributor rotation. Turn the distributor shaft until the contact set mounted on the base plate begins to open when a six volt test lamp, which should be connected in series in the primary circuit, will go out. Carefully note the reading on the leading scale at a point directly opposite the edge of the terminal plate slot in the distributor housing. Then continue to turn the distributor shaft until the same point on the other scale is opposite the same slot edge on the housing. This will indicate that the shaft has been turned through 45 degrees and the lamp will go out, indicating that the second set of contacts are opening if they are properly synchronized. If the lamp does not go out at this point, loosen the two lock screws on the movable breaker plate and turn the eccentric adjusting screw until the contacts begin to open. Tighten the lock screws and check the contact gap. If outside limits of .018-.024 inch, reset at .022 inch and repeat synchronization.



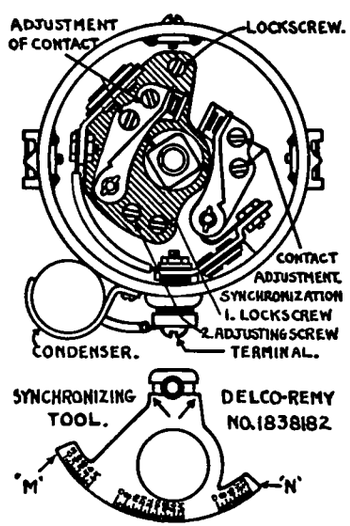


TYPES 660 AND 662

DESCRIPTION:—This type distributor is designed for use on eight cylinder engines. It is fitted with two sets of contacts operating on a four sided cam. The contacts open alternately at intervals of 45 degrees corresponding to the 90 degree firing interval of the engines on which it is used. Both sets of contacts are connected in parallel in the primary circuit of the ignition coil. One condenser mounted on the side of the distributor shaft housing is used for both contacts. The breaker arms are designed so that one set of contacts closes immediately after the other set opens which provides a longer period of time for building up the coil primary current. Both sets of contacts must open to secure a spark at the plugs.

CONTACT ADJUSTMENT:—Contacts should be set at .022 inch and must be held within limits of .018-.024 inch. Set contact gap by loosening the lock screw on the stationary contact mounting plate (directly behind the breaker arm) and turning the eccentric adjusting screw. The breaker gap must be measured with the breaker on the lobe of the cam. Tighten the lock screw. Contacts can be resurfaced when necessary with a fine flat contact file or on a medium hard oilstone. The contact gap must be set before the contacts are synchronized and should be checked after the synchronization has been completed. If synchronizing has affected the gap sufficiently to throw it outside the limits of .018-.024 inch, reset the gap at .022 inch and repeat the synchronization.

SYNCHRONIZATION OF CONTACTS:—A special Delco-Remy synchronizing tool, Part No. 1838182, has been developed for use in synchronizing contacts on Type 660 distributors. Place the synchronizing tool in position on the upper end of the distributor shaft with the spring on the left or 'M' side of the tool in the slot in the cam (if the distributor rotates clockwise) or with the right or 'N' side of the spring in the cam slot (if the distributor rotates counter-clockwise) and connect a test lamp or ammeter in the primary circuit and turn on the ignition so that an accurate check of the contact opening can be made. Then turn the distributor shaft in the direction of rotation until the first set of contacts (mounted directly on the breaker plate—the so-called stationary contacts) begin to open. Note the reading on the center scale which is directly in line with the leading edge of the slot in the distributor housing. Continue to turn the distributor until the same reading on the 'N' side of the scale (for clockwise distributors) or the 'M' side of the scale (for counter-clockwise distributors) is in line with the same edge of the distributor housing slot. Then loosen the two lock screws on the movable sub-plate (on which the second set of contacts are mounted) and turn the eccentric adjusting screw until the contacts begin to open. Tighten the lock screws and check synchronization by turning the distributor shaft through a complete revolution and again noting scale readings as contacts open. The variation must not be greater than 2 tool graduations which corresponds to 2 degrees of crankshaft rotation. The contact gap must be checked after synchronizing contacts. If outside limits of .018-.024 inch, reset at .022 inch and repeat synchronization.

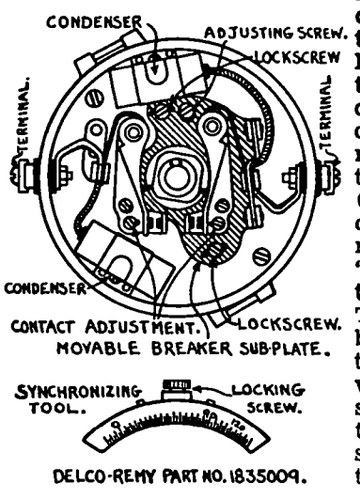


TYPE 668

DESCRIPTION:—This type distributor has two sets of contacts operating on a four sided cam. Contacts open alternately at intervals of 45 degrees which corresponds with the 90 degree firing interval of the eight cylinder engines on which the distributor is designed to be used. Each set of contacts is fitted with a condenser and there is no electrical connection between the two sets. The distributor is used with two ignition coils and each set of contacts controls one coil, firing four cylinders of the engine. The synchronization of the contacts is very important in that the timing of four cylinders will be thrown out if the contacts are allowed to get out of synchronization and the engine performance will be unsatisfactory.

CONTACT ADJUSTMENT:—Breaker contacts should be set at .022 inch and must be held within limits of .018-.024 inch. Set contact gap by loosening lock screw on stationary contact mounting plate and turning eccentric adjusting screw until correct gap is secured with breaker arm rubbing block on lobe of cam. Tighten the lock screw. Contacts can be resurfaced when necessary with a fine flat contact file or on a medium hard oilstone. The contact gap must be set before the contacts are synchronized and should be checked after the synchronization has been completed. If synchronizing has affected the gap sufficiently to throw it outside the limits of .018-.024 inch, reset the gap at .022 inch and repeat the synchronization.

SYNCHRONIZATION OF CONTACTS:—One set of contacts is mounted on the base plate while the second set of contacts is mounted on a movable breaker plate. To synchronize contacts, first connect a six volt test lamp in series with each primary circuit. Then remove distributor head and turn distributor shaft until the first set of contacts begin to open when the lamp will go out. Clip the special synchronizing tool, Delco-Remy Part No. 1835009, on the edge of the distributor housing so that the '0' mark on the scale is opposite the leading edge of the rotor contact (for clockwise distributors) or with the '90' mark on the scale opposite the rotor (counter-clockwise distributors). Then turn the distributor shaft until the same edge of the rotor contact is opposite the '90' mark (if the '0' mark was used) or opposite the '0' mark (if the '90' mark was used for initial reference). This will indicate that the distributor shaft has been turned through 45 degrees and if the contacts are in synchronization the second lamp will go out at this point, indicating that the second set of contacts have begun to open. If the lamp does not go out, loosen the two lock screws on the movable breaker plate and turn the eccentric adjusting screw until the contacts begin to open. Tighten the lock screws and check the contact gap. If outside limits of .018-.024 inch, reset at .022 inch and repeat synchronization. The tool is graduated in engine degrees. The allowable variation in contact synchronization is 2 degrees or one graduation on the tool.



MODEL R & S DISTRIBUTORS

NOTE:—Models R and S distributors are same design except that Vacuum Spark Control (see data below) is fitted on Model R only.

DESCRIPTION:—Furnished in 4, 6, and 8 cylinder types. These distributors have Mallory double contact system and special features as follows:

Contacts—Each distributor has two sets of contacts, each set being operated independently by an "L" shaped breaker arm. One set of contacts is used to load the ignition coil (this set close first and open first), the other set of contacts being used to time the ignition (this set opens last—see Ignition Timing below). No synchronization is necessary and no means is provided to change the relation of the two breaker arms.

Distributor Cap—Spark is distributed by a special type rotor arm which has a "wiping" action. Spark plug cables are inserted through a rubber pad which is compressed when the bakelite cap is tightened down so moisture is excluded from the cable terminals.

Governor Advance Weights—New design mounted in pairs (4 used) so that rolling action secured between weights. Springs are linked between governor advance plate (outer ends) and subplate which is loose on shaft but having pins which engage notches in cam mounting plate (inner ends).

INSTALLATION:—Distributors furnished with correct advance characteristics for each particular engine. Sub-assemblies also furnished from which distributors may be built up for any desired specifications.

BREAKER CONTACTS:—**Contact Gap**—Should be set at .012" (both sets alike). **Contact Adjustment**—Loosen lockscrew on stationary contact mounting bracket and turn stationary contact stud (outer end slotted for screwdriver).

TIMING:—Contact assemblies on breaker plate are stamped "LH" and "RH". When timing engine at firing point for #1 cylinder, set distributor so that "RH" contacts are just opening (distributors with clockwise rotation), "LH" contacts just opening (distributors with counter-clockwise rotation). Rotation is indicated by arrow on top of breaker cam. NOTE—The other set of contacts will open first, but timing is controlled by contacts opening last as indicated above.

MALLORY VACUUM SPARK CONTROL

NOTE:—Vacuum Spark control mechanism shown in illustration (single piston) is type used on Ford distributor and early Mallory models. On Model R, same design is used but two vacuum pistons are located at 180° on distributor housing. Both cylinders are connected to the vacuum port on the distributor by a channel cast in the housing. Vacuum spark control is not adjustable on this model.

DESCRIPTION:—The Mallory Vacuum Spark Control consists of a mechanical brake operated by the vacuum in the intake manifold of the engine which tends to retard the governor cam advance plate in its rotation and so counteract the effect of the automatic advance governor under certain conditions of engine operation.

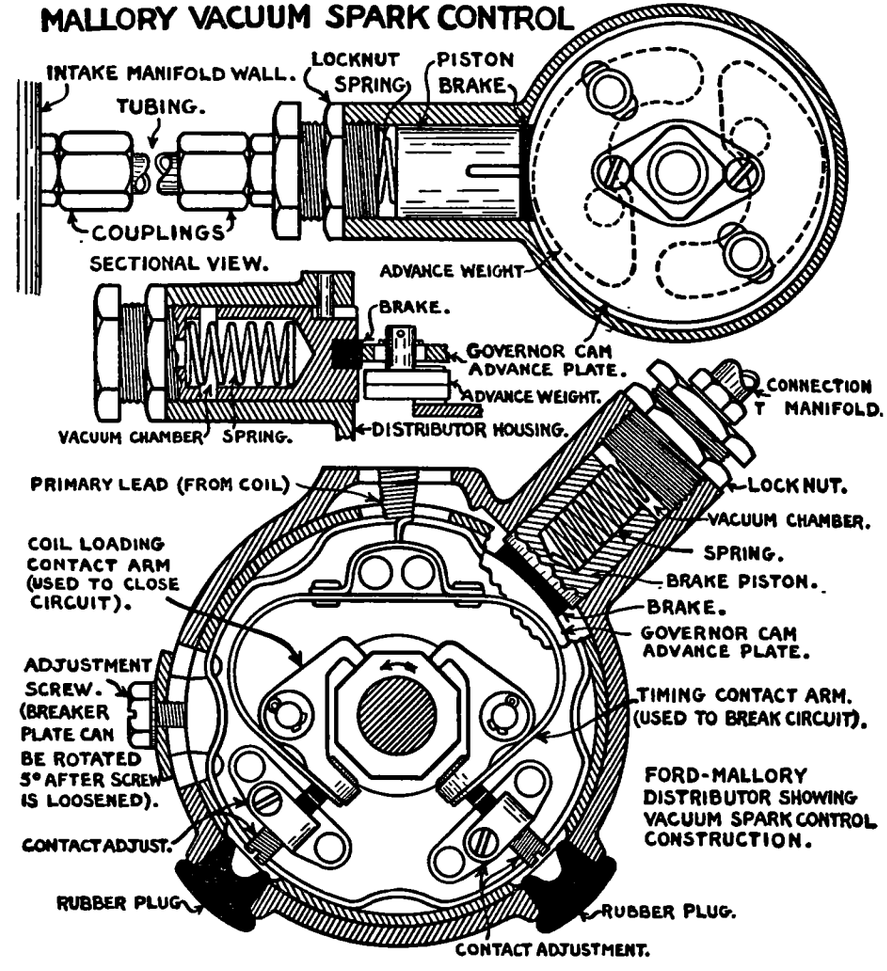
The Vacuum Spark Control consists of a piston in a cylinder in the side of the distributor housing. This piston has on its inner end a brake shoe which bears against the edge of the governor cam advance plate and is kept in contact with the plate by a spring behind the piston. The outer end of the cylinder behind the piston forms the vacuum chamber and is connected to the intake manifold of the car engine by tubing (see diagram for sectional view of entire assembly).

OPERATION:—Whenever the vacuum in the manifold is high, as when the engine is idling or being operated under light load with the throttle closed, the vacuum behind the piston will allow the brake piston and brake shoe to move out (away from the governor cam advance plate) against the spring. The governor cam advance plate is then controlled solely by the centrifugal advance weights and the spark will occur at a point determined by the speed of the engine (the advance in degrees will of course depend upon the particular curve for which the distributor has been designed).

Whenever the engine is accelerated or is being operated under heavy load with the throttle open, the vacuum in the manifold will decrease sufficiently so that the spring will force the piston in toward the governor cam advance plate, engaging the brake shoe with the edge of the plate. This drag on the governor cam advance plate tends to counteract the advancing action of the centrifugal weights so the spark occurs later than would otherwise be the case. At extremely high speeds when the vacuum in the manifold is low, the centrifugal force of the advance weights will be sufficient to overcome the effect of the brake so that no retarding of the spark occurs.

The Vacuum Spark Control has the effect of providing two distinct advance curves for the distributor, a relatively rapid advance for engine operation at light loads, and a slower advance for operation under heavy loads. It also provides a retard when the engine is suddenly accelerated, preventing spark knock. In operation the intake manifold vacuum will be high enough to keep the brake disengaged most of the time. With standard setting the brake begins to engage when the manifold vacuum falls to 10 inches (mercury column) and the full force of the brake is only applied when there is no vacuum in the manifold, as when the engine is operated with wide open throttle or under heavy load at low speeds.

ADJUSTMENT (FORD TYPE):—Spring tension adjustable by loosening nut on the end of the cylinder and changing the position of the adjusting nut. If the engine pings on acceleration or with heavy load, the locknut should be loosened and the adjusting screw turned in just enough to eliminate the ping. NOTE—No adjustment provided on Model R.



FORD-MALLORY DISTRIBUTOR SHOWING VACUUM SPARK CONTROL CONSTRUCTION.

TIMING GAUGE

DESCRIPTION:—The timing indicator is a special micrometer gauge with a direct reading dial which is designed to be mounted on the cylinder head to measure the piston travel directly in thousandths of an inch.

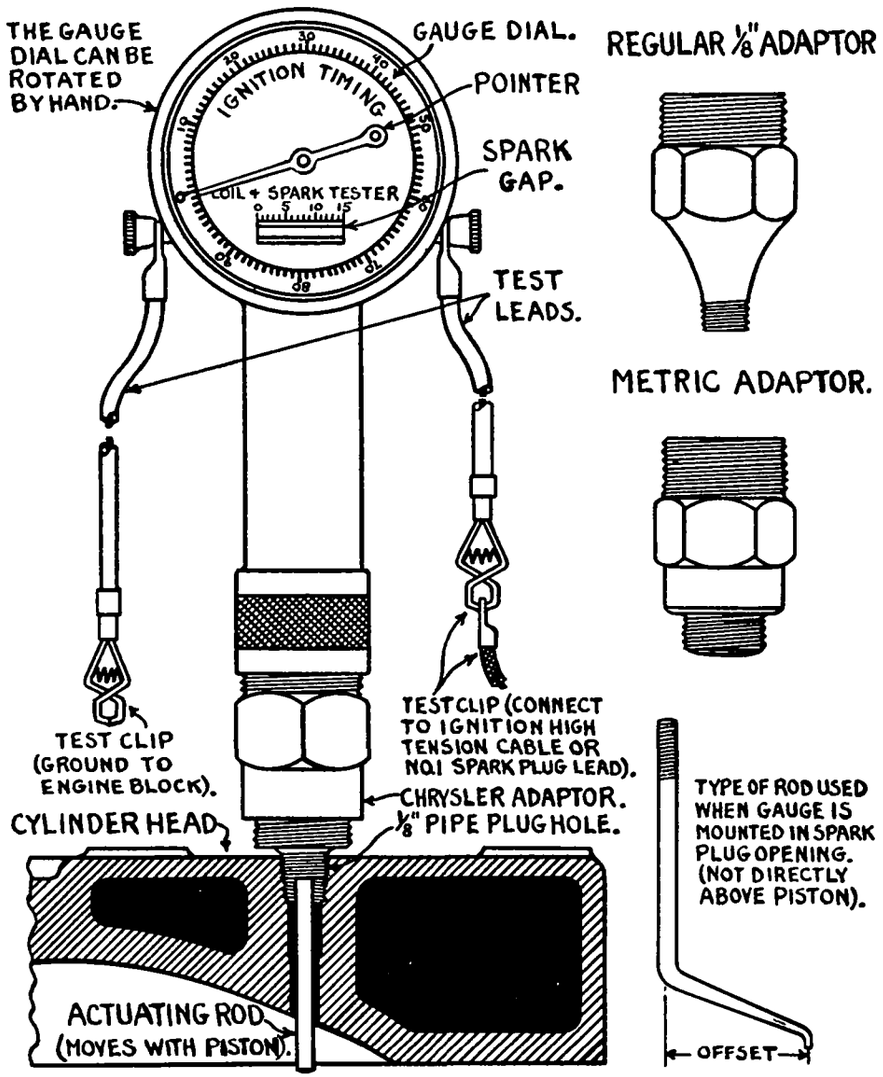
OPERATION:—The operating piston of the gauge is contained in the shaft which is designed to be screwed into the spark plug port in the cylinder head or in the opening in the cylinder head closed normally by a ⅛ inch pipe plug on engines where this plug is provided (the plug will usually be found in the cylinder head directly over No. 6 piston). Special adaptors for use with ⅞ inch S.A.E. spark plug, ½ inch pipe thread, 18 MM. Metric thread and the ⅛ inch pipe plug openings are furnished with the gauge. These adaptors are used in connection with rods which rest on the head of the piston and move with it and thus actuate the gauge piston. Straight rods are used when the gauge is mounted in the ⅛ inch opening directly over the piston and offset rods must be used when the gauge is mounted in the spark plug port which is not directly over the piston head. The gauge is calibrated in thousandths of an inch and one complete revolution of the indicator hand registers .100 inch. The limit of travel of the gauge is six complete revolutions of the indicator or .600 inch and care must be taken when the gauge is used that the rod does not engage the piston more than .6 inch before top dead center.

IGNITION SETTING, USING GAUGE:—In timing the distributor to the engine, first crank the engine over until piston to be used in timing is on compression stroke (see specific car data sheet—the piston used may be No. 1, No. 4 or No. 6). Take out the spark plug or remove the ⅛ inch pipe plug in the cylinder head. Clean the carbon off the cylinder head. This is very important. Assemble the correct adaptor and rod on the gauge and screw the adaptor into the cylinder head. Turn engine over very slowly and see that the gauge indicator does not make more than six revolutions before top dead center. With the piston on top dead center set the gauge dial at zero. Connect the high tension lead from the coil to one of the spark gap terminals on the gauge. Ground the other gauge terminal to the engine and turn on ignition. Turn engine over until, with piston approaching top dead center on compression stroke, the gauge reading indicates the firing position (see car data sheet).

SYNCHRONIZATION OF CONTACTS, USING GAUGE:—The timing gauge can be used to synchronize contacts on distributors using double breakers if it is not desired to use the regular synchronizing tools. To synchronize contacts on a six cylinder engine (distributors with two sets of contacts opening alternately at intervals of 60 degrees corresponding to 120 degrees of crankshaft rotation) after the distributor has been timed to the engine, crank the engine over 180 degrees until the piston again approaches top dead center on the exhaust stroke and repeat the timing operation.

In synchronizing contacts on eight cylinder engines (with two sets of contacts opening alternately at intervals of 45 degrees corresponding to 90 degrees of crankshaft rotation) it will be necessary to move the timing gauge to the next firing cylinder after the distributor has been timed to the engine and repeating the timing operation.

This gauge is Chrysler tool No. DC-150. It is manufactured by the Joseph Weidenhoff Company of Chicago.



SYNCHROSCOPE (NEON LIGHT) IGNITION TIMING

DESCRIPTION:—This device consists of a Neon light which is clipped to #1 spark plug terminal so that the light flashes whenever the spark plug fires. When this light is used to illuminate the flywheel timing mark by being directed at the flywheel housing inspection hole, it gives a stroboscopic effect so that the timing mark appears to be standing still while the engine is being idled. This allows the ignition timing to be checked and set with the engine running.

OPERATION:—Clip one Synchroscope lead terminal to #1 spark plug terminal (on Buick cars with spark plugs covered by shield, disconnect #1 cable at distributor, clip one lead to this cable, insert other lead in #1 terminal on distributor cap). Ground the other Synchroscope lead to the engine. Remove cover plate over inspection hole in flywheel housing, mount Synchroscope so that light is directed at flywheel, inspect flywheel ignition mark (if mark is not distinctive and is likely to be confused with others, fill in mark with white paint or chalk so as to be easily discernible). Start engine and allow to idle at specified speed (do not exceed this speed). If flywheel mark does not appear to be opposite pointer or reference line on flywheel housing, loosen distributor clamp bolt and advance or retard spark until mark is directly in line with pointer. Tighten clamp bolt and remove Synchroscope.

DELCO-REMY IGNITION SWITCHES

Car Model & Year	Ignition Coil	Ignition Switch
Cadillac V8 355D (1934-35	539-D	431-D
Cadillac V12 370D, V-16 452D, ('34-35)	553-E	431-EA
Cadillac V8, 60, 70, 75 (1936)	539-C	431-L, 431-Z
Cadillac V12, 80, 85 (1936)	553-E	435-A
Cadillac V16, 90 (1936)	553-E	431-E
Cadillac V8, 60, 65, 70, 75 (1937)	539-C	435-K, 435-H
Cadillac V12, 85 (1937)	553-E	435-J
Cadillac V16, 90 (1937)	553-E	435-R
Cadillac V8, 60, 65, 75 (1938)	539-C	1116255
Cadillac V8, 60 Spec. (1938)	539-C	435-K
Cadillac V16, 90 (1938)	553-E	1116256
Cadillac V8, 61 (1939)	1115128	435-K
Cadillac V8, 60S, 75 (1939)	1115128	1116255
Cadillac V16, 90 (1939)	553-E	1116256
Chevrolet BA (1932)	633-G, J (distributor)	427-H
Chevrolet CC, CB (1933)	536-W, 536-P	428-A, 429-A
Chevrolet DC, DA (1934)	538-C, 539-J	431-C
Chevrolet EA, ED ('35), FA, FD ('36)	536-D	431-P, 431-Y
Chevrolet GA, GD (1937)	536-D	435-F
Chevrolet Comm. & Truck ('35-37)	536-D	431-P
Chevrolet HA, HB (1938)	536-D	435-F
Chevrolet HC, HD, HE, T (1938)	536-D	431-Y
Chevrolet JA, JB (1939)	536-D	435-F
Chevrolet JC, JD, JE, V (1939)	536-D	1116263
Chrysler CO (1933)	537-U, 538-K, L	428-D, 429-D, S, T
Chrysler CT (1933)	537-U, L, M, 538-L, M	428-D, S, R, 429-S, R
Chrysler CQ (1933)	537-U, M, 538-U, M	428-D, R, 429-D, R
Chrysler CA, CB (1934)	540-J, K, H Export	432-J, K, H
Chrysler CU, CV ('34), C2, C3 ('35)	540-F	432-F
Chrysler CW, CW* (1934-35)	540-L	432-L
De Soto SD (1933)	537-R,,S, Y, P, 538-R	428-M, 429-G, N, E
De Soto SE (1934)	540-E	432-E
Dodge DP (1933)	537-V, 538-Y, V	428-C, 429-Y, C
Dodge DO (1933)	537-Y, M, 538-N	429-E, 428-R, 429-P
Dodge DR, DS, DT (1934)	540-C, D, A	432-C, D, A
Franklin 17, 17B (1932-34)	532-C	427-Z
Graham 65 (1933)	536-U, R	428-H, 429-H
Graham 64, 57A (1933)	536-U, R	428-H, 429-H
Graham 68, 67 (1934)	536-L, M, K	431-H, J, K
Graham Superchgd. 69 (1934)	539-F	431-J
Graham 74, 73, 72 (1935)	536-J	431-U
Graham Superchgd. 75 (1935)	539-M	431-U
Graham 80, 80-A, 90, 90-A (1936)	536-J	431-U
Graham 110 (1936)	536-M	431-U
Graham 85, 95 (1937)	536-J	431-U, 435-P
Graham 116, 120 (1937	536-M	435-P
Graham 96 (1938-39)	1115022	1116261
Graham Superchgd. 97 (1938-39)	1115127	1116261
La Salle 350 (1934-35)	539-B	431-G
La Salle 35-50, 36-50 ('35-36)	539-C	431-L
La Salle 37-50 (1937)	539-C	435-K
La Salle 38-50 (1938)	539-C	435-K
La Salle 39-50 (1939)	1115128	435-K
Oldsmobile F-35, L-35 (1935)	536-E	431-R
Oldsmobile F-36, L-36 (1936)	539-K	430-L
Oldsmobile F-37, L-37 (1937)	540-P, 539-P	435-M
Oldsmobile, F-38, L-38 (1938)	539-P	1116252
Oldsmobile, F-38, L-38 (1938) RHD	539-P	1116258
Oldsmobile '60' F-39 (1939)	1115129	1116266
Oldsmobile '70' G-39 (1939)	1115129	1116267
Oldsmobile '80' L-39 (1939)	1115129	1116267
Packard 1100-5 (1934)	5033450 (NE)	430-F, K
Packard 1107-8 (1934)	CE-4022, 23 (AL)	430-H, J
Packard 1200-5 (1935)	539-K	430-L
Packard 115C (Early 1937)	539-N	435-L
Packard 1500, 1, 2 (1937)	539-K, CE-4026 (AL)	430-L
Packard 1407, 8 ('36), 1506, 7, 8 ('37)	CE-4022, 23 (AL)	430-M
Packard, Six 1600 (1938)	539-N	1116254
Packard, Six 1700 (1939)	539-N	1116254
Pierce Arrow 1601 ('36), 1701 ('37)	539-K	430-U
Pierce Arrow 1702,3 ('36), 1702, 3 ('37)	553-E	430-T
Pierce Arrow, 1801 (1938)	539-K	430-U
Pierce Arrow, 1802, 3 (1938)	553-E	430-T
Plymouth PC (1933)	537-W, T, 538-W, T	429-B, 428-F, 429-W, F
Plymouth PD (1933)	537-J, 538-J, X	428-U, 429-U, X
Plymouth PF, PE (1934)	540-A	432-A
Pontiac 701A, B Six (1935)	539-L	431-L
Pontiac 36-26A, B (1936)	539-L	431-L
Pontiac 605 ('35), 36-38 ('36)	539-L	431-L
Pontiac 37-26CA, 37-28CA ('37)	539-L	435-G
Pontiac 38-26DA, 38-28DA (1938)	539-L	1116253
Pontiac 6, 39-25 (1939)	1115023	1116253
Pontiac 6, 39-26 (1939)	1115023	1116265
Pontiac 8, 39-28 (1939)	539-L & 1115129	1116264
Reo S2, S3 (1933)	536-S	428-J
Reo N-35, 52 (1933)	536-T	428-K
Reo S4 (1934)	538-B	430-C, 429-Z
Reo N-35, 52 (1934)	538-E, F	430-E, D
Reo 6A (1935)	536-G	431-W
Reo 7S (1935)	538-B	430-C, 429-Z
Reo 6D (1936)	536-G	435-C
Studebaker Dict. A (1934)	538-A	430-A
Studebaker Comm. B, Pres. C (1934)	538-A	430-A
Studebaker Comm. B (1935)	538-A	430-A
Studebaker Pres. C (1935)	538-H	430-A
Studebaker Pres. 2C (1936)	537-B	430-R
Studebaker Pres. 4C (1938)	1115021	1116257
Studebaker Pres. 5C (1939)	1115021	1116268

SERVICING IGNITION COILS

BEFORE 1935:—The coil assembly can be serviced either by replacing the entire unit or by disconnecting the coil and replacing the coil or the switch and cable assembly. The entire unit should first be taken off the car by disconnecting the switch leads and removing the switch from the instrument board mounting and removing the ignition coil from the dash mounting. Then bend up the ears that hold the cup on the end of the cable in place on the coil. This will expose the primary terminal at the base of the coil. Disconnect primary lead in the cable from this terminal, connect the new coil and bend down the ears so that the new coil is securely held on the cable.

AFTER 1935:—The cable cap on end of the coil is held in place by two small tangs which lock in 'L' shaped grooves similar to the bayonet socket locking principle of light bulbs. A large flexible tang on the cap snaps into a groove on the coil case when the cap is assembled to prevent the reverse turn which is necessary to free the cap. Use special tool with thin flexible blade (Oldsmobile No. J-726) to free tang. To disconnect coil, insert blade of tool between coil case and cap at a point approximately 1" to right of cable outlet on cap. The tool will press the large tang out of the groove in the coil case. Then turn cap counter-clockwise until it can be withdrawn. Disconnect coil lead wire at terminal on bottom of coil case.

1. Coil Primary Shorted. Check current draw of coil. If current exceeds 6 amperes at 6 volts, coil is probably shorted.

2. Coil Primary Grounded. See Test (4) under Trouble Shooting above. Test from coil terminal on case to ground (unpainted surface of case). Lamp should not light.

3. Coil Secondary Grounded. Test from secondary terminal of coil to ground on coil case. Use 110 volt test lamp. Lamp should not light with coil disconnected from switch.

TYPES 428, 429, 430

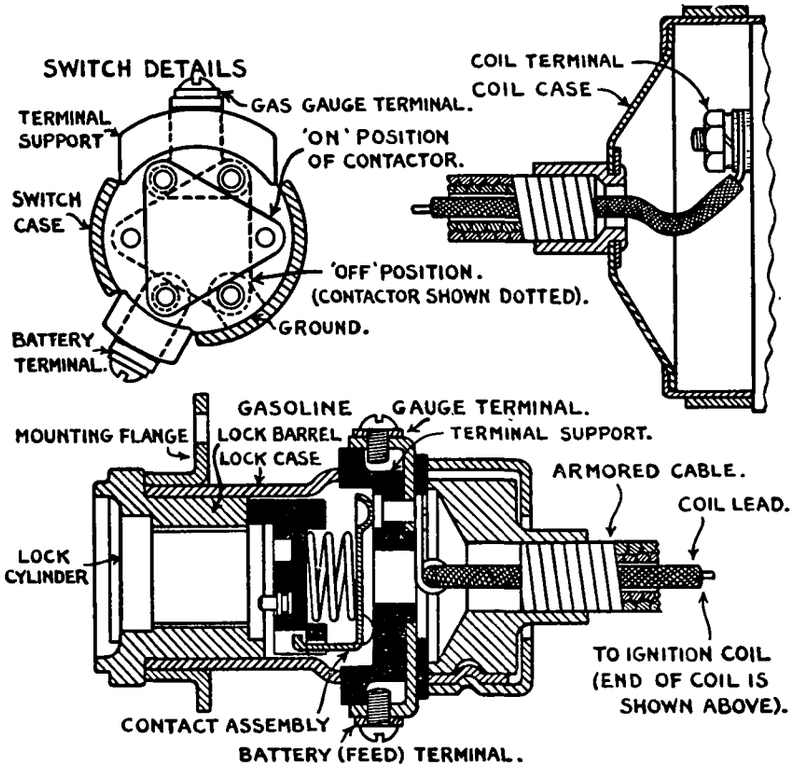
DESCRIPTION:—These ignition locks differ from previous designs in that the primary lead or 'feed' wire from the switch to the coil is armored instead of the breaker lead. The breaker lead from the coil is not taken through the switch but is connected directly to the distributor.

OPERATION:—On this type switch the lock cylinder does not spring out and the turning of the key completes the ignition and gasoline gauge circuits. The key cannot be removed with the switch on. The gasoline gauge terminal and ignition coil are grounded with the switch turned 'off'.

TROUBLE SHOOTING:—Circuits through the switch should be tested with a lamp and test points to determine if the switch is operating satisfactorily. In making the following tests place the test points on the points indicated and note whether the lamp lights or not.

1. Switch off. Disconnect feed wire on switch. Test from feed terminal to to gasoline gauge terminal. Lamp should not light.
2. Switch off. Disconnect feed wire on switch. Test from gasoline gauge terminal to switch case or armored cable. Lamp should light.
3. Switch on. Disconnect feed wire on switch. Test from gasoline gauge terminal to feed terminal. Lamp should light.
4. Switch on. Disconnect feed wire from switch. Test from feed terminal to breaker terminal of ignition coil. Lamp should light. If lamp does not light and previous test indicated switch circuit was satisfactory, coil should be disconnected and tested separately (see next paragraph).
5. Switch on. Disconnect feed wire from switch and block open breaker contacts or disconnect breaker lead at coil. Test from feed terminal on switch to switch case. Lamp should not light. If lamp lights, the switch, coil lead or ignition coil are grounded. Disconnect coil and test separately.

SERVICING COIL:—Coil can be disconnected and tested or replaced separately. See preceding page for complete data.



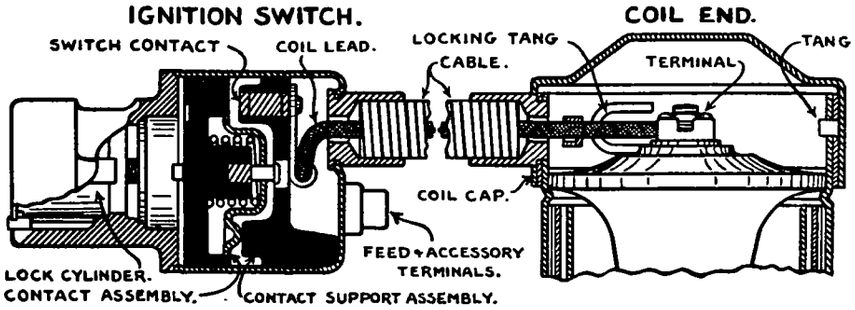
TYPES 431, 432, 435

DESCRIPTION:—This type switch is similar to previous designs in that the ignition coil lead from the switch is enclosed in an armored cable so that the coil can be mounted at a distance from the switch, usually on the engine block or engine side of the dash. An accessory terminal is provided on the switch for the gasoline gauge connection. The method of mounting the cable end cap on the ignition coil is new (see directions below for disconnecting ignition coil).

TROUBLE SHOOTING:—Circuits through the switch can be tested with a test lamp and battery or other current source and test leads as follows: In each case test leads should be connected at points indicated and it should be noted whether test lamp lights or not.

1. Switch Off. Disconnect feed wire on switch. Test from feed terminal on switch to gasoline gauge or accessory terminal. Lamp should not light.
2. Switch On. Disconnect feed wire on switch. Test from feed terminal to gasoline gauge terminal. Lamp should light.
3. Switch On. Disconnect feed wire on switch. Test from feed terminal to breaker terminal on ignition coil. Lamp should light. If lamp does not light and previous test indicated that switch circuits were satisfactory, disconnect coil (as directed below) and test separately.
4. Switch On. Disconnect feed wire from switch and block open breaker contacts or disconnect breaker lead at coil. Test from feed terminal on switch to switch case. Lamp should not light. If lamp lights; switch, coil lead or ignition coil are grounded. Disconnect coil and test separately.

SERVICING COIL:—See directions on preceding page for coil disassembly.



NOTE:—These switches used as standard equipment on the following car models:

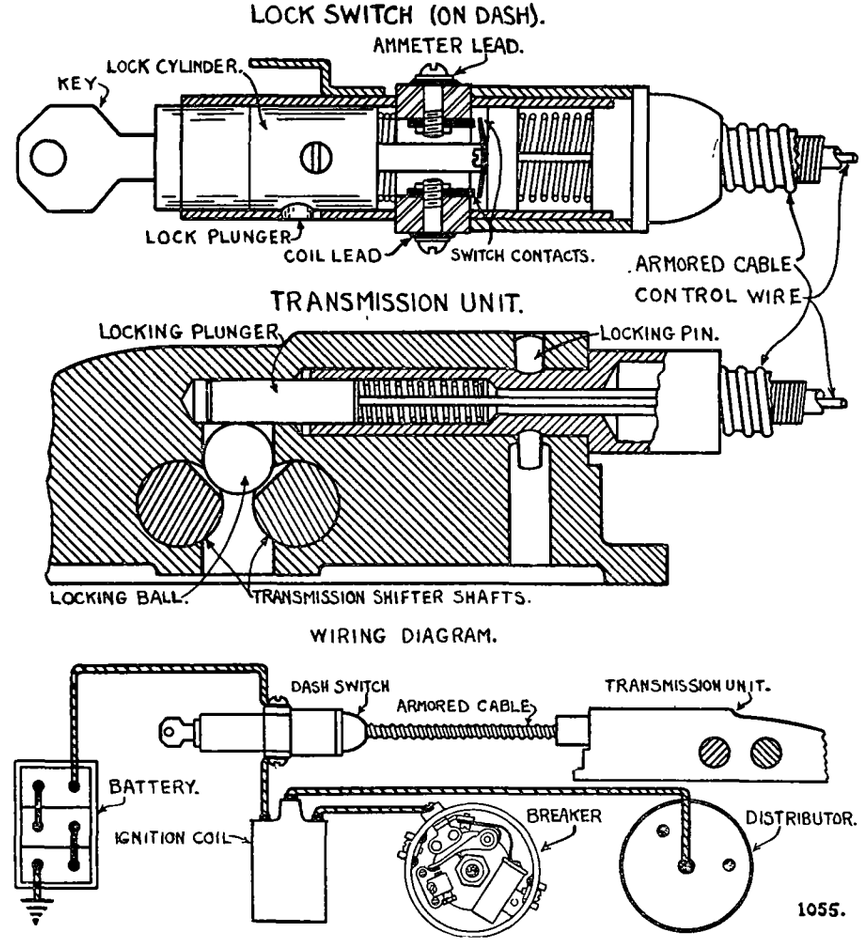
Car Model and Year	Switch Type Number
Cadillac 452 (1930-31)	426-T, 426-U (RHD.
Cadillac 355, 370 (1931)	426-P
Cadillac 355B, 370B, 452B (1932)	426-T, 426-U (RHD.)
Cadillac 355C, 370C, 452C (1933)	426-T
La Salle 345 (1931)	426-P, 426-M (RHD.)
La Salle 345B (1932), 345C (1933)	426-T
Nash 960 (1931), 8, 9, 10, 1170 (1931-33)	425-S
Nash 8, 9, 10, 1180 (1931-33)	425-S
Nash 8, 9, 10, 1190 (1931-33)	425-S
Nash 1220 (1934)	425-U
Nash 1280, 1290 (1934)	425-V
Stutz LA, LAA (1931-32-33)	426-J, 426-K

DESCRIPTION:—The Delco-Remy Dual Lock is a co-incidental ignition switch lock and transmission lock. It consists of an ignition switch and lock mounted on the dash and connected through a flexible control wire with a transmission lock on the transmission case cover. The control wire is protected by an armored steel cable throughout the entire distance between the dash switch and the transmission. This makes it impossible to tamper with the lock action and prevents operation of the tranmission with the switch locked. The ignition switch is fitted with a tumbler lock and acts as a straight ignition switch connected between the battery and the ignition coil.

OPERATION:—The dash switch unit is shown in sectional view in the illustration. When the ignition key is inserted in the lock and turned to unlock the ignition, the spring behind the lock cylinder forces the lock cylinder and the cup on the forward end of the control wire (which fits in a recess in the rear of the lock cylinder) forward withdrawing the locking plunger in the transmission case cover. This permits the locking ball to move upward freeing the transmission shafts and permitting the transmission to be operated. The movement of the control wire assembly in the lock case on the dash permits the spring behind the contacts to force the contactor block forward and close the circuit between the two switch terminals. One of these terminals is connected to the ignition coil and the other is connected to a 'hot' terminal in the car circuit usually the ammeter. When the lock cylinder is pressed in to cut off the ignition and stop the engine, the movement of the control wire assembly positively opens the switch contacts and forces the locking plunger across the top of the locking ball which in turn is forced down into the grooves of the transmission shifter shafts. The transmission must be in neutral (first switch types) to operate the lock. On later models a second locking position was provided with the transmission gears in 'reverse' so that the car could be parked in gear on hills.

SERVICING DUAL LOCK:—The Dual Lock should not be disassembled for service or repair. When it is necessary to service these locks, the key and lock assembly should be taken off and assembled in a new conduit and tube assembly. To test for switch performance, disconnect both lines at switch terminals and test circuit through switch with a lamp and test points. Place one test point on each terminal. With the switch locked the lamp should not burn. With the switch unlocked the lamp should burn. To remove Dual Lock from car, first disconnect switch assembly on dash. Unlock lock cylinder and remove. On the first type switch, the lock cylinder was not connected to the control wire assembly. On the second type, the cup on the forward end of the control wire was pinned to the lock cylinder and it will be necessary to drive out this pin through the hole in the case. Then remove transmission case cover and drive out lock retaining pin. The locking plunger assembly can then be withdrawn.

DELCO-REMY DUAL-LOCK



DELCO-REMY ELECTROLOCK

DESCRIPTION:—The Electrolock is an ignition switch mounted on the dash and connected to the distributor housing terminal through an armored steel cable. The breaker lead from the coil is taken through the switch and then to the distributor through this cable which is fastened to the distributor by a special non-removable clip connection. The breaker is grounded through the switch case when the switch is in the 'Off' position. This absolutely prevents tampering with the car when the ignition is locked since it is impossible to wire around the switch.

OPERATION:—The dash switch consists of a tumbler lock cylinder mounted directly in front of a spring in the lock case. The switch contact is mounted on the rear of the lock cylinder. When the key is inserted in the lock and turned to the right as far as possible, the lock is released and the lock cylinder is forced out by the spring closing the switch contacts and breaking the ground connection. The key may then be removed. To turn off the ignition, the lock cylinder is pressed in. This opens the switch, grounds the distributor and locks the ignition. It is only necessary to make certain that the lock cylinder remains in the 'In' position and that the lock has snapped. This feature makes it impossible for the driver to neglect to lock the switch.

TROUBLE SHOOTING:—To test the Electrolock for possible ignition trouble, first disconnect wire on Electrolock case leading to coil. Turn the distributor shaft until contacts open or block open contacts with a piece of cardboard or any insulating substance. Then make the following tests with a lamp and test points:

1. Place one test point on the terminal stud inside the distributor housing and place the other test point on the terminal on the side of the Electrolock case from which coil lead was disconnected (one terminal type) or on the battery terminal (three terminal type). With the switch unlocked, the lamp should be lighted. With the switch locked, the lamp should not light.

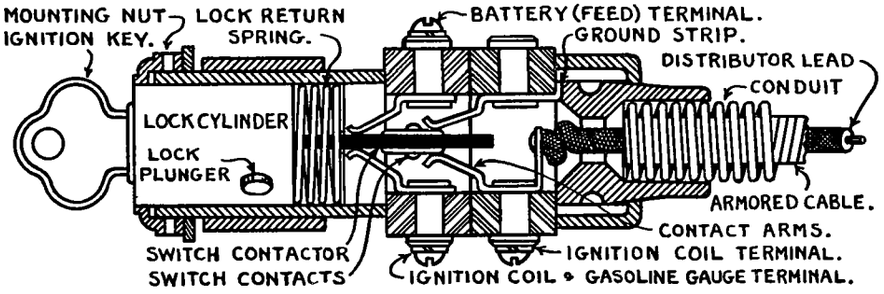
2. Place one test point on the distributor terminal stud as in test (1) and place the second test point on the switch case. With the switch locked the lamp should burn. With the switch unlocked the lamp should not burn. If the lamp burns with the switch unlocked the condenser may be shorted or grounded. Disconnect the condenser and repeat the test. If these tests indicate Electrolock is operating satisfactorily, check coil, breaker contacts, distributor, spark plugs and wiring. If tests indicate trouble in Electrolock, disassemble as directed in the following paragraph.

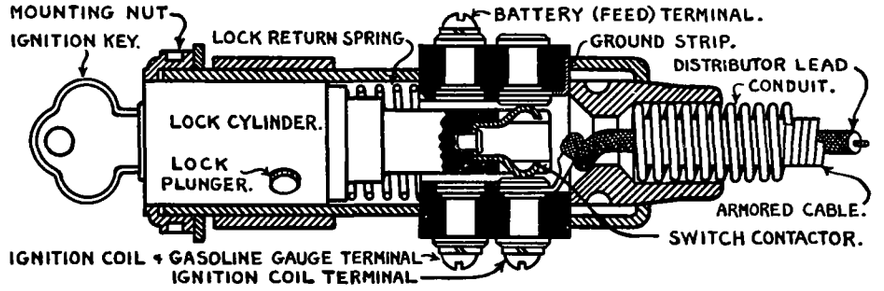
3. Place one test point on battery terminal (three terminal type only), place the second test point on each of the other terminals in turn (coil and gasoline gauge terminals). With the switch unlocked, the lamp should be lighted. With the switch locked, the lamp should not light.

DISASSEMBLY OF ELECTROLOCK:—Remove mounting nut with a spanner wrench and remove switch assembly from dash. Then unlock the switch and depress the plunger in the elongated slot in the side of the case. Then remove the contact assembly and inspect. In reassembling switch make certain that the retainer washer which holds the lock return spring in position does not touch either of the switch contacts. Assemble contact assembly so that the small tang on the side next to the lock cylinder is opposite the terminal screw. This tang fits into a hole on the end of the lock cylinder. On the three terminal type see that the tang on the contact finger base registers with the hole in the lock cylinder. To install this type lock cylinder in the barrel, apply pressure on key in direction key is turned to unlock switch, depress lock plunger, insert lock cylinder in barrel so that plunger lines up with elongated slot in lock barrel.

SERVICING DISTRIBUTOR:—To remove the distributor to the bench for service, remove the Electrolock from the dash and remove distributor from the engine as directed on the car data sheet. Then take entire distributor and Electrolock off the car. To remove Electrolock from the distributor, use special Electrolock wrench Part No. 829034 to remove square nut on terminal stud inside the distributor housing. On the Chevrolet distributor (on which this type Electrolock is standard equipment), it will first be necessary to turn the distributor shaft until advance weight mounting plate studs are 90 degrees from terminal stud, remove the three screws mounting the breaker plate and tilt the breaker plate down on the side nearest the

THREE TERMINAL TYPE.





terminal stud. The breaker arm must be slid up on the pin at the same time. Then remove the square nut and pull the Electrolock cable and stud assembly straight out. To remove the stud from the cable, use the special wrench to loosen the retainer nut in the end of the ferrule. A new locking washer must be used in reassembling. The various parts of the ferrule and stud assembly are illustrated in proper positions. Assemble these parts in order as shown. It will be necessary to remove the Electrolock from the distributor to replace the condenser and it is advisable also in replacing breaker arms.

Car Model & Year	Type	Lock Assembly	Switch & Cable	Lock Cylinder
Auburn 8-100 ('32), 8-101, 5 ('33)	15-S	4531	4625	4539
Auburn 12-160 ('32), 12-161, 5 ('33)	15-SD	4543	4624	4539
Essex Std. (1932)	15-S	4629	4441	4420
Ford A (1928-31)	12-A	5502	—	—
Hudson Eight (1932-33)	15-S	4628	4629	4420
Hupmobile 222('32),322 ('33),422('34)	5-B	4364	4363	1991
Hupmobile 216 ('32), 316 ('33)	5-B	4365	4463	1991
Hupmobile 226('32), 326('33), 426('34	5-B	4366	4369	1991
Packard 905, 6 ('32), 1005, 6 ('33)	15-S	5145	6710	—
Reo S (1932)	—	4637	4665	—
Willys Knight 66-D (1931-32)	—	4644	6761	—
Willys Knight 66-E (1933)	—	4802	6762	—

NOTE—All switches manufactured by the Mitchell Specialty Company and designed to be connected to the distributor by armored cable are known as Electrolocks. Later types connected to ignition coil are known as Mitchellocks. See following section for Mitchellock application list and complete data.

TYPE 5

DESCRIPTION:—The Electrolock is an ingnition switch mounted on the dash consisting of a lock cylinder in a steel case which is connected to the distributor housing terminal by an armored cable. The breaker lead from the coil is carried inside the cable which is fastened to the breaker terminal by a special design non-removable clip connection. This absolutely prevents tampering with the ignition circuit and prevents the car being started with the ignition turned off since the breaker is grounded through the Electrolock case and through the distributor attachment.

To unlock Electrolock, insert key in lock cylinder and turn ¼ turn to right. The lock cylinder will spring out closing the ignition switch. The key should then be removed since it is not necessary to lock the ignition. To turn off ignition, press lock cylinder in and make certain that it does not spring out again. This will turn off ignition, ground the breaker and lock the Electrolock itself to the car.

Connections:—The Type 5-B Electrolock has three connections on the side of the case. The ignition feed wire from the ammeter is connected to the terminal nearest the front or lock cylinder end of the case. The ignition coil lead and all accessories such as gasoline gauges or temperature indicators are connected to the middle terminal. The breaker lead from the coil is connected to the third terminal and the breaker circuit is completed through the armored cable to the terminal on the side of the distributor housing.

Servicing Distributor:—To remove distributor from car, unlock Electrolock, disconnect wires from side of case and remove Electrolock from mounting on dash. Then remove distributor from engine as directed on car data sheet. Lift out entire distributor and Electrolock assembly and remove to bench for distributor tests or repairs.

Trouble Shooting on Car:—Disconnect all wires on side of lock case and block open distributor contacts with a piece of cardboard or turn cam until contacts open. Then make following tests with six volt lamp circuit and test points:

(1) Place one test point on the primary terminal inside the distributor and place the second test point on the lock case. With the switch locked the lamp should burn. With the switch unlocked the lamp should not burn.

(2) Place one test point on the primary terminal inside the distributor and place the second test point on the No. 2 (or center) terminal of the switch. Unlock the switch, push the lock cylinder in half way and release it. The lamp should not light during this movement of the lock cylinder.

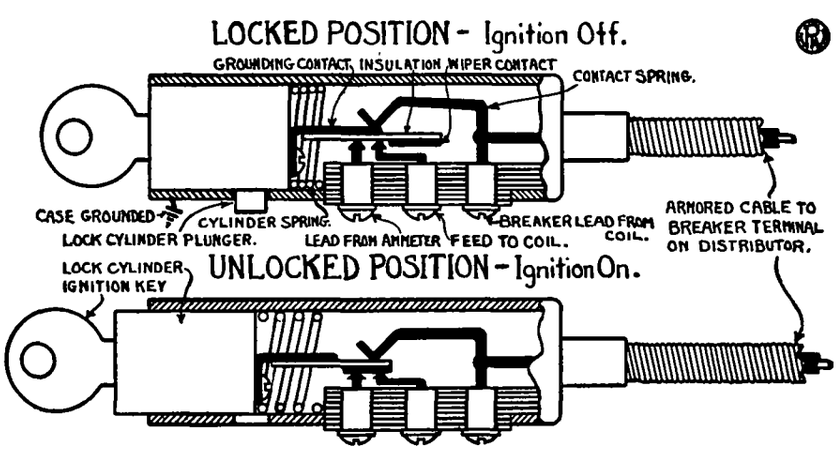
(3) Place one test point on the lock case and place the second test point on the No. 3 (or last) terminal. With the switch locked the lamp should burn. With the switch unlocked the lamp should not burn. If the lamp burns the Electrolock is grounded or the condenser is shorted or grounded. Disconnect condenser and repeat test.

If these tests indicate Electrolock is operating satisfactorily look for ignition trouble in the coil, breaker, distributor or spark plugs. If tests indicate trouble in the Electrolock, disassemble, examine and repair Electrolock as directed in the following paragraph.

SERVICING ELECTROLOCK:—Unlock Electrolock and remove from dash mounting. Disconnect all wires from case. Then take out small set screw on side of lock case and take out lock cylinder. Remove the coil spring directly behind the lock cylinder and pull out metal wedge holding bakelite terminal block in position. With terminal screws removed, the part of the bakelite piece in which the terminal screws are located can be pushed into the lock casing and the lock casing can then be slid back on the cable allowing the switch to be inspected. Any trouble in the switch due to broken parts can then be discovered. New parts for replacement can be obtained and the lock repaired.

If the lock cylinder does not work freely because of dirt in the lock case, the lock cylinder should be removed and cleaned off. Do not put oil or grease in the lock cylinder. If tumblers stick use graphite. In assembling Electrolock make certain that all terminals are insulated down to the screw heads to avoid possibility of short circuits.

ELECTROLOCK-TYPE 5B.



TYPES 15-S, 15-SD

DESCRIPTION:—These types follow Electrolock principles in that the breaker and ignition coil are grounded with the switch turned 'Off' and the breaker lead is armored to prevent the ground being relieved by cutting the lead.

These Electrolocks correspond to the previous 'B' type switches in that provision is made for the connection of accessories such as gasoline gauges (these should be connected to the coil feed terminal—see diagram) and in addition an extra terminal for Startix connection is provided. This terminal should be connected to the 'IGN' terminal on the Startix case.

The Type 15-SD Electrolock is designed for use with ignition systems using two coils, each controlled by a separate set of breaker contacts (see diagram on Auburn 12-160 using this system and Electrolock). Two breaker lead terminals are provided on the Electrolock switch assembly and these are connected to two insulated wires in the armored cable. These wires terminate in a special distributor terminal on the distributor housing from which the connection to each breaker arm is made.

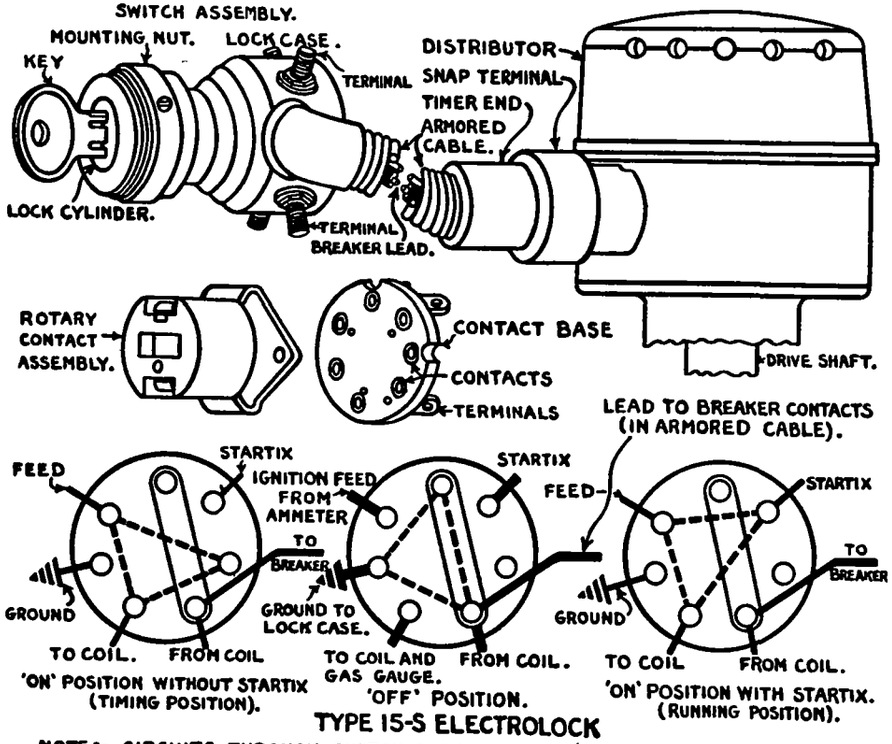
OPERATION:—These switches are provided with two 'On' positions and a special terminal for Startix connection. The 'On' position with Startix operative (key turned to the right) is the normal running position. The second 'On' position (key turned to the left) closes the ignition circuit but does not complete Startix circuit so that Startix is inoperative.

SERVICING:—Switch Assembly. To disassemble assembly for inspection and servicing, remove the lock from the mounting, disconnect all wires from terminals, turn back stakings and remove lock case cover. Take out all terminal screws and bushings, pull out contact base assembly and rotary contact for inspection. Replace all parts in reversed order and take care to securely stake lock case cover before reinstalling Electrolock.

Distributor Terminal and Current Wire Assembly. To disassemble Distributor Terminal for inspection and servicing, first remove lock case cover on switch assembly (see above) and open clips which hold end of current wire, then remove timer end and timer parts assembly from distributor housing, drill out distributor connection cup opposite timer end locking pin, drive out locking pin, turn back stakings and remove distributor terminal and current wire assembly through timer end.

Yale Type Lock Cylinders. To remove these lock cylinders, turn key toward left hand running position and press a small pointed tool into the hole on the side of the lock case at the same time. When the tool enters the hole in the lock cylinder, the retaining pin can be driven out and the lock cylinder withdrawn. In replacing the lock cylinder the retaining pin should be driven in securely.

TROUBLE SHOOTING:—Test circuits through Electrolock with lamp and test points to determine if switch is operating satisfactorily (see diagram for circuits). It should be remembered that 'Startix' terminal is connected to the feed terminal only with the switch in the right hand 'On' position. If these tests indicate that Electrolock is not operating correctly it should be disassembled and examined.



TYPE 15-S ELECTROLOCK

NOTE:- CIRCUITS THROUGH SWITCH COMPLETED BY ROTARY CONTACTOR ARE SHOWN BY DOTTED LINES THUS---- FOR EACH SWITCH POSITION. THE JUMPER ON THE CONTACT BASE ASSEMBLY IS NOT USED ON THE TYPE 15-SD

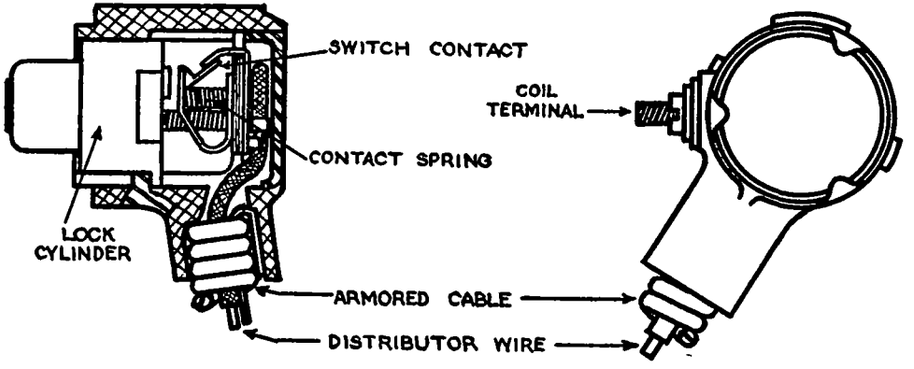
FORD TYPE 12-A

DESCRIPTION:—The design of the Ford Electrolock is different than the other types (see illustration). The plunger (distributor terminal) makes contact with the lock cylinder assembly when the switch is locked, grounding the breaker through the Electrolock case and cable. When the switch is unlocked, the plunger makes contact with the contact cup or contactor mounted on back of lock cylinder assembly which is insulated from it.

TROUBLE SHOOTING:—Use a lamp and test point to check circuits through switch. Disconnect wire on terminal on side of case, block open breaker contacts with an insulator, place on test lamp lead on primary terminal inside distributor housing, place the second test point on terminal on side of Electrolock. Lamp should light with switch turned 'on' and should go out with switch turned 'off'. Leave one test point on terminal inside distributor housing, place second test point on lock case. Lamp should light with switch turned 'off' and should go out when switch is turned 'on' (unlocked). If lamp remains lighted, Electrolock is grounded or condenser is grounded. Disconnect condenser and repeat test.

REMOVAL:—Free lock at instrument panel, disconnect wire, unscrew ferrule (cable connector) on side of distributor, pull entire unit out from lock end (cable passes through junction box on engine side of dash).

If tests indicate that Electrolock is defective, take out small screw on side of case, unlock switch, withdraw lock cylinder assembly. This will allow switch contacts to be inspected.



Car Model and Year	Type	Lock Assembly	Switch and Cable	Lock Cylinder
Chrysler, C6, CZ Coupe ('35)	24-B	6674	6675	—
Chrysler, C6, CZ (Radio)	24-R	6498	6672	—
Chrysler, C6, CZ Sedan ('35)	24-B	6676	6677	—
Chrysler, C6, CZ (Radio)	24-R	6499	6673	—
Chrysler, C1, C3 Exp. (1935)	24-R	6497	6671	—
Chrysler, C7, C8 (1936)	24-B	6519	6743	6286
Chrysler, C7, C8 (Convertible)	24-B	6748	6749	6286
Chrysler, C9, C10, C11 (1936)	24-B	6744	6745	6286
Chrysler, Royal C16, Imp. C14 ('37)	24-B	7055	7056	7075
Chrysler, Cust. Imp. C15 (1937)	24-B	7057	7058	7075
Chrysler, Airflow C17 (1937)	24-B	6744	6745	6286
Chrysler, Royal C18 (1938)	24-B	7055	7056	7075
Chrysler, Imperial C19 (1938)	24-B	7055	7056	7075
Chrysler, Cust. Imp. C20 (1938)	24-B	7057	7058	7075
Chrysler, Royal C22 (1939)	24-R	8054	8055	6286
Chrysler, Imperial C23 (1939)	24-R	8054	8055	6286
Chrysler, Cust. Imp. C24 (1939)	24-R	8112	8113	6286
Continental, 40 ('33), 41 ('34)	16-S	5174	6678	—
Continental, Flyer 60 (1933)	16-S	5174	6678	—
Cord, 810 (1936)	16-S	6679	6680	6622
Cord, 812, Schgd. 812 (1937)	16-S	6679	6680	6622
DeSoto, Airstrm. SF (1935)	24-B	6505	6682	—
DeSoto, Airstrm. (Taxicab)	24-R	6520	6687	—
DeSoto, Airflw. SG (1935)	24-R	6503	6681	—
DeSoto, Airstrm. S1 (1936)	24-B	6518	6686	6286
DeSoto, Airstrm. (Conv.)	24-B	6746	6747	6286
DeSoto, Airflw. S2 (1936)	24-B	6688	6689	6286
DeSoto, S3 (1937)	24-B	7055	7056	7075
DeSoto, S5 (1938)	24-R	7061	7062	6286
De Soto, S6 (1939)	24-R	8054	8055	6286
Dodge, DU, DV Coupe ('35)	24-R	6506	6690	—
Dodge, DU, DV Sedan ('35)	24-R	6507	6691	—
Dodge, D2 (1936)	24-R	6508	6697	—
Dodge, D5 (1937)	24-R	7061	7062	6286
Dodge, D8 (1938)	24-R	7640	7641	6286
Dodge, D11 (1939)	24-R	8054	8055	6286
Franklin, Olympic 18 ('33-'34)	17-S	4990 (A)	5248	—
Hudson, E Six (1933)	16-S	5173	6706	—
Hudson, GH Six (1935)	24-B	6509	6685	—
Hudson, HT, HU, HHU (1935)	24-B	6509	6685	—
Hudson, 63 Six (1936)	24-B	6696	6698	—
Hudson, 64, 65, 66, 67 (1936)	24-B	6696	6698	—
Hudson, 73 Six (1937)	24-B	7063	7064	6095
Hudson, 74, 75, 76, 77 (1937)	24-B	7063	7064	6095
Hudson 83 Six, 89 '112' (1938)	24-B	7642	7643	6095
Hudson 84, 85, 87 (1938)	24-B	7642	7643	6095
Hudson 90 '112', 98 (1939)	24-B	8062	8063	6095
Hudson 91, 92, 93 Six (1939)	24-B	8062	8063	6095
Hudson 95, 97 Eight (1939)	24-B	8062	8063	6095
Hupmobile, 321-K, ('33), 421, A ('34)	16-B	6699	5176	—
Hupmobile, 417W ('34), 517W ('35)	16-B	6701	5722	—
Hupmobile, 421J ('34), 521J ('35)	16-B	6700	5721	—
Hupmobile, 427T ('34), 527T ('35)	16-B	6700	5721	—
Hupmobile, 518D ('35), 618G ('36)	24-B	6702	6703	—
Hupmobile, 521O ('35), 621N ('36)	24-B	6704	6705	—
Hupmobile, 822E, 825H Exp. ('38)	24-B	7662	7663	7517
Hupmobile, Skylark R (1939)	24-B	8182	8183	7517
Hupmobile 6, 822E (1938), 922E (1939)	24-B	7644	7645	7517
Hupmobile 8, 825H (1938), 925H (1939)	24-B	7644	7645	7517
LaFayette, 3610 (1935-36)	24-B	6708	6709	6760
Nash, 1120, 1130 (1933)	16-S	5173	6706	—
Nash, 3540 (1935)	24-B	6510	6707	—
Nash, 3640 ('35), 3640A ('36)	24-B	6708	6709	6760
Packard, 905, 906 (1932)	16-S	5145	6710	—
Packard, 1001, 2, 3, 4 (1933)	16-S	5002	5102	—
Packard, 1005, 6 (1933)	16-S	5145	6710	—
Packard, 1107, 8 (1934)	16-S	5323	6741	—
Packard, 1108S (1934)	16-S	6666	6742	—
Packard, 1207 (1935)	16-S	5323	6741	—
Packard, 1208 (1935)	16-S	6666	6742	—
Packard, 120 LHD. (1935)	24-B	6511 (B)	6711	—
Packard, 120 LHD. (1935)	24-B	6513 (C)	6713	—
Packard, 120 RHD. (1935)	24-B	6512 (B)	6712	—
Packard, 120 RHD. (1935)	24-B	6514 (C)	6714	—
Packard, 120B LHD. (1936)	24-B	6513 (C)	6713	6760
Packard, 120B RHD. (1936)	24-B	6514 (C)	6714	6760
Packard, 115C Six (1937)	24-B	7216	7217	6760
Packard, 120C (1937)	24-B	7065	7066	6760
Packard, 1500, 1, 2 (1937)	16-S	7210	7211	5005
Packard, 1506, 7, 8 (1937)	16-S	7208	7209	5005
Packard, 1601, 1A, 2 (1938)	24-B	7646	7647	6760
Packard, 1603, 4, 5 (1938)	24-B	7650	7651	6760
Packard, 1607, 8 (1938)	24-B	7648	7649	6760
Packard, 1700 (1939)	24-B	8058	8059	6760
Packard, 1701, 1A, 2 (1939)	24-B	8058	8059	6760
Packard, 1703, 3A, 5 (1939)	24-B	8060	8061	6760
Packard, 1707, 8 (1939)	24-B	7648	7649	6760
Plymouth, PJ, PJ DeLuxe ('35)	24-R	6515	6715	—
Plymouth, PJ 7 Pass. Sedan ('35)	24-R	6516	6716	—
Plymouth, P1, P2 (1936)	24-R	6517	6717	6286
Plymouth, P3, P4 (1937)	24-R	7061	7062	6286
Plymouth, P5, P6 (1938)	24-R	7061	7062	6286
Plymouth, P7, P8 (1939)	24-R	8052	8053	6286
Reo, 1N Models (1933)	16-S	6721	6720	—
Reo, 2N Models ('33-'34)	16-S	6719	5171	—
Reo, S2, 3, 4, 5, 7 ('33-4-5)	16-S	6718	5170	—
Rolls Royce, 1934-35	17-S	5796 (A)	—	—
Studebaker, Dict. 5A, 6A (1937)	24-R	7071	7072	6286
Studebaker, Pres. 3C (1937)	24-R	7073	7074	6286
Studebaker, 7A, 8A (1938)	24-R (F)	7652	7653	6770
Studebaker, 7A, 8A (1938)	24-R (G)	7697	7698	6770
Studebaker, 7A, 8A (1938)	24-R (H)	7654	7655	6770
Studebaker, 7A, 8A (1938)	24-R (J)	7658	7659	6770
Studebaker, Pres. 4C (1938)	24-R (F)	7656	7657	6770
Studebaker, Pres. 4C (1938)	24-R (G)	7699	7700	6770
Studebaker, Pres. 4C (1938)	24-R (H)	7701	7702	6770
Studebaker, Pres. 4C (1938)	24-R (J)	7660	7661	6770
Studebaker, Champ. G (1939)	24-R	8150	8151	6966
Studebaker, Comm. 9A, Pres. 5C (1939)	24-R	8056	8057	8078
Terraplane, G, GU (1935)	24-B	6509	6685	—
Terraplane, 61, 62 (1936)	24-B	6696	6698	6095
Terraplane, 70, 71, 72 (1937)	24-B	7063	7064	6095
Terraplane, 80, 81, 82, 88 (1938)	24-B	7642	7643	6095
Willys, 77 (1933-34-35-36)	17-A	5159 (A)	4937	4759
Willys, 37 (1937)	17-A	5159 (A)	4937	4759
Willys Knight, 66E (1932)	16-S	5172 (D)	6726	—
Willys Knight, 66E (1932)	16-S	6724 (E)	6725	—
Willys Overland, 690A, 888A ('32)	16-S	6724 (E)	6725	—
Willys Overland, 690A (Closed)	16-S	5172 (D)	6726	—

(A)—No armored cable used (coil lead not protected). (B)—Cable Length 45½". (C)—Cable Length 37⅞". (D)—Cable Length 4-1/16". (E)—Cable Length 6⅝".
(F)—Mahogany Finish. (G)—Gunmetal Gray Finish. (H)—Burl Tan Finish. (J)—Silver Beige Finish.

NOTE—Mitchellocks are designed to be connected to the ignition coil by armored cable (except 'A' types without cable). See preceding section for complete data on Electrolocks also manufactured by Mitchell Specialty Company which are connected to distributor by armored cable.

TYPES 16-B, 16-S, 17-A, 17-S.

DESCRIPTION:—Mitchellock ignition switches incorporate a change in design from the Electrolock types (previous section) in that the primary lead from the switch to the coil is armored and the breaker lead from the coil is not taken through the switch but is connected directly to the distributor (see wiring illustrations). The Types 17-A and 17-S do not have this armored cable. The location of the terminals on the lock case differs with the various types (see illustration). Mitchellocks designed for use with Startix automatic starting switch have two 'On' positions, one for use in timing with ignition connected but Startix inoperative, and the second position with both ignition and Startix operative. This second position is the regular operating position of the switch. Details on each type switch are given on the car data sheet ('On' positions may be left and right or both to the right of the 'Off' position).

SERVICING:—To Disassemble Mitchellocks—Disconnect all leads and remove lock from mounting on dash. Remove stakings at rear of lock case which retain lock case cover. Remove all terminal screws and bushings. Pull lock case cover and contact base assembly out of lock case. Rotary contact assembly and adapter may then be remove. See special directions below for removal of each type lock cylinder from lock case.

To Assemble Mitchellocks:—Insert adapter in lock case making certain that tongue and pin on end of lock cylinder engage groove and slot on end of adapter. Insert rotary contact assembly and see that tongue and small pin on end of adapter enter groove and pin hole in end of rotor. Install contact base assembly, insert terminal screws (with bushings in place) through holes in lock case and screw firmly in place in terminal lugs on contact base assembly. See that ground strip on contact base assembly makes good contact with lock case, install lock case cover making certain that groove in cover engages projection within case, stake case securely.

Briggs & Stratton Lock Cylinders on Types 16-B, 16-S. To service these lock cylinders, first remove lock from mounting, disconnect ammeter lead and turn key to extreme right hand position, insert a 1/16 inch diameter pin as far as possible in hole in side of lock case, pull lightly on key until lock cylinder can be withdrawn.

Yale & Towne Lock Cylinders on Types 16-S, 17-S. These lock cylinders are removed for servicing in the same manner as the Briggs & Stratton lock cylinders used on the Types 16-B, 16-S. Follow directions in paragraph above.

Hurd Lock Cylinders on Type 16-S#5174. To service these lock cylinders, first remove lock from mounting, disconnect ammeter lead, turn key to extreme right hand position, press down on retaining pin (which projects into the small hole located at the top of the threaded front end of the lock case) with a small pointed tool until lock cylinder can be withdrawn.

Independent Lock Cylinders on Type 16-S—#5172, 17-A—#5159. To service these lock cylinders, disconnect ammeter lead, turn key to extreme right hand position, withdraw key, insert special 'extracting key', press key in as far as possible until lock cylinder can be withdrawn. These special 'extracting keys' will be sold only to authorized service stations and the number of the lock for which they are to be used must be specified (see list below).

TROUBLE SHOOTING:—Test circuits through the switch, using a lamp and test points, for each switch position to determine if switch is operating correctly. If switch appears to be defective, disassemble as directed above and examine. It should be remembered that Startix terminal is connected to feed terminal only with the switch key in the 'running' position and is not connected with the switch in the 'timing' position.

TYPES 24-B, 24-R, 24-S

NOTE:—Mitchellocks differ from 'Electrolock' types also manufactured by the Mitchell Specialty Company in that the switch is designed to be connected to the ignition coil by armored cable (rather than to the distributor as on Electrolocks), so that the coil lead is protected (rather than the breaker lead from the coil to the distributor). When Mitchellocks are used, the breaker lead is run directly from the coil to the distributor terminal and is not taken through the switch. Switch types numbered from 1 to 15 are Electrolocks, types above 15 are Mitchellocks.

DESCRIPTION:—Similar in design to previous type Mitchellocks except that terminals located on lock case cover (see illustration). Furnished in three types as follows:

'B' Type (24-B)—Has extra terminal for gasoline gauge or other accessory connection. Accessory terminal live only with switch 'on'.

'R' Type (24-R)—Same as above but switch has two 'on' positions; one for regular running with ignition on, and a second position with accessory terminal live but ignition off. This position may be used for gasoline gauge reading with engine not running or for radio control with car parked.

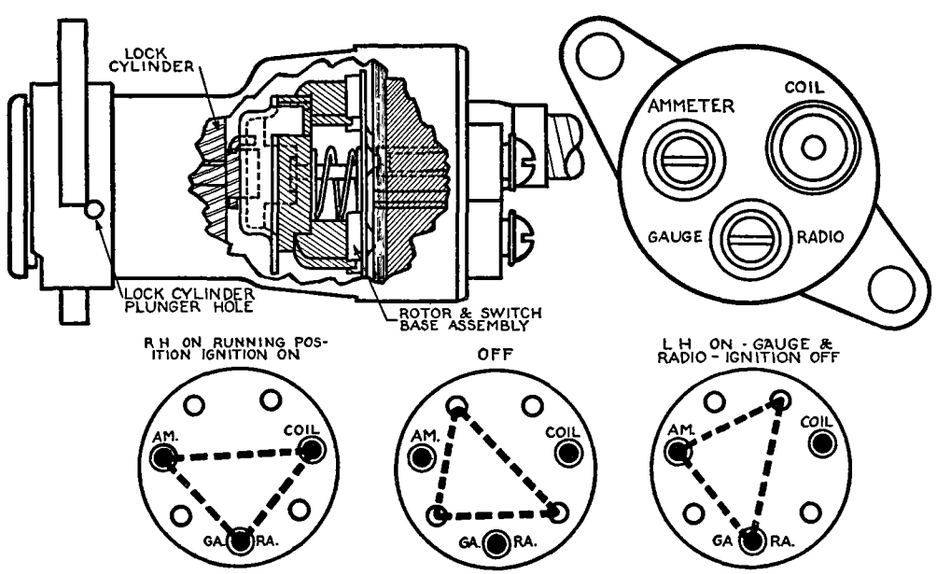
'S' Type (24-S)—Has additional terminal for Startix or other automatic starting device connection. Switch has two 'on' positions; one for regular running with Startix operative, and a second position with ignition on but Startix inoperative. This position used when checking timing or whenever automatic cranking not desired.

SERVICING:—To disassemble Mitchellock—With switch removed from dash and all leads disconnected, remove stakings on lock case retaining lock case cover, pull cover and entire rotor and switch base assembly out of case. Replace rotor and switch base assembly as a unit. This unit (Part No. 6420) normally stocked with sufficient excess current wire length so that wire can be cut to desired length for any installation.

To Assemble Mitchellock—See that prong on lock cylinder enters slot in face of adapter on forward end of rotor and switch base assembly, and that ridge in lock case registers with slot on side of switch base, push assembly into lock case, replace cover, stake securely.

Lock Cylinder:—To remove ignition lock, turn key to extreme right hand position (B & S locks only), insert 1/16" diameter pin in hole in side of lock case directly behind head, depress lock cylinder spring retainer, pull lock cylinder out.

TROUBLE SHOOTING:—Test circuits through switch with lamp and test points. See description above for terminals which should be 'live' with switch key in each position. If switch circuits are completed correctly and ignition still unsatisfactory, remove ignition coil base (cable connection) by taking out three screws. This will expose coil terminal in base. Check circuit through switch and coil lead to this terminal. If circuit tests OK. disconnect coil, test coil and replace if necessary. If tests indicate switch defective, disassemble as directed in Servicing below.



CIRCUITS THROUGH SWITCH SHOWN BY DOTTED LINES

NOTE:—These generators offered as special equipment on car models when fitted with Radio or when car used for special service such as City or State police, taxicab, truck, or school bus service, etc. In addition the manufacturers offer special extra-capacity generators which may be installed on practically any car model as follows:

AUTO-LITE MODELS

Generator Model.	Armature No.	Regulator.
Auto-Lite Model GBJ-4201	GBJ-2006	None
Auto-Lite Model GBJ-4202	GBJ-2035	None
Auto-Lite Model GBJ-4204	GBJ-2041	TC-4302A
Auto-Lite Model GBJ-4205	GBJ-2041	TC-4302A
Auto-Lite Model GBJ-4601	GBJ-2051	TC-4302A

DELCO-REMY MODELS

Generator Model.	Battery Gr. Ter.	Regulator.
930-A (Class A—Ford, Mercury)	Pos.	5597, 5810
930-B, D (Class A)	Pos.	5597
" "	Neg.	5599
930-E (Class A—12 v.)	Pos.	5598
" "	Neg.	5801
934-C, F, H, K, M, S (Class A)	Pos.	5597
" "	Neg.	5599
934-D, G, L, N, R, T (Class A—12 v.)	Pos.	5598
" "	Neg.	5801
935-L (Class C)	—	5554
936-N (Class B)	Pos.	5591
" "	Neg.	5592
954-A (Class A)	Pos.	5596
" "	Neg.	5587
954-B (Class A—Ford)	Pos.	5596
961-N (Class PA)	Pos.	5831
" "	Neg.	5832
973-M (Class A—Ford)	Pos.	5597
1102657 (Class A)	Neg.	5872
1102659 (Class A)	Pos.	5871
1105528 (Class A)	Pos.	5597
" "	Neg.	5599
1106401 (Class A—Ford, Mercury)	Pos.	5865

NOTE—Delco-Remy generators are classified as follows:
Class A—Two brush generator with vibrating voltage and current regulation.
Class B—Third brush control generator with vibrating voltage regulation.
Class C—Third brush control generator with non-vibrating voltage control
Class PA—Same as Class A, but for passenger car use only.
Grounded Terminal—Correct type regulator must be used depending upon which terminal of battery is grounded and care must be taken not to reverse generator polarity when generator and regulator are connected. To avoid polarity reversal, disconnect regulator field lead ('F' terminal) first and connect this lead last after all other leads have been connected.

ARMATURE TABLE.

Auto-Lite Generators.		Delco-Remy Generators.	
Generator.	Armature No.	Generator	Armature No.
GBJ-4201	GBJ-2006	934-L	1864035
GBJ-4202	GBJ-2035	934-M	1864250
GBJ-4204	GBJ-2041	934-N	1864258
GBJ-4205	GBJ-2041	934-P	1864322
GBJ-4601	GBJ-2051	934-R	1864329
GAR-4605	GAR-2089	934-S	1864281
GAR-4609-4	GAR-2116-B	934-T	1864328
GAR-4609A-4	GAR-2116-B	934-U	1861762
GCM—4802A-4	GCJ-2006-B	935-H	1856072
Delco-Remy Generators.		935-J, R, U	1854856
929-A	1856943	935-L	1854856
929-B	1857188	936-A, E, G, M, N	1864856
930-A	1863768	936-J	1858608
930-B	1862999	936-L	1860284
930-D, E	1864756	954-A, B	1865306
931-M, S	1853093	956-L	1857924
931-N, R, V, Z	1853375	961-N	1857866
933-F, G, H, J, L	1853375	967-N	1844827
934-C	1861983	973-M	1869725
934-D	1861702	1102657, 659	1879002
934-H	1863138	1105528	1861561
934-K	1864047	1106401	1874184

Car Application Table

Car Model	Special Service	Generator
Buick 40	City Police	931-Z
Buick 50, 60, 90	Radio and City Police	929-B
Buick 50, 60, 90	Radio and State Police	956-L
Chevrolet	City Police, Milk Truck, Taxi	931-N, R
Chevrolet	State Police	931-S
Chevrolet	High Speed Intercity Truck	931-M
Chevrolet	City Police	933-F, H
Chevrolet	Police, Overland Truck, Bus	933-J, L
Chevrolet	Police, Overland Truck, Bus	934-F, G
Chevrolet	State Police, Spec. Govt. Equip.	935-U
Chevrolet	State Police	936-J, L
Chevrolet	Master '35 (Canadian)	936-A
Graham 68	Radio	935-J
Graham 67	Radio	967-N
Graham 68, 73	Police	931-V
Graham 73	Radio	936-E
Graham 74	Radio	936-L
Graham 72	Radio	936-G
Oldsmobile 6 and 8	Police	933-G, L
Oldsmobile 6 and 8	Police	934-F
Pierce Arrow, all '34	Deluxe Equipment	929-A
Plymouth	Radio and City Police	931-R
Pontiac 603	City and State Police	933-L
Pontiac 6 and 8	City and State Police	934-F
Pontiac 6 and 8	City and State Police	933-L, 934-F
Reo 6A	Radio	936-M
Studebaker A '34	Radio	GAR-4605
Studebaker A '34	Radio	935-R
Studebaker B, C '34	Radio	935-H
Studebaker 1A, 2A '35	Radio (First Cars)	GAR-4609-4
Studebaker '35-'36	Radio (Later Cars)	GAR-4609-A-4
Studebaker Dict. '37	Radio	GCM-4802A-4

POLARIZING NOTE:—Whenever generator disconnected, polarize generator by connecting regulator "BAT" and "GEN" terminals momentarily after all leads connected and generator re-installed on car.

AUTO-LITE EXTRA CAPACITY GENERATORS

MODELS GBJ-4201, GBJ-4202, GBJ-4204, GBJ-4205, GBJ-4601

TYPE:—Third brush control type. Models GBJ-4201, 4202 are not regularly equipped with a regulator. When Type TC-4100 Current Regulator or Type TC-4200 Current Regulator and Cutout Relay are found installed on these generators refer to special article on these regulators for complete data. Models GBJ-4204, 4205, 4601 are regularly equipped with a Type TC-4302A Current Regulator and Cutout Relay. See special article on this type regulator for complete data. All generators are air-cooled by a suction fan built in the generator drive pulley or mounted independently on the drive end of the generator.

INSTALLATION:—Model GBJ-4601 is provided with mounting lugs at each end for conventional pivot-mounting with fan belt drive. When this model is installed on the Ford V8 (Police Service), the fan must be removed from the regular generator and installed on special drive pulley (Part No. SP-166) furnished with the generator. Model GBJ-4205 is designed for cradle mounting.

PERFORMANCE & ADJUSTMENT:— Charging Rate Adjustment. Regulator should be shorted out by connecting jumper wire between 'F' terminal on generator or fuse cup on side of regulator case and ground while adjustment is being made. Take off commutator cover band, shift third brush by hand counter-clockwise to increase, or clockwise to decrease charging rate. Third brush held in position by friction. Remove jumper wire after completing adjustment.
Cuts In—6.75-7.5 volts with charging current not to exceed 5 amperes.
Contacts Open—8.45-8.95 volts at 70°F.

Performance Data.

Cold — Regulator Contacts Closed — Hot					
Amperes	Volts	R. P. M.	Amperes	Volts	R. P. M.
0	6.4	650	0	6.4	680
4	6.7	780	4	6.75	840
8	6.9	900	8	7.0	980
12	7.2	1020	12	7.3	1175
16	7.45	1160	16	7.6	1460
20	7.7	1360	21	8.0	2400
25	8.0	2200			

Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—24 ozs. (min.) 36 ozs. (max.) each.
Field Current—4.18-4.62 amperes at 6.0 volts.
Field Fuse—5 ampere capacity. In knurled cup on side of regulator.
Motoring Current—4.94-5.46 amperes at 6.0 volts.

RELAY-REGULATOR:—Model TC-4302-A. This unit consists of a Cutout Relay and Current Regulator with carbon field resistance and field fuse in a single case. See separate articles for complete data on these units.

Cutout Relay.

Cuts In—6.5-7.25 volts with charging current not to exceed 5 amperes.
Cuts Out—.5-2.5 ampere discharge current with open circuit battery voltage of 6.3-6.8 volts after charging current of 15 amperes has passed through windings.
Contact Gap—.015-.045".
Air Gap—.015" plus .015" or minus .005" with contacts Closed.

Regulator.

Contacts Open—8.25-8.75 volts at 70° F.
Contacts Close—1.2-1.4 volts below opening point at same temperature.
Contact Gap—.005" minimum. **Air Gap**—.045" with contacts closed.

AUTO-LITE OPTIONAL GENERATORS
MODELS GAR-4605, GAR-4609-4, GAR-4609-A-4

TYPE:—Third brush control in conjunction with a Current Regulator (two-rate charging control). All specifications and adjustments are the same as given above for the Model GAR-4601 Extra-Capacity Generator except as noted below:

Performance Data—Model GAR-4605

Cold—Regulator Contacts Closed—Hot					
Amperes	Volts	R.P.M.	Amperes	Volts	R.P.M.
0	6.4	750	0	6.5	840
4	6.75	900	4	6.85	980
8	7.1	1025	8	7.25	1160
12	7.4	1200	12	7.6	1400
16	7.7	1380	16	8.0	1720
20	8.1	1675	21	8.5	2680
24.8	8.5	2400			

Performance Data—Models GAR-4609-4, 4609-A-4

Cold — Regulator Contacts Closed — Hot					
Amperes	Volts	R. P. M.	Amperes	Volts	R. P. M.
0	6.4	720	0	6.4	760
4	6.85	840	4	6.9	920
8	7.25	980	8	7.4	1080
12	7.7	1120	12	7.85	1280
16	8.1	1300	16	8.3	1560
20	8.5	1540	20	8.8	2000
25	9.0	2400	22	9.0	2600

Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—24 ozs. (mimimum—old brushes), 36 ozs. maximum—new brushes).
Field Current—3.75-4.15 amperes at 6.0 volts.
Field Fuse—7½ ampere (GAR-4605), 5 ampere (GAR-4609-4, 4609-A-4) located in knurled cup on side of regulator case.
Motoring Current—4.75-5.25 amperes at 6.0 volts (½ ampere additional if relay and regulator in circuit).

RELAY REGULATOR:—GAR-4605. Cutout Relay Model CB-4021S. Current Regulator Model TC-4101A. These are separate units and are both mounted on generator field frame. See separate articles for complete data on each unit. Specifications are given below:

Cutout Relay

Cuts In—6.4 volts, 750 R.P.M., 6.3 M.P.H. Voltage limits, 6.75-7.5 volts.
Cuts Out—.5-2.5 ampere discharge current.
Contact Gap—.025-.035". **Air Gap**—.010-.030" with contacts closed.

Current Regulator

Contacts Open—8.26-8.67 volts at 70° F.
Contacts Close—6.46-6.86 volts at 70° F.
Contact Gap—005" minimum. **Air Gap**—.030" with contacts closed.

RELAY REGULATOR:—GAR—4609-4, 4609-A-4. Model TC-4302-A. Consists of Cutout Relay and Current Regulator in a single case. All specifications and adjustments same as when used on Model GBJ-4601 Extra-Capacity Generator above.

DELCO-REMY EXTRA-CAPACITY GENERATORS
AERO-VOLT MODEL 935-L

TYPE:—Third brush control in conjunction with a Voltage Control Relay (step-voltage, non-vibrating) providing a two-rate charging control. See article on Voltage Control Relays for complete data. Generator is air-cooled by suction fan built in generator drive pulley.

INSTALLATION:—Generator provided with mounting lugs for conventional pivot-mounting with fan belt drive.

PERFORMANCE & ADJUSTMENT:—Charging Rate Adjustment—Regulator must be shorted out by connecting jumper wire between 'F' terminal on generator or control unit and ground while adjustment is being made. Take off commutator cover band, loosen lockscrew on commutator end plate, shift third brush by hand counter-clockwise to increase or clockwise to decrease charging rate, tighten lockscrew. Performance figures below are maximum rated capacity and must not be exceeded.

Performance Data.

	Amperes	Volts	R. P. M.
Cold	20-23	8.5-8.8	2800
Hot	16-20	8.1-8.5	3100

Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—22-26 ozs. (main brushes), 16-20 ozs. (third brush).
Field Current—2.3-2.6 amperes at 6.0 volts.
Field Fuse—6 ampere capacity (in control unit).

CONTROL UNIT:—Model 5554. This unit consists of a Cutout Relay and a Voltage Control Relay with a field resistance unit and field fuse in a single case. See separate articles for complete data on these units. Cutout Relay has special set of ground contacts above the armature. These contacts (GRD terminal) are used only for control of starter control units, signal lights, etc.

Cutout Relay.

Cuts In—6.4-6.8 volts.
Cuts Out—0-3 ampere discharge current at 6.3 volts.
Contact Gap—.020". **Air Gap**—.015" with contacts closed.

Voltage Control Relay

Contacts Open—8.35-8.65 volts (70°F), 7.8-8.15 volts (180°F).
Contacts Close—7.3-7.7 volts (70°F), 6.6-7.05 volts (180°F).
Contact Gap—.010". **Air Gap & Armature Travel**—.035".
Contact Spring Tension—.7-.9 ounces.

DELCO-REMY EXTRA-CAPACITY GENERATORS
AERO-VOLT MODEL 936-N

TYPE:—Third brush control in conjunction with Vibrating Voltage Regulator regulation. Voltage Regulator is new type with special coil winding controlled by ignition switch (IGN terminal connection). See separate article for complete data. Generator is air-cooled by suction fan built-in generator drive pulley.

INSTALLATION:—Generator is provided with mounting lugs for conventional pivot-mounting with fan belt drive.

PERFORMANCE & ADJUSTMENT:—Third brush on these types is fixed and is not designed to regulate charging rate (this brush is used to limit maximum output at high speeds). Charging rate is adjusted by changing voltage regulator armature spring tension. Increase spring tension to increase charging rate, or decrease spring tension to decrease charging rate. See separate article on Vibrating Voltage Regulators for complete directions for making this adjustment. Maximum rated capacity for generator as given below must not be exceeded.

Performance Data.

	Amperes	Volts	R.P.M.
Cold	23-27	8.8-9.0	3000
Hot	18-23	8.2-8.7	3200

These performance figures are correct with ammeter connected in charging line at 'BAT' terminal with 'F' terminal grounded. This type generator must not be operated on open-circuit.

Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—22-26 ozs. (main brushes), 16-20 ozs. (third brush).
Field Current—2.3-2.6 amperes at 6.0 volts.

CONTROL UNIT:—Model 5591, 5592. Unit consists of a Cutout Relay and a Vibrating Voltage Regulator with field resistance unit in a single case mounted on the dash. The case must be grounded and a ground lead may be found from the case to a ground screw on the generator frame. Cutout Relay has special ground contacts mounted above the armature (GRD terminal) which are used for starter solenoid control, signal light control etc.
NOTE—Model 5591 regulator used with positive (+) battery ground, and Model 5592 with negative (—) battery ground.

Cutout Relay.

Cuts In—6.9-7.6 volts.
Cuts Out—0.3 ampere discharge current at 6.3 volts.
Contact Gap—.020". **Air Gap**—.020" with contacts closed.

Voltage Regulator.

Setting—Generator voltage should be 7.55-7 85 volts (70°) and 7.45-7.55 volts (150°F) operating at 2800-3000 R. P. M. charging a battery at not less than 8 amperes. Generator must not be operated on open-circuit. See separate article for complete adjustment instructions for this vibrating Voltage Regulator.
Contact Gap—.020". **Contact Spring Tension**—2.7-3.5 ounces.
Air Gap—.063" between armature and core (armature down so that fibre bumper just touches stop). .010" between fibre bumper and stop with armature up.

DELCO-REMY EXTRA-CAPACITY GENERATORS

930-A, B, D; 934-F; 954-A, B; 961-N; 973-M; 1102657; 1102659; 1105528; 1106401

TYPE:—Two brush, shunt wound type. Used with vibrating type voltage regulator and current regulator. See article on this type regulator for complete data. Generator is air-cooled by suction fan built in drive pulley.

INSTALLATION:—Model 954-A provided with mounting lugs for conventional pivot mounting with fan belt drive. Models 930-A and 954-B are special Ford types with mounting bracket on drive end similar to bracket on regular Ford generator so that generator may be installed after regular generator is removed without any modification of the mounting on the engine.

PERFORMANCE AND ADJUSTMENT:—No third brush is used and no provision is made for regulation on the generator. Charging rate is determined by setting of voltage regulator (up to rated capacity of generator) and maximum output is controlled by setting of current regulator. See adjustment instructions under Control unit below. Performance figures given below are maximum rated capacity of generator and must not be exceeded.

Performance Data—930-A, D

	Amperes	Volts	R.P.M.
Cold	26	8.1-8.3	1450

Performance Data—930-B

Cold	22	8.0	1100

Performance Data—934-F, 1105528

Cold	26	8.1-8.3	1325

Performance Data—954-A, B

Cold	22	8.0	1600

Performance Data—961-N

Cold	25	8.0	1650

Performance Data—973-M

Cold	26-28	8.0	1500

Performance Data—1102657, 1102659—See Note

Cold	30	8.0	1800

Performance Data—1106401

Cold	30	8.0	960

1102657, 1102659 Note—Output of 30 amperes at 1800 R.P.M. Maximum output dependent upon Current Regulator Setting.
Rotation—Clockwise (930-B), counter-clockwise (others) at commutator end.
Field Current—1.7-2.0 amperes at 6 volts (934-F, 1105528, 1106401), 2.3-2.6 (954-A, B), 2.0-2.2 (961-N), 1.7-1.85 (973-M), 1.76-1.88 (1102657, 1102659), 1.8-2.3 amperes (all others).

CONTROL UNIT:—5587, 5596, (954-A, B); 5597, 5599 (930-A, B, D; 934-F; 973-M); 5810 (930-A); 5831, 5832 (961-N); 5865 (1106401); 5871 (1102659); 5872 (1102657). Consists of Cutout Relay, Vibrating Voltage and Vibrating Current Regulator in single case usually mounted on dash. The case must be grounded and a lead is **usually run from the control unit terminal 'GRD' to a ground screw on the** generator field frame or to the engine block. See separate article for complete data on these units.
NOTE—Models 5596, 5597, 5810, 5831, 5865, and 5871 used when positive terminal of battery is grounded, Models 5587, 5599, 5832, 5872 when negative terminal grounded.

Cutout Relay

Cuts In—6.9-7.6 volts.
Cuts Out—3 ampere maximum discharge current.
Contact Gap—.020". **Air Gap**—.020" with contacts closed.

Voltage Regulator

Setting:—Generator voltage should be 7.05-7.35 volts (70°F), 7.00-7.10 volts 150° F. Regulator is over-compensated for temperature and must be checked at these temperatures. Generator must not be operated on open-circuit when making these tests.

Adjustment:—Disconnect lead on 'IGN' terminal on regulator case, connect jumper between 'IGN' and 'BAT' terminals, connect test ammeter in charging line at 'BAT' terminal, connect voltmeter between 'IGN' terminal and ground, Operate generator at 2800-3000 R.P.M., adjust charging rate to 8-10 amperes, adjust regulator by bending spring hanger at lower end of armature spring slightly until performance is shown above, restore original connections.
NOTE—Do not operate generator on open-circuit at any time or at excessive speed with current regulator shorted out. Voltage Regulator readings should be taken with cover on unit and setting should be checked by decreasing speed until cutout relay contacts open and then increasing speed to original point.
Contact Gap—.020". **Contact Spring Tension**—3.5 ounces.
Air Gap—.057" (5587), .063" (others) between armature and core with armature held down so that fibre bumper just touches stop. .010" between fibre bumper and stop with armature up.

Current Regulator.

Setting:—Must not exceed rated capacity of generator on which unit is installed (see generator performance above). Settings for each type regulator as follows:

Control Unit	Generator	Setting
5587, 5596	954-A, B	20-22 amperes
5597, 5599	930-A, B; 934-F; 973-M; 1105528	26-28 amperes
5810	930-A	24-26 amperes
5831, 5832	961-N	26-28 amperes
5865	1106401	29-31 amperes
5871	1102659	32-34 amperes
5872	1102657	32-34 amperes

Adjustment:—Make connections as above (voltage regulator test) except that lead at 'IGN' terminal should be disconnected to eliminate voltage regulator action. Operate generator. Adjust regulator by bending spring hanger at lower end of armature spring until performance is as shown above.
NOTE—Generator voltage must not be allowed to exceed 8.5 volts with voltage regulator shorted out.
Contact Gap—.020". **Contact Spring Tension**—3.5 ounces.
Air Gap—.075" between armature and core with armature down until fibre bumper just touches stop. .010" between fibre bumper and stop with armature up.

DELCO-REMY OPTIONAL GENERATORS

MODELS 929-A,B, 931-M,N,R,S,V,Z, 935-H,J,R,U, 936-A,E,G,L,M, 956-L, 967-N

TYPE:—These generators are all third brush control type in conjunction with a Voltage Control Relay (step-voltage, non-vibrating type). All specifications and adjustments are exactly the same as given for the Extra-Capacity Generator Model 935-L above except as noted below:

Performance Data—Models 929-A, B

	Amperes	Volts	R. P. M.
Cold	23-26	8.8-9.1	2200
Hot	17-20	8.1-8.5	2400

Performance Data—Models 931-N, R, V, Z

Cold	22-24	8.6-9.0	1300
Hot	13.5-16.5	7.7-8.1	1600-1800

Performance Data—Models 931-M, S

Cold	23-26	8.8-9.1	2300
Hot	17-20	8.1-8.5	2500

Performance Data—Model 956-L

Cold	23-26	8.8-9.2	2500
Hot	18-21	8.2-8.5	2800

Performance Data—Model 967-N

Cold	17-20	8.2-8.5	1900
Hot	13-15	7.7-8.0	1900

Field Current—1.8-2.3 amperes on Models 929-A, B. 1.5-1.8 amperes on Models 931-M, S. 3.5-4.0 amperes on Models 931-N, R, V, Z. 2.1-2.5 amperes on Model 956-L. 1.75-2.25 amperes on Model 967-N. All field readings at 6.0 volts.

Brush Spring Tension—14-18 ozs. (all brushes) on Model 956-L.

CONTROL UNITS:—All data on Cutout Relay and Voltage Control Relay used with these generators is the same as given for the Model 5554 used with the Extra-Capacity Generator Model 935-L except as noted below:

Model 5590 (936-G generator):—On this model the Cutout Relay contact gap should be .018-.025" and the air gap .018-.022". Voltage readings for the Voltage Control Relay (hot) should be made at 150°F. instead of 180°F.

Model 5585 (936-A, 936-L):—On this model voltage readings for the Voltage Control Relay (hot) should be made at 150°F instead of 180°F.

Model 5025554 (931-N, 931-S). This is a North East vibrating type voltage regulator. Cutout Relay is located in regulator case. Specifications are as follows:

Cutout Relay

Cuts In—6.5-6.75 volts. **Cuts Out**—3 ampere maximum discharge current.
Contact Gap—.012-.020".
Air Gap—.027-.030" between armature and core with contacts closed.

Voltage Regulator

Setting—Spring tension should be adjusted to hold generator open-circuit voltage at 7.5 volts when generator is operated at 2200-2300 R.P.M.
Contact Gap—.017-.020". **Air Gap**—.010-.015".

DELCO-REMY OPTIONAL GENERATORS

MODELS 933F, G, H, J, L; 934-C, D, F, G, H, K, L, M, N, R, S, T

TYPE:—These are shunt-wound generators (two brush type, no third brush used) with current and Voltage regulation by individual vibrating Current and Voltage Regulator units in the Control Unit. Generators are air-cooled by a suction fan built in the generator drive pulley.

PERFORMANCE & ADJUSTMENT:—Charging rate is controlled by Voltage regulator and will depend upon battery voltage and lamp load. Current regulator limits charging rate at maximum point so that generator output will be constant for all speeds above the peak or point where output is controlled by the current regulator. Current Regulator is normally set to control output at maximum rated capacity of generator as given in table below and this setting must not be exceeded. Charging rate below this point is controlled by Voltage Regulator. See regulator setting below.

Performance Data—Model 933-F

	Amperes	Volts	R.P.M.
Cold	19.5-22.5	6-7	4000

Performance Data—Models 933-G, H, J, L

Cold	22	8.0	1200

Performance Data—934, C, H, K, M, S

Cold	28	8.0	1400

Performance Data—Models 934-D, G, L, N, R, T

Cold	17	14.5-14.75	1250

Performance Data—934-F

Cold	26	8.1-8.3	1325

Rotation—Clockwise (934-C, D), counter-clockwise (all others) at commutator end.

Brush Spring Tension—22-26 ounces (all brushes).

Field Current—1.7-2.0 amperes at 6.0 volts (all 6 volt generators), 1.25-1.45 amperes at 12.0 volts (all 12 volt generators).

CONTROL UNIT:—**Model 5587 (933-F, G, H, J, L), 5597, 5599 (934-F).** Units consist of a Cutout Relay, Voltage Regulator, Current Regulator, and field resistance mounted in a single case on the dash. The case must be grounded and a ground lead will be found leading from the control unit terminal 'GRD' to a ground screw on the generator field frame. Cutout relay has extra set of ground contacts mounted on the armature (R terminal). These contacts are used for starter solenoid control etc. See separate article for complete data on these units.

Cutout Relay

Cuts In—6.9-7.6 volts.
Cuts Out—3.0 ampere maximum discharge current.
Contact Gap—.020". **Air Gap**—.020" with contacts closed.

Voltage Regulator

Setting:—Generator voltage should be 7.05-7.35 volts (70°F), 7.00-7.10 volts (150°F) operating at 2800-3000 R. P. M. and charging a battery at 8-10 amperes. Do not operate generator on open circuit. Voltage regulator is adjusted by changing armature spring tension. See article on Vibrating Voltage and Current Regulators for complete adjustment instructions.
Contact Gap—.020". **Contact Spring Tension**—3.5 ounces.
Air Gap—The Air Gap should be .063" between armature and core with armature held down so that fibre bumper just touches stop. .010" between fibre bumper and stop with armature up.

Current Regulator

Setting—Check setting with ammeter connected in charging line at 'BAT' terminal. Disconnect lead on 'IGN' terminal to eliminate voltage regulator action (generator voltage must not be allowed to exceed 8.5 volts with voltage regulator out of action). Adjusted by changing armature spring tension. See article on Vibrating Voltage and Current Regulators for complete adjustment directions. Setting should be as follows:

Control Unit	Generator	Setting
5587	933-F, G, H, J, L	20-22 amperes
5597, 5599	934-F	26-28 amperes

Contact Gap—.020". **Contact Spring Tension**—3.5 ounces.
Air Gap—.075" between armature and core with armature down so that fibre bumper just touches stop. .010" between fibre bumper and stop with armature up.

Models 5598, 5801 (934-D, G, L, N, R, T). These are 12 volt units. All specifications and adjustments same as for 6 volt units given above. Settings are as follows:

Cutout Relay

Cuts In—13-14 volts **Cuts Out**—3.0 ampere maximum discharge current.

Voltage Regulator

Setting—Generator voltage should be 14.3-14.9 volts (70°F), 14.2-14.4 volts (150°F).

Current Regulator

Setting—15-17 amperes maximum.

DELCO-REMY OPTIONAL GENERATORS
MODEL 936-J

TYPE:—Third brush control in conjunction with vibrating Voltage Regulator. All specifications and adjustments for this generator are the same as given for the Extra-Capacity Generator Model 936-N above.

CONTROL UNIT:—**Model 5588.** All specifications and adjustments same as for Model 5592 listed under Model 936-N generator above.

NOTE:—This type Regulator used on the following car models:

Car Model	Year	Regulator	Generator
Essex-Terraplane KT, KU	(1933)	TC-4102A	GBK-4602
Hudson LL, LT, LTS	(1933)	TC-4102A	GBK-4602
Hupmobile 427, 527-T	(34-35)	TC-4102A	GAR-4606
Terraplane K, KU	(1934)	TC-4102A	GBK-4602

DESCRIPTION:—The Two-Charge Regulator consists of a relay which cuts in a fixed resistance unit in series with the generator field when the generator voltage reaches the maximum for which the unit is set and cuts out this resistance when the generator voltage falls to the minimum for the which the unit is set. As generator voltage on third-brush control type generators rises as the battery becomes charged, the regulator provides a higher charging rate for a discharged battery and reduces the charging rate as the battery becomes charged. The resistor is a fixed unit and is merely cut in or out of the field circuit as the regulator contacts open and close. This provides two definite charging rates, the high rate being secured with the resistor shorted out of the field circuit (regulator contacts closed), and the lower rate with the resistor in series with the field coils (regulator contacts open).

OPERATION:—When the generator voltage reaches the maximum for which the unit is set, the current flow through the shunt winding of the regulator opens the regulator contacts cutting the resistance in the field circuit (resistor unit is connected across the contacts and is short-circuited when the contacts are closed). The anti-flutter winding (second coil winding) also comes into action when the contacts open. The contacts remain open until the generator voltage falls to the minimum for which the unit is set and then close, shorting out the resistance so that the higher charging rate is resumed. A bi-metal spring support extension on the armature compensates the regulator for temperature variations.

PERFORMANCE AND ADJUSTMENT:—Regulator should perform in accordance with this table:

Models TC-4101-A, TC-4103-A, TC-4201-A, TC-4202-A.

Contact Opening Voltage	Temperature	Contact Closing Voltage
8.38-8.82	50°F.	6.58-6.98
8.32-8.75	60	6.52-6.92
8.26-8.67	70	6.46-6.86
8.20-8.60	80	6.40-6.80
8.13-8.54	90	6.34-6.76
8.07-8.50	100	6.29-6.71
8.02-8.44	110	6.24-6.67

Model TC-4102A

Contact Opening Voltage	Temperature	Contact Closing Voltage
7.98-8.42	50°F.	6.58-6.98
7.92-8.35	60	6.52-6.92
7.86-8.27	70	6.46-6.86
7.80-8.20	80	6.40-6.80
7.73-8.15	90	6.34-6.76
7.67-8.10	100	6.29-6.71
7.61-8.05	110	6.24-6.67

NOTE:—All models are regularly equipped with Part No. TC-51 resistance unit of 1.85-2.10 ohms.

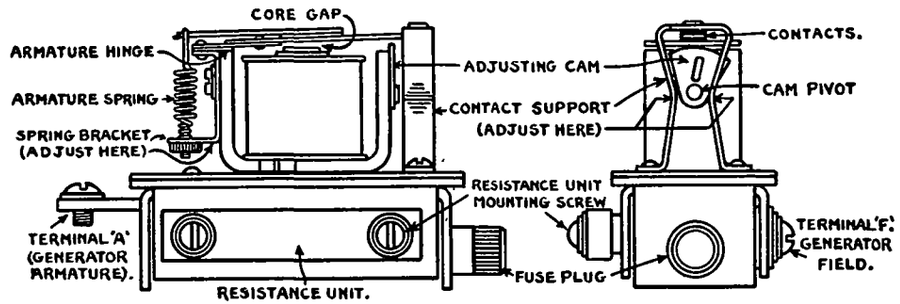
Regulators should be carefully tested (with full allowance being made for air temperature) before adjustments are made. See test procedure below. The manufacturers recommends that units which test defective or out of adjustment be replaced rather than adjusted or repaired in the field. Adjustment instructions are as follows:

(1) **Contact point opening (from high to low charging rate).** Adjust armature spring tension by bending the lower spring bracket (see illustration). Do not unsolder nut, any necessary adjustment can be made by bending the spring bracket. Be careful not to distort the bronze armature hinge. Distortion of hinge will cause unsatisfactory regulator operation. Check performance after adjusting.

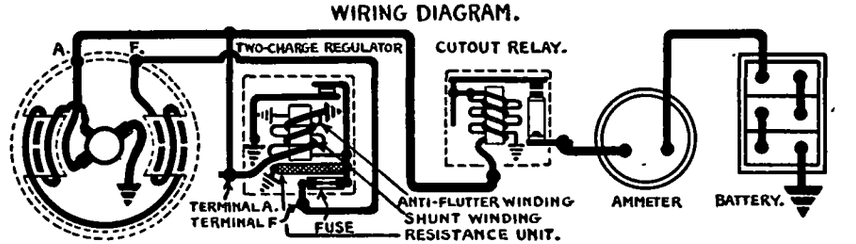
(2) **Contact point closing (from low to high charging rate).** Adjust brass cam, which acts as armature stop and controls contact gap (see illustration). After completing adjustment, apply a small amount of air-drying varnish to cam to prevent it slipping in service. Check performance after adjusting.

TESTING:—On the car. Connect a variable resistance in charging line to control generator voltage. Test voltmeter should read and be accurate to within .1 volt. Before test is made, car should stand in room with uniform temperature for at least one hour. Check air temperature when test is made, by thermometer placed about one inch from regulator. Regulator cover must be in place while testing. Regulator should perform in accordance with figures given in Performance Section above.

Bench Testing. Regulator should preferably be tested on bench. Connect voltmeter between terminal 'A' on regulator and ground. Ground one terminal of a 12 volt battery. Connect the other battery terminal to one side of a variable resistance and ground the other resistance terminal. Connect the sliding contact of the resistance to the 'A' regulator terminal. Connect a 32 cp. 6 volt lamp between the 'F' regulator terminal and a center tap on the battery (supplying 6 volts). Regulator action can now be checked by varying battery voltage by means of the variable resistance. Observe all temperature precautions noted in paragraph above. Resistance unit for this test should be 12 volts, 48-50 ohm type.



WIRING DIAGRAM.



SPECIFICATIONS:—Contact Gap—.005" minimum. See contact point closing adjustment above.

Core Gap:—.030" plus or minus .001" with contacts closed. Adjusted by expanding or contracting upper contact support bridge. If core gap is greater than specified, the temperature compensation feature is increased. If core gap is less than specified, the contacts tend to open at lower voltages with extreme temperatures and performance will not be as noted in performance table.

Resistance Unit:—Resistance units are furnished in following standard sizes:

Resistance	Marking	Part No.
1.85-2.10 ohms	1.85	TC-51
.90-1.1 "	1	TC-51A
2.75-2.95 "	2.85	TC-51B

Coils—Shunt winding should test 43-48 ohms (between generator 'A' terminal and ground). Anti-flutter winding should test 36-44 ohms (between 'F' terminal and ground with contacts open and resistance unit disconnected). All tests should be made at 75°F.

NOTE:—When regulator is mounted on car in any other location than on generator field frame, the armature should be vertical (viewed along length). Excessive vibration should be avoided. Regulator is grounded through mounting and a good ground should be provided (remove paint and grease from under mounting lugs).

SERIES TC-4300 TWO-CHARGE (CURRENT) REGULATOR

DESCRIPTION:—This type unit consists of a Cutout Relay and Two-Charge Regulator or Current Regulator combined in a single case. Types used as standard or optional equipment on car models as follows:

Car Model	Regulator	Generator
Chrysler C6, CZ, C1, C3 Exp. ('35)	TC-4301-A	GAR-4608-A,B,B-5
Chrysler C7, C8, C9, C10, C11 ('36)	TC-4301-A	GAR-4608A-5,B-5
Cord 810 (1936)	TC-4302-A	GAR-4630-5
Cord 810 (1936) 812 (1937)	TC-4306-A	GBR-4603-4
De Soto SF, SG (1935)	TC-4301-A	GAR-4608-5
De Soto S1, S2 (1936)	TC-4301-A	GAR-4608A-5
Dodge DU ('35), D2 ('36)	TC-4301-A	GAR-4608-5,A-5
Hudson GH, HT, HU, HHU, (1935)	TC-4304-A	GBK-4602-1
Hudson 63, 64, 65, 66, 67 (1936)	TC-4304-A	GAR-4701-6
Hupmobile 521-O ('35), 621-N ('36)	TC-4302-A	GAR-4620-5
Hupmobile 825H (1938) Exp.	TC-4302-A	GAR-4620-5
Lincoln V-12 (1935-36-37)	TC-4302-A, 5-A	GBC-4103
Lincoln V12 (1938-39)	TC-4305-A	GBC-4103
Nash 3620, 3680 (1936)	TC-4313-A	GBR-4602-4
Packard 120 (1935)	TC-4302-A	GAR-4611-5
Packard 120B (1936)	TC-4302-A	GAR-4611A-5
Packard 120B (1936) Later cars	TC-4302-B	GBR-4601-5
Plymouth PJ Deluxe (1935)	TC-4301-A	GAR-4608-5
Plymouth P2 Deluxe (1936)	TC-4301-A	GAR-4608E-5
Studebaker 1A, 2A ('35) Radio	TC-4302-A	GAR-4609-4,A-4
Studebaker 3A, 4A ('36) Radio	TC-4302-A	GAR-4609A-4
Studebaker 5A, 6A ('37) Radio	TC-4302-A	GCM-4802A-4
Terraplane G ('35) Spec. Equip.	TC-4304-A	GBK-4601-2
Terraplane GU Deluxe ('35)	TC-4304-A	GBK-4602-1
Terraplane 61 ('36) Spec. Equip.	TC-4304-A	GAR-4702
Terraplane 62 (1936)	TC-4304-A	GAR-4701-6
Willys Truck (1938-39)	TC-4317-A	GCS-4809A-5

OPERATION:—Regulator contacts are normally closed. When the generator voltage reaches the maximum for which the unit is set, the current flow through the regulator winding creates a magnetic field of sufficient strength to open the regulator contacts. This cuts the resistor in the field circuit and reduces the charging rate to the low rate. The resistor unit is connected across the regulator contacts and is short-circuited with the contacts closed. The generator continues to charge at the low rate until the voltage drops to the minimum for which the unit is set, the contacts then close, short-circuiting the resistor and the generator again charges at the high rate. A magnetic shunt of nickel alloy is used to compensate for temperature changes and operating voltages are not uniform for all temperatures (see table below).

PERFORMANCE & ADJUSTMENT:—Regulators should perform as shown below. Regulators should be carefully tested with allowance being made for temperature before any adjustments are made. Check mechanical specifications, connect accurate voltmeter at battery terminal of unit, if necessary insert small resistance in charging circuit (approximately .25 ohms) to bring generator voltage up to regulator operating point. Cycle regulator by increasing generator speed up to point where regulator contacts just open and then decreasing speed to point where contacts just close before taking readings. All tests should be made with regulator cover in place.

Contact Opening Voltage

Models TC-4301A, 1B, 2A, 2B, 4A, 5A, TC-4306A, 7A, 8A, 9A, 11A, 12A, 13A, TC-4314A, 16A, 17A, 19A.

Temperature	Volts
50°F	8.40-8.90
60	8.32-8.82
70	8.25-8.75
80	8.18-8.68
90	8.10-8.60
100	8.03-8.53
110	7.96-8.46

Model TC-4304A (Hudson and Terraplane)

Temperature	Volts
50°F	8.14-8.64
60	8.07-8.57
70	8.00-8.50
80	7.93-8.43
90	7.86-8.36
100	7.79-8.29
110	7.72-8.22

Contact Closing Voltage

All 6 Volt Units—1.2-1.4 volts below opening point at same temperature.

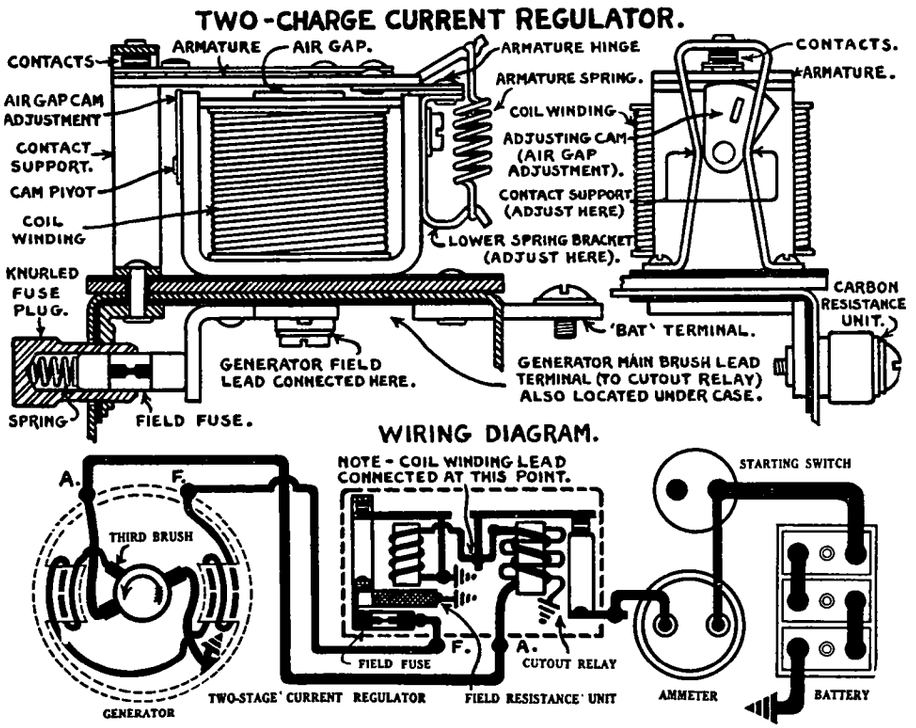
Models TC-4303A, 3B, 3C, 10A, 15A, 18A, 21A, 22A.

Temperature	Contact Opening Voltage	Volts
50°F.		16.90-17.70
60		16.74-17.54
70		16.60-17.40
80		16.46-17.26
90		16.30-17.10
100		16.16-16.96
110		16.02-16.82

Contact Closing Voltage

All 12 Volt Units—2.4-2.8 volts below opening point at same temperature.

Testing:—On the Car. Allow car to stand in room with uniform temperature for one hour before testing. Check air temperature when test is made by placing thermometer about one inch from regulator winding. Regulator cover must be replaced when tests are run. Increase generator speed slowly and note voltmeter reading when regulator contacts open (connect small resistance in charging line if necessary in order to secure regulator action). Decrease speed, note when contacts close. Adjust as follows:



(1). Contact Opening Point (from high to low charging rate)—Adjusted by bending lower spring bracket to increase or decrease armature spring tension. Bracket should be bent down (increase spring tension) to raise operating voltage, or up (decrease spring tension) to lower operating voltage. Be careful not to distort armature hinge (armature must move freely).

(2). Contact Closing Point (from low to high Charging Rate)—Adjusted by changing position of brass cam which controls core gap with contacts open (lower armature stop). Turn cam to increase core gap to increase operating voltage, or decrease core gap to decrease operating voltage. Apply small amount of air-drying varnish after completing adjustment tc prevent cam from moving in service. Check performance after adjusting.

After adjustments have been completed, regulator should be cooled off tc room temperature and performance rechecked.

SPECIFICATIONS:—Contact Gap—.005" minimum. See contact closing adjustment above and core gap adjustment below.

Core Gap—.045" with contacts closed. Adjust by expanding or contracting upper contact support bridge to change position of upper contact. On first models with two holes punched in the nickel plate, core gap was set at .041" plus or minus .001".

Coil Resistance—To check winding, disconnect coil lead at point where it is soldered to cutout relay yoke. Coil should test 29-33 ohms at 77°F. (6 volt units), 102-112 ohms at 70-80°F. (12 volt units).

Field Resistance Units:—Resistors consist of carbon blocks mounted on side of regulator base plate. Resistor is marked with figure indicating nominal resistance in ohms as follows:

Resistor Unit Specifications

Regulator Model	Resistor Part No.	Marking
TC-4301A, 1B	TC-51G	1.4
TC-4302A, 3C, 4A, 5A, 6A, 7A, 8A, 9A	TC-51	1.85
TC-4302B, 20A	TC-51E	1.1
TC-4303A, 3B, 10A, 15A, 21A	TC-51B	2.85
TC-4311A, 12A, 13A, 14A, 16A, 17A, 18A, 19A, 22A	TC-51	1.85

NOTE—First TC-4301A regulators used TC-51E (1.1) resistor.

Field Fuse:—In knurled plug on side of regulator base plate (see illustration). When replacing fuse make certain that spring is in place in plug behind fuse to insure good fuse contact with terminal plate.

Fuse Capacity—5 ampere, No. X-842 (all regulators except TC-4314A, 15A, 20A); 7½ ampere, No. X-844 (TC-4314A, 15A, 20A).

CUTOUT RELAY

The Cutout Relay used with the Type TC-4300 series Regulators is similar in design and operation with previous types. See separate article for complete description and adjustments for Cutout Relays. Specifications are as follows:

Contact Gap—.015-.045". Adjust by bending upper armature stop.

Air Gap—.015" plus .015" or minus .005" with contacts closed. Adjust by bending lower contact support to raise or lower contact.

Contact Closing (Cut-in) Point—6.5-7.25 volts with charging current not to exceed 5 amperes.

Contact Opening (Cut-out) Point—.5-2.5 ampere discharge current (after charging current of 15 amperes has passed through winding) with open circuit battery voltage of 6.3-6.8 volts.

AUTO-LITE HORN RELAYS

OVERDRIVE & STARTER CONTROL RELAY NOTE:—For all data on Relays used with Overdrive Control Solenoids and Starter Control Solenoids, see separate articles as follows:

Overdrive Solenoid Relay—See "Warner Electric Kick-down Control" in Mechanical Equipment Section.

Starter Solenoid Relay—See "Auto-Lite Starter Controls—Solenoid Pinion Shift Type" in this section.

TYPE:—Series HR-4000 Horn Relays have been made in two types, without fuse (early type), with fuses in relay base (later type). Terminal locations are not the same on the two types (see illustration). These relays used on the following car models:

Car Model	Horn Relay	Horn Set
Chrysler C16 (1937)	HR-4002	HC-5103-B
Chrysler C14, C15 (1937)	HR-4002	HC-5103
Chrysler C18 (1938)	HR-4101	HC-5105
Chrysler C19, C20 (1938)	HR-4101	
Chrysler C22 (1939)	HR-4101	HH-4001, 2
Chrysler C23, C24 (1939)	HR-4101	HH-4001, 2 & HC-5107 (set)
Cord 810 (1936), 812 (1937)	HR-4002	HC-5005
De Soto S3 (1937)	HR-4002	HC-5103,B
De Soto S5 (1938)	HR-4101	HC-5105
De Soto S6 (1939)	HR-4101	HH-4001, 2
Dodge D5 (1937)	HR-4002	HC-5103,B
Dodge D8 (1938)	HR-4101	HC-5105
Dodge D11 (1939)	HR-4101	HH-4001, 2
Hupmobile 6, 822E, ('38), 922E ('39)	HR-4002	HC-5105
Hupmobile 8, 825H ('38), 925H ('39)	HR-4002	HC-5105
Plymouth P3, P4 (1937)	HR-4002	HC-5103,B
Plymouth P5, P6 (1938)	HR-4101S	HC-5105
Plymouth P7, P8 (1939)	HR-4101	HH-4001, 2

Manufacturer recommends that later type relay with fuse should be used for all new installations and to replace earlier type relay without fuse.

OPERATION:—Horn relay winding connected between feed 'B' terminal and horn button 'S' terminal so that winding energized when horn button is pressed. This attracts armature closing contacts and completing circuit to horn 'H' terminal on relay. Horn current does not pass through winding or horn button.

SPECIFICATIONS:—Contact Gap. Should be .026" with contacts open. Adjust by bending armature stop.

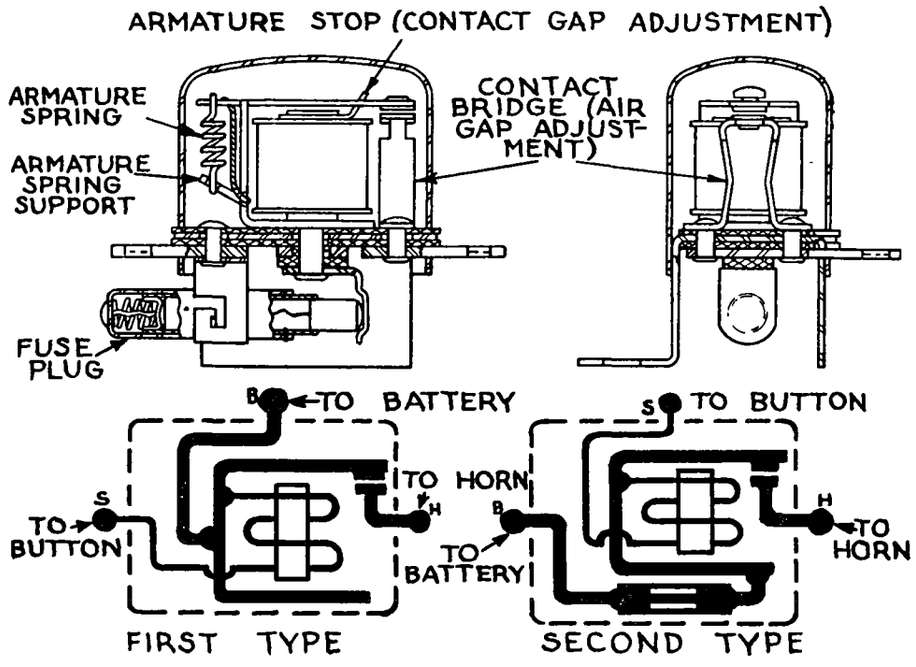
Air Gap. Should be .012" min., .017" max., with contacts closed. Adjust by expanding or contracting contact bridge (lower or stationary contact support).

Contact Closing Voltage. Contacts should close with terminal voltage f 3.0 volts min., 4.0 volts max. Adjust by changing armature spring tension. Bend armature spring support (lower end of spring) down to increase spring tension and raise closing voltage, or up to decrease spring tension and lower closing voltage.

Contact Opening Voltage. Contacts should open with terminal voltage of 1.5 volts minimum, 2.5 volts maximum. See adjustment directions above.

TESTING:—Connect battery and rheostat between relay 'S' terminal and ground on frame. Connect test voltmeter to same points. Use rheostat to control battery voltage and note relay performance.

FUSE:—Located in bayonet type plugs in relay base (released in same manner as lamp bulb). When replacing fuse see that spring is in place in plug behind fuse. See car model page for recommended fuse capacity.



These Regulators are used as standard or special equipment on the following car models:

Voltage-Current Regulators

Car Model	Generator	Regulator	Grounded Ter.
Chrysler C16 (1937)	GBW-4803A,C	VRB-4005A	Pos.
Chrysler C14, C15, C17 ('37)	GCO-4801C,D	VRB-4004B	Pos.
Chrysler C14 ('37) Exp.	GCE-4804-A	VRB-4004A	Pos.
Chrysler C18 (1938)	GDA-4801A, B	VRB-4004B	Pos.
Chrysler C19, C20 (1938)	GCO-4801C,D	VRB-4004B	Pos.
Chrysler C22, C23, C24 ('39)	GDA-4801A	VRB-4004B	Pos.
DeSoto S3 (1937)	GBW-4803A,B,C	VRB-4005A	Pos.
DeSoto S5 (1938)	GDA-4801A,B	VRB-4004B	Pos.
DeSoto S6 (1939)	GDA-4801A	VRB-4004B	Pos.
Dodge D5 (1937)	GBW-4803A,C	VRB-4005A	Pos.
Dodge D8 (1938)	GDA-4801A,B	VRB-4004B	Pos.
Dodge D11 (1939)	GDA-4801A	VRB-4004B	Pos.
Nash 3720, 3780 (1937)	GCO-4802,A	VRB-4002D	Pos.
Nash 3820, 3880 (1938)	GCO-4802B,C	VRB-4010A	Pos.
Nash-Lafayette 3710 ('37)	GCO-4802,A	VRB-4002D	Pos.
Nash-Lafayette 3810 ('38)	GCO-4802C	VRB-4010A	Pos.
Packard 1500,1,2 (1937)	GCO-4803A	VRB-4002D	Pos.
Packard 1507, 8 (1937)	GCE-4803A	VRB-4008AP	Pos.
Packard 1603,4,5 (1938)	GCO-4803A	VRB-4008C	Pos.
Packard 1607, 8 (1938)	GCE-4803A	VRB-4008AP	Pos.
Packard 1703,3A,5 (1939)	GCO-4803A,6A,7A,8A	VRB-4012A-1	Pos.
Packard 1707,8 (1939)	GCE-4803A	VRB-4008-AP	Pos.
Plymouth P3,4 ('37) Police	GCB-4802A,B	VRB-4004C	Pos.
Plymouth P4 (1937) Taxi	GBW-4803E	VRB-4005A	Pos.
Plymouth P5, 6 ('38) Police	GCB-4802A	VRB-4009A	Pos.
Plymouth P5, 6 ('38) Police	GDA-4801A	VRB-4004B	Pos.
Studebaker Comm. 9A (1939)	GDA-4804A	VRB-4012A	Pos.

Voltage Regulators

Hudson 73,4,5,6,7 (1937)	GCJ-4803A	VRD-4003A, B	Pos.
Hudson 83,4,5,7 (1938)	GDF-4802A	VRD-4008A	Pos.
Hudson 89 (1938) Radio	GDF-4802A	VRD-4008A	Pos.
Hudson 90,91,98 ('39) Radio	GDS-4801A	VRD-4008A	Pos.
Hudson 92,3,5,7 (1939)	GDS-4801A	VRD-4008A	Pos.
Hupmobile 822E ('38), 922E ('39)	GDF-4804A	VRD-4009A	Pos.
Hupmobile 825H ('38), 925H ('39)	GDF-4804A	VRD-4009A	Pos.
Hupmobile Skylark R (1939)	GDF-4804A	VRD-4009A	Pos.
Nash 3920, 3980 (1939)	GDS-4802A,B	VRD-4010A	Pos.
Nash-Lafayette 3910 Del. ('39)	GDS-4802A	VRD-4010A	Pos.
Packard 115C, 120C (1937)	GCJ-4801A	VRD-4001A	Pos.
Packard 1601,1A,2 ('38) First	GCJ-4807A-2	VRD-4005A	Pos.
Packard 1601,1A,2 ('38) Later	GCJ-4807A-2	VRD-4001B	Pos.
Packard 1700 (1939)	GCJ-4807A2,10A2	VRD-4001B	Pos.
Packard 1701,1A,2 (1939)	GCJ-4807A2,10A2	VRD-4001B	Pos.
Plymouth P4 (1937)	GCJ-4802A	VRD-4002A	Pos.
Plymouth P6 (1938)	GDF-4801A	VRD-4002B	Pos.
Plymouth P7, P8 (1939)	GDF-4801A	VRD-4002B	Pos.
Studebaker 7A, 8A (1938)	GCJ-4808A	VRD-4006A	Pos.
Studebaker 7A, 8A (Late '38)	GDF-4804B	VRD-4006B	Pos.
Studebaker Champion G ('39)	GDF-4812A	VRD-4006B	Pos.
Terraplane 71 ('37) Radio	GCJ-4804A-1	VRD-4003A, B	Pos.
Terraplane 72 (1937)	GCJ-4803A	VRD-4003A, B	Pos.
Terraplane 80,81,88 ('38) Radio	GDF-4803A-1	VRD-4008A	Pos.
Terraplane 82 (1938)	GDF-4802A	VRD-4008A	Pos.
Willys-Overland 39 Del. ('39)	GCJ-4811A	VRD-4004A	Neg.

IMPORTANT CHANGES:—Voltage Setting (New Regulator Coil). Voltage Regulator coil changed beginning with Regulator Serial No. 8R-000001. This new coil requires different regulator voltage settings (new settings used also on units before 8R-000001 when this new coil installed). See Test Specifications below for settings for all models.

Regulator Resistance Units. Resistor units changed on some Voltage Regulators and second resistance unit added on some Voltage-Current Regulators. See Resistor specifications below for complete data on all types.

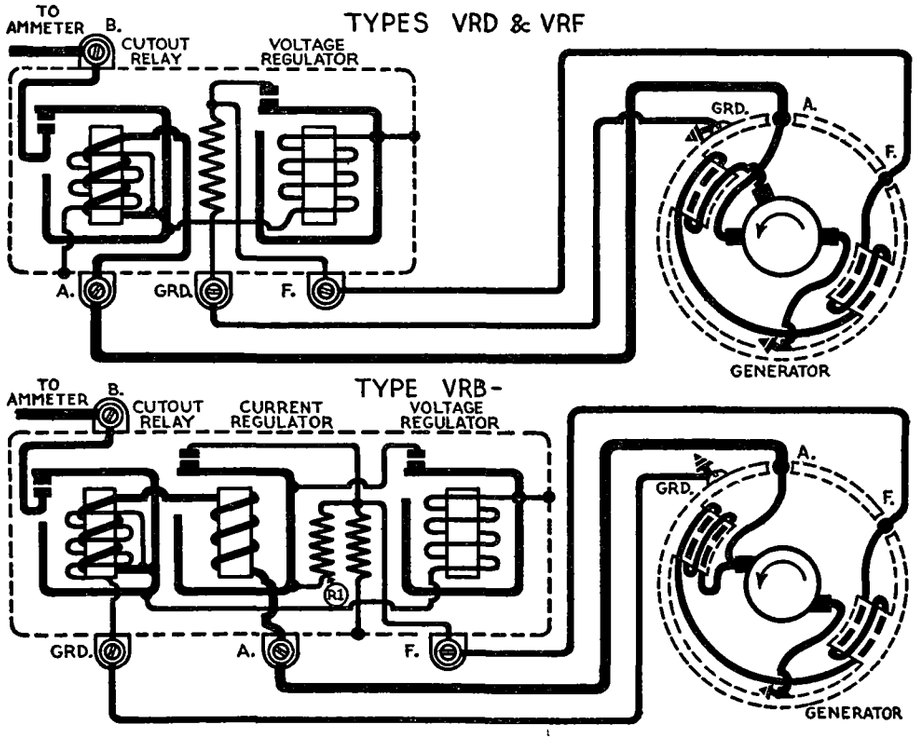
GROUNDED TERMINAL NOTE:—Each regulator designed to be operated with particular battery terminal grounded as noted in table above. See that battery is correctly grounded, and polarize generator when it is disconnected or removed from car (see Polarizing directions under Current Regulator Testing and Adjusting below).

TYPE:—Both the vibrating Voltage Regulators and the vibrating Current-Voltage Regulators are made in two general designs 'Small Type' and 'Large Type.' See following article on Truck & Bus Type Regulators for data on Large Type.

Model No.	Type	Voltage	Design
VRB Series	Small Type	6	Current-Voltage Regulator
VRD Series	Small Type	6	Voltage Regulator
VRE Series	Small Type	12	Current-Voltage Regulator
VRF Series	Small Type	12	Current-Voltage Regulator

DESCRIPTION & OPERATION:—Voltage Regulator. Consists of a conventional Cutout Relay and a new type Vibrating Voltage Regulator in a single case. Voltage Regulator has a single winding. When the generator voltage reaches the value for which the regulator is set, the regulator armature vibrates, opening and closing the regulator contacts, and cutting the resistance unit in and out of the field circuit. This action holds the generator voltage constant. These voltage Regulators are used only with third-brush control generators and the maximum output is controlled by the third brush in the usual manner.

Current-Voltage Regulators. Consist of the same Cutout Relay and Voltage Regulator units described above and an additional Current Regulator unit which controls the maximum generator output. These types used with two-brush shunt wound generators only. Current Regulator has a single winding connected in series so that the entire generator output goes through this winding. In operation on the car, when the generator output (entire current) reaches the value for which the regulator is set, the regulator armature vibrates, opening and closing the regulator contacts, and cutting the resistance unit in and out of the field circuit so that the output is held constant. The Current and Voltage Regulator contacts are connected in series so that the same resistance is used for both current and voltage control (when one resistance used—see Resistor data below for data on types using two resistors).



VRB, VRE NOTE

Resistor "R1" not used on units before No. 8R-000001 except on VRB-4008-A.

TESTING (ON THE CAR):—If regulator action not satisfactory, check these points first:

1. Generator Circuits. See that generator and regulator properly connected (see car wiring diagram) and that all connections are clean and tight. Examine charging line connections, check for high resistance in charging circuit. Voltage drop between generator and regulator and between regulator and battery must not exceed .1 volt when generator is charging 10 amperes. At this same charging rate, there should be no drop on voltage as measured between regulator base and battery ground post, generator frame and regulator base, and generator frame and battery ground post.

2. Generator Type & Performance. See that generator and regulator are correct types (special types designed to be used together, will not operate satisfactorily if different type generator or regulator used). Check generator performance with regulator out of circuit. Generator should produce rated output (see Performance Table on car model page). Examine commutator and brushes.

3. Battery. See that battery is in good condition and fully charged. High charging rate may be caused by overheated or discharged battery. Low charging rate may be caused by defective or sulphated battery plates. Check battery open-circuit voltage and specific gravity.

Regulator covers are sealed and Regulators are serviced on an exchange basis if seals are not broken. Performance can be checked on the car without breaking seals or removing covers as directed below. Complete bench testing and adjusting directions (requiring cover removal) are given in separate section below.

VOLTAGE REGULATOR

Voltage Regulator (All Series). Connect test ammeter (graduated to read to 1 ampere) in charging line at 'B' terminal of regulator using short heavy leads. Connect test voltmeter (graduated to read to .1 volt) between 'B' and 'GD' terminals (or between 'B' terminal and ground screw on regulator frame for VRA and VRC regulators). Make certain that car battery is fully charged (specific gravity reading of 1.275-1.280). Operate generator at speed equivalent to 30 M.P.H. for at least 15 minutes before taking meter readings. Ammeter should show reading less than maximum noted on regulator nameplate. After 15 minutes, note voltmeter reading which should agree with specifications given below. IMPORTANT NOTE—Voltage setting given for regulators "After Serial No. 8R-000001" apply also to units before this number if the new regulator coil winding (10.4-11.2 ohms) installed.

Voltage Setting

VRD-4003-A (Before 8R-000001)		All 'VRE', 'VRF' Types	
Temperature	Voltage Limits	Temperature	Voltage Limits
50°F.	7.53-7.83	50°F.	14.44-14.74
60	7.51-7.81	60	14.39-14.69
70	7.50-7.80	70	14.35-14.65
80	7.48-7.78	80	14.31-14.61
90	7.47-7.77	90	14.27-14.57
100	7.46-7.76	100	14.22-14.52

Voltage Setting—Before Serial No. 8R-000001.

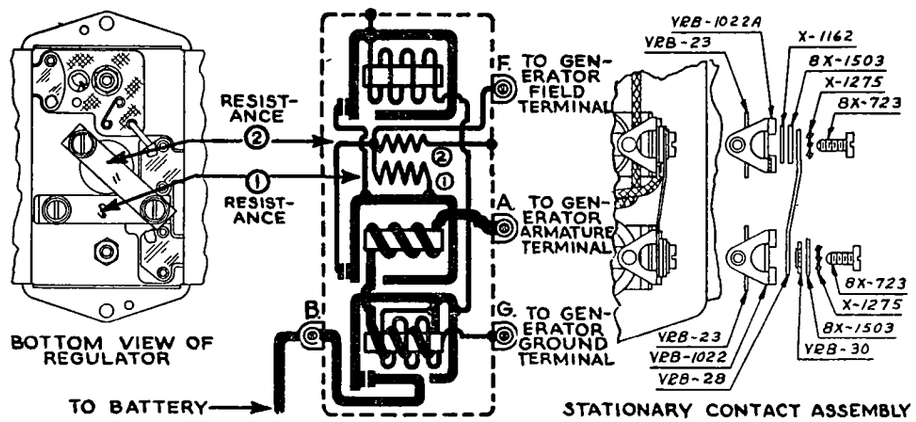
VRD-4003-B (Hudson)		All other 'VRB', 'VRD' Types.	
Temperature	Voltage Limits	Temperature	Voltage Limits
50°F.	7.83-8.13	50°F.	7.53-7.83
60	7.81-8.11	60	7.51-7.81
70	7.80-8.10	70	7.50-7.80
80	7.78-8.08	80	7.48-7.78
90	7.77-8.07	90	7.47-7.77
100	7.76-8.06	100	7.46-7.76

Voltage Setting—After Serial No. 8R-000001. (or when new Voltage Regulator Coil installed).

VRD-4003-A, 3-B, 8-A, 8-B (Hudson)		All other 'VRB', 'VRD' Types.	
Temperature	Voltage Limits	Temperature	Voltage Limits
50°F.	7.48-7.78	50°F.	7.36-7.66
60	7.41-7.71	60	7.33-7.63
70	7.35-7.65	70	7.30-7.60
80	7.28-7.58	80	7.27-7.57
90	7.22-7.52	90	7.24-7.54
100	7.15-7.45	100	7.21-7.51
110	7.09-7.39	110	7.19-7.49
120	7.02-7.32	120	7.16-7.46
		130	7.13-7.43
		140	7.10-7.40

SPECIAL SETTINGS (VRD Regulators used with GCJ Generators — except Hudson). If battery is continuously overcharged, or charging rate is to high, check generator charging rate with regulator out of circuit and adjust third brush (see car model page for directions and settings on each car model), check regulator voltage with engine running at speed equivalent to 30 MPH. car speed. If voltage exceeds 7.5 volts, adjust regulator for voltage between 7.3 and 7.5 volts.

Regulator Resistor Units:—On most regulators, resistors have been changed (second resistor unit added, or resistance of single resistor changed) as follows (see illustration for location and numbering of resistor units):



Voltage-Current Regulator Resistors

Regulator Model	Before 8R-000001 "R1"	Before 8R-000001 "R2"	After 8R-000001 "R1"	After 8R-000001 "R2"
VRB-4002-A, C, D	60	....	60	....
VRB-4003-A	30	....	30	....
VRB-4004A	60	....	60	11
VRB-4004B	30	....	30	7
VRB-4004-C	60	....	60	....
VRB-4005-A, 6-A	30	....	30	....
VRB-4007-A	60	....	60	11
VRB-4007-B	....	....	30	7
VRB-4008-A, AP, B	60	....	60	11
VRB-4008-C	....	....	30	7
VRB-4008-D, E	....	....	60	11
VRB-4009-A	60	....	60	11
VRB-4010-A	....	....	30	7
VRB-4011-A	....	....	60	11
VRB-4011B, 12-A, 12A-1, 12B-1	....	....	30	7
VRE-4001-A, B, C	60	....	60	....
VRE-4002-A, B, C, D	60	....	60	....
VRE-4003-A, 3A-1, 5-A	60	....	60	....
VRE-4004-A	60	20	60	20

Voltage Regulator Resistors

Regulator Model	Resistor
VRD-4001A, B; 2-A, B; 3-A, B; 4-A; 6-A, B (See Note)	20
VRD-4008-A, 9-A, 10-A	20
VRD-4008-B	30
VRF-4001-A, 3-A, 4-A, 5-A, 6-A, 7-A (See Note)	30

VRD Note—Resistor TC-51L (28-32 ohms—marked 30) used on these models before Serial No. 7R-000001. Use only TC-51T (19-21 ohms—marked 20) for replacement.

VRF Note—Resistor TC-51M (57-63 ohms—marked 60) used on these models before Serial No. 9R-000001. Use only TC-51L (28-32 ohms—marked 30) for replacement.

Current Regulator (All Series). Connect test ammeter and voltmeter as directed above. Add load (turn on car lights and accessories or use a bank of headlamp bulbs connected at point between ammeter and battery) in excess of ampere rating stamped on regulator cover. Operate generator, as above, and note ammeter reading which will indicate point at which current regulator controls generator output. Ammeter reading should agree with regulator rating stamped on cover. Allowable variation is 5% (1 ampere above or below rating).

Current Setting

6 Volt Types		12 Volt Types	
Model	**Amperes**	**Model**	**Amperes**
VRB-4002A, 4A	29-31	VRE-4001A	14-16
VRB-4002C, 4C	24-26	VRE-4001B	11-13
VRB-4002D, 4B	27-29	VRE-4001C	16-18
VRB-4003A, 5A	21-23	VRE-4002A	14-16
VRB-4006A	11-13	VRE-4002B	16-18
VRB-4007A, 8A, 8AP	29-31	VRE-4002C	19-21
VRB-4007B, 8C	27-29	VRE-4002D	11-13
VRB-4008B, 9A	24-26	VRE-4003A	14-16
VRB-4008D	19-21	VRE-4003A-1	14-16
VRB-4008E	31-33	VRE-4004A	14-16
VRB-4010A, 11B	27-29	VRE-4005A	14-16
VRB-4011A	24-26		
VRB-4012A, 12A-1	27-29		
VRB-4012B-1	34-36		

ADJUSTMENT SPECIFICATIONS:—If regulator is being completely tested and adjusted on the bench (with cover removed), check specifications of all units as directed below before checking performance or changing settings.

CUTOUT RELAY

Specifications

Model	Voltage Coil Resistance	Air Gap	Contact Gap
All 'VRB' Types	35-39 ohms	.034-.038"	.015" Min.
All 'VRD' Types	35-39 ohms	.034-.038"	.015" Min.
All 'VRE' Types	111-123 ohms	.034-.038"	.015" Min.
All 'VRF' Types	111-123 ohms	.034-.038"	.015" Min.

Voltage Winding Resistance. Use ohmeter to measure resistance directly, or use accurate ammeter and voltmeter to measure current draw and voltage and calculate resistance in ohms. To check, disconnect voltage regulator lead on cutout relay frame and measure between 'A' terminal and ground.

Air Gap. Measure with contacts open at hinge end of armature core using special flat type gauge Part No. ST-281-3. Adjust by bending armature stop. Make certain that stop is in center of armature slot and that gap between armature and yoke does not exceed .002" at hinge end.

Contact Gap. Adjust by expanding or contracting stationary contact support keeping contacts exactly aligned and making certain that armature does not touch magnet yoke which will cause contacts to stick (clearance between armature and yoke with contacts closed should be .020").

VOLTAGE REGULATOR

Model	Coil Resistance	Air Gap	Contact Gap
All 'VRB' Types	10.4-11.2 ohms (see Note)	.0595-.0625"	.010-.020"
All 'VRD' Types	10.4-11.2 ohms (see Note)	.0595-.0625"	.010-.020"
All 'VRE' Types	45.8-49.6 ohms	.0595-.0625"	.010-.020"
All 'VRF' Types	45.8-49.6 ohms	.0595-.0625"	.010-.020"

NOTE—Resistance of coil used on regulators before Serial No. 8R-000001 was 12.8-14.3 ohms. Use new type coil (10.4-11.2 ohms) for replacement on all regulators. On regulators before Serial No. 8R-000001, change voltage setting to new figures (use table for regulators after No. 8R-000001) when this new coil installed.

Coil Winding Resistance. To check, disconnect voltage regulator lead on cutout relay frame and measure between this lead and ground.

Air Gap. Measure with contacts just opening at point side of armature stop pin using special pin gauge Part No. ST-281-2. To adjust, loosen screw on upper (stationary) contact bracket and use tool ST-282 to raise or lower the upper contact. Make certain that contacts are in exact alignment.

NOTE—To test gap setting (all models), connect test lamp in series with six volt battery between 'F' and 'GD' terminals. Insert low limit pin gauge depress armature (apply pressure equally at each side of contact spring, do not touch contact spring). Test lamp should go out. Repeat test using high limit pin gauge. Test lamp should remain lighted.

Armature Hinge Adjustment (Small Type). To check armature for correct 'floating' position, remove armature spiral spring, check armature position by holding regulator to the light and noting that armature floats midway between stationary contact and core stop (contacts must be open, armature must not touch stop). To adjust, bend both armature hinge support ears equal amount up or down (use square nosed pliers). Check alignment of support ears with straightedge. Re-install spiral spring, make certain that both ends of spring are down in holding grooves and that lower spring bracket is not distorted (spring must be vertical).

Contact Gap. Measure with armature held down against stop pin. If contact gap varies widely, armature stop pin is wrong length and unit should be replaced.

Contact Assembly (All Types). When installing new stationary contacts make certain that all insulating washers, lockwashers and other parts installed in correct order (see illustration for correct sequence of assembly).

CURRENT REGULATOR

Model	Air Gap	Contact Gap
All 'VRB' Types	.0595-.0625"	.010-.020"
All 'VRE' Types	.0595-.0625"	.010-.020"

Contact Gap, Spring Pressure, Air Gap. Check and adjust in same manner as directed for Voltage Regulator above. Use pin gauge Part No. ST-281-2 to measure air gap.

TESTING & ADJUSTING (ON THE BENCH):—Mount unit firmly (so there is no vibration) in same position as when mounted on car. Heat regulator before making tests by operating for 15 minutes with generator charging 10 amperes (for all units rated below 30 amperes), 20 amperes (all units rated above 30 amperes). Cover must be in place while heating unit and when making tests.

Resistor Units

Remove resistors (remove, check, and replace separately to avoid possibility of interchanging resistors when two used). Check resistance with ohmeter. Resistance value must be within limits shown in table below (figures stamped on resistor unit is nominal resistance in ohms, see table for resistance limits). See Resistor data under Voltage Regulator (above) for correct type and changes made on each regulator model.

Resistor Marking	Resistance (In Ohms)
7	6.5-7.5
11	10-12
20	19-21
30	28-32
60	57-63

CUTOUT RELAY

Connect ammeter in series in charging line between battery and regulator 'B' terminal, voltmeter between regulator 'A' terminal and ground. When checking cut-in voltage, connect single earphone (2000 ohms resistance or higher) between regulator 'A' and 'B' terminals, a click will be heard in the earphone when the contacts close.

Model	Closing Voltage	Opening Amperage
All 'VRB' & 'VRD' Types	6.4- 7.0 volts	.5-3.0 amperes
All 'VRE', 'VRF" Types	13.0-13.75 volts	.5-3.0 amperes

VRD-4008A, B Note. On Model VRD-4008A (after Serial No. 2T-000001) and all VRD-4008B regulators, Cutout Relay opening amperage should be 1.5-4.5 amperes.

Cut-in Voltage. To adjust, change armature spring tension by bending lower spring arm. Cutout Relay cut-in voltage must always be .5 volts below voltage at which voltage regulator begins to operate (contacts will not close if cut-in voltage set at higher figure).

Cut-Out Amperage. To adjust, change contact gap by raising or lowering lower (stationary) contact. See Cutout Relay Contact Gap specifications above for instructions.

Note for Rechecking Cutout Relay. When rechecking, with Cutout Relay hot (after Voltage and Current Regulators have been adjusted), if cut-in voltage and cut-out amperage are no longer correct, check armature hinge and see that it is installed with brass side up. If hinge has been installed incorrectly, replace Cutout Relay unit.

VOLTAGE REGULATOR

Connect voltmeter between regulator 'A' terminal and ground, single earphone (2000 ohms resistance or higher) between regulator 'A' and 'B' terminals. Earphone will register 'click' of regulator contact opening and closing and give accurate indication of regulator action. Operate regulator and note voltage. Voltage should be within limits shown in table for 'Testing on Car' above.

To Adjust. Increase armature spring tension (to increase voltage), decrease spring tension (to lower voltage) by bending the lower spring arm (Small Type), or turning the adjusting nut at the lower end of the spring (Large Type). If setting is changed, reheat regulator by operating generator for 15 minute period with charging rate as above and then recheck voltage.

Final 'Flash' Test. After making adjustments, replace cover, stop generator momentarily, note maximum voltage reading immediately after generator is restarted.

CURRENT REGULATOR

Connect test ammeter in series in charging line at regulator 'B' terminal. Use earphone to check regulator action (connect as directed for Voltage Regulator adjustment above). Increase generator output by connecting lamp bank or resistance across battery, note ammeter reading when current regulator operates to limit generator output. Output should be within 5% (1 ampere more or less) of rated figure stamped on regulator cover. See table for 'Testing on Car' above for each regulator model.

To Adjust. Increase armature spring tension (to increase output), or decrease armature spring tension (to decrease output) by bending the lower spring arm (Small Type) or turning adjusting nut at lower end of spring (Large Type).

Final 'Flash' Test. After making adjustments, replace cover, stop generator momentarily, note maximum current reading immediately after generator is restarted.

Polarizing Generator

Use jumper wire from starting switch battery connection to generator 'A' terminal. Do not close cutout relay contacts by hand for this purpose (excessive current will cause burnt contacts). Generator must be polarized when operated on bench and when replaced on car.

TROUBLE SHOOTING:—If regulator action is not satisfactory, check possible causes as listed below.

Cutout Relay contacts do not close. Cutout Relay shunt winding open or shorted, series coil open. 'A' terminal grounded or Cutout Relay grounded. Current Regulator series coil open.

Cutout Relay Cuts in late or at high speed. Voltage Regulator or Current Regulator contacts burnt, dirty or high resistance (if contacts burnt, check for broken or wrong type resistance unit).

Cutout Relay action erratic or intermittent. Same as above. Cutout Relay air gap wrong. Armature hinge reversed. Armature binding (armature should float without touching stop or stationary contact at room temperature with tension spring removed).

Cutout Relay Contacts Flutter. Cut-in voltage set too low. Discharge current for cut-out point too low or contacts opening with generator charging.

Generator does not charge Battery. Cutout Relay contacts dirty or burnt. 'A' terminal or cutout relay grounded. Cutout Relay air gap wrong, cut-in voltage setting too high. Voltage Regulator setting too low. Current Regulator or Cutout Relay series coil open.

No Output Control (Current Regulator Inoperative). 'F' terminal, lead to stationary contact, or stationary contact support grounded. Current Regulator frame grounded to base.

Charging Rate too low. Current Regulator air gap set wrong, current setting too low, contacts burnt, dirty or high resistance.

Charging Rate too high. Voltage Regulator setting too high, winding resistance too great. Current Regulator series coil shorted.

Voltage Regulator inoperative (No voltage control). Voltage Regulator contacts sticking, stationary contact grounded, winding open. Cutout Relay shunt coil open. 'F' terminal or lead grounded.

Voltage too high or too low. Voltage Regulator air gap set wrong, contact spring tension wrong, high resistance in winding (examine connections). Resistance units wrong type or broken. Voltage Regulator winding shorted.

Voltage drops when Voltage Regulator operates. Voltage regulator contacts sticking.

Ammeter fluctuates excessively. Slight fluctuation normal at point where voltage regulator begins to operate. If excessive, check for Voltage Regulator or Current Regulator contacts dirty, sticking, burnt or high resistance. Resistance units broken or wrong type. Voltage or Current Regulator armature hinge loose. Cutout Relay cut-out discharge current too low.

Current Discharge with Generator not running. 'B' terminal or Cutout Relay stationary contact grounded, Cutout Relay contacts sticking or air gap set wrong.

NOTE:—These "Large Type" Regulators are intended for use with generators of larger output and consist of the following types:

Regulator Model	Type	Voltage
All "VRA" Types	Current-Voltage Regulator	12 volts
All "VRC" Types	Current-Voltage Regulator	6 volts
All "VRG" Types	Current-Voltage Regulator	12 volts

GROUND TERMINAL NOTE:—Each regulator designed to be operated with particular battery terminal grounded as noted in following table. See that battery is properly grounded and polarize generator whenever it is disconnected or removed from car (see Polarizing instructions below).

Model	Grounded Terminal
VRA-4101A, 2A, 3A; VRC-4101A, 2A, 2B; VRG-4101A, 2A	Positive.
VRG-4103A	Negative.

DESCRIPTION & OPERATION:—Similar in design to "Small Type" regulators intended for passenger car equipment (see preceding article) except for additional winding on current regulator unit which is connected in series with an additional resistor unit as shown in the illustration. Adjustments and specifications for these Large Type regulators are not the same as for Small Type units and Large Type regulators should be checked and adjusted as directed below.

TESTING (ON THE CAR):—If regulator operation is not satisfactory, check the following points first:

1. **Charging Circuit.** See that generator and regulator are properly connected and that all connections are clean and tight. Check charging circuit for high resistance. Voltage drop between generator and regulator or between regulator and battery should not exceed .1 volt with generator charging at 10 amperes. There should be no voltage drop between regulator base and battery ground post, generator frame and regulator base, or between generator base and battery ground post.
2. **Generator Type & Performance.** See that generator and regulator are correct type (special types designed to be used together, will not operate satisfactorily with other units). Check generator performance with regulator out of circuit. Generator should produce rated output.
3. **Battery.** Check battery open-circuit voltage and specific gravity. See that battery in good condition and fully charged. NOTE—High charging rate may be caused by overheated, discharged, or short-circuited battery. Low charging rate may be caused by defective or sulphated battery plates, high separator resistance or extreme cold.

Regulator Seal Note—Covers are sealed. Regulator performance may be checked without breaking seals or removing covers as directed below. Complete bench testing and adjustment directions require that cover be removed.

Voltage Regulator (All Types):—Connect test ammeter in charging line at regulator "B" terminal (ammeter must read to 1 ampere and have maximum internal resistance of .01 ohm or .1 volt at 10 amperes) using short heavy leads. Connect test voltmeter between regulator "B" terminal and ground screw on regulator frame. Make certain that car battery is fully charged with specific gravity reading of 1.275-1.280. Run engine at speed equivalent to 30 M.P.H. for at least 15 minutes to bring units up to operating temperature, then note meter readings. Ammeter should indicate charging current less than maximum figure noted on regulator nameplate. Note voltmeter reading which should agree with specifications given below.

Voltage Setting

VRA-4101A, 2A; VRG-4101A		VRA-4103A, VRG-4102A, 3A	
Temperature	Volts	Temperature	Volts
50°F.	14.51	50°F.	14.31
60	14.48	60	14.28
70	14.45	70	14.25
80	14.42	80	14.22
90	14.39	90	14.19
100	14.36	100	14.16

VRC-4101A, VRC-4102A, VRC-4102B

Temperature	Volts
50°F.	7.51
60	7.48
70	7.45
80	7.42
90	7.39
100	7.36

Note—All voltage figures above are plus or minus .15 volts.

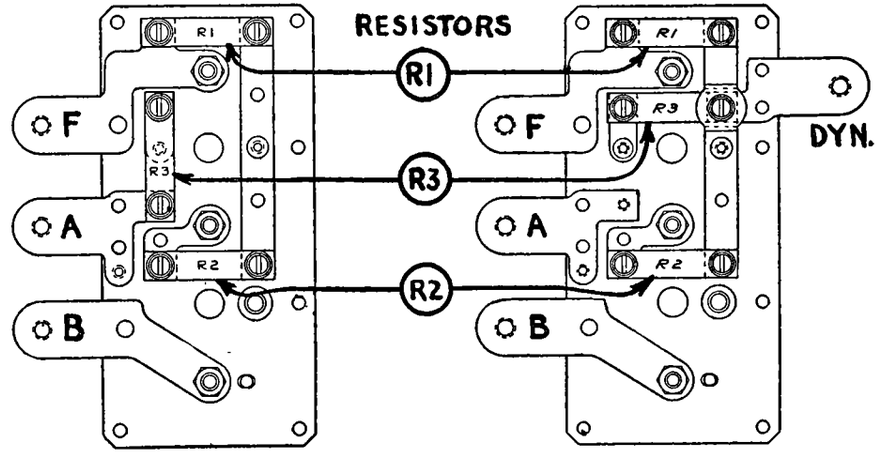
Regulator Resistor Units:—Three resistor units used on all models (see illustration for mounting of resistors on regulator base plate). To check resistor units, remove from regulator and test singly with ST-284 ohmeter. Use extreme care not to interchange resistor units make certain that resistors are of correct value as shown in table below.

Regulator Model	Resistor Markings "R1"	"R2"	"R3"
VRA-4101A, 2A, 3A	135	15	.65
VRC-4101A, 2A, 2B	80	5	.2
VRG-4101A, 2A, 3A	135	15	.65

Current Regulator (All Types):—Connect test ammeter and voltmeter as directed for voltage test above. Run engine and add load in excess of ampere rating noted on regulator nameplate (turn on lamps and accessories or connect bank of headlamp bulbs at point between generator and battery). Note ammeter reading which should agree with regulator rating stamped on cover. Allowable variation is 5% (1 ampere above or below rating) and ammeter reading should be within limits shown in table below.

Current Setting

6 Volt Types		12 Volt Types	
Model	Amperes	Model	Amperes
VRC-4101A	39-41	VRA-4101A, 3A	19-21
VRC-4102A	39-41	VRA-4102A	39-41
VRC-4102B	29-31	VRG-4101A, 2A	39-41
		VRG-4103A	19-21



ADJUSTMENT SPECIFICATIONS:—If above tests indicate that regulator is not operating properly, and units are being adjusted on the bench with the cover removed, check specifications of all units as directed below before checking performance or changing settings.

CUTOUT RELAY

Model	Voltage Coil Resistance	Air Gap	Contact Gap
All "VRA" Types	49.7 ohms	.055-.062"	.015" Min.
All "VRC" Types	15.3 ohms	.055-.062"	.015" Min.
All "VRG" Types	49.7 ohms	.055-.062"	.015" Min.

Voltage Winding Resistance. Use ohmeter to measure resistance directly or use accurate ammeter and voltmeter to measure current draw and voltage and then calculate resistance in ohms. To check, disconnect voltage coil ground lead at screw on baseplate and measure between this lead and stationary contact of cutout relay.

Air Gap. Measure with contacts open at point side of brass core pin using flat gauge No. ST-281-4. Adjust by raising or lowering stop at contact end of armature.

Contact Gap. Adjust by bending stationary contact support arms with tool ST-283 using extreme care to keep contact points in alignment and to maintain uniform gap for both sets. Check alignment with straightedge placed across tops of contact brackets.

VOLTAGE REGULATOR

Model	Coil Resistance	Air Gap	Contact Gap	Contact Spr. Pressure
All "VRA" Types	15.8 ohms	.040-.042"	.010" Min.	7-8 ozs.
All "VRC" Types	4.15 ohms	.040-.042"	.010" Min.	7-8 ozs.
All "VRG" Types	15.8 ohms	.040-.042"	.010" Min.	7-8 ozs.

Coil Winding Resistance. Disconnect both leads at screws on baseplate and measure between these leads using ST-284 ohmeter.

Air Gap. Measure with contacts just opening at point side of brass armature stop pin with gauge No. ST-281-1. To adjust, loosen screws and raise or lower armature contact stop. Make certain that contacts are in exact alignment and that contact stop screws are securely tightened.

NOTE—To test air gap setting, connect test lamp in series with a battery between regulator "A" and "F" terminals. Insert low limit pin gauge, depress armature (apply pressure equally at each side of contact spring, do not touch contact spring). Test lamp should go out. Repeat test with high limit pin gauge. Lamp should remain lighted.

Contact Gap. Measure with armature held down against stop pin, depressing armature with one finger on either side of contact spring so that no pressure applied to spring. If contact gap varies greatly, armature stop pin length is wrong and unit should be replaced. See that contact spring is straight and parallel with armature.

Contact Spring Pressure. To check, disconnect armature spring, remove armature stop, hook spring scale on contact arm at contact, note scale reading at instant contacts separate. When replacing armature stop make certain that fibre bumper block is in place.

CURRENT REGULATOR

Model	Freq. Coil Resistance	Air Gap	Contact Gap	Contact Spr. Pressure
All "VRA" Types	.018 ohms	.047-.049"	.010" Min.	7-8 ozs.
All "VRC" Types	.066 ohms	.047-.049"	.010" Min.	7-8 ozs.
All "VRG" Types	.018 ohms	.047-.049"	.010" Min.	7-8 ozs.

Frequency Winding Resistance (Large Type only). This is the second winding which is used only on Large Type regulators. To check, disconnect lead from screw on base plate at right of current regulator (contact end) and measure between this lead and current regulator frame.

Air Gap, Contact Gap, Contact Spring Pressure. Check and adjust in same manner as directed for Voltage Regulator above. Use pin gauge No. ST-281-5 to check air gap (not same as voltage regulator).

TESTING & ADJUSTING (ON THE BENCH):—Mount unit firmly in same position as when mounted on car so that there is no vibration. Heat regulator before making test by operating for 15 minutes with generator charging 10 amperes (all units rated below 30 amperes), 20 amperes (units rated above 30 amperes). CAUTION—Cover must be in place when heating regulator and when making tests.

Resistors:—Remove resistors singly (to avoid replacing in wrong position) and test with ohmeter ST-284. Resistance values must be within values shown in table below (figure stamped on resistor is nominal resistance in ohms, see separate table above for resistors used on each regulator).

Resistor Marking	Resistance in Ohms.
.2	.18-.22
.65	.6-.7
5	5-5.5
15	13.5-16.5
80	76-84
135	130-140

CUTOUT RELAY

Connect test ammeter in series in charging line between battery and regulator "B" terminal, voltmeter between regulator "A" terminal and ground. When checking cut-in voltage, connect single earphone (2000 ohms resistance or higher) between regulator "A" and "B" terminals. A click will be heard in the earphone when the contacts close.

Model	Closing Voltage	Opening Amperage
All "VRA", "VRG" Types	13.0-13.5	.5-4.0
All "VRC" Types	6.5-7.0	.5-4.0

Cut-in Voltage. To adjust, change armature spring tension by turning screw at lower end of spring. Cut-in voltage must always be set .5 volts below voltage at which voltage regulator begins to operate (contacts will not close if set at higher figure).

Cut-out Amperage. To adjust, change contact gap by raising or lowering lower (stationary) contact. See contact gap adjustment above.

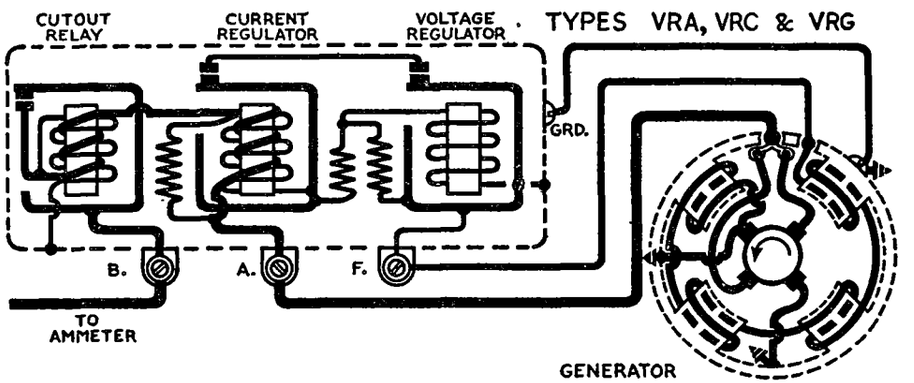
Final Performance Test. After making adjustments, replace regulator cover and recheck performance. Make final 'flash' test after adjustments and checking have been completed.

VOLTAGE REGULATOR

Connect voltmeter between regulator "B" terminal and ground screw on regulator frame. Connect single earphone (2000 ohms resistance or higher) between regulator "F" terminal and ground. Earphone will register "click" or vibration of regulator contact opening and closing and will give accurate indication of regulator operation. Operate regulator and note voltage. Voltage should be within limits shown in table under "Testing on Car" above.

To Adjust. Increase armature spring tension (to increase voltage) or decrease spring tension (to lower voltage) by turning adjusting screw at lower end of spring.

Final Flash Test. After completing adjustments, replace regulator cover, take a "flash" voltage reading by stopping generator and then noting voltage reading immediately after restarting generator.



CURRENT REGULATOR

Connect test ammeter in charging line at regulator "B" terminal. Use earphone to check regulator action (connect as for Voltage Regulator test above). Operate generator and increase load by connecting bank of headlamp bulbs as load, or use resistance connected across battery, so that current regulator operates. Note ammeter reading which should be within 5% (1 ampere more or less) than rated capacity of regulator as shown in table above.

To Adjust. Increase armature spring tension (to increase output), decrease spring tension (to decrease output) as directed for Voltage Regulator above.

Final Flash Test. Make flash test of output after all adjustments completed and regulator cover replaced by stopping generator momentarily and then noting ammeter reading immediately after generator is restarted.

POLARIZING GENERATOR:—Generator should be polarized before being run on bench or car by connecting jumper wire from starting switch battery connection to generator "A" terminal momentarily. Do not close relay contacts by hand to accomplish this result (excessive current will burn contacts).

TROUBLE SHOOTING:—Same as for other regulator types. See Trouble Shooting table for "Small Type" regulators.

AUTO-LITE CUTOUT RELAYS

DESCRIPTION:——All Cutout Relays used as automatic switches to disconnect the generator when it is not charging the battery and thus prevent the battery discharging through the generator windings are similar in operation although individual types and makes are somewhat different in construction. See special sections below for details of design and adjustment instructions for each type.

OPERATION:—There are two coil windings, a fine winding called the shunt or voltage coil, which is connected directly from the generator terminal to ground (on 'insulated' type coil is not grounded but is connected across generator main brushes), and a heavy winding called the series or current coil, which is connected in the charging line from the generator so that the entire generator output (charging current to battery) passes through it. The series coil is in series with the cutout relay contacts so that no current flows in this coil with the contacts open. When the generator is operated at speeds below the cut-in point (with relay contacts open), there is a small current flow through the voltage or shunt winding. At the cut-in point, the magnetic field created by the shunt coil is sufficiently strong to attract the relay armature, closing the relay contacts. The generator output then flows through the series coil and the relay contacts to the battery. As long as the generator speed is high enough to produce a charging current (generator voltage greater than battery voltage), the series coil acts in conjunction with the shunt coil to keep the contacts closed.

When the generator voltage falls below that of the battery, the current flow in the series coil is reversed and the battery discharges through the generator. The magnetic field created by the series field due to this reverse current opposes that of the shunt coil, and the relay contacts open, opening the circuit between the battery and generator and preventing a further discharge of the battery.

ADJUSTMENT:—Mechanical specifications (contact gap, air gap, armature spring tension, etc.) should be checked and adjusted before the performance (cut-in and cut-out points) are checked or adjusted. See instructions for individual types below.

AUTO-LITE CB-4000 SERIES STANDARD RELAY

MECHANICAL ADJUSTMENT:—Air Gap. Close relay contacts (hold armature down), measure air gap between armature and top of coil core, using a feeler gauge. Air gap should be within limits of .010-.030". Adjust by loosening lower contact mounting screw and shifting contact bracket up or down (early types) or by expanding or contracting lower contact support so as to raise or lower contact (later types).

Contacts. Examine contact surfaces. Contacts must be flat and parallel, free from dust or oil, and not burned or pitted. If necessary, resurface contacts with a fine file or #00 sandpaper.

Contact Gap. With armature up against upper stop, check contact gap. Contact gap should be within limits of .025-.035". Adjust by bending upper stop backward or forward.

ELECTRICAL ADJUSTMENT:—Cut-in (contact closing) Point. Connect an accurate voltmeter between generator terminal of relay and ground. Operate generator and slowly increase speed until contacts close. Note voltmeter reading (there will be a slight 'kick-back' or voltage drop as contacts close). Performance should be as follows:

Model	Cut-in Voltage	Maximum Load
All 6 Volt Types	6.5 Min., 7.25 Max	5 amperes
All 12 Volt Types	13.0 Min., 14.5 Max	3 amperes

If performance is not satisfactory, adjust as follows:

To raise Cut-in Voltage. Increase air gap (see above) or increase armature spring tension by bending spring arm down (early types), or by bending lower spring bracket down (later types).

To lower Cut-in Voltage. Decrease air gap or decrease armature spring tension by bending spring arm up (early types), or by bending lower spring bracket up (later types).

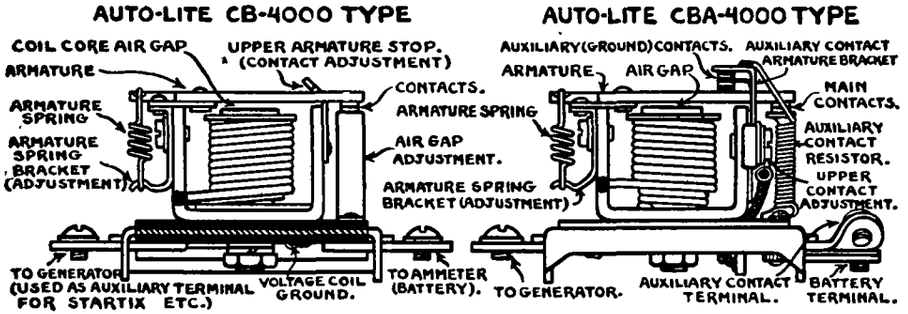
Cut-out (Contact opening) Point. Connect an ammeter in the charging line at the relay. Operate generator and slowly decrease speed until contacts open. Note ammeter reading (pointer will drop to '0' when contacts open). Performance should be as follows:

Model	Minimum — Discharge Current — Maximum
All 6 Volt Types	.5 ampere — 2.5 amperes
All 12 Volt Types	.5 ampere — 2.0 amperes

NOTE—A charging current of not less than 15 amperes must pass through relay windings before cut-out test is made. If discharge current is excessive, increase armature spring tension and decrease air gap slightly.

AUTO-LITE CBA-4000 SERIES SPECIAL RELAY

This type relay has a special set of auxiliary ground contacts mounted above the armature for signal light control (auxiliary contacts are closed with main contacts open and open when main contacts close). See illustration). The auxiliary contacts were grounded directly on the first Type CBA-4001 relays. On later types (which may be identified by one terminal being copper-plated) these contacts were grounded through a 6 ohm resistor to prevent damage to the contact spring through overloading caused by accidental application of full battery voltage (signal light circuit current regulated normally by 6 volt, 3 cp. signal light in series with contacts).



MECHANICAL ADJUSTMENT:—Air Gap. Close relay contacts (hold armature down, measure air gap between armature and coil core, using a feeler gauge. Air gap should be within limits of .010-.030". Adjust by expanding or contracting lower contact support so as to raise or lower lower contact.

Contacts. Examine contact surfaces. Contacts must be flat and parallel, free from dust or oil, and not burned or pitted. Resurface contacts when necessary with a fine file or #00 sandpaper.

Contact Gap. With upper contacts closed, check lower or main contact gap. Contact gap should be within limits of .025-.035". Adjust by loosening upper contact support bracket screw (auxiliary contacts) and raising or lowering this upper contact. Check auxiliary contacts after adjusting contact gap. If these contacts do not open when main contacts close, adjust by bending auxiliary contact armature bracket (see illustration).

ELECTRICAL ADJUSTMENT:—All adjustments are the same as for the standard relay (see above). Performance should be as follows:

Cut-in (Contact Closing)

Minimum Voltage	Maximum Voltage	Maximum Load
6.75	7.5	5 amperes

Cut-out (Contact Opening)

Minimum	Discharge Current	Maximum
.5 ampere		2.5 amperes

NOTE:—A charging current of not less than 10 amperes must pass through the relay coil windings before this cut-out test is made.

TYPES RJ75/6-900, RJA75/6-900, RJB75/6-900 (WITH AND WITHOUT BATTERY)

DESCRIPTION:—These generators have been furnished for use with battery or without battery where genrator is used for lighting only on tractors, etc. They may be changed over from one type of service to the other by following the directions given below. See separate articles for illustration of generator and regulator and complete description and adjustment of the regulator used with these generators.

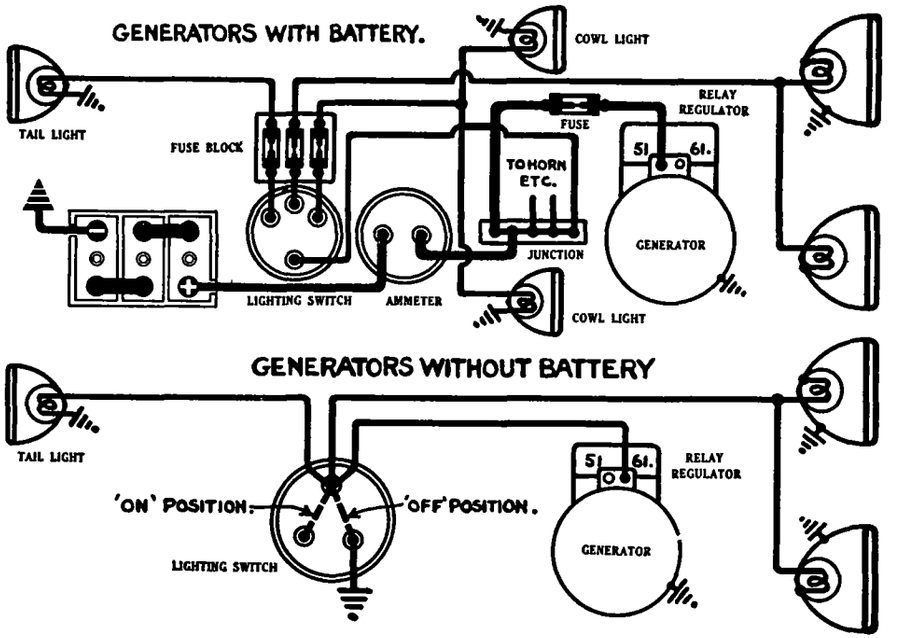
TO CHANGE GENERATOR FROM USE WITHOUT BATTERY TO USE WITH BATTERY:—Remove the plug from the cable hole for terminal '51' and plug terminal '61'. Bend the pole piece stop outward until gap between pole piece and magnet core is 3-3.2 MM. or .118-.126" with pole piece against stop. This will allow relay cutout contacts to open. Check relay contact gap. With the pole piece stop in correct position, relay contact gap should be .3-.5 MM. or .012-.020". Adjust regulator as directed in article on Bosch Regulators (Generators With Battery). Follow the complete adjustment procedure—Regulating Voltage (No Load), Regulating Voltage (With Load), Cut-in Voltage, Reverse Current, and final load test. When generator is installed, make certain that negative (—) terminal of battery is grounded.

TO CHANGE GENERATOR FROM USE WITH BATTERY TO USE WITHOUT BATTERY:—Remove the plug from the cable hole for terminal '61' and plug terminal '51'. Bend the pole piece stop in so that pole piece is moved toward magnet core sufficiently to close cutout relay contacts permanently. See that a small gap remains between pole piece pin and reverse current screw with pole piece against stop so that lower regulator contacts are closed. The gap should be small enough so that the slightest movement of the pole piece toward the magnet core will open the lower regulator contacts. Connect a voltmeter between terminal '61' and ground. Operate the generator on the test bench and make the following tests.

Maximum Voltage (No Load). Slowly increase generator speed to 3600 R.P.M. Note voltmeter readings. Maximum voltage must not exceed 6.75 volts. It will be necessary to turn regulator adjusting nut about ½ turn to left or counter-clockwise to secure this setting.

Maximum Voltage (With Load). Connect a lamp load comprising 2 6v. 21cp. and 1 6v. 4 cp. lamps (34 watt total) between terminal '61' and ground (lamps in parallel). Operate generator and slowly increase speed to 3600 R.P.M. Maximum voltage should be 6.5 volts. To adjust, turn regulator adjusting nut slightly out or counter-clockwise to decrease voltage, and in or clockwise to increase voltage.

Final Load Test. After completing load test, operate generator for one-half hour at 2000 R.P.M. with this same load (34 watts). Repeat tests for maximum voltage (no load), and maximum voltage (with load). Readjust as necessary. If readjustments have been made, repeat final load test.



BOSCH REGULATOR—GENERATORS WITH BATTERY

NEW TYPE SINGLE UNIT VOLTAGE REGULATOR AND CUTOUT RELAY

DESCRIPTION:—This type unit is a combined cutout relay and voltage regulator using only one coil (see illustration). The unit is mounted on top of the generator or inside the commutator end cover. Types used on particular generators are as follows:

Voltage Regulator Type	Generator Types
SSM-11/1	RE
SSM-6/1, SSM-6/11, SSM-6/15	RJ & RJA
SSM-11/1, SSM-11/15	RJB
SSM-23/2	RJC
SSM-11/14, SSM-11/17	RK
SSM-23/10	RKC-130/6
SSM-23/44, SSM-23/5	RKC 130/12

ROTATION:—With field connections as shown in illustration (red field coil lead) connected near red arrow, generator rotation is clockwise as viewed from commutator end. To reverse direction of rotation, disconnect and exchange red and blue field coil leads. The battery used with these generators must always have the negative (—) terminal grounded. On Types RJ and RJA generators, terminal 'H' is located in place of terminal 'F' and terminal 'F' is located near regulator adjusting nut. On Types RJC and RKC generators, the leads for the field coil and field resistance are not connected to terminals 'H' and 'F' but are connected to the positive brush and to an insulated bar inside the commutator end plate. The red and blue arrows are stamped into the commutator end plate. When the red field coil lead is connected near the arrows, the generator rotation is clockwise as viewed from the drive end. To reverse the direction of rotation, disconnect and exchange the red and blue field coil leads.

OPERATION:—The illustration shows the position of the regulator with the generator not running (cutout contacts open, lower regulator contacts closed, upper regulator contacts open). In this position the generator field resistance (wound on one field pole) is short-circuited. When the generator is operated, the generator current flows through the current or 'series' winding and then through the voltage or shunt winding. When the cut-in point is reached the magnetic field created by this current flow is sufficient to attract the pole piece, closing the cut-out contacts so that the generator current flows to terminal '51' and to the battery.

As the generator voltage rises, the movement of the pole piece toward the coil core first opens the lower regulator contacts which cuts the field resistance in series with the generator field. If the voltage continues to rise, the pole piece then closes the upper regulator contacts which momentarily short-circuits the generator field. This action results in maintaining an even voltage for all generator speeds.

ADJUSTMENT:—If generator performance is not satisfactory, check the following points before removing generator from the car:

1. Generator Drive. See that generator is properly driven without belt slippage, etc.

2. Wiring. Examine wiring, see that all connections are clean and tight (see illustration). Look for possible short-circuits.

3. Commutator and Brushes. See that brushes are not worn and that they are properly fitted. Examine commutator, clean if necessary.

Generator should be removed to the test bench and operated with regulator disconnected to make certain that regulator unit is at fault. To make this test, disconnect current winding lead from terminal 'H' and ground terminal 'F'. Operate the generator at speed shown in the following table and note whether voltage is within limits indicated. If voltage is not correct, examine generator for correct rotation, defective brushes, armature or field coils burnt out, or open connections.

Generator Type	Operating R.P.M.	Voltage Limits
RE	1600 R.P.M.	6-9 volts
RJ, RJA, RJB-75/6-900	850	6-9
RJC-90/6-1100	1100	6-9
RK-100/12-700	640	12-17
RK-130/12-900	750	12-17
RKC-130/6-1000	1000	6-9
RKC-130/12-825	825	12-17

If this test indicates that generator performance is satisfactory, reconnect regulator and test as follows. The entire test procedure as outlined below should be followed out before any readjustments are made. Before testing, examine relay and regulator contacts. If contacts are worn or pitted, clean and resurface contacts without disassembling. Relay contact gap should be .3 MM. (.012").

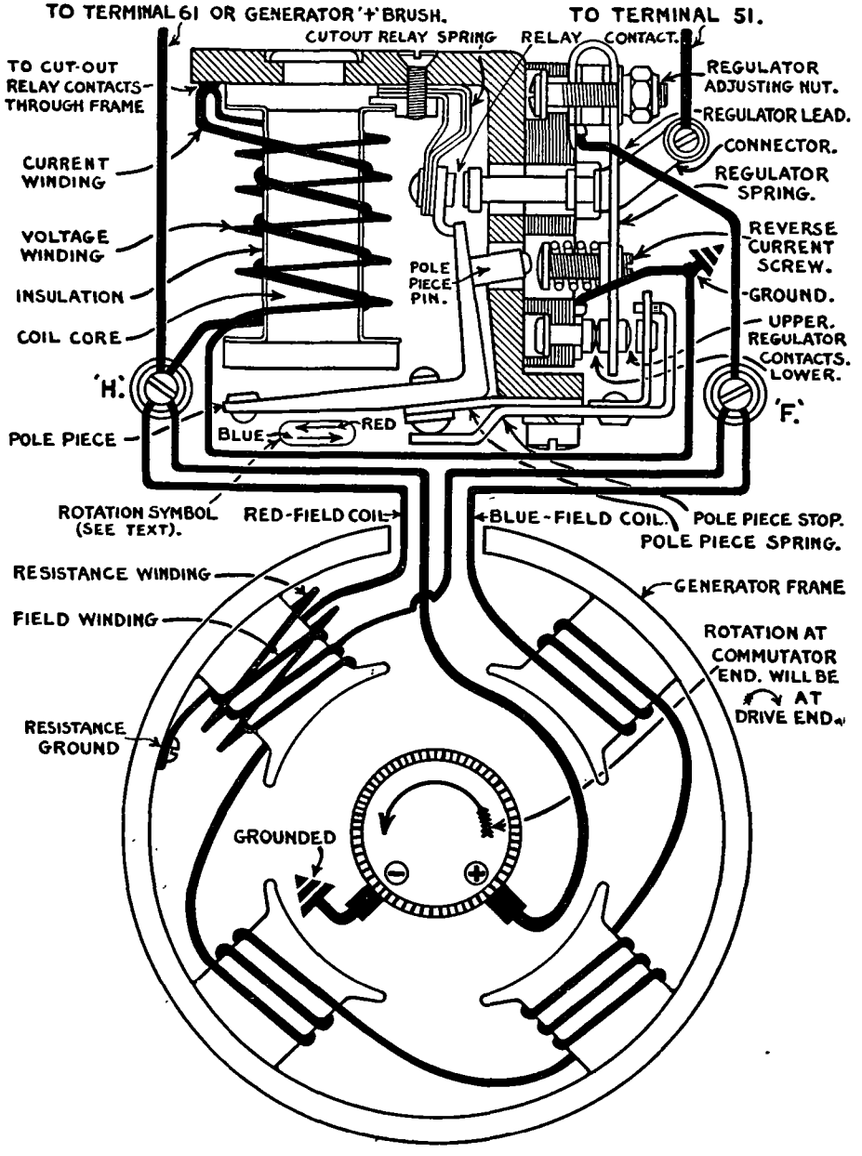
1. Regulating Voltage (No Load). Connect a voltmeter between terminal '61' and ground (if terminal 61 is plugged, connect voltmeter to stud 'H' or insulated brush. Operate the generator without load at 'nominal' speed given in table below. Note voltmeter reading. Then increase generator speed to 'maximum' and note voltmeter reading. Maximum voltage readings as recorded during this period while generator speed is increased to maximum point must be within limits given in the table and the voltage reading at maximum speed must not be more than .5 volts above or .2 volts below the voltage at nominal speed. To adjust, turn regulator adjusting nut to left (counter-clockwise) if regulating voltage is too high, or to the right (clockwise) if regulating voltage is too low. If correct regulating vontage cannot be secured with this adjustment, the regulator unit should be replaced.

Generator Type	Nominal Speed	Maximum Speed	Regulating Voltage
RE	1700 R.P.M.	5000 R.P.M.	7.3-8.5 volts
RJ, RJA, RJB	900	3500	7.3-8.5
RJC-90/6-1100	1100	4500	7.3-8.5
RK-100/12-700	700	3600	14.3-16.8
RK-130/12-900	900	3600	14.3-16.8
RKC-130/6-1000	1000	3600	7.3-8.5
RKC-130/12-825	825	4500	14.3-16.8

2. Regulating Voltage (With Load). If perforformance without load (Test 1) is satisfactory, this test can be omitted or may be made as a check on the results secured in the no-load test. Connect a voltmeter between terminal '51' and ground. Connect a lamp load of size indicated in table below between this same terminal and ground (lamps to be connected in parallel). Disconnect field lead on stud 'H', connect this lead to one terminal of an ammeter and connect the other ammeter terminal to the stud (placing ammeter in series with field to read field current). Operate generator and slowly increase speed until ammeter reading suddenly drops to about 1 ampere. This indicates that lower regulator contacts have opened and the voltmeter reading at this point is known as the 'lower regulating voltage'. Voltage readings must be within limits given in table below. To adjust, turn regulator adjusting nut to right (clockwise) if lower regulating voltage is too low, or to the left (counter-clockwise) if lower regulating voltage is too high.

As generator speed increases the upper regulator contacts finally close, short-circuiting the field winding (ammeter pointer will drop to '0'). The voltmeter reading at this point is known as the 'upper regulating voltage'. It must be within .5 volts above or .2 volts below the lower regulating voltage. If correct regulating voltage cannot be secured with this adjustment, the regulator unit should be replaced.

Generator Type	Load Watts	No. & Cp. Lamps	Lower Regulating Voltage	Maximum Speed
RE	60	4-6v.-21cp.	6.7- 7.2 volts	5000 R.P.M.
RJ, RJA, RJB	75	5-6v.-21cp.	6.7- 7.2	3600
RJC-90/6-1100	90	6-6v.-21cp.	6.7- 7.2	4500
RK-100/12-700	100	7-12v.-21cp.	12.9-14.1	3600
RK-130/12-900	130	9-12v.-21cp.	12.9-14.1	3600
RKC-130/6-1000	130	9-6v.-21cp.	6.7- 7.2	3600
RKC-130/12-825	130	9-12v.-21cp.	12.9-14.1	4500



3. Cut-in Voltage. Connect a voltmeter between terminal '61' and ground or between insulated brush and ground. Operate generator and slowly increase speed. Note voltmeter reading at instant relay contacts close (pole piece will move toward magnet core and can be easily noted). Voltmeter reading (cut-in voltage) must be within 6 and 9 volts for 6 volt generators (see tables above), or 12 and 17 volts for 12 volt generators. To adjust, bend pole piece stop (see luustration) slightly outward or away from pole piece to increase cut-in voltage, or in toward pole piece to lower cut-in voltage. On first type regulators the pole piece stop is located at the lower end of the pole piece instead of as shown. When making this adjustment, see that relay contact gap and pole piece gap (between pole piece and magnet core) does not exceed limits in table below. If correct adjustment cannot be secured wihout exceeding these contact gap and pole piece gap limits, replace regulator unit.

Relay Contact Gap Limits	.3- .5 MM. or .012-.020"
Pole Piece Gap Limits	3-3.2 MM. or .118-.126"

4. Reverse (Cut-out) Current. Depress the pole piece until the lower regulating contacts are about to open, measure distance from pole piece to relay contact spring angle (point of contact between pole piece and contact spring when contacts open). This distance must be within limits of .2-.4 MM. or .008-.016". To adjust, turn the reverse current screw in or clockwise to decrease this distance, and out or counter-clockwise to increase this distance. Then connect a voltmeter between terminal '51' and ground and an ammeter between terminal '51' and the positive (+) terminal of a battery. Ground the negative (—) terminal of the battery. Use a 6 volt battery for 6 volt generators and 12 volt battery for 12 volt generators. Battery must have sufficient capacity to show a voltage of 6.1-6.2 volts (6 volt battery), or 12.2-12.4 volts (12 volt battery) with a 6 ampere discharge. Operate the generator at a speed sufficient to charge the battery (relay contacts closed). Slowly decrease generator speed until ammeter reading drops to '0' and then shows a discharge or reverse current. Note ammeter reading when contacts open (ammeter pointer will drop to '0' at this point). Maximum reverse current as shown on ammeter must be within limits of 3-6.5 amperes. To adjust, turn reverse current screw in (clockwise) to decrease reverse current, and out or counter-clockwise to increase reverse current. Do not attempt to bend relay contact spring.

FINAL LOAD TEST (AFTER ADJUSTING):—After adjusting regulator, generator must be given a final load test to determine regulator action in service. Connect a lamp load as given in table below between terminal '51' and ground (lamps connected in parallel). Operate the generator for at least 15 minutes at speed given in table. Then allow generator to cool off to room temperature, repeat tests given above (regulating voltage without load, regulating voltage with load, cut-in voltage, reverse current), readjust as necessary. If readjustment is necessary, repeat the final load test.

Generator Type	Lamp Load Watts	Lamp Load No. & Cp. Lamps	Operating Speed
RE	60	4- 6v.-21cp.	4000 R.P.M.
RJ, RJA, RJB	75	5- 6v.-21cp.	3000
RJC-90/6-1100	90	6- 6v.-21cp.	3500
RK-100/12-700	100	7-12v.-21cp.	2500
RK-130/12-900	130	9-12v.-21cp.	3000
RKC-130/6-1000	130	9- 6v.-21cp.	3000
RKC-130/12-825	130	9-12v.-21cp.	3000

BOSCH REGULATOR—GENERATORS WITHOUT BATTERY

NEW TYPE SINGLE UNIT VOLTAGE REGULATOR AND CUTOUT RELAY AS USED ON TYPES RE, RJ, RJA, RJB GENERATORS (WITHOUT BATTERY)

DESCRIPTION:—This type regulator is the same as the type used on these generators with battery (see previous article). The generators are changed over for use without battery principally by having the pole piece stop bent so that the relay cutout contacts are permanently closed although a small gap must be normally found between the pole piece and the reverse current screw with the pole piece against the stop. See special article for complete directions for changing these generators over for use with or without battery.

ROTATION:—With field connections as shown in illustration (red field coil lead connected to terminal 'H'), generator rotation is clockwise as viewed from drive end. To reverse direction of rotation, disconnect and exchange red and blue field coil leads. On Types RJ and RJA generators, terminal 'H' is located in place of terminal 'F" and terminal 'F" is located near regulating adjusting nut.

ADJUSTMENT:—Check generator, drive, wiring, commutator, etc., as directed in article on generators with battery, before removing generator from car. If preliminary test on test bench indicates that regulator performance is unsatisfactory or that regulator is out of adjustment, make the following tests in order before readjustments are made.

1. Regulating Voltage (No Load). Connect a voltmeter between terminal '61' and ground (these generators will normally have terminal '51' plugged). Operate generator at 'nominal' speed and observe voltmeter reading. Voltage must be 6 volts or more. Then increase speed to 'maximum' speed and note voltmeter readings while speed is being increased. Voltage must be held within limits indicated. See table below for 'nominal', 'maximum' speeds and voltage limits. If generator voltage is not within limits, adjust as follows:

T Increase Voltage (maximum less than 6.6 volts)—Turn regulator adjusting nut in or clockwise to increase regulator spring tension.

T Decrease Voltage (maximum more than 7.4 volts)—Turn regulator adjusting nut out or counter-clockwise to decrease spring tension.

Generator Type	Nominal Speed	Maximum Speed	Voltage Limits
RE	1600 R.P.M.	5000 R.P.M.	6.6-7.4 volts
RJ, RJA, RJB	850	3600	6.6-7.4

2. Regulating Voltage (With Load). Connect a voltmeter between terminal '61' and ground. Connect a load comprising 2 6v. 21cp. and 1 6v. 4cp. lamps (34 watts total) between terminal '61' and ground (lamps in parallel). Operate generator and slowly increase speed to maximum as given in table below. Generator voltage must be within limits as shown. If voltage is not within these limits, adjust as follows:

To increase Voltage (maximum less than 6.4 volts)—Turn regulator adjusting nut in or clockwise to increase regulator spring tension.

To Decrease Voltage (maximum more than 6.6 volts)—Turn regulator adjusting nut out or counter-clockwise to decrease spring tension.

Generator Type	Maximum Speed	Voltage Limits
RE	5000 R.P.M.	6.4-6.6 volts
RJ, RJA, RJB	3600	6.4-6.6

NOTE:—Since the relay cutout contacts are permanently closed, it is not necessary to make a cut-in and cut-out test as on generators used with battery.

FINAL LOAD TEST (AFTER ADJUSTING):—After adjusting regulator, generator must be given a final load test to determine regulator action in service. Connect a load comprising 2 6v. 21cp. and 1 6v. 4cp. lamps (34 watts total) between terminal '61' and ground (lamps must be in parallel). Operate the generator for at least 15 minutes at the speed given in the table below. Allow generator to cool down to room temperature and check regulating voltage without load and regulating voltage with load as directed above, readjust as necessary. If any readjustment is found necessary, repeat final load test.

DELCO-REMY TWO TERMINAL CUTOUT RELAYS (NO GROUND CONTACTS)

NOTE:—For specifications on Cut-out Relays used in Control Units (Vibrating Voltage Regulators, Vibrating Voltage and Current Regulators, Voltage Control Relays) or Apparatus Boxes (except 480-Z), see separate articles on each type of equipment. Type 480-Z and Types 264-H (Cut-out Relay and Horn Relay), 264-D, F, (Cut-out and Solenoid Relays) listed below.

MECHANICAL ADJUSTMENT:—Air Gap. Close contacts by hand (hold armature down), check air gap between armature and coil core using a feeler gauge. See table below for air gap limits. Adjust by loosening armature hinge bracket support screws and shifting armature up or down (later types with 'L' shaped armature hinged at side of coil frame), or by bending armature mounting, moving armature away from or toward core (first types with armature mounted on top of coil core). On this first type relay, check also the air gap between the brass contact support and the armature at a point directly behind the contacts. This gap must be within limits of .010-.020". Adjust by bending the brass contact support.

Contact Gap. With armature up against upper stop, check contact gap. See table below for contact gap limits. Adjust by bending upper stop.

Cutout Relay Specifications and Performance
(Two and Three Terminal Types)

Type	Contact Gap	Air Gap	Cut-in Volts	Cut-out Amperes
263-A, C, D, F, G	.020"①	.015"	7.0-7.5	0-3.0
263-B, E	.020"	.015"	13.5-14.0	0-2.0
264-A to F, H to L	.020"①	.015"	7.0-7.5	0-3.0
264-N (Small Type)	.035"	.035"	15.0-18.0	1.5 amps. at 34 v.
264-N (Large Type)	.020"	.020"	37.0-39.0	1.5 amps. at 34 v.
265-B to V	.020"①	.015"	7.0-7.5	0-3.0
265-W	.020"	.015"	13.5-14.0	0-2.0
266-E to K	.020"①	.015"	7.0-7.5	0-3.0
266-N, P	.020"①	.015"	7.0-7.5	0-3.0
267-A to E	.020"	.015"	13.5-14.0	0-2.0
269-K	.020"①	.015"	7.0-7.5	0-3.0
270-A	.020"	.015"	6.75-7.5	0-5.0
270-D	.020"	.025"	14.2-14.6	1.5
480-Z	.020"①	.015"	7.0-7.5	0-3.0
5779	.045"	.045"	28.0-29.0	0-2.0
5780	.....	.045"	34-35	0-3.0
5781	.045"	.045"	6.0	4.5
1116751, 55, 88	.020"①	.015"	7.0-7.5	0-3.0
1116752, 71	.020"①	.015"	6.3-6.8	0-3.0
1116753, 61, 87	.020"	.015"	13.5-14.0	0-2.0
1116766, 73	.020"②	.020"	6.75-7.5	0-3.5
1116767	.020"	.020"	7.0-7.3	0-1.5
1116768	.030"	.020"	35-37	0-1.5
1116777	.020"	.015"	13.0-13.8	0-3.0
1116784	.025"	.055"	39.0-41.0	1.0 max.
1116791	.020"	.025"	14.8-15.2	0-1.1
1116795	.030"	.020"	28.0-30.0	0-3.0
SM-1418, 1728, 1849	.020"	.015"	13.5-14.0	0-2.0
SM-1495	.020"①	.015"	7.0-7.5	0-3.0
SM-1622	.020"	.057"	13-14	0-3.0
265-A	.020"①	.015"	6.0-6.5	0-1.5
266-A to D	.020"①	.015"	6.0-6.5	0-1.5
266-L	.020"①	.015"	6.0-6.5	0-1.5
269-C	.015"	.020"	7.3-7.6	0-1.0
269-D, H	.020"	.020"	7.0-7.3	0-1.5
270-B, C	.020"②	.020"	6.75-7.5	0-3.5
1116758	.020"	.020"	14.0-14.75	0-1.5

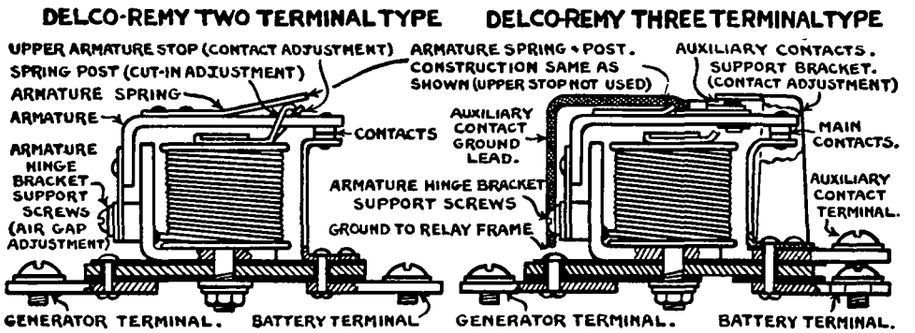
①—Armature Spring Tension 3.5 ounces.
②—Armature Spring Tension 6.2 ounces.

ELECTRICAL ADJUSTMENT:—Cut-in (contact closing) Point. Connect an accurate voltmeter between generator terminal of relay and ground. Operate generator, slowly increase speed until contacts close. Note voltmeter reading (there will be a slight 'kick-back' or voltage drop when contacts close). See table below for voltage limits at cut-in point. Adjust as follows:

To raise Cut-in Voltage. Increase armature spring tension by bending spring post upward (later types with 'L' shaped armature), or by pulling armature stop back in notch and lifting up armature until contacts are approximately ¼" apart, then resetting armature stop and checking contact gap (first types with armature mounted on top of coil core).

To lower Cut-in Voltage. Decrease armature spring tension by bending spring post down slightly (later types), or by pressing armature down toward core (first types with armature mounted on coil core).

Cut-out (contact opening) Point:—Connect an ammeter in charging circuit at relay. Operate generator and slowly decrease speed until current reverses and contacts open. Note discharge current at instant contacts open (pointer will fall to '0'. See table below for discharge current limits. If discharge current is excessive, increase armature spring tension and decrease air gap slightly.



DELCO-REMY THREE TERMINAL CUTOUT RELAY (WITH GROUND CONTACTS)

These types relays have a set of auxiliary contacts mounted above the armature for signal light or starter solenoid relay control. The auxiliary contacts are closed with the main contacts open and open when the main contacts close (see illustration). The upper contact of the auxiliary contacts serves as the relay armature upper stop.

MECHANICAL ADJUSTMENT:—Air Gap. Adjustments same as for standard relay later type with 'L' shaped armature. Settings given in table above.

Contact Gap. With upper contacts closed (armature in extreme upward position) check contact gap. See table above for contact gap limits. Adjust by bending upper auxiliary contact support. See that upper contacts are closed with main contacts open, and open when main contacts close.

ELECTRICAL ADJUSTMENT:—All adjustments are the same as for the standard relay later type with 'L' shaped armature. Settings given in table above.

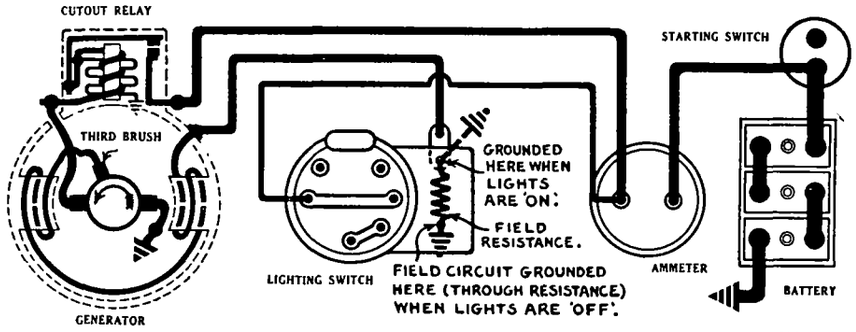
LIGHT SWITCH CONTROLLED FIELD RESISTANCE TYPE

NOTE:—This type Generator used on the following car models:

Car Model	Year	Generator Model
Chevrolet Master DA	1934	935-B
Chevrolet Master EA, ED	1935	935-V
Chevrolet Master FA, FD	1936	935-V
Chevrolet (All)	1937	948-R
Chevrolet Comm'l & Trucks	1938-39	948-R
Graham 90, 90-A, 110	1936	948-B
Graham 95, 116	1937	948-B
Graham, 96 (Without Radio)	1938-39	1100455
Oldsmobile F-34, L-34	1934	935-F
Oldsmobile L-34	1934	935-M

DESCRIPTION:—This type generator has a resistance unit in series with the generator field. The resistance unit is mounted on the lighting switch and is in series with the field coils with the switch turned 'off' or in the 'Park' position. When the switch is operated to turn on the headlights (principal lamp load), the resistance is shorted out, decreasing the total field resistance and increasing the generator output. Lighting switch (except on 1934 car models) has special position between 'OFF' and 'PARK' (button pulled out one notch) in which field resistance is shorted out so that the higher charging rate is available with the lamps turned off.

PERFORMANCE:—There are two distinct charging rates, the lower charging rate for day driving (lights turned off—resistance in circuit), and the higher charging rate for night driving (lights turned on—resistance shorted out). The generator used for this type installation is a conventional third brush control type, the lighting switch being used as a convenient method of switching the field resistance in or out of the field circuit. See car data sheets for performance data on particular generator models.



ADJUSTMENT:—Charging rate is adjusted in usual manner by shifting the third brush. Field resistance must be shorted out while adjustment is being made (ground field terminal on generator to generator field frame). Shift third brush in direction of armature rotation to increase charging rate and in opposite direction to decrease charging rate. See car data sheets for instructions and performance data on each generator model.

FIELD RESISTANCE:—All generators are regularly equipped with 1 ohm field resistance unit (on lighting switch). This is standard for average driving conditions (day and night, high and low speed). If car is operated in service with other than average driving conditions, make adjustments as noted below:

Excessive Day Use—Battery Overcharged:—Change resistance to 1½ ohm unit or reduce charging rate (third brush setting).

Excessive Night Use—Battery Undercharged:—Change resistance to ½ or ¾ ohm unit, check charging rate (do not set third brush beyond rated capacity of generator—see performance data on car data sheets for maximum setting).

Replacement resistance units are standard Delco-Remy thermostat resistance units. Parts numbers are as follows:

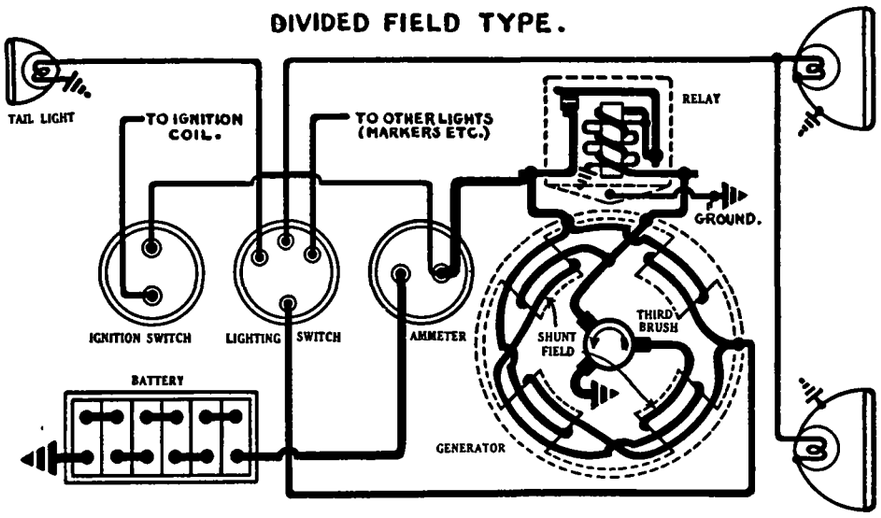
Resistance	Part No.
½ ohm	807180
¾ "	817911
1½ "	808767

DIVIDED FIELD TYPE

DESCRIPTION:—This type generator is a four pole unit with a conventional third brush controlled shunt field wound on two opposite field poles. A second winding on the other two field poles is connected in series with the lamp load (lamps are connected to special terminal on generator—see diagram). With all lamps off, generator operates as a regular third brush control type, all of the field excitation being supplied by the two third brush field coils, the field being of the 'consequent' or alternately excited pole type. When the lamps are turned on, the lamp current flows through the other two coils, strengthening the field and increasing the generator output.

PERFORMANCE:—Generators of this type are designed for a definite maximum lamp load and the 'lamp load' must not exceed 20 amperes (check lamp load with all lamps turned on by connecting ammeter in lamp circuit at terminal 'L'). Generators should not be operated with all load connected to ammeter terminal, since the stepped or two-stage charging rate is secured only with lamp load connected to generator terminal 'L'.

DIVIDED FIELD TYPE.



ADJUSTMENT:—Charging rate adjusted in usual manner by shifting third brush. Connect test ammeter between generator terminal and cut-out relay (do not connect ammeter to battery side of relay as ammeter will not register any current flowing to lamp circuits). Shift third brush in direction of armature rotation to increase charging rate, and in opposite direction to decrease charging rate. Charging rate should be set in accordance with operating conditions of car—performance table given below is maximum output, which must not be exceeded.

Performance Data—No Lamp Load

Generator	Cold Amperes	Cold Volts	Cold R.P.M.	Hot Amperes	Hot Volts	Hot R.P.M.
434	10-12	7.45-7.65	2000	6-8	7.05-7.35	2100
438	7.0	14.2	2100	4.6	13.7	2300
552	10-12	7.45-7.65	2000	6-8	7.05-7.35	2100
970-A	15-17	7.9-8.1	1500	11-13	7.45-7.65	1600
SM-1211	7.0	14.2	2100	4.6	13.7	2300
SM-1268	15-17	7.9-8.1	1500	11-13	7.45-7.65	1600

Allowable Lamp Load

Generator	Amperes
434, 552, 970-A, SM-1268	20
438, SM-1211	13

FUSE:—A 20 ampere capacity fuse is connected in the lamp circuit to protect the generator from excessive lamp load.

NOTE:—This type generator standard equipment on following car models:

Car Model	Generator	Regulator
Buick, 37-40 (1937)	918-B, 918-G	5807
Buick, 37-60, 80, 90 (1937)	918-A, 918-F	5807
Buick, 38-40 ('38), 39-40 ('39)	1101052	5807, 5858
Buick, 38-60 ('38), 39-60 ('39)	1101053	5807, 5858
Buick, 38-80, 90 ('38), 39-80, 90 ('39)	1101055	5807, 5858
Cadillac, 37-60, 65 (1937)	918-C	5817
Cadillac, 38-60, 38-60S (1938)	1101051	5817
Cadillac, 38-65 (1938)	1101054	5817
Cadillac, 39-60, 39-60S (1939)	1101056	5860
La Salle, 37-50 (1937)	918-C	5817
La Salle, 38-50 (1938)	1101051	5817
La Salle, 39-50 (1939)	1101056	5860

TYPE:—New type two-pole generator with fixed third brush and vibrating voltage regulator control. Field coils are connected separately so that left hand coil has third brush control (connected between third brush and field terminal), while right hand coil is straight shunt type (connected between main brush and field terminal). Both field coils are in regulator circuit and are controlled by the voltage regulator.
NOTE—Design of Shunt-Field Coil (right hand) has been changed so that lead location and connection points are different. See illustration and instructions below for old and new type coils. Old coils need not be discarded and will give satisfactory service if care is taken to see that leads located so that no short-circuits can result. New coils only are furnished for service.

OPERATION:—Both coils work together so that output is determined by 'balanced' characteristics of the third-brush and straight-shunt field design. Field strength of third-brush field coil drops off at high speed while that of the straight-shunt coil continues to increase so that better high speed performance is secured. This feature allows generator to be driven at greater engine-speed ratio so that improved low speed performance is secured without affecting the high speed performance. Actual charging rate on the car is determined by the voltage regulator setting.

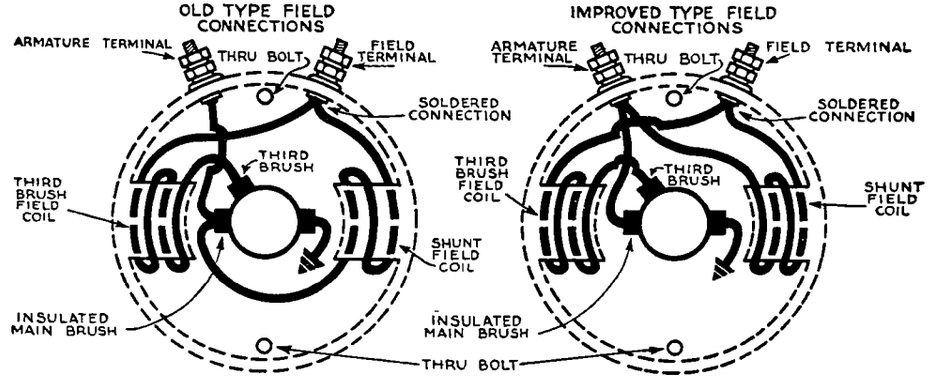
PERFORMANCE:—See individual car model page for recommended setting for each car model. Specifications for testing as follows:
Motoring Performance—900-1000 R.P.M., 4.5-7 amperes, 6.0 volts.
Stalled or Lock Current—28-34 amperes, 5.0 volts.
Field Current (Total)—2.33-2.50 amperes, 6.0 volts.
Field Coil Testing—Specifications for each coil as follows:

Coil	Resistance (75° F.)	Field Current (at 6 volts)
Third Brush Coil	6.6-7.1 ohms	.89- .94 amperes
Shunt Coil	4.0-4.25 ohms	1.44-1.56 amperes

NEW TYPE SHUNT FIELD COIL

NOTE:—Shunt field coil (Part No. 1866409) has been redesigned so that both leads are located on top of coil and connections are made directly to the generator terminals (see illustration). Whenever old type coils are replaced by this new type follow special instructions below.

INSTALLATION:—To install new type coil, unsolder old field coil lead connection on terminal post 'F', disconnect second coil lead on insulated main brush, remove coil. Remove old armature terminal post 'A' together with lead to insulated main brush. Install new type coil with leads at top. Solder short lead of new coil to field terminal post 'F'. Arrange second lead (furnished with new terminal post attached) across top of frame, install new terminal post. See that third brush field lead connected to third brush, connect second lead on new terminal post to insulated main brush being careful to lay this lead OVER the third brush lead.



DELCO-REMY LAMP LOAD TYPE GENERATORS

CURRENT REGULATED SHUNT TYPE

DESCRIPTION:—This type generator is shunt wound, no third brush being used. An external current regulator is used to regulate the generator output. The feed wire or lead for the lamps is taken from the current regulator so that the lamp current does not flow through the entire current regulator winding (one coil only instead of both coils). This has the effect of increasing the generator output by an amount equal to one-half the lamp load when the lamps are turned on.

PERFORMANCE:—Generators of this type are designed for a definite maximum lamp load and lamp load figure in table below must not be exceeded (check lamp load with all lamps turned on by connecting ammeter in lamp circuit at terminal 'L').

Generator Model	Control Unit	Max. Lamp Load—Amperes
933-B, C	5541	11
933-D	5543	7
5030591	5545	7
961-C	5541	11

ADJUSTMENT:—Charging rate is adjusted by changing current regulator armature spring tension. Increase spring tension to increase generator output, decrease spring tension to decrease output. See article on Types 5541, 5543, 5545 Current Regulators below for complete data on adjustment, and maximum generator output.

LIGHTING THERMOSTAT:—A thermostatic arm type current limit relay (no winding) mounted in the Control Unit is used to protect the lighting circuits from overload. Thermostat contacts open with lamp load of 20 amperes wih temperature of 210°F. (air—thermostatic arm temperature 375-385°F.).

NOTE:—This type Regulator used with the 'Current Regulated-Shunt Type Generators' described above on the following car models:

Car Model	Year	Regulator	Generator
Cadillac V-8 355-D, 10, 20, 30	(1934-35)	5541	933-B
Cadillac V-12 370-D, 40	(1934-35)	5541	933-C
Cadillac V-16 452-D, 60	(1934-35)	5541	933-C
La Salle Model 350, Series 50	(1934-35)	5541	961-C

DESCRIPTION:—The Current Regulator used in these type control units is designed to control the generator output. It is used in connection with a straight shunt wound generator (see separate article on 'Lamp Control Current Regulated Shunt Type Generators') and is designed to provide a higher generator output when the car is operated with the lamps turned on. Some types are compensated for temperature variations and the output increases with abnormally low temperatures and decreases with abnormally high temperatures (see table below). All compensated types should be adjusted with the control unit warmed up to room temperature (70°F.).

OPERATION:—The entire generator output from the cutout relay is fed through the two coil windings of the Current Regulator (with lamps off). When the output reaches the maximum figure for which the unit is set, the Regulator contacts open (or vibrate), cutting the resistance unit which is connected across the contacts in series with the field current and holding the output constant. The car lamps are connected to a lead which is taken off on the battery side of the first regulator coil (see illustration) so that the lamp current does not flow through both coils (one coil instead of two) When the lamps are turned on this has the effect of reducing the magnetic field of the Regulator coils since a portion of the generator output is shunted by the second regulator coil. This increases the generator output by an amount equal to one half the lamp load and results in a more even charging rate to the battery. It is very important with this type generator that the lamp load should not exceed the maximum rating for the particular generator (see tables on car data sheets and article on shunt type lamp control generator).

PERFORMANCE:—Current Regulators used on 1934 car models should perform in accordance with the following table:

Current Regulator Setting

Regulator Type	Maximum Lamp Load	Maximum Cold Generator Ouput Lights Off	Lights On
x-5541	11 amperes	13-16 amperes	19-22 amperes
5543	7 amperes	7.5-8.5 amperes	11-13 amperes
5545	7 amperes	6.5-7.5 amperes	10-12 amperes

(x)—This type Current Regulator over-compensated for temperature and setting given above is correct with unit at room temperature (70°F). With generator hot (200°F), setting should be 9-11 amperes (lights off) and generator output with 11 ampere lamp load should be 14-16 amperes.

ADJUSTMENT:—Check mechanical specifications of Current Regulators before testing or adjusting performance. Follow procedure below:

Mechanical Adjustment:—Air Gap. Press down on armature until fiber bumper touches the stop. Hold in this position and check air gap between center of core and armature with feeler gauge. Air gap should be .057". Adjust by bending contact spring post.

Contact Gap. Hold armature down against lower stop and check contact gap. Gap should be .020". Spring tension should be 2.25 ozs. (at contacts).

Contact Spring Gap. Release armature. With contacts closed, measure gap between the fibre bumper and contact spring stop. Correct air gap is .008". Adjust by bending upper stop.

Electrical Adjustment:—Connect accurate ammeter in charging circuit at generator terminal. Connect voltmeter between generator and battery terminals on control unit. Operate generator and note generator output. If output is not correct (see performance table above), adjust as follows:

To Increase Output. Increase armature spring tension by bending lower spring bracket down.

To Decrease Output. Decrease armature spring tension by bending lower spring bracket up.

Check output with cover in place on regulator and repeat adjustment until correct setting is secured.

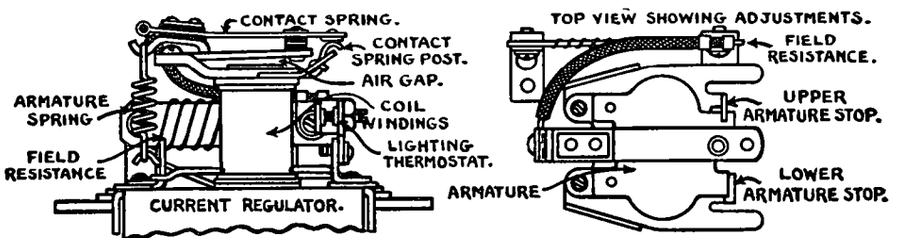
CUTOUT RELAY:—Cutout Relay used on above regulator types similar to units used singly on other generator models except for specifications as given below. See separate article on Delco-Remy Cutout Relays for complete adjustment directions.

Cutout Relay Specifications

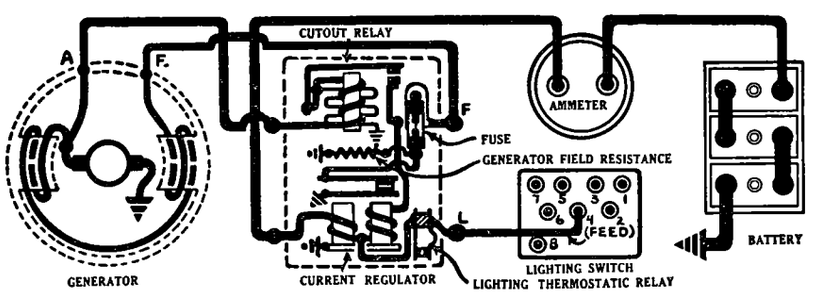
Cuts In—6.75-7.25 volts.

Cuts Out—0-3.0 ampere discharge current.

Contact Gap—.020". **Air Gap**—.015" (contacts closed).



WIRING DIAGRAM.



LAMP LOAD:—Lamp load should be checked by connecting an ammeter in circuit at the regulator 'L' terminal. Lamp load must not exceed maximum rating for the particular type generator.

THERMOSTAT:—A thermostatic relay (thermostatic arm type circuit breaker) mounted within the control unit case is connected in the lamp circuit to protect the regulator and generator from overloads. Thermostat contacts open with load of 20 amperes with an air temperature of 210°F. (thermostatic arm temperature will be 375-385°F.).

DELCO-REMY REGULATORS

VOLTAGE CONTROL RELAY (STEP VOLTAGE CONTROL)

Car Model	Regulator Generator
All Cars	5554.....935-L
Buick 34, 35-40	5555.....931-Z
Buick 35-40	5589.....936-C
Buick 34, 35-50, 60, 90	5549.....956-L
Buick 34, 35-50, 60, 90	5544.....929-B
Buick 36-40 Optl.	5589.....936-C
Buick 36-60, 80, 90	5594.....936-W
Chevrolet (Canada)	5585.....936-A
Chevrolet (Taxicab)	5540.....931-R
Chevrolet (High Spd.)	5540.....931-M
Chevrolet (Police)	5547.....933-F
Chevrolet Spec. Govt.	5542.....935-U
Chrysler CA, CB	5542.....935-D
Chrysler CU, CV, C2, 3	5544.....935-G
Chrysler CW, CW*	5550.....967-P
De Soto SE	5542.....935-D
Dodge DR, DS, DT	5540.....937-P
Graham 68 (Radio)	5544.....935-J
Graham 67 (Radio)	5548.....967-N
Graham 69	5544.....967-L
Graham 68, 73 (Pol.)	5558.....931-V
Graham 73 (Radio)	5585.....936-E
Graham 74 (Radio)	5585.....936-L
Graham 72 (Radio)	5590.....936-G
Graham 75	5590.....936-G
Graham 80, 80A Radio	5585.....936-L
Graham 85 (Radio)	5585.....936-L
Oldsmobile F, L-35	5585.....935-X
Pierce Arrow Del. '34	5540.....929-A
Pierce Arrow all '35	5540.....929-A
Pontiac 603 (Radio)	5540.....931-R
Plymouth PE	5540.....937-P
Reo 6-A (Radio)	5542.....936-M
Reo 6-D Radio	5542.....936-M
Studebaker A (Radio)	5542.....935-R
" B, C (Radio)	5542.....935-H
" 1B, 1C	5546.....935-Y
Studebaker 2C	5546.....936-X

DESCRIPTION:—The Voltage Control Relay provides a stepped or two-rate charging control. The relay is non-vibrating and acts as an automatic switch to cut the resistance unit in or out of the field circuit, providing a high charging rate with the contacts closed (resistance short-circuited) and a lower charging rate with the contacts open (resistance in field circuit). Types used as standard or special equipment on car models as follows:

OPERATION:—The voltage control relay has only one winding (there are two coils but windings are connected in parallel). When the generator voltage reaches the maximum point for which the unit is set, the current flow through the coil winding opens the relay contacts, cutting the resistance into the field circuit. The contacts remain open (providing the lower charging rate) until the generator voltage falls to the minimum point and then close so that the higher charging rate is resumed. The resistance is connected across the relay contacts and is short-circuited with the contacts closed.

PERFORMANCE:—Voltage Control Relays are over-compensated for temperature and operating voltage will not be uniform over entire range. Tests should be made with unit cooled down to room temperature (70°F). Settings may be rechecked with generator and control unit hot (180°F). Performance should be as follows:

Performance Data

Type	Contact Opening Voltage 70°F	Contact Opening Voltage 180°F	Contact Closing Voltage 70°F	Contact Closing Voltage 180°F
5539	8.5-8.9	8.5-8.7	7.0-7.5	7.0-7.2
5540, 2, 4, 6, 8, 9	8.3-8.7	7.75-8.2	7.25-7.75	6.55-7.1
5550, 1, 4, 5, 6, 8	8.3-8.7	7.75-8.2	7.25-7.75	6.55-7.1
5560	15.4-16.35	14.4-15.35	13.9-15.1	12.8-14.1
5581, 2	8.3-8.7	7.75-8.2	7.25-7.75	6.55-7.1
5583, 4, 5	8.3-8.7	7.75-8.2†	7.25-7.75	6.55-7.1†
5586	15.4-16.35	14.4-15.35	13.9-15.1	12.8-14.1
5590, 3	8.3-8.7	7.75-8.2†	7.25-7.75	6.55-7.1†
5589, 94, 5	8.3-8.7	7.75-8.2	7.25-7.75	6.55-7.1
5800	7.65-8.05	7.55-7.95	6.65-7.15	6.35-6.95
5804	8.1-8.55	7.65-8.05†	7.15-7.55	6.35-6.95†
5805,16	8.3-8.7	7.75-8.2	7.25-7.75	6.55-7.1
5821	7.65-8.05	7.55-7.95	6.55-7.15	6.35-6.95
5830, 9	8.3-8.7	7.75-8.2†	7.25-7.75	6.55-7.1†
5833	7.45-7.85	6.95-7.35†	6.0 Max.	6.0 Max†
5834, 8	15.4-16.35	14.4-15.35	13.9-15.1	12.8-14.1
5845, 9	14.1-14.7	14.1-14.7	12.0 Max.	12.0 Max.
5850	8.3-8.7	7.75-8.2	7.25-7.75	6.55-7.1
5851	7.45-7.85	6.95-7.35†	6.0 Max.	6.0 Max. †
5857	14.1-14.7	14.1-14.7	12.0 Max.	12.0 Max.
5859	28.5-31.5	26.5-28.5	15.0 Max.	15.0 Max.
5863	7.65-8.05	7.55-7.96	6.65-7.15	6.35-6.95
5864, 8, 9	7.45-7.85	6.95-7.35†	6.0 Max.	6.0 Max.†
5879, 80, 81	8.3-8.7	7.75-8.2	7.25-7.75	6.55-7.1
5882	14.6-15.55	13.6-14.55	13.3-14.5	12.2-13.5
5883	7.9-8.3	7.35-7.8†	6.95-7.45	6.25-6.8†
5884	15.4-16.35	14.4-15.35	13.9-15.1	12.8-14.1
5886	14.5-15.2	13.5-14.2	12.5-13.2	11.5-12.2

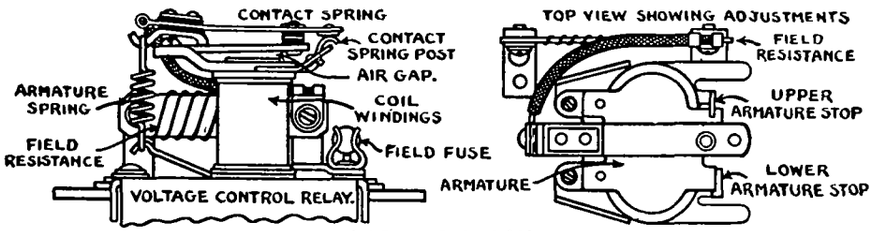
†—At temperature of 150°F.

ADJUSTMENT:—Check mechanical specifications of Voltage Control Relay before testing or adjusting performance. Follow complete procedure below:

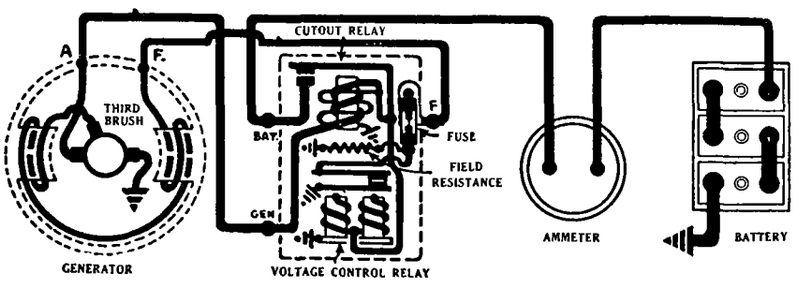
Mechanical Adjustment:—Air Gap. Hold armature down against lower stop and use feeler gauge to check gap. Use sensitive spring scale to check spring tension at contacts. See table below for specifications (spring tension given in ounces).

Armature Travel. Gauge armature travel (between lower stop and under side of armature with armature up against upper stop). Adjust by bending upper armature stop. See table below for specifications.

Contact Gap. Hold armature down against lower stop. Use feeler gauge to check gap, being careful not to disturb position of upper contact spring arm. See table below for specifications.



WIRING DIAGRAM



Regulator Specifications

Type	Air Gap	Contact Gap	Spring Tension	Armature Travel
5539	.057"	.015"	—	—
5540, 2, 4, 6, 8, 9	.035"	.010"	.7-.9	.035"
5550, 1, 4, 5, 6, 8	.035"	.010"	.7-.9	.035"
5560	.035"	.010"	.5-1.1	.030"
5581, 2, 3, 4, 5, 9	.035"	.010"	.7-.9	.035"
5586	.035"	.010"	.5-1.1	.030"
5590, 3, 4, 5	.035"	.010"	.7-.9	.035"
5800	.045"	.015"	.7-1.4	.045"
5804	.035"	.010"	.5-1.1	.035"
5805, 16	.035"	.010"	.7-.9	.035"
5821	.045"	.015"	.5-1.1	.045"
5830, 9	.035"	.010"	.7-.9	.035"
5833	.035"	.010"	.5-1.1	.035"
5834, 8	.035"	.010"	.5-1.1	.030"
5845, 9	.045"	.015"	.7-1.4	.045"
5850	.035"	.010"	.7-.9	.035"
5851	.035"	.010"	.5-1.1	.035"
5857, 63	.045"	.015"	.7-1.4	.045"
5859	.015"	.022"	.7-.9	.060"
5864, 8, 9	.035"	.010"	.5-1.1	.035"
5879, 80, 1	.035"	.010"	.7-.9	.035"
5882, 4	.030"	.010"	.5-1.1	.030"
5883	.035"	.010"	.5-1.1	.035"
5886	.035"	.010"	.5-1.1	.030"

Electrical Adjustment:—Connect accurate voltmeter between terminal marked 'Bat' and ground. Operate generator charging a fully charged battery and cycle generator by increasing speed until voltage control relay contacts just open and then decrease speed until contacts just close. Then repeat test and note voltmeter reading at instant contacts open and close. Voltage Control Relay performance should agree with table above. If operating voltages cannot be secured even with generator charging a fully charged battery, connect a variable resistance or fixed resistance of about .25 ohms in charging circuit. Resistance must have sufficient current carrying capacity to take entire generator load (20-25 amperes). Adjustments are as follows:

Cut-in (contact opening) Voltage Adjustment. Increase armature spring tension to increase operating voltage, or decrease armature spring tension to decrease operating voltage. Adjust by bending spring lower bracket. Correct spring tension before making this adjustment is ¾ oz. measured at contacts.

Cut-out (contacts closing) Voltage Adjustment. Increase armature air gap to increase operating voltage or decrease air gap to decrease operating voltage. Adjust by bending lower armature stop. Adjustment to correct closing voltage should be very slight. If it is necessary to change air gap considerably, recheck armature travel and contact gap, then repeat test.

CHARGING RATE ADJUSTMENT:—It should be remembered that the Voltage Control Relay establishes a high and low charging rate. The actual charging rate (maximum for both 'high' and 'low' rates) is determined by the third brush setting of the generator. The third brush is adjusted in the usual manner except that the Voltage Control Relay must be shorted out by connecting a jumper wire from the generator 'F' terminal to ground while the adjustment is being made in order to prevent regulator action. See individual car data sheets for standard settings and allowable maximum settings for each generator. Data given in 'Performance Data' tables is the maximum rating for the particular generator and must not be exceeded. Be sure to remove the jumper wire after the adjustment is completed.

WIRING:—Terminals are as shown except where Cut-out Relay ground contacts are used for starter solenoid control, when an extra 'GRD' terminal is provided. On one model the solenoid circuit is grounded through the generator third brush and the extra terminal is marked '3B'.

CUTOUT RELAY

The Cutout Relay used with these Voltage Control Relays is similar in design and operation with previous types. See separate article for complete description and adjustments. Specifications are as follows:

Cutout Relay Specifications & Performance

Type	Contact Gap	Air Gap	Cut-in Volts	Cut-out Amperes
5539	.020"	.015"	6.75-7.5	0-2.5
5540, 2, 4, 6, 8, 9	.020"	.015"	6.3-6.9	0-3.0
5550, 1, 4, 5, 6, 8	.020"	.015"	6.3-6.9	0-3.0
5560	.020"	.015"	13.0-14.2	0-4.0
5581, 2, 5	.020"	.015"	6.3-6.9	0-3.0
5583, 4	.020"	.020"	6.3-6.9	0-3.0
5586	.020"	.015"	13.0-14.2	0-4.0
5589, 94, 5	.020"	.020"	6.4-7.0	0-3.5
5590, 3	.020"	.020"	6.3-6.9	0-3.0
5800	.020"	.015"	6.3-6.9	0-4.0
5804	.020"	.020"	6.3-6.9	0-3.5
5805, 16	.020"	.015"	6.3-6.9	0-3.0
5821	.020"	.020"	6.3-6.9	0-4.0
5830, 9	.020"	.020"	6.3-6.9	0-3.0
5833	.020"	.020"	6.3-6.9	0-4.0
5834, 8	.020"	.015"	13.0-14.2	0-4.0
5845, 9	.020"	.015"	12.9-13.9†	0-4.0
5850	.020"	.015"	6.3-6.9	0-3.0
5851	.020"	.020"	6.3-6.9	0-4.0
5857	.020"	.015"	12.9-13.9	0-4.0
5859	.020"	.020"	24.5-27.5	3.0 Max.
5863	.020"	.015"	6.3-6.9	0-4.0
5864, 8, 9	.020"	.020"	6.3-6.9	0-4.0
5879, 81	.020"	.020"	6.4-7.0	0-3.5
5880	.020"	.020"	6.3-6.9	0-3.0
5882	.020"	.020"	12.4-13.6	4.0 Max.
5883	.020"	.020"	6.0-6.6	3.0 Max.
5884	.020"	.015"	13.0-14.2	0-4.0
5886	.020"	.020"	13.2-14.0	0-4.0

†—Compensated for temperature. This figure correct both Cold and Hot.

DELCO-REMY HORN RELAYS

DELCO-REMY HORN AND SOLENOID RELAYS

DESCRIPTION:—These types are similar in design and construction to the Cut-out Relays without ground contacts as described above except that only one coil winding is used and this is connected between the terminals (Solenoid Relays) or one end is brought out to a terminal and the other end connected to the main circuit within the relay case (Horn Relays). See car wiring diagrams where these units are used. In some instances Solenoid Relays or Horn Relays are combined with Cut-out Relays in a single case or the Solenoid Relay is built in the starter solenoid switch case (see special article on Starter Control Solenoid Switches).

ADJUSTMENT:—Adjustments are made in the same manner as for Cut-out Relays. Specifications are given in the table below.

Solenoid Relays

Type	Contact Gap	Air Gap	Closing Volts	Opening Volts
*264-D, E, F, L	.035"	.010"	3.2 Max.	1.6-2.0
264-G, M	.035"	.010"	8.5 Max.	3.5-4.2
268-M	.035"	.010"	3.2 Max.	1.6-2.0
268-V, Z	-----	.008"	8.0 Min.	3.0 Max.

*—These types combined with Cutout Relays in a single case.

Horn Relays

Type	Contact Gap	Air Gap	Closing Volts
①264-H, I, J, K	.020"	.015"	3.0-4.0
266-A, TK	.020"	.012"	3.0-4.0
268-J, L, P, T, W	.020"	.012"	3.0-4.0
268-R	.020"	.015"	8-10
269-E	.020"	.012"	3.0-4.0
271-A, B, C	.020"	.015"	2.3-2.5
271-D	.020"	.015"	4.5-6.5
①480-Z	.020"	.015"	3.0-4.0
1116759	.020"	.015"	4.5-6.5
1116760	.020"	.015"	3.0-4.0
1116762, 63, 64	.020"	.012"	3.0-4.0
1116770	.020"	.012"	3.0-4.0
1116774, 75, 78, 79	.020"	.015"	3.0-4.0
1116780	.020"	.015"	3.0-4.0
1116781	.020"	.015"	4.5-6.5
1116786	.020"	.012"	3.0-4.0
1116789	.020"	.015"	3.0-4.0
1116790, 92, 94	.020"	.015"	3.0-4.0
1116800	.020"	.015"	4.5-6.5

①—These types combined with Cutout Relays in a single case.

Standard or Special Equipment on the following car models:

Car Model	Generator	Regulator	Grounded Ter.
All Cars (Spec. Equip.)	936-N	5591	Pos.
All Cars (Spec. Equip.)	936-N	5592	Neg.
Buick 36-40 (Canadian)	936-V	5557	Neg.
Buick 36-60, 80, 90 (Canadian)	936-W	5557	Neg.
Buick 37-40 (1937)	918-B	5807	Neg.
Buick 37-60, 80, 90 (1937)	918-A	5807	Neg.
Cadillac 37-60, 65 (1937)	918-C	5817	Pos.
Chevrolet 1936 (Canadian)	936-U	5588	Neg.
Chevrolet (State Police)	936-J, N	5588	Neg.
Chevrolet 1937 (Canadian)	960-G	5814	Neg.
Graham 95, 116 (1937) Radio	948-Z	5812	Pos.
Graham 120 (1937)	948-Z	5812	Pos.
La Salle 37-50 (1937)	918-C	5817	Pos.
Oldsmobile F-36, L-36	936-T	5588	Neg.
Oldsmobile F-37, L-37 (1937)	936-T	5814	Neg.
Packard 115C (1937)	948-U	5812	Pos.
Pontiac Six 701A, B; 36-26A, B	935-W	5588, 5557	Neg.
Pontiac Eight 605, 36-28	935-W	5557	Neg.
Pontiac Taxi 1936	936-R	5557	Neg.
Pontiac 37-26CA, 37-28CA (1937)	948-S	5808	Neg.

1938-39 Car Models

Car Model	Generator	Regulator	Grounded Ter.
Buick 40, 60, 80, 90 (1938)	1101052, 3, 5	5807	Neg.
Cadillac 60, 60S, 65 (1938)	1101051, 4	5817	Pos.
Chevrolet HA, HB (1938)	1100004	5814	Neg.
Graham 96 Radio (1938-39)	1100007	5827	Pos.
Graham 97 (1938-39)	1100007	5827	Pos.
La Salle 38-50 (1938)	1101051	5817	Pos.
Oldsmobile 6 & 8 (1938)	1100002	5814	Neg.
Packard Six 1600 ('38), 1700 ('39)	1100005	5827	Pos.
Pontiac 6 38-26DA (1938)	1100003	5835	Neg.
Pontiac 8 38-28DA ('38), RHD ('39)	1100003	5808	Neg.

DESCRIPTION:—These units are composed of a new type Vibrating Voltage Regulator and a Cutout Relay in a single case. Unlike previous units, the voltage regulator is not designed to control generator voltage on open circuit and generator should be operated only when charging a battery. The control unit cover is sealed in place and unauthorized breaking of the seals (necessary to service either Cutout Relay or Voltage Regulator) voids the warranty on the unit. See Trouble Shooting Section below for tests which can be made without breaking the seals or removing the cover to determine whether unit is defective. These units are used as standard or special equipment on car models as listed above. Battery ground terminal must be positive (Pos.) or negative (Neg.) as indicated in table. This is important.

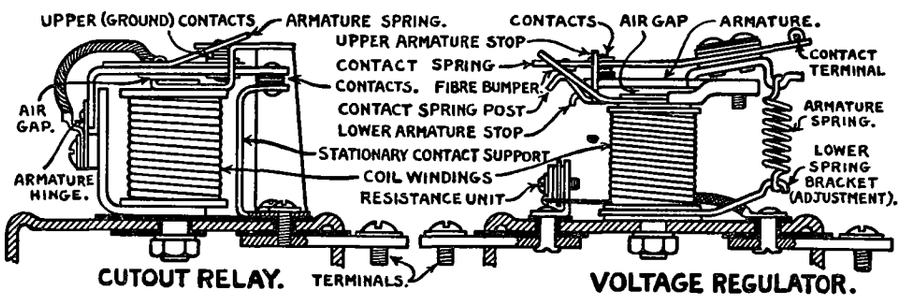
NOTE—To avoid changing generator polarity, disconnect lead on 'F' terminal of regulator **First** and connect this lead **Last.** To insure correct polarity, connect 'GEN' and 'BAT' terminals on regulator together momentarily after all leads have been connected but before engine is started.

Generators used with this type control unit have a 'fixed' or non-adjustable third brush. No regulation of the charging rate is possible except by changing voltage regulator setting.

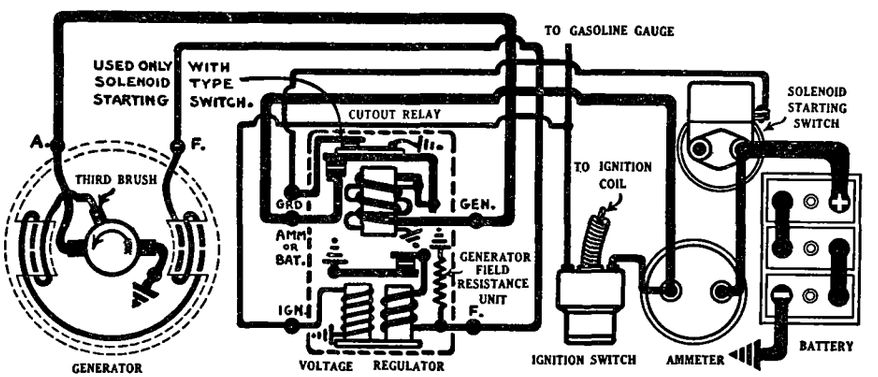
OPERATION:—Two windings are used on the regulator unit. The shunt or fine winding is connected at point near the battery (battery side of Cutout Relay) and is controlled by the ignition switch to prevent the battery discharging through the winding when the car is not being operated. Regulator is thus actuated by battery voltage (line voltage at a point near the battery) rather than by generator voltage (voltage directly across main brushes). The series or heavy winding is connected in series with the generator field and regulator contacts so that a current flows through this winding only when the regulator contacts are closed. In operation the current flow through both windings creates a magnetic field which attracts the regulator armature and opens the contacts when the battery voltage reaches the maximum for which the unit is set. When the contacts open, the current flow through the series coil is interrupted and the resistance unit is cut in the field circuit (resistance is connected across the contacts and is short-circuited with the contacts closed). This reduces the field strength and the generator voltage so that the regulator contacts again close. The opening and closing of the contacts is extremely rapid (vibrating action) and the generator voltage is held reasonably constant.

The generator will charge a discharged battery at the maximum rate and will be controlled by the fixed third brush (generator voltage depends upon battery voltage—both will come up as battery becomes charged). As the battery voltage comes up on charge, the voltage regulator will tend to hold generator voltage constant; charging rate tapering off to 'finish' rate.

The regulator is over-compensated for temperature variations by means of a bi-metal armature hinge. For this reason all tests should be made with regulator at room temperature (70°F) and rechecked when hot (150°F).



WIRING DIAGRAM.



TROUBLE SHOOTING:—If generator performance is not satisfactory, check in accordance with following table to determine whether Voltage Regulator or Cutout Relay is defective (not necessary to remove control unit cover to make these tests). Control unit is separately mounted and must be well grounded. See that a good ground exists through the base of the control unit or connect a separate ground lead from one of the mounting screws to a ground on the engine block.

1. Generator Not Charging. Operate engine at speed equivalent to 25 M.P.H. and ground 'F' terminal on control unit. If generator charges, regulator is defective. If generator does not charge, ground 'F' terminal on generator. If generator charges, the lead connecting the 'F' terminals is broken or open-circuited and should be replaced. If generator does not charge, disconnect the lead on the 'GEN' terminal of the control unit and flash to ground on engine block. If a spark is noted, the regulator or cutout relay is defective. If no spark is noted, examine this lead (connecting 'A' terminal on generator and 'GEN' terminal on control unit) before disassembling and examining generator.

2. Charging Rate Too High or Too Low. This may be caused by incorrect setting or defective operation of the Voltage Regulator. To check voltage of regulator, connect a variable resistance in the charging line between 'BAT' terminal of control unit and ammeter (in charging line). Dis-

connect lead on 'IGN' terminal of control unit and connect jumper wire from this terminal to 'BAT' terminal. Connect accurate test voltmeter between 'IGN' terminal and ground. Take readings with control unit at room temperature (70°F) and hot (150°F). To test, operate engine at speed of approximately 25 M.P.H. or generator speed of 2000-3000 R.P.M. until regulator reaches proper temperature, decrease speed until cutout relay contacts open, then increase speed to 2000-3000 R.P.M., holding charging current at 8-10 amperes and note reading. See table under Adjustment Section below for correct voltages. If voltages are correct, high charging rate may be caused by a shorted battery or a low charging rate may be caused by loose connections or a badly sulphated battery.

Oxidized Regulator Contacts—To check with regulator on the car, disconnect lead on 'IGN' terminal of regulator, connect ammeter in charging line at 'BAT' terminal. Operate engine at low speed so that charging current indicated on ammeter is 4-5 amperes. Maintain constant engine speed, ground 'F' terminal on regulator, note ammeter reading (wait until pointer remains steady after first momentary surge). If ammeter reading is 2 amperes or more greater than with 'F' terminal not grounded, contact point oxidization is excessive. To check with regulator on bench, see that commutator and brushes in good condition, then check generator speed at which cutout relay contacts close with 'F' terminal grounded and not grounded. Closing point with 'F' terminal grounded is normally slightly lower than when terminal not grounded. If difference is 100 R.P.M. or more, contacts are oxidized and should be cleaned.

NOTE—Radio by-pass condensers must not be installed on field or 'F' terminals of generator or regulator as these will cause oxidation of contacts. Condensers should be removed and contacts examined and resurfaced.

SERVICING:—If above tests indicate that Voltage Regulator or Cutout Relay are defective or that settings are incorrect, the entire control unit should be returned for service. All adjustments outlined below require breaking of the seals (voiding the warranty) and removing of the control unit cover.

CUTOUT RELAY ADJUSTMENT:—When the Cutout Relay has a set of auxiliary contacts mounted above the armature for starter solenoid relay circuit control or generator charge indicator control, these contacts should be closed with the main contacts open, and should open when the main contacts close. All other adjustments listed below.

Air Gap—Hold contacts closed and measure gap between armature and coil core with a feeler gauge. Air gap should be .020". Adjust by loosening two screws in armature hinge bracket and moving armature up or down.

Contact Gap—Measure gap with armature up against stop or with upper contacts closed (when used). Contact Gap should be .020". To adjust, bend upper armature stop backward or forward, or bend support arm carrying upper auxiliary contact (stop not used on this type).

Cut-in Voltage. Connect test ammeter in charging line at regulator 'BAT' or 'AMM' terminal, voltmeter between regulator 'GEN' terminal and ground. With regulator connected (lead attached to 'IGN' terminal), operate generator and slowly increase speed. Note voltmeter reading at instant relay contacts close. See table below for correct figure for each model. To adjust, change flat armature spring tension by bending spring post. Increase spring tension to increase closing voltage, decrease tension to lower voltage.

Cut-out Amperage. Connect test ammeter in charging line at regulator 'BAT' terminal. Operate generator, increase speed until cutout relay contacts close, then slowly decrease speed and note discharge (reverse) current at point where contacts open.

Cutout Relay Performance Data

Type	Cut-in Volts	Cut-out Amperes
5557, 88, 91, 92	6.9-7.6	0-4.0
5600	6.9-7.6	0-4.0
5802	12.8-14.2	0-4.0
5803, 7, 8	6.9-7.6	0-4.0
5812, 14, 15, 17	6.9-7.6	0-4.0
5820, 22, 27, 35	6.9-7.6	0-4.0
5843	12.4-13.6①	0-4.0
5844	6.2-6.9①	0-4.0
5862, 70	6.2-6.8	0-4.0
5866	12.4-13.6	0-4.0

①—Compensated for temperature. This setting correct both Cold and Hot.

Torrid Climate Setting—To correct overcharged battery condition where regular atmospheric temperatures are 95° to 100° F. and above, adjust Cutout Relay to close at 6.8-7.2 volts cold.

VOLTAGE REGULATOR ADJUSTMENT:—Check and adjust mechanical specifications listed below before changing voltage setting.

Contact Gap—Examine contacts and resurface by dressing lightly with a fine, flat contact file if oxidized to such an extent that generator performance is affected (this may be caused by excessive sparking due to low spring tension, poor alignment of contacts, etc.). Contact metal on small contact is extremely thin and filing should be held to a minimum. See that contacts are aligned and that contact surfaces are square. Check tension of the upper contact mounting spring. Spring tension should be 3.5 ozs. when contacts just open (measure by means of a spring scale hooked under contact spring). Adjust by bending contact spring slightly. Check contact gap with armature held down. Gap should be .020". Adjust by bending lower armature stop up or down. Check clearance between fibre bumper and stop with armature up. Clearance should be .010". Adjust by bending upper armature stop.

Air Gap—Check air gap between armature and coil core with contacts closed so that fibre bumper just touches the contact spring stop. Air gap should be .063". To adjust, bend contact spring stop. See Voltage Setting section below.

VOLTAGE REGULATOR SETTING:—***Using Variable Resistance (AVR Set)***—Resistance unit should be approximately .25 ohms. Connect resistance and test ammeter in charging line at 'BAT' terminal on regulator, disconnect lead at 'IGN' terminal, connect jumper between 'IGN' and 'BAT' terminals, connect voltmeter between 'IGN' terminal and ground. Operate generator at rated maximum output RPM., adjust resistance for output of 8-10 amperes. When regulator reaches proper temperature, 'cycle' regulator by decreasing speed until cutout relay contacts just open, then increase speed to original figure and note voltmeter reading with regulator operating. If performance cold (70° F.) and hot (150° F.) is not correct, adjust regulator as directed below.

Fixed Resistance Method. Use ¾ ohm (6 volt), 1½ ohm (12 volt) resistance capable of carrying 10 amperes (Nichrome wire preferred, do not use other wire). Disconnect leads on 'BAT' and 'IGN' regulator terminals, connect fixed resistance between 'BAT' terminal and ground on engine block, connect jumper between 'BAT' and 'IGN' terminals, connect voltmeter between 'IGN' terminal and ground. Operate engine, increase speed to R.P.M. at which maximum rated output is reached (see car model page for performance on each generator model), note voltmeter reading. If regulator action not satisfactory, adjust as directed below, then cycle regulator and recheck performance.

Voltage Setting. Regulator voltage setting is adjusted by bending armature spring lower bracket up or down to decrease or increase the spring tension. Only a slight change in the position of the bracket should be required. Increase spring tension (bend bracket down) to increase regulator voltage, or decrease spring tension (bend bracket up) to decrease regulator voltage. If spring tension must be decreased to a point where the spring is free with the contacts closed, change upper contact spring tension slightly (do not exceed limits as given above or change gap). If correct regulator voltages cannot be secured cold and hot by adjusting the armature spring tension, the regulator air gap may be changed slightly as follows: Increase air gap to increase cold setting, or decrease air gap to decrease cold setting with respect to hot setting.

Voltage Regulator Setting

Type	Cold Voltage (70°F)	Hot Voltage (150°F)
5557, 88, 91, 92	7.5-7.9	7.4-7.6
5600	7.25-7.65	7.2-7.4
5802	14.2-15.0	14.1-14.5
5803	7.25-7.65	7.2-7.4
5807, 8, 12, 14, 17	7.5-7.9	7.4-7.6
5815	6.95-7.45	6.95-7.15
5820, 22	7.25-7.65	7.2-7.4
5827, 35	7.5-7.9	7.4-7.6
5843	14.2-15.0	14.1-14.5
5844	7.25-7.65	7.2-7.4
5862, 70	7.3-7.6	7.25-7.35
5866	14.2-15.0	14.1-14.5

Torrid Climate Setting—To correct overcharged battery condition where regular atmospheric temperatures are 95° to 100° F. and above, set Voltage Regulator to operate at 6.8-6.9 volts hot.

These vibrating Voltage Regulators standard or optional equipment on the following car models:

Vibrating Voltage Regulators

Car Model	Generator	Regulator	Grounded Ter.
Buick 39-40, 60, 80, 90 (1939)	1101052,3,5	5858**	Neg.
Cadillac 39-60S, 61 (1939)	1101056	5860**	Pos.
Chevrolet Pass. Cars (1939)	1100004	5858**	Neg.
LaSalle 39-50 (1939)	1101056	5860**	Pos.
Oldsmobile 6 & 8 (1939)	1100009	5858**	Neg.
Packard 6 (Service Unit)		5860**	Pos.
Pontiac 6 & 8 (1939)	1100003	5858**	Neg.

**New type Regulator without 'IGN' Terminal.

REGULATORS WITHOUT 'IGN' TERMINAL

CHECKING:—High Charging Rate with Fully Charged Battery—To locate cause of trouble, connect ammeter in charging line at 'BAT' terminal of regulator, run engine at medium speed, disconnect generator field lead at regulator 'F' terminal. If charging current drops to '0' (no ammeter reading), regulator is out of adjustment, field circuit in regulator is grounded so that field current does not pass through resistance and contacts, or shunt winding of voltage regulator is open-circuited. If charging current does not drop to '0' (ammeter continues to register charging current), field circuit is grounded directly (at some point in field lead, or within generator). To check lead, disconnect at generator 'F' terminal. If generator continues to charge, ground is at terminal or within generator.

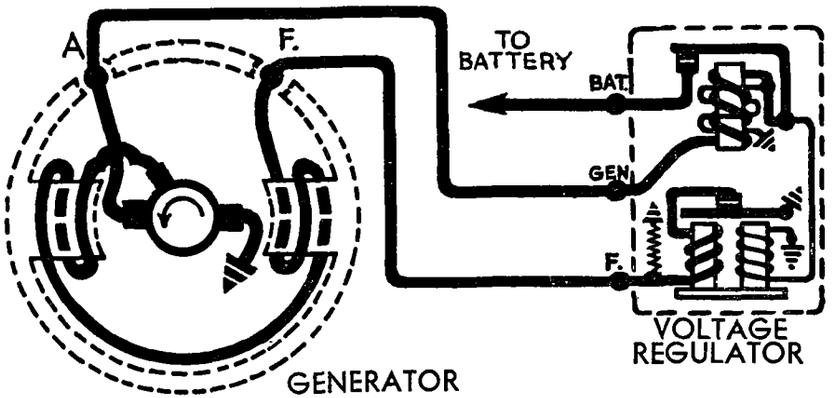
Low Charging Rate (or no output) with Discharged Battery—Check all wiring between generator and regulator, and between regulator and battery. Connect ammeter in charging line at regulator 'BAT' terminal. Start engine and increase speed slowly until charging current of 4-5 amperes is indicated on ammeter, hold engine speed steady at this point, ground regulator 'F' terminal. If charging rate increases by 2 amperes or more, regulator contacts are dirty or oxidized (see Servicing data below for contact resurfacing). If no increase noted, or if contacts are in good condition, increase engine speed slowly and note if generator produces rated output (see car model 'T&E' pages for generator performance tables). If generator performance is satisfactory, regulator is defective, out of adjustment, or voltage setting is too low (see Adjustment below). If generator output is less than capacity, check third brush setting and overhaul generator. If generator does not charge at all, leave 'F' terminal grounded, disconnect lead on regulator 'GEN' terminal and flash to ground. If spark occurs, trouble is in Cutout Relay which should be checked for dirty contacts, open shunt winding, grounded series winding or grounded frame. If no spark secured, repeat this check at generator 'GEN' terminal (to make certain that this lead is not grounded or open-circuited), and overhaul generator.

CAUTION—Do not operate generator more than momentarily with lead disconnected from 'GEN' terminal (not designed to be operated on open-circuit).

SERVICING:—When servicing and adjusting regulators, always check contacts (resurface if necessary as directed below), contact gap, contact spring tension, air gap before making adjustments to change performance.

Contact Point Resurfacing—If flat contact has a pit or cavity, use a special spoon shaped 'riffler' file to clean out the cavity and remove all oxidized material, then finish cleaning contact with a flat fine-cut contact file. Use file lightly on smaller rounded contact (contact metal is very thin). Use extreme care not to bend contact spring (file each contact separately) and keep all grease off contact surfaces. Do not use sandpaper or emery cloth on these contacts.

IMPORTANT SERVICE CAUTION—Badly burn or fused contacts, burnt resistor unit and regulator winding are caused by open-circuit operation, high resistance in charging circuit or radio condenser connected to field terminal. Check car wiring and correct trouble before replacing regulator.



TESTING & ADJUSTMENT:—Test and adjust each unit in order as follows:

CUTOUT RELAY

Air Gap—Hold contacts closed, check gap between armature and coil core with a feeler gauge. Should be .020". Adjust by loosening two screws on armature hinge bracket and move armature up or down.

Contact Gap—Check with feeler gauge with armature up against upper stop. Should be .020". To adjust, bend upper armature stop (or upper contact support on types with auxiliary ground contacts on armature—make certain that these auxiliary contacts open when main contacts close).

Cut-in Voltage & Cut-out Current—Connect ammeter in charging line at regulator 'BAT' terminal (disconnect lead at this terminal, connect lead to one ammeter terminal, connect other ammeter terminal at 'BAT' terminal). Connect voltmeter between regulator 'GEN' terminal and ground on regulator case. Start engine and slowly increase speed. Note voltage at which relay contacts close. Should be 6.3-6.9 volts (cold or hot—see note below). Then decrease speed slowly and note ammeter reading at instant contacts open. Should be 0-4.0 amperes. Adjust as follows:

Cut-in Voltage Adjustment—Bend spring post (at outer end of armature spring) up to increase cut-in voltage (increase spring tension), down to decrease cut-in voltage (decrease spring tension).

Torrid Climate Setting—To correct overcharged battery condition where regular atmospheric temperates are 95° to 100° F. and above, adjust Cutout Relay to close at 6.4-6.6 volts hot or cold.

Cut-out Current Adjustment—Adjust by changing armature spring tension and air gap slightly. Air gap limits are .018-.022".

CAUTION—On all regulators without 'IGN' terminal, relay voltage must be set below regulator voltage or relay will not close until high generator speed is reached which will result in discharged battery and burned relay contacts. Set voltage to exact figures given above. Low setting will cause vibrating and burning of relay contacts. Relays used on these regulators are compensated and performance will be same cold and hot (can be checked regardless of temperature). This is not true of regulators with 'IGN' terminal.

VOLTAGE REGULATOR

Check regulator for broken, burned, loose or unsoldered leads, and defective resistor unit. Check contacts and resurface if dirty or oxidized (see Servicing directions above—replace armature assembly if contacts are pitted or have been filed excessively).

Air Gap—Move armature down by hand until fibre bumper just touches stop, check air gap between armature and center of core with feeler gauge. Should be .063". Adjust by bending contact spring post. Check clearance between fibre bumper with armature up. Should be .010". Adjust by bending upper stop.

Contact Gap & Spring Tension—Hold armature down against lower armature stop and check gap with feeler gauge. Should be .020". Adjust by bending lower armature stop. Check contact spring tension with spring scale hooked between fibre bumper and contact point as near point as possible, note scale reading at instant contacts open. Should be 3½ ozs. minimum. Adjust by bending the flat contact spring (carrying upper contact) as near as possible to point where it is attached to the frame.

Voltage Setting (Using Variable Resistance or AVR Set)—Connect variable resistance (approximately .25 ohms required) and ammeter in series in charging line at regulator 'BAT' terminal, connect voltmeter between 'BAT' terminal and ground on regulator case. Run engine at speed at which generator maximum output normally secured (2800-3000 R.P.M.), adjust resistance so that charging rate is 8-10 amperes (if charging rate less than 8 amperes, turn on lights while making this check), operate generator until regulator reaches operating temperature of 150°F. (very hot when felt by hand). Note voltmeter reading. Should be 7.4-7.6 volts at this temperature (7.5-7.9 volts at 70°F.—Cold). To adjust, remove regulator cover, change regulator armature spring tension slightly by bending spring hanger (at lower end of spring) down to raise regulator voltage (increase spring tension), or up to lower regulator voltage (decrease spring tension). Replace regulator cover and repeat test. CAUTION—Cover must always be in place when tests are made.

Torrid Climate Setting—To correct overcharged battery condition where regular atmospheric temperatures are 95° to 100° F. and above, set Voltage Regulator to operate at 6.8-6.9 volts hot.

Fixed Resistance Method—Disconnect lead at 'BAT' terminal of regulator (leave this lead off while making test), connect 3/4 ohm fixed resistance between 'BAT' terminal and ground (see Resistance Note below), connect voltmeter between 'BAT' terminal and ground. Operate engine at speed at which generator normally produces maximum output until regulator reaches operating temperature of 150°F (very hot when felt by hand). Note voltmeter reading. Should be 7.4-7.6 volts at this temperature (7.5-7.9 volts at 70°F—Cold). Adjust in same manner as directed for AVR setting method above.

RESISTANCE NOTE—Resistance unit must be capable of carrying 10 amperes and must have same resistance cold and hot. It is extremely important that correct resistance unit value be used when using this method of checking regulator setting. Use 3/4 ohm resistance for all 6 volt regulators, 1½ ohm resistance for 12 volt units.

GENERATOR OUTPUT (THIRD BRUSH CONTROL).

Checking—Connect 1/4 ohm variable resistance and ammeter in series in charging line at regulator 'BAT' terminal, connect voltmeter between 'GEN' terminal and ground. Operate generator at speed for which maximum output figure given in generator performance tables (see car model 'T&E' pages for each model), adjust variable resistance until voltage is correct—this is extremely important. Note ammeter reading.

Adjustment—On generators with adjustable third brush, adjust brush for correct output. On types with fixed third brush, no adjustment is possible and generator must be overhauled if rated output cannot be secured.

These regulators standard or optional equipment on following car models:

Car Model.	Generator.	Regulator.	Grounded Ter.
All Cars (Spec. Equip.)	954-A	5587	Neg.
All Cars (Spec. Equip.)	954-A	5596	Pos.
All Cars (Spec. Equip.)	All 930 or 934	5597	Pos.
All Cars (Spec. Equip.)	All 930 or 934	5599	Neg.
All Cars (12 volt Spec. Equip.)	All 934	5598	Pos.
All Cars (12 volt Spec. Equip.)	All 934	5801	Neg.
All Cars (Spec. Equip.)	961-N	5831	Pos.
All Cars (Spec. Equip.)	961-N	5832	Neg.
Cadillac V8 60, 70, 75 (1936)	961-E	5559	Pos.
Cadillac V12 80, 85; V16 90 ('36)	933-M	5559	Pos.
Cadillac 37-70, 75 (1937)	961-K	5818	Pos.
Cadillac V12, 85, V16, 90 (1937)	933-M	5559, 5818	Pos.
Chevrolet (Police, Bus, Truck)	933-H, J, L	5587	Neg.
Chevrolet (Police, Bus) 12 volts	934-G	5801	Neg.
Graham 80, 80A, 85 (Police)	933-R	5596	Pos.
Graham 95, 116, 120 ('37) Police	934-F	5597	Pos.
La Salle 35-50, 36-50	961-D	5559	Pos.
Oldsmobile 6 & 8 (Police)	933-L	5587	Neg.
Packard 1500, 1, 2 (1937)	961-J	5813	Pos.
Packard 1506, 7, 8 (1937)	930-F	5811	Pos.
Pontiac 6 & 8 (Police)	933-G, L	5587	Neg.
Studebaker Pres. 3C (1937)	961-H	5818	Pos.
1938 Car Models			
Cadillac V8 38-75 (1938)	1102652	5818	Pos.
Cadillac V16 38-90 (1938)	1102651	5818	Pos.
Studebaker Pres. 4C (1938)	1102653	5818	Pos.
1939 Car Models			
Cadillac 39-75 (1939)	1102654	5867	Pos.
Cadillac 39-90 (1939)	1102655	5867	Pos.
Chevrolet Spec. Equip. ('39)	934-F	5599	Neg.
	934-F	5854	Neg.
Studebaker Pres. 5C (1939)	1102656	5861	Pos.

DESCRIPTION:—These units are composed of a vibrating type Voltage Regulator of a new design, a vibrating type Current Regulator, and a Cutout Relay in a single case. The Voltage Regulator is not designed to control generator voltage on open circuit and the generator should be operated only when charging a battery. The Control Unit cover is sealed in place and unauthorized breaking of the seal (necessary to service any of the units) voids the warranty on the unit. See Trouble Shooting Section below for tests to determine whether the unit is defective without removing cover. These models are standard or special equipment on car models listed below. Battery ground terminal must be positive (Pos.) or negative (Neg.) as indicated in table. This is important.

NOTE—To avoid changing generator polarity, always disconnect lead on 'F' terminal of regulator **First** and connect this lead **Last.** To insure correct polarity, connect 'GEN' and 'BAT' terminals on regulator together momentarily after all leads have been connected but before engine is started.

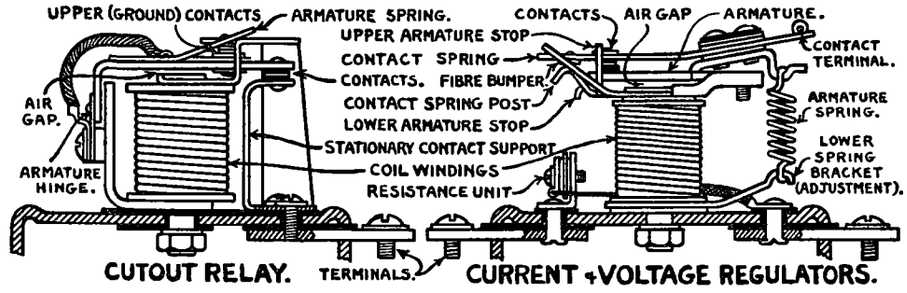
Generators used with this type Control Unit are shunt wound, two-pole, two-brush machines (no third brush being used). No regulation of generator charging rate is possible except by changing setting of Current Regulator (maximum output) or Voltage Regulator (maximum voltage).

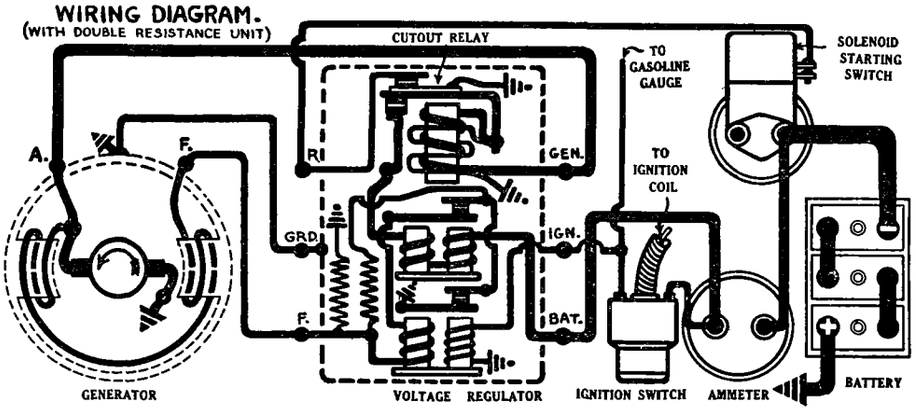
OPERATION:—Voltage Regulator. Operation of this type voltage regulator is same as Vibrating Voltage Regulator when used alone (see preceding article) except that resistance unit has been increased to 30 ohms.

Current Regulator. The two coils of the Current Regulator are connected in series in the charging line between the cutout relay and the 'BAT' terminal of the control unit so that the entire generator output flows through these coils when the cutout relay contacts are closed. When the current flow reaches the maximum for which the unit is set, the current regulator contacts vibrate, cutting the resistance units in and out of the field circuit (both resistance units are in parallel in the field circuit so that total resistance is less than the single resistance which is cut into the field circuit by the opening of the voltage regulator contacts). Generator output is held reasonably constant at maximum point until speed is reduced or load decreased.

TROUBLE SHOOTING:—If generator performance is not satisfactory, check in accordance with the following table to determine whether Voltage Regulator or Current Regulator is defective (not necessary to remove control unit cover to make these tests). Control Unit is separately mounted and must be well grounded. A separate ground lead is run from the 'GRD' terminal on the control unit for this purpose. Examine this lead and ground.

1. Generator Not Charging. Operate engine at speed above cut-in point (do not operate engine at high speed as tests eliminate regulating action and damage may result to generator). Ground 'F' terminal on control unit. If generator charges, regulator is defective. If generator does not charge, ground 'F' terminal on generator. If generator charges, the lead connecting the 'F' terminals on the generator and the control unit is broken or open-circuited and should be replaced. If generator does not charge, disconnect lead at 'GEN' terminal of control unit and flash this lead to ground with 'F' terminal still grounded. If a spark is noted, the regulator or cutout relay is defective. If no spark is noted, examine this lead (connecting 'A' terminal on generator and 'GEN' terminal on control unit) before disassembling and examining generator.





2. Generator Charging Rate Too High or Too Low. This may be caused by incorrect setting or defective operation of either the Voltage Regulator or Current Regulator. To check Voltage Regulator setting, connect a variable resistance in the charging line between the 'BAT' terminal on the control unit and the ammeter and adjust to hold charging current at 8-10 amperes (approximately .25 ohm max.). Disconnect lead to 'IGN' terminal of control unit and connect a jumper wire between this terminal and the 'BAT' terminal. Connect accurate test voltmeter between 'IGN' terminal

and ground. Take readings with control unit at room temperature (70°F) and hot (150°F). To test, operate engine at speed above cut-in point, decrease speed until cutout relay contacts open, then increase speed to 2000-3000 R.P.M., holding charging current at 8-10 amperes and note voltmeter reading. See table under Adjustment Section for correct voltages.

To check Current Regulator setting, turn on lights and other accessories so that current load exceeds Current Regulator setting (see table below), disconnect lead on 'IGN' terminal of control unit (this cuts out the Voltage Regulator action), connect accurate test ammeter in charging line at control unit terminal 'BAT'. Operate engine and slowly increase speed until generator output remains constant. This figure will be the point for which the current regulator is set and should normally be the maximum rated output of the generator (see table under Adjustment Section for standard current regulator settings). If the generator output increases beyond the maximum point which represents the rated output for the particular generator, do not continue to increase engine speed as this indicates that current regulator is not operating and damage may result to the generator.

Oxidized Voltage or Current Regulator Contacts—To check with regulator on car, disconnect lead on 'IGN' terminal of regulator, connect ammeter in charging line at 'BAT' terminal. Operate engine at low speed so that charging current indicated on ammeter is 4-5 amperes, ground 'F' terminal on regulator and note ammeter reading (wait until pointer steadies after first momentary surge). If ammeter reading is 2 amperes or more greater than with 'F' terminal not grounded, contact point oxidation is excessive. To check with regulator on bench, see that commutator and brushes are in good condition, then check generator speed at which cutout relay contacts close with 'F' terminal grounded and not grounded. Closing point with 'F' terminal grounded is normally slightly lower than with terminal not grounded. If difference is 100 R.P.M. or more, contacts are oxidized and should be corrected.

NOTE—Radio by-pass condensers must not be installed on field or 'F' terminals of generator or regulator as these will cause oxidation of contacts. Condensers should be removed and contacts examined and resurfaced.

SERVICING:—If above tests indicate that Voltage Regulator, Current Regulator, or Cutout Relay are defective or that settings are incorrect, the entire control unit should be returned for service, which is handled on an exchange basis. All adjustments outlined below require the breaking of the seals (voiding the warranty) and removing the control unit cover.

CUTOUT RELAY ADJUSTMENT:—If cutout relay has a set of auxiliary contacts above the armature (for starter solenoid relay circuit control, etc.), these contacts should be closed with main contacts open and should open when main contacts close. All other adjustments listed below.

Cutout Relay Performance Data

Type	Cut-in Volts	Cut-out Amperes
5559, 87, 96, 97, 99	6.9-7.6	0-4.0
5598, 5801	12.8-14.4	0-4.0
5806	12.3-13.7	0-4.0
5809, 10, 11	6.9-7.6	0-4.0
5813, 18	6.7-7.6	0-4.0
5819	6.3-6.9	0-4.0
5823	12.3-13.7	0-4.0
5825, 26	12.8-14.2	0-4.0
5828	6.3-6.9	0-4.0
5829	12.3-13.7	0-4.0
5831, 32	6.9-7.6	0-4.0
5836, 37, 40, 41, 42	12.3-13.7	0-4.0
5846	12.8-14.2	0-4.0
5847, 48	6.9-7.6	0-4.0
5852, 53	6.3-6.9	0-4.0
5854	6.9-7.6	0-4.0
5855	6.4-7.1	0-4.0
5856	12.3-13.7	0-4.0
5861, 67	6.9-7.6	0-4.0
5865①	6.3-6.9	0-4.0
5865②	6.9-7.6	0-4.0
5871, 72	6.3-6.9	0-4.0
5873①	6.3-6.9	0-4.0
5873②	6.9-7.6	0-4.0
5874, 75	6.9-7.6	0-4.0
5877, 78	6.3-6.9	0-4.0
5885	6.3-6.8	0-4.0

①—No IGN terminal. ②—With IGN terminal.

Torrid Climate Setting—To correct overcharged battery condition where regular atmospheric temperatures are 95° to 100° F. and above, adjust Cutout Relay to close at 6.8-7.2 volts cold (with IGN terminal), 6.4-6.6 volts hot or cold (without IGN terminal).

Air Gap—Hold armature down (contacts closed) and measure air gap between armature and coil core with a feeler gauge. Air gap should be .020". Adjust by loosening two screws on hinge bracket and shifting armature up or down.

Contact Gap—Measure gap with armature up and auxiliary contacts closed. Gap should be .020". Adjust by bending support arm carrying upper auxiliary contact.

Cut-in Voltage. Connect test ammeter in charging line at regulator 'BAT' or 'AMM' terminal, voltmeter between regulator 'GEN' terminal and ground. With regulator connected (lead attached to 'IGN' terminal), operate generator and slowly increase speed. Note voltmeter reading at instant relay contacts close. See table below for correct figure for each model. To adjust, change flat armature spring tension by bending spring post. Increase spring tension to increase closing voltage, decrease tension to lower voltage.

Cut-out Amperage. Connect test ammeter in charging line at regulator 'BAT' terminal. Operate generator, increase speed until cutout relay contacts close, then slowly decrease speed and note discharge (reverse) current at point where contacts open.

VOLTAGE & CURRENT REGULATOR ADJUSTMENTS:—Check and adjust mechanical specifications listed below before changing voltage or current settings. Adjustments for both Voltage and Current Regulator are the same except as noted.

Contact Gap—Examine contacts and resurface by dressing lightly with a fine, flat contact file if oxidized to such an extent that generator performance is affected (this may be caused by excessive sparking due to low contact spring tension, misalignment of contacts, etc.). Contact metal on small contact is extremely thin and filing should be held to a minimum. See that contacts are aligned and that surfaces are square. Check tension of upper contact mounting spring. Tension should be 3½ oz. min. when contacts just open (measure by means of a spring scale hooked under contact spring). Adjust by bending contact spring slightly. Check contact gap with armature held down. Gap should be .020". Adjust by bending lower armature stop. Clearance between fibre bumper and stop with armature up should be .010". Adjust by bending upper armature stop.

Air Gap—Check air gap between armature and coil core with contacts closed so that fibre bumper just touches the contact spring stop. Air gap should be .063" (all Voltage Regulators), .075" (all Current Regulators). Adjust by bending contact spring stop.

VOLTAGE REGULATOR SETTING:—Using Variable Resistance (AVR Set)—Resistance unit should be aprpoximately .25 ohms. Connect resistance and test ammeter in charging line at 'BAT' terminal on regulator, disconnect lead on 'IGN' terminal, connect jumper between 'IGN' and 'BAT' terminals, connect voltmeter between 'IGN' terminal and ground. Operate generator at rated maximum output RPM., adjust resistance for output of 8-10 amperes. When regulator reaches proper temperature, 'cycle' regulator by decreasing speed until contacts just open, then increase speed to original figure and note voltmeter reading with regulator operating. If performance cold (70°F) and hot (150° F) is not correct adjust regulator as directed below.

Fixed Resistance Method. Use ¾ ohm (6 volt), 1½ ohm (12 volt) resistance capable of carrying 10 amperes (Nichrome wire preferred, do not use other wire). Disconnect leads on 'BAT' and 'IGN' regulator terminals, connect fixed resistance between 'BAT' terminal and ground on engine block, connect jumper between 'BAT' and 'IGN' terminals, connect voltmeter between 'IGN' terminal and ground. Operate engine, increase speed to R.P.M. at which maximum rated output is reached (see car model page for performance on each generator model), note voltmeter reading. If regulator action not satisfactory, adjust as directed below, then cycle regulator and recheck performance.

Voltage Setting—Adjust by bending armature spring lower bracket up or down to decrease or increase the spring tension. Only a slight change in the position of the bracket should be required. Increase spring tension (bend bracket down) to increase regulator voltage or decrease spring tension (bend bracket up) to decrease regulator voltage. If spring tension must be decreased to a point where the spring is free with the contacts closed, change upper contact spring tension slightly (do not exceed limits as given above). Cover must be on and regulator checked cold (70° F.) and hot (150°F). If tested on the bench, control unit should be placed in same position as on the car (horizontal or vertical). If correct regulator voltages cannot be secured both cold and hot by adjusting armature spring tension, the regulator air gap may be changed slightly as follows: Increase gap to increase cold setting, or decrease gap to decrease cold setting, with respect to hot setting.

Voltage Regulator Setting

Type	Cold Voltage (70°F)	Hot Voltage (150°F)
5559	7.5-7.95	7.4-7.6
5587, 96, 97, 99	7.0-7.4	6.95-7.15
5598, 5801, 6	14.2-15.0	14.1-14.5
5809, 10	7.0-7.4	6.95-7.15
5811	7.5-7.9	7.4-7.6
5813, 18	7.5-7.95	7.4-7.6
5819, 28	7.0-7.4	6.95-7.15
5823, 25, 26, 29, 36, 37	14.2-15.0	14.1-14.5
5840, 41, 42, 46	14.2-15.0	14.1-14.5
5847, 48, 52, 53, 54	7.0-7.4	6.95-7.15
5855	7.5-7.95	7.4-7.6
5856	14.2-15.0	14.1-14.5
5861, 67	7.5-7.9	7.4-7.6
5865	7.0-7.4	6.95-7.15
5871, 72, 73, 74, 75, 77, 78	7.0-7.4	6.95-7.15
5885	7.0-7.4	6.95-7.15

Torrid Climate Setting—To correct overcharged battery condition where regular atmospheric temperatures are 95° to 100° F. and above, set Voltage Regulator to operate at 6.8-6.9 volts hot.

CURRENT REGULATOR SETTING:—Connect ammeter in charging line at 'BAT' terminal on regulator, disconnect lead on 'IGN' terminal (to eliminate regulator action), turn on lights. Operate engine and increase speed until output remains constant, note ammeter reading. If current regulator performance not satisfactory, adjust as directed below.

Current Setting—Adjust by bending armature spring lower bracket up or down to decrease or increase the spring tension. Only a slight change in position of the bracket should be required. Increase spring tension (bend bracket down) to increase maximum output, or decrease spring tension (bend bracket up) to decrease maximum output. Settings are given in table below. Current Regulator must never be set at higher figure than the rated capacity of the generator on which it is being used.

Current Regulator Setting

Type	Maximum Amperes	Type	Maximum Amperes
5559	20-23	5846	11.5-13.5
5587, 96	20-22	5847, 48	34-36
5597, 99	26-28	5852, 53	34-36
5598, 5801, 6	16-18	5854	29-31
5809, 10	24-26	5855	13
5811	28-30	5856	14-16
5813, 18	24-26	5861, 67	28-30
5819	26-28	5865①	28-30
5823	16-18	5865②	29-31
5825	11.5-13.5	5871, 72	32-34
5826	19-21	5873①	28-30
5828, 31, 32	26-28	5873②	29-31
5829	7-9	5874	29-31
5836, 37	24-26	5875	32-34
5840	12-14	5877, 78	28-30
5841, 42	24-28	5885	38-40

①—No IGN terminal. ②—With IGN terminal.

NOTE—Type 5559 regulator rated at 20-22 amperes, but when used with 933-M generator on 1937 Cadillac V12 or V16, setting is 26 amperes.

Delco-Remy Regulators or 'Apparatus Boxes' are made in two types: a two-element (Cutout Relay and Voltage Regulator) type used in conjunction with third brush control generators, and a three-element (Cutout Relay, Current Regulator, and Voltage Regulator) type used with shunt wound generators. Both types of units are checked and adjusted in exactly the same manner and no distinction is made between them in the following discussion except that the material on the Current Regulator applies only to the three-element Apparatus Box. The maximum output of the third brush controlled generator used with the two-element Apparatus Box is regulated by the third brush setting (see paragraph on Third Brush Setting). First check following points:

1. **Connections.** See that all connections are clean and tight and that generator and Apparatus Box are correctly wired up (see diagram).
2. **Commutator and Brushes.** Clean commutator and examine brushes. If commutator is rough or worn down to the mica it should be turned down in a lathe (taking a very fine cut) and the mica then undercut to a depth of 1/32 inch. Brushes must seat over at least 75% of the bearing surface and should be sanded in if necessary.
3. **Generator Voltage.** Check generator voltage by operating generator with a voltmeter connected between the "Armature" terminal of the genrator and ground. Generator voltage should build up properly (see table below for performance data). If generator does not build up, check for shorted or grounded armature or field coils.
4. **Apparatus Box Ground.** Apparatus Box must be well grounded. A ground screw is provided on each end of the Apparatus Box and, if Apparatus Box is not grounded through the frame by being firmly mounted on a clean metal surface on the car, a ground wire should be provided between one of these screws and the car frame or generator frame.

MECHANICAL ADJUSTMENTS

CUTOUT RELAY:—Air Gap. Air gap between armature and coil core should be .057". To check the air gap, hold armature down (contacts closed) and measure gap between underside of armature and coil core with a feeler gauge. Adjust by loosening the 3 screws on the lower contact bracket and shifting the position of the stationary contacts (the lower contact bracket mounting screw holes are slotted to permit this adjustment).

Contact Gap. The Contact gap must be .020 inch. Check gap with a feeler gauge. Adjust by bending the armature stop above the armature (between the upper contact fingers).

CURRENT REGULATOR AND VOLTAGE REGULATOR:—Contact Gap. Contact gap should be .015 inch. To check the contact gap, hold armature down against coil core and measure gap with a feeler gauge. Adjust gap by loosening lock nut on stationary contact stud (upper contact) and turning down stud. Tighten locknut after making adjustment.

ELECTRICAL ADJUSTMENTS

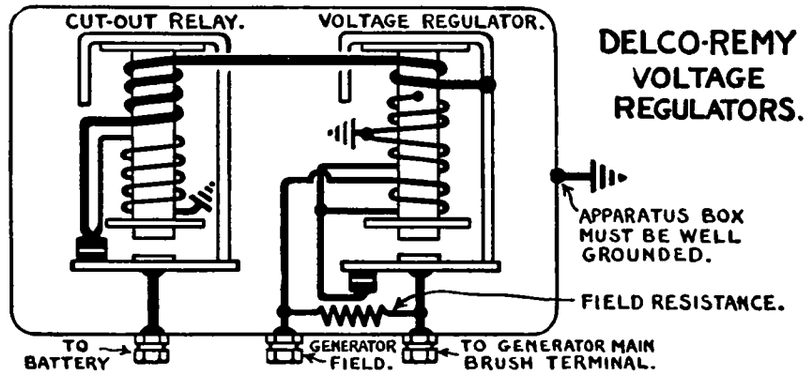
CUTOUT RELAY:—Cut-in Point. Connect negative (—) terminal of test voltmeter to "Armature" terminal on the generator and ground positive (+) terminal of voltmeter to Apparatus Box case. Short out Voltage Regulator by connecting one end of a short jumper to the upper contact support on the regulator and connect the other end of the jumper to the armature on which the lower contact is mounted. Operate generator and slowly increase generator speed until relay contacts close. Note voltmeter reading at instant contacts close (there will be a slight 'kick-back' of the voltmeter pointer when the contacts close and this can be used to check the closing point). Contacts should close with a generator voltage of 7.0 volts (6 volt units), 13.5 volts (12 volt units), 26.0 volts (24 volt units), 35.0 volts (32 volt units except 5611), 33.0 volts (5611 only). To adjust closing point, change relay armature spring tension by loosening lockscrew on lower spring bracket and turning eccentric adjusting screw. Increase the spring tension to raise the cut-in voltage and decrease the spring tension to lower the cut-in voltage. Tighten lockscrew and repeat test.

Cut-out Point. Connect a test ammeter in the battery line (disconnect the lead on the 'Ammeter' terminal of the Apparatus Box and connect this lead to one terminal of the test ammeter and connect the other ammeter terminal to the 'Ammeter' terminal on the Apparatus Box). Operate the generator at a speed above the cut-in point so that generator is charging the battery and slowly decrease the speed until the relay contacts open. Note ammeter reading. Contacts should open with 0-3 ampere discharge.

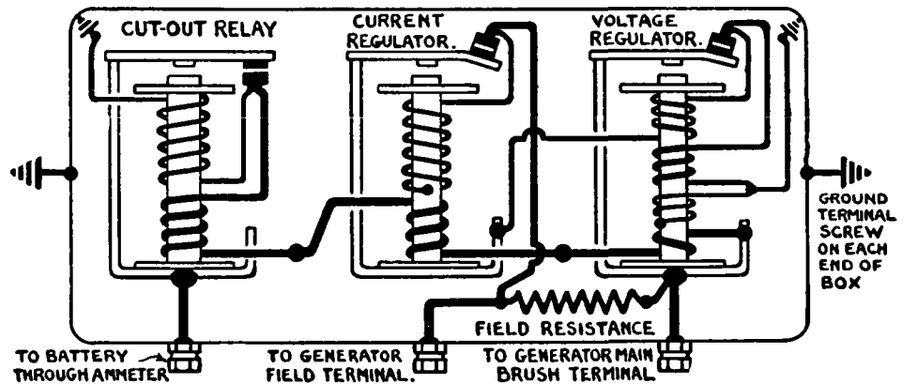
CURRENT REGULATOR (Three-element Apparatus Boxes only):—Disconnect lead on 'Ammeter' terminal of Apparatus Box and connect to positive (+) terminal of test ammeter. Connect negative (—) terminal of test ammeter to 'Ammeter' terminal on Apparatus Box. The Voltage Regulator must be shorted out (see Cut-out Relay adjustment). Operate th generator and increase the speed to the maximum for the particular generator (see table below, Special Note, and Individual Car Data Sheets). Turn on enough lamp load to cause Current Regulator to begin operation. Note ammeter reading. If generator output as indicated by ammeter reading does not correspond with rated setting for the Apparatus Box, the Current Reulator setting must be changed. To adjust Current Regulator, loosen lock screw on lower spring bracket and turn eccentric adjusting screw to right or clockwise to decrease, or to left or counter-clockwise to increase the output. Tighten lockscrew and repeat test. NOTE—Current regulator setting must not be changed until after regulator contact gap has been checked.

THIRD BRUSH SETTING (Two-element Apparatus Boxes only):—To check third brush setting on generators used with a two-element Apparatus Box, first connect test ammeter in charging line and short out Voltage Regulator as directed in paragraph above on Current Regulator. Then operate generator at speed indicated in table below and change third brush setting until generator output corresponds with maximum rated capacity for the particular machine being tested (see table and individual car data sheets). Shift the third brush in the direction of armature rotation to increase the charging rate and in the opposite direction to decrease the charging rate.

TWO ELEMENT APPARATUS BOX.



THREE ELEMENT APPARATUS BOX.



VOLTAGE REGULATOR:—Voltage Regulator should be checked and adjusted on open circuit. Disconnect the battery lead at the 'Ammeter' terminal on the Apparatus Box. Connect the negative (—) terminal of the test voltmeter to the 'Ammeter' terminal on the Apparatus Box and ground the positive (+) lead of the voltmeter to the Apparatus Box case. Operate the generator at the speed shown on the table below and note the voltmeter reading after regulator has reached operating temperature. If not within limits shown in table below, check contact gap before setting changed. Loosen the lock screw on the armature spring lower mounting bracket plate and turn the eccentric adjusting screw to change the spring tension. Increase the spring tension to increase the open circuit voltage and decrease the spring tension to decrease the voltage. Tighten the lock screw and check adjustment by varying speed throughout operating range.

DELCO-REMY REGULATORS

TRUCK & BUS TYPE APPARATUS BOXES CONT.

Generator	Apparatus Box	Voltage Regulator Volts	Voltage Regulator R.P.M.	Current Regulator Amperes	Current Regulator Volts	Current Regulator R.P.M.
361	5525	15.0	1400	40	13.0	1100
①392	5524	15.0	1800	26	13.0	1100
401, 3, 5	5526, 5578	15.0	1400	40	13.0	1100
402	5526	15.0	1500	40	13.0	1500
407, 8, 9	5526	15.0	1400	40	13.0	1100
410	5526	15.0	1400	40	13.0	1100
①416	5524	15.0	1600	24-26	13.0	1600
①417, 18, 19	5524, 5535	15.0	1600	24-26	13.0	1600
①430	5524	15.0	1600	24-26	13.0	1600
433, 35	5529	15.0	1400	18	13.0	1100
①440	5524, 5535	15.0	1600	24-26	13.0	1600
461, 66	5530	15.0	1700	50	13.0	1700
464, 5, 7, 9	5526	15.0	1400	40	13.0	1100
501, 2	5526, 30, 66, 71	15.0	1400	50	13.0	600
505	5566	15.0	1400	50	13.0	600
507	5566	15.0	1400	50	13.0	600
508	5571	15.0	1400	57	13.0	800
514	5571	15.0	1400	57	13.0	800
515	5571	15.0	1400	57	13.0	800
517	5571	15.0	1400	57	13.0	800
518	5571	15.0	1400	57	13.0	800
522, 23	5526	15.0	1400	40	13.0	1100
524	5530	15.0	1400	50	13.0	1100
525, 6, 7, 8	5526	15.0	1400	40	13.0	1100
529, 30	5530	15.0	1700	50	13.0	1700
531	5526	15.0	1400	40	13.0	1100
532	5526	15.0	1400	40	13.0	700
533, 4, 5, 6	5526	15.0	1400	40	13.0	1100
537, 8, 9	5526	15.0	1400	40	13.0	1100
①550	5524, 5535	15.0	1600	24-26	13.0	1600
①551, 53	5524, 5535	15.0	1800	24-26	13.0	1600
①554, 55, 56	5535	15.0	1600	24-26	13.0	1600
557, 58	5535	15.0	1200	13-15	13.0	1200
559	5529	15.0	1400	18	13.0	1100
560	SM-1527, 5561	30.0	1000	14	26.0	1000
561	5535	15.0	1600	24-26	13.0	1600
563	5567	8.5	1000	40	7.0	950
564	5538	8.5	1000	28-32	7.0	1000
566	5529	15.0	1400	18	13.0	1100
①567	5533	8.5	1500	38-40	7.0	1500
①568	5535, 5573	15.0	1600	24-26	13.0	1600
570	5574	15.0	1400	40	13.0	1400
601	5563	15.0	1600	19-21	13.0	1600
①604	5538	8.5	2000	28-30	7.0	1000
606	5576	15.0	1400	33	13.0	950
607	5604	15.0	1400	40	13.0	1250
608, 9	5567	8.5	2000	40	7.0	950
610	5530	15.0	1700	50	13.0	1700
613	5526	15.0	1400	40	13.0	1100
614	5577	8.5	2000	50	7.5	800
615	5526	15.0	1400	40	13.0	1100
①616	5538	8.5	2000	28-30	7.0	1000
617	5526	15.0	1400	40	13.0	1100
619	5579	15.0	1400	54	13.0	1000
620	5566	15.0	1400	50	13.0	1100
621	5565	30.0	1300	25	26.0	1300
622, 24	5526, 5530	15.0	1400	40	13.0	1100
625	5526	15.0	1400	40	13.0	1100
627	5526, 5530	15.0	1700	50	13.0	1700
630	5526	15.0	1400	40	13.0	1100
631	5579	15.0	1400	54	13.0	1000
632	5579	15.0	1400	54	13.0	1000
633	5526	15.0	1400	40	13.0	1100
634	5526	15.0	1400	40	13.0	1100
635	5530	15.0	1700	50	13.0	1700
636	5530	15.0	1700	50	13.0	1700
637	5526	15.0	1400	40	13.0	1100
638	5526	15.0	1400	40	13.0	1100
639	5526	15.0	1400	40	13.0	1100
670	5567	8.5	2000	40	7.0	950
671	5567	8.5	2000	40	7.0	950
672	5526	15.0	1400	40	13.0	1400
673	5567	8.5	2000	40	7.0	950
①674	5538	8.5	2000	28-30	7.0	1000
①677	5535	15.0	1600	24-26	13.0	1100
678	5526	15.0	1400	40	13.0	1400
679	5567	8.5	2000	40	7.0	950
680	5567	8.5	2000	40	7.0	950
682	5576	15.0	1400	33	13.0	950
683	5575	15.0	1400	33	13.0	950
①687	5535	15.0	1600	24-26	13.0	1600
688	5567	8.5	2000	40	7.0	950
689	5567	8.5	2000	40	7.0	950
690	5576	15.0	1400	33	13.0	950
692	5574, 5604	15.0	1400	40	13.0	1250
693	5526	15.0	1400	40	13.0	1250
694	5576	15.0	1400	33	13.0	950
①695	5535	15.0	1600	24-26	13.0	1600
696	5576	15.0	1400	33	13.0	950
697	5604	15.0	1400	40	13.0	1400
698	5526	15.0	1400	40	13.0	1400
699	5604	15.0	1400	40	13.0	1250
①927-X	5536	15.0	2200	16-18	13.0	2200
950	5530	15.0	1700	50	13.0	1700
952	5579	15.0	1400	54	13.0	1000
953	5579, 5610	15.0	1400	54	13.0	1000
954	5579	15.0	1400	54	13.0	1000
955	5579	15.0	1400	54	13.0	1000
956	5579	15.0	1400	54	13.0	1000
957	5579	15.0	1400	54	13.0	1000
958	5579	15.0	1400	54	13.0	1000
959	5579	15.0	1400	54	13.0	1000
960	5579	15.0	1400	54	13.0	1000
962	5577	8.5	1400	40	7.5	675
964	5579	15.0	1400	54	13.0	1000
965	5579	15.0	1400	54	13.0	1000
966	5610	15.0	1400	54	13.0	1000
①970-D	5535	15.0	2000	28-30	9.5-9.75	2200
①970-E	5534	8.5	2000	26-28	7.0	1400
①970-F	5534	8.5	2000	17-19	7.0	1200
①970-G	5535, 5536	15.0	1800	20-22	15-15.2	2000
①973-E, F	5538	8.5	2000	24-26	7.0	2000
①973-G	5535	15.0	2400	21-23	13.0	2400
①973-H	5535	15.0	2400	21-23	13.0	2400
①973-K	5535	15.0	2400	21-23	13.0	2400
①975-F, G	5534, 5538	8.5	2000	26-28	7.0	1400
①975-H, J	5535	15.0	2000	22-24	13.0	2000
①975-M, U	5538	8.5	2000	26-28	7.0	1400
①975-N, S	5538	8.5	1600	28-30	9.5-9.75	2200
①975-R	5535	15.0	1600	20-22	15-15.2	2000
①975-Y	5535	15.0	2000	22-24	13.0	2000
①975-Z	5535	15.0	2000	22-24	13.0	2000
977-E	5562	30.0	1200	10	26.0	1200
①977-J	5538	8.5	2000	26-28	7.0	1400
①977-M	5538	8.5	2000	30-31	7.0	2000
①977-N	5538	8.5	2000	26-28	7.0	1400
①977-U	5538	8.5	2000	30-31	7.0	2000
①977-V	5535	15.0	2600	25-28	13.0	2600
①977-Y	5535	15.0	1500	17-20	13.0	1500
①977-Z	5535	15.0	2000	22-24	13.0	2000
①1106253	5538	8.5	2000	30-31	7.0	2000
①1106255	5538	8.5	2000	17-19	7.0	1200
1106501	5611	37.5	1100	10	32.5	1080
1106527	5608	40.0	1250	10	35.0	1175-1225
1106528	5608	40.0	1250	10	35.0	1175-1225
1106529	5608	40.0	1250	10	35.0	1175-1225
1106530	5608	40.0	1250	10	35.0	1175-1225
1106580	5567	8.5	2000	35	8.0	1400
1117001	5604	15.0	1400	40	13.0	1250

①—Third brush current control type generator.

Generator	Apparatus Box	Voltage Regulator Volts	Voltage Regulator R.P.M.	Current Regulator Amperes	Current Regulator Volts	Current Regulator R.P.M.
①1117002	5535	15.0	1600	24-26	13.0	1600
①1117003	5538	8.5	2000	28-30	7.0	1000
1117004	5604	15.0	1400	40	13.0	1250
1117007	5529	15.0	1400	18	13.0	800
1117009	5567	8.5	2000	40	7.0	950
1117010	5613	15.0	1400	20	13.0	950
①1117011	5538	8.5	2000	28-30	7.0	1000
1117012	5604	15.0	1400	40	13.0	1250
1117013	5567	8.5	2000	40	7.0	950
1117019	5604	15.0	1400	40	13.0	1250
1117021	5604	15.0	1400	40	13.0	1250
1117023	5529	15.0	1400	18	13.0	800
1117024	5604	15.0	1400	40	13.0	1250
1117025	5529	15.0	1400	18	13.0	800
1117201	5565	30.0	1300	25	26.0	1300
1117202	5572	40.0	1450	25	35.0	1450
1117203	5572	40.0	1450	25	35.0	1450
1117501	5571	15.0	1400	57	13.0	800
1117502	5607	40.0	1050	40	35.0	1050
1117503	5607	40.0	1050	40	35.0	1050
1117504	5571	15.0	1400	57	13.0	800
1117513	5571	15.0	1400	57	13.0	800
①SM-1120	5524, 5535	15.0	1600	24-26	13.0	1600
①SM-1278	5533, 5538	8.5	1500	38-40	7.0	1500
SM-1298	5530	15.0	1700	50	13.0	1700
②SM-1298	5526	15.0	1700	40	13.0	1700
①SM-1315, 16	5533, 5538	8.5	1500	38-40	7.0	1500
①SM-1321	5524	15.0	1600	24-26	13.0	1600
SM-1324, 28	5526	15.0	1400	40	13.0	1100
①SM-1326	5535	15.0	2000	22-24	13.0	2000
①SM-1333	5524	15.0	1600	24-26	13.0	1600
①SM-1334	5538	8.5	2000	26-28	7.0	1400
SM-1337	5536	15.0	2200	16-18	13.0	2200
①SM-1342	5524	15.0	1600	24-26	13.0	1600
①SM-1342	5535	15.0	1600	24-26	13.0	1100
SM-1348	5530	15.0	1700	50	13.0	1700

Generator	Apparatus Box	Voltage Regulator Volts	Voltage Regulator R.P.M.	Current Regulator Amperes	Current Regulator Volts	Current Regulator R.P.M.
①SM-1353	5538	8.5	2000	23-26	8.8-9.2	1900
①SM-1354	5538	8.5	1500	38-40	7.0	1500
①SM-1364	5535	15.0	1600	24-26	13.0	1600
①SM-1374	5534	8.5	2000	17-19	7.0	1200
SM-1385	5530	15.0	1700	50	13.0	1700
SM-1405	5526	15.0	1400	40	13.0	1100
①SM-1439	5538	8.5	2000	17-19	7.0	1200
SM-1440	5526	15.0	1400	40	13.0	1100
①SM-1449	5535	15.0	1600	20-22	15-15.2	2000
①SM-1454	5535	15.0	1800	40	8.0	16-1800
SM-1460	SM-1428, 5561	30.0	1000	14	26.0	1000
①SM-1505	5538	8.5	1500	38-40	7.0	1500
①SM-1516	5535	15.0	2100	19-21	13.0	2100
①SM-1535	5538	8.5	1400	26-28	7.0	1400
①SM-1536	5535	15.0	1600	24-26	13.0	1600
①SM-1544	5538	8.5	2000	18-20	8.3-8.5	1300
SM-1545	5524	15.0	1600	24-26	13.0	1600
①SM-1549	5535	15.0	1200	13-15	13.0	1200
SM-1551, 2	SM-1553, 5565	30.0	1300	25	26.0	1300
SM-1591	5565	30.0	1300	25	26.0	1300
SM-1594	5530	15.0	1700	50	13.0	1700
SM-1595	5530	15.0	1100	40	13.0	1100
SM-1597	5535	15.0	1600	20-22	15-15.2	2000
SM-1615, 16	5535	15.0	1600	20-22	15-15.2	2000
SM-1638	5561	30.0	1000	14	26.0	1000
SM-1656	5565	30.0	1300	25	26.0	1300
①SM-1660	5538	8.5	1400	26-28	7.0	1400
SM-1680	5561	30.0	1000	14	26.0	1000
SM-1801	5530	15.0	1700	50	13.0	1700
①SM-1838	5535	15.0	1600	22-24	13.0	1000
①SM-1873	5538	8.5	1200	22	8.0	1200
SM-1874	5607	40.0	1050	40	35.0	1050
①SM-1884	5535	15.0	1600	24-26	13.0	1100
①SM-1921	5535	15.0	1600	13-15	13.0	1200

②—For 40 ampere output and special armature.

①—Third brush current control type generator.

FORD REGULATOR

TWO-RATE RELAY TYPES

NOTE:—These regulators used as standard or special equipment on the following models:

Models.	Regulator.	Generator.
Ford V8 (1934-36)	40-10505, A	40-10000-B
Ford V8 All Models (1937)	68-10505	78-10000-HA, HB
Lincoln Zephyr H (1936)	68-10505	68-10000-HA, HB
Lincoln Zephyr HB (1937)	68-10505	78-10000

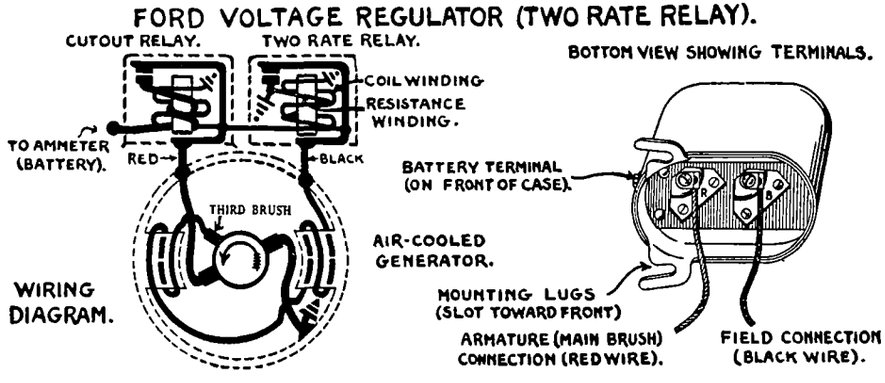
DESCRIPTION:—The Voltage Regulator or Two Rate Relay is combined with the Cutout Relay in a case on the generator field frame. The regulator consists of a fixed resistance unit which is cut in or out of the generator field circuit by the action of the regulator contacts (resistance is connected across the contacts and is short-circuited with the contacts closed). Resistance is wound on a form over the regulator coil winding. This coil winding (shunt coil) is connected in parallel with the shunt winding of the cutout relay. Regulator is compensated for temperature variations by having one contact mounted on a thermal support.

OPERATION:—The regulator contacts are normally closed (resistance short-circuited) when the generator is not operating. The generator will charge the battery at the high rate until the generator voltage reaches 8.5 volts. At this point the current flow through the regulator coil winding will cause the regulator contacts to open, cutting the resistance in the field circuit, and reducing the charging rate to approximately 20% of the high rate. The contacts remain open, and the generator charges at the low rate until the generator speed decreases sufficiently so that the cutout relay contacts open. The regulator contacts then close so that generator will again charge at the high rate when the generator speed is increased sufficiently to close the cut-out relay contacts. This action provides two charging rates, a high rate with discharged battery or for a short interval after the generator begins to charge (regulator contacts closed), and a lower rate after the battery is charged (regulator contacts open).

The regulator also acts as a safeguard against high voltage due to resistance in charging circuit, high internal resistance in battery, or other causes, since these factors all cause the generator voltage to rise and the regulator will operate when the generator voltage reaches 8.5 volts even when the battery is not fully charged (generator voltage normally rises as battery voltage comes up on charge).

ADJUSTMENTS:—No provision made for adjustments. Replace units which do not operate satisfactorily.

FORD VOLTAGE REGULATOR (TWO RATE RELAY).



Car Model	Std. or Optl. Equipment On: Generator	Regulator Model
Ford '60' 82A, C, Y (1938)	82-A-10000-D, E	81-A-10505 ①
Ford '85' 81A, C, Y (1938)	81-A-10000-D, E	81-A-10505 ①
Ford '85' Trucks (1938)	81-T-10000-A, B	81-A-10505 ①
Ford '60' 922A, C, 92Y, ('39)	82-A-10000-D, E	91-A-10505-A
Ford '85' 91A,C,Y (1939)	81-A-10000-D, E	91-A-10505-A
Ford '85' 91A Deluxe ('39)	91-A-10000	91-A-10505-A
Ford '85' & '95' Trks. ('39)	81-T-10000-A, B	91-A-10505-A
Ford '95' 99C (1939)	81-A-10000-D, E	91-A-10505-A
Lincoln-Zephyr 86H (1938)	81-A-10000-D	81-A-10505-A1 ①
Lincoln-Zephyr 96H (1939)	91-A-10000	91-A-10505-A
Mercury 99A (1939)	91-A-10000	91-A-10505-A

①—Superseded by 91-A-10505-A.

TYPE:—Regulator consists of a vibrating type combination voltage-current regulator and a cutout relay in a single case designed to be mounted on the dash and used in conjunction with a two-brush shunt wound generator (see illustration).

OPERATION:—Voltage Regulation. Regulator voltage winding is connected across the generator main brushes. When the generator voltage reaches the value for which the regulator is set, regulator contacts vibrate (cutting the resistance in and out of the field circuit) so that the voltage is held constant (winding actually connected in two sections, one of which is short-circuited by the contacts when they are closed but is energized when the contacts open—see illustration).

Current Regulation. Current coil on regulator is connected in series in charging circuit so that the entire generator output flows through this winding. When the current reaches the maximum for which the regulator is set, the regulator contacts vibrate and the output is held from exceeding this figure.

REGULATOR TESTING:—Voltage Regulation. Connect voltmeter between regulator 'B' terminal and ground. Start engine and operate at 900 R.P.M. minimum (set hand throttle control to hold engine at this speed while test being made). Disconnect battery ground connection—generator will then operate with only voltmeter and ignition system in circuit so that voltage will rise until regulator comes into action. Regulator should limit voltage to 7.6 volts at 70° F. If voltage exceeds this figure, regulator should be replaced. If voltage is 7.0-7.6 volts, regulation action is satisfactory. If voltage below 7.0 volts and battery is not maintained in fully charged condition on car, regulator should be replaced.

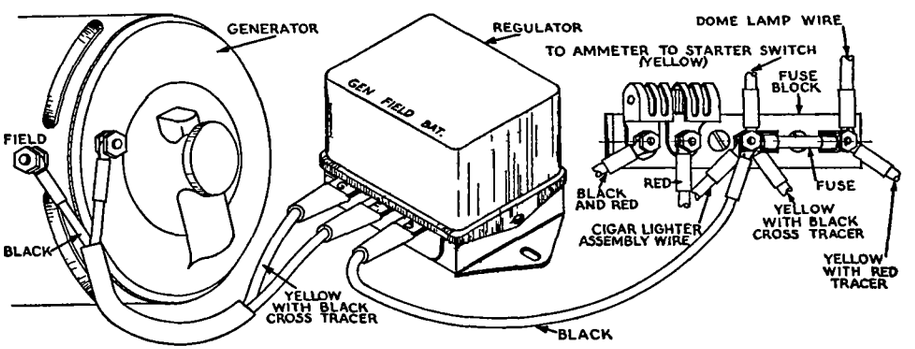
Current Regulation. Connect ammeter in charging line at 'B' terminal on regulator. Use 'BRS' test set attachment or rheostat and voltmeter connected across battery terminals (do not disconnect battery cables) and apply load until battery voltage drops to 5.75 volts. Start engine and increase speed until current regulator limits generator output. Note ammeter reading. Regulator should limit output to 23 amperes (Generator Models 81-A-10000-E, 82-A-10000-E, 81-T-10000-B) 30 amperes (Generator Models 81-A-10000-D, 82-A-10000-D, 81-T-10000-A, 91-A-10000).

REGULATOR ADJUSTMENT:—No adjustments can be made (regulator cover riveted in place). Replace defective units.

INSTALLING NEW GENERATORS & REGULATORS:—Disconnect battery ground strap. Disconnect yellow wire with black tracer (old generator lead) from fuse block, draw this two-wire cable (contains also black wire not used with three-brush generator) back through rubber grommet in dash. Mount regulator securely on dash on bosses provided (near bottom on first cars, on inclined surface to left of center on later cars—avoids interference with oil-bath air cleaner and the oil filter when installed). Connect regulator ground lead to the dash (scrape paint from dash and tighten ground lead screw securely for good ground connection). Insert special black wire through the dash grommet, connect one end to fuse block, opposite end to regulator 'B' terminal. Disconnect wire on old generator, replace with new generator (do not install belt). Connect wires in two-wire cable to regulator as follows: Yellow-with-black tracer wire to regulator 'G' terminal, Black wire to 'F' terminal. Connect battery ground strap, touch yellow-with-black tracer wire to 'G' terminal on generator commutator endplate. No spark should be evident and generator should not motor or show other reaction (see Note below). If O.K., connect this wire permanently, connect black wire to other (field) terminal on generator. Install fan belt. With a fully charged battery, generator output may be as low as 6-7 amperes with ignition load only, or as high as 30-35 amperes with low battery and maximum load.

NOTE—If spark noticed or generator motors when yellow-with-black tracer wire flashed to generator 'G' terminal, replace regulator. Use extreme care not to interchange the generator leads (transposing these two wires will cause destruction of the regulator).

Ground Note—Early type regulators grounded through base of regulator. Later types mounted on rubber cushions and grounded to dash through a separate ground lead.



Voltage Regulator and Cutout Relay adjustments on both the two-element Control Unit (designed for use with third brush control generators) and the three-element Control Unit (for use with shunt wound generators) are made in exactly the same manner. No distinction is made between these two types in the following discussion except that the material on the Load Limit Controller (Current Regulator) applies only to the three-element Control Unit. Generator output on third brush control types using the two-element control unit is controlled by the setting of the third brush. The elements of the Control Unit should be checked in the order shown and the mechanical adjustments of each element must be checked in the order shown and the mechanical adjustments of each element must be checked before any attempt is made to check or adjust the electrical settings.

The Control Unit should be mounted in a vertical position and all connections between the battery, Control Unit, and generator should be clean and tight. Special test hook-ups for test ammeter and voltmeter are given for each test.

VOLTAGE REGULATOR:—Mechanical Adjustment. All gaps should be measured with the armature held down so that the stop pin is against the coil yoke.

Contacts. Examine Regulator Contacts. If necessary clean contacts by drawing 'crocus' cloth between them while holding contacts closed. Blow out all dust and draw a piece of clean, smooth paper between contacts while holding them closed. See that contact surfaces are square and parallel so that a good contact is established between them.

Hinge Gap. IMPORTANT. Check hinge gap between magnet frame or yoke and hinge (under armature) at hinge end of Voltage Regulator by means of a feeler gauge. If hinge gap is not between .008-.015 inch, adjust by loosening bracket screw on end of coil yoke and shifting hinge bracket up or down. Tighten bracket screw after making adjustment.

Contact Point Gap. Contact gap should be .020-.025 inch. Check with feeler gauge. Adjust by bending armature stop (upper contact support).

Core Gap. Core gap between armature and coil core should be .021-.026 inch. Check with feeler gauge.

Electrical Adjustment:—Open Circuit Setting. Disconnect battery lead from 'B' terminal on Control Unit. Connect test voltmeter from this terminal to ground. Clean Load Limit Controller contacts and close contacts by wedging a small piece of some non-conductor, such as a matchstick, below the armature. This wedge should be left in place to prevent Load Limit Controller operating while Voltage Regulator and Cutout Relay are being tested or adjusted. Operate generator for 15 minutes at R.P.M. in table below in order to bring Regulator up to operating temperature. Note voltmeter reading at the end of this period. If open-circuit voltage corresponds with figure given in table, the adjustment is correct. If voltage is not correct, adjust Regulator by turning Regulator adjusting nut above hinge bracket until exact voltage reading is secured. Tap Regulator armature several times at a point back of the armature stop to check Regulator operation. If voltage is held within range given in the table the setting is satisfactory. See that the loop end of the armature spring is in the grooves of the spring bracket and that the adjusting nut locking clip is in place so that the adjustment cannot change in service.

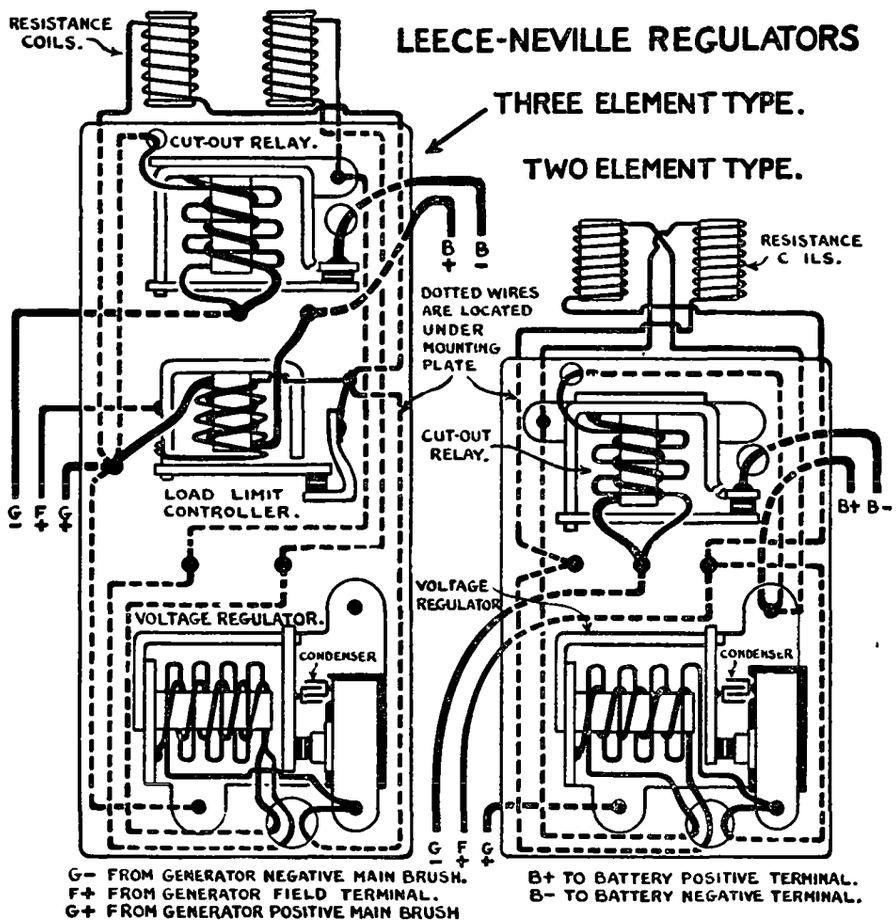
If the open circuit voltage varies widely for no apparent reason or if a correct setting cannot be secured, locate trouble from following table:

High Voltage. Check following points:—
1. Large resistance coil (upper coil in case) open circuited or disconnected.
2. Connections on terminals 'G+' and 'F+' reversed.
3. Lead to 'G—' terminal open circuited or disconnected.
4. Regulator point condenser shorted.
5. Regulator contact gap incorrect.
6. Regulator coil defective.

No voltage or very low voltage. Check following points:
1. Generator field fuse open. Check fuse and fuse clips.
2. Leads to 'G—' and 'F+' terminals shorted.
3. Leads to 'G+' or 'F+' terminals open circuited or disconnected.
4. Regulator coil defective.
5. Poor contact at Regulator contact points. Clean and adjust contacts.

Voltage varies widely for no apparent reason.
1. Small resistance coil (lower coil in case) open circuited or disconnected.
2. Regulator coil defective.
3. Poor contact at Regulator contact points. Clean and adjust contacts.
4. Regulator armature binding. See that armature moves freely and check hinge gap.

Arcing at Regulator Contacts.
1. Condenser disconnected or defective.
2. Poor contact at Regulator contact points. Clean and adjust contacts.
3. Regulator coil defective.
4. Small resistance coil (lower coil in case) open circuited or disconnected.
5. Open circuit voltage set too high.



CUTOUT RELAY:—Mechanical Adjustments. All gaps should be measured with the armature held down with the stop pin against the coil yoke. Do not guess at gap dimensions. Use a feeler gauge. This is important.
Contacts. Examine relay contacts. Clean contacts by drawing 'crocus' cloth

between them while contacts are held closed. Blow out all dust and finish by drawing a piece of smooth,clean paper between contacts while they are held closed. See that contact surfaces are square and parallel and that a good contact is established between them.

Hinge Gap. IMPORTANT. Check hinge gap between magnet frame or yoke and hinge under armature by means of a feeler gauge. If hinge gap is not within .008-.015 inch, adjust by loosening bracket screw on end of coil yoke and shifting hinge bracket up or down until correct gap is secured. Tighten bracket screw after making adjustment.

Contact Point Gap. Contact point gap should be .028-.032 inch. Check with a feeler gauge. Adjust by bending armature stop (directly above armature at contact end of relay).
Core Gap. Core gap between armature and coil core should be .020-.025 inch with relay contacts closed.

Electrical Adjustments:—To Set Cut-in Point. This test is made on open circuit with battery lead disconnected from 'B—' terminal on Control Unit. If desired a small (3 cp.) test lamp may be connected between this terminal and ground to determine the point at which the contacts close (the lamp will light up when the contacts close). Connect the test voltmeter between terminals 'G+' and 'G—' on the Control Unit. Operate the generator and slowly increase speed until relay contacts close. Note voltmeter reading at instant test lamp lights.

Relay cut-in point can also be checked by operating generator at a speed above the cut-in point and momentarily opening Voltage Regulator contacts by pressing on the regulator armature at a point directly behind the armature stop. The opening of the contacts in this manner will cause the generator voltage to drop to a very low figure and if the pressure on the regulator is released very slowly, the generator voltage will build up slowly enough so that the cut-in voltage (when the relay contacts close and the test lamp lights) can be noted on the voltmeter. This test requires less time than the slowing down and increasing of the generator speed and should be used when successive tests are being made. If voltmeter reading corresponds with the figure in the table below, the relay setting is satisfactory. If the cut-in voltage is not correct, turn the adjusting nut at the top of the hinge bracket to the right or clockwise to increase the cut-in voltage and to the left or counter-clockwise to decrease the cut-in voltage. Repeat the test after each adjustment until the exact setting is secured. After the cut-in point has been set, the cut-out point or discharge current necessary to open the relay contacts must be checked. See that the loop ends of the armature spring are in the grooves of the spring bracket and that the adjusting nut locking clip is in place so that the adjustment cannot change in service.

To Check Cut-out Point. Connect battery lead to one terminal of test ammeter and connect other ammeter terminal to 'B—' terminal on Control Unit. This is a closed circuit check. Operate the generator at a speed above the cut-in point with the generator charging the battery and slowly decrease the generator speed until the relay contacts open. Note ammeter reading at the instant the contacts open. This discharge current must be within the range shown in the table above. If the discharge current is not correct, disconnect the battery and recheck the cut-in point as directed above.

If repeated adjustments fail to secure the correct setting, check trouble from following table:

If either Cut-in point or Cut-out point cannot be correctly set.
1. Cut-out relay windings defective.
2. Voltage Regulator winding defective.
3. Generator voltag low.
4. Poor contact at relay contacts. Clean and adjust cut-out relay contacts.
5. Generator to Control Unit wires disconnected or incorrectly connected.

If Cut-out Point is not correct.
1. Battery disconnected or connections defective (loose terminals).
2. Battery defective. Check battery and electrolyte level.
3. Battery connections reversed, causing relay contacts to vibrate.

LOAD LIMIT CONTROLLER:—The Load Limit Controller is designed to limit the generator output to the maximum rated capacity of the system. For this reason a low charging rate as indicated on the instrument panel ammeter means that the car battery is fully charged and should never be taken to mean that the Load Limit Controller should be adjusted. The Load Limit Controller should be checked on closed circuit with the generator charging the battery.

Mechanical Adjustment:—These are made in exactly the same manner as on the Voltage Regulator (the construction of the two units is similar). All settings are the same except that the core gap on the Load Limit Controller should be .020-.025 inch.

Electrical Adjustment:—Connect battery lead to one terminal of the test ammeter and connect the other ammeter terminal to the 'B—' terminal on the Control Unit. This is a closed circuit test with the generator charging the battery. Remove the wedge from the Load Limit Controller armature (see Voltage Regulator paragraph) so that Load Limit Controller can function. Operate the generator at R.P.M. shown in table below. Close Voltage Regulator contacts momentarily by pressing up on regulator armature. This will cause voltage to rise and charging rate to increase if Load Limit Controller is not correctly set. Note ammeter reading with Voltage Regulator contacts held closed. If ammeter reading is within range shown in table below, the Load Limit Controller setting is satisfactory. If reading is outside this range, turn the adjusting nut above the hinge bracket to the right or clockwise to increase the generator output and to the left or counter-clockwise to decrease the output until the correct setting is secured. The upper figure in the table is the maximum allowable output for the particular generator and must never be exceeded. See that the loop ends of the armature spring are in the grooves of the spring bracket and that the adjusting nut locking clip is in place so that the adjustment cannot change in service.

If it is not possible to secure a correct setting of the Load Limit Controller, check the following points:
1. Load Limit Controller winding defective.
2. Load Limit Controller incorrectly adjusted. See Mechanical adjustments and check condition of contacts, contact gap, and hinge gap.
3. Generator voltage too low. See Voltage Regulator paragraph.

THIRD BRUSH SETTING:—On all third brush control generators equipped with a two-element Control Unit, the generator maximum output is controlled by the third brush setting. To check third brush setting, connect battery lead to one terminal of the test ammeter and connect the other ammeter terminal to the 'B——' terminal on the Control Unit. Operate the generator at the R.P.M. shown on the Load Limit Controller adjustment table. Close Voltage Regulator contacts momentarily by pressing on Voltage Regulator armature. This will cause voltage to rise and generator charging current will increase if third brush is not correctly set. Note ammeter reading with Voltage Regulator contacts closed. If ammeter reading is within range shown in output column of Load Limit Controller Table, the third brush setting is correct. If reading is not correct, shift third brush in direction of armature rotation to increase output or against rotation to decrease output until exact setting is secured. The figure in the table is the maximum allowable output for the particular generator and must never be exceeded.

GENERATOR AND REGULATOR SPECIFICATIONS

Equipment Type		Voltage Regulator Adjustment Table		Cutout Relay Adjustment Table		Load Limit Controller and Third Brush Adjustment Table	
Generator	Control Unit	Generator R.P.M.	Open-Circuit Voltage	Cut-in Voltage	Cut-out Discharge Current	Generator R.P.M.	Maximum Output
x-528-G	528-R	1500	14.4-14.6	11.7-12.3	2-4 amperes	1500	10 amperes
x-529-G	529-R	"	"	"	"	"	"
x-530-G	530-R	"	"	"	"	"	"
x-531-G	531-R	"	"	"	"	"	"
x-532-G	532-R	"	"	"	"	"	"
x-534-G	534-R	"	"	"	"	"	"
x-535-G	535-R	"	"	"	"	"	"
x-553-G	553-R	1350	"	"	"	1000	"
x-555-G	555-R	1350	7.4- 7.6	6.0-6.3	"	1350	15 amperes
x-590-G	590-R	2000	7.3- 7.5	"	"	2000	"
x-594-G	594-R	"	"	"	"	"	"
x-598-G	598-R	"	"	"	"	"	"
x-599-G	599-R	"	"	"	"	"	"
x-602-G	602-R	"	"	"	"	"	"
x-603-G	603-R	"	"	"	"	"	"
x-610-G	610-R	1500	14.4-14.6	11.7-12.3	"	1500	10 amperes
x-618-G	618-R	"	"	"	"	"	"
x-619-G	619-R	"	"	"	"	"	"
x-628-G	628-R	"	"	"	"	"	"
x-629-G	629-R	"	"	"	"	"	"
x-630-G	630-R	"	"	"	"	"	"
x-632-G	632-R	"	"	"	"	"	"
x-648-G	648-R	"	"	"	"	"	"
x-649-G	649-R	"	14.4-14.6	"	"	"	"
x-656-G	656-R	2000	7.3- 7.5	6.0-6.3	"	2000	15 amperes
x-659-G	659-R	1500	14.4-14.6	11.7-12.3	"	1500	10 amperes
x-668-G	668-R	"	"	"	"	"	"
x-669-G	669-R	"	"	"	"	"	"
x-672-G	672-R	2000	7.3- 7.5	6.0-6.3	"	2000	15 amperes
x-676-G	676-R	1350	7.4- 7.6	"	"	1350	"
x-678-G	678-R	2000	7.3- 7.5	"	"	2000	"
x-686-G	686-R	"	"	"	"	"	"
x-694-G	694-R	2000	"	"	"	"	"
x-698-G	698-R	1500	15.0-15.2	11.7-12.3	"	"	"
x-699-G	699-R	"	"	"	"	"	"
x-702-G	702-R	1350	14.4-14.6	"	"	1000	10 amperes
x-706-G	706-R	"	"	"	"	"	"
x-708-G	708-R	"	7.4- 7.6	6.0-6.3	"	1350	15 amperes
x-722-G	722-R	2000	7.3- 7.5	"	"	2000	"
x-724-G	724-R	"	"	"	"	"	"
x-734-G	734-R	"	"	"	"	"	"
x-736-G	736-R	1500	14.4-14.6	11.7-12.3	"	1500	10 amperes
x-740-G	740-R	"	"	"	"	"	"
x-762-G	762-R	"	"	"	"	"	"
x-764-G	764-R	2000	7.3- 7.5	6.0-6.3	"	2000	15 amperes
x-782-G	782-R	1500	14.4-14.6	11.7-12.3	"	1500	10 amperes
871-G	871-R	2500	7.4- 7.6	6.0-6.3	"	2000	25-27
x-882-G	882-R	1500	"	"	"	1200	10
910-G	910-R	2500	"	"	"	2000	25-27
911-G	911-R	"	"	"	"	"	"
912-G	912-R	"	"	"	"	"	"
914-G	914-R	"	"	"	"	"	"
915-G	915-R	"	"	"	"	"	"
947-G	947-R	2500	14.1-14.3	11.7-12.3	"	1500	15-17
984-G	984-R	"	"	"	"	"	"

x- Indicates third brush control generator using two-element Control Unit.

NOTE:—This unit is a vibrating type voltage regulator designed for universal application and may be installed on any 6-8 volt generator (where field current does not exceed 5 amperes) to provide voltage regulation. No cutout relay is included and the original cutout relay installed on the generator is used.

DESCRIPTION:—Regulator consists of a vibrating armature with two movable contacts, one of which contacts upper stationary contact (armature not operating or vibrating on upper contacts), and the other contacts the lower stationary contact (armature vibrating in lower position). Armature is controlled by a spring at the hinge end (spring tension controlled by adjustment knob) and is operated by a two-coil winding. Primary winding of coil is connected directly across the generator main brushes (from main brush lead to ground). Secondary winding is connected between main brush lead and armature contacts so that winding is alternately connected across main brushes (upper contacts closed), in series with resistance unit (both contacts open), or its shorted out (lower contacts closed). Resistance unit consists of a fixed resistance coil mounted on the regulator base plate and connected between the armature and ground. Field lead is also conected to the armature so that field circuit is completed to ground with the resistance shorted out (upper contacts closed) or through the resistance coil (both contacts open or when lower contacts closed).

OPERATION:—Upper contacts are closed with generator voltage below point for which regulator is set so that resistance is shorted out and charging rate is at maximum. As generator voltage increases when battery comes up on charge, current flow through coil windings increases to point where armature is attracted, opening upper contacts, and setting up a vibrating action (Operation on Upper Contacts—see explanation below). When battery is fully charged or at high speeds, armature is attracted toward coil more strongly and vibrating action is set up on lower contacts (Operation on Lower Contacts—see explanation below.) Operation on lower contacts provides maximum regulation and will hold charging rate down to 6 ampere finish rate (see Regulator setting above).

Operation on Upper Contacts—When current flow through primary and secondary coil windings is sufficient to attract armature and open the upper contacts and regulator comes into action, the opening of the contacts cuts the resistance into the field circuit, weakening the field and reducing the generator voltage so that the contacts again close. The cycle is then repeated and the armature vibrates between the open and closed positions cutting the resistance in and out of the field circuit. In addition, when the contacts open, the field voltage (both field lead and secondary coil lead are attached to armature) is superimposed on the secondary coil as a counter or 'bucking' voltage to the main brush voltage across the coil. This voltage differential sets up a steady vibratory 'beat' and increases the frequency of armature vibration. This regulating action maintains generator voltage at a practically constant figure throughout the normal speed range. The dwell or period during which contacts are closed depends on armature spring tension (adjustment knob setting) and will be shorter (lower generator voltage) with less spring tension, and longer (higher generator voltage) with greater spring tension.

Operation on Lower Contacts—When lower contacts close, resistance is connected across generator main brushes as well as in series with the field. This acts as an additional load on the generator to prevent overvoltage in addition to cutting down the field strength. When the contacts open (generator voltage drops due to regulating action above) resistance is in series with secondary and differential voltage action is the same as in operation on upper contacts.

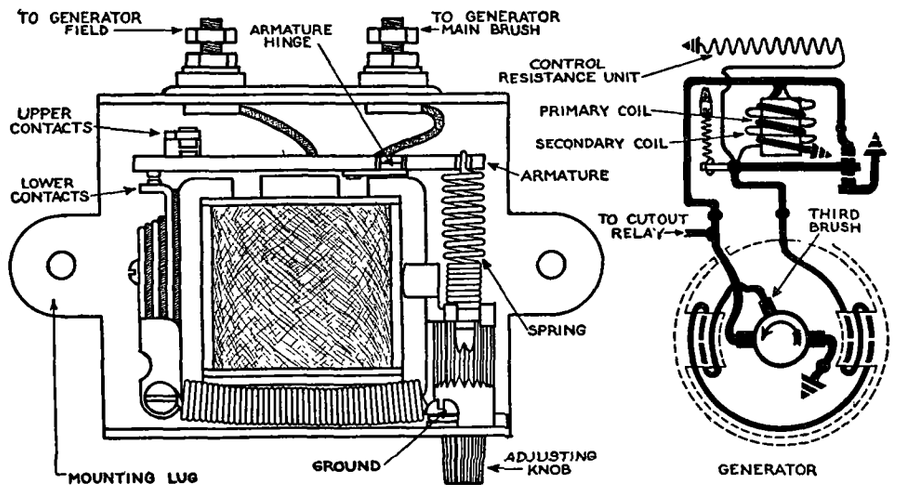
INSTALLATION:—Regulator case provided with mounting lugs for preferred mounting on generator field frame. Lugs can be bent flat for dash or other mounting. Regulator grounded through case and surface under mounting lugs must be cleaned to provide good ground contact (generator mounting) or separate ground wire may be run from mounting lug screw to engine (dash or other insulated mounting). Connect 'G' terminal on regulator case to main brush lead at terminal on generator field frame or at generator terminal of cutout relay—never connect to battery terminal of cutout relay. Connect 'F' terminal on regulator to field terminal on generator field frame, remove ground connection at this terminal (terminal will be grounded if no regulator used previously). If no field terminal provided, make field connection as noted

Generator Field Connection—If field lead grounded internally and not brought out through field frame, drill frame and mount insulated terminal stud or install insulated bushing so that lead can be brought out (drilling hole in commutator cover band not recommended). Locate ground connection in generator, disconnect grounded field lead, connect this lead to terminal stud or splice on section of insulated wire and bring wire out through insulated bushing. Test field for grounds (third brush should be insulated from commutator while making this test), remove any grounds which may be found (field grounds will cause arcing and burning of regulator lower contacts). Install soldered terminals on all leads, see that terminal nuts are tight.

INSTALLATION ADJUSTMENTS:—These adjustments must be made with battery fully charged (1.260 or higher) and generator warm. Battery must be in good condition with all cells equal. Operate generator for 15 minutes at maximum output speed charging battery. Then adjust as follows:

Cutout Relay—Must be set for cut-in voltage of 6.5-7.0 volts for operation with regulator. This may be under standard setting (see separate articles on Cutout Relays). To check cut-in point, disconnect charging line at battery terminal of cutout relay, connect 6-8 volt, 3 cp. lamp between this terminal and ground, connect test voltmeter between generator terminal of cutout relay and ground. Operate generator, increase speed slowly, note voltmeter reading at instant test lamp lights. Adjust cutout relay so that voltmeter reading at this cut-in point is 6.5-7.0 volts. Do not increase generator speed above the cut-in point with the battery line disconnected.

Generator Third Brush Setting—Connect test ammeter in charging line at battery terminal of cutout relay. Disconnect lead on 'G' terminal of regulator to cut out regulator action—do not connect jumper between 'F' terminal and ground. Operate generator at speed for maximum output, set third brush so that ammeter reading corresponds with rated capacity of generator (see car model page for third brush adjusting directions and generator rated capacity). Connect lead to regulator "G" terminal. Charging rate should drop indicating regulator is operating (charging rate will increase with discharged battery).



Regulator Setting—With ammeter connected in charging line at battery terminal of cutout relay, battery fully charged (1.260 reading or higher), generator warm, operate generator at speed at which maximum output secured, turn regulator adjustment knob to right or left as required until ammeter indicates 6 ampere charging current. This is average taper charge requirement

REGULATOR ADJUSTMENT:—Regulator adjustment knob on side of case controls armature spring tension and is the only adjustment provided. Six ampere finish charging rate (setting section above) may be varied slightly (1-2 amperes above or below this point) for special operating conditions or seasonal requirements. Turn adjustment knob to right or clockwise (increase spring tension) for higher charging rate, and to left or counter-clockwise (decrease spring tension) for lower charging rate. Adjustment must be made with fully charged battery only (with discharged battery, charging rate will approach third brush setting or maximum generator rated output).

SERVICING:—No service operations necessary other than to clean contacts when this is required. Clean contacts by drawing crocus cloth between them while holding the contacts closed with light pressure. Blow out all cleaning dust.

TROUBLE SHOOTING:—Slight fluttering of dash ammeter pointer may occur when regulator action changes over from vibrating on upper contacts to vibrating on lower contacts. If ammeter flutters excessively or at other times, check generator commutator for roughness or eccentricity, check brush fit in holders and seat on commutator, check generator drive belt adjustment. See that all connections in charging circuit are clean and tight. Check ammeter.

If regulator lower contacts arc or burn (most evident with fully charged battery) check entire field circuit for grounds.

DESCRIPTION:—Voltage regulator and cutout relay adjustments on two-element Control Unit (for use with third brush control generators) and the three-element Control Units (for use with shunt wound generators) are made in exactly the same manner. No distinction is made in the following discussion between these two types except that the material on the Current Regulator Unit applies only to the three-element Control Unit. The special two-unit combined Current-Voltage Control Unit requires a special setting (see note under Voltage Regulator Unit).

Old and new model numbers for these type regulators or control units are as follows:

Old Model No.	New Model No.	Type of Equipment
3912-B	240936	Voltage & Current Regulator
3916-A	295025	Voltage Regulator
3917	5003917	Voltage Regulator
3919-A	238102	Voltage Regulator
14502	5014502	Voltage Regulator
14502-A	284432	Voltage Regulator
14502-B	284370	Voltage Regulator
——	5030658	Voltage Regulator
——	5030692	Voltage Regulator
(x) 3922	——	Combined Voltage-Current Regulator
(x) 3924-A	5003924	Combined Voltage-Current Regulator

(x)—See special section in article following for data on these types.

Since the generator charging rate with voltage regulation depends upon the condition of the battery, the instrument panel ammeter does not indicate that generator performance is unsatisfactory or that adjusment is necessary. In general, the operation of the regulator unit should be checked whenever the generator is serviced or repaired. The generator should be checked whenever the regulator is set or the setting is changed. The exact procedure in checking and setting individual regulators will be found on the following pages. This procedure should be carefully and exactly followed. Preliminary procedure is as follows:

Generator. Check condition of generator commutator and brushes. Clean commutator and reseat brushes if necessary. Examine generator connections. See that all connections are clean and tight, see that generator is correctly hooked up. Check field fuse.

Regulator. Mount regulator in operating position (same position as on car). Use accurate voltmeter and ammeter to check settings—see illustrations and specific directions for hookup of instruments for each test. Make settings in following order:

1. **Cut-out Relay.** Mechanical Adjustments—Check condition of contacts and resurface if necessary, set contact gap; check and set core gap; check and set hinge gap. Electrical Adjustments—Check and set cut-in point; check and set cut-out point.
2. **Voltage Regulator.** Mechanical Adjustments—Check condition of contacts and resurface and align if necessary, set contact gap; check and set core gap (on North East units check length and clearance of core pin); check and set hinge gap; check sideplay of armature. Electrical Adjustments—Operate generator and set regulator to maintain correct open circuit voltage.
3. **Current Regulator.** Mechanical Adjustments—Check and set contact gap, check and set core gap (on North East units check length and clearance of core pin), check and set hinge gap, check sideplay of armature. Electrical Adjustment—Operate generator with full load and set regulator to maintain rated capacity of generator. On two-element control units with third brush current control, this setting is made by shifting the third brush to secure correct output.

MECHANICAL ADJUSTMENTS

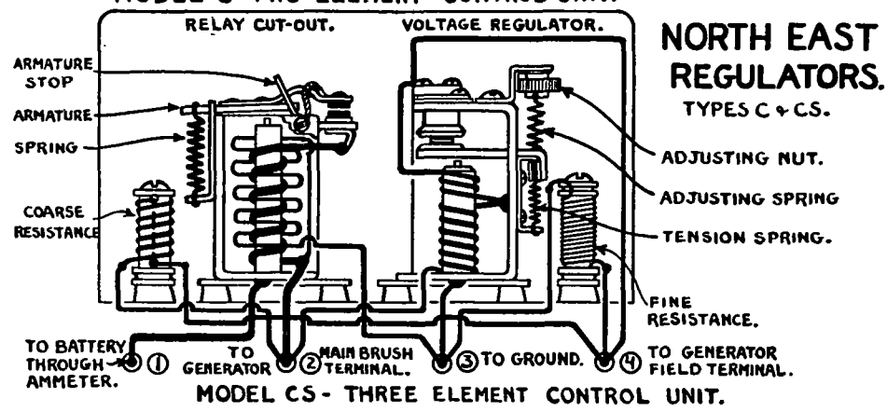
CUT-OUT RELAY:—Contacts. Check contacts by slipping off tension spring and removing armature (it will not be necessary to disconnect pigtails). If necessary resurface contacts with a fine flat contact file or No. 00 sandpaper. In re-installing armature see that pigtails do not bind under stop lug and that stationary contact is perfectly flat and armature contact slightly rounded. Align contacts by bending armature support lugs. On double contact type of relay see that contacts open and close simultaneously. Adjust by bending armature contact supporting fingers.

Armature Side Play. Side play of armature at contacts should be 1/64-1/32 inch to prevent binding. Adjust by bending armature support lugs Tension spring must be unhooked before making this adjustment.

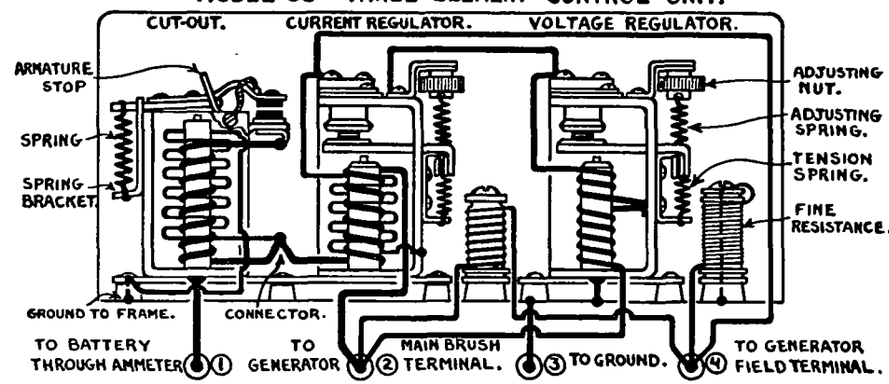
Core Gap Clearance. Double Contact Type—Air gap between coil core stop pin and armature should be .040-.045 inch. Check with feeler gauge and set by bending stop lug above armature up or down. Stop pin height above core should be .025 inch (minimum) to .040 inch (maximum). Pin should be replaced if less than .025 inch or filed down if more than .040 inch in height. Single Contact Type—Air gap should be .015 inch. Adjust by bending stop lug.

Contact Gap. Single and Double Contact Type—Contact gap should be .025 inch. On single contact type adjust by bending lower (stationary) contact bracket. On Double Contact Type adjust by bending upper (armature) contact support fingers. The gap must be kept exactly the same on both sets to insure their opening and closing simultaneously.

MODEL C-TWO ELEMENT CONTROL UNIT.



MODEL CS - THREE ELEMENT CONTROL UNIT.



VOLTAGE REGULATOR:—Contacts. On 6 and 12 volt systems with positive battery terminal grounded, stationary contact is of metal and armature contact of carbon. On systems with negative battery terminal grounded, both contacts are made of carbon. Contacts should be surfaced on a piece of No. 00 sandpaper laid on a flat surface and all dust brushed off with a fine brush. Contacts should never be touched with the fingers as greasy finger marks will interfere with correct operation. Align contacts after reassembly by shifting armature bracket after slacking off bracket screws (hinged armature type) or by bending support lugs on armature bracket (first type). Do not bend or twist armature bracket or hinge. On first type, see that sideplay of armature at contacts is 1/32-1/64 inch to prevent armature binding.

Regulator Type	Contact Assemblies Upper Contact	Lower Contact
240936	Tungsten	Carbon
295025	Silver	Carbon
5003917	Carbon	Carbon
238102	Silver	Carbon

Core Gap Clearance. Check clearance between armature and magnet frame to see that armature has full movement without touching frame. Clean out all dirt. Check length of pin in coil core. If under .025 inch, pin should be replaced. If over .040 inch, pin should be filed down. Air gap between pin and armature should be .003-.005 inch with contacts closed. Check with a feeler gauge.

Contact Gap. Check contact gap by inserting feeler gauge between coil core pin and under side of armature with contacts closed. Gap should be .003-.005 inch. To set gap, loosen lock screw on stationary contact mounting bracket on top of magnet frame and turn stationary contact locking nut to raise or lower stationary contact. See that contact surfaces are square and parallel. To align contacts, loosen locking nut with locking screw tight, which will release ball-and-socket joint in contact thimble, press armature up firmly to close contacts and tighten locking nut.

CURRENT REGULATOR:—Same as for Voltage Regulator (above).

ELECTRICAL ADJUSTMENTS

CUT-OUT RELAY:—Cut-out Relay action may be checked on open or closed circuit. In each case the voltage regulator should be shorted out by connecting a short jumper between terminals 3 and 4 on the Control Unit. The generator should never be operated at excessive speeds with the voltage regulator out of the circuit as damage may result. For closed circuit operation all lights must be turned off.

Open Circuit Setting. Connect voltmeter between terminals 2 and 3 on Control Unit. Connect a test lamp (3 cp.) between terminals 1 and 3. Disconnect battery lead on terminal 1. Operate generator and gradually increase speed until test lamp lights, indicating that relay contacts have closed. Note voltmeter reading. Decrease generator speed until test lamp goes out, indicating that contacts have opened. Note voltmeter reading. These tests should be repeated several times. Correct settings for cut-in and cut-out points are as follows:

Type of Equipment	Contacts Close Volts	Contacts Open Volts	Amperes
All 6 Volt Relays	7.0-7.25	5.75-6.0	0-3 (discharge)
All 12 Volt Relays	13.25	11.0-11.50	0-2 (discharge)

To set Cut-in Point:—Change armature spring tension by bending lower spring bracket down (away from armature) to raise cut-in voltage. Bend spring bracket up (toward armature) to lower cut-in voltage. Check adjustment by repeating test until correct setting is secured.

Closed Circuit Setting. Disconnect generator lead on terminal 2 of Control Unit and connect this lead to one terminal of the test ammeter. Connect the other ammeter terminal to terminal 2 on he Control Unit. Connect voltmeter between terminals 2 and 3 on the Control Unit. Operate generator and gradually increase speed until kick-back of voltmeter pointer indicates that contacts have closed. Voltmeter readings and method of adjusting are the same as for open circuit testing as given above.

To check cut-out point of Relay, gradually decrease generator speed and note discharge current indicated on test ammeter. Contacts should open with discharge current of less than 3 amperes. If discharge current is greater than 3 amperes, increase air gap between coil core and armature as directed under mechanical adjustments above. If contacts open with the generator still charging, decrease the air gap. After changing air gap, check the cut-in point again and adjust if necessary.

Relay should be checked again after Voltage Regulator has been set and any necessary adjustments made to secure Relay performance in accord with data given above. As a final test, check cut-in and cut-out points several times by increasing and decreasing generator speeds and noting voltmeter readings.

VOLTAGE REGULATOR:—Before Voltage Regulator is adjusted, generator should be tested to make certain that it is operating satisfactorily and will produce the full rated output. To make this test, short out Voltage Regulator by connecting a short jumper between terminals 3 and 4 on the Control Unit and connect an accurate voltmeter between terminals 2 and 3. Operate generator at moderate speeds and note output (on straight shunt generators current will continue to rise with an increase of speed and generator should never be operated at speeds higher than the rated R.P.M. for maximum output). If generator produces rated output (see table below), remove jumper between terminals 3 and 4 and proceed with adjustment

Open-circuit Setting. Take off battery lead on terminal 1 of Control Unit and operate generator on open circuit. Bring generator speed up to rated R.P.M. for maximum output. If regulator does not control voltage within two volts of correct figure (see table), turn adjusting nut to center of stud, adjust tension spring by bending spring toward armature to raise voltage or away from armature to lower voltage until setting is within 2 volts of correct figure. Operate generator for 15 or 20 minutes to allow regulator winding to reach operating temperature and check voltmeter reading at end of this period. If Voltage Regulator does not control voltage within 2 volts of correct figure, bend tension spring until approximate setting is secured. Then turn adjusting nut at upper end of adjusting spring to right (to increase operating voltage) or to the left (to lower operating voltage) until exact setting is secured. If it is necessary to turn the adjusting nut near the end of the stud to secure the correct setting, the nut should be turned back to the center of the stud and another preliminary adjustment made by bending the tension spring. After each adjustment the speed of the generator should be decreased and the generator then brought up to the rated R.P.M. figure again in order to overcome the effect of the residual magnetism of the regulator. Correct settings are given in the following table:

Type of Equipment	Open Circuit Voltage Setting
All 6 Volt Regulators	7.5 volts
All 12 Volt Regulators	14.5 volts

Check final setting by varying generator speed throughout operating range and checking voltmeter readings carefully.

Closed Circuit Check. After setting of Voltage Regulator has been completed on open circuit, the operation of the Voltage Regulator should be checked on closed circuit. Connect a variable resistance (carbon pile rheostat) between battery lead and terminal 1 on Control Unit. Connect test ammeter between terminal 2 and generator lead. Connect voltmeter between terminals 2 and 3 on Control Unit. Operate generator at correct speed to produce maximum output. Reduce resistance to minimum (screw up carbon pile) and note ammeter reading. Charging rate should be between finish rate and maximum charging rate of generator. Increase resistance (decrease pressure on carbon pile) until voltmeter reading indicates that Voltage Regulator is operating (voltmeter reading will correspond with setting of Voltage Regulator). Ammeter should indicate 'finish rate' or approximately 1-3 amperes. If generator output is higher than this figure the Voltage Regulator open circuit operation should be rechecked.

CURRENT REGULATOR:—The separate Current Regulator should be checked and adjusted on closed circuit. Connect the test ammeter between generator lead and terminal 2 on Control Unit. Short out Voltage Regulator by connecting a short jumper across Regulator contacts from upper contact support to regulator frame (do not connect terminals 3 and 4 on Control Unit as this would also short out the Current Regulator). Operate generator and increase speed gradually to rated R.P.M. for maximum output. Close Current Regulator contacts momentarily by hand and note whether generator output increases. Then release contacts and note at what point Regulator controls generator output. Regulator should be set in accordance with rated output figure for each generator. Standard settings for 12-volt generators are as follows:

Generator Rated Capacity	Current Regulator Setting
300 Watts	24 amperes
400 Watts	31 amperes
500 Watts	38 amperes
600 Watts	45 amperes
800 Watts	60 Amperes

The Current Regulator is adjusted in the same manner as the Voltage Regulator. Approximate settings are made by bending the tension spring and a final adjustment is secured by turning the adjusting nut at the upper end of the adjusting spring. The setting should be checked by operating the generator at various speeds throughout the entire range.

FINAL CHECK:—After all adjustments have been made on Control Unit, allow Unit to cool off and recheck Cut-out Relay cut-in point. If voltage Regulator operates before Cut-out Relay contacts close (which will prevent generator from charging until Control Unit warms up) the Voltage Regulator setting should be raised slightly but not more than .25 volts.

A final operating test should be made with the Control Unit cover in place and with the Control Unit mounted on the car.

TWO-ELEMENT COMBINED CURRENT-VOLTAGE CONTROL UNIT TYPES: 3922, 3924-A:—Adjustments are made in exactly the same manner as directed for Voltage Regulators (above) but the open circuit voltage should be set at 17.00 volts to compensate for the action of the current coil. In checking the operation of the Control Unit on closed circuit, the variable resistance should be set to hold the voltage at 13 volts and the charging rate noted (ammeter reading should be 17-19 amperes). The resistance should then be adjusted to hold the voltage at 14 volts and the ammeter reading again noted. The generator output should show a drop of approximately 3 amperes or a charging rate of 14-16 amperes. If necessary the Voltage Regulator setting should be readjusted slightly to secure this result.

NORTH EAST CONTROL UNITS

USED ON GENERATORS OF 150 WATT CAPACITY OR LESS

The types which will be found in service are as follows:

Model Number	Voltage	Type of Equipment
5025067	6 volts	Voltage Regulator
5025554	6 volts	Voltage Regulator
5028271	12 volts	Voltage Regulator
5028280	6 volts	Voltage Regulator
5029044	6 volts	Current Regulator
5029314	6 volts	Voltage Regulator
5030060	6 volts	Voltage Regulator
5030885	6 volts	Voltage Regulator

DESCRIPTION:—These units consist of vibrating type voltage or current regulators combined with cutout relays in a single case. Voltage regulators are designed to hold generator voltage constant at the point for which the unit is set and provide a tapered charging rate as the battery voltage comes up on charge. Current regulators are designed to limit the maximum generator output to the amperage for which the unit is set. They are used only on two-brush shunt wound generators and should not be installed on third brush control type.

ADJUSTMENT:—Cutout relay should be adjusted before voltage regulator or current regulator adjustments are made. In each case all mechanical adjustments, such as air gap, contact gap, and contact spring tension should be made before the electrical setting is checked or adjusted. Adjustments are listed in order below.

CUTOUT RELAY:—**Contact Gap**—Check with feeler gauge. Should be .012-.020". Adjust by bending upper stop.

Air Gap—Check air gap at two points. Should be .027-.030" at point near contacts and .018-.020" at point near spring. Armature should be up (contacts open) in each case.

Electrical Setting—Cut-in Point. Contacts should close with generator voltage of 6.5-6.75 volts (6 volt units), or 13.0-13.5 volts (12 volt units). Adjusted by changing armature spring tension. Increase spring tension to increase cut-in voltage, or decrease spring tension to decrease cut-in voltage.

Cut-out Point—Contacts should open with discharge current of 0-3 amperes (6 volt units), or 0-2 amperes (12 volt units).

VOLTAGE REGULATOR:—**Air Gap**—Gap between armature and core (measured at rear near spring) should be .010-.015" with armature down and contacts open. Adjust by bending contact spring stop. Gap between fibre bumper block and stop should be .005-.007" with armature up and contacts closed. Adjust by bending upper armature stop.

Contact Gap—Should be .017-.020" with armature down. Adjust by bending lower armature stop.

Contact Spring Tension—Should be 1.5-2.0 ounces. Measure at tip of top contact.

Electrical Setting—Operate generator on open circuit at speed at which maximum output is secured. Open circuit voltage should be 7.1-7.5 volts (6 volt units), 14.2-14.5 volts (12 volt units) with generator hot after being operated for 15-20 minutes. Units are compensated for temperature and cold voltage should be 7.5 volts (6 volt units), 15.0 volts (12 volt units). Adjust by bending arm holding spring which normally holds contact closed. In crease spring tension to increase regulator voltage or decrease spring tension to decrease voltage.

CURRENT REGULATOR:—Air gap, contact gap, contact spring tension specifications and adjustments are the same as given above for the Voltage Regulator.

Electrical Setting—Check setting by connecting ammeter in battery lead at regulator. Output should be 11.5 amperes normally or 14.5 amperes maximum. Adjust by bending arm holding spring which normally holds contacts closed. Increase spring tension to increase current setting or decrease spring tension to decrease current setting.

NOTE:—North-East Generator model numbers have recently been changed. Old and new model numbers for Lamp Load Generators are as follows:

Old Model Number	New Model Number
LAB-6564-A	5006564
LAB-6620	5006620
LAB-6624	5006624
———	5004486

DESCRIPTION:—This type generator, although it resembles the ordinary generator in construction (except that there are two terminals 'L' and 'B' on the field frame), operates differently than the regular third brush shunt field control types. The regular shunt field connected between the third brush and the grounded main brush through a field fuse mounted on the end plate is wound on one field pole. The other pole carries a divided series field ('A' and 'B' on the diagram). Both sections of this field are inoperative at speeds below the relay cut-in point when the lamps are turned off. When the lamps are turned on, the lighting current from the battery goes through both sections of the series field, which strengthens the magnetic field and causes the generator to cut in at a lower speed. The 'A' section of the series field continues to strengthen the magnetic field as long as the lights are turned on and is inoperative at all speeds when the lights are turned off. The 'B' section of the series field acts to strengthen the magnetic field when the lights are turned on until the relay cut-out contacts close and the generator takes care of the lamp load when it opposes or bucks the shunt field. This 'B' section also bucks the shunt field at all speeds above the cut-in point with the lights turned off. This tends to hold the charging rate down with the lights turned off and automatically increases the generator output when the lights are being used.

ADJUSTMENT:—Generator output can be adjusted in the usual manner by shifting the third brush. The third brush adjusting screw is located on the commutator end plate. Turn the adjustment screw to the right or in a clockwise direction to increase the charging rate and in the opposite direction to decrease the charging rate.

PERFORMANCE:—With standard car setting, the generator performance is as follows with all lamps turned off:

Generator Data—Maximum Hot Output—Lamps Off

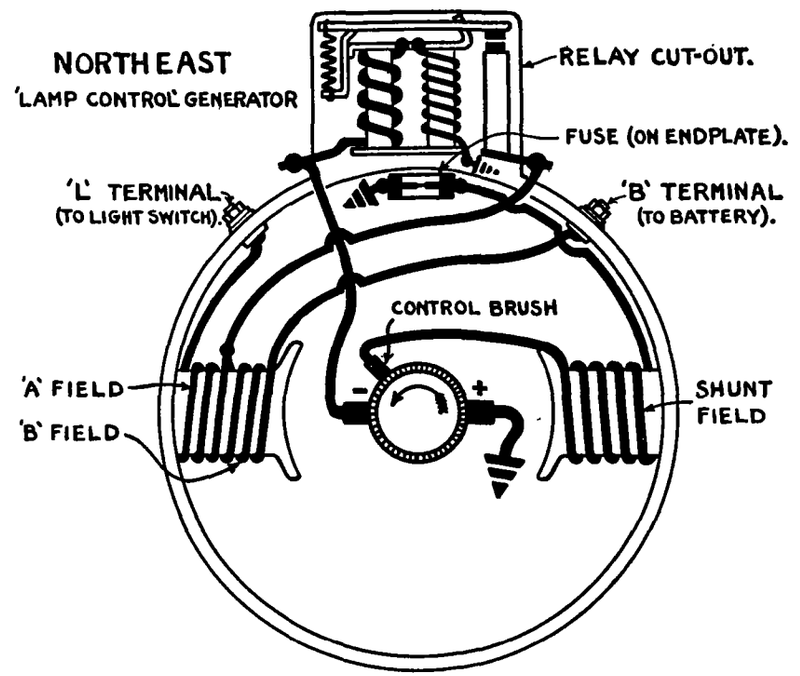
Model	Amperes	Volts	R.P.M.
5006564	7.7	8.0	1930
5006620	8.2	7.35	1800
5006624	9.0	7.3	2600
5004486	9.0	7.3	2600

LAMP LOAD:—These generators are designed for a definite maximum lamp load as shown in table below. This figure must not be exceeded and lamps must be connected as shown in wiring diagram (lamps should not be connected at the ammeter terminal as in conventional practise).

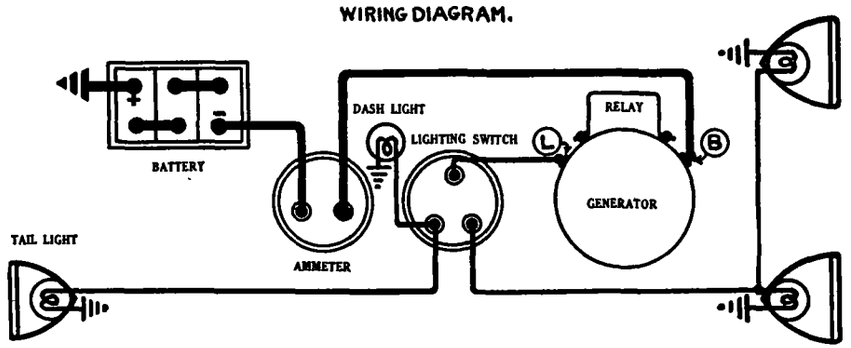
Generator Model	Maximum Lamp Load (Amperes)
5006564	7
5006620	7
5006624	8
5004486	8

RELAY CUTOUT:—Type 20220. Relay is mounted on the generator field frame. One terminal is connected to the negative main brush and the other relay terminal is connected to the series field lead. Note that the relay is not connected to the battery as is the usual practice. The battery is connected to the 'B' terminal on the field frame. Relay contacts close when the generator voltage reaches 7.0-7.25 volts and open with a discharge current of 0-3 amperes when the generator voltage drops to 5.75-6.0 volts. Relay contact gap is .012-.020". Air gap is .027-.030" with contacts closed.

FUSES:—The shunt field is grounded through a 10 ampere fuse mounted in a plug on the commutator end plate. No other size fuse should be used for replacement.



WIRING DIAGRAM.



OWEN-DYNETO BATTERY CHARGE REGULATOR

DESCRIPTION:—The Owen-Dyneto Battery Charge Regulator consists of an electrically operated thermostatic regulator and a relay cut-out mounted in a single case which is designed to be mounted on top of the generator. It is standard equipment on certain models of Owen-Dyneto generators and can be installed on generators of other manufacture by making minor alterations in the relay mounting and wiring hookup. The regulator permits a relatively high charging rate without danger of damaging the battery and automatically varies the charging rate to cover different driving conditions by permitting the high charging rate over short periods of time or for short trips and automatically cutting down the rate after the regulator thermostat heats up which will occur on long trips or after the generator has nearly completed the battery charge.

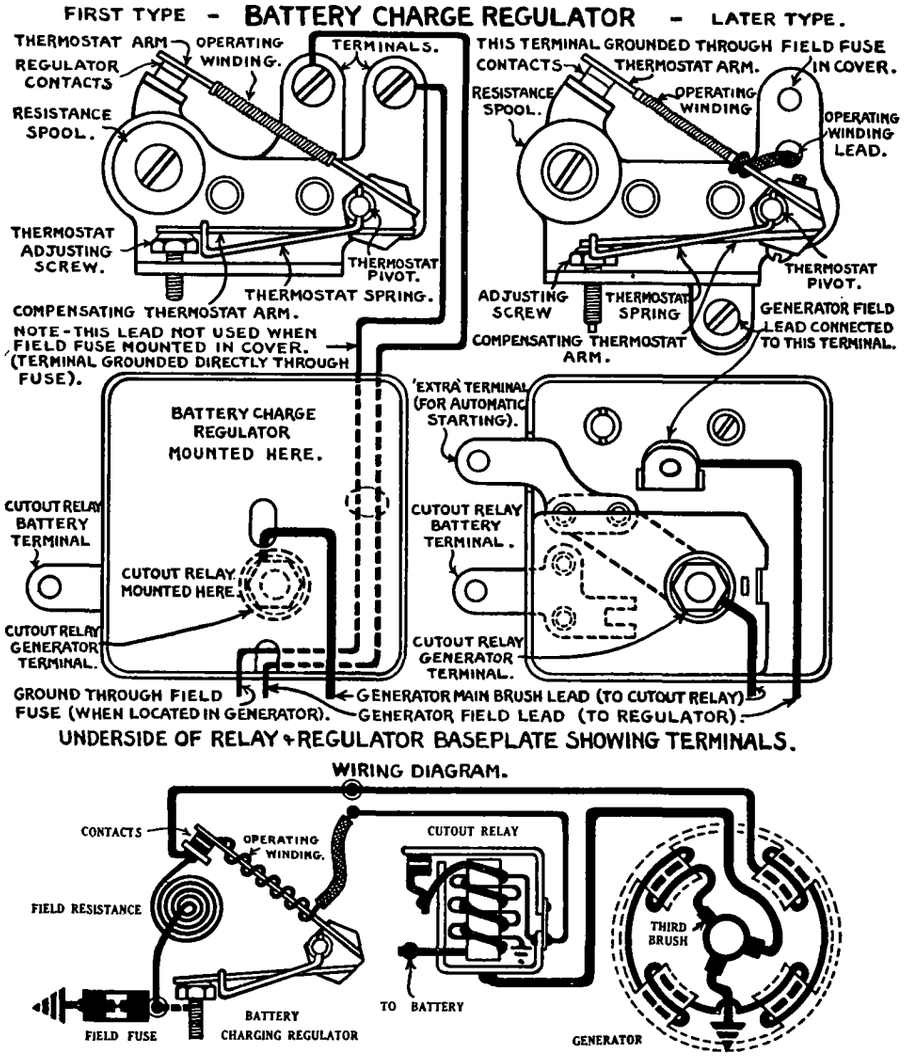
OPERATION:—The regulator consists of two thermostat arms mounted on a pivot. The upper arm carries the regulator contacts and has a fine resistance unit wound on it. This resistance is connected directly between the generator relay terminal in the base of the unit and ground and is thus connected directly across the main brushes of the generator. The lower thermostat arm is a compensating unit and carries no winding. It is designed to compensate the regulator for temperature changes. The spring which normally keeps the regulator contacts closed engages the lower thermostat arm. The two upper terminals of the regulator should be connected to the field as marked in the illustration. The field resistance is wound on a spool on the regulator frame and is connected between the two regulator terminals and across the contacts. It is thus connected in series with the generator field winding but is short circuited by the regular contacts when the contacts are closed.

In operation with the regulator contacts closed the generator operates as a straight third brush shunt machine charging the battery at the rate determined by the third brush setting. Current likewise flows through the winding on the upper thermostat arm. When the generator voltage reaches 8 volts (cold) or 7.5 volts (hot) this winding heats up causing the arm to flex and open the contacts which inserts the resistance in the field circuit. This reduces the charging rate to the finish rate of the battery.

ADJUSTMENT:—The regulator is set at the factory and should not require adjustment. However, if adjustment is necessary, connect a voltmeter between the battery terminal of the generator and ground and operate the generator for several minutes to allow the thermostat winding to heat. The regulator cover must be in place or the air blast of the fan will prevent the proper functioning of the thermostat. Then turn the adjusting screw under the lower thermostat arm clockwise to increase the operating voltage and counter-clockwise to decrease the voltage. The regulator should operate at 8.0 volts cold or 7.5 volts hot.

NOTE:—A carbon button or disc type resistance was used on the earlier types. The amount of resistance could be varied by increasing or decreasing the pressure of the brass disc on the carbon button. This type resistance has been discontinued and all regulators are fitted with a wire-wound type of resistance unit.

INSTALLATION:—The regulator can be installed on practically any generator after removing the old relay cutout and modifying the old relay mounting to take the regulator mounting screws. Then connect the old relay lead from the generator main brush to the terminal in the base of the regulator unit. Disconnect the generator shunt field ground and bring this lead out of the generator, drilling a hole through the commutator cover band to take the wire. Connect this lead to the regulator field terminal. The other regulator terminal should be grounded through the fuse mounted in the regulator cover. On Owen-Dyneto generators or generators with the field grounded through a fuse mounted on the generator frame, the field should be disconnected from the fuse terminal and brought out to the regulator and a second lead should be brought out from the fuse terminal to the regulator ground terminal.



TYPES CD-836, CD-839, CD-846

DESCRIPTION:—The Owen-Dyneto Lamp Control Generator is designed to deliver a set amount of current to the battery regardless of the load on the generator. It will charge the battery at pratically the same rate whether the car lamps are burning or not. It is a compound wound machine with two shunt coils wound on opposite poles and connected between the third brush and ground through a five ampere field fuse. There are two main brushes, one being grounded and a lead from the other being taken out to the relay cutout and then to the battery. A series field is wound on the other two field poles. This field is connected in series with the lamp load through a 15 ampere fuse mounted on the generator field frame and consists of two coils in series with each other. This field circuit is open with the lamp switch off.

OPERATION:—With the lamp switch 'Off' and lamps not burning, the generator operates as a third brush shunt wound generator with two field coils and 'consequent' poles between the field poles which are energized. When the lamp switch is turned on the lamp circuit current which is taken from the battery side of the generator relay cutout flows through the 'series' windings strengthening the field and increasing the generator output in proportion to the current drawn by the lamps. The 15 ampere fuse in the lighting circuit is designed to prevent overload and the lamp load should be so regulated as to keep the current below this figure. The ignition current should never be taken through the generator and the coil lead should be connected directly to the generator side of the ammeter.

PERFORMANCE:—The generators are set at the factory to give the following performance:

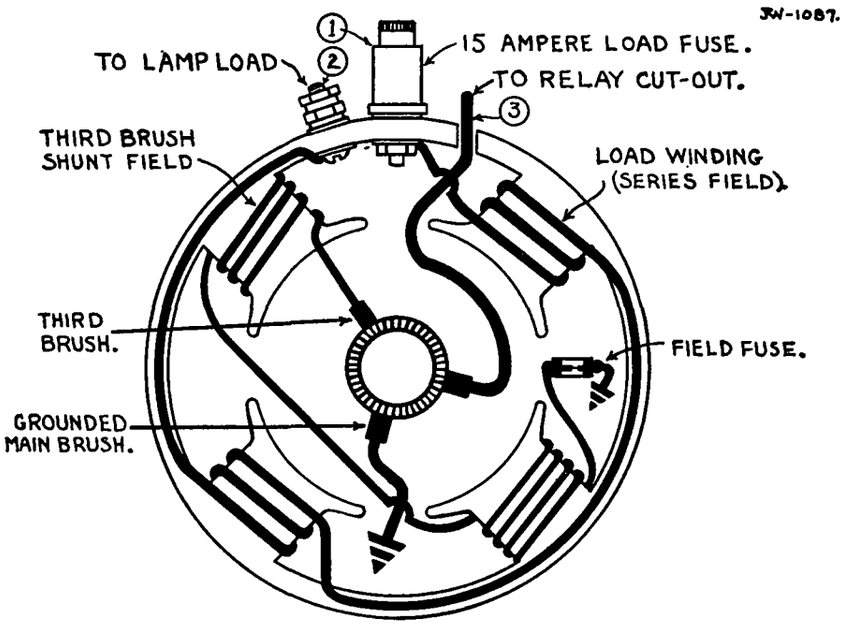
Generator Data

Load	Amperes	Volts	R.P.M.
Without Lamp Load.	0	12.4	1200
With Lamp Load.	0		900
Without Lamp Load.	7		2320
With Lamp Load.	4		1800
Without Lamp Load.	6		3200
With Lamp Load.	1		3200

The above table indicates current supplied to the battery by the generator at various speeds and under different conditions. The maximum output of the generator is 15 amperes. The normal lamp load is approximately 11 amperes.

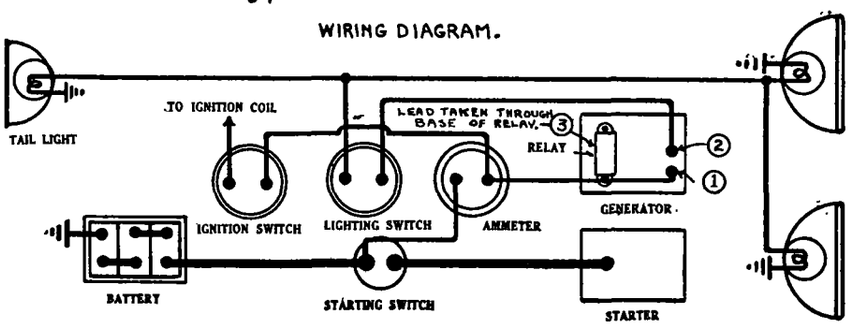
ADJUSTMENT:—The third brush setting is adjustable. To adjust third brush, remove the commutator end cover and turn the slotted shifter shaft on the generator end plate.

RELAY:—Type 20070. Relay is mounted on the generator. Relay contacts close at 900 R.P.M. with lamp load and 1200 R.P.M. without lamp load when the generator voltage reaches 12.4 volts.



OWEN-DYNETO GENERATOR

Types CD-836, 838, 839, 846.



TYPES KB-873, KB-897, KB-878 AND KB-890

DESCRIPTION:—The Owen-Dyneto Starter-generator for outboard engines is a six pole, compound wound machine. The armature is keyed directly on the upper end of the crankshaft and serves as the engine flywheel. It revolves within the field frame which is mounted on the upper end of the crankcase. The two main brushes and a movable control brush are mounted on the brush ring which is centered on the upper end of the field frame by six small tongues. A battery charge regulator is also mounted on the brush ring. The ignition unit is mounted on the upper end of the shaft under the cover plate of the starter-generator.

OPERATION:—The starter-generator is controlled by a three position 'slide bar' type switch. The three positions of the switch are:

OFF. In this position of the switch the starter-generator is disconnected from the battery and the ignition is likewise disconnected from the battery. It is the normal position of the switch when the engine is not running.

NEUTRAL. In this position of the switch, the ignition is connected to the battery but the starter-generator is not connected. The switch should be placed on 'Neutral' when for any reason it is desired to hand-crank the engine. It may also be used for high speed operation to eliminate the drag of the generator. No damage will occur to the starter-generator windings if the engine is run with the switch in 'Neutral' as both the series and shunt windings are open. The neutral position of the switch is secured by sliding the switch bar 3/16 inch from the 'Off' position.

ON. When the switch is placed on the 'On' position the ignition is turned on and the starter-generator is connected to the battery. In addition the shunt field circuit of the generator is completed. The starter-generator then acts as a motor to spin the engine at approximately 400-450 R.P.M. The starter continues to assist the engine until the engine speed reaches 1000 R.P.M. when it begins to charge the battery. At all speeds above 1000 R.P.M. the machine will operate as a generator to charge the battery. Whenever the engine speed drops below 1000 R.P.M. the machine operates as a motor which prevents the engine from stalling at low speeds. The cut-in speed of the Types KB-873, KB-878 and KB-897 six volt starter-generators is 1000 R.P.M. as above. On the Type KB-890 starter-generator this cut-in speed is 1500 R.P.M. The Type KB-890 is a twelve volt machine.

The generator output is controlled by an Owen-Dyneto 'Battery Charge Regulator' operating in conjunction with the third brush shunt field control. The control brush or 'third brush' can be shifted on the brush ring to change the generator output. The control brush should be shifted in the direction of armature rotation to increase the charging rate and in the opposite direction to decrease the charging rate. The Battery Charge Regulator is fully covered on a separate page. See Generators.

Generator Performance Data

Types KB-873, 878, 897

Amperes	Volts	R.P.M.
0	6.3	1000
16	7.6	2500
13	7.4	4500

Type KB-890

Amperes	Volts	R.P.M.
0	13	1500-1600
9	14	3500
8	14	4500

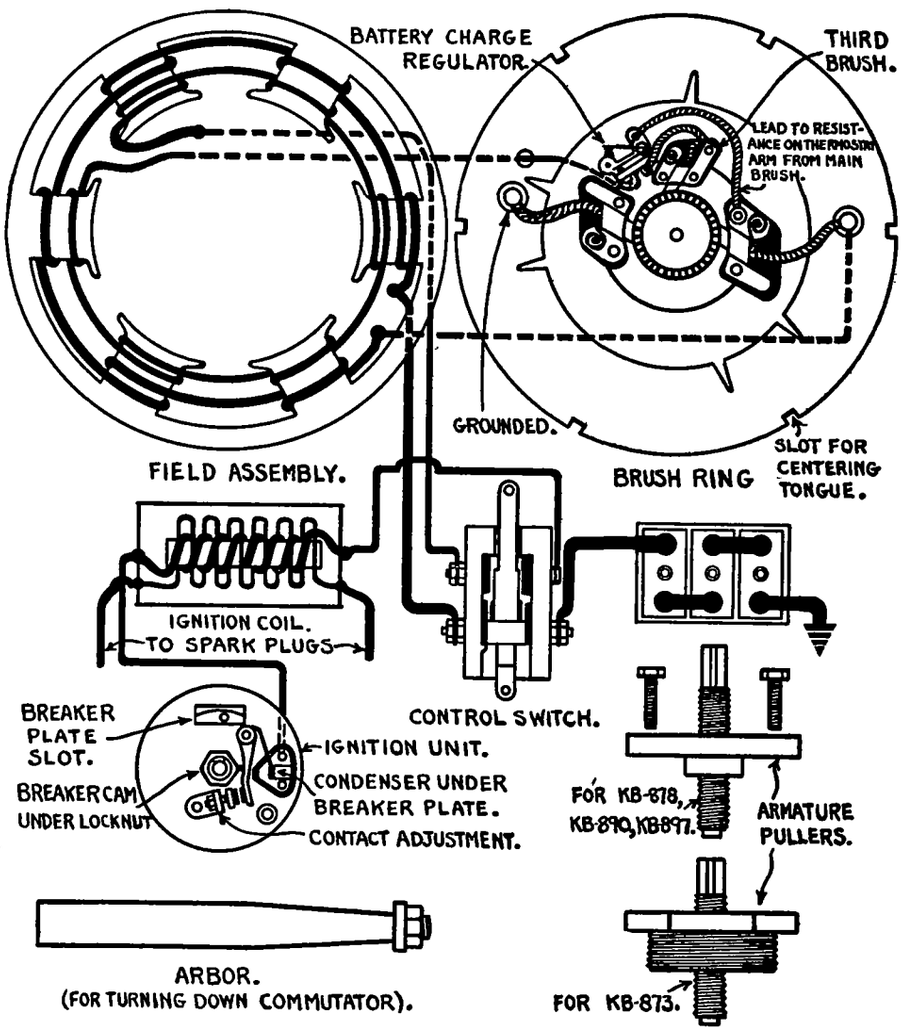
Starter Performance Data

Types KB-873, 878, 897

Torque	R.P.M.	Volts	Amperes
4 lb. ft.	400	6	65
27 "	Lock	5.5	290

Type KB-890

Torque	R.P.M.	Volts	Amperes
14 lb. ft.	400	11	130
35 "	Lock	9.5	330



MOUNTING:—The starter-generator must be disassembled before it can be removed from the engine. To remove starter-generator, perform the following operations in order:

1. Remove the cover. Take out the six screws that hold the cover in place on the field frame (Types KB-878, 890) or loosen the clamping screw (Types KB-873, 897). Raise the cover slightly and disconnect the spark advance control wire from the ignition mounting plate and the ignition coil lead from the breaker assembly. Then lift the cover from place.

2. Remove the ignition unit. Mark the position of the breaker plate on the armature (so that it may be reassembled in the same position without disturbing timing). Insert a screwdriver through the opening of the breaker plate and take out the six screws mounting the ignition unit on the end of the armature shaft. The ignition unit may then be lifted off.

3. Remove the hand cranking pulley (Types KB-873, 897, used on Johnson engines only). On the Type KB-873 the pulley is mounted on a split sleeve which screws into the armature hub and is held in place by a taper plug in the armature hub. The taper plug is locked in place by a nut on the stud which projects up through the pulley from the plug. To remove this type pulley, loosen the nut on the stud in the center of the pulley and tap stud down to loosen the taper plug. The pulley can then be unscrewed. The split sleeve has a right hand thread. On the Type KB-897 the pulley is mounted on a stud which is mounted on the end of the armature shaft by six screws. To remove pulley, take off the nut and cam on the stud bolt and lift pulley from place.

4. Remove the Brush Ring assembly. Take out the three screws which mount the brush ring on the field frame. Remove the two terminal stud nuts on the main brush leads and disconnect the shunt field coil lead at the regulator. The brush ring can then be lifted off.

5. Remove the Armature. The armature can be withdrawn after the nut which holds it in place on the crankshaft has been taken off. Several special armature pullers have been developed by the Owen-Dyneto Corporation for this purpose.

6. Remove the Field Frame Assembly. The field frame is mounted on the crankcase by four machine screws. These screws are accessible after the machine has been disassembled as directed above.

NOTE:—Since the armature is designed to be mounted on the crankshaft there is no armature shaft. If the armature is to be mounted in a lathe to turn down the commutator a special arbor must be used. This can be secured from the Owen-Dyneto Corporation.

IGNITION

OPERATION:—The ignition unit is of standard automotive design with a single lobe cam mounted on the crankshaft revolving at engine speed. The coil for two cylinder ignition is of the two spark type with both ends of the secondary brought out to high tension terminals which are connected to the spark plugs. Both cylinders fire simultaneously once in each revolution of the crankshaft. On four sylinder engines a double coil is used with two primaries and two secondaries which terminate in four high tension terminals. One coil fires the two upper cylinders and the other coil fires the two lower cylinders. Two breakers are used, each breaker controlling one coil. Both breakers are mounted on the breaker plate and operate on the same cam. The condensers for the breakers are mounted under the breaker plate.

TIMING THE ENGINE:—To set the ignition timing, turn the engine over until the pistons reach top dead center (the extreme outer end of the stroke). Fully retard the spark advance. Loosen the locking nut on the upper end of the breaker shaft and carefully locate the cam so that contacts are beginning to open. Tighten the locking nut and connect the coil secondary leads to the spark plugs. With the spark advanced the contacts will be wide open at top dead center. Breaker contact gap should be .022-.025 inch. Set contact gap by loosening lock nut on stationary contact mounting stud and turning up stud. Resurface contacts when necessary with a fine flat contact file or on a medium hard oilstone.

Vibrating Voltage & Current Regulators

Car Models	Regulators	Generators	Grd. Ter.
Chrysler C25, C26, C27 ('40)	VRP-4001A	GDZ-4801A	Pos.
Chrysler C25, 6, 7 Police ('40)	VRP-4001B	GEB-4801A	Pos.
De Soto S7 (1940)	VRP-4001A	GDZ-4801A	Pos.
De Soto S7 Police ('40)	VRP-4001B	GEB-4801A	Pos.
Dodge D14, D17 (1940)	VRP-4001A	GDZ-4801A	Pos.
Dodge D14, 17 Police ('40)	VRP-4001B	GEB-4801A	Pos.
Hudson 41, 43 Police ('40)	VRP-4008A	GEG-4801A	Pos.
Packard 1800, 1, 1A (1940)	①VRP-4002A	GEA-4801A	Pos.
Packard 1803, 4, 5, 6, 7, 8 ('40)	VRP-4003A	GEA-4802A	Pos.
Plymouth P9 P10 (1940)	VRP-4001A	GDZ-4801A	Pos.
Plymouth P9, 10 Police ('40)	VRP-4001B	GEB-4801A	Pos.
Studebaker Champ. 2G (1940)	VRP-4004A	GEA-4804A	Pos.
Studebaker 2G Police ('40)	VRP-4004C	GEB-4803A	Pos.
Studebaker Comm. 10A ('40)	VRP-4004A	GEA-4803A	Pos.
Vibrating Voltage Regulator			
Hudson 40, 48 (1940)	②VRR-4001A, B	GDS-4801A	Pos.
Hudson 41, 43 (1940)	②VRR-4001A	GEC-4801A	Pos.
Hudson 44, 45, 47 (1940)	②VRR-4001A	GEC-4801A	Pos.
Hupmobile R (1940)	③VRR-4009A	GDF-4804A	Pos.
Willys 440 (1940)	VRR-4004A	GCJ-4811A	Neg.

①—VRB-4012B-1 used on first cars. ③—VRD-4009A used on first cars.
②—VRD-4008B used on first cars.

PRODUCTION CHANGE NOTE:—VRB & VRD Regulators—When these types used on early 1940 cars, refer to Auto-Lite Regulator article in 1939 Supplement in Electrical Equipment Section of manual for specifications.

GROUND TERMINAL NOTE:—Each type regulator designed for use with particular battery terminal grounded as noted in table above. When installing regulator, see that correct battery terminal grounded and repolarize generator (after all connections made) as follows:

Polarizing Generator—Connect jumper wire momentarily from starting switch battery connection to generator 'A' terminal (after all connections have been made). This momentary surge of current through generator windings will polarize generator for correct operation.

TYPE:—These regulators similar to previous 'VRB' and 'VRD' types except as follows:

Cutout Relay—New type armature with contact mounted on spring so that armature seals against yoke after contacts close. Designed to produce wiping action of contacts.

Armature Springs (all units)—Two different type springs used. Springs on Cutout Relay and Current Regulator units have 12¾ coils while spring on Voltage Regulator unit has 14½ coils. CAUTION—Springs must not be interchanged. Make certain that correct spring used on each unit.

VRP Current Regulator Windings—Two windings used (see illustration).

CHECKING & ADJUSTMENT:—Check each unit as directed below. See that correct armature spring installed (see note above), check resistors for correct value and location, and check and adjust all gaps before making adjustments to change regulator performance. After making adjustments, always make final 'flash' test (see instructions below) and polarize generator when generator and regulator replaced on car (see Ground Terminal Note above).

CUTOUT RELAY

Model	Voltage Winding Resistance	Contact Gap	Air Gap
All 'VRP' Types	29.8-33.0 ohms	.015" Min.	.034-.038"
All 'VRR' Types	29.8-33.0 ohms	.015" Min.	.034-.038"

Winding Resistance—Use ohmeter (ST-384) to measure resistance directly, measure from regulator 'A' terminal to ground with voltage regulator lead disconnected from cutout relay yoke.

Air Gap—Use flat gauge (ST-281-3) to measure between magnet core and armature at point as close to armature hinge as possible with contacts open. Adjust by bending armature stop making certain that stop does not rub against side of armature. NOTE—Armature 'seals' against yoke after contacts close

Contact Gap—Check with feeler gauge. Gap must not be less than .015" but may exceed this figure in service. With correct adjustment, contacts will close and armature will then 'seal' against yoke. CAUTION—If contact gap too large, contacts will not close before armature seals against yoke (armature must have further travel to effect this sealing).

Model	Contacts Close	Contacts Open
All 'VRP' Types	6.4-6.6 volts	4.8-5.6 volts①
All 'VRR' Types	6.4-7.0 volts	6.0 Amperes Max.

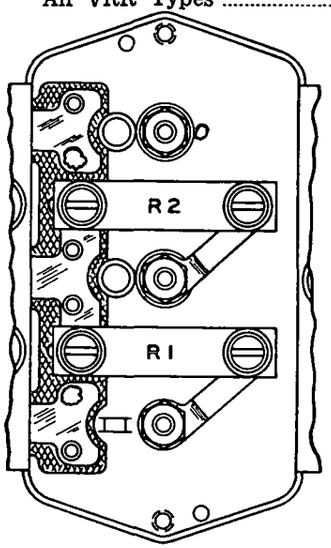
①—Discharge current will be approximately 7-8 amperes.

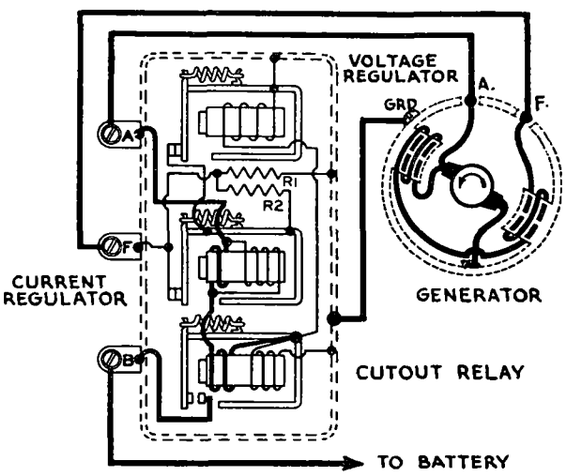
Closing Voltage—Connect ammeter in charging line at regulator 'B' terminal, connect voltmeter between 'A' terminal and ground. Operate generator and increase speed slowly until contacts just close **but without sealing against yoke,** note voltmeter reading at this point (NOTE—a 2000 ohm earphone connected between 'B' terminal and ground may be used to check closing, a click will be heard as the contacts close). To adjust, use tool ST-283 and adjust armature spring tension by bending lower spring hanger. Increase spring tension to increase closing voltage, lower spring tension to decrease voltage. CAUTION—Closing voltage must always be set .5 volts less than Voltage Regulator setting (contacts will not close if closing voltage higher than regulator setting).

Opening Voltage or Amperage—Connect meters as for Closing Voltage Check (above), decrease generator speed slowly and note voltmeter (or ammeter) reading as contacts open. Adjust by changing contact gap (see above).

VOLTAGE REGULATOR

Model	Winding Resistance	Contact Gap	Air Gap
All 'VRP' Types	10.8-12.0 ohms	.012" Min.	.048-.052"
All 'VRR' Types	10.8-12.0 ohms	.012" Min.	.048-.052"





Winding Resistance—Use Ohmeter (ST-284) to measure resistance directly. Measure between lead (disconnect lead from cutout relay yoke) and ground.

Air Gap—Use pin gauge ST-281-7 and measure at point next to stop pin on contact side with contacts just opening. Test air gap by connecting test lamp and battery between 'F' terminal and ground. Insert low limit pin gauge, depress armature by hand, lamp should dim or go out. Repeat test with high limit pin gauge. Lamp should remain lighted. To adjust air gap, loosen screw holding upper contact bracket, use tool ST-282 to raise bracket (to increase gap), tap top of bracket to lower contact (to decrease gap), tighten screw. See that contact spring is straight and parallel with armature.

Contact Gap—Check gap with feeler gauge while holding armature down against stop pin (CAUTION—do not press on contact spring, press down on armature evenly on both sides of spring). Gap may vary in service, if gap variation too great stop pin is wrong length and unit should be replaced.

Model	Voltage Setting	Setting Table
VRP-4001A,B,C,D,E; 2A,B; 3A; 4A,B,C,D,E; 5A,B,C,D		No. 1
VRP-4006A, AP,B,C,D,E,F; 7A,B; 9A,B,C,D		No. 1
VRP-4008A, B		No. 2
VRR-4001A, B		No. 2
VRR-4002A, 2B, 3A, 4A, 5A		No. 1

Table No. 1

Temperature	①Volts
50° F.	7.51
60°	7.48
70°	7.45
80°	7.42
90°	7.39
100°	7.37
110	7.34

Table No. 2

Temperature	①Volts
50° F.	7.63
60°	7.56
70°	7.50
80°	7.43
90°	7.38
100°	7.31
110°	7.24

①—Allowable variations in these voltage settings is ± .15 volt.

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Voltage Setting Check—Connect ammeter in charging line at regulator 'B' terminal (ammeter must read to 1 ampere and internal resistance must not exceed .01 ohm, use short heavy leads for connections), connect voltmeter between regulator 'B' terminal and ground (meter must read to .1 volt). Make certain that car battery is fully charged with gravity reading of 1.275-1.280 (substitute fully charged battery if car battery run down). Run engine at speed equivalent to 30 MPH for at least 15 minutes with generator charging battery to bring regulator up to operating temperature. Then note voltmeter reading which should agree with table above. NOTE—Single earphone of 2000 ohm or greater resistance connected between 'F' terminal and ground is recommended in checking regulator operation.

Adjustment—Use tool ST-283 to vary armature spring tension by bending arm at lower end of spring. Increase spring tension to increase voltage, decrease tension to decrease voltage. Replace cover and recheck performance.

CURRENT REGULATOR

NOTE—Data below applies to 'VRP' types only with separate Current Regulator. Disregard this data for 'VRR' Regulators used with third brush generators.

Model	Contact Gap	Air Gap
All 'VRP' Types	.012" Min.	.034-.038"

Air Gap—Use pin gauge ST-281-6 to check gap, tool ST-282 to adjust gap. Check and adjust in same manner as Voltage Regulator (see above).

Contact Gap—Check in same manner as Voltage Regulator (above).

Model	Current Setting	Max. Amperes
VRP-4001A, 2A, 3A, 4A, 5A, 8B		34-36
VRP-4001B, 4C, 5B, 6E, 7A		31-33
VRP-4001C, 2B, 4D, 5D, 6C, 9B		27-29
VRP-4001D, 4B, 6A, 6AP, 9A		29-31
VRP-4001E, 5C, 6B		24-26
VRP-4004E, 6F, 7B, 8A, 9C		39-41
VRP-4006D, 9D		19-21

Current Setting Check—Connect test meters and heat regulator as directed for Voltage Regulator Check (above). Then connect load in excess of rated capacity of regulator at point between regulator and battery (use bank of headlamp bulbs, or turn on all lights and accessories). Note ammeter reading with Current Regulator operating. Generator output must be within 5% of rated capacity stamped on regulator cover as shown in table above.

Adjustment—Same as Voltage Regulator (above). Use ST-283 tool.

FINAL 'FLASH' TEST:—After adjusting Cutout Relay, Voltage Regulator, or Current Regulator, final flash test should be made after regulator cover replaced, by operating generator and noting regulator performance immediately.

REGULATOR RESISTORS:—One resistance unit used on 'VRR' regulators, two used on 'VRP' models (see VRP illustration for resistor locations). Resistors should be checked for correct resistance by testing with ohmeter (ST-284). CAUTION—Remove one resistor at a time to avoid interchanging units. Use extreme care to replace resistors in exact original location.

Voltage-Current Regulator Resistors

Model	Mark — R1 — Ohms		Mark — R2 — Ohms	
VRP-4001A, 2A, 3A, 4A, 5A, 8B	38	36-40	7	6.5-7.5
VRP-4001B, 1D, 1E, 4B, 4C, 4E	60	57-63	11	10-12
VRP-4001C, 2B, 4D, 5D, 6C, 9B	30	28-32	7	6.5-7.5
VRP-4005B, 5C, 6A, 6AP, 6B, 6E	60	57-63	11	10-12
VRP-4006F, 7A, 7B, 8A, 9A, 9C, 9D	60	57-63	11	10-12

Voltage Regulator Resistors

Model	Mark	Ohms
VRR-4001A, 2A	30	28-32
VRR-4001B, 2B, 3A, 4A, 5A	20	19-21

TROUBLE SHOOTING:—Same as for previous VRB and VRD types. See Auto-Lite Regulator article in Electrical Equipment Section of manual (or 1938 Supplement) for data.

1940 FORD REGULATOR

Std. Equipment On:	Regulator	Generator
Ford '60' & '85' Pass. Cars & Comm'l. ('40)	**01A-10505A**	**01A-10000**
Ford Trucks, All except C-O-E (1940)	**01A-10505A**	**01A-10000**
Ford Trucks, Cab-over-Engine Models ('40)	**01A-10505A**	**81T-10000A, B**
Lincoln-Zephyr, 06H (1940)	**01A-10505A3**	**01A-10000**
Mercury, Model 09A (1940)	**01A-10505A**	**01A-10000**

These Regulators same design as used on 1939 cars with 2-brush generators.

SERVICE NOTE:—Regulator covers are sealed and should not be removed. No adjustments are possible and units which are defective as determined by tests given below should be replaced.

Bench Test Caution—Ford Generator and Regulator circuits and wiring not same as units used on other cars and these units must always be tested together. Do not operate generator or regulator with regulator or generator of other make on test sets.

REGULATOR TESTING:—Make all tests exactly as given below.

CUTOUT RELAY

Contact Closing Voltage—Use 15 voltmeter connected across relay contacts (connect one lead to regulator 'B' terminal, other lead to regulator 'G' terminal). With contacts open, voltmeter will read full battery voltage. Operate engine and slowly increase speed until contacts close (voltmeter will drop to zero and then reverse). Engine speed should be 400 RPM. (01A-10000 Gen.), 550 RPM. (81T-10000A), 350 RPM. (81T-10000B).

Contact Resistance—With voltmeter connections as above, turn on headlamps and increase engine speed so that charging rate is maximum. Voltmeter reading should not exceed ¼ volt (voltage drop across relay contacts). If voltmeter reads above ½ volt, contacts are burnt and cutout relay should be replaced. NOTE—This reading will be in reverse from closing voltage test above and voltmeter leads should be exchanged so that pointer will move in proper direction on scale.

Contact Opening Reverse Current—Connect ammeter in charging line at regulator 'B' terminal. Operate generator and increase speed until contacts close. Then slowly decrease speed and note reverse reading at instant contacts open. Current varies with temperature and must not exceed following maximum figures (replace regulator if current is excessive): 5.5 amperes—60°, 4.7—80°, 4.0—100°, 3.5—120°, 2.8—140°, 2.2—160°, 1.7—180°.

VOLTAGE & CURRENT REGULATOR

IMPORTANT NOTE—Regulator should be tested with resistance of ¾ ohm (two 32 cp. headlamp bulbs) in generator circuit instead of battery to eliminate differences caused by battery being more or less charged. Regulator temperature should be carefully gauged with thermometer in contact with regulator case (performance varies with temperature).

Voltage Setting Test—See Note below for Ford Test Set connections. If test set not used, disconnect lead at regulator 'B' terminal, connect two 32 cp. headlamp bulbs in series between this terminal and ground (so generator output flows through both bulbs in series), connect voltmeter between 'B' terminal and ground. Operate generator at speed of 900 engine RPM. and note voltmeter reading. If voltage is within range given in table below, regulator is OK. If voltage is below minimum or above maximum figure, replace regulator.

Ford Test Set Connections—Disconnect high and low beam headlamp wires under hood, connect negative test set high tension lead to headlamp side of these wires. Ground positive low tension lead to engine, plug in 15 voltmeter, connect both negative low tension lead and positive interrupter lead to regulator 'B' terminal (disconnect regular lead from this terminal). If headlamp bulbs do not light up, close interrupter contacts. Test regulator as directed above and note readings on test set 'B' scale. Replace regulator if readings not within minimum-maximum figures in table below.

Ford Test Set 'B' Scale		Voltage Setting	Equivalent Volts	
Maximum	Minimum	Temperature	Maximum	Minimum
51	48	60°	7.65	7.20
50	47¼	80°	7.50	7.0875
49½	46¾	100°	7.425	7.0125
49	46¼	120°	7.35	6.9375
48¾	45¾	140°	7.3125	6.8625
48¼	45½	160°	7.2375	6.825
48¼	45½	180°	7.2375	6.825

Current Setting Test—Use 'BRS' test set attachment to discharge battery until voltage drops to 5¾ volts. Connect ammeter in charging line at regulator 'B' terminal. Operate engine at speed at which maximum output produced (see car model 'T&E' pages for generator data) and note ammeter reading. If output exceeds following maximum, regulator should be replaced: 32 amperes (01A-10000 Generator), 28 amperes (81T-10000A Generator), 20 amperes (81T-10000B Generator).

SERVICING:—No adjustment possible. Replace defective regulators.

These regulators standard or optional euqipment on following car models:

Car Model	Regulator	Generator	Ground Ter.
Vibrating Voltage Regulator			
Graham 107, 8, 9 ('40)	1118204	1100007	Pos.
Vibrating Voltage & Current Regulator			
Buick 40, 50 (1940)	1118201	1102661, 2	Neg.
Buick 60, 70, 80 (1940)	1118201	1102668	Neg.
Buick 90 (1940)	1118201	1102669	Neg.
Buick All—City Police ('40)	1118229	1106404	Neg.
Buick All—State Police ('40)	1118237	1105852	Neg.
Cadillac 60S,62,72,75 (1940)	1118202	1102661	Pos.
Cadillac 90 V16 (1940)	1118202	1102666	Pos.
Chevrolet—all (1940)	1118201	1102667	Neg.
Chevrolet City Police & U.S. ('40)	1118229	1106403	Neg.
	1118232	1106403	Pos.
Chevrolet State Police (1940)	1118237	1105851	Neg.
①Dodge City Police (1940)	1118232	1106403	Pos.
①Dodge State Police (1940)	1118238	1105851	Pos.
①Ford & Mercury City Police ('40)	1118232	1106405	Pos.
①Ford & Mercury State Police ('40)	1118238	1105853	Pos.
LaSalle 50, 52 (1940)	1118202	1102661	Pos.
Oldsmobile—all (1940)	1118201	1102664	Neg.
Oldsmobile City Police (1940)	1118229	1106403	Neg.
Oldsmobile State Police (1940)	1118237	1105851	Neg.
①Plymouth City Police (1940)	1118232	1106403	Pos.
①Plymouth State Police (1940)	1118238	1105851	Pos.
Pontiac—all (1940)	1118201	1102665	Neg.
Pontiac City Police (1940)	1118229	1106403	Neg.
Pontiac State Police (1940)	1118237	1105851	Neg.
Studebaker Pres. 6C (1940)	1118202	1102671	Pos.

①—Accessory Equipment.

IMPORTANT SERVICE NOTE:—For High Charging Rate and High Voltage complaints, always check generator for grounded field coils or grounded leads before changing regulator settings. To check, disconnect lead from regulator 'F' terminal with generator operating. If output drops off, trouble is in regulator. If output does not drop off, trouble is in generator and generator should be inspected for grounded field coils or leads.

Open Circuit Caution—Generator must never be operated on open circuit which will damage Generator or Regulator and cause burnt generator windings or regulator windings, burnt field resistance, or fused contacts. If these conditions found in service, check wiring circuits for open circuits or high resistance and correct before re-installing generator or regulator.

Regulator Seals—Regulator covers are sealed to indicate they are adjusted to original factory specifications. Warranty is void if unit is damaged by improper servicing (adjustments may be made by competent operators).

GROUND TERMINAL NOTE:—Each regulator designed to be used on cars with a particular battery terminal grounded as shown in table above. When installing regulator, make certain that correct battery terminal is grounded and always repolarize generator whenever generator or regulator has been disconnected. Reversed polarity will cause Cutout Relay contacts to vibrate and burn.

Polarizing Generator—After generator and regulator connected, connect jumper lead between regulator 'BAT' and 'GEN' terminals momentarily. This will allow momentary flow of current through generator windings and cause generator to assume correct polarity for operation on car.

IMPORTANT PRODUCTION CHANGE:—Voltage Regulator Armature Springs—First units fitted with one light spring and one heavy spring, later units have two springs of equal weight (same as Current Regulator). When adjusting regulator, light spring (or one spring only if both alike) should normally be adjusted. Heavy spring (or other spring if both alike) should only be adjusted if satisfactory performance cannot be secured otherwise (see Adjustment directions below).

TYPE:—These new "Single Core Regulators" differ in design from previous Regulators Without IGN Terminal as follows:

Windings—All windings for each unit (Cutout Relay, Voltage Regulator, Current Regulator) are wound on a single core.

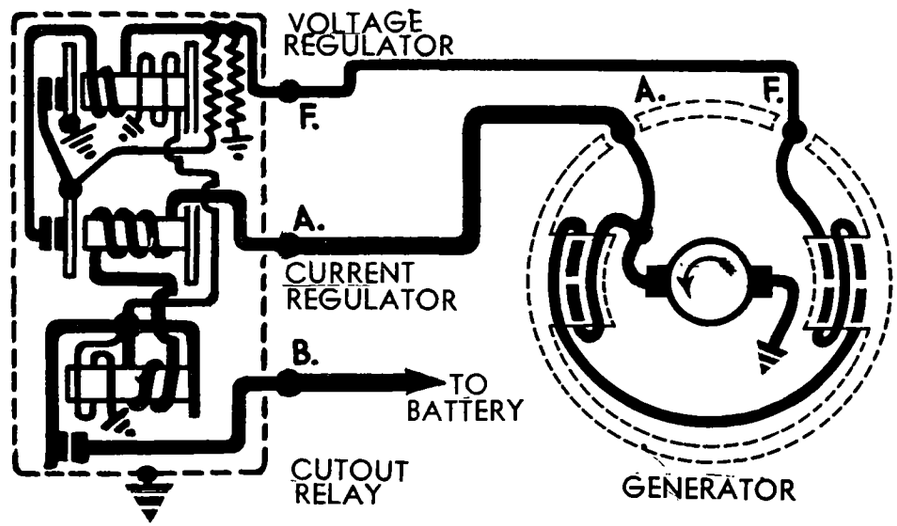
Cutout Relay—Has double contacts. Both sets of contacts must be set so as to open and close together.

Regulator Armature Springs—Two armature springs used (both springs same weight on Current Regulator, one light and one heavy spring on Voltage Regulator). Adjustments normally made on one spring only (light spring on Voltage Regulator). Special directions required for adjustment of both springs (required when unit badly out of adjustment or new springs installed).

Regulator Contacts—Lower movable contact mounted directly on upper surface of armature (spring type mounting not used).

CHECKING REGULATOR & GENERATOR PERFORMANCE:—To quickly locate trouble on the car, make the following tests before removing the generator or regulator for further testing and adjustment on the bench. Check battery condition with hydrometer, note whether battery low (discharged) or high (fully charged), operate engine and note charging rate as follows:

Fully Charged Battery & Low Charging Rate—This indicates that Voltage Regulator is operating normally. To check Current Regulator operation, connect test ammeter in charging line at regulator 'BAT' terminal, use starter motor to crank engine for about 15 seconds (disconnect high tension lead to prevent engine starting) to bring battery down, then run engine at medium speed, turn on all lights and accessories to start Current Regulator operating and not ammeter reading which should agree with current regulator setting (see table below). As soon as generator replaces current used in starting, charging rate should taper off to original low rate.



Fully Charged Battery & High Charging Rate—Check battery temperature (charging rate will be higher with hot battery). If charging rate excessive, operate generator at medium speed with ammeter in charging line at regulator 'BAT' terminal and note ammeter reading as follows: Disconnect lead from regulator 'F' terminal. This opens field circuit and generator output should drop off (indicating that trouble is in regulator). If output does not drop off, disconnect this lead at generator 'F' terminal. If this causes output to drop off, this lead is grounded in harness and should be replaced. If output does not drop off, check generator for grounded field leads or windings. If trouble is located in regulator, reconnect field lead at regulator 'F' terminal, remove regulator cover, depress voltage regulator armature so as to open regulator contacts manually. If output drops off, regulator has not been functioning correctly and should be adjusted. If output does not drop off, check field circuit within regulator for shorts or grounds, see that all insulators in place and that both voltage and current regulator contact support bushings and insulators are properly installed (see Servicing data below).

Discharged Battery & Low Charging Rate or No Output—Check entire charging circuit for loose connections, damaged or broken wires, and short-circuits. If entire charging circuit in good condition and no high resistance in circuit, ground regulator 'F' terminal and operate generator, increase speed slowly and note generator output (CAUTION—Do not operate generator at excessive speed —generator is operated with no regulation when 'F' terminal is grounded and output may cause generator to burn out if speed increased excessively). If output increases with speed, regulator is defective and should be checked for incorrect setting or dirty or burnt contacts. If output does not increase beyond a few amperes, check generator for grounded or open field coils, dirty or burnt commutator, defective armature or brushes. If no output is noted, quickly disconnect lead from regulator 'GEN' terminal and flash this lead to ground. If no spark is noted, generator is defective. If spark occurs, check Cutout Relay

CONTINUED ON NEXT PAGE

CONTINUED FROM PRECEDING PAGE

for contacts not closing (burnt contacts, open shunt winding, high voltage setting, or grounds).

CAUTION—Do not operate generator more than momentarily with lead disconnected from regulator 'GEN' terminal. This is open-circuit operation and will cause damage to generator or regulator if continued more than momentarily.

ADJUSTMENT:—Check all specifications for each unit first and adjust each unit as follows:

CUTOUT RELAY

Model	Cut-in Setting Volts (Hot)	Cut-out Setting Disch. Amperes	Contact Gap	Air Gap
1118201 to 8	6.2-6.7	0-4.0	.020"	.020"
1118209, 10	12.4-13.4	0-4.0	.020"	.020"
1118211, 12, 13	6.2-6.7	0-4.0	.020"	.020"
1118214	12.4-13.4	0-4.0	.020"	.020"
1118215, 16	6.2-6.7	0-4.0	.020"	.020"
1118217 to 20	12.4-13.4	0-4.0	.020"	.020"
1118221, 22, 23	6.2-6.7	0-4.0	.020"	.020"
1118224	6.3-6.9	0-4.0	.020"	.020"
1118225	12.4-13.4	0-4.0	.020"	.020"
1118226	6.2-6.7	0-4.0	.020"	.020"
1118227, 28	12.4-13.4	0-4.0	.020"	.020"
1118229 to 34	6.2-6.7	0-4.0	.020"	.020"
1118235	12.4-13.4	0-4.0	.020"	.020"
1118236, 37, 38	6.2-6.7	0-4.0	.020"	.020"

Cut-in Setting Note—Should be checked with unit HOT (at operating temperature).

Contact Gap—Adjust by bending upper armature stop (see Air Gap adjustment). Both contacts must have same gap so as to open and close together.

Air Gap—Check with armature pressed down so contacts just close. If both sets of contacts do not close simultaneously, bend spring fingers until they do. To adjust air gap, loosen two screws on hinge bracket at back of relay, raise or lower armature and hinge assembly.

Cut-in Voltage & Cut-out Amperage—To check, connect ammeter in charging line at regulator 'BAT' terminal, voltmeter between 'GEN' terminal and ground. Operate generator and gradually increase speed until relay contacts close, note voltmeter reading. Decrease speed slowly and note reverse current reading on ammeter when contacts open. To adjust closing voltage, bend spring post down (to decrease voltage), up (to increase voltage).

VOLTAGE REGULATOR

Model	Voltage Setting Volts (Hot)	Model	Volts (Hot)
1118201 to 6	7.2-7.4	1118221, 22, 23	7.0-7.2
1118207, 8	7.0-7.2	1118224	7.4-7.6
1118209, 10	14.0-14.2	1118225, 27, 28	14.0-14.2
1118211, 12	7.0-7.2	1118226, 29, 30	7.0-7.2
1118213	7.2-7.4	1118231	7.2-7.4
1118214	14.0-14.2	1118232, 33, 34	7.0-7.2
1118215, 16	7.0-7.2	1118235	14.0-14.2
1118217 to 20	14.0-14.2	1118236, 37, 38	7.0-7.2

Important Note—Regulator over-compensated for temperature and must be checked only when hot and with cover in place (setting higher when cold).

Checking Voltage Setting—Connect ammeter and variable resistance of 'AVR' set in charging line at regular 'BAT' terminal, or disconnect charging line and ground the 'BAT' terminal through ¾ ohm fixed resistance (6 volt units), 1½ ohm fixed resistance (12 volt units). Resistance must be capable of carrying 10 amperes and must not change in value during temperature changes. Connect voltmeter between 'BAT' terminal and ground. Operate generator and increase speed to point where rated output normally produced (see car model 'T&E' page for generator data), adjust variable resistance of 'AVR' set so that charging current is 8-10 amperes (not required if fixed resistance method used). When regulator reaches operating temperature (150° or very hot to the touch) with regulator cover in place, cycle generator by decreasing speed to point where relay contacts open, then increase speed to original figure and note voltmeter reading. Adjust regulator if voltage does not agree with figure in table above.

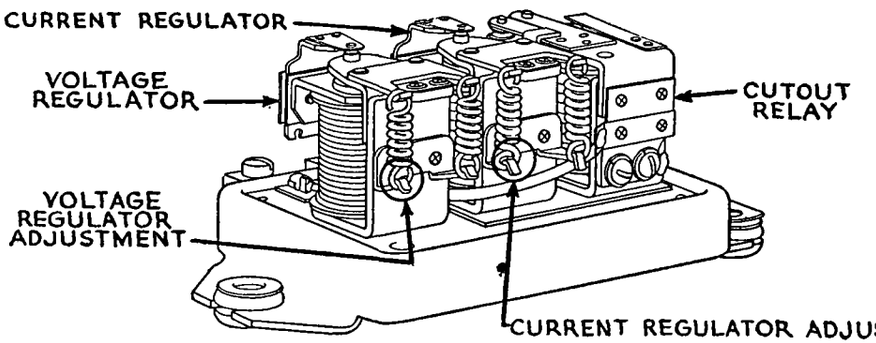
CAUTION—Do not change setting to correct High Voltage without first checking generator for grounded fields—see 'Important Service Note' above.

Adjustment—Bend spring hanger at lower end of **light (left spring) or one spring only (on later units where both springs alike)** down to increase tension and raise voltage setting, or up to decrease tension and lower voltage setting. If correct adjustment cannot be secured on light spring (or one spring) or if new springs are being installed, adjust second spring as follows:

Heavy Spring (or Second Spring) Adjustment—Disconnect light spring (or one spring if both alike), connect voltmeter between regulator 'GEN' terminal and ground. Open regulator contacts by hand (press down on regulator armature), operate generator and increase speed slowly until voltmeter reading is 3 volts (6 volt units), 6 volts (12 volt units). Release armature, adjust spring tension by bending lower spring hanger up or down until voltage is 4.5-5.0 volts (6 volt units), 8.5-9.0 volts (12 volt units). Connect light spring (or second spring if both alike), adjust this spring as directed above.

Air Gap—.070" (supersedes gap of .075" originally specified for these units).

Air Gap Adjustment—To check, press armature down and allow it to come back until contacts just close, measure air gap at center of core with armature in this position. To adjust, loosen two screws on upper contact support bracket, move bracket up or down being careful to keep contacts lined up.



CURRENT REGULATOR

NOTE—Data below applies only to 3 unit Regulators (with separate Current Regulator Unit). Disregard this current regulator data when adjusting 2 unit Regulators (no Current Regulator) used with third-brush generators.

Model	Current Setting Amperes	Model	Amperes
1118201, 2	32-34	1118222, 23	34-36
1118207, 8	28-30	1118224	12.5-13.5
1118209, 10	16-18	1118225	14-16
1118211, 12	38-40	1118226, 29	34-36
1118214	24-26	1118230	26-28
1118215, 16	22-24	1118232	34-36
1118217	19-21	1118233, 34	24-26
1118218	7-9	1118235	9-11
1118219	24-26	1118236	26-28
1118220	12-13	1118237, 38	38-40
1118221	26-28		

Important Note—On units with steel armature spring hinges, regulators are over-compensated for temperature and must be checked only when hot (have higher setting when cold). Units with bronze armature spring hinges operate at same value both cold and hot.

Checking Current Setting—Remove regulator cover and connect short jumper from voltage regulator frame to upper contact support bracket (this will short out voltage regulator while current regulator being checked). Connect ammeter in charging circuit at regulator 'BAT' terminal. Turn on lights, radio and other accessories (to provide load which will bring current regulator into operation), operate generator and increase speed until output remains stationary. With regulator at operating temperature (150° or very hot to the touch) and cover in place, ammeter reading should agree with setting given above.

CAUTION—Do not change setting to correct High Charging Rate without checking generator first for grounded fields—See "Important Service Note" above.

Adjustment—Bend spring hanger at lower end of **one spring only** down to increase tension and increase current setting, up to decrease tension and decrease current setting. If adjustment cannot be secured on one spring, or new springs are installed, proceed as follows:

Spring Adjustment—With one spring disconnected, operate generator at medium speed, adjust hanger at lower end of spring until output is regulated at approximately half rated output (17 amperes on 1118201,2). Then connect second spring and adjust this spring as directed above (do not touch first spring when making this final adjustment).

Air Gap—.075" (supersedes gap of .080" originally specified for these units).

Air Gap Adjustment—Same as for Voltage Regulator (above).

DESCRIPTION:—These magnetos are manufactured by the Scintilla Magneto Company and embody the rotating magnet and stationary coil and breaker as found in Scintilla Magnetos. They are designed for automotive, marine and stationary engine installation. Magnetos are completely enclosed for protection in service (ventilation is provided for by wire gauze covered ventilating windows) and housings can be removed for inspection and adjustment without special tools. Magnet shaft and distributor rotor are mounted on ball bearings which are packed with grease at overhaul periods and require no lubrication in service. Breaker contacts are easily adjusted with a screwdriver and entire breaker assembly is quickly removable by releasing a spring catch. All connections are made by means of bronze leaf springs.

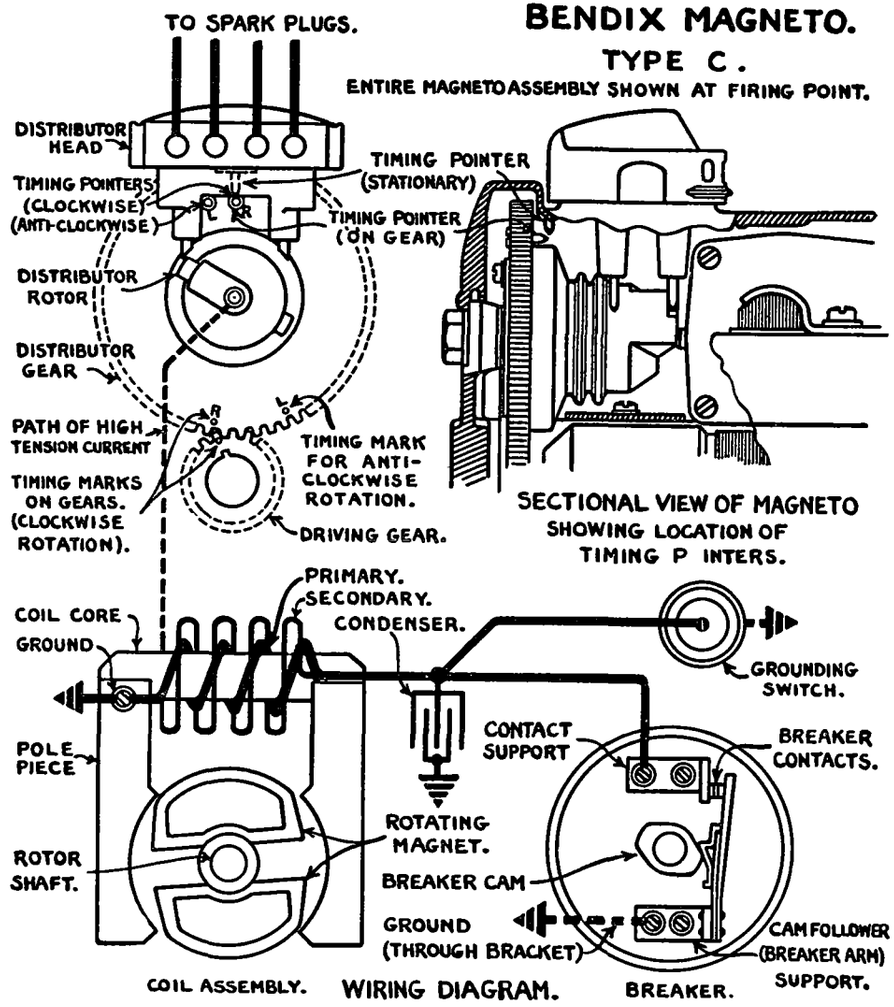
INSTALLING MAGNETO:—Adjustment of Timing Range Scale. Spark advance range of magneto must be set for the particular engine on which magneto is installed. Advance range is adjustable up to 45° for rotation in either direction by means of the Timing Range Scale mounted on the back of the breaker housing (see illustration 3). When the figure '45°' in the center of the scale is opposite the arrow on the housing, the magneto is set for 45° maximum advance with rotation in either direction. To set advance range, loosen the two screws 'A' on the scale and shift the scale itself to the correct position. On magnetos for clockwise rotation (drive end) shift the scale to the left over the range marked 'L' to decrease the spark advance range (each division on the scale is 15°). On magnetos for counter-clockwise rotation (drive end), shift the scale to the right over the 'R' portion of the dial to decrease the timing range. Timing range must be set in accordance with engine manufacturers' specifications. On magnetos driven at 1½ times engine speed the setting as indicated on the Timing Range Scale should be 1½ times the desired range as measured on the engine crankshaft.

TIMING:—Timing Magneto to Engine—when crankshaft setting for full advance is known. Turn engine to correct firing position for No. 1 piston with spark advanced. Advance magneto spark control lever, take off distributor head, disengage impulse coupling when used. Turn magneto drive shaft until timing pointer on face of large distributor gear lines up with timing pointer inside magneto main cover (at top of magneto—see illustration). Couple magneto to engine (see paragraph on adjustable drive member).

When Advance Firing Point is Not Marked. Set Timing Range Scale to correspond with the specified maximum advance for the engine (where magneto is driven at 1½ times crankshaft speed, Timing Range Scale setting must be 1½ times specified advance). Turn engine to top dead center firing position for piston No. 1. Retard magneto spark advance lever and time magneto to engine by turning magneto drive shaft until breaker contacts begin to open (slightly after position when timing pointer on large distributor gear lines up with timing pointer on magneto frame).

Fixed Spark Ignition when Advance Point is not Marked. Set Timing Range Scale to amount of fixed spark advance before top dead center desired. Time magneto to engine with spark advance lever retarded and piston No. 1 at top dead center as directed in paragraph above. After timing has been completed, remove contact breaker from magneto, reset Timing Range Scale at '0' for correct rotation, replace breaker on magneto. This will provide Fixed Spark Ignition with the setting at the correct point before top dead center.

Adjustable Drive Member. An adjustable drive member is designed to be mounted on the engine drive shaft. This drives the magneto through two dogs on its outer face which engage with a flexible fabric center disc which in turn engages two dogs on the magneto coupling member. The adjustable drive member should be set when the magneto is timed to the engine initially. The drive member consists of an inner hub keyed to the drive shaft with worm teeth on its outer circumference. These teeth engage with the adjusting screw in the outer or dog plate member. The screw also clamps the entire drive member together after the setting has been made. With the magneto shaft turned to the firing position and the engine crank-



shaft turned to firiing position for piston No. 1, center the central disc of the coupling on the magneto shaft coupling member, then with the cotter removed and castellated nut on the adjusting screw loosened, turn the adjusting screw in until it has turned the dogs on the drive coupling into position so that they are centered on the slots of the central disc. When adjustment has been completed clamp the dog plate securely in position by tightening the castellated nut on the adjustment screw and replacing the cotter pin. In making the adjustment the screw should always be turned clockwise or in, as reversing the direction will only back the screw out of the dog plate.

Impulse Couplings. Heavy duty Bendix Impulse Couplings have been developed for installation on these magnetos. As usually installed, the couplings are automatic; that is, the impulse coupling automatically engages whenever the engine is cranked and is automatically disengaged at the throw-out speed. Impulse couplings may be manually engaged and disengaged with engine running or stopped by means of buttons on top of the coupling. The center button marked 'ON' should be depressed to engage the coupling. The other button marked 'OFF' should be pressed to disengage the coupling. The 'ON' button should not be pressed with the magneto operating at high speeds. Impulse couplings must always be disengaged when the magneto is being timed to the engine. Impulse couplings are lubricated when installed and require no attention in service. The felt washer between the coupling housing and dust cover is saturated with graphite grease and should be given a drop of oil occasionally.

SERVICING:—Inspection of Contacts. At intervals of 500 hours or 10,000 miles of operation, remove breaker cover and see that lubricating felt attached to cam follower is saturated with oil. This felt oils the breaker cam surface and should be given one or two drops of medium oil if necessary. Check contact setting by cranking engine to firing position of piston No. 1, advance magneto spark control lever, see that timing pointer on large distributor gear lines up with pointer on housing main cover, check contacts, which should begin to open at this point. If contacts are not opening, loosen two mounting screws on contact support block, shift block to one side or the other until contacts begin to open. There is a slot in the breaker housing on each side of the support block which serves as a purchase point for the screwdriver in shifting the support. A very slight movement should be sufficient to adjust contacts. Tighten mounting screws after completing adjustment. It is not usually necessary to check contact gap but this should be approximately .018" maximum.

Alignment of Breaker Contacts. Movable contact can be adjusted vertically and horizontally to properly align contact with stationary contact. Horizontal adjustment is made by inserting a shim of correct thickness under the cam follower support. This is necessary only when new contacts are installed and should be done by a Scintilla Service Station. Vertical adjustment of the cam follower is made by shifting the cam follower support slightly. The hole in the support for the mounting screw '2' is slightly elongated, permitting this adjustment. To adjust, loosen the two mounting screws slightly, move the contact support up or down, as necessary, to align contacts, tighten mounting screws, recheck alignment.

LUBRICATION:—At intervals of 1,500 hours, or 30,000 miles of operation, the magneto should be disassembled and inspected for wear. The ball bearings of the rotating magnet or drive shaft should be washed with gasoline and repacked with No. 44 Keystone grease or equivalent. Grease should also be applied to teeth of the distributor gear.

At 3,000 hour or 60,00 mile intervals the large distributor gear and distributor should be removed and disassembled, the bearings washed in gasoline and repacked with grease.

DESCRIPTION:—Bosch Magneto, Type AT, is of the high tension armature type. A single magnet is mounted over the armature and end plates completely enclose all working parts. Magneto can be equipped with Type IC-200 automatic impulse coupling or Type EC impulse coupling which is entirely enclosed in a water and dust-proof housing. Type G automatic advance governor can also be fitted to Type AT magneto. The Type AT-4 should be driven at crankshaft speed on four cylinder, four cycle engines and the Type AT-6 should be driven at one and one half times engine speed on six cylinder four cycles engines. Magneto must be driven in direction indicated on frame.

OILING:—Put one or two drops of light machine oil in the oiler at each end of the magneto every 500 miles. Do not oil interrupter.

BREAKER:—Breaker contacts separate .4 millimeter or 1/64 inch with interrupter arm on highest point of cam. Breaker contacts and mounting are fixed on end of armature shaft and rotate while cam and cam ring are stationary. To set contact gap, turn armature shaft until fiber bumper is on highest point of cam. Then loosen lock nut on stationary contact stud and turn contact until proper gap is secured. Tighten the lock nut. Contacts are made of platinum. Resurface contacts with worn No. 00 sandpaper or with a fine flat jeweler's file. Do not use emery cloth.

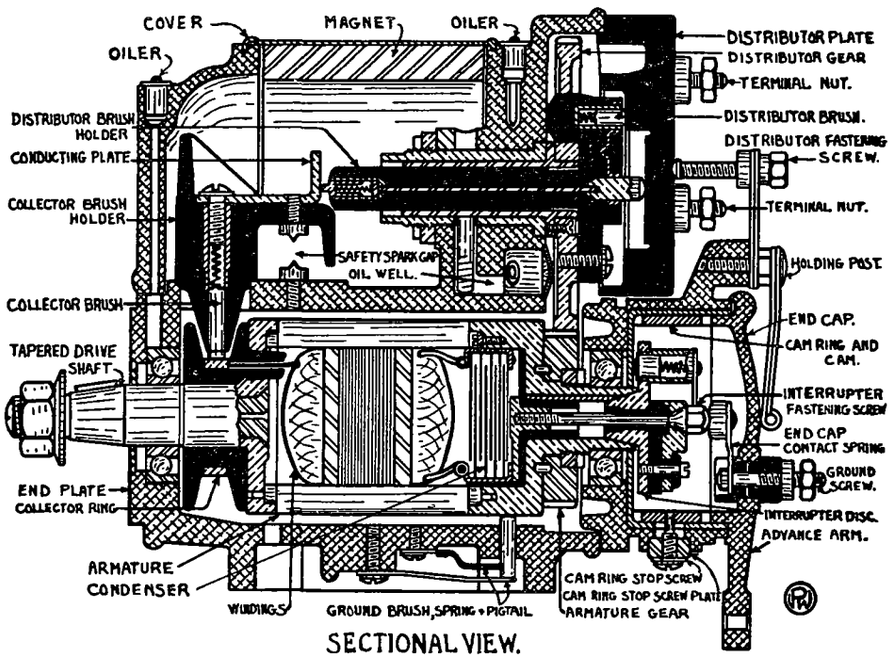
TIMING:—Crank engine until crankshaft reaches proper position for piston in No. 1 cylinder with manual advance lever fully retarded. See manufacturers' specifications as given on specific car data sheets in the National Manual. Fully retard magneto advance arm and turn magneto in direction of rotation until contacts begin to separate when the fiber bumper of the interrupter arm reaches the steel segment in the cam ring. Make certain that magneto is firmly bolted to base mounting and couple drive shaft to engine without disturbing either crankshaft or magneto armature shaft. Remove distributor cover and note position of distributor brush. Connect the segment directly over the brush to the spark plug in cylinder No. 1 and connect remaining plugs in proper firing order around the distributor plate in a direction opposite to rotation of the interrupter.

When manufacturers' specifications are not available, the engine may be timed to fire with piston on top dead center entering power stroke with full retard. Crank engine over until piston No. 1 enters compression stroke (the upstroke with both valves closed). Then continue to crank engine slowly noting dead center on flywheel or checking piston travel with a wire inserted in spark plug port until the piston reaches top dead center. Then connect magneto as directed above.

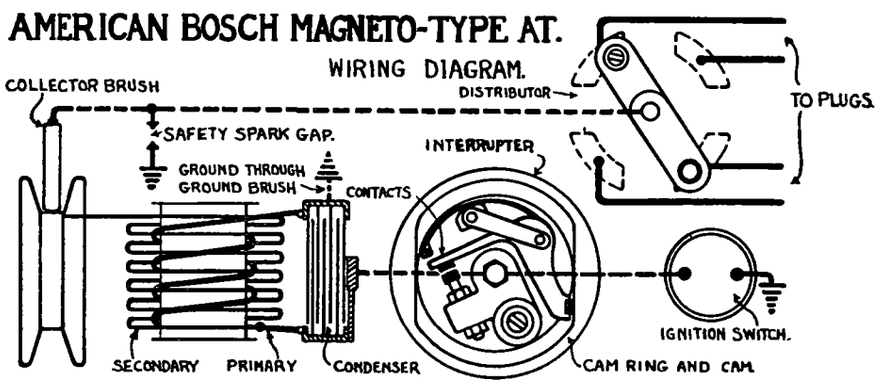
Timing Magneto with Impulse Coupling:—Turn magneto in direction of rotation until coupling is released from arrester plate. This point will be after proper firing position since impulse coupling will spin magneto over firing position. Then turn magneto backward in direction opposite to rotation until the breaker contacts open and begin to close as fiber bumper passes off steel segment in cam ring. This is the correct firing position and the magneto can then be coupled to the engine.

SPARK PLUG GAPS:—Spark plug gaps must be set at .020 or 1/50 inch. It is important that the gap be set at this figure. If spark plug gap is too wide engine will miss at low speeds and will be difficult to start. A safety spark gap is located above the armature. If spark jumps safety gap frequently check magneto and spark plugs to locate trouble.

TROUBLE SHOOTING:—Engine Misses on One Cylinder:—Check spark plugs for correct gap. Check spark plug in missing cylinder for short circuit due to fouling or cracked insulator. Check for chafed or burnt insulation on cable. Check distributor plate for dirty distributor track or segment.



SECTIONAL VIEW.



Irregular Firing on All Cylinders:—Check interrupter contacts and set gap. Resurface contacts if necessary. Tighten fastening screw in center of interrupter plate. Check ground brush under armature in base plate. Check collector brush and collector ring. Check distributor plate and wipe out with a clean rag moistened with gasoline if dirty or gummed with oil.

DESCRIPTION:—These magnetos are of the rotating field magnet, stationary coil and breaker type. The magnet assembly, consisting of five cobalt steel plate magnets, forms the rotor which is mounted on ball bearings. The stationary armature or coil assembly is mounted directly above the rotor on the upper ends of the laminated pole pieces so that the magnetic field is completed through the laminated coil core. The direction of the magnetic field is changed twice for each revolution of the rotor shaft so that the magneto produces two sparks per revolution and must be driven at 1½ times crankshaft speed on a six cylinder engine.

The breaker assembly and distributor are mounted in a tower at one end of the magneto and the vertical distributor shaft is driven by spiral gears from the rotor shaft. The primary lead from the coil to the breaker runs through the frame or housing on the distributor end of the magneto and into the distributor cup directly above the timing lever. The coil high tension current is taken from the coil through a brush in the brush holder on the drive end of the magneto and then through a flexible lead to the central tower of the distributor cap. A special waterproof cover is mounted on top of the distributor cap and all high tension cables emerge from under the lower edge of this cover. When the magneto is furnished with automatic spark advance the advance mechanism (centrifugal weight governor type) is mounted on the lower section of the distributor drive shaft in the distributor tower. These magnetos are built in three distinct types.

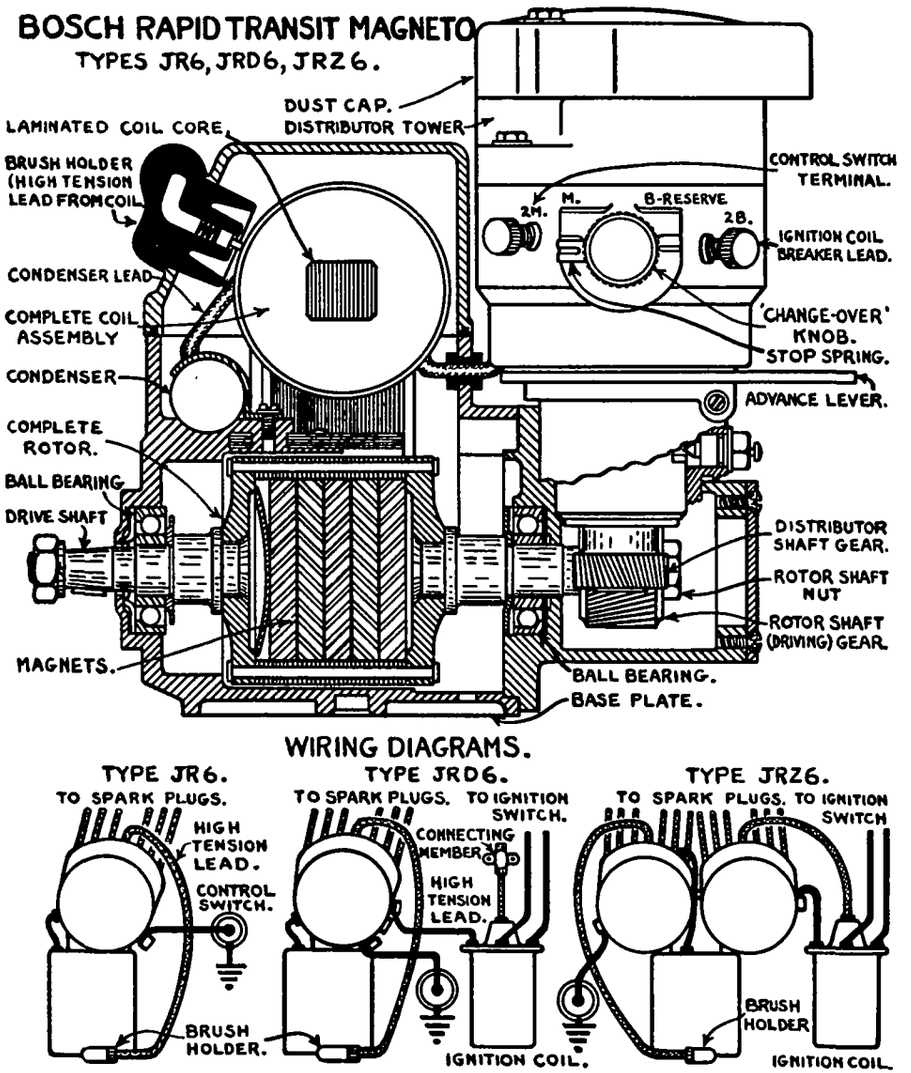
Type JR-6—Single Spark Plug Magneto Ignition. This type has a single interrupter or breaker assembly and is furnished with manual spark control.

Type JRD-6—Dual Magneto or Battery Ignition. This type has two distinct interrupter assemblies with a simple changeover device so that the second set of contacts can be used as a reserve or emergency set with an ignition coil to provide an emergency battery ignition system. Magneto and battery ignition can be used alternately but not at the same time. Magneto is fitted with automatic spark advance.

Type JRZ-6—Twin Ignition. This magneto has two distributor towers and two distinct distributor and breaker assemblies. Both distributor shafts are driven by the spiral gear on the rotor shaft. One distributor tower (right hand facing distributor end) is used for magneto ignition and fires one set of spark plugs on the engine. This distributor is similar in design to that used on the JR-6 and has a single set of contacts. The battery ignition distributor (let hand facing distributor end) has two sets of breaker contacts and in conjunction with an ignition coil fires the second set of spark plugs on the engine. This type magneto is fitted with manual spark advance.

TIMING MAGNETO TO ENGINE:—Magnetos must always be timed to the engine with spark control levers advanced and the advanced firing point for the particular engine must be determined. With the engine crankshaft turned to this advanced firing point for piston No. 1, and with the magneto distributor cap removed (take out two screws and lift off cap), turn the magneto shaft until the rotor segment or electrode is directly opposite the red line on the upper edge of the distributor cup. See that spark advance levers are in the advanced position (on the JRZ-6 the lever is on the end of the drive shaft and is returned to the advanced position by a spring behind the drive gear on the rotor shaft). Continue to turn the magneto drive shaft carefully in the direction of rotation until the breaker contacts begin to open (do not use paper strips to check contact opening, if this method is used employ thin steel strips not over .03MM. or .001 inch in thickness.) Couple the magneto to the engine, being careful not to disturb relative position of magneto drive shaft and crankshaft.

In timing the Type JRD-6 magneto, the magneto breaker contact must be used and the change-over knob must be in position to allow the breaker arm of this set of contacts to be in contact with the cam (see paragraph below). On the Type JRZ-6 magneto, the distributor cap on the magneto distributor (right hand distributor viewed from distributor end) should be



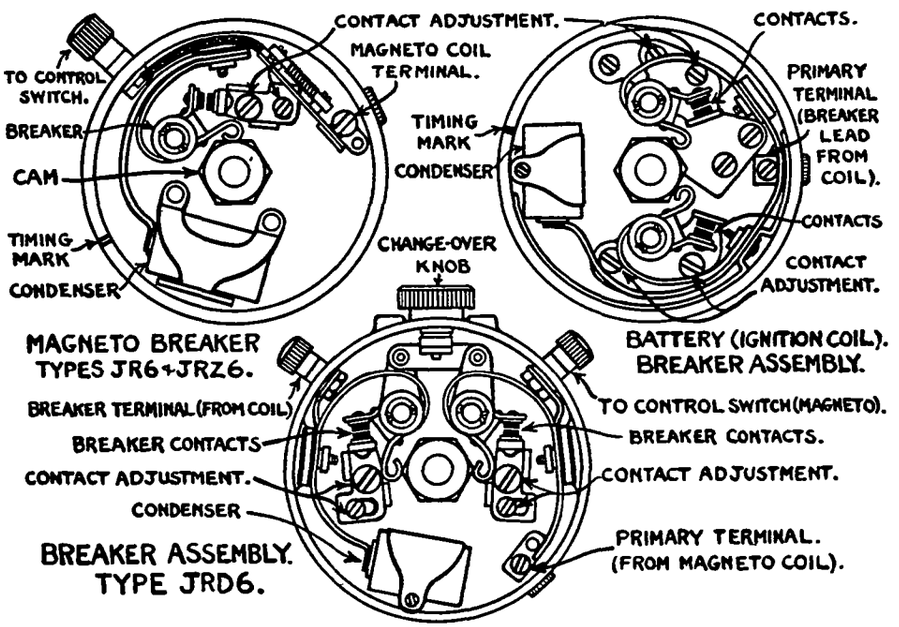
removed and these contacts used to time the magneto to the engine. The battery contacts will be correctly timed to the engine if the battery distributor has not been removed or the timing screws (the copper plated screws on the breaker plate) disturbed.

SERVICING:—At intervals of 20,000 miles or 30,000 kilometers, the distributor caps should be removed and the breaker contacts inspected. If necessary the contacts should be resurfaced with a fine, flat contact file and the breaker gap adjusted. Breaker contact gap should be set at .3MM. or .012 inch (minimum)—.4MM. or .0157 inch (maximum). to adjust contacts, loosen lock screw on stationary contact mounting plate and turn eccentric adjusting screw until gap is within above limits with breaker arm on the lobe of the breaker cam (use a feeler gauge to insure accuracy). The battery breaker contacts on the Type JRZ-6 should also be inspected, resurfaced, and adjusted if necessary. In adjusting these contacts none of the copper plated screws on the breaker plate should be loosened as this will affect the ignition setting. On the Type JRD-6, the change-over knob must be in position for magneto ignition when the magneto contacts are checked and adjusted. The battery contacts will need adjustment only if battery ignition has been used extensively. In this case turn the change-over knob 180° counter-clockwise from the position marked 'M' to the position marked 'B-Spare' before the battery contacts are checked and adjusted.

LUBRICATION:—The ball bearings on both the rotor shaft and distributor shaft are packed with a heat-resisting grease which should not require renewal between overhaul periods. Whenever the magneto is disassembled for inspection or overhaul the bearings should be cleaned and repacked with this special grease (melting point 175°C.). The drive gear case is filled with 'ambroleum' which should not require any attention.

WIRING:—See illustrations for complete wiring diagrams of each magneto type. The terminal on the side of the distributor marked '2M' on each type should be connected to the magneto short-circuiting switch. The other side of the switch is grounded. Whenever work is being done on the car wiring or circuits are being tested, the magneto ground wire should be disconnected at the '2M' terminal in order to avoid any possibility of current flowing through the magneto windings and demagnetizing the magnets.

CHANGE-OVER ON TYPE JRD-6:—See wiring diagram for details of complete installation of the Type JRD-6 magneto, ignition coil and change-over coupling. The magneto is designed to operate ordinarily as a simple magneto ignition installation controlled by the short-circuiting or ground switch. If it is desired to use battery ignition for any reason, the change-over knob on the side of the distributor should be turned 180° counter-clockwise from the 'M' point to the 'B-Spare' position. The spring on the pointer will snap into place at each position. The screw plug on the high tension lead at the brush holder on top of the magneto case should then be unscrewed and the lead pulled out of the brush holder. This lead should then be inserted in the open end of the coupling or connecting member to which the coil high tension lead is connected. There is a needle point at the base of the socket which enters the end of the cable, insuring a good contact. The cable plug should then be screwed in firmly so that the cable is gripped and cannot be withdrawn. This completes the change-over and the engine can be operated on battery ignition by turning on the ignition coil switch. In order to operate the engine on magneto ignition again it will only be necessary to return the high tension lead to the brush holder on the magneto (the connection is made in the same manner as on the coupling, and rotate the change-over knob clockwise to the 'M' position.



The change-over knob controls the breaker contacts through a cam action and lifts the breaker arm not being used free of the breaker cam so that the contacts remain open. The timing of the engine is not affected by this action so that it is not necessary to retime the magneto when it is changed over from magneto to battery ignition. However the magneto contacts can only be checked and adjusted when the change-over knob is in position 'M' and the knob must be turned to position 'B-Spare' before the battery contacts are adjusted.

DESCRIPTION:—The Robert Bosch Magneto Types FF4A and FF6A are of the armature type with all moving parts entirely enclosed. They are furnished with cylindrical base for cradle mounting or with flat base with locating pins for bracket mounting. Magneto should be driven only in direction shown by arrow on collector ring brush holder.

ADVANCE:—Type FF4A has 40° manual advance range. This is equal to 40° measured on flywheel since magneto must be driven at crankshaft speed. Type FF6A has 60° manual advance range equal to 40° on the flywheel since the magneto must be driven at 1½ times crankshaft speed. An automatic advance device may be fitted to all FF4A and FF6A magnetos giving an automatic advance range of 30°. This may be used in conjunction with the manual advance or the manual advance mechanism may be locked by inserting a set screw screwed in the endplate so that it fills the notch in the interrupter housing. The interrupter must first be turned to the fully advanced position. The manual advance arm may be set in any desired position to facilitate connecting of advance control rod. The advance arm ring is held in position by friction against the interrupter housing. To set arm, loosen set screw in side of arm and turn to desired position. Then tighten the set screw.

BREAKER:—Breaker is mounted on end of armature shaft and rotates with armature. Contacts separate 1/64 inch with bumper of contact arm on cam. Clean contacts with a soft brush and gasoline. Contacts may be trued up with a fine flat contact file or on a medium hard oilstone. To replace contacts, remove hexagonal headed screw and remove breaker. Replace in correct position.

OILING:—The armature shaft is mounted on ball bearings packed with heavy grease. The breaker arm pivot pin is oiled by wick oiler saturated with oil. This is sufficient for a running period of 35,000-50,000 miles and need be renewed only when the magneto is disassembled for servicing. Every 4500 miles remove the oil plug in the top of the magneto at rear of distributor housing and fill oil hole with heavy machine oil. It may be necessary to warm the oil but it is essential to use heavy oil so that it will not get in the distributor or breaker housing.

TIMING:—To check magneto for correct position of armature when contacts open. Remove the distributor plate. There are two circular windows in the large gear marked 'R' and 'L'. Fully advance manual control arm and turn magneto shaft in direction of rotation until red line on stationary pole piece is visible through proper window. Use 'R' window in timing clockwise magnetos and 'L' window in timing counter-clockwise drive magnetos. Slowly turn the shaft until the red mark on the end of the armature lines up with the red mark on the pole piece. If magneto is correctly assembled the breaker contacts will just begin to separate at this point.

To time magneto to engine. Crank engine until crankshaft reaches proper firing position of No. 1 cylinder with manual advance lever fully retarded. See manufacturer's specifications as given on specific car data sheets in the National Manual. Then fully retard manual advance arm and turn magneto shaft in direction of rotation until red line on pole piece appears through proper window in distributor gear. Continue to turn the shaft until breaker contacts begin to separate. Couple the magneto to the engine being careful not to disturb the relative position of the magneto and crankshaft. Connect the segment opposite the carbon brush in the distributor head to the spark plug in cylinder No. 1. Connect the remaining terminals to the spark plugs following the proper firing order of the engine.

IMPULSE COUPLING:—Both the FF4A and FF6A magnetos can be fitted with impulse couplings to furnish a very hot spark at low speeds to start the engine. To time engines where impulse couplings are used, it will be necessary to turn the magneto in the opposite direction from that in which the magneto is driven (as given by arrow on collector brush holder). If this is not done the impulse coupling will spin the armature over the timing position so rapidly that it will be impossible to set magneto.

SPARK INTENSIFIER:—A spark intensifier or auxiliary spark gap can be fitted to the magneto. This is provided with a switch on the dash and inserts a second spark gap in the secondary circuit when the plugs are fouled. To install spark intensifier it is necessary to remove collector brush holder and install special unit with two terminals for cables to the switch. If it is desired to operate magneto equipped for spark intensifier without this device, it will be necessary to connect a short piece of high tension cable between the two terminals on the side of the collector brush holder.

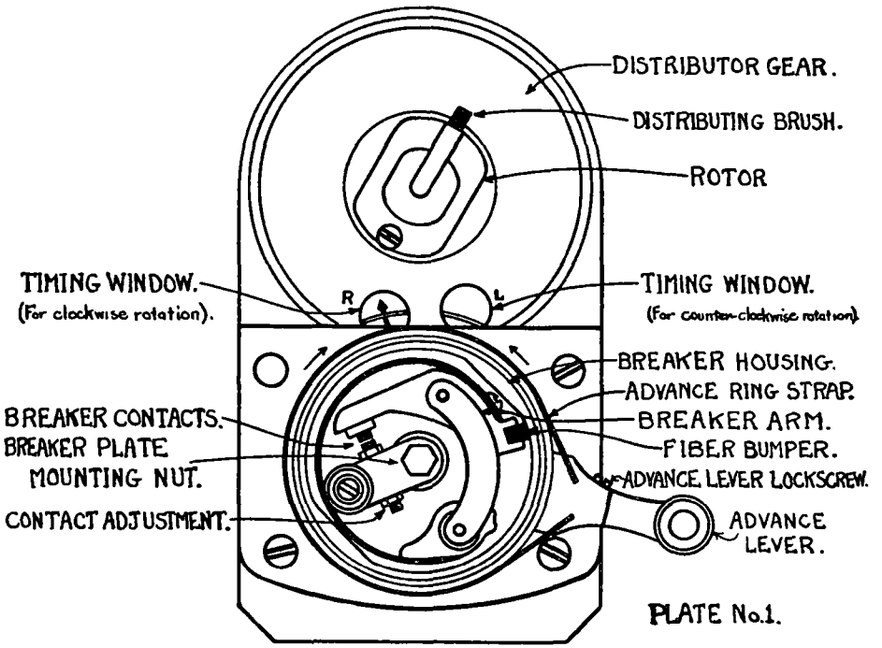


PLATE No.1.

ROBERT BOSCH MAGNETO - MODELS FF4A-FF6A.

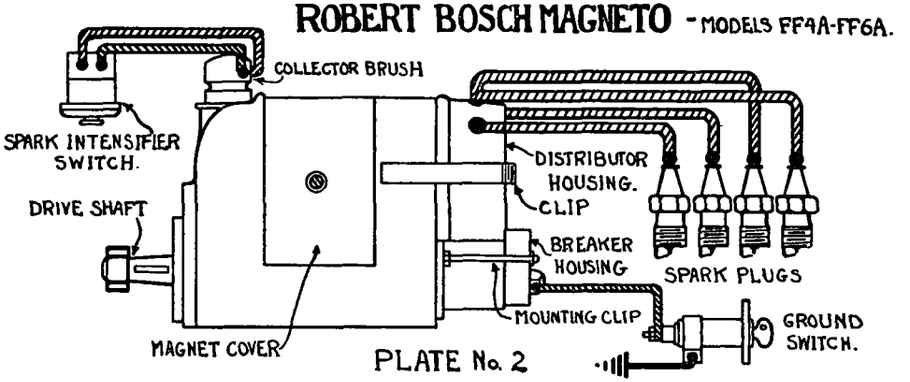


PLATE No. 2

DESCRIPTION:—The Robert Bosch Magneto Types FR4B and FR62 are powerful magnetos of the armature type with all moving parts entirely enclosed. They are furnished with flat base and tapped holes for bracket mounting. Magneto should be driven only in direction shown by arrow on top of magneto frame.

ADVANCE:—Type FR4B has 30° manual advance range. This is equal to 30° measured on the flywheel since magneto must be driven at crankshaft speed. Type FR6C has 45° manual advance range equal to 30° on the flywheel since the magneto must be driven at 1½ times crankshaft speed. The manual advance mechanism may be locked by inserting a set screw screwed in the breaker housing so that the latter is held in advance position. The manual advance arm may be set in any desired position to facilitate connecting of advance control rod. The advance arm ring is held in position by friction against the interrupter housing. To set arm, loosen set screw in side of arm and turn to desired position. Then tighten the set screw.

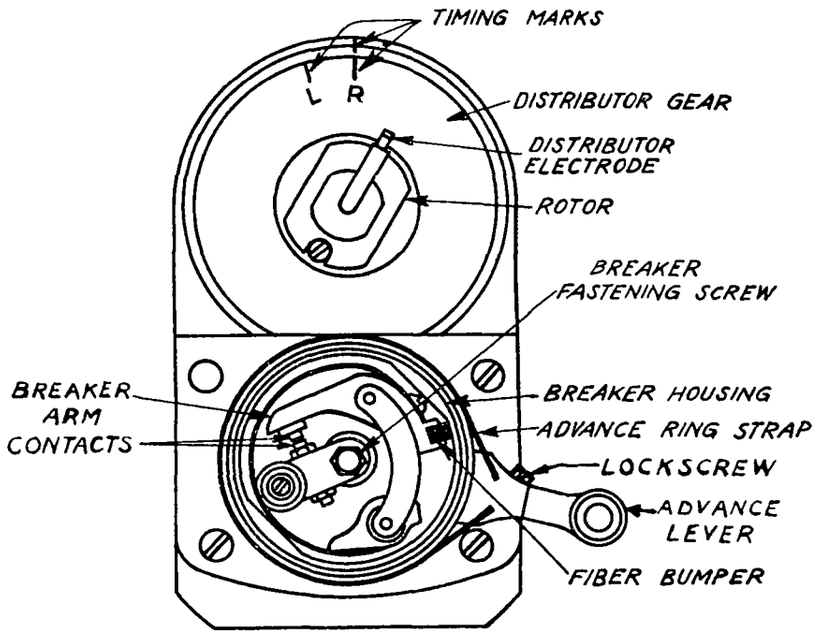
BREAKER:—Breaker is mounted on end of armature shaft and rotates with armature. Contacts separate 1/64 inch with bumper of contact arm on cam. Clean contacts with a soft brush and gasoline. Contacts may be trued up with a fine flat contact file or on a medium hard oilstone. To replace contacts, take out breaker fastening screw and remove breaker. Replace in correct position, with key properly engaging the corresponding keyway.

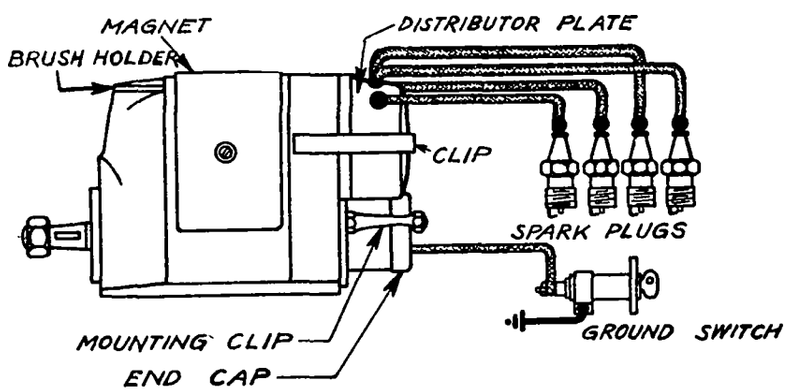
OILING:—The armature shaft is mounted on ball bearings packed with heavy grease. The breaker arm pivot pin is oiled by wick oiler saturated with oil. This is sufficient for a running period of 35,000-50,000 miles and need be renewed only when the magneto is disassembled for servicing. Every 4500 miles fill oil cup in the top of the magneto with light machine oil, preferably Robert Bosch non-freezing oil US-506.

TIMING:—**To Check Magneto for Correct Position of Armature When Contacts open.** Remove the distributor plate. There are two lines in the large gear marked 'R' and 'L'. Fully advance manual control arm and turn magneto shaft in direction of rotation until proper line on gear is opposite timing mark on magneto frame. Use 'R' mark in timing clockwise magnetos and 'L' mark in timing counter-clockwise drive magnetos. If magneto is correctly assembled the breaker contacts will just begin to separate at this point.

To Time Magneto to Engine. Crank engine until crankshaft reaches proper firing position of No. 1 cylinder with manual advance lever fully retarded. See manufacturer's specifications as given on specific car data sheets in the National Manual. Then fully retard manual advance arm and turn magneto shaft in direction of rotation until proper mark ('R' for clockwise, 'L' for anti-clockwise rotation) is opposite timing mark on magneto frame. Continue to turn the shaft until breaker contacts begin to separate. Couple the magneto to the engine being careful not to disturb the relative position of the magneto and crankshaft. Connect the distributor head segment opposite the distributor electrode to the spark plug in cylinder No. 1. Connect the remaining terminals to the spark plugs following the proper firing order of the engine.

IMPULSE COUPLING:—Both the FR4B and FR6C magnetos can be fitted with impulse couplings to furnish a very hot spark at low speeds to start the engine. To time engines where impulse couplings are used, it will be necessary to turn the magneto in the opposite direction from that in which the magneto is driven (as given by arrow on top of magneto frame). If this is not done the impulse coupling will prevent the proper setting of the magneto.





APPLICATION NOTE:—These magneto types designed for the following service:

Magneto Model	No. of Cylinders	Max. Engine Bore	Max. Magneto RPM.
MJA4A, MJA4B (See Note)	4	All except HC	4500
MJA6A, MJA6B (See Note)	6	All except HC	4500
MJB4A	4	Up to 4½"	4500
MJB6A	6	Up to 4½"	4500

NOTE:—MJA4A and MJA6A magnetos are similar to MJA4B and MJA6B except that an improved timing mechanism and cam lubrication system and an additional anchoring washer which prevents accidental removal of the timing gear and rotor are used on the "B" types.

Models MJB4A, MJB6A. These models are intermediate type and are smaller than "MJA" models. They are similar in design to MJA4B and MJA6B except that distributor gear shaft is mounted on a plain bushing instead of the double-row ball bearing used on the "MJA" models.

H.C. Engines. Special "Heavy Duty" MJA4B and MJA6B magnetos are furnished for use on engine with unusually high compression ratios.

DESCRIPTION:—These magnetos are of the Inductor Type with stationary coil mounted on a laminated core directly above the rotating magnets. Magnets are permanently assembled on a steel rotor shaft which is mounted on ball bearings in the magneto housing. Housing is a single piece aluminum die-casting with laminated pole pieces cast in. Screened ventilator openings are provided in each side of the housing and the fan action of the rotor insures proper cooling. Breaker mechanism is mounted on end of housing with stationary breaker arm and rotating cam mounted on rotor shaft. Distributor gear and distributor are mounted on ball bearings (MJA4A, 4B, 6A, 6B), plain bushing (MJB4A, 6A) in the housing at the end of the coil and the high tension current is conducted to the distributor by brushes and conductors cast in the distributor plate (see illustration). High tension terminals on distributor plate are provided with individual brushes which contact the track on the distributor.

TIMING:—Turn engine over to firing position for #1 piston with retarded or advanced spark (usually indicated by flywheel mark "IGN", "SP.#1" etc.—see engine manufacturers recommendation). Then turn magneto to correct firing position for #1 cylinder as directed below for each type. NOTE—Timing window provided on distributor plate for each magneto so that distributor plate need not be removed to observe distributor gear markings.

Fixed Ignition Magneto without Impulse Coupling. Remove control arm cap (breaker housing cover), turn magneto shaft in direction of regular rotation until breaker contacts just begin to open. Couple magneto to engine being careful not to disturb relative positions of magneto shaft and engine crankshaft. Connect distributor terminal which is in line with arrow on distributor visible through timing window on distributor plate to spark plug in cylinder #1, connect remaining spark plugs in accordance with firing order of engine.

Fixed Ignition Magneto with Impulse Coupling. Remove control arm cap (breaker housing cover), rotate impulse coupling in direction opposite to regular rotation until contacts open and then close, then rotate coupling in direction of regular rotation until contacts just begin to open (this procedure necessary to prevent impulse coupling spinning magneto past firing point). Couple magneto to engine being careful not to disturb positions of magneto and engine. Connect spark plugs as directed in paragraph above.

Variable Ignition Magneto without Impulse Coupling. Set timing arm of magneto in full retard position (rotate arm in direction of magneto rotation as indicated by arrow on nameplate), or full advance position (rotate arm in direction opposite to magneto rotation) depending on whether engine manufacturer recommends that engine be timed with retarded or advanced spark. Remove control arm cap (breaker housing cover), turn magneto shaft in direction of rotation until breaker contacts just begin to open, couple magneto to engine being careful not to disturb relative positions of magneto shaft and engine crankshaft. Connect distributor terminal which is in line with arrow on distributor visible through timing window on distributor plate to spark plug in cylinder #1, connect remaining spark plugs in accordance with firing order of engine.

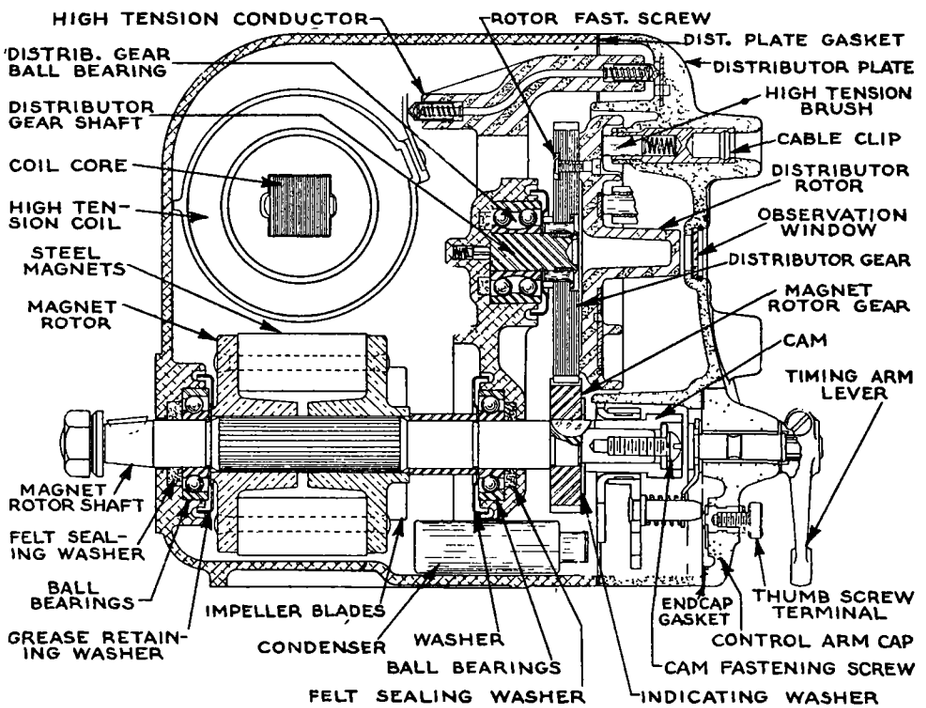
Variable Ignition Magneto With Impulse Coupling. Set timing arm in full retard position (rotate arm in direction of magneto rotation as indicated by arrow on nameplate) or full advance position (rotate arm in direction opposite to magneto rotation) depending on whether engine manufacturer recommends timing engine with retarded or advanced spark. Remove control arm cap (breaker housing cover), rotate impulse coupling in direction opposite to regular rotation until contacts open and then close, then rotate coupling in direction of regular rotation until contacts just begin to open (this procedure necessary to prevent impulse coupling spinning magneto past the timing point). Couple magneto to engine being careful not to disturb position of magneto shaft and crankshaft. Connect spark plugs as directed in paragraph above.

Rotor Position when Contacts Open. See "Edge Distance Setting" under Adjustment below for directions for checking and adjusting rotor position when contacts open.

BREAKER CONTACTS:—Contact Gap. Should be .014-.016" (.35-.40 MM.).

Contact Gap Adjustment. Loosen lockscrew on stationary contact mounting bracket and turn eccentric adjusting screw (in slotted hole). Tighten lockscrew securely after making adjustment.

Contact Servicing. See that contacts are free from oil or grease and properly aligned so that full surfaces of both contacts meet squarely. Contacts are tungsten and may be filed flat or cleaned on a stone. NOTE—Manufacturer recommends tool SA-69526 (file and stone) for this purpose. Always replace stationary contact and breaker arm and contact assembly as a unit.



LUBRICATION:—All MJA Models. Magnet rotor ball bearings and distributor gear ball bearings are packed with U.S. 505 high temperature grease and require repacking at intervals of 12 months or longer. Cam Lubricator is packed with Mobile No. 3 lubricant and requires replenishing only when magneto is being serviced.

All MJB Models. Place few drops of engine oil in distributor shaft oil hole (on distributor shaft boss in housing back of distributor gear) once each year. Rotor ball bearings are packed with U.S. 505 high temperature grease and require repacking at intervals of 12 months or longer. Cam lubricator packed with Mobile No. 3 lubricant which should be replenished when magneto is serviced.

CHANGING MAGNETO ROTATION:—To change magneto for rotation in opposite direction, disassemble magneto, replace necessary parts, and make adjustments when reassembling as directed below. NOTE—If Impulse Coupling is used, this must be changed over for opposite rotation or replaced with unit for new rotation when magneto is changed.

Disassembly. Take out attaching screws and remove complete distributor plate assembly. Remove breaker plate stopscrew, spring, and plain washer (fixed ignition types only). Remove breaker plate assembly. Remove breaker cam fastening screw, retaining washer, lockwasher, and breaker arm. Take out attaching screws and remove stop angle plate and breaker support plate. Remove indicating washer (on rotor shaft in front of drive gear) and distributor gear assembly (these parts must be removed together).

New Parts. Correct Stop Angle Plate must be installed for each rotation and type of service as follows:

Type of Service	Stop Angle Plate Clockwise Rotation	Counter-clockwise Rotation
Fixed Spark Ignition	PL-528	PL-527
20° Timing Range	PL-526	PL-529
35° Timing Range	PL-525 (Unchanged)	PL-525

Reassembly. Turn rotor shaft until woodruff key in shaft is on top and in line with hole in distributor gear bracket. Line up indicating mark on indicating washer with line marked "A" on distributor gear rotor segment (for counter-clockwise rotation), line marked "C" (for clockwise rotation). Make certain that spacer is on distributor gear shaft, install indicating washer and distributor gear together, keeping indicator lines together and making certain that indicating washer slot engages woodruff key on rotor shaft. Install breaker support plate and stop angle plate (see table above for correct stop angle plate). Install breaker cam on rotor shaft with notch in cam marked "A" (for counter-clockwise rotation), "C" (for clockwise rotation) engaging woodruff key on rotor shaft. Install cam fastening screw, lockwasher, and retaining washer. Replace breaker plate assembly. Check Edge Distance (See "Edge Distance Setting" under Adjustment below) and contact gap. Replace distributor plate, change type designation and direction arrow on nameplate (this is important to prevent confusion in timing).

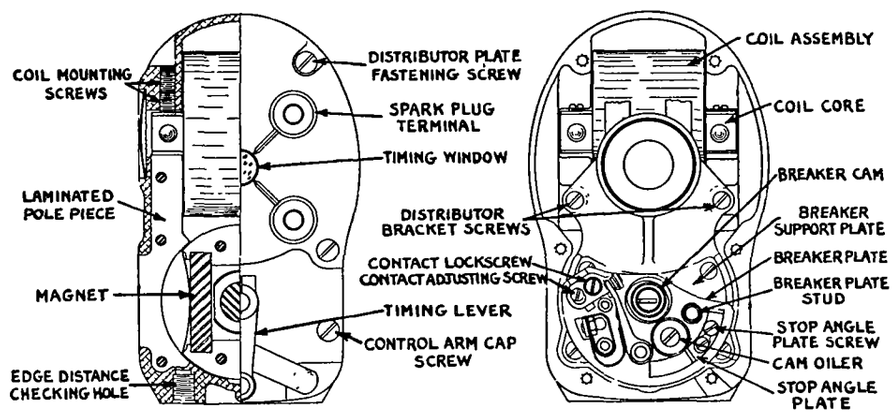
ADJUSTMENT:—Edge Distance Setting. To check, remove setscrew in edge distance checking hole in magneto base, fully advance timing lever, turn rotor shaft in direction of rotation until breaker contacts are just beginning to open, check clearance between edge of rotor and side of housing which should be 3 MM. (plus or minus .5 MM.). Use 3 MM. edge distance gauge (Tool #415) to make this check. To adjust, insert 3 MM. edge distance gauge through checking hole in magneto base, turn rotor shaft in direction of rotation until it is against the gauge, loosen stop plate screw on breaker plate and adjust plate so that breaker contacts are just opening with timing lever in full advance position.

SERVICING:—Recharging Magnets. Magnets can be recharged by placing entire magneto in charger by using special jaws SE-524 in conjunction with magnetizer service tool EF-1161 or EF-1180. Turn rotor shaft so that keyway in shaft is toward the left (facing drive end of magneto).

Rotor Bearing Replacement. Ball bearings are three-piece type, Part No. BB-60226 and must be replaced as an assembly (do not install single parts). To replace bearings, remove complete rotor assembly from housing, remove ball cages from inner races on rotor shaft, use special tool #2922 and jaws HY-41 to pull inner races from shaft. Use tool #61 to remove outer ball races from housing and distributor gear bracket. Press new outer races in housing and distributor gear bracket in an arbor press making certain that paper packing strip IS-400 and paper washer IS-399 are used. Press inner races on rotor shaft with grease retaining washer between race and rotor. Pack bearings with US-505 high temperature grease before installing rotor in magneto.

Distributor Gear Ball Bearing (MJA Models). Ball bearing is one-piece double row type, Part No. BB-1001. To replace bearing, remove distributor gear bracket from housing, remove ball bearing with tool #452. Install new bearing in arbor press making certain that paper packing strip IS-387 is used. Pack bearing cage with US-505 high temperature grease before installing assembly in housing.

Distributor Gear Bushing (MJB Models). Bearing consists of a bushing pressed in the distributor gear bracket. To replace bushing, remove distributor gear bracket from housing, remove old bushing by using punch and pilot in an arbor press. Press new bushing in place in arbor press.



APPLICATION NOTE:—These magneto types designed for the following service:

Magneto Model	No. of Cylinders	Max. Engine Bore	Max. Magneto RPM.
MJC1A (See Note)	1	3½"	4500
MJC4A	4	3½"	4500
MJC6A	6	3½"	4500

NOTE:—Model MJC1A. This model is intended for use on one cylinder engines and consists of a MJC4A magneto without the distributor mechanism. Distributor cover plate has a single high tension terminal which has a contact on its inner end bearing against the coil contact strip. This model is not timed in same manner as MJC4A and MJC6A models and special directions are given below.

DESCRIPTION:—MJC magnetos are of the Inductor Type and are smaller in size than corresponding MJA and MJB models. They are similar in design to the MJA and MJB models (see preceding article) except for different breaker plate and distributor mechanism (see illustration).

TIMING (MJC1A):—Note. Timing will be simplified if indicator card is used. This card is designed to be placed on the rotor shaft and has a lug which engages the shaft keyway so that the arrow on the card lines up with a mark on the housing when the magneto is in firing position.

Timing Engine—Turn engine crankshaft until piston is in firing position for retarded or advanced spark (usually indicated on flywheel by mark "IGN", "SPK" etc.—see engine manufacturers recommendations). Then turn magneto to firing position (see directions below for each type), couple magneto to engine being careful not to disturb relative position of magneto shaft and crankshaft, connect high tension terminal on distributor plate to spark plug.

Fixed Ignition (without Impulse Coupling) using Indicator Card. Install indicator card on magneto driveshaft so that rotation arrow on card points in same direction as arrow on magneto housing and lug on card engages keyway in shaft. Turn magneto in direction of rotation until arrow on card lines up with mark on housing directly above shaft. Couple magneto to engine.

Fixed Ignition (without Impulse Coupling) not using Indicator Card. Remove distributor plate, rotate magneto shaft in direction of rotation until breaker contacts just begin to open. Replace distributor plate, couple magneto to engine.

Fixed Ignition (with Impulse Coupling). Rotate impulse coupling in reverse direction from regular rotation until red mark on impulse member lines up with arrow on arrester plate (first magnetos), or mark on housing directly above shaft (later magnetos). Couple magneto to engine in this position.

Variable Ignition (without Impulse Coupling) using Indicator Card. Place timing arm in full retard position (rotate arm in direction of rotation) or full advance position (rotate arm against direction of rotation) depending on whether flywheel mark is for retard or advance timing. Install indicator card on shaft and time in same manner as for Fixed Ignition (using Indicator Card) above.

Variable Ignition (without Impulse Coupling) not using Indicator Card. Set timing arm as directed in paragraph above, remove distributor plate, rotate magneto shaft in direction of rotation until breaker contacts just begin to open. Replace distributor plate and couple magneto to engine.

Variable Ignition (with Impulse Coupling). Set timing arm in full advance position (move lever to limit of travel in direction opposite to regular rotation of magneto). Turn impulse coupling in direction opposite to regular rotation until red mark on impulse member lines up with arrow on arrester plate (first magnetos), or mark on housing directly above shaft (later magnetos).

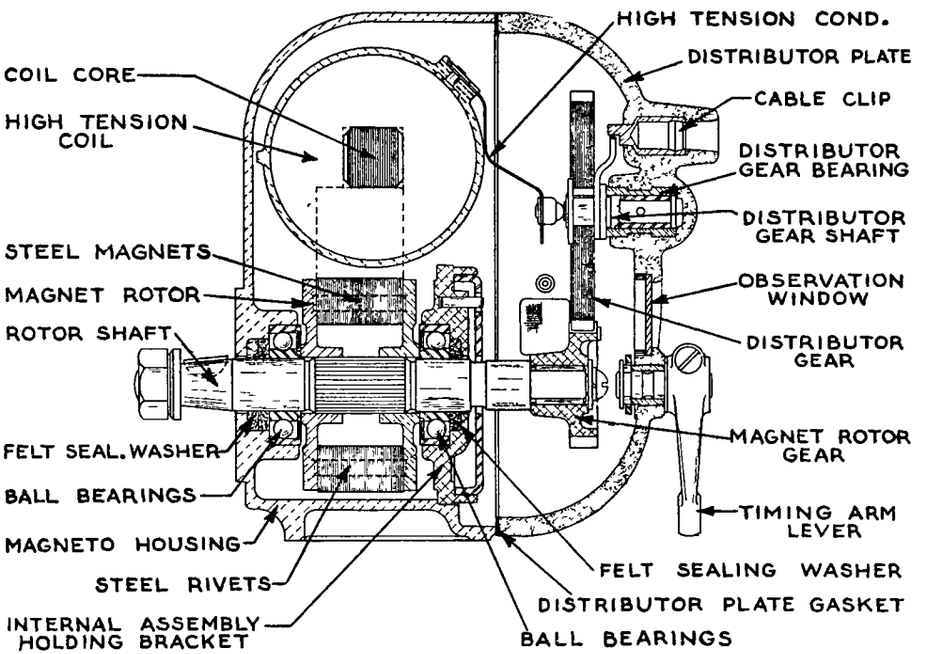
TIMING (MJC4A, MJC6A):—Note. Distributor gear is mounted on distributor plate and removal of distributor plate will disturb gear mesh. Distributor gear must be properly meshed with rotor gear or "timed" when distributor plate is replaced as follows:

Distributor Plate Installation & Distributor Gear Timing. Turn engine over to firing position of #1 piston (see timing directions below). Take out base mounting screws and remove magneto from engine, being careful not to disturb position of engine drive coupling. Rotate magneto rotor shaft in opposite direction from regular rotation until marked tooth on rotor gear points straight up toward coil. Install distributor gear in distributor plate and turn gear until dot on gear points down and is centered in observation window on distributor plate. See that gasket is in place on magneto housing, install distributor plate on housing so that mark on distributor gear is lined up with marked tooth on rotor gear. Use extreme care to engage dowel pins on magneto frame in holes in distributor plate without forcing plate in position, tighten four mounting screws carefully. Rotate rotor shaft in direction opposite to regular rotation until arrow on distributor gear is visible in observation window. Install magneto on engine and install coupling, being careful not to change relative positions of rotor shaft and crankshaft. Magneto will be timed to engine and upper right hand high tension terminal should be connected to the spark plug in cylinder #1 (on MJC6A magnetos for counter-clockwise rotation, connect upper left hand terminal to #1 spark plug). Connect remaining spark plugs in accordance with firing order of engine.

CAUTION—On all magnetos with variable timing range, holes in "U" shaped timing lever within distributor plate must be properly engaged with studs on breaker assembly when distributor plate is installed. If timing lever not properly engaged, lever will contact distributor gear in extreme end positions and will cause stripping of distributor gear teeth. Check timing lever engagement by moving lever through entire range and turning rotor shaft by hand at the same time to determine if lever is striking distributor gear teeth.

Timing Engine—Turn engine crankshaft until piston #1 reaches firing position for retarded or advanced spark (usually indicated on flywheel by mark "IGN", "SPK.#1"etc.—see engine manufacturers recommendations). Then turn magneto to firing position (see special directions below), couple magneto to engine, being careful not to disturb relative position of rotor shaft and crankshaft. Connect upper right hand terminal on distributor plate to #1 spark plug (except on MJC6A counter-clockwise magnetos on which upper left hand terminal should be connected to #1 spark plug), connect remaining spark plugs in accordance with firing order of engine.

All Magnetos where Engine Coupling not disturbed. With magneto off engine, rotate rotor shaft in direction opposite to regular rotation until arrow on distributor gear is visible in observation window on distributor plate. Mount magneto on engine an connect engine coupling, being careful not to disturb position of rotor shaft.



Magnetos with Impulse Coupling when Engine Coupling disturbed. If adjustable driving member of magneto coupling on engine shaft has been disturbed, make certain that crankshaft turned to firing position of #1 cylinder, loosen keyed hub nut of adjustable driving member so that coupling flange may be freely moved. Remove distributor plate on magneto, mount magneto loosely on engine with fibre driving disc in place between driving member and impulse coupling. Rotate magneto rotor shaft in direction opposite to regular rotation until breaker contacts open and then close, then rotate rotor shaft in regular direction of rotation until contacts just begin to open. Securely fasten engine drive member in this position by tightening keyed hub nut, being careful not to move rotor shaft. Remove magneto from engine, install distributor plate (see directions on "Distributor Plate Installation and Distributor Gear Timing"

above) and see that timing lever is properly engaged on breaker plate studs (variable timing type magnetos). Install magneto on engine and engage coupling, making certain that rotor shaft is turned so that arrow on distributor gear is visible in observation window on distributor plate.

Rotor Position when Contacts Open. See "Edge Distance Setting" under Adjustment below for directions on checking and adjusting rotor for correct position when contacts open.

BREAKER CONTACTS:—Contact Gap. Should be .014-.016" (.35-.40 MM.).

Contact Gap Adjustment. Loosen lockscrew on stationary contact mounting bracket, shift bracket by turning eccentric adjusting screw (this eccentric screw not used on MJC1A). Tighten lockscrew securely.

Contact Servicing. See that contacts are free from oil and grease and are properly aligned so that full surfaces of both contacts meet squarely. Contacts are tungsten and may be filed or cleaned with a stone. NOTE—Manufacturer recommends tool SA-69526 (file and stone) for this purpose. Always replace stationary contact and breaker arm and contact assembly as a unit. Coat breaker arm fibre bumper block lightly with US505 grease.

LUBRICATION:—Rotor shaft ball bearings are packed with US-505 high temperature grease and require repacking at intervals of 12 months or longer. Distributor gear shaft is hollow and should be filled with US-505 grease (grease is fed out through small hole in shaft to bearing). Cam lubricator is packed with US-505 grease and needs replenishing only when magneto is serviced. NOTE—Cam oiler on MJC1A should be packed with heavy oil or Mobile No. 3 lubricant.

CHANGING MAGNETO ROTATION (MJC1A):—Take out attaching screws and remove distributor plate. On Fixed Ignition Types, loosen breaker assembly fastening screws, shift breaker assembly counter-clockwise (for counter-clockwise rotation), clockwise (for clockwise rotation) until stop pin is at opposite (trailing) end of slot in breaker plate, retighten breaker assembly fastening screws. On Variable Ignition Types (20° Timing Range), take out attaching screws, remove breaker plate assembly and replace with correct unit for desired rotation (IN-529 for counter-clockwise, IN-5210 for clockwise rotation), retighten attaching screws. Check and adjust Edge Distance (see "Edge Distance Setting" under Adjustment below), change direction arrow and type designation on magneto nameplate.

Impulse Coupling Note. If magneto fitted with impulse coupling, this must be changed over for opposite rotation or replaced with unit for new rotation when magneto rotation is changed.

CHANGING MAGNETO ROTATION (MJC4A, MJC6A):—To change magneto for rotation in opposite direction, disassemble, replace necessary parts, and make adjustments when reassembling as directed below. NOTE—If Impulse Coupling used, this must be changed over for opposite rotation or replaced with unit for new rotation when magneto rotation is changed.

Disassembly. Take out attaching screws, remove distributor plate and distributor gear assembly. Remove rotor shaft gear fastening screw, plain washer and lockwasher, remove gear with tool #425. Take out breaker assembly holding bracket fastening screw, plain washer and lockwasher, remove breaker assembly holding bracket and breaker assembly. Withdraw rotor assembly from housing.

New Parts. Correct Rotor Assembly, Rotor Shaft Gear, and Breaker Assembly (20° Timing Range Variable Ignition Types only) must be installed for each rotation as listed below. NOTE—On Fixed Ignition types, same Breaker Assembly is used for rotation in both directions, breaker assembly need be changed only on Variable Ignition Types.

Magneto Parts	Clockwise Rotation	Counter-clockwise Rotation
Rotor Assembly①	RT-5216	RT-5215
Rotor Gear①	GE-5213	GE-5216
Breaker Assembly②	IN-528	IN-527

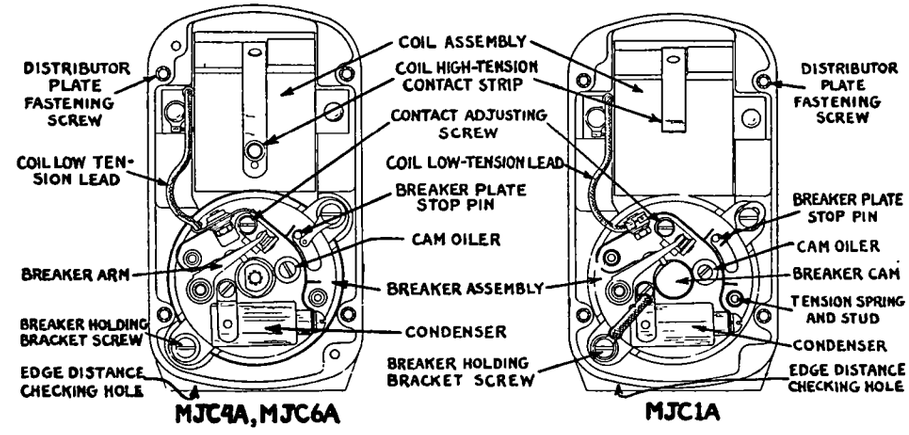
①—All Magnetos (Fixed Ignition & 20° Range Variable Ignition Types).
②—20° Range Variable Ignition Types only (unchanged for Fixed Ignition)

Reassembly. Install correct rotor assembly (see list above), breaker assembly holding bracket, breaker assembly (on Variable Ignition models, install correct breaker assembly as noted in list above), tighten breaker assembly fastening screws securely. On Fixed Ignition Types only, rotate breaker assembly counter-clockwise (for counter-clockwise rotation), clockwise (for clockwise rotation) as far as possible so that stop pin is at trailing end of breaker plate slot before tightening fastening screws. Install rotor shaft gear (see list above for correct type), plain washer, lockwasher, tighten fastening screw securely. Check and adjust edge distance (see "Edge Distance Setting" under Adjustment below), check contact gap. Change type designation and direction arrow on nameplate (necessary to prevent confusion when timing magneto). Install distributor gear and distributor plate (see "Distributor Plate Installation and Distributor Gear Timing" under Timing above).

ADJUSTMENT:—Edge Distance Setting. To check, remove setscrew (MJC4A, MJC6A), felt plug (MJC1A) in edge distance checking hole in magneto base, fully advance timing lever (Variable Ignition Types), turn rotor shaft in direction of rotation until breaker contacts just begin to open (remove distributor plate to check contact opening), check clearance between edge of rotor and side of housing which should be 3 MM. (plus or minus .5 MM.). Use 3 MM. edge distance gauge (Tool #415) to make this check. To adjust, insert the 3 MM. edge distance gauge through hole in base plate, turn rotor in regular direction of rotation until it is against the gauge, adjust breaker assembly holding bracket so that contacts are just opening. Replace setscrew or felt plug to seal checking hole in base plate. NOTE—See "Distributor Plate Installation and Distributor Gear Timing" under Timing (above) for distributor plate installation on MJC4A, MJC6A.

SERVICING:—Recharging Magnets. Magnets can be charged by placing entire magneto in charger by using special jaws SE-524 in conjunction with magnetizer service tool EF-1161 or EF-1180. Turn rotor shaft so that keyways in shaft is toward left (facing drive end of magneto).

Rotor Bearing Replacement (All MJC Models). Same bearings used on other MJ magnetos. See preceding article on MJA, MJB Magnetos for complete bearing installation instructions.



DESCRIPTION:—This magneto is of the high tension, rotating armature type and has been developed for high speed, heavy duty engines and also for heavy duty, slow speed work. For this latter type engine, an Ed. 4 impulse coupling may be installed. The U-4, Ed. 1 type is equipped with screw terminals while the U-4, Ed. 2 has sleeve terminals. In all other respects the two types are identical.

ROTATION:—Magnetos are furnished for both clockwise and counter-clockwise rotation (viewed from the drive end). The direction of rotation of a particular magneto is indicated by an arrow stamped on the lower part of the shaft end plate. In order to change the direction of rotation it will be necessary to replace the interrupter assembly with the unit designed for the opposite rotation and to change the position of the distributor disc on the distributor gear. The distributing segment is mounted in a hard rubber block which is held on the face of the distributor gear by two screws. Holes are provided for two separate positions. For clockwise rotation the disc must be mounted so that one screw is in the hole marked 'C' on the gear. For counter-clockwise rotation the screw must be inserted in the hole marked 'A'.

BREAKER:—The breaker or interrupter is mounted on the end of the armature shaft. The contact assembly and interrupter arm rotate with the armature while the cam ring and cam segments are stationary. The spark is advanced or retarded by rotating the cam ring. Interrupter contacts are made of platinum. They should separate .4 millimeter or approximately 1/64 inch with the interrupter arm on the high point of the cam segment. Set contact gap by loosening lock screw and turning up stationary contact mounting stud. Resurface contacts when necessary with worn No. 00 sandpaper or a fine flat contact file. Do not use emery cloth.

TIMING:—Crank engine over until piston No. 1 reaches firing position with spark fully retarded. (See manufacturer's specifications.) Mount magneto on engine and turn armature until contacts begin to separate with the spark lever fully retarded. Couple magneto to engine, being careful not to change position of crankshaft or magneto shaft.

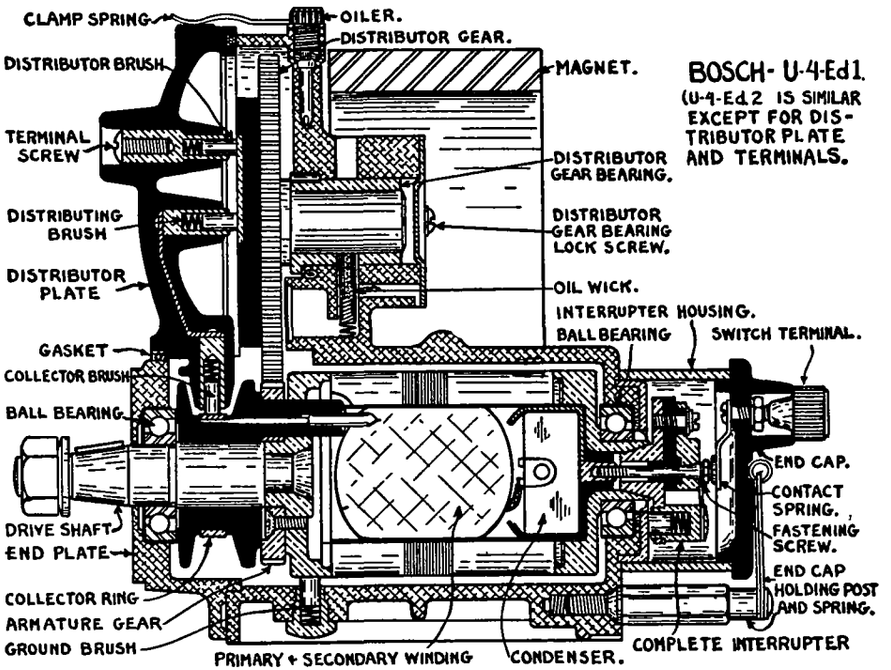
The magneto is fitted with a spark advance range of 25-35 degrees. It can be used with fixed ignition if desired. The distributor gear and armature gear are marked and must be correctly assembled to insure correct position of the distributor segment when the contacts open. One tooth of the armature gear is beveled. This should be meshed with the distributor gear tooth marked by a punch mark.

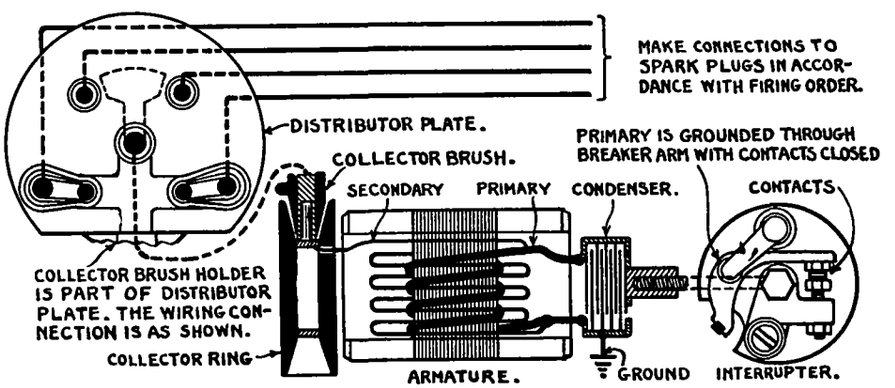
OILING:—The armature shaft is carried on ball bearings which are packed in grease and require no oil. The distributor gear shaft is carried on a plain bushing and is fitted with an oil hole at the top of the magneto. Put 2 or 3 drops of light machine oil in this oiler every 500 miles of operation.

SPARK PLUGS:—Spark plug gaps should be correctly set. This will depend on the type of engine used and in general should be .020-.025 inch. A safety spark gap consisting of a pointed screw extending through the shaft end plate to within a short distance of the collector ring is provided. This will protect the windings if the plug gaps are too wide or if cables become disconnected. The current should not be allowed to jump across the safety gap for any length of time and the ignition system should be checked whenever this occurs.

SERVICING:—The magneto is very simple in design and can be disassembled without difficulty. Disassemble in the following order: (1) Remove ground brush from under plug in base plate. (2) Swing spring on holding post to one side, remove end cap, remove interrupter housing. Then remove interrupter assembly using special Tool No. 339 to first take out interrupter fastening srcew. (3) Press the holding screws to one side and remove distributor plate. Be careful not to damage collector brush which is carried on the lower end of the plate. (4) Carefully pull the distributor gear and armature assembly out together.

In reassembling the magneto be careful to properly mesh the gears (see Timing). Make certain that the oil wick does not interfere with the distributor gear shaft. If the gears are replaced it will be necessary to see that they are properly meshed. The gear mesh is adjustable by turning the distributor gear bushing slightly. This bushing is slightly eccentric and turning it will raise or lower the distributor gear. It is held in place by the distributor gear bearing lock plate which engages in the slot in the end of the bearing. The lock plate is slotted for two mounting screws to retain the bearing position.





DESCRIPTION:—The Bosch Magneto Type ZR is of the high tension armature type. Two magnets are mounted above the armature and the end plates completely enclose all working parts. A safety spark gap is located above the armature under the magnets. The Type ZR magneto can be used with a Bosch Duplex Vibrating ignition coil to provide dual battery and magneto ignition. The Type ZR-4 magneto should be driven at crankshaft speed on four cylinder four cycle engines. The Type ZR-6 magneto must be driven at one and one half crankshaft speed on six cylinder four cycle engines. The direction in which magneto should be driven is stamped on the frame.

OILING:—Put 2 or 3 drops of light machine oil in the oiler at each end of the magneto every 500 miles of operation. Do not oil the interrupter. Examine interrupter occasionally and wipe off all oil and dirt.

BREAKER:—Breaker or interrupter contacts separate .4 millimeter or 1/64 inch with interrupter arm on highest point of cam. At this point the fiber bumper of the interrupter arm will be in the center of the steel segment of the cam ring. Set contact gap by turning armature shaft until fiber bumper is on highest point of cam. Then loosen lock nut on stationary contact stud and turn contact until proper gap is secured. Tighten the lock nut. Contacts are made of platinum. Resurface contacts with worn No. 00 sandpaper or with a fine flat jeweler's file. Do not use emery cloth.

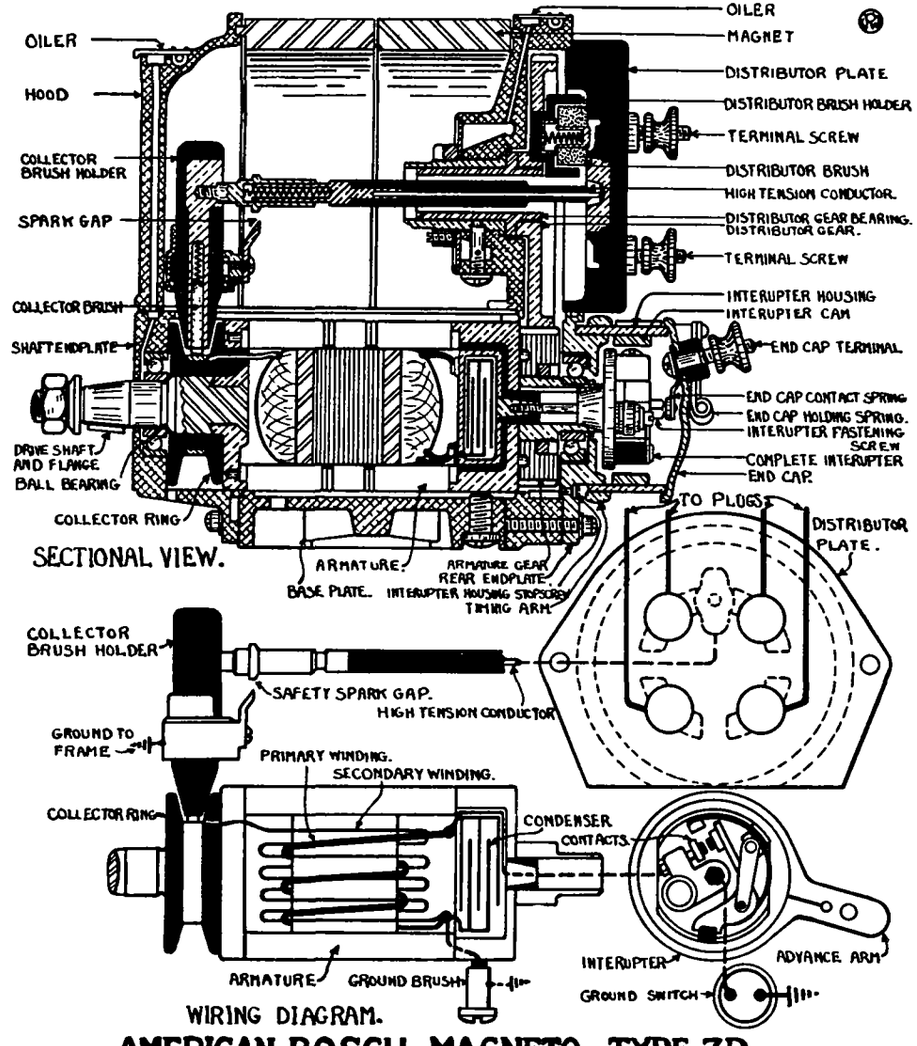
TIMING:—Crank engine until crankshaft reaches proper position for piston in No. 1 cylinder with manual advance lever fully retarded. See manufacturers' specifications as given on specific car data sheets in the National Manual. Fully retard magneto advance arm and turn magneto in direction of rotation until contacts begin to separate when the fiber bumper of the interrupter arm reaches the steel segment in the cam ring. Make certain that magneto is firmly bolted to base mounting and couple drive shaft to engine without disturbing either crankshaft or magneto armature shaft. Remove distributor cover and note position of distributor brush. Connect the segment directly over the brush to the spark plug in cylinder No. 1 and connect remaining plugs in proper firing order around the distributor plate in a direction opposite to rotation of the interrupter.

When manufacturers' specifications are not available, the engine may be timed to fire with piston on top dead center entering power stroke with full retard. Crank engine over until piston No. 1 enters compression stroke (the upstroke with both valves closed). Then continue to crank engine slowly noting dead center on flywheel or checking piston travel with a wire inserted in spark plug port until the piston reaches top dead center. Then connect magneto as directed above.

Timing Magneto with Impulse Coupling:—Turn magneto in direction of rotation until coupling is released from arrester plate. This point will be after proper firing position since impulse coupling will spin magneto over firing position. Then turn magneto backward in direction opposite to rotation until the breaker contacts open and begin to close as fiber bumper passes off steel segment in cam ring. This is the correct firing position and the magneto can then be coupled to the engine.

SPARK PLUG GAPS:—Spark plug gaps must be set at .020 or 1/50 inch. It is important that the gap be set at this figure. If spark plug gap is too wide engine will miss at low speeds and will be difficult to start. A safety spark gap is located above the armature. If spark jumps safety gap frequently check magneto and spark plugs to locate trouble.

TROUBLE SHOOTING:—Engine Misses on One Cylinder:—Check spark plugs for correct gap. Check spark plug in missing cylinder for short circuit due to fouling or cracked insulator. Check for chafed or burnt insulation on cable. Check distributor plate for dirty distributor track or segment.



AMERICAN BOSCH MAGNETO - TYPE ZR.

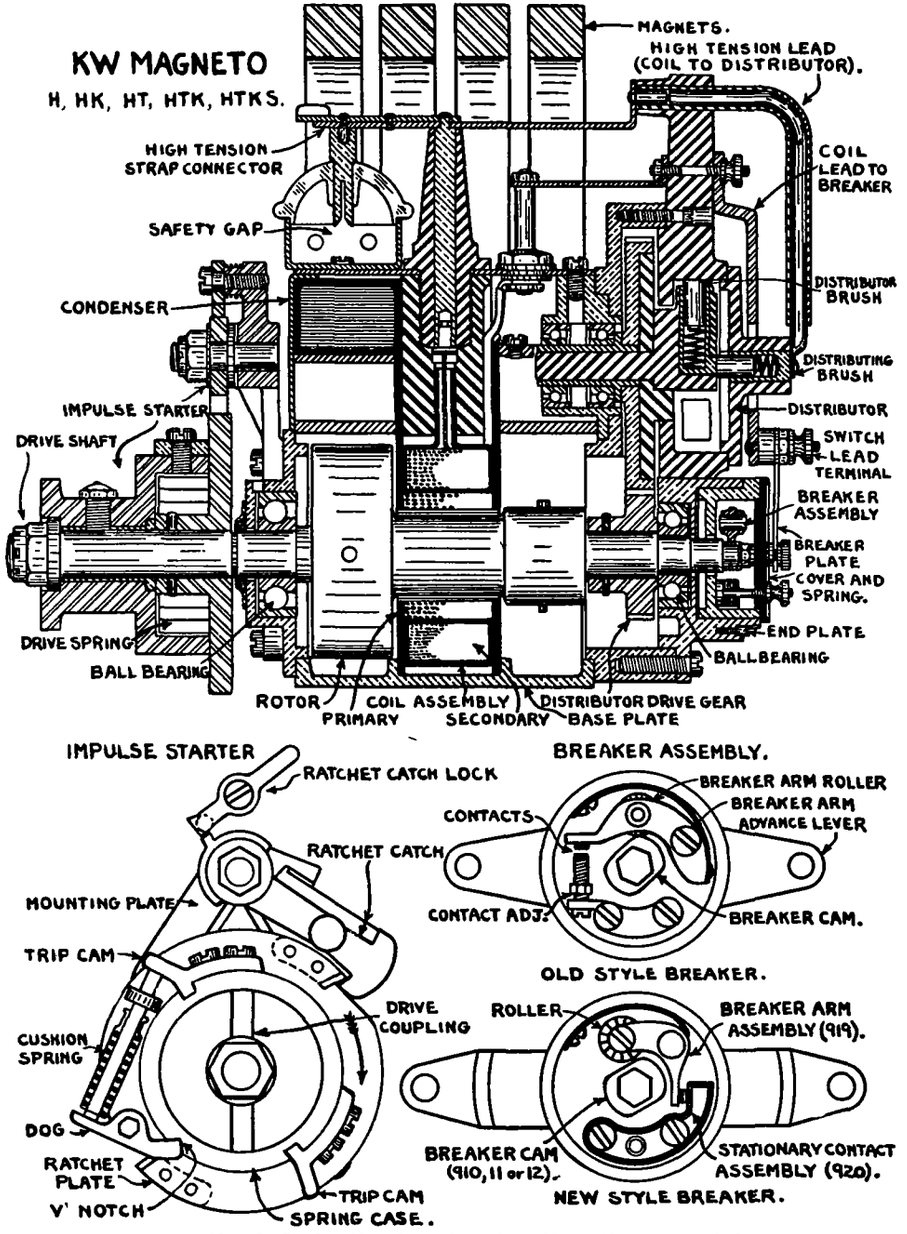
Irregular Firing on All Cylinders:—Check interrupter contacts and set gap. Resurface contacts if necessary. Tighten fastening screw in center of interrupter plate. Check ground brush under armature in base plate. Check collector brush and collector ring. Check distributor plate and wipe out with a clean rag moistened with gasoline if dirty or gummed with oil.

DESCRIPTION:—These magnetos are designed for large, heavy duty stationary engines. They are of standard KW design and are of the inductor type with stationary magnets and coil and rotating inductors. There are two inductors set at right angles and mounted on the ends of the rotating shaft. The coil is wound concentrically around the shaft between the two inductors. The magnetic field is completed from the magnet pole piece through the inductor and the shaft which forms the coil core to the other inductor and through it to the opposite magnet pole piece. The rotation of the inductors breaks the magnetic field and then reverses it, causing an interruption and reversal of the magnetic flux. This generates a current in the coil primary which is interrupted when the primary circuit is broken by the opening of the interrupter contacts. This generates a high tension current in the secondary which is distributed to the spark plugs through a conventional distributor mounted on the breaker end of the magneto. These magnetos are designed for 2, 3, 4 and 6 cylinder engines. The Type H has four permanent magnets and is designed for use on engines operating at speeds above 300 R.P.M. When fitted with an Impulse Starter it is known as Type HK. The Type HT has five permanent magnets and should be used on engines operating at speeds under 300 R.P.M. as it produces a hot spark at speeds as low as 30 R.P.M. An Impulse Starter can be fitted in which case the magneto is known as Type HTK. The Type HTKS is designed for exceptionally heavy duty single cylinder engines. It is fitted with an Impulse Starter and the interrupter cam is driven at one half inductor shaft speed. This means that the magneto must be driven at twice engine speed on two cycle engines.

ROTATION:—The magneto as supplied by the manufacturer is designed for rotation in the direction indicated by the arrow on the bearing cap on the drive end or on the Impulse Starter. The magneto can be set so that it can be driven in the opposite direction but no provision is made to change rotation of Impulse Starters. If it is desired to change the rotation on a magneto equipped with an Impulse Starter, it will be necessary to remove the Impulse Starter and replace it with a similar unit designed for opposite rotation. To change the direction of rotation, remove the interrupter housing cover and take off the interrupter cam on the end of the shaft. The cam is stamped 'L' for left hand or counter-clockwise rotation on one side, and 'R' for right hand or clockwise rotation on the reverse side. Replace the cam with the letter indicating the desired rotation facing out. Then remove distributor block which will expose the moulded distributor and segment. Remove the three screws and replace in the other three holes in the distributor gear. This completes the operation.

MOUNTING:—Magnetos are fitted with a brass base and may be mounted directly on the magneto bracket on the crankcase. Base mounting screws should not enter the holes in the magneto base plate more than ⅜ inch or they will break through and strike the rotor. If desired the magneto can be mounted at an angle. If a mounting strap is used this must be of brass or non-magnetic material.

BREAKER:—The breaker or interrupter assembly is mounted on the end of the magneto frame. The cam is mounted on the rotor shaft and revolves while the contacts and interrupter lever are stationary. Contacts should separate 1/64 inch. On the old style breakers with roller located in center of breaker arm, adjust contacts by loosening lock nut on stationary contact mounting stud and turning up stud until gap is correct with breaker arm roller on the high point of the cam. This type breaker is no longer used and is not furnished for service. The new style Parts 920 (stationary contact assembly) and 919 (breaker arm assembly) should be used. The old steel cam cannot be used with the new assembly and the cam should be replaced with a new unit of similar design. These are Parts Nos. 910 (one point cam), 911 (two point cam), 912 (four point cam). To install the new type breaker, remove breaker housing from magneto and completely disassemble all parts. Then



file or scrape the hole in the housing to allow the new style cam to pass freely. Install the stationary contact assembly (920) carefully insulating it at all points from the housing. A new composition insulator to be placed

under the block is furnished and the rubber bushings should be slipped over the two mounting screws and the fibre washers placed under the screw heads. The contacts spring plunger and spring must be in place before the block is mounted. These parts fit the new block without change. Then install breaker arm assembly. The spring must be properly hooked on the breaker arm and the other end fastened to the housing by the mounting screw. The breaker arm pivot screw should be tightened just enough so that arm moves freely and the lock washer and lock nut on the back of the housing should be tightened. Remove the old cam from the rotor shaft and replace with new cam. Check to see that the proper letter on the face of the cam points outward (see Rotation). To set contact opening, loosen screw in eccentric roller at end of breaker arm and rotate roller slightly until the correct gap is secured with the roller on the high point of the cam. The gap should be 1/64 inch. Then tighten screw to hold adjustment.

TIMING:—The firing position of the engine will depend largely on the speed at which it operates and the type of the engine. Manufacturer's specifications should be followed whenever available. In general the engine should be cranked over until piston No. 1 reaches top dead center entering power stroke. Then turn magneto shaft until the distributor brush is on the lower left hand segment and the breaker contacts are beginning to open as the breaker arm roller reaches the leading edge of the high point of the breaker cam. The spark control lever should be advanced one half or in a horizontal position if the engine operates at speeds below 700 R.P.M., or fully retarded (by being moved as far as possible in the direction of rotation) for engines running at higher speeds. This will allow low speed engines to be started with the spark retarded past top dead center if necessary. Then couple the magneto shaft to the engine without disturbing the relative positions of the magneto or the engine crankshaft. Sonnect the terminal at the left of the distributor block to the spark plug in cylinder No. 1 and connect the remaining spark plugs in accordance with the firing order of the engine.

Timing Magnetos with Impulse Starters:—The Models HK and HTK Magnetos equipped with Impulse Starters can be timed to the engine exactly as directed above if the ratchet catch is locked out of engagement in the ratchet by the ratchet catch lock. This will render the Impulse Starter inoperative and the shaft can be turned as though the coupling were rigid. It is possible to time the magneto by using the Impulse Starter without reference to the contacts. Turn the magneto shaft until the distributor is opposite No. 1 segment. Then turn the starter case or coupling member until the cam on the case is under the center of the roller on the ratchet case. This is the position at which the Impulse Starter would ordinarily be tripped. Then turn the engine over until piston No. 1 is slightly past top dead center entering power stroke and couple the magneto to the engine.

Timing Model HTKS:—See that Impulse Starter is out of engagement with ratchet catch locked by ratchet catch lock. Turn engine over until piston reaches top dead center entering power stroke (on two cycle engines it is only necessary to set piston at top dead center since every stroke is a power stroke). Place spark control lever in a horizontal position which is midway between full advance and full retard. Turn magneto shaft until breaker contacts are beginning to open. Couple the magneto to the engine in this position. This will provide 15 degrees advance before top dead center and 15 degrees retard after top dead center, since the timing range of the lever is 30 degrees.

SPARK PLUGS:—Spark plug gaps should be 1/64 or approximately .016 inch.

OILING:—The oiler at the top of the distributor block oils both the distributor shaft and rotor breaker end bearing. The oiler at the opposite end oils the drive end rotor bearing. Put a few drops of light oil in each of the oilers every month. Examine the breaker housing and see that breaker contacts are clean and free from oil.

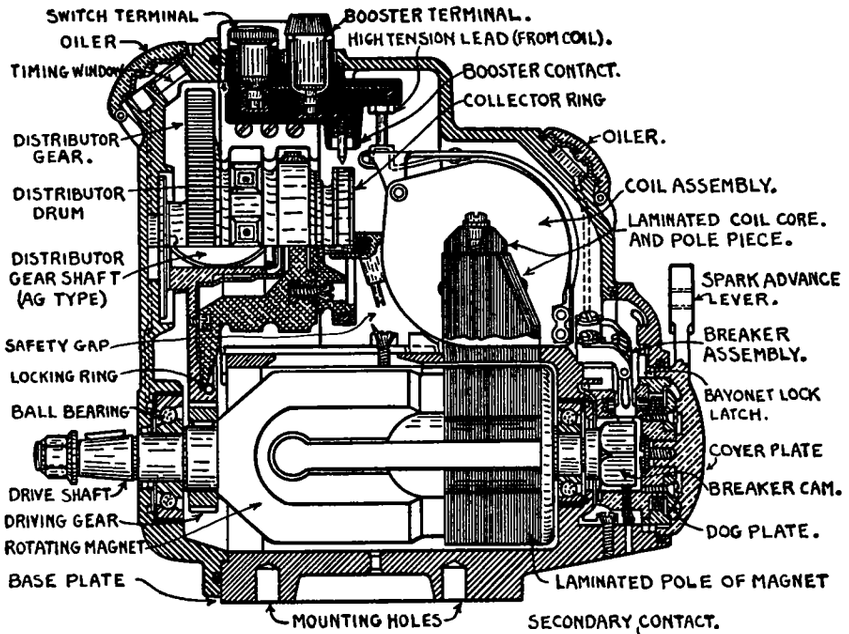
IMPULSE STARTER:—The Impulse Starter designed for these models is of the manually operated semi-enclosed type. See illustration. The magneto shaft is coupled to the ratchet plate by means of a nut on the end of the shaft. This nut is visible in the center of the coupling. The magneto half of the coupling rotates on the magneto shaft and is fastened to it only through a driving spring. When the ratchet catch lock is released, the ratchet catch drops down and engages the slot in the edge of the ratchet plate. This prevents the ratchet plate and magneto shaft from turning and as the coupling is rotated in cranking the engine, the spring inside the starter case or coupling is compressed. When the engine reaches firing position the cam on the outside of the case trips the ratchet catch and the spring rotates the ratchet plate and magneto shaft at high speeds, producing a hot spark. The ratchet catch then drops down and engages the next point on the ratchet plate and the operation is repeated. This continues until the speed of the magneto is sufficient to throw the ratchet catch out with sufficient force to cause it to be locked out by the ratchet catch lock. The magneto is then driven exactly as though connected by a solid coupling. It is necessary to release the ratchet catch whenever the engine is cranked.

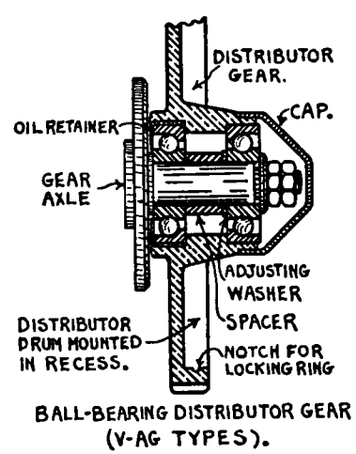
Servicing Impulse Starter:—The only service operation likely to be necessary will be to replace the Impulse Starter driving spring. To replace spring, perform the following operations in order: First, remove the cushion spring assembly and dog on ratchet without disurbing the flattened stud which acts as a guide for the cushion spring sleeve. Take off the dog and the two trip cams on the spring case. Then take off nut on magneto shaft (in center of coupling) and pull starter spring case off shaft. Assemble the new spring on the ratchet plate and place the inner end of the spring in the notch on the ratchet plate sleeve on the shaft. The spring must be put in place so that when compressed it will tend to drive the magneto shaft in the direction of rotation. Place the outer end of the spring in the notch in the starter spring case. There are two notches, one to the left and one to the right of the 'V' notch on the outside of the case in which the dog engages. On clockwise magnetos the spring should be inserted in the notch at the left of the 'V' notch and for counter-clockwise rotation the spring should be inserted in the notch at the right of the 'V' notch. In each case the spring end is inserted in the notch furthest from the 'V' notch against the direction of rotation. It will not be possible to seat the spring end in the notch until the spring is wound up one turn by turning the spring case. Seat the spring end and then push the spring case in place. Put on the shaft nut to hold the spring case in place. Then trip the ratchet catch and wind up the spring slightly more than one turn. Mount the cam which has just passed the flat stud on the ratchet which holds the cushion spring. Replace the cushion spring assembly and the other cam and the Impulse Starter is ready for operation.

TYPES AG-8-D, AG-9-D, AG-12-D

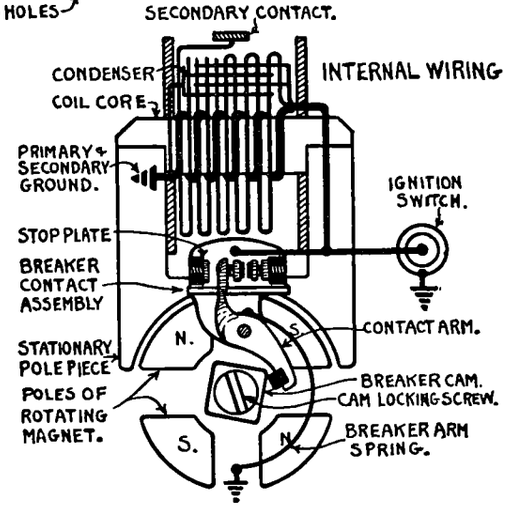
DESCRIPTION:—These models are Aircraft Magnetos. They are similar to other Scintilla Magnetos in being of the inductor type with rotating magnets and stationary coil. The rotating magnet has four poles and revolves within two laminated field poles. The coil is wound on a laminated core which is mounted directly on the upper ends of the pole pieces so that the magnetic field of the permanent magnets is completed through the coil core. The magnetic flux through the coil is reversed every time one of the poles of the magnet passes the pole piece, or four times in each revolution of the magnets. The magneto thus produces four sparks per revolution of the drive shaft. The interrupter cam is mounted on the end of the magnet shaft. The contacts and interrupter assembly are rigidly mounted on the breaker cage. The stationary contact is mounted on an insulated bracket at the top of the breaker cage. A bayonet lock and flat spiral bayonet lock spring are assembled on the breaker cage to hold the breaker assembly in the fully advanced position except when the magneto is retarded for starting by means of the timing lever. The advance lever is assembled in the end cover and is held in place by a central screw which is screwed in the end boss of the end cover. There are two dogs on the advance lever which engage in holes in the dog plate on the breaker cage assembly and permit a number of positions of the advance lever. A distributor drum is mounted directly above the rotating magnet and is driven by a distributor gear at one-half magnet speed. The high tension current is led from the coil through a carbon brush to the distributor drum terminals from which it is distributed to the spark plugs. The magneto is equipped for a 'booster' starting system. See paragraph on 'Booster'.

ROTATION:—The direction of rotation in which the magneto is designed to be driven is indicated by the arrow in the small disk on the frame at the distributor end of the magneto. The direction of rotation can be changed although this requires an almost complete disassembly of the magneto and the adjustment of the various parts. To change rotation, disassemble the magneto and pull the breaker cam. There are two keyways on the shaft marked 'D' for clockwise rotation and 'G' for counter-clockwise rotation. Place the woodruff key in the proper keyway, replace cam and pull cam fastening screw up tight. Then remove distributor cylinder and large distributor gear. The small dog screw in the face of the gear should be inserted in the hole marked 'D' for clockwise rotation and in the hole marked by 'G within a circle' for counter-clockwise rotation. The hole marked 'G without a circle' is only used for counter-clockwise rotation when no booster connection is fitted. Replace distributor gear and distributor cylinder. Take off the collector ring for booster current. There are two holes on the collector ring marked 'D' for clockwise rotation and 'G' for counter-clockwise rotation. The fastening screw should be inserted in the proper hole and this should line up with the line on the face of the distributor cylinder. Then remove cover and advance lever essembly. Unscrew dog plate fastening screws on breaker cage and remove dog plate. Carefully lift off bayonet lock latch and spring from breaker cage. Remove bayonet lock spring, turn spring over and replace. Remove breaker lever axle and breaker lever. Then take out stationary contact screw and fibre stop and interchange. Reverse breaker lever and replace so that contacts match up. Screw the breaker lever axle in and lock threaded end to breaker cage. Replace bayonet lock latch and spring and check to see that both ends of the spring are secured. Replace dog plate and dog plate screws, locking the screw heads to the dog plate. Mesh large distributor gear tooth marked 'D' with marked tooth of small gear for clockwise rotation and fasten end plate in place on housing. Replace contact assembly and rotate magnet until the number 'T' on the distributor gear appears in the opening for the timing window in the end plate and the contacts are just beginning to open. Replace the timing window so that the white line is directly above the mark on the distributor gear opposite the figure 'T' for clockwise rotation. This completes the change in rotation although it will be necessary to mark the end plate with new timing marks to correspond to the timing marks on the distributor gear; change the rotation indicating arrow to indicate the new rotation and to change the number discs to indicate the new order of cable connections (these will not be the same). This entire operation is so intricate and requires so much care to insure the proper assembly of all units that the Scintilla Magneto Company recommends that the magneto be returned to the factory whenever it is necessary for the rotation to be changed. It should be attempted only as an emergency measure.





BALL-BEARING DISTRIBUTOR GEAR (V-AG TYPES).



BREAKER:—The breaker assembly is stationary while the breaker cam revolves

with the magnet shaft. Contacts separate .012 inch. Set contact gap by loosening lock nut on stationary contact mounting stud and turning up stud until correct gap is secured with breaker lever on the high point of the cam. Resurface contacts when necessary with a fine flat contact file. The clearance between the breaker lever and the fibre stop on the contact support directly behind the contact end of the breaker lever must be not less than .002 inch with the contacts fully open. If necessary the fibre stop can be filed to secure this clearance although if this is done care must be used to see that the breaker lever bears against the entire face of the stop when the breaker lever is pressed back against it.

OILING:—There is an oiler with a hinged cover at each end of the magneto. The oiler at the drive end has two holes. Put 30 to 40 drops of oil in the drive end oilers when oil should appear at the overflow hole about one inch below the oil hole cover. One of these oil holes oils the drive end bearing while the other oils the distributor shaft on the AG models. This second oil hole is not used on the V-AG models with ball bearing distributor shaft. The oiler at the breaker end oils the other magnet shaft ball bearing. This oiler should be given 3 to 5 drops of oil. Any excess is to be avoided as it will work out in the breaker case. The wick at the bottom of the breaker cage should be saturated with heavy oil. The oiling should be done every 10 hours of operation.

TIMING:—The magneto should be mounted on the engine bracket with base cap screws which extend into the holes in the magneto base plate 7/16 to ½ inch. This is very important. Locating dowel pins are also used. These should be a snug fit in the magneto base. With magneto on base and magneto half of drive coupling locked in place, crank engine over until firing position of piston No. 1 with spark fully advanced is reached. The manufacturer's specifications must be followed. Then carefully turn magneto shaft in the direction of rotation until No. 1 can be seen in the timing window. The line opposite the 'I' mark should coincide with the mark on the timing window when the contacts are just opening. If no timing window is used, remove the distributor gear cover and line up the supplementary marks on the distributor gear and the end plate. Couple the magneto to the engine in this position and connect the terminal marked No. 1 to the spark plug in No. 1 cylinder. The remaining magneto terminals should be connected in numerical order to the spark plugs in accordance with the firing order of the engine.

SPARK PLUGS:—The spark plug gap will depend entirely on the type of engine on which the magneto is used. The manufacturer's specifications should be followed. The magneto is fitted with a safety gap in which the spark jumps from an extension of the high tension brush assembly to a ground screw on the frame. This gap is set at ⅜-½ inch.

BOOSTER STARTING:—The magnetos of this series are equipped for use with booster current to assist in starting. This consists of an extra terminal on the top of the frame marked 'H' to which a supplementary high tension current source is connected. This will normally be a small hand magneto which is turned over at speed by the operator during the cranking operation. This booster current jumps from the terminal screw to the booster collector ring on the end of the distributor drum from which it is led to auxiliary terminals on the distributor drum directly behind the regular terminals. From these terminals the spark jumps to the cable electrodes and is distributed to the spark plugs. Due to the position of the terminals on the drum the booster current will lag behind one cylinder so that when the timing mark for cylinder No. 1 is visible in the timing window the booster current will be distributed to No. 12 cylinder.

TYPES V-AG-8-D, V-AG-9-D, V-AG-12-D

The V-AG Magnetos differ from the AG series only in the mounting of the distributor gear.

On the AG series the distributor gear revolves on a plain bearing carried on an eccentric shaft to permit the adjustment of the distributor gear mesh. This will probably not be required unless one of the gears has been replaced. In this event the fastening screws on the shaft flange should be loosened and the shaft drifted slightly to the right (viewed from the drive end) to raise the large gear or to the left to lower the large gear. The flange mounting screws should then be tightened and locked to the outside face of the end plate.

On the V-AG series the distributor gear is carried on two plain ball bearings. The bearings are packed with grease which is retained by brass caps at each end of the assembly and require no attention between overhauls. The assembly endplay is adjusted by means of a spacer and adjusting washers between the two bearings.

SCINTILLA VERTEX MAGNETO

FORD V-8 TYPE

DESCRIPTION:—This installation consists of an eight cylinder Vertex magneto and a special aluminum adaptor or drive housing which is designed to be bolted on the timing gear cover in place of the regular ignition unit. The magneto and adaptor or drive are furnished as a unit and the ignition will be correctly timed when the unit is installed if the seal (which prevents disassembly of the unit) is not broken. Special tubes for the spark plug leads and mounting brackets are furnished.

SERVICING:—Lubrication and other servicing instructions for this model are the same as for the standard Vertex (see next page). An additianal grease cup is located on the adaptor or drive housing. This cup should also be screwed down once each 1000 miles or 50 hours of operation and refilled with light cup grease.

INSTALLATION:—The engine should be cranked to firing position for piston #1 before the old ignition unit is removed. With engine turned to this position, take off distributor caps, remove cable tubes, take out three capscrews and lift off old ignition unit. Place Vertex unit in position and fasten with the regular capscrews. Check timing by removing distributor head and noting whether mark on breaker cam lines up with mark on oil protection ring around cam. If marks are in line, seal has not been broken and ignition timing is correct. If not, ignition timing must be set as directed above. Install new cable tubes and connect spark plugs as follows:

Top Row of Outlets	To Cylinder	Lower Row of Outlets	To Cylinder
#1	#1	#5	#6
#2	#5	#6	#3
#3	#4	#7	#7
#4	#8	#8	#2

See car page for method used in numbering engine cylinders.

IGNITION SWITCH:—A special switch adaptor is provided which should be used to replace the insulating plate on the under side of the ignition switch (combination ignition switch and steering post lock). The regular ignition lead on the switch (red) can be used to connect the switch terminal 'V' and the low tension terminal 'P' on the Vertex. The 'M' terminal on the switch should be grounded. On cars equipped with the electric oil pressure gauge, the gauge lead should be taken off the switch and connected to the generator side of the cutout relay.

SCINTILLA VERTEX MAGNETO

DESCRIPTION:—The Vertex is an inductor type magneto (stationary coil, rotating magnet) provided with automatic spark advance and designed to replace the battery ignition systems used on car models. The entire assembly (magnet, coil, automatic advance mechanism, breaker and distributor) is contained in a cylindrical case and is fitted with a standard SAE. type mounting on the drive end. It is mounted in place of the battery distributor on the engine (see special section below on Ford type). As with other magnetos, ignition is cut off by grounding the coil primary and in most cases a special switch must be installed for this purpose.

OPERATION:—The rotating magnet with laminated poles is mounted on the vertical shaft directly above the automatic advance mechanism so that the poles of the magnet pass across the lower ends of the pole pieces. The pole pieces are alternately long (connected to upper end of coil core) and short (connected to lower end of coil core) so that the magnetic flux through the coil core is reversed as the magnet pole passes from one pole piece to the next. At the point where the magnetic flux is strongest, the breaker contacts open, interruping the primary current and inducing a high tension current in the secondary winding. The secondary current is fed to the distributor rotor by the lead on the side of the magneto case and is distributed to the correct spark plug. The distributor head (at top of unit) and breaker (directly under distributor head) are similar in design to conventional battery ignition units. The automatic advance unit uses centrifugal weights of the usual design and advances the entire mechanism (magnet, breaker cam, and rotor) in accordance with the engine speed.

INSTALLATION:—Timing of the magneto after installation will be simplified if the engine is cranked to #1 piston firing position before the battery distributor is removed. With #1 piston on compression, turn engine over until contacts just begin to open (if semi-automatic type, place spark control lever in full retard position). Remove distributor, take off drive gear or coupling, transfer to Vertex unit, allowing .003" clearance between drive gear and lower end of Vertex housing. Install Vertex on engine but do not tighten clamp bolt, rotate magneto housing until rotor is opposite #1 terminal in distributor head (#1 terminal is marked on head) and contacts begin to open. Tighten clamp bolt to hold magneto housing in this position. Connect spark plugs in accordance with firing order of engine (see car pages for firing order for each engine). Distributor head is of the side outlet type but head is marked to indicate relation between terminals and outlets.

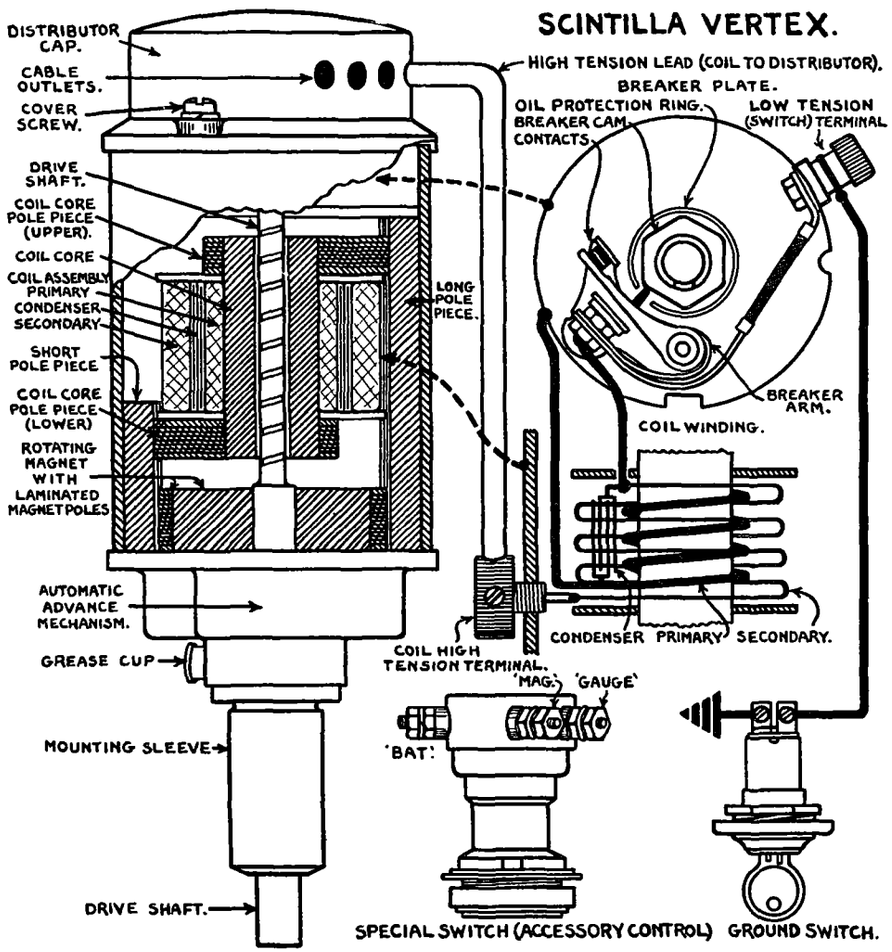
Ignition timing can be checked with engine operating under full load by loosening clamp bolt and rotating magneto housing against direction of rotation to advance spark until engine begins to knock. Magneto should then be rotated in direction of rotation until knock is eliminated, and the clamp bolt tightened. The drive gear or coupling can be changed on the shaft to relocate the position of the distributor head outlets if desired but the position of the breaker cam on the shaft should not be changed (this is set with relation to position of magnet poles and must be maintained).

SERVICING:—Lubrication—The Vertex shaft is lubricated by a grease cup at the lower end. Grease cup should be refilled with light cup grease and turned down once each 1000 miles or 50 hours of operation. Two felt lubricators saturated with oil are located on the breaker plate under the distributor head. If oil does not show on the surface of the lubricators when they are pressed, apply one drop of medium engine oil to each felt. Keep all oil off breaker contacts.

Breaker Contacts—Inspect contacts at 10,000-mile or 500-hour periods. Check gap with breaker arm on lobe of cam. Gap should be .014" or within limits of .012-.016". Adjust by loosening screw on stationary contact mounting bracket and shifting position of bracket. Tighten screw after making adjustment. Do not resurface contacts unless badly pitted.

SPECIAL SWITCHES:—The Vertex magneto is controlled by a ground switch (single circuit through switch to ground). The switch is turned 'on' by breaking the circuit through the switch, and 'off' by completing the circuit through the switch so that the breaker contacts are short-circuited and the primary winding grounded directly.

On car models fitted with ignition switch control of accessories, such as gasoline gauges, stop lights, or starter solenoid switch circuits, it will be necessary to control these in some other manner or install the special Type EV switch furnished by the Scintilla Company, which has additional 'Bat' (ammeter) and 'Gauge' terminals.



DESCRIPTION:—The Scintilla Magneto differs from conventional design in that the field magnet rotates within the pole pieces of a 'U' shaped core on which the stationary coil is wound. The coil consists of primary, condenser and secondary wound in turn on a laminated core which is held in place on the upper end of the pole pieces by two bolts. The breaker cam is mounted on one end of the rotating magnet while the breaker contacts are mounted stationary in the breaker housing at the end of the magneto. The magnet is mounted on ball bearings and carries the drive gear which meshes with the distributor gear. All connections are made by spring clips. The distributor is of the jump spark type and consists of a drum on which are mounted metal segments. These distributing segments are connected to the secondary winding through the carbon brush in the end of the distributor drum and the secondary current jumps from the segment to the cable terminal electrode in the distributor block.

INSTALLATION:—The magnetos of this series are designed for aircraft use. The type of engine on which each magneto should be used is indicated by the model number. Type MN magnetos are designed for small engines up to approximately 4 inch bore while GN magnetos are for 4 inch bore engines and larger. The number 5, 7, etc.) indicates the number of cylinders. The letter D indicates that the magneto may be fitted with a booster magneto for starting. This device consists of an extra terminal marked 'H' on the distributor block to which the booster cable should be attached. The distributor drum is fitted with an extra set of segments which are electrically connected to the distributor segments. The current from the booster magneto jumps from the booster terminal electrode to the distributor drum and is then distributed to the cylinders in the usual manner.

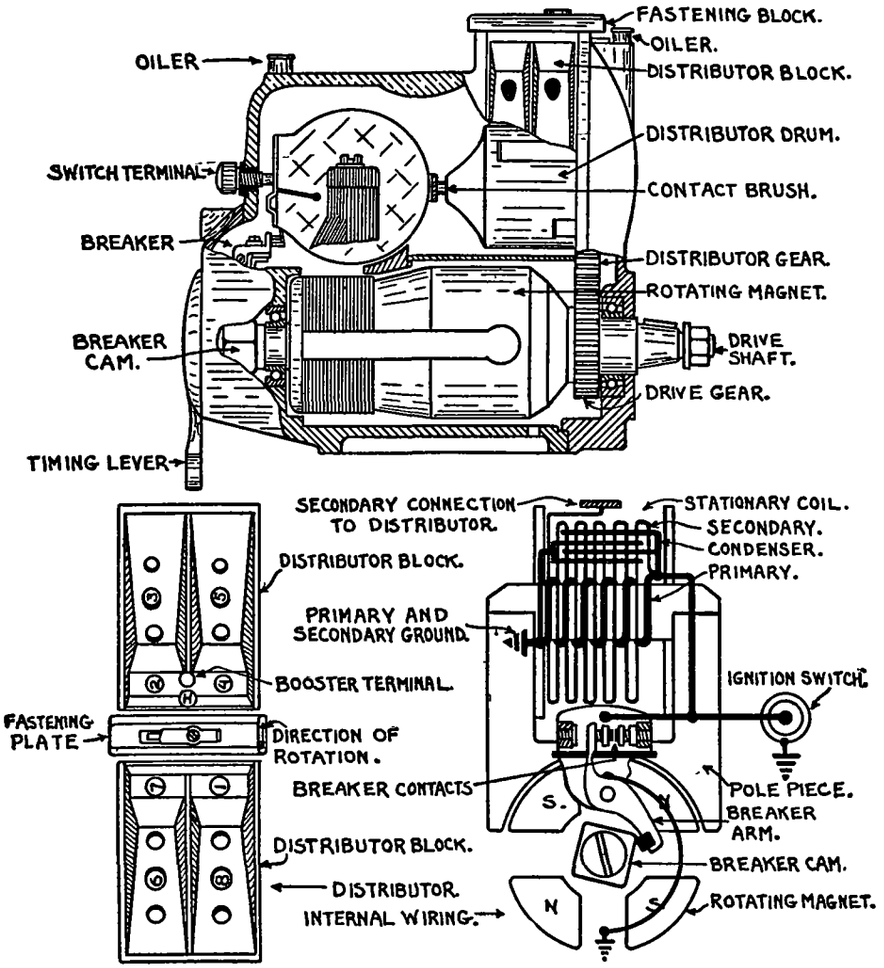
The magneto is designed for base mounting either by base screws or mounting band. It is held in alignment by studs in the base plate. Drive should be through a flexible coupling. The gear ratio and timing range of each type is given on the following table:

Magneto Type	Timing Range	Magneto Speed
MN- 5-D	30°	1¼ to 1
MN- 7-D	25°	⅞ to 1
MN- 8-D	25°	1 to 1
GN- 6-D	35°	1½ to 1
GN-14-D	30°	1¾ to 1
GN-16-D	30°	2 to 1
GN-18-D	30°	2¼ to 1

ROTATION:—The magneto must be driven in the direction indicated on the front end of the securing block over the distributor blocks. There is a second arrow on the top of the end plate which is visible when the securing block is off the magneto. In order to change the direction of rotation it will be necessary to change the contact breaker, distributor drum or cylinder, distributor blocks and securing cover.

BREAKER:—Breaker contacts separate .012 inch. Adjust contacts by loosening lock nut on stationary contact mounting stud and turning up stud until correct gap is secured with the breaker arm on lobe of the cam. The breaker assembly can be removed by taking out the fastening screw is the breaker end cover and removing the two fastening screws in the breaker cage securing ring. One of these screws should then be screwed in the central hole in the breaker cage which will allow the breaker assembly to be withdrawn. Resurface contacts with a fine flat contact file.

TIMING:—Turn the engine over until piston No. 1 enters compression stroke and continue cranking until the piston reaches the full advance position. Remove the distributor blocks and rotate the magneto in the proper direction until the timing marks on the rim of the large distributor gear line up with the mark on the front end plate. The contacts should be just pening at this point with the timing lever in the fully advanced position. There are two sets of these marks, one consisting of a single line and the other of two parallel lines located on the right and left sides of the end plate. Then carefully couple magneto to the engine and connect the terminal marked '1' on the distributor block to the spark plug in cylinder No. 1. The remaining terminals on the distributor blocks are numbered in order of firing. The firing order of the engine must be ascertained and the spark plugs connected in numerical order. A simple method of doing



this is to number the cylinders 1, 2, 3, etc., in accordance with the firing order and then to connect the spark plug and magneto terminal of the same number together.

OILING:—There is an oil hole in each end plate of the magneto. The oiler at the drive end should be given 30-40 drops of medium machine oil every 600 miles (automobile) or 25 hours of flying. The oiler is fitted with an overflow drain and all excess oil drains through an outlet in the magneto base. The oiler at the breaker end of the magneto oils the breaker oil wick in addition to the main bearing and excess oil is to be avoided. Put 5 to 8 drops of oil in this oiler.

DESCRIPTION:—The Scintilla Magneto is of the inductor type with a stationary coil assembly and a rotating magnet. The magnet itself forms the drive shaft and rotates under the laminated pole pieces on which the coil core is mounted. The magnet on the two, four and six cylinder types has two poles and the magneto produces two sparks per revolution. On the eight cylinder type, a four pole magnet is used and the magneto produces four sparks per revolution. The breaker cam is mounted on the end of the drive shaft and the breaker assembly is stationary. The coil secondary is connected to the distributor drum contacts through a carbon brush mounted at the end of the drum. Distributor brushes are mounted in distributor blocks at each side of the magneto. The primary terminal is located at the top of the magneto. This should be connected to the switch which stops the engine by shortcircuiting the breaker contacts. The other side of the switch is grounded.

ROTATION.—The direction in which the magneto operates is indicated by an arrow on the magneto cover.

BREAKER.—The contact points are made of platinum-iridium and separate .013 inch. The complete breaker assembly may be removed by hand for cleaning and inspection. The contact points seldom require resurfacing, but if their condition affects the ignition, they should be resurfaced with a fine, flat jeweler's file.

OILING.—Put 5 or 6 drops of light engine oil in the two oil wells every 500 miles.

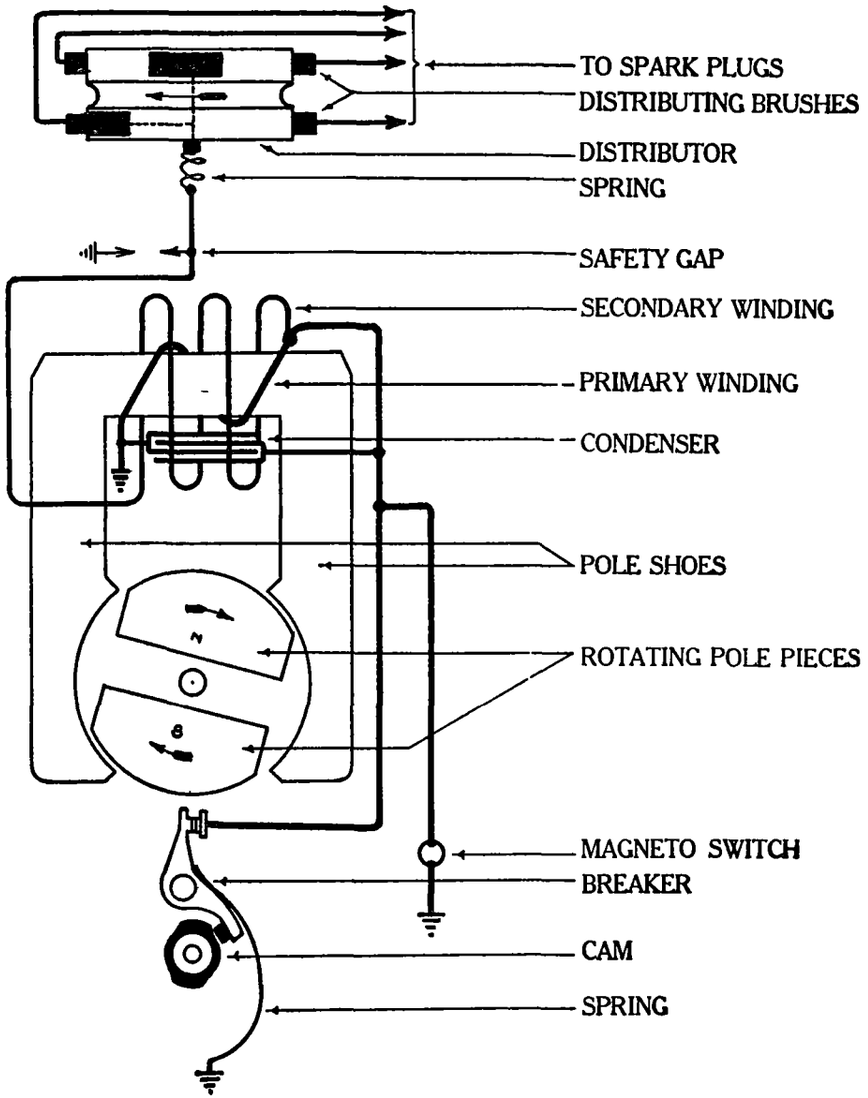
TIMING.—1st. When the maximum advance of the magneto is known:

Turn the engine over until the piston in Number 1 cylinder is in the position where the fully advanced spark should occur. Then turn the magneto shaft until Number 1 on the distributor gear wheel corresponds with the index in the timing window in the front end plate. At this moment the contact points begin to separate, provided the advance lever is set at full advance (opposite to the direction in which the magneto rotates). Contact is then made between the corresponding segment on the distributor cylinder and terminal Number 1 on the distributor carbon brush holder.

2nd. When the maximum advance of the magneto is not known:

Turn the engine over until the piston in Number 1 cylinder is on top dead center. Set the advance lever at full retard (in the same direction in which the magneto rotates), and turn the magneto shaft until Number 1 on the distributor gear wheel has passed the timing window and the contact points just begin to open. To see the breaker points, remove the contact breaker cover by releasing the two spring clamps. Tighten the coupling and fasten the magneto securely to the base. Connect terminal Number 1 to the spark plug in cyinder Number 1. Then follow the firing order of the magneto as marked on the distributor carbon brush holders, that is: 1, 2, 3, 4, 5, 6, 7, 8, and connect the cables to the spark plugs in accordance with the firing order of the engine.

SPARK PLUG GAPS.—The spark plug gaps should be .020 inch.



SCINTILLA MAGNETO

Types AM4, AG4, AM6 and AG6

Types Used on Four and Six Cylinder Engines

The Six Cylinder Type Uses Six Distributor Brushes Instead of Four, as Shown Here

DESCRIPTION:—The Model B Splitdorf Magneto is of the inductor type. Primary and secondary windings are mounted on a 'U' shaped core and are mounted inside the arch of the magnets. They are stationary. The condenser is mounted directly above the winding. The rotor is of die-cast aluminum mounted on a steel shaft carried on ball bearings and has on its circumference four laminated steel members which complete the magnetic field between the pole pieces. Magneto is fitted with both 20° and 30° timing slots. The advance arm may be mounted in either a right, left or vertical position. Magneto is fitted with taper shaft for standard coupling. It should be driven at crankshaft speed on a four cylinder engine and 1½ crankshaft speed on a six cylinder engine.

BREAKER:—Breaker contacts separate .020 inch with contact arm fully depressed by cam. Resurface contacts when necessary with a fine flat contact file. If breaker contacts are badly worn they should be removed and replaced. Use Splitdorf Parts Nos. 63700 and 64503 for this purpose.

TIMING:—To set magneto for correct position of rotor when contacts open. To check magneto for correct assembly, fully advance spark control lever and connect a battery in series with a buzzer between the stationary contact and the magneto frame. The buzzer will operate while the contacts are closed. Then insert a .062 inch feeler gauge in the slot on the right side for clockwise drive and left side for counter-clockwise drive of the magneto frame (viewed from drive end). Rotate drive shaft in a direction opposite to direction of rotation until the feeler gauge is just gripped by the rear rotor segment. The buzzer should stop vibrating at this point indicating that the breaker contacts have opened.

To time magneto to engine. Crank engine until piston No. 1 reaches firing position. See manufacturer's recommendations as given in car data sheets. If these are not available the engine may be timed with piston No. 1 on top dead center entering power stroke. Remove distributor block and rotate magneto shaft until the keyway points directly upward. Fully retard spark control lever and continue to rotate shaft until contacts begin to separate. At this point the distributor finger will be approaching the lower left hand segment position. Couple magneto to engine being careful not to disturb relative positions of magneto shaft and crankshaft, Replace the magneto distributor block and connect the lower left hand segment to the spark plug in cylinder No. 1. Connect the remaining terminals to the spark plugs in the other cylinders in accordance with the firing order of the engine.

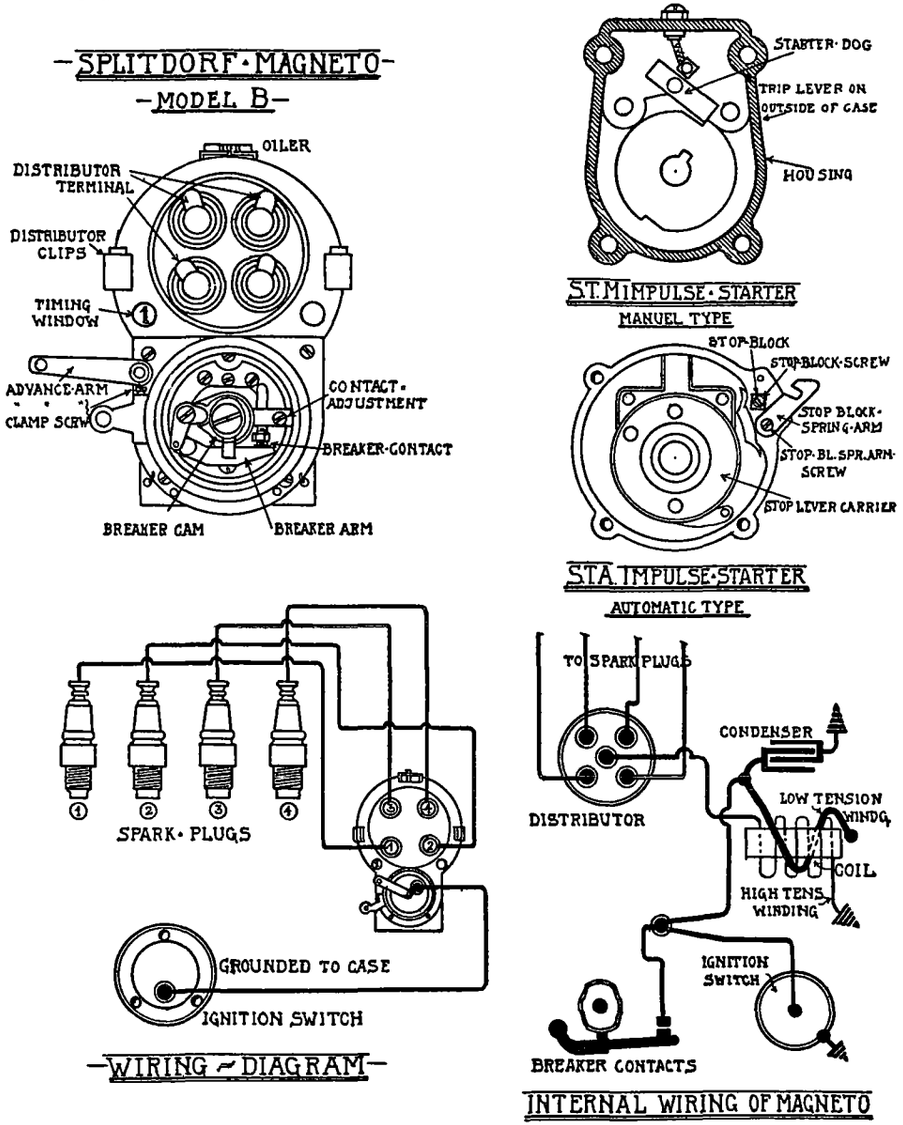
OILING:—Care must be taken not to over-oil the magneto. Every 200 hours of running, put 2 or 3 drops of light engine oil in the oiler at each end of the magnet dust cover plate. At the same time remove the breaker housing cover and put a few drops of oil in the wick oiler directly above the breaker arm pivot. The distributor block may be wiped out with a clean soft cloth moistened with gasoline but it should be wiped dry before assembling the block.

IMPULSE STARTERS:—The Model B magneto may be fitted with two types of impulse starters, the STM manual enclosed type and the STA automatic enclosed type. In each case the outer cam member serves as half the coupling to the engine.

Model STM. To operate this type impulse starter the trip lever 'G' must be thrown to the left hand position (viewed from the drive end). This places the starter in operation and causes the spring to rotate the magneto armature at a high rate of speed to produce a very intense spark. This action continues until the starter dog is thrown out of engagement with sufficient force to cause it to fall over dead center. The hand lever must then be operated to place impulse starter in action again.

To time engines with magneto with Model STM impulse starter, throw starter dog out of engagement with hand lever in right position and then proceed with timing as directed in paragraph on 'Timing'.

Model STA. With this model the impulse stater operates until the magneto speed reaches 250 R.P.M. when the centrifugal action throws the stop levers out of engagement. To time engine with STA impulse starter, loosen screw in stop block



spring arm, swing aside stop block spring, loosen stop block screw and pull out stop block. Then proceed with timing as directed in paragraph on 'Timing'.

Oiling of Impulse Starters:—Impulse starters are packed with grease. This must be renewed at infrequent intervals by removing the impulse starter from the magneto.

TYPE C

DESCRIPTION:—New design inductor type magneto with stationary coil, magnet, and breaker assembly. All parts (except magnet) completely enclosed in two compartment die-cast housing and accessible by removing front cover plate. Coil mounted in top compartment behind distributor assembly and directly in front of condenser. All connections (except high tension lead to distributor) made at terminal block above coil. Rotor assembly mounted on ball bearings in lower compartment with breaker cam on one end and is a die-casting with laminated iron inserts and a steel shaft.

Specifications:—Furnished for right or left hand rotation (see change-over instructions below), 1 to 6 cylinders, Fixed spark at 10°, 20°, 30° variable spark advance, Jump Spark (standard) or Brush type distributor (optional), and with External switch, built in push-pull switch or automatic control. With automatic control, breaker contact is grounded by ground strip when breaker plate moved to full retard position. Magneto may be fitted with Type SA full automatic or Type STM manual Impulse Starter.

TIMING:—Timing Magneto to Engine (No Impulse Starter). Crank engine over to fully retarded firing position for No. 1 piston. Remove magneto distributor block, retard magneto advance lever fully (move in direction of rotation as far as possible), turn magneto shaft by hand in direction of rotation until rotor finger approaches No. 1 segment (extreme lower left for RH, extreme lower right for LH when facing distributor), stop when breaker contacts begin to open. Couple magneto to engine without disturbing position of crankshaft or magneto shaft. See that floating member of coupling is free and recheck timing.

Timing (When Impulse Starter used)—Impulse Starter must be disengaged to prevent magneto being rotated past the firing position. When fitted with Type SA (automatic), remove cover screw at upper end of latch plate on impulse starter case, swing latch plate back exposing stop block hole, insert cover screw which has been removed in this hole and engage stop block, draw stop block forward, then time magneto as directed above. When fitted with Type STM, see that trip lever is in 'Out' position to prevent engagement. For other types of Impulse Starters which cannot be disengaged, turn magneto backward (opposite to direction of rotation) until approximate firing position is reached and then turn shaft forward until contacts open. This will prevent starter functioning.

Timing (Breaker Assembly & Rotor Position). See Adjustment section below to test magneto for correct rotor position when contacts open.

BREAKER CONTACTS:—Gap should be .015" (regular service), .013" (extreme high speed). To adjust, loosen locknut on stationary contact stud and turn stud. Resurface contacts when necessary with a fine contact file, crocus cloth or fine sandpaper. When platinum contacts (optional) are used, resurface only with very fine sandpaper.

LUBRICATION:—Every 500 Hours. Use No. 40 oil. Put 4-6 drops in main shaft oilers (drive end and on top of housing behind terminal), 20-25 drops, slowly, on felt in distributor shaft oiler at right of rotor, 1-2 drops on breaker arm bearing felt and in advance lever shaft oiler, 4-6 drops on breaker cam wick (do not saturate wick). If no felt used in distributor shaft oiler and breaker arm bearing oiler, use good grade soft grease with high melting point at these points. Do not over-oil.

SERVICING:—Dismantling. Remove Impulse Starter. Remove front cover plate. Pull distributor spool straight forward and out. Remove breaker assembly by disconnecting primary lead and taking out screw and bronze spring clamp at each side. Disconnect wires at terminal plate at top of magneto, disconnect hexagonal nut on top of housing, remove terminal plate. Remove distributor bearing plate and gear by disconnecting primary lead clamp at side and taking out two screws being careful not to pull on the lead wires. Take out screw on end of cam, use special Splitdorf puller and remove cam. Use pinion puller and remove pinion. Take out one stud at bottom and remove front bearing plate by tapping drive end of shaft forward. Take out key in rotor shaft and pull rotor out. Remove high tension connector by taking out snap ring and pulling moulded part forward. Do not remove coil or condenser unless tests indicate these parts defective. Do not remove magnet unless magneto has been operated in extremely dusty territory and screened openings to coil compartment are clogged (magnet should be recharged on the magneto—do not remove for this purpose).

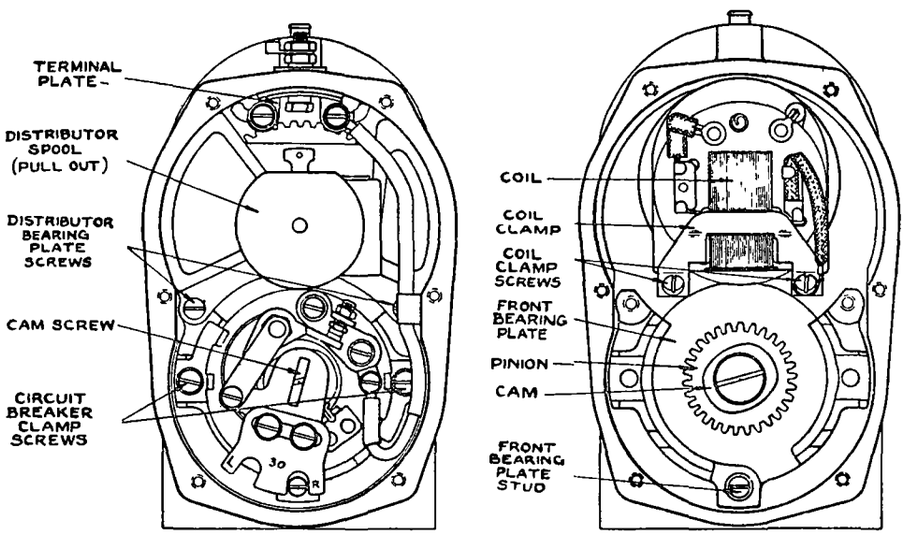
Coil. Take out two screws at front and remove coil clamp. Pull coil straight forward. Coil is held by wedge fit and can be freed by slight side-to-side motion. Do not try to lift coil and do not apply strain to condenser lead which passes ver top of coil.

Condenser. Take out three screws on back plate of magneto. Lift condenser out.

Magnet. Mark one side of magnet and housing to insure correct replacement. Pry out sealing cap (new cap must be used when reassembling), take out mounting screw on top of magnet, lift magnet straight up.

Servicing:—Test coil and condenser as directed below. Clean and inspect all parts. Replace parts which are worn perceptibly (replace breaker arm and stationary contact screw together if either worn). Clean ball bearings in gasoline and pack with high melting point soft grease.

Assembly:—Reverse dismantling directions given above. Check rotor endplay with front bearing plate tight and held by stud at bottom and two holding screws at side (lockwasher must be in place on stud). Rotor should be free but endplay must not exceed .001". If endplay incorrect, refit bearing shims (see Adjustment below). When replacing high tension connector, coat with thin film of vaseline and see that spring and coil quill enter hole in connector and that two wires are in place in slots (where coil quill terminates in flat washer, see that pyramid shaped spring is in place in bottom of quill hole in back of connector). See that snap ring seats firmly in groove with open end at top. When replacing cam see that key enters proper keyway for desired rotation and that cam marks are toward open end of magneto. When replacing distributor spool see that pointer on spool driving member is midway between R and L marks on distributor gear and that snap ring is seated. When installing distributor gear, mesh gears so that punch mark on pinion is opposite R or L mark on distributor gear in accordance with rotation. See that breaker plate fits snugly without sideplay but rotates freely for advance and retard. Clamp primary lead under second screw on right side and see that this lead is free from interference with moving parts. Charge magnet, check and adjust contact gap, test magneto.



Coil. To replace coil, clean coil core ends and coil shoes in housing, apply thin film of soft grease or oil to these surfaces. See that insulation in place in arch of housing with condenser lead inside insulator and insulator notch on ventilating hole side. Before tightening hold-down clamp, tap coil lightly to seat it at the back. With clamp tightened, coil should be down firmly on coil shoe. Test condenser for short-circuit to ground (connect one end of test light to frame, other end to condenser lead).

Magnet. Replace in accordance with marks made previously. In general, magnet pole marked 'N' should be on right side for right hand rotation and left side for left hand rotation. Clean magnet poles and pole shoes on housing, apply thin film of grease or oil to these surfaces, see that magnet seats firmly on shoes and apply new sealing cap using special punch to seat cap on magnet screw.

TESTING:—Magneto should be run for one hour at 1500 R.P.M. before making these tests. Block open breaker contacts if breaker assembly in place.

Primary Voltage. Connect voltmeter between primary coil lead and magneto housing. Operate magneto at 800 R.P.M. Voltage must not be less than 6 volts. If voltage low, recharge magnet, repeat test. If still low, install new magnet. If no improvement, see that magnet down firmly on pole shoes and that coil down firmly on coil shoes and that these surfaces are clean. Then replace coil.

Primary Current. Connect ammeter in place of voltmeter making certain connections are good. Operate magneto at 800 R.P.M. Amperage must not be less than 1.65 amperes. If current reading low and ammeter connections are good, replace coil.

Secondary Tests. Operate magneto at 3000 R.P.M. Use short piece of good high tension cable, hold one end against high tension connector insert and other end against magneto frame. Draw frame end of cable away slowly to form a gap. Spark should occur and can be drawn out into arc. If less than ⅛" in length, remove high tension connector and repeat test at quill spring. If spark now OK, replace high tension connector. If spark still weak, replace coil. In making this test, spark must be drawn out, it will not jump the gap.

CHARGING MAGNET:—Use large charger with special pole pieces arranged so that magneto can be placed between them with tips of pole pieces contacting sides of magnet poles at extreme lower ends. Magnet pole marked 'N' must be made north pole (attracts north pole of compass needle). Turn magneto shaft so that keyway is 45° from vertical on either side. Close charger switch for three successive 1-2 second intervals, opening switch so that decided arc is drawn out. Open charger pole pieces before removing magneto. If magnet must be charged separately, use assembled 'U' shaped keeper which will allow magnet to be replaced before keeper is removed. When removing keeper, slide it down over ends of magnet or open it sideways, do not slide keeper up toward magnet arch.

ADJUSTMENT:—Rotor Timing. Connect 110 volt series test lamp across breaker contacts (lamp will light with contacts closed and go out when contacts open). Fully advance breaker assembly. Remove small cover plate on side of magneto under magnet pole (right side for RH rotation, left side for LH rotation when facing driving end). Turn magneto shaft in direction of rotation until sharp edge of rear rotor lobe (lobe toward drive end) is visible in slot. Contacts should open when distance from this edge to top of slot is .045-.060". To check, insert .045" feeler (do not insert feeler at extreme end of slot), turn rotor so that feeler is gripped between sharp edge of lobe and top of slot. Contacts should be closed (lamp lighted). Repeat test with .060" feeler. Contacts should be opened (lamp not lighted). To adjust, loosen two screws on breaker assembly stop plate, hold rotor firmly against .060" feeler, rotate breaker plate until contacts just open. Hold breaker plate in this position, rotate stop plate until right leg (RH. rotation), left leg (LH rotation) when facing breaker plate is against stop stud, tighten two mounting screws. For fixed spark ignition, stop plate has two notches marked R and L which engage the stud. Recheck rotor position with .045" and .060" feelers.

Rotor Endplay. Controlled by shims between rotor and bearing inner race at one end only. If endplay incorrect (should be free to .001"), use Splitdorf inner race puller to remove one race, adjust shims, use special race replacer to install race. Clean and pack bearings with high melting point soft grease.

Advance Range. Adjusted by replacing breaker assembly stop plate with new plate of correct type. Advance controlled by arc between legs on plate which engage stop stud at end positions (for fixed spark, plate has notch which engages stud). Rotor must be retimed whenever stop plate is removed.

CHANGING ROTATION:—Magneto. Proceed as follows, engaging all marked parts as indicated, at 'R' for right hand or 'L' for left hand rotation. Remove front plate, distributor spool, breaker assembly, disconnect wires at terminal plate, remove plate, distributor gear, and cam. Install cam with key in keyway marked R or L and marks toward open end of magneto. Mesh distributor gear tooth marked R or L with punch mark on pinion. Replace breaker assembly. Replace terminal plate and connect leads. See that pointer on driving spool member midway between R and L marks on gear, replace distributor spool. Check rotor timing and shift breaker assembly stop plate over so that opposite leg contacts stop stud with breaker contacts opening and breaker assembly fully advanced (for fixed spark engage stop plate notch marked R or L with stop stud). If Impulse Starter fitted, change as directed below.

Type SA. Change entire rotating assembly (magneto and drive member) for unit for opposite rotation, shift stop block and round felt to opposite side. Check lag angle of new unit.

Type STM. Change entire rotating assembly (magneto member and drive member) and starter pawl for units for opposite rotation. Check lag angle of new unit.

IMPULSE STARTERS:—When impulse starters are fitted, lag angle must be 5° greater than advance range of magneto (or 5° more than firing position advance if fixed spark type). If lag angle less than this amount, engine may fire before top dead center, if more than 5°, firing will be too late for easy starting.

TYPE CO OSCILLATING MAGNETO

NOTE:—This unit is a standard Type C magneto without distributor assembly (gears, distributor bearing assembly and distributor rotor). Plate on drive end carries tripping mechanism.

TRIPPING MECHANISM:—Consists of hardened trip lever furnished 2 9/16" (standard), 2¾", 2⅞", 3¼", 3½" long, mounted on drive shaft and linked to two heavy actuating springs which snap rotor over firing position when trip lever is released from the trip cam, operating rod, or rocker arm which is operated by the engine. Operating mechanism must be designed to oscillate the magneto over an angle of at least 35°.

SERVICING:—Serviced in same manner as Type C. See instructions above and disregard sections covering distributor and distributor drive.

Rotation:—Tripping lever provided with two keyways for drive shaft key. Use lower keyway for right hand oscillation, upper keyway for left hand oscillation. Breaker cam key should be inserted in keyway 'R' for right hand, or keyway 'L' for left hand operation.

SPLITDORF MAGNETO

DESCRIPTION:—The Model SS Splitdorf Magneto is of the inductor type with a stationary coil and magnets and rotating inductors. The inductors complete the magnetic path between the magnet pole pieces and the coil core pole pieces and direct the magnetic flux through the coil core. The rotation of the inductors breaks this magnetic path and reverses the magnetic flux while the opening of the breaker contacts generates the ignition current in the coil secondary. The coil is mounted on a 'U' shaped core mounted within the magnets directly above the rotating inductors. The condenser is mounted under the end frame at the distributor end of the magneto. The distributor ring is mounted on the end plate by three cap screws and carries the cable terminals and contacts. The distributor block and brush assembly rotates within the distributor ring and is bolted on the face of the distributor gear. These parts are exposed for examination and service by disconnecting the advance rod and fastening clips and lifting off the front cover plate.

ROTATION:—The direction in which the magneto should be driven is stamped on the end plate directly above the drive shaft. It is not practical to attempt to change the direction of rotation.

BREAKER:—The breaker assembly is mounted on the front end of the magneto under the front cover plate. The breaker arm and contact assembly is stationary and the breaker cam is mounted on the end of the inductor shaft. Breaker contacts are made of platinum. Contacts separate .020-.024 inch with the breaker arm on the high point of the cam. Set contact gap by loosening lock nut on stationary contact mounting stud and turning up stud until correct gap is secured. The manufacturer advises that no attempt be made to resurface contacts and that they will seat themselves in service.

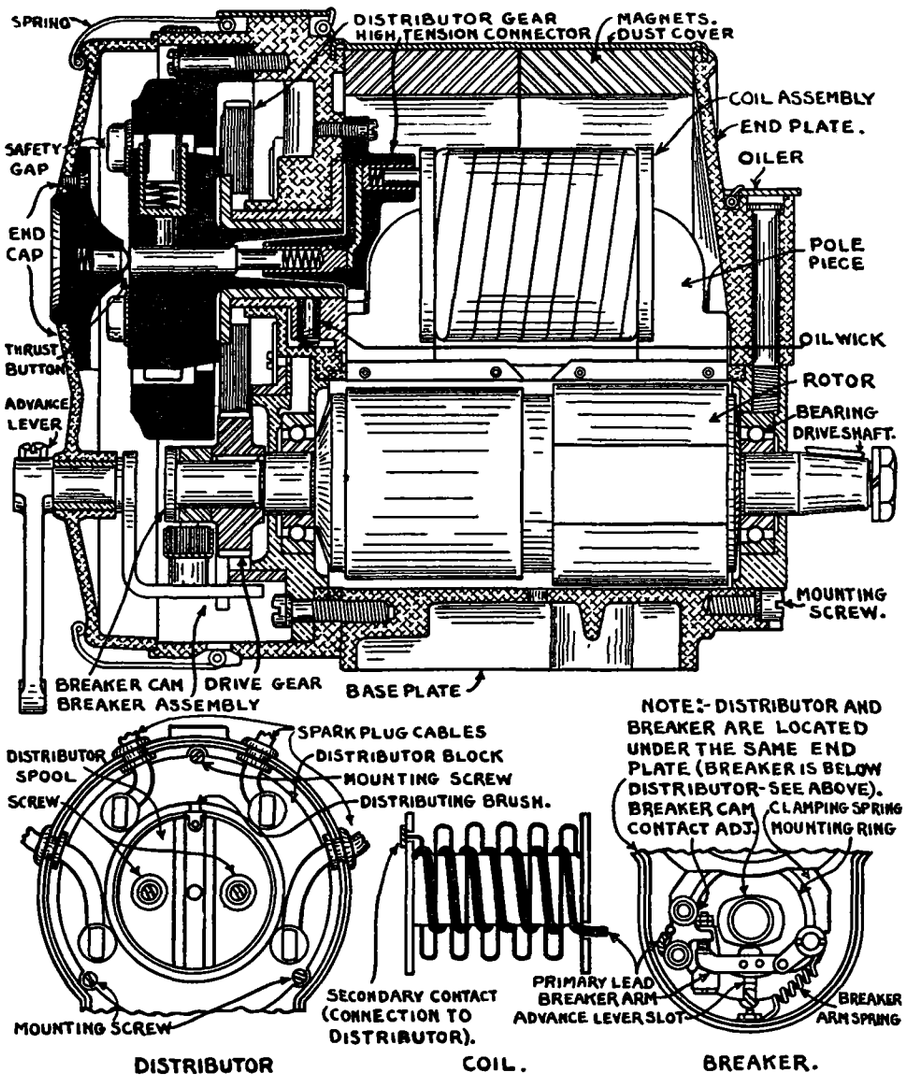
TIMING:—With magnet disconnected, crank engine over until piston No. 1 reaches firing position with spark retarded. It is very important that engine manufacturer's specifications be followed exactly in order to secure satisfactory engine performance. Then retard magnetic breaker assembly and remove front cover plate so that contacts can be observed. Carefully turn magneto shaft until contacts begin to separate. Couple magneto to engine in this position without disturbing the relative position of the magneto shaft and crankshaft.

Timing Magneto with Impulse Coupling:—The magneto may be equipped with a Splitdorf Type ML semi-automatic impulse coupling. If the impulse coupling is used it will be necessary to see that the impulse coupling starter pawl is disengaged before rotating the magneto shaft. If the pawl is engaged the magneto shaft will be spun over the firing position by the impulse coupling and it will be impossible to determine the point at which the contacts open.

OILING:—The magneto shaft is carried on ball bearings. The distributor shaft is carried on a plain bearing. There is an oiler at each end of the magneto. Put 2 or 3 drops of light machine oil in each oiler every 100 hours of operation. If the magneto has been out of service for any length of time it must be oiled before being used. The impulse coupling is packed with grease and this should be renewed whenever the coupling is disassembled. There is an oil hole in the case and this should be oiled every week with light machine oil. Put a few drops of oil on the pawl pin, spring and plunger and see that these parts work freely.

SPARK PLUGS:—Spark plug gaps for ordinary service should be .025 inch. The spark plug gap is very important and will vary on different engines. The specific instructions for each particular engine should be followed.

SPECIAL NOTE:—In starting an engine equipped with an impulse coupling, the Impulse Starter pawl must be engaged with one of the notches in the rotating housing. The Impulse Starter automatically retards the spark so that it will occur at the proper piston position. With the pawl engaged the magneto will be 'impulsed' until the speed increases sufficiently to throw the pawl out of engagement when the magneto will operate as though it were directly coupled to the engine. If the impulse coupling is sluggish in action examine the coupling and see that the clearance is sufficient to prevent binding.



TYPE:—Models are similar in design except that rotor on Model AP is mounted on needle bearings and are inductor type with stationary coil. Coil is mounted on laminated core on top of pole pieces under magneto housing top cover. Distributor and breaker assembly is similar to type used with battery ignition and is mounted horizontally on one end of magneto housing (gear driven from rotor shaft) with a secondary interlead connection between the coil terminal on the magneto case and the center terminal on the distributor cap. All models can be fitted with impulse Coupling and are furnished for fixed spark ignition or manual spark control (advance range determined by Range Plate which can be changed for greater or smaller spark advance—Range Plate furnished in 21 different types for advance ranges from 0° to 35° in 2½° steps).

TIMING:—**Timing Magneto to Engine (Without Impulse Coupling)**—Turn engine over to firing position of #1 piston with advanced spark (usually indicated by flywheel mark 'IGN', 'SP.ADV' etc.—see engine manufacturers recommendations). Rotate magneto rotor until breaker contacts are just opening with pointer on distributor arm marked with correct number of cylinders for engine in line with pointer on end of breaker box (with distributor cap removed), couple magneto to engine in this position. Connect distributor cap terminal in line with rotor to #1 spark plug, connect remaining spark plugs in accordance with firing order of engine.

Timing Magneto to Engine (With Impulse Coupling)—Turn engine over to firing position for #1 piston (if specific timing recommendations for engine not available, place #1 piston on top dead center entering power stroke). Turn magneto shaft in regular direction of rotation until impulse starter has just tripped and distributor rotor is at No. 1 terminal in distributor cap. Couple magneto to engine in this position, connect No. 1 terminal in distributor cap to No. 1 spark plug and connect remaining spark plugs in accordance with firing order of engine.

Timing (Rotor Position when Breaker Contacts Open)—See Adjustment Section below for directions on testing magneto for correct rotor position with contacts open).

BREAKER CONTACTS:—Breaker gap should be .015". To adjust loosen locknut on fixed contact mounting bracket, turn eccentric adjusting screw. When necessary, replace both contacts as a unit (see Servicing directions below).

LUBRICATION:—Oiler provided on each side of housing at distributor end for convenience (use either oiler). Fill oiler to overflowing at 200 hour intervals using special Wico oil or SAE. #20. At 1000 hour intervals, remove plug located just below distributor cap and lubricate gears (Model A). Whenever magneto serviced, or at 1000 hour intervals, saturate cam oil pad with special Wico Cam Lubricant, working lubricant thoroughly into pad.

SERVICING:—**Breaker Contact Renewal**—To remove movable contact point (integral with breaker arm, spring, and spring terminal), remove breaker arm clamp screw, lockwasher, clamp washer, breaker arm spring terminal screw and lockwasher. Remove assembly from breaker arm pivot. Remove fixed contact mounting screw, remove contact and bracket from breaker arm pivot.

Coil Assembly—To remove coil, pull secondary interlead out of terminal on magneto cover, loosen cover screws (screws retained in cover by springwasher and cannot be removed), remove cover. Remove screws holding core clamps and lockwashers. Loosen screw holding primary lead to condenser case in breaker box and straighten lead so that it will pull through opening in housing (Model A), unscrew small slotted nut holding primary lead to condenser (Model AP). Turn rotor until magnetism no longer grips coil core to pole pieces in main housing and leave rotor in this position while coil is off magneto—**this is important to avoid necessity of recharging magnet when coil replaced.** Pull coil and coil core free. If coil is to be replaced, pull gaskets on either side of coil off core, press coil off core (coil held in place by wedge, considerable force required to remove coil, use extreme care not to damage coil windings when pressing coil off core). When replacing coil, make certain that ground surface of core is against pole pieces of housing and that primary leads are properly located and connected.

Condenser (Model A)—Gear case must be removed. Then take out screw holding primary and ground lead to condenser, and two filister head screws holding breaker box on housing, remove breaker box, take out two filister head condenser mounting screws, remove condenser. NOTE—When replacing breaker box make certain that locating mark at top is lined up with mark on housing.

Condenser (Model AP)—Remove magneto top cover by loosening cover screws (screws retained in cover by spring and cannot be removed). Disconnect lead to condenser support, remove screw holding condenser support in housing.

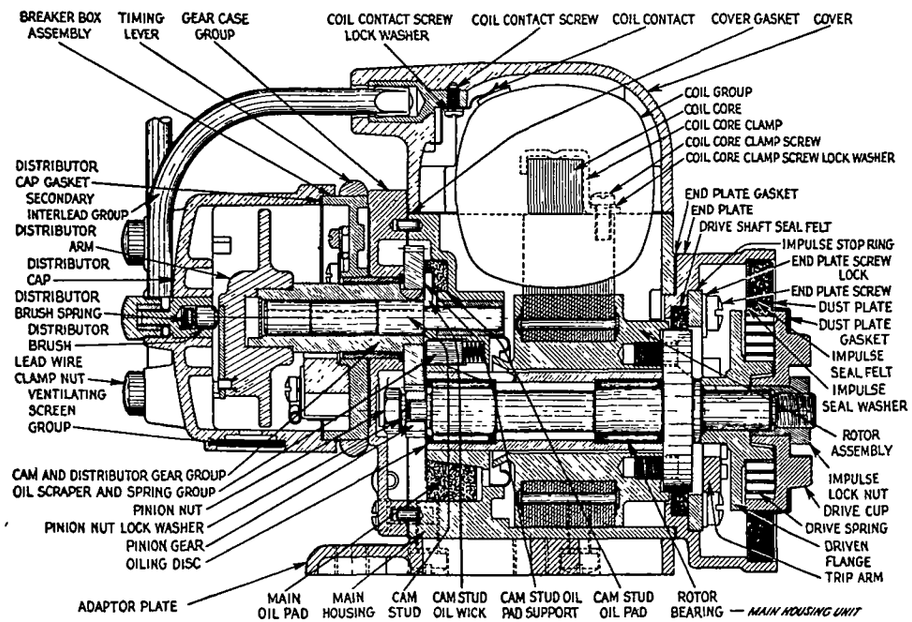
Distributor—Wedge distributor clips out with screwdriver, disconnect secondary interlead, pull distributor cap and gasket off. Pull rotor arm off cam. When replacing rotor arm, see that key molded in arm hole is entered in slot in end of cam. Clean ventilation screen at bottom of distributor cap.

Breaker Box—To remove (with distributor off), remove two breaker box screws and spring washers, disconnect primary lead, pull breaker box off.

Gear Housing—To remove (with breaker box off), take out four screws holding gear housing on main magneto housing, pull gear housing off threading primary lead back through slot in housing.

Breaker Cam & Distributor Gear—With gear housing removed, cam and distributor gear can be pulled off which will expose cam stud and oil wick. NOTE—When installing cam and distributor gear, make certain that marked tooth on rotor pinion is lined up with mark on distributor gear for correct rotation (gear marked for clockwise and counter-clockwise rotation).

Rotor & Shaft Assembly—With cam and distributor gear removed, remove nut on pinion gear (keep shaft from turning by holding lugs on impulse cap), remove Impulse Coupling and end plate (see Impulse Coupling data below),



pull shaft and rotor assembly out at impulse end. Remove oiling disc, pinion gear, oil pads, oil scraper, and spring. Install in reverse order. NOTE—Magnets must be recharged whenever rotor removed from magneto—see Charging directions below.

TESTING:—Operate magneto at speed of 225 R.P.M. and observe spark on Wico Star Type spark gap (electrodes must be clean and bright) with secondary current taken through distributor gap. Magneto should fire steadily with 5/16" gap (Standard Model AP), 7/16" gap (Heavy Duty Model AP).

ADJUSTMENT:—**Rotor Timing (Model AP)**—Must be checked when range plate setting disturbed. To adjust range plate, advance plate as far as possible with range plate lockscrew loose. With impulse coupling inoperative (hold magneto upside down), turn shaft in direction of regular rotation until 3/32" shim or No. 42 drill rod can just be inserted between trailing edge of rotor and pole shoe in main housing. Retard breaker box until contacts just close, lock range plate screw in this position (for fixed spark ignition), or hold breaker box in this position, advance range plate as far as possible and then tighten lock screw (for manual spark control type). NOTE—Magnet must be recharged after this adjustment complete.

Advance Range—Adjusted by replacing Range Plate (furnished in different types for advance ranges from 0° to 35° in 2½° steps). Spark advance limited by

slot in range plate (plate for fixed spark has hole instead of slot which prevents any movement of plate). When installing range plate, adjust rotor timing as directed above.

CHARGING MAGNET:—Magneto can be recharged without being removed from magneto by holding magneto between poles of charger so that charger pole pieces contact sides of housing at nameplates. Turn rotor horizontal and make-and-break charger circuit several times.

Note for Heavy Duty Types—When recharging heavy duty types, or when low voltage charger used, magneto cover and coil and coil core unit can be removed and magneto mounted on charger so that pole pieces contact pole shoe laminations at top of magneto housing. If magneto charged in this manner, turn rotor horizontal while charging but turn rotor to vertical position before magneto removed from charger to prevent loss of magnetism while coil is being re-installed.

CHANGING ROTATION:—Magneto must be dismantled and Breaker Cam, End Plate, Impulse Stop Assembly, Impulse dust cover base, and driven flange group replaced with correct units for opposite rotation. See Servicing data above for dismantling instructions and Impulse Coupling data below for reversing Impulse Coupling. When reassembling magneto, make certain that correct mark on distributor gear is meshed with marked tooth on pinion gear (distributor gear marked for both clockwise and counter-clockwise rotation).

IMPULSE COUPLING.

SERVICING:—**Removal**—When dust cover used on impulse coupling, take out four screws holding dust plate and gasket on impulse cup, pry out impulse seal felt, remove impulse seal washer. Take out cotter pin and remove impulse nut (on clockwise rotation magnetos, use Wico tool No. 1820 between driven flange and impulse stop to prevent shaft turning while nut unscrewed, on counter-clockwise units, turn shaft until trip arm is against impulse stop which will prevent shaft turning). With nut removed, turn in direction of regular rotation until trip arm latches against impulse stop and continue until projection on cup clears projection on driven flange, then pull cup out until it is released and spring unwinds, pull cup off. Pull driven flange off shaft (pry off with two screwdrivers 180° apart using care not to damage end plate casting).

Installation—Make certain that all parts are clean, place small amount of grease in spring turns. Pull inner end of spring out of cup slightly and insert inner eye of spring in slot in driven flange, press cup and driven flange together. Wind flange up against spring tension ½ turn, separating parts so that projections on flange clear projections on cup, and stop with flange projections ahead of cup projections (this will provide correct spring tension). Press entire unit on shaft making certain that woodruff key is in place in driven flange.

CHANGING ROTATION:—**Spring Assembly**—Spring must be installed in cup so that spring turns spiral in toward eye in clockwise direction for clockwise rotation, counter-clockwise direction for counter-clockwise rotation. See Servicing directions above for impulse dismantling and assembling directions.

Trip Arm Assembly—To reverse rotation, trip arms must be reversed on pivots. Clamp driven flange in vise, hold snap ring from turning by wedging screwdriver between flange hub and point on ring gear opening, use hacksaw blade or pointed tool to unwind snap ring from around pivot so that it is free to fly off. If one trip arm only is used, shift trip arm to opposite pivot. Install new snap ring (if old ring distorted by removal), make certain that snap ring seats properly in groove.

Impulse Stop Ring—Must be shifted on end plate to reverse rotation. Stop ring has two marks 180° apart and mark for correct rotation must be lined up with correct mark on end plate (see Impulse Lag adjustment below).

ADJUSTMENT:—**Impulse Lag**—Lag must be correctly set so that impulse range is greater (by at least 1°) than manual advance range of magneto (to insure spark when impulsing with manual control retarded). Adjust lag as follows:

Model A—Impulse stop can be shifted from one to another of the three holes in the end plate to provide lag of 5° to 36°. Entire end plate can be shifted in mounting slot to provide intermediate settings between these different mounting holes.

Model AP—End plate marked with eleven 5° graduations to indicate lag range Install impulse stop ring with mark on ring for correct rotation (see Changing Rotation data above) in line with center graduation on end plate (for impulse range of 24-25°). Shift stop ring in direction of regular rotation (for greater range), in opposite direction to rotation (for less range). One graduation is equal to approximately 5°. Tighten end plate screws after this adjustment completed. Manufacturer recommends that impulse lag be set on rotary spark gap so that range can be accurately determined (graduation figures approximate only).

NOTE:—Type numbers for these drives are designated by prefix 'A' (A-1673). See Starter Drive listing on each car model page for type used.

DESCRIPTION:—This type drive retains Bendix inertia principle of engagement and free longitudinal movement to insure pinion mesh but has been redesigned so that all parts of drive mechanism except drive spring are located within the pinion barrel. The threaded sleeve is mounted loosely on an extension of the drive head (instead of directly on the starter shaft) and is rtained by the stop nut which is screwed and staked in place on the outer end of the head. The pinion is integral with the barrel or drive sleeve and is mounted loosely on the starter shaft (not on threaded sleeve as in former types). Starter drive is through lugs on the control nut or driving ring on the screw shaft which engage slots in the end of the pinion barrel. Pinion barrel is held in place on control nut by a locking ring within the end of the barrel directly behind the driving lugs. A coil type anti-drift spring is mounted on the threaded sleeve ahead of the control nut and a meshing spring is located within the head of the barrel

OPERATION:—Pinion, barrel and control nut operate as a unit so that pinion is moved out into mesh with the flywheel as the control nut is threaded along the threaded sleeve. If the pinion teeth strike the ends of the flywheel teeth, the free longitudinal movement of the threaded sleeve on the drive head allows the pinion to turn slightly and mesh properly. This free movement important to insure correct meshing and prevent jammed pinion or damage to gear teeth.

TROUBLE SHOOTING:—If pinion jams or does not mesh properly with flywheel teeth check following points:

(1) Armature shaft rough or burred, dirty or rusty under threaded sleeve (first type only). Remove Bendix, clean and smooth shaft, lubricate shaft lightly with graphite grease Gredag 31½ before replacing drive.

(2) Armature shaft rough, burred or dirty under Bendix pinion (all types). Thread pinion back on threaded sleeve (demeshed position), smooth shaft with emery cloth or clean with kerosene (do not use gasoline), lubricate shaft lightly with Gredag 31½ graphite grease.

(3) Armature Shaft Bent. Remove Bendix drive. Check shaft and straighten

(4) Drive spring screw at threaded sleeve end too long. See that spring does not project through sleeve and bind on drive head extension (on first type screw will bind on armature shaft).

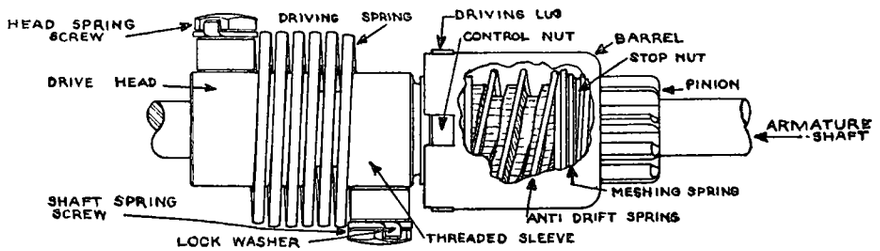
(5) Cocked or deformed drive spring. This will cause threaded sleeve to drag on armature shaft (first type) or on drive head extension (later types). Remove spring by taking out spring screws, examine spring, replace if necessary. Spring eye centers should be at right angles to spring axis (See Spring note below). Use new lockwashers under spring screw heads when replacing screws and see that one lip of washer is turned down in spring eye gap and other lip turned up against screw head flat.

SERVICING:—No servicing required other than cleaning and oiling of threaded sleeve and armature shaft under pinion when operation not satisfactory.

Armature Shaft:—Rotate pinion back to demeshed position, clean exposed portion of shaft with kerosene lubricate lightly with Gredag 31½ graphite grease

Threaded Sleeve:—Rotate pinion forward to meshed position as far as possible, wipe threads clean with dry cloth or use kerosene sparingly (not gasoline). Do not wash entire drive in kerosene or grease installed under threaded sleeve at time of assembly will be removed (threaded sleeve cannot be removed to replace this lubricant). Lubricate threaded sleeve lightly with 10-W engine oil.

BENDIX SPRINGS:—Both Type 'F' and 'H' driving springs formed with special smaller diameter end coil designed to fit closely on shaft at ends. No spring clips used with these types. Springs may be identified by larger (⅜") spring eye. Spring eyes located on same side of coil (Type F), or 180° apart (Type H).



SPECIAL 'BARREL' TYPE USED ON FORD '60' & STUDEBAKER 'CHAMPION'

IDENTIFICATION NOTE:—Type A-1806 (Ford '60') stamped with letter "B" on pinion barrel. Type A-2033 (Studebaker Champion) stamped with letter "D" on pinion barrel. Units identical except for pinion tooth design. **These two drives should never be interchanged due to difference in form of pinion teeth.**

FORD NOTE:—Three different Drives have been used as follows: TYPE 1—First 1937 cars only. TYPE 2—Before Sept. 15, 1937. TYPE 3—After Sept. 15, 1937.

TYPE 1. Ford No. 52-11350. This type serviced by Type 2. Drive Spring and Anchor Plates were permanently assembled on Screw Shaft Assembly so that spring cannot be serviced in the field (Use Type 2 'SA' assembly for replacement). Mounting on armature shaft same as Type 2.

TYPE 2. Ford No. 52-11350B, Bendix No. A-1806 BR. Similar to Type 1 except that Drive Spring Anchor Plates can be removed and spring serviced in the field (see Servicing data below). Drive mounted on armature shaft by short stub pilot pin and woodruff key.

TYPE 3. Ford No. 52-11350C, Bendix No. A-1806. Same design as Type 2 except that Drive mounted on armature shaft by special pilot pin extending through armature shaft. No woodruff key used. Type 2 and Type 3 drives not interchangeable because of this different mounting.

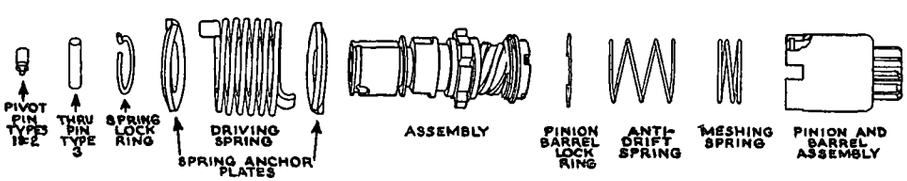
TYPE:—Design same as other 'Barrel' type Bendix Drives except that Drive Spring is anchored by two identical notched plates (instead of screws used on other types). Inner anchor plate retained by locking ring (Types 2 and 3 only) and anchor plates and drive spring can be taken off after locking ring removed.

REMOVAL & INSTALLATION:—To remove drive from armature shaft, screw pinion and barrel assembly all the way back toward the drive spring, push head anchor plate in against drive spring compression to uncover pilot pin, remove pin, slide drive off shaft being careful not to lose woodruff key in shaft (Types 1 and 2). When installing drive, make certain that pilot hole in armature shaft is clean to permit full seating of pilot pin, install woodruff key in shaft, see that pilot pin tongue does not extend above the edge of the hole when installed and that the head anchor plate covers the top of the pin (this is important to prevent pin working out in service).

SERVICING:—Disassembly. Remove locking ring within pinion barrel (at drive spring end) by inserting screwdriver in lug recess in barrel nearest lock ring end and working ring out (be careful not to distort ring), remove pinion and barrel assembly from screw shaft. To remove anti-drift spring, pull spring back until end coil slips over stop nut shoulder (hook finger under spring 180° from end coil), remove spring taking care not to distort it.

Drive Spring & Anchor Plates (Types 2 and 3 only). Remove lock ring on screw shaft at outer end of anchor plate (use pliers and take care not to distort ring), slide head anchor plate and spring off. Do not remove shaft anchor plate (nearest barrel) unless necessary. If this anchor plate removed, install by cocking the fibre washer so that the edge projects through hole at point under spring slot in anchor plate, then feed it through hole in anchor plate carefully to avoid damage. When installing drive spring, see that dished faces of anchor plates face spring (see illustration), and that the anchor plate covers the top of the pilot pin. See that lock ring is properly seated in groove and spring opening is over the top of the pilot pin (important).

Drive Assembly. Check anti-drift spring clearance in pinion barrel (spring should fall into barrel freely, if either end binds, install new spring). To install spring hook end over stop nut and thread spring in until it strikes control nut, then push end over stop nut. Check by threading control nut half turn forward on screw sleeve and making certain that spring does not project beyond control nut or stop nut shoulder. See that meshing spring is in place in pinion barrel, install pinion barrel and lock ring. See that pinion and barrel assembly moves freely on screw sleeve. In fully demeshed position, pinion and barrel assembly should rethread itself (slight click will be evident) on all three screw sleeve threads with slight reverse rotation of barrel.



SOLENOID TYPES SS-4000 SERIES

Car Model	Solenoid Type
Hudson Eight, Models LL, LT, ('34), HT, HH, HHU ('35)	SS-4001
Hudson 6, GH ('35), 63 ('36), 73 ('37), 83 ('38), 92,3 ('39)	SS-4001
Hudson 8, 64,5,6,7 ('36), 74,5,6,7 ('37), 84,5,7 ('38), 95,7 ('39)	SS-4001
Hupmobile Models 417-W ('34), 517-W ('35)	SS-4001, 2
Hupmobile Models 421-J ('34), 521-J ('35)	SS-4001
Hupmobile Models 427-T ('34), 527-T ('35)	SS-4001
Hupmobile Models 518-D ('35), 521-O ('35)	SS-4001
*Lincoln, V12 Model (1935-36-37-38-39)	SS-4004
*Lincoln, V12 Export Models (1935-36-37-38)	SS-4005
Packard '120' 8, 120 ('35), 120-B ('36)	SS-4001
Packard 8, 1400, 1, 2 ('36)	SS-4001
Packard Super 8, Models 1403, 4, 5 ('36)	SS-4001-A
Packard Twelve, Models 1407, 8 ('36)	SS-4001-A
Packard 6, 115-C ('37), 1700 ('39)	SS-4001
Packard '120' 8, 120-C ('37), 1601,1A,2 ('38), 1701,1A,2 ('39)	SS-4001
Packard Super 8, 1500,1,2 ('37), 1603,4,5 ('38)	SS-4001
Packard Super 8, 1703,3A,5 ('39)	SS-4012
Packard Twelve, 1506,7,8 ('37), 1607,8 ('38), 1707,8 ('39)	SS-4001
Terraplane, Models K, KU ('34), G, GU ('35)	SS-4001
Terraplane, 61,62 ('36), 70,71,72 ('37), 80,81,82,88 ('38)	SS-4001
Willys, 48 ('39)	SS-4001

*On the Lincoln type, the lead for the winding is taken from the battery terminal within the switch case and the pushbutton switch is grounded. On all other models, the feed lead is connected to the pushbutton and the coil winding is grounded (see car wiring diagrams).

DESCRIPTION:—These are conventional magnetic solenoid type switches mounted on the starter field frame and controlled by a pushbutton switch on the instrument panel. The feed wire for the switch solenoid is connected to the coil side of the ignition switch so that the starter is operative only with the ignition turned on. See car diagrams for wiring and connections of each installation.

OPERATION:—Two springs are used in connection with the solenoid coil to control the switch action. When the solenoid circuit is completed by pressing the pushbutton switch, the solenoid plunger is drawn into the coil against the tension of a light spring. After the main switch contacts close, the plunger compresses a second spring, insuring a positive connection at the switch contacts. When the pushbutton switch is released, breaking the solenoid circuit, this second spring quickly separates the main switch contacts, preventing arcing or burning of the contacts. The first spring then returns the solenoid plunger to the off position.

PERFORMANCE:—The solenoid coil winding resistance is 1.82-2.06 ohms at 77°F. and the coil draws 2.9-3.3 amperes at 6 volts. Terminal voltage required for initial closing of switch contacts is less than 4 volts and plunger should bottom with not more than 5.25 volts. The switch releases when the terminal voltage falls to .75-2.0 volts. Switch has a capacity of 450 amperes at 10°F. or 250 amperes at 70°F. when held closed for not more than 4 minutes.

NOTE:—For emergency operation the switch can be operated by hand by taking off the brass cap on the end and pushing the plunger in by hand.

AUTO-LITE STARTER FIELD EQUALIZER

AS INSTALLED ON MODELS MAW AND MAX STARTERS

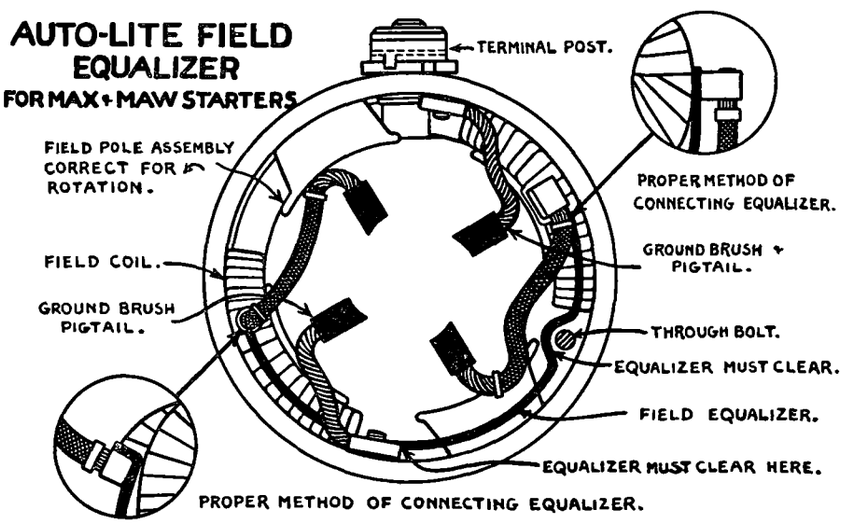
This Field Equalizer should be installed on all Model MAW and MAX starters where commutators are found to be burnt or 'smoky'. It consists of a jumper or connector across the brush leads from the field coil assemblies, which equalizes the load on the ungrounded brushes.

INSTALLING EQUALIZER:—Disassemble starter and remove armature. Install Equalizer on commutator end of field coil assembly, looping ends of Equalizer in grooves formed by the looping of the field coil ribbon end around the brush pigtail. Solder Equalizer ends securely in place, using a non-acid flux (alkaline paste or flux made of white rosin and denatured alcohol). Position Equalizer so that it does not touch starter frame or grounded brush pigtails. Turn down commutator and polish to remove all traces of burning before reinstalling. Equalizer type to be used on each starter model is as follows:

Starter Model	Equalizer Part No.
MAW (with switch terminal)	MAW-58
MAW (with terminal post)	MAW-59
MAX (all models)	MAX-58

TESTING INSTALLATION:—With starter reassembled see that Equalizer is not grounded at any point (frame, grounded brush pigtail, through-bolt, etc.). Check brush spring tension. See that brushes bear on commutator over entire face and are correctly installed (long side of brush should be toward direction of armature rotation). Bend grounded brush pigtails up so that they cannot touch Equalizer. Test starter for correct performance.

FIELD POLE ASSEMBLY:—The field poles used on these starters are formed with a long and a short tip. Viewed from the commutator end of the starter, the pole pieces should be installed with the short tip in a clockwise direction from the pole piece center line (see illustration).



DESCRIPTION:—This type starting switch is operated by the clutch pedal (clutch is disengaged to start engine), and uses a vacuum release and lock to prevent operation while the engine is running. The operating linkage must be adjusted whenever the clutch pedal is adjusted (see instruction below).

Car Model	Vacuum Control Type
Nash Six 1220 ('34), 3520 ('35)	VC-4002
Nash Ambass. Six, Model 3620 ('36)	VC-4002
Nash Adv. Eight 1280 ('34), 3580 ('35)	VC-4003
Nash Adv. Eight 1280 ('34), 3580 ('35) Export	VC-4002
Nash Ambass. Eight, 1290 ('34), 3680 ('36), 3780 ('37)	VC-4003
Nash Ambass. Eight, 3880 ('38), 3980 ('39)	VC-4003

OPERATION:—The switch is mounted directly on the starter field frame and is linked to the clutch throw-out shaft by a cable and pulley mechanism. When the clutch pedal is depressed, the cam 'A' is rotated, operating the switch lever 'C' through the latch 'B'. The latch will be engaged whenever the engine is not running. When the switch lever 'C' is rotated, the roller on the lower end of the lever depresses the switch upper contact arm and closes the starting switch contacts. As soon as the engine begins to fire, the intake manifold vacuum acts on the vacuum unit on top of the switch case, the diaphragm moving up and disengaging the switch latch. As long as the engine is running, the switch latch is held in this upper or disengaged position so that subsequent rotation of the switch cam (whenever the clutch is disengaged) does not operate the switch. When the engine is stopped, the return spring in the vacuum unit engages the switch latch.

Two springs are used on the switch operating lever rod. A return spring attached to the end of the control rod returns the switch operating lever and cable linkage to the 'off' position when the clutch is engaged. The control rod spring is designed to permit full travel of the clutch pedal after the starting switch contacts are closed. This spring is adjustable.

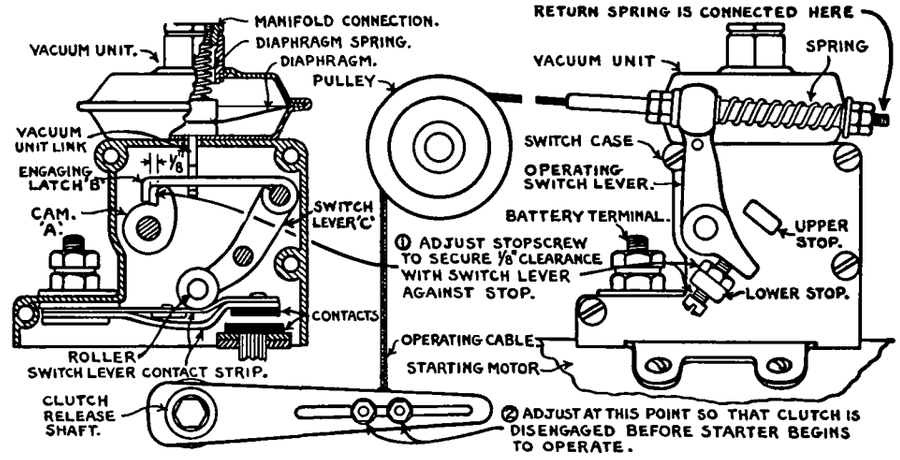
ADJUSTMENT:—The starting switch assembly should be adjusted as follows:

(1) Operating lever position. Adjust stop screw below operating lever so that switch lever is 5° plus or minus ½° past the vertical position with the lever against the stop screw. This setting can be checked by measuring distance from center of switch lever to edge of switch case (see illustration). This distance should be 1 19/32" with correct setting. Clearance between switch lever and upper stop lug must be at least 1/16" after initial contact is made on new switches.

(2) Control rod spring tension should be adjusted so that spring is not compressed more than ⅛" before starting to close switch contacts. This spring is compressed after switch contacts are closed to permit full clutch pedal travel. Check clutch pedal operation and see that spring is not compressed solidly under any conditions.

Adjust switch operating cable linkage so that switch is closed as soon as clutch is disengaged. Test as follows to determine if clutch pedal travel is too great, or if switch operates before clutch is disengaged:

(1) **Switch operates before clutch is disengaged.** Place car in gear. Do not turn ignition on. Slowly depress clutch pedal until starting switch closes. If car has a tendency to move, clutch is not fully released. Loosen cable clamp on switch lever on clutch throw-out shaft, move clamp toward shaft to decrease cable travel. Tighten clamp and repeat test.



(2) **Clutch pedal travel is excessive.** Place car in gear. Turn on ignition. Depress clutch pedal until switch contacts are closed and engine starts. Slowly release clutch pedal until clutch begins to engage (engine take hold), note clutch pedal travel. Correct by loosening cable clamp on switch lever on clutch throw-out shaft and moving clamp out or away from shaft to increase cable travel. All tests must be made with the switch operating lever return spring in place.

TROUBLE SHOOTING:—If switch action is unsatisfactory, check following points:

(1) **Engine does not start when clutch pedal is depressed.** Check starting motor cable and connections at switch and battery. See that switch operating lever return spring is in place. Check switch and operating linkage adjustment (see Adjustment above).

(2) **Switch operates whenever clutch is disengaged.** Check vacuum line and connections. Replace vacuum unit.

DESCRIPTION:—This is a solenoid type combined starting switch and pinion shift mounted on the starter field frame. The solenoid plunger is connected to the pinion shift lever by an adjusting stud and link so that the pinion is engaged and the switch contacts closed when the solenoid is energized. The solenoid is controlled by a relay in the solenoid case which is operated by a pushbutton on the instrument panel. Types used as standard equipment on current car models are as follows:

Car Model	Solenoid Starting Switch	Starter
Chrysler C-6 ('35) Export	SS-4101	MAX-4005
Chrysler C-7 ('36)	SS-4104	MAX-4016
Chrysler CZ ('35) Export	SS-4101	MAX-4005
Chrysler C-8 ('36)	SS-4106	MAX-4020
Chrysler C-1 ('35), C-9 ('36)	SS-4101	MAX-4003
Chrysler C10, C11 ('36), C15, C17 ('37)	SS-4101	MAX-4003
Chrysler C16 ('37) Export	SS-4104	MAW-4011
Chrysler C14 ('37) Export	SS-4104	MAX-4016
De Soto SF ('35) Export	SS-4101	MAX-4005
De Soto SG ('35)	SS-4101	MAX-4003
De Soto S-1 ('36) Export	SS-4104	MAX-4016
De Soto S-2 ('36)	SS-4104	MAX-4016
De Soto S3 ('37) Export	SS-4104	MAW-4011
Dodge DU ('35) Export	SS-4101	MAW-4004
Dodge D2 ('36), D5 ('37) Export	SS-4104	MAW-4011
Plymouth PJ ('35) Export	SS-4101	MAW-4004
Plymouth P3, P4 ('37) Export	SS-4104	MAW-4011
1938-39 Car Models		
Chrysler C18 (1938), C22 (1939)	SS-4206	MAX-4020-A
Chrysler C19 (1938)	SS-4203	MAX-4037
Chrysler C20 (1938)	SS-4208	MAX-4038
Chrysler C23, C24 (1939)	SS-4206	MAX-4037
DeSoto S5, Dodge D8, Plymouth P5, P6, Export models (1938)	SS-4203	MAW-4011-A

OPERATION:—The feed wire for the starting pushbutton is normally connected to the ignition switch (or switch side of gasoline gauge) so that the starter can be operated only when the ignition is turned 'on'. The closing of the pushbutton contacts completes the solenoid relay circuit, energizing the relay and closing the relay contacts. This completes the solenoid circuit, allowing a current flow of approximately 65 amperes through the two (series and shunt) coils of the solenoid. The solenoid plunger is drawn into the solenoid coil, engaging the starter pinion with the flywheel and closing the main starting switch contacts. The series coil is short-circuited when the switch contacts close (being connected across the contacts), but a current of approximately 15 amperes continues to flow through the shunt coil which holds the plunger in so that the pinion remains in mesh and the switch contacts closed while the starter is cranking the engine. When the pushbutton is released, the solenoid relay circuit is broken, the relay contacts open, breaking the solenoid circuit, and interrupting the current flow through the shunt coil. The return spring on the shift lever then disengages the pinion from the flywheel and the starting switch contacts open.

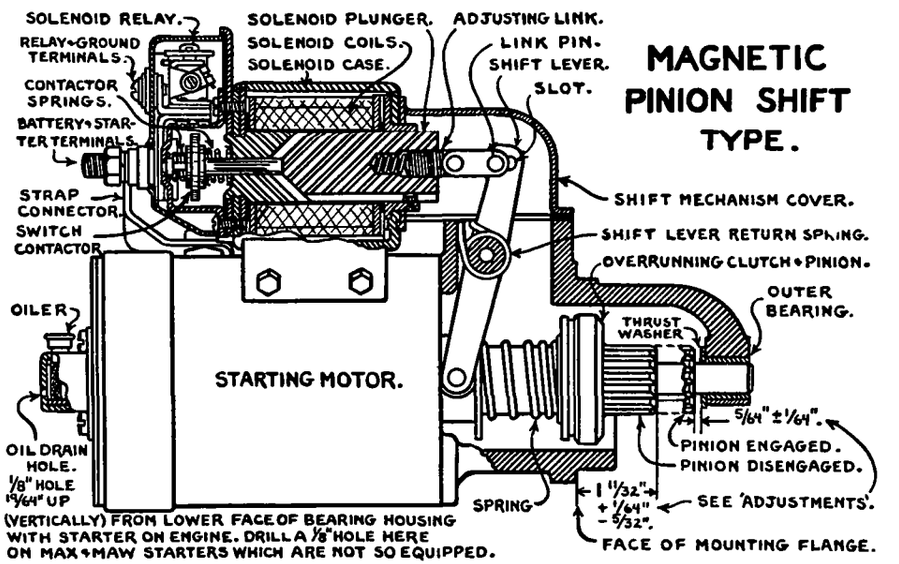
An overrunning clutch is built into the starter pinion to prevent the starter being driven by the engine after the engine begins to fire and before the pushbutton is released. A spring between the shift lever collar on the armature shaft and the overrunning clutch housing is provided to assist in meshing the pinion.

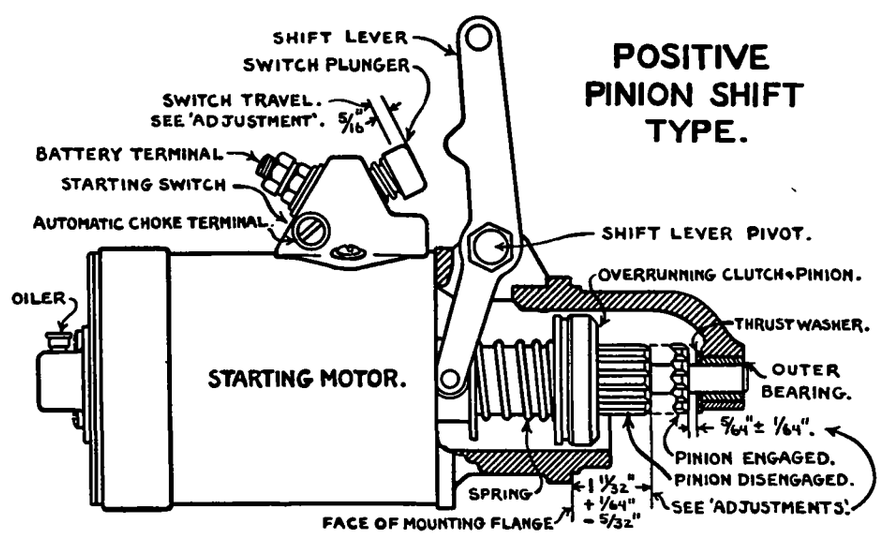
ADJUSTMENT:—The position of the pinion at rest or with the starter not operating and the clearance of the pinion when fully meshed should be checked as follows:

Pinion Position when Disengaged:—The distance from the mounting face of the pinion housing (face of starter mounting flange) to the outer face of the pinion should be 1 11/32" plus 1/64" or minus 5/32". The pinion should be meshed with the flywheel teeth to a depth of 33/64" when the starting switch contact is made (operate shift by hand by pressing on the end of the plunger—do not press on shift lever) and a further movement of approximately 3/16" is required to bottom the plunger in the core. See paragraph below for adjustment.

Pinion Clearance when Engaged:—With the plunger bottomed in the core, the clearance between the outer face of pinion and the thrust washer next to the outer pinion bearing should be 5/64" plus or minus 1/64". To check this clearance, press in on the plunger by hand until it bottoms (do not press on shift lever or pinion) or disconnect strap connector to starter terminal so that starter will not spin and connect battery to solenoid relay terminal and ground on starter field frame. Current flow through shunt coil will hold plunger in while adjustment is being made. Take out pin connecting shift lever and plunger link, turn adjusting stud in or out of plunger until pin can just be inserted with pinion in correct position. Pin should be against the solenoid end of the slot in the upper end of the shift lever. The endplay in the linkage provided by the slot is necessary for correct operation and should not be taken up by pressing on the shift lever or the pinion.

Starter Armature Endplay—Armature endplay must be held within limits of .005-.030". Adjust by using thrust washers (Part MU-54) between the thrust washer and the commutator end plate.





SPECIFICATIONS:—Solenoid—The pull of the solenoid plunger with the solenoid coils energized should be 45 lbs. with plunger ¾" from end of stroke bottomed in core), or 105 lbs. with plunger ⅜" from core with a current draw of 65 amperes. The pull with the plunger bottomed should be 80 lbs. with a current draw of 15 amperes at 6 volts (shunt coil only—series coil short-circuited with starting switch contacts closed). Current draw for the coils is shown below. NOTE—On '4200' Series, plunger pull should be 170 lbs. (⅜" gap), 40 lbs. (¾" gap), 75 lbs. (0" gap). All other specifications are same for both '4100' and '4200' series.

Coils	Minimum — Amperes — Maximum		Volts
Both Coils	34	38	3
Shunt Coil only	14	16	6

Solenoid Relay:—Relay is built in solenoid case at starting switch end. Performance should be as follows:

Contacts Close—3.5-4.5 volts. Adjust by changing position of armature upper stop (contact gap adjustment). Increase gap to increase operating voltage or decrease gap to decrease voltage.

Contacts Open—1.5-2.5 volts. Adjust by changing armature spring tension. Increase spring tension to increase operating voltage or decrease spring tension to decrease voltage.

Contact Gap—.025-.030". Adjusted by changing position of armature upper stop (see closing adjustment above).

Air Gap—.005-.007" with contacts closed. Adjusted by changing position of lower armature stop.

Coil Resistance—7.5-8.3 ohms at 77°F.

POSITIVE PINION SHIFT TYPE

DESCRIPTION:—This is a manually operated pinion shift and starting switch. Starting switch is mounted on the starter field frame and the switch plunger is depressed by a knob on the shift lever after the pinion has been meshed with the flywheel. It is used as standard equipment on current car models as follows:

Car Model	Starting Switch	Starter
Chrysler C-6 ('35)	SW-2813	MAX-4002
Chrysler CZ ('35)	SW-2813	MAX-4002, 4
Chrysler C16 ('37)	SW-2813	MAW-4010
Chrysler C14 ('37)	SW-2813	MAX-4015
De Soto SF ('35)	SW-2813	MAX-4002
De Soto S-1 ('36)	SW-2813	MAX-4015
De Soto S3 ('37)	SW-2813	MAW-4010
De Soto S5 ('38)	SW-2813	MAW-4010
De Soto S6 ('39)	SW-2813	MAW-4016
Dodge DU ('35)	SW-2813	MAW-4003
Dodge DV Canadian ('35)	SW-2677-A	MAW-4002
Dodge D2 ('36), D5 ('37)	SW-2813	MAW-4010
Dodge D8 ('38)	SW-2813	MAW-4010
Dodge D11 ('39)	SW-2813	MAW-4016
Plymouth PJ ('35)	SW-2677-A	MAW-4002
Plymouth P1, P2 ('36), P3, P4 ('37)	SW-2677-A	MAW-4009
Plymouth P5 ('38)	SW-2677-A	MZ-4056
Plymouth P6 ('38)	SW-2677-A	MAW-4009
Plymouth P7, P8 ('39)	SW-2813	MZ-4062
Plymouth P7, P8 Canada ('39)	SW-2813	MAW-4016
Studebaker Dict. 5A, 6A ('37)	SW-2677-B	MAX-4028**

(**)—This starter used on first 15,000 cars only. Model MAX-4019 with Bendix drive used on later cars.

OPERATION:—The shift lever is connected through a linkage to the starting pedal in the driving compartment and is operated by depressing the pedal. A spring located on the shaft between the shift lever collar and the starter pinion permits movement of the lever in case the starter pinion and flywheel teeth strike. When the switch is closed and the armature begins to turn, the spring then meshes the pinion. Normally this spring will not be compressed and the switch will not be closed until the pinion is meshed in the flywheel to a depth of 33/64" (see adjustments below). An overrunning clutch is built into the starter pinion to prevent the starter being driven by the engine after the engine begins to fire. When the starting pedal is released, the pinion is pulled out of mesh by the shift lever return spring and the starting switch contacts are opened by the spring on the plunger.

ADJUSTMENTS:—Pinion Position when Disengaged—The distance from the outer face of the pinion housing (face of starter mounting flange) to outer face of pinion should be 1 11/32" plus 1/64" or minus 5/32". The pinion should be meshed with the flywheel teeth to a depth of 33/64" when the starting switch makes contact. See paragraph below for adjustment.

Pinion Clearance when Engaged—With shift lever at end of travel clearance between outer face of pinion and thrust washer next to outer pinion bearing should be 5/64" plus or minus 1/64". Adjust by pressing down on spring on switch plunger and turning button at outer end of plunger in or out. The button is locked by the end of the spring.

Switch Travel—The stroke or travel of the switch plunger should be approximately 5/32" (see paragraph above).

Starter Armature Endplay—Armature endplay must be held within limits of .005-.030". Adjust by using thrust washers (Part MU-54) between thrust washer and commutator end plate.

DESCRIPTION:—The Starterator consists of a mechanism by which the accelerator pedal is connected to the starter switch operating linkage (with the engine stopped) so that pressing down on the accelerator pedal starts the engine. It is entirely automatic in operation and is engaged by a spring whenever the engine stops and the accelerator is released. After the engine has been started, the linkage is disengaged by the vacuum of the intake manifold and is held out of engagement as long as the engine is running.

OPERATION:—The starter control fork, which is pivoted on the end of the cross shaft, is operated by a rod connected to the vacuum unit mounted on the right hand end of the cross shaft support bracket. With the engine stopped, when there is no vacuum in intake manifold, the vacuum unit diaphragm will be pushed to the left by the spring in the vacuum unit. The connecting rod will force the control fork to the left so that it engages the slot in the accelerator pedal linkage. When the accelerator pedal is pressed (after the ignition has been turned on), the rotation of the cross shaft caused by the movement of the control fork will depress the starter switch mounted on the starter field frame (through the switch linkage), closing the switch and allowing the starter to crank the engine. As soon as the engine begins to fire, the vacuum in the intake manifold will draw the vacuum unit diaphragm to the right, disengaging the control fork from the accelerator linkage. This allows the starter switch return spring to open the switch and the starter Bendix pinion is automatically disengaged from the flywheel. As long as the engine is running the control fork will be held out of engagement by the vacuum unit so that the accelerator pedal controls the carburetor throttle in the usual manner. Whenever the engine is stopped or stalls, the control is automatically engaged.

ADJUSTMENT (1933-35):—Starterator should not require attention. However if new parts are installed or Starterator does not operate satisfactorily the following points should be checked and the adjustments correctly made:

1. Clearance between Control Fork and Floor Boards. Clearance between control fork and floor board should be ⅛ inch. To adjust, take up floor board and install special gauge in toe board anchor nut holes. Loosen check nut and turn adjusting screw on starter link arm at vacuum unit end of Starterator until control fork just touches gauge. Tighten check nut. This will give the required ⅛ inch clearance.

2. Control Fork at right angles to Cross Shaft. If the control fork is not at right angles to cross shaft, loosen check nut on left hand side of control fork and turn adjusting screw until angle between control fork and adjusting shaft is exactly 90°. Tighten check nut.

3. Clearance between face of Control Fork and Accelerator Rod. Clearance between the face of the starter control fork and the accelerator rod must be ⅛ inch. To adjust, disassemble the accelerator rod from the accelerator bell crank on the side of the engine, loosen the lock nut on the yoke end of the accelerator rod and adjust the length of the rod so clearance between rod and face of control yoke is ⅛ inch when accelerator rod is connected to bell crank with bell crank in idle position. Tighten lock nut on accelerator rod at yoke to hold adjustment.

4. Clearance between Starter Link and Switch. Clearance between the end of the starter link and the starter switch must be 5/16 inch. If this distance is greater than 5//16 inch, a special adjusting spring should be snapped in place below the link.

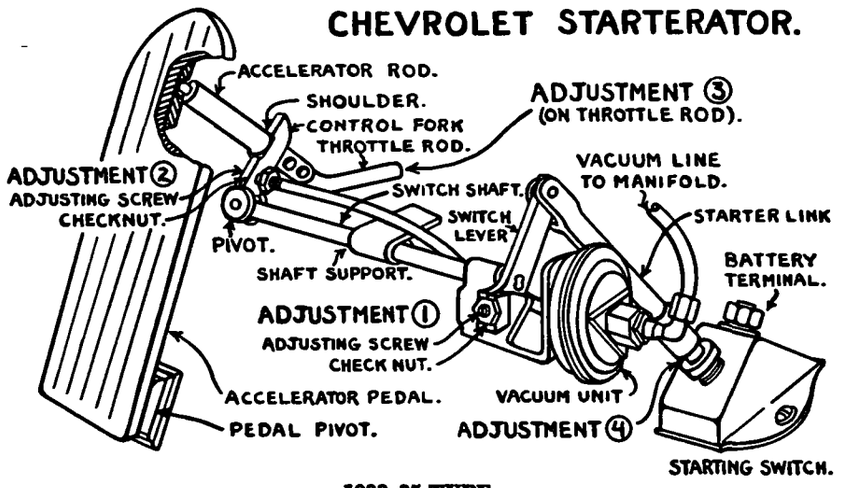
ADJUSTMENT (1936-37):—Check following points and make adjustments in the order shown. Engine must not be running when adjustments are made.

1. Control Fork and Toeboard Clearance—Should be ¾". To adjust, loosen locknut on adjusting screw on bracket at right hand end of control shaft (screw serves as stop for control shaft lever), turn adjusting screw. Tighten locknut after making adjustment.

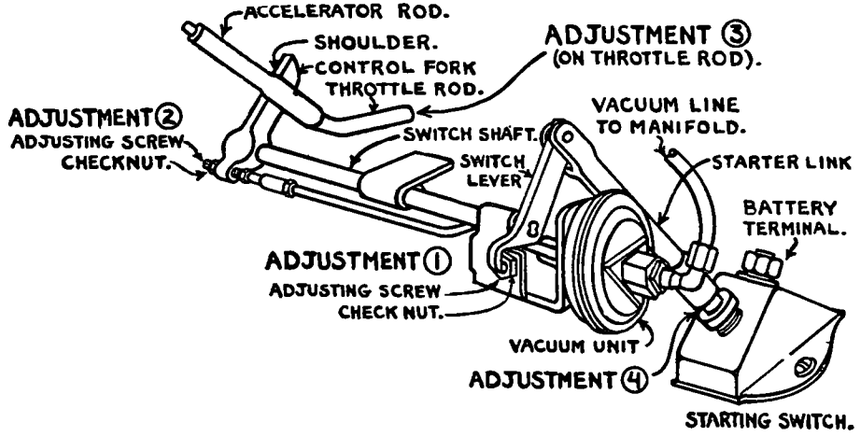
2. Control Fork Angle—Loosen locknut on end of control fork operating rod (at control fork), turn adjusting screw until fork is ⅛" to the right of a right-angle position on the rod. Tighten locknut.

3. Control Fork and Accelerator Rod Clearance—Clearance between top of notch in accelerator rod and control fork should be ⅛" (necessary for correct throttle opening when starting). To adjust, disassemble accelerator rod from bellcrank on left side of engine, loosen locknut on clevis end of rod, turn clevis in or out on rod, tighten locknut, re-connect rod and check clearance.

4. Starter Link and Switch Clearance—Clearance between shoulder on starter link (pushrod connected to starterator lever) and switch button should be ⅜-½". To adjust, add or remove snap rings on link shaft between shoulder and button.



1933-35 TYPE



1936-37 TYPE

NOTE—This type switch used on the following car models.

Car Model	Control (Dash) Switch	Magnetic Switch
Chevrolet (1933-36) Export	1378	1503
Chevrolet (1937) Export	1378	1528
Packard Six 115C (1937)	1417	1539
Packard Super 8, 1500, 1, 2 ('37)	—	1540
Packard 12, 1506, 7, 8 ('37)	—	1541
Packard Six, 1600 ('38), 1700 ('39)	—	1539
Pontiac 601 (1933)	1379	1503
Pontiac 605 (1934) First cars	1379	1503
Pontiac 36-26A, B ('36), 37-26CA ('37) RHD	1588 (See Note)	1528
Pontiac 38-26DA ('38)	1605 (See Note)	1528

NOTE—Type 1588 and 1605 control switches are Vacuum Type with accelerator pedal control for automatic starting. See preceding article for Vacuum Switch data.

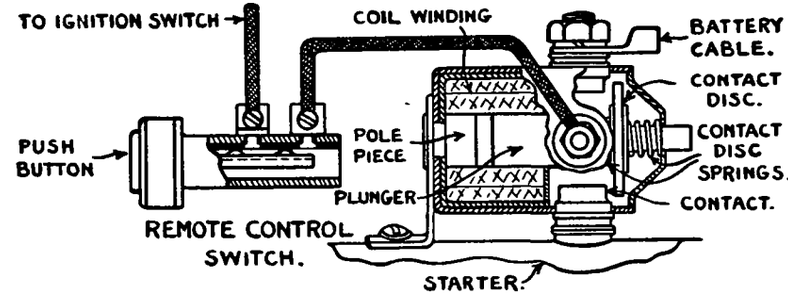
DESCRIPTION:—This model is a magnetic switch mounted on the starter field frame. It is used in connection with a Bendix drive and does not include the pinion shifting mechanism of the previous models. It is operated by a 'remote control switch' or push-button starting switch connected to the ignition switch so that the starter may only be operated with the ignition turned on.

OPERATION:—Switch has two windings (pull-in coil, and hold-in coil) both connected to the switch terminal. Both coils are energized when the starting button circuit is closed so that a strong 'pull-in' action results. When the main switch contacts close, the pull-in coil is short-cricuited and the contact disc is held in by the hold-in coil only. Contact disc is returned to off position by the spring when the starting button is released.

PERFORMANCE DATA:—Switch current draw is 3.1-3.7 amperes at 4.0 volts. Switch contacts should remain closed with current of .54-.65 amperes at .7 volts.

ADJUSTMENT:—This model requires no adjustment.

TYPE 1503 SOLENOID SWITCH



MODEL 1550 SELECTOR (DE SOTO AND CHRYSLER, 1933)

DESCRIPTION:—This Selector consists of a selective clutch by means of which the accelerator pedal is connected alternately to the starting pedel linkage (with the engine stopped) or to the carburetor throttle linkage (with the engine running. The operation is entirely automatic and employs a vacuum unit operated by the intake manifold vacuum. The unit is mounted on the engine side of the dash directly above the starter so that there is 1/16-⅛ inch clearance between the starting pedal on the unit and the pinion shift lever roller on the starter. The vacuum control unit is mounted on one end of the selector and is connected to the selector clutch plate assembly by a linkage within the selector case. The clutch plate is free to slide on the splined end of the selector shaft, which is linked to the accelerator pedal. In the inner position (vacuum unit not operating) a tang on the clutch plate engages with a tang on the starting pedal so that movement of the accelerator pedal operates the starter. In the outer position (vacuum unit opeerating as a result of vacuum in intake manifold) a tang on the clutch plate engages a tang on the throttle plate, which is connected to the throttle shaft running through the selector shaft (with the throttle lever connected to the carburetor throttle mounted on the other end) so that the accelerator pedal controls the carburetor throttle in the usual manner.

OPERATION:—When the accelerator pedal is depressed, with the engine stopped and ignition turned 'On', the starting pedal will rotate during the first 12° of movement. During the remainder of the accelerator pedal movement all the levers will move together so that the throttle is opened, the starter pinion meshed with the flywheel, and the starting switch closed, allowing the starter to crank the engine. As soon as the engine begins to fire, the accelerator pedal should be released momentarily to relieve the pressure on the selector clutch. The vacuum unit will then declutch the starter pedal and the return spring will demesh the starter pinion and open the starter switch. The accelerator pedal will then control the carburetor throttle in the usual manner as long as thte engine is operating. The vacuum unit will hold the starter out of engagement under all conditions of engine operation. If the engine stalls, the accelerator pedal should be released so that the selector clutch can engage the starting pedal. When the engine is stopped the lack of vacuum disengages the clutch plate from the tang on the throttle plate so that the accelerator lever returns to the starting position. It should be kept in mind that there are two 'closed throttle positions' of the accelerating lever, an 'idling' position with vacuum unit operative, and a 'starting' position with vacuum unit not operative.

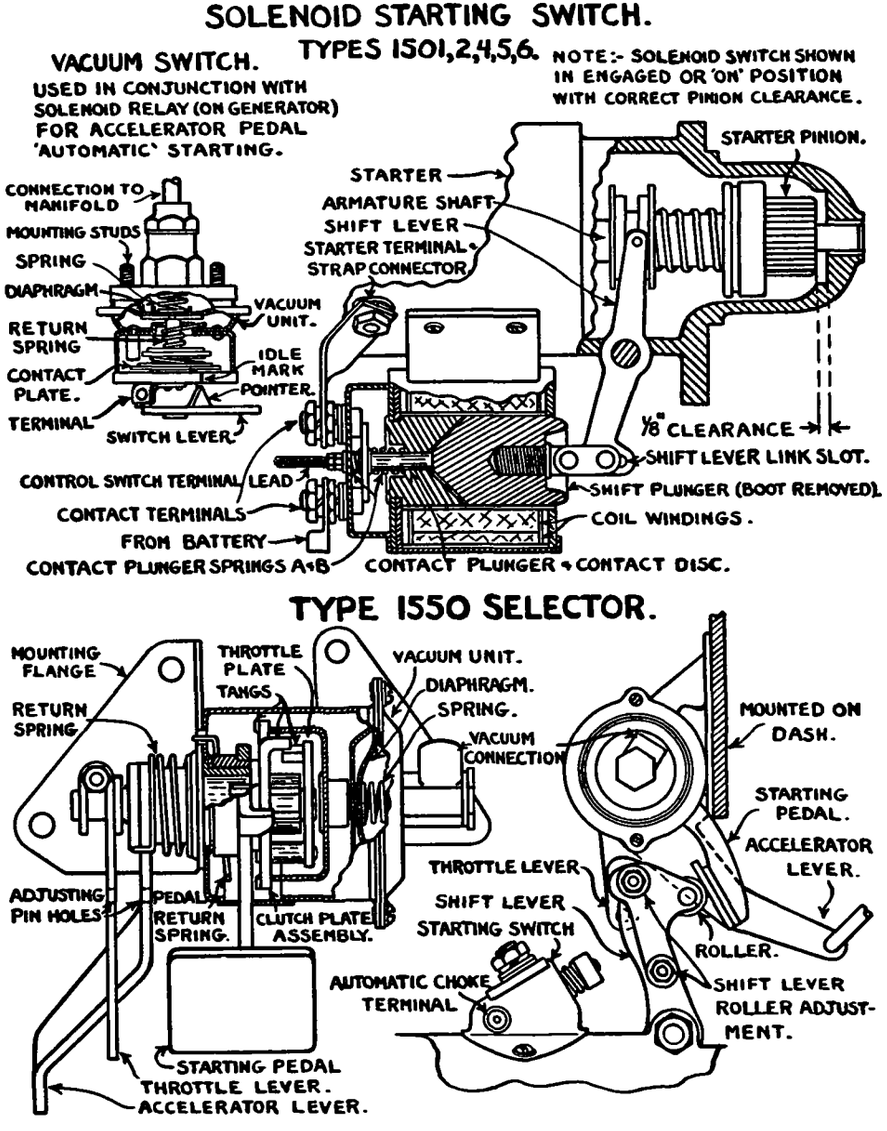
ADJUSTMENT:—Starting Pedal. The roller on the pinion shift lever plate must be directly opposite the center of the starting pedal and there must be 1/16-⅛ inch clearance between the roller and the pedal with the starter inoperative. To adjust, loosen two bolts mounting the plate on shift lever, this will allow plate to be moved up and down and toward the pedal.

Throttle Lever. There are holes drilled through the accelerator lever and throttle lever on the Selector to maintain the alignment while adjusting the carburetor. The throttle lever linkage should be disconnected and a steel pin passed through these holes (a 5/16" drill may be used on the De Soto). With the carburetor correctly adjusted, adjust linkage so that throttle lever may be connected without disturbing position. Remove pin.

De Soto Data. After adjusting as directed in preceding paragraph, check by operating starter with ignition turned 'Off'. While cranking, the clearance between the idle adjustment screw and the stop on the carburetor should be 5/16 inch, corresponding to 1/3 throttle. Then turn ignition 'On' and start engine. With the accelerator pedal depressed, turn ignition 'Off' and depress accelerator pedal as far as possible. With accelerator pedal in this position see that throttle lever on carburetor is wide open and that clearance between accelerator pedal and floor boards is sufficient so that there is no interference. If throttle opening while cranking is more than 1/3, lengthen the adjustable link on the throttle lever of the Selector. If throttle opening is less than 1/3, the link should be shortened.

Assembly of Vacuum Unit. Vacuum unit diaphragm is connected to the clutch yoke hub by means of an adjustable stud. In assembling the unit, turn the entire unit in a clockwise direction until it is tight (farthest position). Then back assembly off until corfrect position as indicated by cover mark is reached. This must be at least ¼ turn; if less than ¼ turn, back off another complete turn. This will insure sufficient clearance within unit to prevent binding.

All vacuum connections must be tight and there must be no leaks in vacuum lines. This is very important. Also check all linkage for sufficient clearance to prevent interference or binding.



MODELS 1502 (BUICK 50, 1933), 1501 (BUICK 60, 80, 90, 1933)

MODEL 1501 (STUTZ MODELS SV-16, DV-32, 1933-34-35)

DESCRIPTION:—The solenoid switch, mounted rigidly on the starter field frame, consists of a pointed end plunger which is free to move within a double coil winding and is linked to the pinion shift lever. The pinion shifting linkage is similar to other Delco-Remy installations and the starter drives through an overrunning clutch. One end of the coil winding is connected to the small terminal on the end of the unit. This terminal is connected through the 'remote control switch' or push-button starting switch to the coil side of the ignition switch so that the control is operative only with the ignition turned 'On'. The other end of the coil winding is grounded. The two large terminals on the end of the unit are the starting switch contact terminals and are connected to the battery and the starting motor (through a strap connector).

OPERATION:—When the remote control switch is pressed with the ignition turned 'On' the solenoid is energized and the plunger is drawn into the coil. This causes the shift lever to mesh the pinion with the flywheel. The pointed end of the plunger then presses on the end of the contact plunger, forcing the contact disc against the starting switch terminal contacts and completing the starting circuit. This permits the starting motor to crank the engine. The movement of the contact disc toward the contacts compresses the contact plunger spring 'A' in front of the disc and when the disc stops against the contacts the further movement of the contact plunger compresses the spring 'B' on the contact plunger shaft in back of the contact disc. These springs insure a good contact between the contact disc and the terminal contacts and instantly break the circuit by movement of the disc when the remote control switch is released. The second coil winding is designed to instantly neutralize the magnetic field of the coil when the coil circuit is opened and allows the return spring on the shift lever to quickly demesh the pinion.

If the starting motor stalls for any reason when cranking the engine, the pinion will be held in mesh by the pressure between the teeth of the pinion and the flywheel, but as soon as the remote control switch is released the contact plunger spring 'A' will move the contact disc away from the contacts, forcing the plunger back the distance of the slot in the linkage. The opening of the starting motor circuit by this movement of the contact disc will relieve the pressure on the pinion teeth and permit the return spring to demesh the pinion.

ADJUSTMENT:—There is only one adjustment on the solenoid switch. With the solenoid plunger bottomed in the coil, the clearance between the end of the pinion and the starting motor drive housing must be ⅛ inch. This adjustment is made by taking out the pin in the linkage which passes through the shift lever slot and turning the stud in the plunger in or out until the correct setting is secured. In making this adjustment the starter should be off the car and the plunger must be held in position in the coil, preferably by the magnetic attraction of the coil. First, disconnect the starting motor from the solenoid switch by taking off the strap connector, close the circuit between the control terminal on the switch and the battery and press the plunger in until it is held in position by the coil. Then take out the linkage pin, position the pinion so that there is exactly ⅛ inch clearance between the end of the pinion and the housing, turn the adjusting stud in the plunger until the pin can be inserted in the slot in the shift lever so that it bears against the rear end of the slot (see illustration) without disturbing the position of the shift lever or the plunger.

MODELS 1504, 1505, 1506 (CHRYSLER, DE SOTO, DODGE, 1933)

DESCRIPTION:—These solenoid switch units are exactly the same as the units used on the Buick models insofar as the construction, mounting and adjustment of the unit is concerned. The control, however, is automatic, employing a vacuum switch and solenoid relay instead of the 'remote control switch' or push-button. The vacuum switch is connected to the accelerator pedal linkage so that depressing the accelerator pedal (with the engine stopped) serves to start the engine. The vacuum switch is held open by the intake manifold vacuum and a latch is used so that the switch is inoperative while the engine is running even at full throttle with consequent low manifold vacuum. The relay solenoid on the generator also holds the control circuit open as long as the generator is operating and acts as an auxiliary control device. Either unit will control the solenoid switch independently in case of failure of the other unit. The control circuit is connected to the ignition switch so that the starter may be operated only with the ignition turned 'On'.

OPERATION:—Vacuum Switch. The vacuum switch lever is connected to the accelerator pedal linkage so that the switch lever is rotated whenever the accelerator pedal is depressed. With the engine stopped, when there is no vacuum in the manifold, the contact plate and contact surface in the switch will be pressed together by the switch spring. When the accelerator pedal is depressed with the ignition turned on, the rotary movement of the switch lever will complete the circuit through the switch, energizing the solenoid switch and allowing the starting motor to crank the engine. When the engine begins to fire, the vacuum in the manifold will cause the vacuum switch diaphragm to open the switch circuit and latch the contact plate in the running or 'Open' position so that the control circuit is open and subsequent movement of the accelerator pedal will have no 'starting' effect as long as the engine is running. If the engine stalls with the car 'free-wheeling' and the accelerator pedal in 'closed throttle' position, the contact plate will be unlatched so that the next movement of the accelerator pedal will crank the engine. If the starting motor stalls while cranking the engine, releasing the accelerator pedal will open the vacuum switch circuit and allow the return spring to demesh the starter pinion in the usual manner.

Solenoid Relay. The solenoid relay is built in the cut-out relay case on the generator field frame. The current from the vacuum switch flows through the solenoid relay winding to ground through the generator. This energizes the relay, closes the relay contacts, and allows current from the battery to flow to the coil winding of the solenoid switch (see illustration of wiring). The solenoid relay contacts close at 3.2 volts max. and will remain closed while cranking until the battery voltage drops to 2.0 volts or less. As soon as the engine fires and the generator voltage builds up so that the difference between the generator voltage and battery voltage is less than 2.0 volts the solenoid relay contacts open. If the engine stalls and the generator voltage drops to zero the closing of the vacuum switch contacts by the movement of the accelerator pedal will again energize the solenoid relay.

ADJUSTMENT:—The adjustment of the solenoid switch mounted on the starter is same as given for Buick models (above). In addition, the Vacuum Switch and Solenoid Relay will require adjustment.

Vacuum Switch. There is a pointer on the vacuum switch lever which should be directly opposite the white line on the switch case with the throttle closed, or in idling position. To make this adjustment, first adjust carburetor for correct idling setting, then disconnect switch linkage and adjust so that pointer on lever is opposite line on switch case. See that all vacuum connections are tight and that there are no leaks in vacuum line to manifold. Any leakage will interfere with correct operation of the switch.

Solenoid Relay. Contact gap of solenoid relay should be .030-.045 inch. Air gap should be .010-.014 inch with contacts closed. Contacts should close at 3.2 max. and open at 2.0 volts or less. See that all connections are tight and check generator performance.

Std. Equipment On:

Car Model	Year	Solenoid Switch	Starter	Pushbutton Switch
Solenoid Switch with Pushbutton Control				
Cadillac V8	(1934-35)	1514, 1521	728-U	1379
Cadillac V8 RHD	(1934-35)	1519	728-V	1379
Cadillac V-12	(1934-35)	1515	580	1379
Cadillac V16	(1934-36)	1515	580	1379
Cadillac V8, Series 60	(1936)	1512	727-V	1405
Cadillac V8, 60 (RHD)	(1936)	1532	729-C	1405
Cadillac V8, 70, 75	(1936)	1512	727-V	1407
Cadillac V12, 80, 85	(1936)	1515	580	1407
Cadillac V12 (RHD)	(1936)	1515	SM-1748	1407
Cadillac 37-60	(1937)	1542	727-V	1389
Cadillac 37-60 (RHD)	(1937)	1542	729-F	1389
Cadillac 37-65, 70, 75	(1937)	1542	727-V	1407
Cadillac V12 37-85	(1937)	1515	580	1407
Cadillac V16 37-90	(1937)	1515	580	1379
Cadillac V8, 60, 60S, 65, 75	(1938)	1542	727-V	1996001
Cadillac V8, 60 RHD	(1938)	1542	1110604	1996001
Cadillac V16, 38-90	(1938)	1555 (x)	714	1996001
Cadillac V8, 60S, 61, 75	(1939)	1542	1107912	1996003
Cadillac V8, 60S RHD	(1939)	1542	1107911	1996003
Cadillac V8, 61 RHD	(1939)	1542	1107913	1996003
Cadillac V16, 39-90	(1939)	1555 (x)	714	1996003
Chrysler CW, CW*	(1934-35)	1518	728-W	1394
Chrysler C2, C3	(1935)	1516	727-J, L	
De Soto SE	(1934)	1516	727-L	1387
Graham 68, 67, 69	(1934)	1517	734-U	1388, 1386
Graham 90, 90-A, 110	(1936)	1515	738-X	1388
Graham 95, 116, 120 (RHD)	(1937)	1516	738-X	1388
Graham 96, 97 Exp.	(1938-39)	1546	738-X	
La Salle 350, Series 50	(1934-35)	1514	727-N	1379
La Salle 36-50	(1936)	1516	727-N	1405
La Salle V8 37-50	(1937)	1542	727-V	1389
La Salle V8 37-50 (RHD)	(1937)	1542	729-F	1389
La Salle V8, 38-50	(1938)	1542	727-V	1389
La Salle V8, 38-50 Exp.	(1938)	1542	1110604	1389
La Salle V8, 39-50	(1939)	1542	1107912, 13	1996003
Oldsmobile L-34	(1934)	1514	727-H	1385, 1389
Pontiac 6, 39-25, 39-26 Exp.	(1939)	1546	727-S	1996004
Studebaker Pres. 3C	(1937)	1516	729-G	R.B.M.1875
Studebaker Pres. 4C	(1938)	1546	1107903	
Studebaker Pres. 5C	(1939)	1546	1107903	Doug. #5701

(x) Solenoid Relay 268-M mounted separately on right side of dash.

Car Model	Year	Solenoid Switch	Starter	Vacuum Switch
Solenoid Switch with Vacuum Switch Control				
Buick 34, 35, 36-40	(1934-35-36)	1512	734-Z	1594
Buick 34, 35-50	(1934-35)	1513	727-G	1587
Buick 34, 35-60, 90	(1934-35)	1512	727-F	1587
Buick 36-60, 80, 90	(1936)	1512	727-W	1601
Buick 36-60, 80, 90 (RHD)	(1936)	1530	729-B	1601
Buick 37-40	(1937)	1542	734-Z	1607
Buick 37-60, 80, 90	(1937)	1542	727-W	1607
Buick " (Marvel Carb.)	(1937)	1542	727-W	1594
Buick 37-60 (RHD)	(1937)	1545	729-B	1607
Buick 38-40	(1938)	1542	734-Z	①1868512
Buick 38-60, 80, 90	(1938)	1542	727-W	①1868512
Buick 38-60, 80, 90 (RHD)	(1938)	1545	729-B	①1868512
Buick 39-40	(1939)	1542	1107005 ①	Carter 192-10U
Buick 39-60, 80, 90	(1939)	1542	1107908	①1990126
Buick 39-60, 80, 90 (RHD)	(1939)	1545	1107909	①1990126
Chrysler CU, CV	(1934)	1516	727-J	1592
Graham 72, 75	(1935)	1517	734-U	1600
Graham 72, 75 (RHD)	(1935)	1512	738-A	1600
Pontiac 603	(1934)	1513	738-B	1588, 1593
Pontiac 701A, B (RHD)	(1935)	1516	727-S	1588
Pontiac 605, 36-28	(1935-36)	1516	727-S	1588
Pontiac 37-28CA	(1937)	1516	727-S	1605
Pontiac 38-28DA	(1938)	1546	727-S	1605

① Vacuum switch is mounted on carburetor. See following articles for data.

NOTE:—On the first Buick models in 1934, equipped with a Type 264-H Cut-out Relay (and Horn Relay), the starter solenoid lead was connected to the generator terminal of the relay and grounded through the generator. On later cars the Type 264-H Cutout Relay was superseded by Type 264-K, which has the extra ground contacts mounted on the cut-out relay armature. On this type the solenoid lead was connected to the extra terminal (this type has six terminals instead of five, used on Type 264-H).

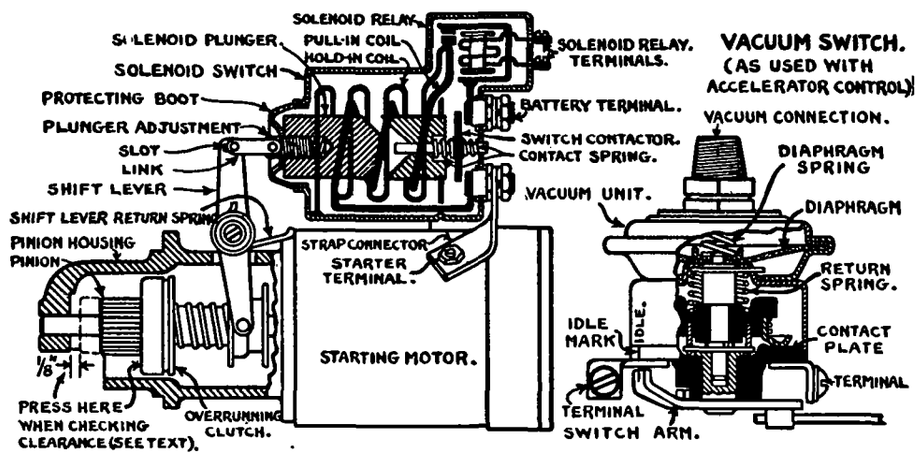
On both the pushbutton type and vacuum switch control type, the relay circuit is grounded in one of three ways:

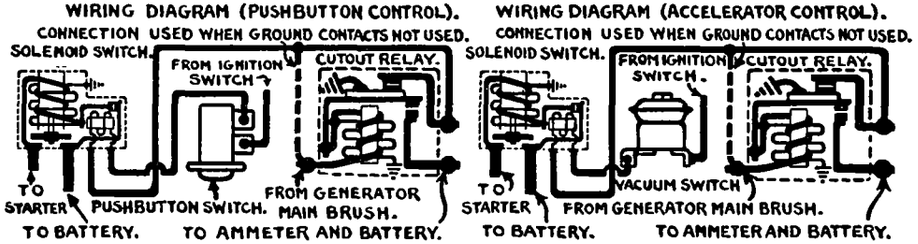
(1) Directly to the starter field frame.

(2) Through the generator main brushes (connected to generator terminal of cutout relay).

(3) Through special auxiliary contacts mounted directly above cutout relay armature (these contacts open when main contacts close).

See individual car wiring diagrams for circuit used on each car model.





DESCRIPTION:—This solenoid type switch is a combined pinion shift and starting switch. The design is the same as used in 1934 except that the solenoid relay terminals are now located on the side of the solenoid case instead of on the end of the case above the starting switch contacts.

OPERATION:—When the pushbutton switch is closed, or the accelerator pedal is depressed (vacuum switch type), with the ignition turned on, the solenoid relay circuit is completed, energizing the relay and closing the relay contacts. This completes the solenoid circuit. The solenoid plunger is drawn into the coil, meshing the starter pinion, and closing the starting switch contacts. When the engine begins to fire, the solenoid relay circuit is broken in one or more of the following ways:

(1) Operation of the vacuum switch. Caused by the vacuum built up in the intake manifold.

(2) By the rise in generator voltage. Where solenoid relay is grounded through generator main brushes or auxiliary contacts in cutout relay, the voltage built up by the generator opposes the current flow through the solenoid relay winding.

(3) By releasing the pushbutton switch. On De Soto, Graham, and other installations where solenoid relay is grounded directly to starter field frame, the circuit will not be broken until the pushbutton is released.

(4) By the opening of the ground contacts. Where solenoid relay is grounded through auxiliary contacts in cutout relay, these contacts open when generator begins to charge and main contacts close.

When the solenoid relay circuit is broken, the relay contacts open, breaking the solenoid circuit. The starting pinion is demeshed by the shift return spring and the starting switch contacts are opened by the contact spring.

1939 OVERRUNNING CLUTCH & PINION DESIGN:—Not interchangeable with previous models and may be identified by groove cut in pinion teeth approximately ⅛" from clutch shell. Clutch cam is now mounted on pinion and clutch collar (with plungers and springs) is mounted on sleeve and collar assembly (reversed from previous design). Serviced in same manner as previous types.

PERFORMANCE: The solenoid should close (bottom in core) against a pull of 70 pounds when the gap is ½ inch. Current draw should be 65-71 amperes at 5.0 volts (both coils). The hold-in coil current draw should be 12-14 amperes with the switch closed (pull-in coil shorted out).

ADJUSTMENT:—Solenoid Switch. There is only one adjustment on the solenoid switch. Clearance between the end of the pinion and the starting motor drive housing should be ⅛" with shift plunger at inner end of stroke. Remove starter from car, take out all lash in overrunning clutch by pressing on clutch shell before checking clearance. Adjust by taking out pin in shift lever and turning adjusting stud in or out of shift plunger.

Solenoid Relay Specifications

Solenoid Types 1542, 45, 46, 47, 48 & Relay Type 268-M

Contacts Close—1.9 volts Max. **Contacts Open**—1.0-1.2 volts.
Contact Gap—.035". **Air Gap**—.010" (contacts closed).

Solenoid Types 1512,13,14,15,16,17,18,19,21,23,30,32

Contacts Close—3.2 volts Max. **Contacts Open**—1.6-2.0 volts.
Contact Gap—.035". **Air Gap**—.010" (contacts closed).

Where the solenoid relay circuit is grounded through auxiliary ground contacts in the cutout relay, the contact gap for these contacts should be .015-.025" (main contacts closed). If starting system does not operate, see that these contacts are in good condition and closed. If main contacts stick or do not open, check cutout relay as directed on car data sheets. Where solenoid relay circuit is grounded through generator main brushes, check condition of generator armature. Armature must be kept clean and free from oil.

VACUUM SWITCH

Buick 1938-39 Models—Switch mounted on Automatic Carburetor Control (Delco-Remy Carburetor Control) on 1938-39 models except 39-40. On 39-40 switch (Carter Car Starter) is built in carburetor. See following articles for complete servicing and adjustment data on these switches.

Vacuum Switch (all other models)—Only adjustment of switch is the 'off' position (accelerator pedal released—engine not running). The correct position of the vacuum switch lever is indicated by a line on the switch case and linkage should be adjusted so that pointer on lever is opposite this line. In operation, the manifold vacuum disengages the switch clutch drive tangs and clutch plate. The contact plate assembly is then returned to the original 'off' position by the return spring. The switch can not be operated again until the engine stops and the accelerator pedal is returned to the 'off' position.

Vacuum Switch Specifications

Contacts Close (Rotation)—10-14° CCW for all type except 1937 Buick with Stromberg carburetor (Type 1607—10-14° CW).

Unlatch Action (30° from Latch Position)—3.4-4.6" of HG. (all).

VACUUM SWITCH—TYPE 1990101 CARBURETOR CONTROL

Switch No. **Used On:**

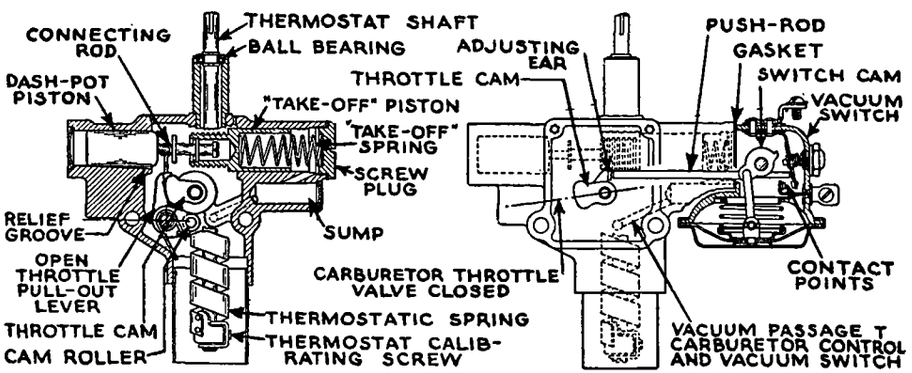
1868512—BUICK, SERIES 38-40, 38-60, 38-80, 38-90 (1938)

OPERATION:—Movable switch contact mounted on a spring loaded arm and controlled by a cam linked to the vacuum unit diaphragm and also by a pushrod operated by the throttle cam in the choke control housing. With the throttle closed and the engine not running, contacts will be held open by the pushrod and the vacuum unit diaphragm will be in the 'at rest' position (pushed down by spring) with switch cam rotated out of contact with the switch arm. When the throttle is opened 30-40°, pushrod movement in toward the choke housing allows contacts to close, completing solenoid circuit, and starter cranks engine. As soon as engine begins to fire and vacuum builds up to 5" of HG., vacuum diaphragm is pulled up (against diaphragm spring tension) and switch cam is rotated so that contacts are opened and latched in this open position (lug on cam engages under insulated pin on switch arm). Vacuum diaphragm will remain in the upper or switch-open position until vacuum drops to ½" of HG. (due to spring and ball detent mechanism) and will then return to the 'at rest' position when unlatched by the pushrod action.

Unlatch Action. When manifold vacuum drops to less than ½", vacuum diaphragm will be prevented from returning to the 'at rest' position by the engagement of the cam lug and switch arm pin. When the throttle valve is closed to the 23-26° open position, pushrod will move switch arm sufficiently to release cam lug and diaphragm and cam then return to the 'at rest' position. Additional throttle opening will then allow switch contacts to close and starter will crank engine in the usual manner. NOTE—This 23-26° setting is designed to allow for stiffness of new engines. If starter pinion clashes on acceleration after engine has been broken in, setting can be changed to 20° (see directions below).

TESTING & ADJUSTMENT:—Unlatch action. With carburetor throttle stopscrew set for 8 M.P.H. hot or slow idling speed, engine not running and cold (so that Cold Idle Cam in fast idle position), pull out hand throttle button so that clearance between throttle stopscrew and cold idle cam is 1/16" and leave hand throttle in this position while making tests. Turn on ignition and start engine, stop engine, repeat start immediately. Start engine in this manner at least three or four times. If engine starts satisfactorily each time, vacuum switch is properly timed. Pull out hand throttle button so that clearance between stopscrew and cam is ¼", repeat tests. Engine should not start more than once with throttle open this far. Adjustment is made by bending lug on switch cam. Manufacturer recommends that Ac-U-Vac tester be used in making tests on switch.

NOTE—When installing switch on choke housing, make certain that gasket is in good condition and no leaks occur at this point (vacuum chamber in switch is above diaphragm).



DELCO-REMY VACUUM SWITCH

Delco-Remy No. **Used On:**

1990126—BUICK, SERIES 39-60, 39-80, 39-90 (1939)

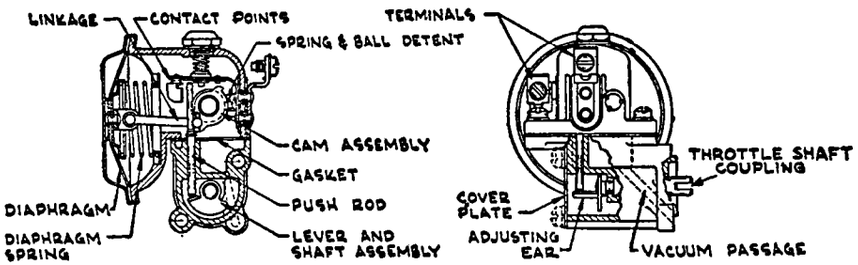
DESCRIPTION & OPERATION:—Switch operated through pushrod by carburetor throttle valve shaft and controlled by vacuum in same manner as in 1938 but mounted on adapter which is mounted on carburetor casting at end of throttle shaft. Pushrod located in adapter housing and actuated by lever and shaft linked to carburetor throttle shaft by tongue-and-slot coupling. Vacuum passage to switch diaphragm chamber is drilled through adapter housing.

CHECKING & ADJUSTMENT:—To Check Switch Action. See that throttle lever stopscrew correctly set for 8 M.P.H. hot or slow idle speed, rotate fast idle cam to Cold or Fast Idle position and pull out hand throttle button so that clearance between stopscrew and fast idle cam is 3/64". Leave hand throttle button in this position while making tests. Turn on ignition, start engine, allow engine to run for several seconds (to build up vacum), stop engine. Repeat test three or four times in rapid succession. If engine starts each time, vacuum switch is correctly timed, if not, retime switch as directed below. Pull out hand throttle to 3/32" position, repeat test as given above. Engine should not start more than once with this throttle opening. If engine starts repeatedly vacuum switch should be retimed.

Timing Vacuum Switch. Loosen two cover screws on adapter housing, swing adapter cover to one side to expose operating lever, tighten screws (this is important). Check switch action as directed above bend ear on operating lever which contacts pushrod slightly toward pushrod (if engine does not start with 3/64" throttle opening), away from pushrod (if engine starts repeatedly with 3/32" throttle opening).

Vacuum Switch Calibration. Switch contacts should close when throttle valves rotated not more than 49° from closed position and switch lockout (unlatch action) should occur with throttle valves 25-28° from closed position (throttle valves must be rotated from wide open position toward closed position to check this action). Switch should lock out with 2-5" of HG. measured at vacuum passage.

SERVICING:—Serviced in same manner as 1938 type. Switch mounted on adapter by two screws, adapter mounted on carburetor casting by two screws (adapter cover screws). If switch and adapter disassembled, make certain that gasket between them and between adapter and carburetor is in good condition and that vacuum passage holes in gaskets line up with vacuum channels in carburetor casting and adapter body.



CARTER CAR STARTER (BUICK)

Carter No. **Used On:**

192-10U—BUICK SPECIAL SERIES 39-40 (1939)

NOTE:—This Carter Car Starter or Vacuum Switch is built in the Model WDO Type carburetor which is standard equipment on this car.

DESCRIPTION & OPERATION:—Plunger type switch mounted on carburetor body casting and operated by steel ball which engages switch plunger and flat on carburetor throttle valve shaft when engine is not running. Depressing accelerator pedal to open throttle forces switch plunger up until 'W' shaped contact spring on upper end completes circuit between two brass contact blocks in the switch cap. When the engine begins to fire, switch ball is drawn up out of engagement by manifold vacuum (ball blocks vacuum passage as long as engine is running) so that switch is inoperative. When engine stops, throttle must be closed momentarily to allow switch ball to drop down between throttle shaft and switch plunger.

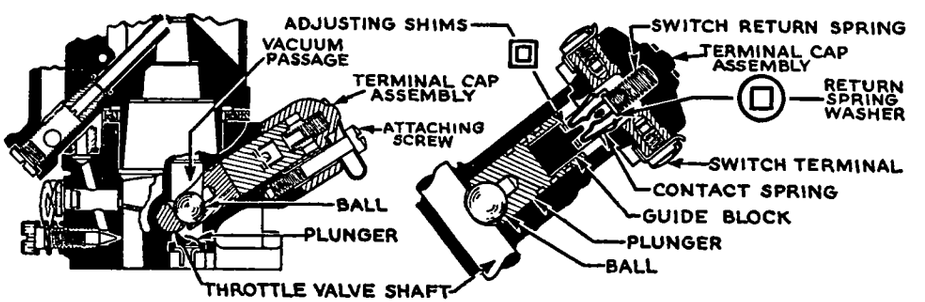
ADJUSTMENT:—Checking Vacuum Switch Timing. Use special Carter tool T109-121S consisting of protractor scale clamped on choke housing and indicator arm fastened on throttle lever. Connect test lamp in switch circuit to check switch closing. Rotate fast idle cam to hot or slow idle position, back off throttle lever stopscrew so that throttle valves are tightly closed. Loosen setscrew and set indicator arm opposite '0' on the 'WDO' scale of the gauge. Open throttle valve and note gauge reading when switch closes (test lamp will light). Gauge reading should be between 30° and 40°. Adjust by adding (if throttle opening more than 40°), removing (if throttle opening less than 30°) square brass adjusting shims located on bakelite guide block under 'W' shaped contact spring (these shims have square hole which engages tongue on guide block, do not confuse these shims with round spring seat washer which seats on middle leg of contact spring).

Checking Switch Without Gauge. If tool not available, rough check can be made on car by measuring clearance between machined surface of stop boss on carburetor throttle base and nearest edge of throttle stop arm. Distance should be 23/64" minimum, 27/64" maximum when switch closes.

SERVICING:—Removal & Disassembly. Disconnect and tape leads on switch terminals (wire with red tracer on terminal nearest engine is 'hot' with ignition turned on). Remove switch terminal cap attaching screw, hold-down clip, switch cap, withdraw return spring, guide block and contact spring assembly, switch plunger and ball. Be careful not to lose spring seat washer (on contact spring) or adjusting shims (on guide block under contact spring).

Servicing. Clean switch ball, plunger, cylinder, carburetor vacuum chamber and inlet screen, throttle valve shaft flat with gasoline. Check 'W' contact spring dimension across outer contact legs which should be 3/8" plus or minus 1/64" with spring seat washer seated on middle leg. Check spiral switch return spring tension. Free length should be 11/16-3/4" and pressure of 24 ozs. required to compress spring to 3/8".

Reassembly. When installing switch plunger make certain that lip on inner end of plunger is down toward manifold (lip will prevent ball engaging on flat of shaft if installed incorrectly). See that adjusting shims are in place under contact spring, and spring seat washer seated on middle leg of contact spring. Make certain that return spring enters socket in switch cap and that boss on cap enters counterbore on casting. Do not oil any part of switch mechanism. Connect wire with red tracer (hot wire) to terminal nearest engine (away from throttle stopscrew).



OWEN-DYNETO AUTOMATIC STARTING

DESCRIPTION:—The Owen-Dyneto automatic starting device consists of an electrically operated starting switch controlled by a Vacuum Relay. The starting switch containing the main switch contacts is actuated by a solenoid connected to the ignition switch so that the solenoid is energized whenever the ignition switch is turned on. The solenoid circuit is completed through a set of contacts in the Vacuum Relay. These contacts are normally closed with the engine stopped. In operation when the ignition switch is turned on, the starting switch is energized, the main switch contacts are closed, completing the starter circuit, engaging the Bendix drive and cranking the engine. As the vacuum in the intake manifold builds up, the diaphragm in the vacuum relay opens the solenoid circuit contacts. There are a second set of contacts in the switch case, connected in parallel with the relay contacts, which remain closed as long as the starter is cranking the engine. These contacts are controlled by a horseshoe magnet which opens the contacts as soon as the engine begins to fire and the starter drive is disengaged (the current drawn by the starter decreases when cranking stops which allows the horseshoe magnet to open the contacts). This opens the solenoid circuit and breaks the starter circuit.

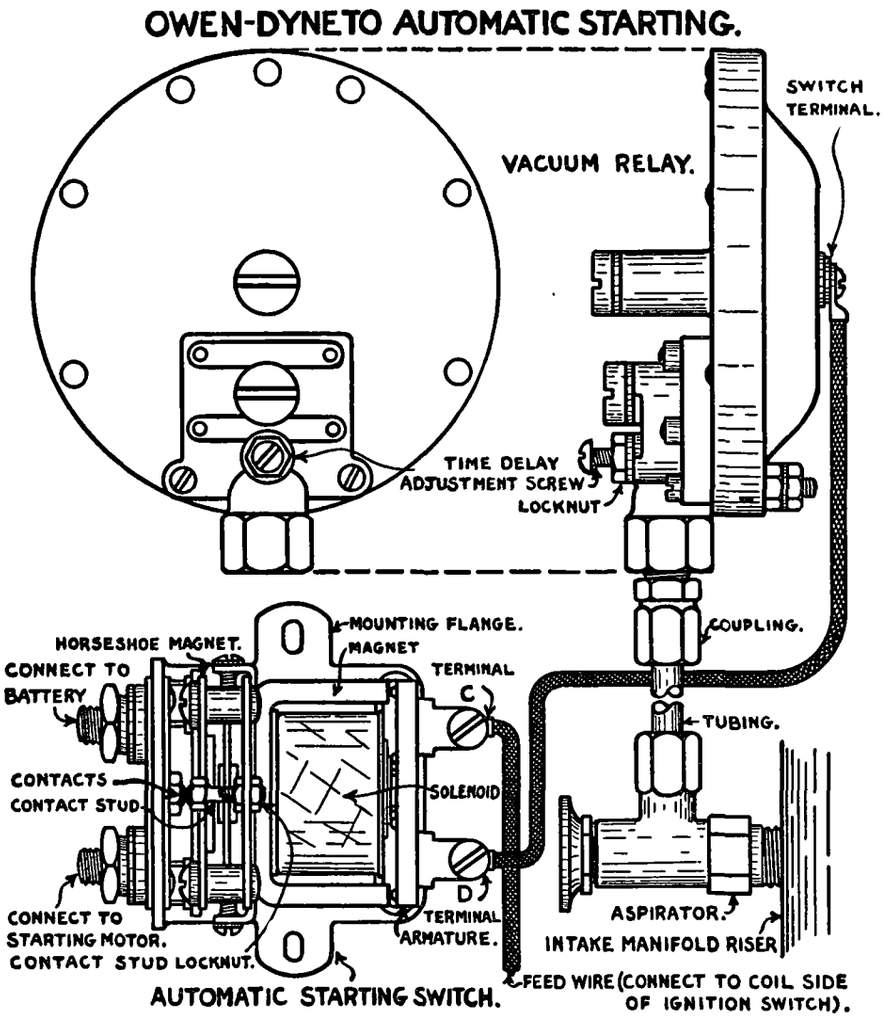
As long as the engine is running and a vacuum exists in the manifold the starter will not operate. Whenever the engine stops, the diaphragm in the Vacuum Relay will close the contacts, completing the solenoid circuit and cranking the engine. The Vacuum Relay is fitted with a time delay adjustment to permit a short interval between stalling of the engine and cranking so that the Bendix drive will not engage while the flywheel is still rocking (see paragraph on Adjustment).

INSTALLATION:—The magnetic switch is designed to be mounted on the starter field frame. The left hand main terminal should be connected to the car battery. The right hand terminal is connected to the starter terminal through a short busbar or strap connector. The right hand solenoid terminal is connected to the coil terminal of the ignition switch (this connection may be made to the gasoline gauge or any other 'hot' point connected directly to the ignition switch. The left hand solenoid terminal is connected to the Vacuum Relay (see illustration).

The Vacuum Relay is mounted on the manifold and is connected to the 'Aspirator' (manifold connection) through a short piece of ⅛ inch pipe. It is necessary to drill and tap a ⅛ inch hole in the manifold directly above the carburetor in order to install the Aspirator.

ADJUSTMENT:—The magnetic switch is correctly adjusted at the factory. However, an adjustment is provided so that the original setting can be changed if the starter gives evidence of faulty operation by interrupted cranking (repeated attempts to crank the engine at irregular intervals) or if the starter spins after the engine has begun to fire. To check and adjust switch operation, remove high tension cable, open throttle wide, take off switch cover, loosen lock nuts on contact screw. With ignition turned on, turn screw slowly clockwise (right hand direction) until starter cranks engine without interruption. Tighten adjustment lock nuts and test setting. If starter spins after engine begins to fire, loosen lock nuts and turn contact screw slowly counter-clockwise (left hand direction) while the starter is spinning until contacts open. Then test for interrupted cranking. The extreme left hand or counter-clockwise setting of the contact screw will cause interrupted cranking, while the extreme right hand or clockwise setting will result in the starter spinning. The correct setting will be found between these two positions. All tests should be made after the engine has been thoroughly warmed up.

Time Delay Adjustment. The Vacuum Relay is correctly adjusted at the factory so as to provide a short interval of time between the stalling of the engine and the closing of the relay contacts in order to permit the engine to stop rocking before the starter is engaged. If the time delay adjustment is too short the starter will spin and will not engage the Bendix drive. This can be remedied by increasing the time lag or delay. Time delay setting is adjusted by a screw on the back of the Vacuum Relay. The throttle should



be open whenever time delay is checked in order to overcome any vacuum in the intake manifold. Correct time delay should be one to two seconds. To increase the time delay, loosen the lock nut on the adjustment screw and turn screw in (clockwise) until correct interval is obtained. To shorten or decrease the time delay, turn adjustment screw out (counter-clockwise) until correct interval is obtained. When satisfactory adjustment is obtained tighten the lock nut to hold adjustment.

DESCRIPTION:—Startix is an automatic magnetically operated switch. It will be found installed on a number of 1932 car models as original equipment. It is used in conjunction with starters equipped with Bendix drives and is designed to crank the engine automatically whenever the ignition switch is turned on. It will also crank the engine whenever the engine stalls with the ignition switch on.

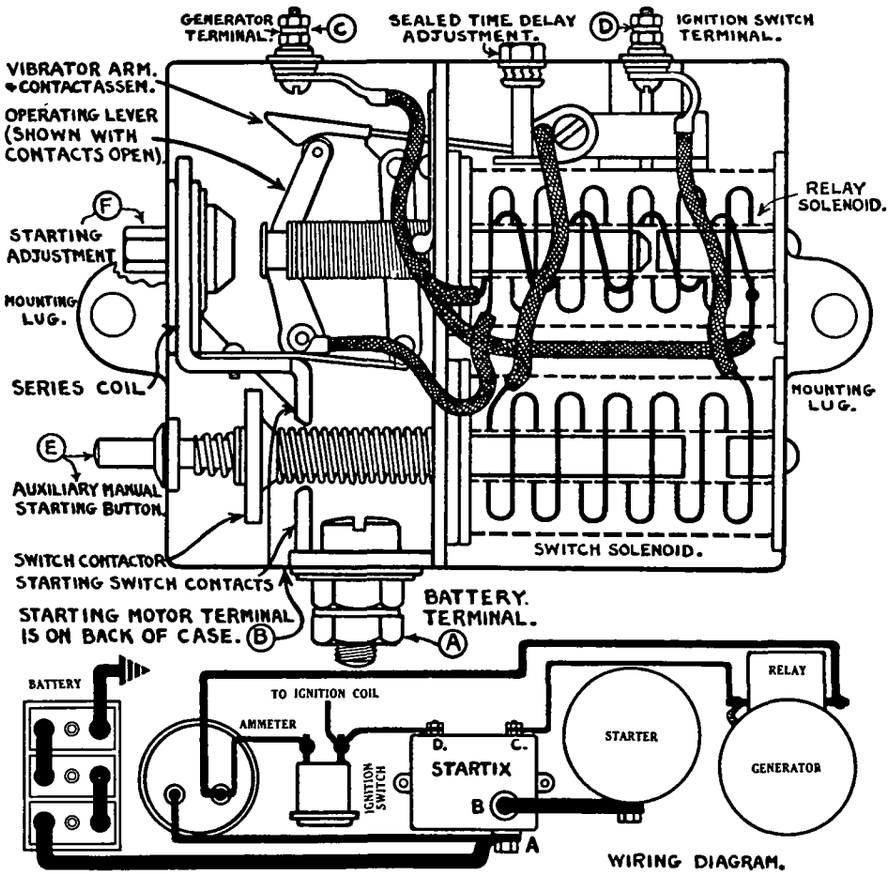
OPERATION:—Startix consists essentially of the main switch contacts, a movable contactor and two solenoids, a main switch solenoid, and a relay solenoid. The starting switch contactor is mounted on a plunger in the main switch solenoid. The main switch solenoid is connected between the 'IGN' terminal on the startix case and ground through a set of contacts controlled by a vibrating arm operated by the relay solenoid plunger. The 'IGN' terminal is connected to the coil side of the ignition switch so that the main switch solenoid is energized whenever the ignition switch is turned on (the contacts are normally closed with the ignition switch off and the engine stopped). This causes the main switch solenoid plunger to move in closing the circuit between the main switch contacts, completing the starter circuit and cranking the engine. There is a large one half turn series coil wound around the relay solenoid plunger which is connected in series with the starting switch contacts so that the entire starting motor current flows through this coil. When the engine begins to fire, disengaging the Bendix drive, the current drawn by the starter will decrease sufficiently so that the effect of this series coil (which tends to hold the relay solenoid plunger out and the vibrating arm contacts closed) will be overcome by the outer starting motor circuit winding on the relay solenoid drawing the plunger into the relay solenoid and causing the operating lever to deflect the vibrating arm and open the contacts. This opens the main switch solenoid circuit and the starting motor circuit is opened by a spring on the solenoid plunger. There is also a second winding on the relay solenoid connected between the 'GEN' terminal and ground. The 'GEN' terminal is connected to the generator side of the relay and a small current will begin to flow through this coil as soon as the generator begins to operate. This assists in holding thte relay solenoid plunger in as long as the engine is operating. Whenever the engine stalls, the relay solenoid moves out, closing the contacts and completing the main switch solenoid circuit.

Manual Operation. An auxiliary starter button is located on the end of the Startix case for use whenever it is desired to operate the starting switch manually. The button should be pressed firmly and released quickly.

Ignition Settings:—A number of the ignition switches used on car models in conjunction with Startix provide two switch positions. The first 'On' position connects the Startix in the circuit, providing automatic cranking. The second 'On' position completes the ignition circuit but does not complete the Startix circuit. This switch position should be used in setting the ignition (with the ignition turned on) when the automatic cranking feature is not desired. On cars not equipped with this type switch it will be necessary to disconnect the wire on the 'IGN' terminal of the Startix case to prevent Startix operation.

INSTALLATION:—Startix is usually mounted on the engine block near the starter, or on the dash. The case is grounded and a separate ground wire must be run from the case to the car frame or engine block whenever the Startix is mounted on a wooden dash or other insulated mounting. Connections should be made as indicated on the diagram. In making connections to the main terminals care should be taken not to twist the main terminal posts as this may interfere with correct operation of the starting switch by affecting the alignment of the switch contacts.

ADJUSTMENT:—A starting adjustment is provided on the end of the Startix case directly in front of the relay solenoid plunger. This adjustment consists of a slotted screw held in position by a locknut. It is designed to correct interrupted cranking (repeated attempts to crank the engine) or spinning of the starter after the engine has begun to fire and the Bendix drive has been disengaged. The extreme outward (counter-clockwise or left) position of the adjustment screw will cause interrupted cranking while the extreme inner (clockwise or right hand) position of the adjustment screw



WIRING DIAGRAM.

will result in the starter spinning. The correct adjustment will consist in finding a position between these two extremes which will result in satisfactory starter operation. To set Startix adjustment, first disconnect coil high tension lead at center terminal of distributor cap (to prevent engine firing). Loosen locknut on adjustment screw, turn ignition on and while starter is cranking engine determine interrupted cranking position of adjustment screw by turning screw slowly to left or counter-clockwise until interrupted cranking begins. Tighten locknut slightly and make a mark on the case in line with the screw slot. If adjustment is being made because of interrupted cranking, turn screw slowly to the right until starter cranks engine steadily and make the mark at this point. Then connect coil high tension lead so that engine will fire, disconnect wire on 'GEN' terminal of Startix case, turn on ignition and turn adjustment screw to right or clock-

wise until starter spinning occurs after engine begins to fire. Then turn adjustment screw to left or counter-clockwise until a click is heard indicating the opening of the starting switch contacts. Tighten the locknut and check this point by operating the Startix by turning ignition switch on. The starting motor should begin to slow down as soon as the engine begins to fire. Mark position of adjustment screw slot by a line on the case. The final setting of the adjustment screw should be midway between the two lines on the case (where the lines are less than 180° apart), or one quarter turn or 90° from the 'starter spinning' reference line (when the two lines are more than 180° apart). Lock the adjustment screw by securely tightening the locknut.

Time Delay Adjustment. There is a sealed 'Time Delay Adjustment' screw on the top of the Startix case. This adjustment is set and sealed at the factory and should not be disturbed. It is designed to provide a short interval of time between the stalling of the engine and the automatic cranking operation to prevent damage to the Bendix drive through engagement of the Bendix while the engine crankshaft is rocking.

TROUBLE SHOOTING:—Failure of the generator or a short-circuit in the line between the 'GEN' terminal on the Startix and the generator will be evidenced by a clicking sound caused by the meshing contact of the Bendix drive pinion and the flywheel. This may be corrected temporarily to enable the car to be driven to a service station by disconnecting the wire on the 'IGN' terminal on the Startix case rendering the Startix inoperative. Correct by checking line, checking generator connections, cleaning generator commutator, checking ground, and, in some cases, advancing engine idling speed slightly where engine idles at so low a speed that generator will not operate the relay solenoid.

THERMOSTATIC SAFETY DEVICE:—There is a thermostatic control incorporated in the Startix which will open and close the circuit (this will be evidenced by a clicking sound) whenever the Bendix pinion sticks or jams in the flywheel for as long as the ignition is left on. This clicking sound will indicate that the ignition should be turned off and the Bendix pinion freed. No adjustment will be necessary on the Startix.

STARTIX CIRCUIT CONTROLLER

DESCRIPTION:—This device is an automatic circuit breaker designed to open the Startix circuit and prevent automatic cranking momentarily whenever a backfire occurs. It is designed to be screwed in the intake manifold and is operated by the pressure built up in the manifold when the backfire occurs. The two terminals on the side of the Circuit Breaker case should be connected as follows: Terminal marked 'IGN' to Startix terminal on ignition switch (feed terminal), Terminal marked 'STARTIX' to 'IGN' terminal on Startix case. These connections must not be reversed as incorrect connections will interfere with the proper action of the Circuit Breaker.

OPERATION:—The pressure built up in the manifold by the backfire causes the plunger within the Circuit Breaker case to move upward, closing a set of contacts on a thermostatic arm and short-circuiting the current from the ignition switch through the thermostatic arm to ground. The thermostatic arm is heated and is flexed upward, opening the main contacts and breaking the circuit to the Startix switch, thus stopping the automatic cranking of the engine. As soon as the crankshaft stops moving backward and the pressure in the intake manifold drops, the plunger drops down, opening the thermostatic arm contacts, breaking the circuit through the thermostatic arm and permitting the arm to cool. After several seconds the arm flexes downward, closing the main contacts and the Startix switch will then resume the cranking operation. The entire action of the Circuit Breaker is automatic. It must be kept in mind that several seconds will intervene between a backfire and the resumed cranking.

SERVICING:—The Circuit Breaker requires no service operations. Connections should be kept tight and care must be taken that the unit is correctly hooked up ('IGN' terminal on unit should be connected to ignition switch and 'STARTIX' terminal connected to 'IGN' terminal on Startix case). If the Circuit Breaker does not operate satisfactorily it should be replaced by a new unit.

OPTIONAL EQUIPMENT ON PACKARD EIGHT, SUPER EIGHT, TWELVE (1934-35-36)

NOTE:—Type F Startix not interchangeable with standard Type D. Types may be readily identified by red background (Type F), black background (Type D) on nameplate on which type number and operating voltage is indicated. Type F must always be used with special cutout relay and any attempt to use this type with conventional cutout relay will result in burnt out generator winding of Startix relay solenoid.

DESCRIPTION AND OPERATION:—Similar to Type D in construction and operation except that generator winding of relay solenoid is special low resistance type to make this winding effective with low generator voltages (characteristic of Owen-Dyneto high capacity generator armatures). Resistance unit in Relay-Regulator case on generator is cut into this coil circuit when the cutout relay contacts close to protect the winding from overload when the generator is charging. This resistance is short-circuited by the auxiliary contacts above the cutout relay armature when the main contacts open. A cutout relay of this type (Owen-Dyneto No. 40203, used also in 40210 assembly) must always be used with the Type F Startix.

SERVICING:—Same as for Type D. See previous Startix article. Type F is designed to hold out with voltage of .07 volt or greater at 'GEN' terminal on Startix case. If Startix cuts in with engine idling, check voltage with voltmeter connected between 'GEN' terminal and ground on Startix case. If voltmeter reading less than .07 volt, check generator for burnt or worn commutator, high mica, worn or defective brushes, open field coils or connections, defective armature. Check cutout relay. If voltmeter reading more than .07 volt, Startix is defective. See Trouble Shooting.

TROUBLE SHOOTING:—If Startix operation is not satisfactory, turn on ignition switch making certain that 'on' position is one in which Startix is operative, note whether one or more 'clicks' heard in Startix case when switch turned on

No 'click', Starter does not operate.

(1) Startix relay plunger sticking. Check by jarring car or tapping on Startix case with screwdriver. Replace Startix if this condition repeated frequently.
(2) Open-circuit in Startix 'IGN' lead. Disconnect lead at terminal and flash to ground. If no spark noted, check ignition wiring.
(3) Short-circuit in Startix main switch solenoid. Connect ammeter in lead at 'IGN' terminal (flash lead to terminal only to avoid damage to ammeter if current excessive. Current draw should be approximately 1 ampere. Replace Startix if excessive.
(4) Open-circuit in Startix main switch solenoid. No current draw in test (3) above with 'IGN' lead known to be live. Replace Startix.
(5) Current in generator winding of relay solenoid. Check by disconnecting lead at 'GEN' terminal on Startix. If Startix cranks engine, generator cutout relay is defective or lead is shorted at some live point (this lead must be connected on generator side of cutout relay, not to battery terminal).

Single 'click' heard, Starter does not operate.

(1) Main switch contacts defective or out of alignment. Check by connecting heavy jumper (starter cable) across Startix main switch terminals.
(2) Loose or corroded battery terminals, broken cables, or defective ground connection. Examine cables and terminals.
(3) Second winding of relay solenoid defective. See test (3) under Starter spinning below.

Series of 'clicks' heard, Starter does not operate.

(1) Open-circuit in starter. Examine cable and connections at Startix and starter, check internal wiring and connections in starter, check starter brushes and commutator.

Starter Spins but Bendix does not engage before Startix cuts out.

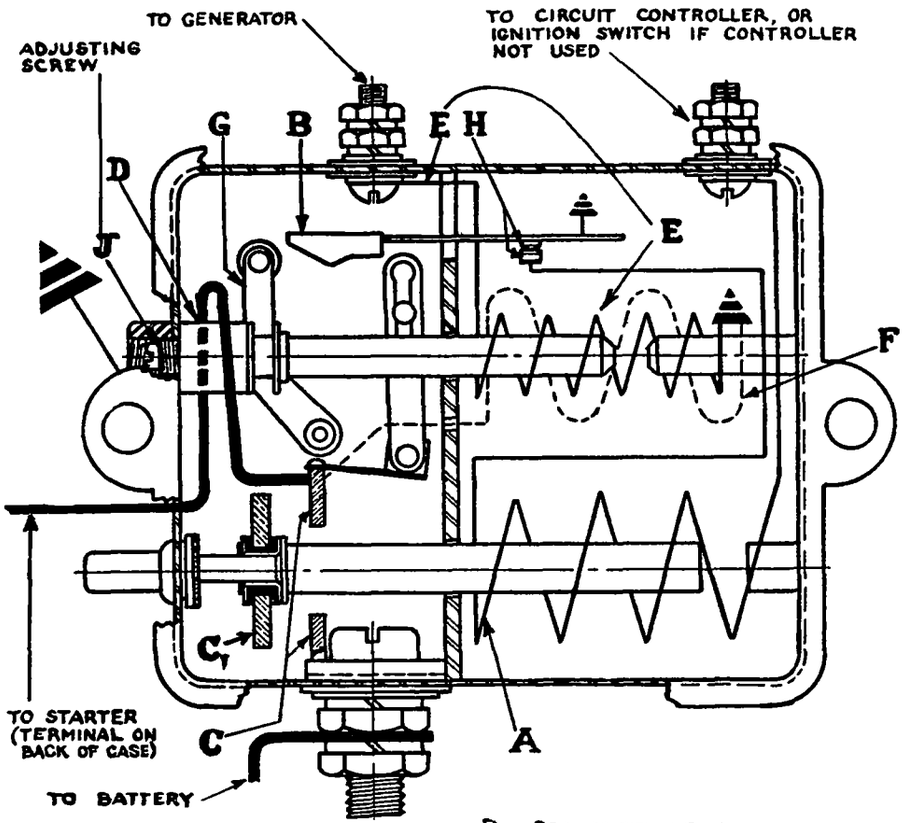
(1) Bendix drive defective. Check for broken spring, broken spring screw, dirty or gummy Bendix shaft.

Bendix engages, Starter does not crank engine.

(1) Bendix pinion jammed. Release Bendix. Examine Bendix drive and flywheel teeth. See that engine is free and can be turned over easily.

Starter overruns or Spins after engine fires, Contacts may flutter.

(1) Startix not properly grounded. Startix grounded through case. When mounted on dash, or if good ground connection not secured through mounting screws, connect ground lead between mounting lug and engine.
(2) Startix 'IGN' lead connected to wrong side of ignition coil. If this lead connected at coil instead of ignition switch, see that connection is made to switch side of coil.
(3) Discharged battery or excessive starter draw when running free. Replace battery if voltage when starter running free is less that 4.8 volts. Check starter draw (see '0 ft. lb.' torque test figure on car page).
(4) Startix adjustment incorrect. To adjust with ignition turned on, disconnect lead on 'GEN' terminal, loosen locknut on starting adjustment screw 'J', turn screw counter-clockwise until click is heard indicating that main contacts have opened. Turn screw ⅛ turn further counter-clockwise, tighten locknut.



Starter makes repeated attempts to crank engine. Does not crank continuously.

(1) Discharged battery. Voltage should not drop below 4.8 volts when starter is spinning freely.
(2) Dirty or gummy Bendix Drive. Wash drive in kerosene and apply thin film of light oil.
(3) Startix adjustment incorrect. To adjust with ignition turned on, disconnect lead on 'GEN' terminal, loosen locknut on starting adjustment screw 'J', turn screw slowly clockwise until point is reached where starter begins to spin continuously after engine begins to fire, then turn screw ⅛ turn counter-clockwise, tighten locknut. This adjustment must be made slowly since turning the screw in too far will result in the main switch solenoid contacts being held open so that the Startix will be inoperative.

AUTO-LITE
SOLENOID PINION SHIFT TYPES

Car Model	Solenoid Switch	Starter Model
Chrysler C25 (1940)	SS-4206	MAX-4020A
Chrysler C26 (1940)	SS-4206	MAX-4027
Chrysler C27 (1940)	SS-4206	MAX-4020A
Packard Super 8 (1940)	SS-4205	MAX-4041

These Starter Controls same as types used on corresponding 1939 car models (see Packard note).

PACKARD NOTE:—Packard Super 8 starter is new type reduction gear unit with solenoid operated pinion on reduction gear shaft which is driven at 14/29 armature speed. Grease plug provided on drive end of starter through which gear compartment can be packed with heat-resisting grease. Solenoid Switch unit is similar to types use on other starters and is serviced in the same manner.

PERFORMANCE & ADJUSTMENT:—Same as for previous types. *See 'Auto-Lite Starter Control—Solenoid Pinion Shift Type' article in Electrical Equipment Section of manual for complete data and adjust to the following specifications:*

Solenoid Winding Tests—Shunt and series windings together should draw 34-38 amperes at 3.0 volts. Shunt coil only should draw 14-16 amperes at 6.0 volts (this is 'hold-in coil' and operates when series coil has been shorted out by closing of main switch contacts).

Solenoid Relay Specifications

Contacts Close—3.5-4.5 volts. **Contacts Open**—1.5-2.5 volts.

Contact Gap—.025-.035". **Coil Resistance**—7.5-8.3 ohms at 77° F.

Pinion Position when disengaged—With pinion at rest, distance between outer face of mounting flange on pinion housing to outer end of pinion should be 1 11/32" (MAX-4020A, MAX-4037), 15/16" (MAX-4041) plus 1/64" or minus 5/32".

Pinion Clearance when engaged—With switch closed and plunger fully bottomed in core (press in on plunger when making this test), clearance between end of pinion and thrust washer next to outer pinion housing bearing should be 5/64" plus or minus 1/64". To adjust, remove pin in plunger link and turn stud in or out of plunger.

Armature Endplay—Armature endplay must be .005" minimum, .030" maximum. Adjust by inserting MU-54 thrust washer of correct thickness between the MAD-96 thrust washer and the commutator end plate. These thrust washers furnished in three thicknesses as follows: MU-54—1/32", MU-54A—1/64", MU-54B—3/64".

Checking Switch Action—Switch action can be checked by slipping special steel spacer (square stock 1" wide, ¾" thick, with ⅝" slot in the 1" face) on armature shaft between pinion and thrust washer at pinion housing outer bearing. With spacer in place, switch plunger should bottom and switch contacts should close with normal voltages.

TROUBLE SHOOTING:—Pinion fails to engage or disengage properly. Check for interference between shift yoke and collar at open end of yoke where curved section passes over rim on collar. Binding of yoke on collar at this point should be corrected by filing yoke at point where interference occurs. Check for binding of yoke shoes on mounting pins which causes shoes to turn and bind in collar. Correct by cleaning all dirt from between shoes and yoke, lubricate shoe pins and make certain that yoke shoes installed with curved side toward pinion end of starter clutch. Check for binding of yoke assembly on yoke fulcrum pin due to paint or dirt on pin. Clean yoke pin and yoke sleeve thoroughly, examine return spring on pin. If starter does not function correctly after these corrections have been made, yoke assembly should be replaced.

Flywheel ring gear teeth damaged by pinion. May be caused by too early closing of starting switch contacts which will result in starter operating before pinion has been meshed with flywheel. Check pinion position (see specifications above). Switch contacts should close approximately 3/16" plunger travel before plunger bottoms in solenoid core.

AUTO-LITE
POSITIVE PINION SHIFT TYPES

Car Model	Starting Switch	Starter Model
De Soto S7 (1940)	SW-2813	MAW-4016
Dodge D14, D17 (1940)	SW-2813	MZ-4062
Dodge D14, D17 ('40) Canada	SW-2813	MAW-4016
Plymouth P9, P10 (1940)	SW-2813	MZ-4062
Plymouth P9, P10 ('40) Canada	SW-2813	MAW-4016

These Starter Controls same as types used on corresponding 1939 models.

PERFORMANCE & SERVICING:—Same as for previous types. *See 'Auto-Lite Starter Control—Positive Pinion Shift Type' article in Electrical Equipment Section of manual for complete data and adjust to following specificatinns:*

Pinion Position when disengaged—With pinion at rest, distance from outer face of mounting flange on pinion housing to outer end of pinion should be 1 1/32" plus 1/64" or minus 5/32".

Pinion Clearance when engaged—With pinion fully meshed in flywheel (full travel of shift lever), clearance between outer end of pinion and face of thrust washer next to outer pinion housing bearing should be 5/64" plus or minus 1/64".

Armature Endplay—Armature endplay should be .005" minimum, .030" maximum. Adjust by inserting MU-54 thrust washer of correct thickness between the MAD-96 thrust washer and the commutator end plate. These thrust washers furnished in three thicknesses as follows: MU-54—1/32", MU-54A—1/64", MU-54B—3/64".

Switch Travel—Plunger travel between at rest position and closed position should be approximately 5/32".

AUTO-LITE
MAGNETIC SWITCH TYPE SS-4000 SERIES

Car Model	Switch Type	Starter Model
Lincoln V12 (1940)	SS-4004	MAO-4003B
Packard '110' 1800 (1940)	SS-4001	MZ-4078
Packard '120' 1801,1A (1940)	SS-4001	MAW-4018
Willys 440 Truck (1940)	SS-4001	MZ-4049

These Switches same as types used on corresponding 1939 car models.

PERFORMANCE & ADJUSTMENT:—Same as for previous types. *See "Auto-Lite Starter Controls—Magnetic (Solenoid) Types SS-4000 Series" article in Electrical Equipment Section of manual for complete data.*

DELCO-REMY
MANUAL PINION SHIFT TYPES

Car Model	Starting Switch	Starter Model
Chevrolet All Models ('40)	820052	1107009
Oldsmobile F-40, G-40 ('40)	820052	1107007
Oldsmobile L-40 (1940)	820052	1107907
Pontiac 40-25, 26 (1940)	820052	1107022
Pontiac 40-28, 29 (1940)	820052	1107914

These Starter Controls same as types used on corresponding 1939 models.

DESCRIPTION:—These starters have a pinion assembly and shift lever similar to that used on Solenoid Pinion Shifts but the shift lever is connected through linkage to the starting pedal so that the pinion is positively engaged with the flywheel teeth when the starting pedal is depressed. The starting switch is mounted on the starter field frame and switch plunger is depressed by lug on shift lever to close switch contacts and operate starter after pinion has been meshed with the flywheel.

SERVICING:—No servicing required and no adjustments provided. Switch contacts should not close until after pinion has been meshed (except when pinion teeth butt against flywheel teeth in which case compression of spring between shift collar and overrunning clutch on pinion sleeve will allow switch contacts to close and revolve pinion to meshing position). Return spring on shift lever should have sufficient tension to disengage pinion promptly when starting pedal is released.

Pinion Assembly. Same as types used on Solenoid Pinion Shift Starters (see above). Compression spring and collar can be serviced but no attempt should be made to dismantle or service overrunning clutch.

SOLENOID SWITCHES (WITH PUSHBUTTON CONTROL)

Car Model	Solenoid Switch	Starter	Pushbutton No.
Cadillac 60S, 62, 72, 75 ('40)	1542	1107912	1996005
Cadillac 60S, 62 RHD. ('40)	1542	1107911	1996005
Cadillac V16 90 ('40)	1555①	783	1996005
Chevrolet RHD. (1940)	1546	1107023	1996006
Graham 107, 8 Exp. (1940)	1546	738-X	
La Salle 50, 52 (1940)	1542	1107912	1996005
La Salle 50, 52 RHD. ('40)	1542	1107913	1996005
Oldsmobile F-60 RHD. ('40)	1546	1107019	1996008
Oldsmobile G-70 RHD. ('40)	1546	1107019	1996008
Pontiac 40-25, 26 RHD. ('40)	1546	727-S	1996007
Studebaker Pres. 6C (1940)	1546	1107903	R-B-M

①—With Solenoid Relay No. 268-M (mounted separately).

SOLENOID SWITCHES (WITH VACUUM SWITCH CONTROL)

Car Model	Solenoid Switch	Starter	Vacuum Switch
Buick 40, 50 (1940)	1542	1107005	1990127②
Buick 40, 50 RHD. (1940)	1542	1107018	1990127②
Buick 60, 70, 80, 90 (1940)	1542	1107908	1990127②
Buick 60, 70, 80, 90 RHD. ('40)	1545	1107909	1990127②

②—**These Starter Controls same as types used on corresponding 1939 models.**

PERFORMANCE & ADJUSTMENT:—Same as for previous types. *See 'Delco-Remy Starter Control—Solenoid Switch Type' article in Electrical Equipment Section of manual for complete data and adjust to following specifications:*

Solenoid Switch Performance—Solenoid should close (bottom in core) against 70 lb. pull with ½" gap drawing 65-71 amperes at 5 volts. While closed, current should be 12-14 amperes (hold-in coil only).

Solenoid Setting—Clearance between end of pinion and inner face of starter pinion housing should be ⅛" with solenoid plunger bottomed in core. Adjustment will be simplified if lead disconnected at terminal on starter field frame (so starter will not spin) and relay contacts closed so that plunger is drawn into coil core. Press back on pinion to take up backlash in overrunning clutch, remove solenoid plunger link pin, adjust link (by turning link stud in plunger) until pin can just be inserted at forward end of shift lever slot.

Relay Specifications (1542, 1545, 1546)

Contacts Close—1.9 volts maximum. **Contacts Open**—1.0-1.2 volts.
Contact Gap—.035" (.025-.045"). **Air Gap**—.012" (contacts closed).

268-M Relay Specifications (1555 Solenoid)

Contacts Close—3.2 volts maximum. **Contacts Open**—1.6-2.0 volts.
Contact Gap—.035" (.025-.045"). **Air Gap**—.010" (contacts closed).

Pinion Assembly & Compression Spring—Pinion assembly same type as used on 1939 models (may be identified by groove in pinion teeth approximately ⅛" from clutch shell). Compression spring must have tension of at least 34 lbs. when compressed to 1". To remove spring, press shift collar down on pinion sleeve to compress spring until lock ring on end of sleeve is exposed, remove lock ring. Spring and collar can be serviced but no attempt should be made to dismantle overrunning clutch mechanism. Clutch is packed with high melting point grease and pinion assembly should not be cleaned by any method which may remove this lubricant.

Shift Lever Return Spring—Return spring on shift lever should have tension of 9-12 lbs. (start of travel), 28-35 lbs. (end of travel). Weak spring may cause sluggish disengagement particularly in cold weather or if shaft is gummy.

1940 DELCO-REMY VACUUM SWITCH

Model **Used On:**

1990127—BUICK, SERIES 40-40, 50, 60, 70, 80, 90 (1940)

This Switch new design and not similar to type used on 1939 Buick models.

DESCRIPTION:—Switch is entirely new design 'direct operated type' with contact rotor mounted directly on end of throttle valve shaft within switch body (switch assembly mounted directly on carburetor casting at end of throttle shaft by two screws). Vacuum chamber is formed within top cover plate and is connected to the manifold below the throttle valve by a channel extending through the top cover, switch body, and carburetor casting. Diaphragm is clamped between switch body and top cover and consisted of a riveted assembly including spring cup (spring sits in cup and is positioned by recess in top cover) and combination guide pin and lockout plunger (which moves in guides formed in switch body). The internal circuit through the switch is completed from one contact spring through the contact rotor to the opposite contact spring (mounted on the lockout lever).

OPERATION:—With the engine not running (no vacuum) and the throttle valve closed, lockout will free lockout lever (diaphragm pressed down by return spring) but lockout lever and contact will be held away from contact plate on contact rotor by insulating knob on rotor. When the throttle is opened to start the engine, contact rotor turns with throttle valve shaft and as soon as insulating knob is turned away from the lockout lever, the contact spring on the lever contacts the rotor and completes the circuit through the switch. As soon as vacuum is developed in the manifold, diaphragm attempts to move upward but is prevented from doing so by hook on upper end of lockout lever which engages top of lockout plunger. When throttle is closed (to idle engine after it has started), insulating knob on contact rotor presses out on lockout lever and frees lockout plunger, diaphragm then moves up and lockout engages lockout lever so that the contact spring is held away from the contact rotor while the engine is running. When engine is stopped, the closing of the throttle valve lifts the lockout lever from the lockout (this Unlatch Action occurs 17-23° from closed throttle position) and diaphragm and lockout plunger drop down into position for a new start.

ADJUSTMENT:—No adjustment ordinarily required. Switch is "timed" for correct throttle position when contacts closed by timing washer assembled on face of contact rotor which positions rotor on throttle valve shaft. Timing can be checked, and new washers installed to change timing as follows:

Switch Timing Check:—See that carburetor throttle lever stopscrew set for correct 8 MPH. hot or slow idle speed. Take out screws and remove side cover plate on switch. Start engine, close throttle, then open throttle until clearance between throttle stopscrew and highest step of fast idle cam is ¼" (cam in fast idle position—engine must be cold), stop engine without disturbing throttle position. Place mirror so that switch guide pin and lockout visible from left side of car, close throttle slowly by lightly tapping on hand throttle lever until guide pin and lockout releases, then measure clearance between stopscrew and fast idle cam with cam in fast idle position. Clearance should be 3/64" minimum, 3/32" maximum. If less than 3/64" timing washer should be replaced by one having a **higher number.** If more than 3/32", timing washer should be replaced by one having **lower number.** See directions below.

Switch Action Check (On Car):—See that carburetor throttle lever stopscrew set for correct 8 MPH. hot or slow idle speed. Start engine, close throttle then open throttle until clearance between throttle stopscrew and highest step of fast idle cam is ¼" (cam in fast idle position—engine cold), stop engine. Tap throttle closed until clearance between stopscrew and cam is exactly 3/64" (use extreme care not to close throttle further, if clearance less than 3/64", repeat entire procedure). Start engine by opening throttle from this position. Repeat this test several times. Engine should start each time. If engine does not start more than once, timing washer should be replaced with one having a **higher number.** After making above test for minimum clearance between fast idle cam and stopscrew, check for maximum clearance as follows. Repeat test instructions given above except that clearance between fast idle cam and stopscrew should be set at not less than ⅛". Engine should not start from this position. If engine starts, timing washer should be replaced with one having a **lower number** and first test (for minimum clearance) should be repeated.

Timing Washers:—Washer has slot which engages flat on throttle shaft and lug which engages hole in contact rotor (rotor is free on shaft and is positioned by timing washer). Washer marked by number on side opposite rotor lug and furnished with lug in different positions for smaller or larger stopscrew-to-fast idle cam clearance (washer with higher number will increase clearance, lower number decrease clearance). Select correct washer by means of tests given above and install as follows:

Timing Washer Installation. Take out screws in side cover on switch, remove cover and gasket. Remove nut on end of throttle valve shaft within switch, remove lockwasher and timing washer (if contact rotor removed, make certain that steel washer installed on shaft behind rotor). Install timing washer being careful to see that lug engages hole in contact rotor, install lockwasher and tighten nut, replace cover and gasket. Recheck switch timing.

SERVICING:—No servicing required. If top cover removed (for diaphragm replacement), make certain that return spring properly seated in cover recess and spring cup on diaphragm and that vacuum channel in top cover and switch body line up. When installing new parts, always check switch timing and install correct timing washer as directed above.

CAUTION—Cover gasket is felt and is designed to provide necessary 'breathing' action required by diaphragm movement. This gasket must always be installed under side cover and no other type gasket should be used.

CARBURETOR SECTION

'C' PAGES

This Section covers the Illustrations, Adjustment, Performance, Jet Sizes, Overhaul and Special Instructions for all Carburetors.

Two Separate Indexes are provided. The Carburetor Index directs you to Each *Carburetor Type.* The Carburetor Car Model Index to the Carburetor *Installed on Each Car Model.* The Jet Specifications for Each Car Model are listed in Separate Tables following the sections on each make of Carburetor.

NOTE: For EQUIPMENT connected with the Fuel System *see Carburetion Equipment Section.*

CARBURETOR INDEX

NOTE: *Two Separate Indexes* are provided for CARBURETORS. The CARBURETOR INDEX directs you to Each Carburetor *Type*. The CARBURETOR CAR MODEL INDEX to the CARBURETOR *installed on each Car Model.*

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GRAHAM	116, 120 Schgr	1937	Marvel	B3 10-1744	C-161
GRAHAM	96 Std., Spec	1938	Marvel	C2 10-1808	C-163
GRAHAM	97 Schgr	1938	Marvel	C3 10-1809	C-163
GRAHAM	96 Std., Spec	1939	Marvel	C2 10-1808	C-163
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HUDSON	91 Pacemaker	1939	Carter W1 Vacm.	437-S, 38-S	C-127
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WILLYS	38, 48	1938-39	Tillotson	U-1A	C-197
WILLYS KN'T	66-D, E	1932-33	Tillotson	V-5B	C-200
WILLYS-OV'LND	39 Speedway	1939	Tillotson	U-1B	C-198
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1940 CARBURETOR CAR MODEL INDEX

NOTE: *Two Separate Indexes* are provided for CARBURETORS. The CARBURETOR INDEX directs you to Each Carburetor *Type*. The CARBURETOR CAR MODEL INDEX to the CARBURETOR *installed on each Car Model.*

Car	Model	Year	Carburetor Make	Carburetor Model No.	Page No.
BANTAM	65 Super Four	1940	Zenith	61A5	C-222
BUICK	40, 50	1940	Carter WDO Vacm.	440-S, 47-S	C-209
BUICK	40, 50	1940	Stromberg	AAV-16	C-215
BUICK	60, 70, 80, 90	1940	Carter WDO Vacm.	448-S	C-209
BUICK	60, 70, 80, 90	1940	Stromberg	AAV-26	C-215
CADILLAC	60S, 62, 72, 75 V8	1940	Stromberg	AAV-26	C-215
CADILLAC	90 V16	1940	Carter WDO	407-S, 408-S	C-209
CHEVROLET	KA,H,B,C,D,E;W	'40	Carter W1	420-S	C-205
CHEVROLET	'V' Economy	1940	Carter W1	434-S	C-205
CHEVROLET	WE-H COE Tr'ks.	'40	Carter (BB)	447-S	C-212
CHRYSLER	C25 Royal & Win.	'40	Carter (B&B)	E6S1, 1*, 2	C-213
CHRYSLER	C26 Eight	1940	Stromberg	AAV-2	C-216
CHRYSLER	C27 Crn Imp'l	1940	Stromberg	AAV-2	C-216
CROSLEY	A	1939-40	Tillotson	DY-1A	C-220
DE SOTO	S7	1940	Carter (B&B)	E6N2, 3	C-213
DODGE	D14, D17	1940	Stromberg	BXV-3	C-218
FORD '60'	'022' Models	1940	Ch. Groves	AA-⅞	C-214
FORD '85'	'01' Models	1940	Ch. Groves	AA-1	C-214
GRAHAM	108	1940	Carter WA-1	472-S	C-207
GRAHAM	107 Schgr	1940	Carter WA-1	473-S	C-207
GRAHAM	109 H'wd. Schgr.	1940	Carter WDO	488-S	C-209
HUDSON	40P, 40T	1940	Carter WA-1 Vacm.	454-S	C-207
HUDSON	40, 48 Business	1940	Carter WA-1 Vacm.	454-S	C-207
HUDSON	41, 43 Six .Early	1940	Carter WDO Vacm.	430-SV	C-209
HUDSON	41, 43 Six .Late	1940	Carter WDO Vacm.	461-S	C-209
HUDSON	44, 45, 47 Eight	1940	Carter WDO Vacm.	455-S	C-209
HUPMOBILE	R Skylark 6	1940	Carter W1 Vacm.	398-S	C-205
LA SALLE	40-50, 52 V8	1940	Carter WDO Vacm.	460-S	C-209
LINCOLN	V12	1940	Stromberg	EE-22	C-218
LINC.-ZEPHYR	06H	1940	Ch. Groves	AA-1	C-214
MERCURY	09A	1940	Ch. Groves	AA-1	C-214
NASH	4020 Amb. 6	1940	Carter WA-1 Vacm.	435-S	C-207
NASH	4080 Amb. 8	1940	Carter WDO	465-S	C-209
NASH-LAFAYETE	4010	1940	Carter WDO	458-S	C-209
OLDSMOBILE	F, G-40 Six	1940	Carter WA-1 Vacm.	466-S	C-207
OLDSMOBILE	F, G-40 Six Spec.	'40	Carter WA-1 Vacm.	467-S	C-207
OLDSMOBILE	L-40 Eight	1940	Carter WDO Vacm.	389-S	C-209
OLDSMOBILE	L-40 Eight Spec.	'40	Carter WDO Vacm.	471-S	C-209
PACKARD	1800 Six	1940	Stromberg	BXOV-26	C-217
PACKARD	1801, 1A Eight	1940	Stromberg	EE-16	C-219
PACKARD	1803,3A,4,5 Spr 8	1940	Stromberg	AAV-26	C-215
PACKARD	1806, 7,8 Spr 8	1940	Stromberg	AAV-26	C-215
PLYMOUTH	P9, P10	1940	Carter (B&B)	D6A2, D6C2	C-213
PLYMOUTH	P9, P10 Econ.	1940	Carter (B&B)	B6P1	C-213
PONTIAC	40-25, 26 Six	1940	Carter WA-1	463-S	C-207
PONTIAC	40-28 Deluxe 8	1940	Carter WA-1	462-S	C-207
PONTIAC	40-29 Torpedo 8	1940	Carter WDO	469-S	C-209
STUDEBAKER	2G Champion	1940	Carter WO	468-S	C-206
STUDEBAKER	10A Comm.	1940	Carter WA-1 Vacm.	410-S	C-207
STUDEBAKER	10A Comm.	1940	Stromberg	BXO-26	C-218
STUDEBAKER	6C Pres.	1940	Carter WDO	409-S	C-209
STUDEBAKER	6C Pres.	1940	Stromberg	AAO-161	C-216
WILLYS	440 Spdwy & Del.	'40	Carter WO	450-S	C-206
WILLYS	440, P Comm'l	1940	Tillotson	U-1B	C-221

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* Manual page number in latest edition of manual. For other editions, see previous Carburetor Index listings.

215-S—DODGE SIX, MODEL DL (1932)

147-SA—NASH SIX, MODEL 9-60 (1932)

TYPE:—Plain tube updraft type with throttle operated accelerating pump and economizing device (metering rod). Multiple jet nozzle (main discharge nozzle) is fed by fuel flowing through well jet. Discharge from multiple jet nozzle is controlled by metering rod which is lifted in the nozzle as the throttle is opened, providing maximum economy for partial throttle operation and full power with wide open throttle. All jets are 'fixed' type (non-adjustable). Fuel for idling is taken from float chamber through low speed jet tube and discharged through a port in the carburetor wall opposite the throttle edge (closed throttle position). Idle discharge passage has an air bleed hole regulated by the idling adjusting screw. Idle adjustment and accelerating pump adjustment (summer and winter setting) are the only points requiring attention.

IDLE ADJUSTMENT:—Air bleed type operating on air. Engine must be thoroughly warmed up before idling adjustment is made (on Nash models pull out heat control button on dash and leave in this 'Heat On' position while warming up engine and adjusting carburetor). With engine warm and running, close throttle, adjust throttle stop screw if necessary to secure correct idling speed of 300 R.P.M. or approximately 5-6 M.P.H. Adjust idling adjusting screw by turning screw out until engine begins to miss (mixture too lean), then turn screw in or clockwise slowly until engine fires smoothly. Idling screw operates on air and should be turned out or counter-clockwise to secure leaner mixture and in or clockwise for richer mixture. After completing adjustment, readjust throttle stop screw to secure correct idling speed. Do not idle engine below 300 R.P.M. or 5 M.P.H.

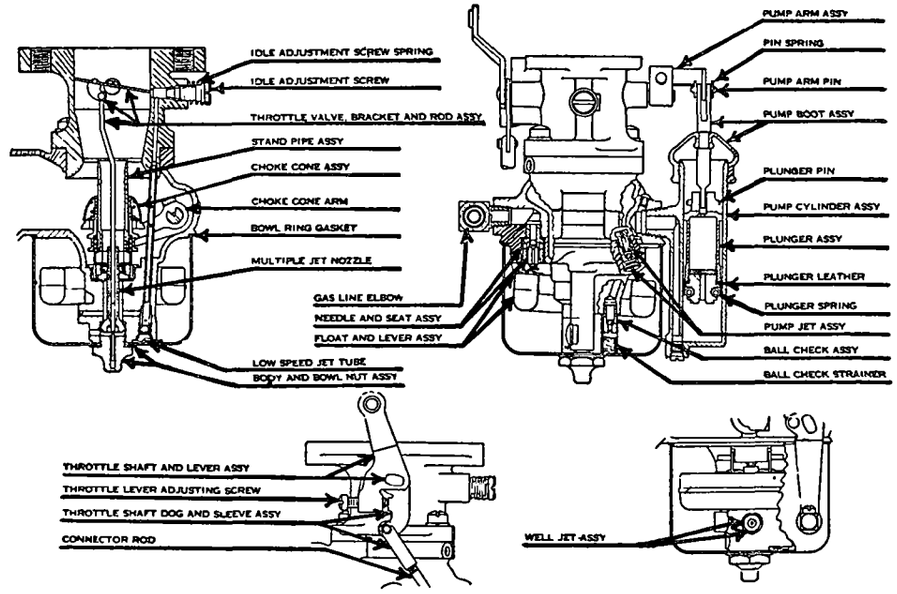
If correct idling adjustment cannot be secured, take out idling tube (in float bowl) and clean with compressed air. See that soldered joints on tube are tight and that tube is seated airtight in casting at top and bottom.

PERFORMANCE AND ECONOMY:—Multiple jet nozzle fuel supply is metered by main well jet, which is not adjustable. Well jet can be changed to secure leaner-than-standard fuel mixtures (see specifications). This is done ordinarily to compensate for special fuels or high altitudes.

Metering rod attached to throttle restricts discharge of multiple jet nozzle with throttle partly open. When throttle is opened wide, metering rod is raised in nozzle, permitting greater fuel discharge for full power operation. Metering rod is not adjustable and requires no attention.

ACCELERATING PUMP:—Low pressure delayed action type. Fuel is drawn into pump cylinder through ball check strainer and ball check valve (in lower part of float chamber) when throttle is closed and discharged through pump jet into mixing chamber when throttle is opened. Pump arm on throttle valve shaft has two or three holes for engagement of pump arm pin to provide varied pump stroke. Center hole in pump arm (when provided) should be used for normal temperature ranges. Pump pin should be engaged in outer hole (marked 'W') providing maximum pump stroke for winter driving. Inner hole (marked 'S') providing minimum pump stroke should be used for summer driving, high altitudes, or high test gasoline.

NOTE:—If increased resistance on foot throttle is noticed, take out pump discharge jet and clean with compressed air or replace jet. Poor acceleration may be caused by incorrect pump setting (above), damaged or worn pump plunger leather, loose pump cylinder, bent pump arm, clogged ball check strainer or ball check assembly. Ball check assembly can be removed and cleaned with compressed air. If pump plunger is removed from pump cylinder, a loading tool should be used to install the plunger in order to avoid damaging the plunger leather.



FLOAT LEVEL:—To check float level, take out float bowl nut, remove float bowl, invert carburetor, remove gasket, measure distance from gasket seat (machined surface on carburetor body) to nearest point on float (top when not inverted) at a point opposite needle valve. Correct float levels on all models should be 11/16". Adjust by bending lip of float lever.

THROTTLE VALVE SETTING:—When installing throttle valves, idle port opening above valve should be .030-.034" (315-S), .048-.052" (147-SA) with valve closed tightly. Idle ports are slotted or key-hole type.

CHOKE:—Compensating cone type consisting of a cone-shaped restriction on the standpipe which is raised in the venturi by the choke cone arm, increasing the air flow through the standpipe and the relative fuel discharge of the multiple jet nozzle. Choke lever and throttle lever on all models except 150-S (Chevrolet) are interconnected so that throttle valve is opened slightly when carburetor is fully choked. Connecting lever will not require adjustment and setting should not be disturbed.

CARTER UPDRAFT CARBURETOR JET SPECIFICATIONS

Car Model	Yr.	Carb. No.	Well Jet Assem. Standard Size	Well Jet Assem. Standard Part No.	Well Jet Assem. 1 Size Lean Size	Well Jet Assem. 1 Size Lean Part No.	Well Jet Assem. 2 Sizes Lean Size	Well Jet Assem. 2 Sizes Lean Part No.	Mult. Jet Nozzle Part No.	Low Speed Jet Tube Size	Low Speed Jet Tube Part No.	Pump Jet Assem. Size	Pump Jet Assem. Part No.	Pump Adj. Screw	Metering Rod Top Diam.	Metering Rod Bott. Diam.	Metering Rod Length
DODGE DL	1932	215-S	#53½	43-59S	#54	43-45S	—	—	12-158	#57	11-118S	#74	48-26S	—	.070"	.055"	5 1/64"
NASH 9-60	1932	147-SA	#56	43-43S	#57	43-29S	#58	43-35S	12-144	#66	11-90S	#74	48-26S	—	.066"	.051"	4 57/64"

NOTE:—Sizes of Jets given as '#53' are wire drill sizes.

212-S —CHEVROLET CONFEDERATE, SERIES BA (1932).
222-SA—CHEVROLET TRUCK, SERIES BB (1932).
235-S —CHEVROLET CONFEDERATE, SERIES BA (1932).
259-S —CHEVROLET MASTER SIX, SERIES CB (1933).
260-S —CHEVROLET STANDARD SIX, SERIES CC (1933).
243-S —ESSEX TERRAPLANE SIX, SERIES K (1932), SERIAL NOS. 350000 TO 367858.
267-S —ESSEX TERRAPLANE SIX, SERIES K, KU (1933), SERIAL NOS. 367858 UP.
261-S —ESSEX TERRAPLANE EIGHT, SERIES KT (1933).
258-S —HUPMOBILE SIX, SERIES K (1933).
255-S —PONTIAC EIGHT, SERIES 601 (1933), BEFORE SERIAL NO. 778380.
266-S —PONTIAC EIGHT, SERIES 601 (1933), AFTER SERIAL NO. 778380.
280-S PONTIAC EIGHT, SERIES 601 (1933), AFTER SERIAL NO. 827801.

TYPE:—Plain tube downdraft type with throttle operated accelerating pump and economizing device (metering rod). Main nozzle is located at an angle in the upper or primary venturi with a secondary and a main venturi directly below this point in the mixing chamber. Fuel for main nozzle is metered by metering jet and metering rod. Accelerating pump discharges through a pump jet against the wall of the secondary venturi. Idle adjustment and accelerating pump setting are the only points requiring attention.

IDLE ADJUSTMENT:—Air bleed type operating on air. Engine must be thoroughly warmed up before adjustment is made. With engine warm and running, close throttle, adjust throttle stop screw if necessary to secure correct idling speed of 300 R.P.M. or approximately 5-6 M.P.H. Turn idling adjusting screw out or counter-clockwise until engine begins to miss (mixture too lean), then turn screw slowly in or clockwise until engine fires smoothly. Idling screw operates on air and should be turned out to secure leaner mixture and in for richer mixture. Correct idling settings are as follows:

	Idling Screw	Idling Speed
Chevrolet (all)	½-1 turn open	300-350 R.P.M.
Hupmobile	⅜-1 turn open	
Pontiac	⅝-1⅛ turns open	300 R.P.M.
Terraplane 6 (243-S)	⅝-1⅛ turns open	300 R.P.M. or 5 M.P.H.
Terraplane 6 (267-S)	¾-1¼ turns open	300 R.P.M. or 5 M.P.H.
Terraplane 8	⅜-1 turn open	300 R.P.M. or 5 M.P.H.

Check idling speed after completing idling adjustment and readjust throttle stop screw if necessary. Do not idle engine below 300 R.P.M. If correct idling adjustment cannot be secured, remove low speed jet tube and clean with compressed air. See that tube is seated airtight in casting at top and bottom. If necessary replace with new tube of same characteristics.

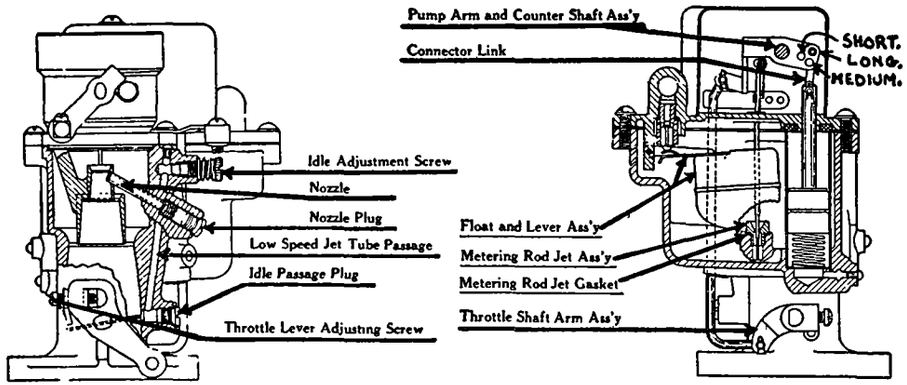
ACCELERATING PUMP:—Pump arm (on countershaft under dust cover) has three holes for engagement of pump plunger connector link to provide varied pump stroke. Medium setting with pin engaged in center hole is correct for ordinary temperature ranges and standard gasoline. Engage pin in inner hole (short pump stroke) for operation in hot climates, high altitudes, or with high test gasoline. Upper hole (long stroke) should be used for extremely cold temperatures. Accelerating pump countershaft should be lubricated at 5000 mile intervals. Take out dust cover screw (on top of cover) and fill threaded hole with a good grade of graphite grease.

METERING ROD (ECONOMIZER):—Fuel is metered by a two or three step metering rod being raised in the metering jet as the throttle is opened, allowing an increased fuel flow through the jet. No adjustment is provided but metering rods can be changed to secure leaner-than-standard fuel mixtures to compensate for special fuel or operating conditions such as high altitudes. To change metering rod, take off dust cover, take off pin spring, turn rod one-quarter turn to left to disengage pump arm, lift rod out, being careful not to lose disc on rod. Insert new rod (with disc in place), holding rod vertically so that lower end of rod will enter jet in float chamber. Turn rod one-quarter turn to engage pin on pump arm (throttle must be closed). If rod is correctly assembled no difficulty will be experienced in connecting the rod to the pin and rod will hang vertically. Replace pin spring and dust cover.

NOTE:—Metering rod setting should be checked whenever carburetor is serviced or when rods are changed. This will require a special gauge, Part No. T109-15 (2.797″). To check rod setting, remove dust cover, disengage upper end of throttle connector rod, back off throttle lever adjusting screw so that throttle closes tight, remove metering rod (see above), insert gauge in place of rod so that beveled end is seated in metering rod jet and gauge is held in vertical position. See that metering rod pin rests on top of gauge with throttle closed and upper end of connecting rod centering freely in the hole in the pump arm. If setting is not correct, bend lower end of throttle connector rod so that upper end centers freely in hole.

FLOAT LEVEL:—To check float level, take off float bowl cover, remove gasket, invert cover, measure distance from gasket seat (machined surface) on cover to nearest point on float (top when not inverted) at a point opposite the needle valve. Float level can be reset by bending lip of float lever.

Car Model	Carburetor Model	Float Level
Chevrolet	All Carbs	⅜″
Hupmobile Six 321	258-S	½″
Pontiac Eight	255-S, 266-S	½″
Pontiac Eight	280-S	⅜″
Terraplane Six	243-S, 267-S	⅜″-13/32″
Terraplane Eight	261-S	½″



THROTTLE VALVE SETTING:—When installing throttle valves, set valve so that idle port opening is as shown in table below with valve tightly closed.

Model	Idle Port Opening	Model	Idle Port Opening
Chevrolet 212-S	.031-.035″	Essex 267-S	.032-.036″
Chevrolet 222SA, 35S	.031-.035″	Hupmobile 258-S	.018-.022″
Chevrolet 259S, 60S	.035-.038″	Nash 186S	.048-.052″
Essex 243-S	.028-.032″	Pontiac 255S, 66S	.023-.027″
Essex 261-S	.018-.022″	Pontiac 280-S	.010-.014″

CHOKE:—On all models except Chevrolet and Nash (186-S, 212-S, 222-SA, 235-S, 259-S, 260-S) choke valve and throttle valve are interconnected so that throttle is opened slightly when carburetor is partially choked. This provides a fast idle during warming up period. Throttle returns to closed position when choke valve is fully open. Carburetor models 255-S, 261-S, 267-S are fitted with auxiliary relief poppet valves on the choke valve to prevent over-choking. Models 186-S, 212-S, 222-SA, 235-S, 259-S, 260-S, 243-S, 266-S have one side of the choke valve hinged and controlled by a spring so that when the engine begins to fire, this hinged portion of the valve acts as an automatic air valve during the warming up period. The hinged portion of the valve is held closed by a trigger lock when carburetor is fully choked and choke valve must be opened slightly to release this lock. Adjust valve lip under lock pawl so that clearance between valve edge and carburetor wall is .008-.012″ (259-S, 260-S), or .058-.068″ (266-S) with choke in fully closed position.

Car Model	Carburetor	Throttle Opening (Choke Closed)
Pontiac 601 ('33)	255-S, 266-S, 280-S	.031-.035″
Terraplane K ('32)	243-S	.022-.026″
Terraplane K ('33)	267-S	.036-.040″
Terraplane KT ('33)	261-S	.038-.042″

288-S—AUBURN, MODELS 652-X, 652-Y (1934)
307-S—AUBURN, MODEL 653 (1935)—FIRST 3036 CARS
285-S—CHEVROLET, STANDARD MODEL DC (1934)
284-S—CHEVROLET, STD. EC ('35), MASTER DA ('34), EA, ED ('35)
284-S—CHEVROLET, COMM'L, EB (1935), TRUCKS Q (1935)
321-S—CHEVROLET, FLEET MODEL (1935)
319-S—CHEVROLET, ALL MODELS (1936)—FIRST CARS.
334-S—CHEVROLET, ALL MODELS (1936)—LATER CARS.
335-S—CHEVROLET, ALL MODELS WITH ECONOMY 'V' ENGINES.
346-S—CHEVROLET, MASTER MODEL GB, DE LUXE MODEL GA (1937)
CHEVROLET, HALF TON TRUCK GC, 1½ TON SA, B, C, D (1937)
358-S—CHEVROLET, ALL FLEET MODELS (1937)—SEE NOTE.
391-S—CHEVROLET, ALL MODELS (1938)
358-S—CHEVROLET, ALL MODELS WITH ECONOMY ENGINE (1938)
420-S—CHEVROLET, ALL PASS. CARS & TRUCKS (1939)—SEE NOTE
434-S—CHEVROLET, ALL MODELS WITH ECON. ENGINE (1939)
299-S—HUDSON EIGHT, CHALLENGER MODEL LTS (1934)
316-S—HUPMOBILE AERODYNAMIC SIX, MODEL 518-D (1935)
333-S—HUPMOBILE SIX, MODEL 618-G (1936).
283-S—PONTIAC EIGHT, MODEL 603 (1934)
306-S—PONTIAC SIX, 701-A, 701-B (1935)—FIRST CARS
314-S—PONTIAC SIX, 701-A, 701-B (1935)—AFTER 19475 CARS
295-S—TERRAPLANE, CHALLENGER MODEL KS (1935)
311-S—TERRAPLANE, STANDARD SIX MODEL G (1935)
331-S—TERRAPLANE, DE LUXE MODEL 61 (1936).
348-S—TERRAPLANE, DE LUXE MODEL 71, COMMERCIAL MODEL 70 (1937)

NOTE:—Chevrolet (all). Main nozzle consists of Slip Nozzle in primary venturi and Screw Nozzle seated in slip nozzle. Furnished as an assembly and must not be dismantled.

Chevrolet Cab-over-Engine Trucks—Use Carter (BB) updraft type carburetors. See separate article for data on these models.

Chevrolet Models 319-S and 334-S Carburetors. Metering rod changed in production from Part No. 75-144 (319-S), 75-171 (334-S) to Part No. 75-176. Fuel economy will be improved in intermediate range (319-S) or throughout driving range (334-S) by installing this new metering rod.

Chevrolet Fleet Models. This carburetor has smaller main venturi and jet calibration and is fitted with stop pin which limits throttle opening to half-throttle (45 M.P.H.). Pin may be removed to permit top speed where necessary by inserting hacksaw blade behind lever and cutting off pin.

Chevrolet 420-S, 434-S Jet Changes—The metering rod and low speed jet changed in production for better low speed economy and performance. Original Standard Metering Rod changed to 1 Size Lean. See Carter Jet Specification Table for complete jet data.

Hupmobile Model 333-S—This model fitted with Anti-percolator. Adjustment instructions given below.

Pontiac Model 314-S—This model fitted with Anti-percolator. Adjustment instructions given below.

Terraplane Models. Carburetor fitted with Anti-Percolator and Throttle Cracker. See these sections below for adjustments.

SPECIAL SHOP NOTES:—Chevrolet Engine Running Backward (When key is turned off)—To corect this complaint, check idle speed and set stopscrew for idle speed not to exceed 7 M.P.H. Check throttle valve and make certain that it is not sticking. Check manifold heat control valve thermostatic spring. Spring must be wound up only enough so that end can be slipped over manifold pin (approximately ½ turn). Excessive tension will cause poor performance.

Chevrolet 391-S Stalling when Hot. If engine stalls while idling when hot but idles properly when cool, this condition probably caused by pressure in float bowl caused by fuel 'percolation' forcing fuel through nozzle to manifold and stalling engine. Correct by installing new lightweight Bakelite Metering Rod Disc Part No. 129-21 (supersedes No. 129-18). Any pressure in float bowl will raise this disc and relieve bowl pressure. This stalling not caused by carburetor flooding and fuel pump pressure should not be reduced or jets and intake needle valve changed.

Chevrolet 391-S Excessive Pinging. If engine pings excessively at start of acceleration from constant speed of 20 MPH (after Octane Selector correctly set for slight ping when accelerating with wide open throttle from 10 MPH—see tune up data on car model for instructions), this ping probably caused by 'time lag' of vacuum control in retarding spark. Correct by removing vacuum line brass fitting on carburetor body and, on first models with small round hole in carburetor casting, drill hole out first with a #52 (.0635") drill and then with a #46 (.081") drill. On later models with rectangular hole in carburetor body, do not make this correction. Remove vacuum line fitting at vacuum diaphragm and drill out with #46 (.081") drill. On cars after March 15th, vacuum line and fittings were increased to 3/16" (first cars ⅛") to cut down this vacuum control 'time lag.'

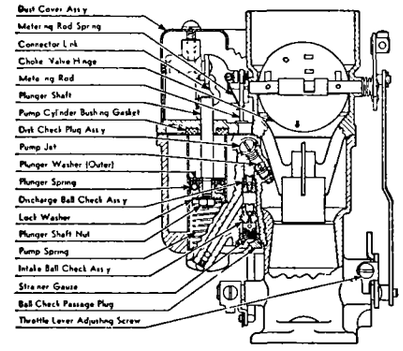
Chevrolet 391-S 'Loading' on Rough Roads. See that correct bowl cover gasket (No. 121-55) installed which has hole provided for vent by-pass. No. 121-46 gasket (used on 1937 models) does not provide for this vent by-pass and must not be used.

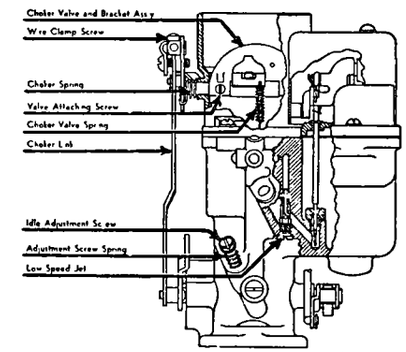
Chevrolet 391-S Excessive Fuel Consumption (Poor Mileage). Make certain that small gasket between air horn and carburetor body at the air horn and fuel bowl air passage is in good condition and that the sealing washer at metering rod on bowl cover is in place. Air leaks at either point will upset the balanced bowl vent system (see description below) and cause excessive gasoline consumption at intermediate speeds.

Chevrolet 420-S, 434-S Rich & Lean Complaints—To correct fuel mixture being too rich at low speed, or too lean at high speed (caused by metering rod disc hanging on metering rod), install special Metering Rod Disc Retainer No. 201-10. This retainer should be installed on these carburetors (420-S, 434-S) whenever carburetors are serviced.

TYPE:—Plain tube downdraft type with throttle operated accelerating pump and economizing device (metering rod). Main nozzle is located at an angle in the upper or primary venturi with a secondary and a main venturi directly below this point in the mixing chamber. Fuel for main nozzle is metered by metering jet and metering rod. Accelerating pump discharges through a pump jet against the wall of the secondary venturi. Idle adjustment and accelerating pump setting are the only points requiring attention.

Chevrolet Model 391-S. New 'balanced' type bowl construction. Bowl is vented through system of passages in bowl cover, carburetor body, and air horn casting to air intake below air cleaner (#35 drill hole below choke valve, #27 hole above choke valve through drilled hole in shaft). This construction eliminates surging of fuel into air passages on rough roads (bowl vent located in top of countershaft dome on bowl cover) and holds air-and-fuel proportions constant under all conditions. See Loading and Gasoline consumption complaint remedies above.





IDLE ADJUSTMENT:—Needle valve type controlling fuel mixture. Engine must be thoroughly warmed up before adjustment is made. With engine warm and running, close throttle, adjust throttle stop screw if necessary to keep engine from stalling (do not set lower than 300 R.P.M. or approximately 5-6 M.P.H.). Turn idling adjusting screw in or clockwise until engine begins to miss (mixture too lean), then turn screw slowly out or counter-clockwise until engine fires smoothly. Idling screw controls fuel mixture and should be turned in to secure leaner mixture or out for richer mixture. See tune up data for each model on car model page. Approximate settings as follows:

Car Model	Idle Screw Setting	Idling Speed
Auburn (all models)	½-1⅛ turn open	350 R.P.M., 6 M.P.H.
Chevrolet (1934-35)	½-1½ turn open	350 R.P.M.,
Chevrolet 1936-37-38-39	1-2 turn open	400 R.P.M., 7 M.P.H.
Hudson	⅜-1 turn open	350 R.P.M., 7 M.P.H.
Hupmobile (all models)	⅜-1 turn open	300 R.P.M.,
Pontiac (all models)	½-1 turn open	360 R.P.M., 6 M.P.H.
Terraplane (all models)	⅜-1 turn open	350 R.P.M., 7 M.P.H.

METERING ROD (ECONOMIZER):—Fuel is metered by a two or three step metering rod being raised in the metering jet as the throttle is opened, allowing an increased fuel flow through the jet. No adjustment is provided but metering rods can be changed to secure leaner-than-standard fuel mixtures

to compensate for special fuel or operating conditions, such as high altitudes. To change metering rod, take off dust cover, take off pin spring, turn rod one-quarter turn to left to disengage pump arm, lift rod out, being careful not to lose disc on rod. Insert new rod (with disc in place), holding rod vertically so that lower end of rod will enter jet in float chamber. Turn rod one-quarter turn to engage pin on pump arm (throttle must be closed).

NOTE:—Metering rod setting should be checked whenever carburetor is serviced or when rods are changed. This will require a special gauge (see table below for correct gauge for each carburetor model). To check rod setting, remove dust cover, disengage upper end of throttle connector rod, back off throttle lever adjusting screw so that throttle closes tight, remove metering rod (see above), insert gauge in place of rod so that beveled end is seated in metering rod jet and gauge is held in vertical position. See that metering rod pin rests on top of gauge with throttle closed and upper end of connecting rod centering freely in the hole in the pump arm. If setting is not correct, bend lower end of throttle connector rod so upper end centers freely in hole Replace metering rod and dust cover (lubricate pump shaft—see Accelerating Pump Section). Readjust throttle stopscrew for correct idling speed.

Car Model	Carburetor Model	Gauge Part No.	Length
Auburn 652X, Y	288-S	T-109-15	2.797"
Auburn 653	307-S	T-109-20	2.795"
Chevrolet DC Std.	285-S	T-109-15	2.797"
Chevrolet DA, EA, EC, ED	284-S, 321-S	T-109-20	2.795"
Chevrolet	All 1936-37-38-39 Models	T-109-25	2.795"
Hudson LTS	299-S	T-109-20	2.795"
Hupmobile 518-D	316-S	T-109-21	2.718"
Hupmobile 618-G	333-S	T-109-25	2.795"
Pontiac 603 '34	283-S	T-109-15	2.797"
Pontiac all '35	306-S	T-109-21	2.718"
Terraplane all '34-35	295-S, 311-S	T-109-20	2.795"
Terraplane '36-37	331-S, 348-S	T-109-25	2.795"

NOTE—On Chevrolet Model 391-S, make certain that gasket is in place at metering rod on bowl cover. This gasket seals off metering rod opening and must be in good condition (air leaks at this point will disturb 'balanced' operation).

ACCELERATING PUMP:—Low pressure type positively actuated by throttle lever. Fuel drawn into pump chamber through intake ball check valve and strainer on upstroke of plunger and discharged through outlet disc check valve to pump jet in carburetor wall on downstorke of plunger when throttle opened.

Adjustment—Pump arm on countershaft under dust cover on top of float bowl cover provided with three holes for engagement of pump plunger connecting link. Inner hole provides minimum stroke, outer hole medium stroke, and upper hole maximum stroke. See tune up data on car model page for recommended setting and seasonal changes.

NOTE—Pump countershaft should be lubricated at 5000 mile intervals by removing dust cover screw at top of carburetor and filling screw hole with good grade of graphite grease before replacing screw.

PERFORMANCE:—Should be satisfactory if Idle Setting and Accelerating Pump setting are correct. See Carter Jet Specification Table and tune up data on car model pages for any recommended changes.

ANTI-PERCOLATOR:—Saxophone Type. Consists of a vent above main jet well controlled by a cap linked to the accelerating pump rod so that the vent is opened with the throttle closed to prevent any 'percolating' discharge of fuel through the main jet with the carburetor hot. The setting of the Anti-percolating device should be checked as follows:

Adjustment—Anti-percolating cap must be off seat when throttle closed in idling position. Adjust by bending anti-percolating cap arm slightly to permit pump arm to depress bracket. Cap must be seated when throttle opened slightly beyond idling position. Check by opening throttle .030" (insert drill rod between throttle edge and carburetor wall on side opposite port), adjust rocker arm so that clearance between rocker arm lip and pump arm is .005-.015" (with metering rod setting correct).

FLOAT LEVEL:—To check float level, take off float bowl cover, remove gasket, invert cover, measure distance from gasket seat (machined surface) on cover to nearest point on float (top when not inverted) at a point opposite the needle valve. Float level can be reset by bending lip of float lever. Correct float level setting is ½" (Chevrolet 420-S, 434-S), ⅜" (all others).

CHOKE:—Choke valves on these models are in most instances fitted with a pressure relief device of the split-valve or poppet-valve type.

Models 283S, 84S, 316S, 19S, 21S, 33S, 34S, 35S, 46S, 58S. Split type with half of the choke valve hinged and controlled by a spring. The hinged portion is held closed by a trigger lock when carburetor is fully choked for starting but is released as soon as the choke valve is opened slightly and acts as an automatic air valve during the warming-up period. Valve lip under pawl should be adjusted so that clearance between edge of choke valve and carburetor wall is .070-.075" (284-S, 285-S) with choke valve closed.

Models 281-S, 282-S, 288-S, 295-S, 298-S, 299-S, 307-S, 309-S, 310-S, 311-S, 315-S. Poppet type relief valve mounted on choke valve. Poppet valve is spring-controlled and opens to prevent over-choking when engine begins to fire.

391-S, 420-S, 34-S—Offset valve, semi-automatic type. Choke valve shaft and lever linked by coil springs (light inner spring allows choke valve to operate automatically during warming up period regardless of choke button position, heavy outer spring absorbs back pressure and prevents damage to valve.

Throttle Connector Used on Models 283-S, 288-S, 295-S, 299-S, 306-S, 307-S, 311-S, 314-S, 331-S, 348-S. Choke and throttle valves interconnected on these models so that throttle valve is opened slightly when carburetor is choked for starting, providing a 'fast idle' for as long as the choke valve is in use. Throttle returns to closed position when choke valve is opened. Correct throttle openings with choke valve closed are shown in table below:

Car Model	Carburetor	Throttle Opening
Auburn (all models)	288-S, 307-S	.031-.035"
Hudson LTS	299-S	.036-.040"
Pontiac Eight 603 ('34)	283-S	.031-.035"
Pontiac Six 701A, B ('35)	306-S, 314-S	.031-.035"
Terraplane ('34-37)	295-S, 311-S, 331-S, 348-S	.036-.040"

THROTTLE VALVE SETTING:—When installing valves, check setting with stopscrew backed off so that valve tightly closed. Idle Port Opening is opening of lower port (below throttle valve) except as noted.

Car Model	Carburetor	Idle Port Opening
Auburn	288-S	.008-.012"
Auburn	307-S	.003-.007"
Chevrolet	284-S (Keyhole Type Port), 285-S	.011-.015"
Chevrolet	284-S (Slotted Type Port)	.014-.018"
Chevrolet	319-S, 334-S	① .016-.020"
Chevrolet	321-S	① .158-.162"
Chevrolet	335-S, 358-S	① .012-.016"
Chevrolet	346-S	① .034-.038"
Chevrolet	391-S, 420-S, 434-S	① .047-.051"
Hudson	299-S	.007-.011"
Hupmobile	316-S, 333-S	.008-.012"
Pontiac	283-S, 306-S, 314-S	.010-.014"
Terraplane	295-S, 311-S, 331-S, 348-S	.016-.020"

①—Top of lower idle port above top edge of throttle valve.

TROUBLE SHOOTING:—Poor Idling Performance—If correct adjustment cannot be secured, engine stalls, or low speed performance is unsatisfactory, remove low speed idle tube, clean with compressed air, see that tube is tight in casting at top and bottom. Remove idle adjusting screw and clean idle passage with air.

Acceleration Unsatisfactory—Check pump setting, examine pump for damaged or worn plunger leather, bent pump arm or loose plunger, corrosion or sediment in pump cylinder. Use loading tool when replacing plunger in pump cylinder to avoid damage to plunger leather. If increased resistance felt on throttle lever, remove pump jet and clean with compressed air. Examine ball check valves and see that they are free and seat gasoline tight.

Carburetor 'Loads Up'—If carburetor has been in use for some time, check float level and adjust if necessary.

SERVICING:—To Disassemble Carburetor—Take out screw and remove pump arm dust cover, disconnect choke and throttle interconnecting link (when used), take off pin spring on metering rod, lift out rod and disc (disc is loose on rod). Take off pin locks on throttle connector link and pump connector link, disengage links and remove. Take out float bowl cover screws, lift off cover being careful not to damage float chamber gasket. Pull out pump plunger, remove plunger spring from pump cylinder. Remove idle adjusting screw and spring, nozzle plug and main nozzle, pump jet plug and pump jet being careful not to lose jet gasket, idle passage plug, low speed jet tube assembly, metering rod jet assembly, and other jets and plugs. Take out float lever pin, lift out float and lever assembly being careful not to drop float needle valve.

Servicing—Wash all parts and body castings in gasoline, blow out all passages in castings and jets with dry air. Replace all worn and damaged parts.

Reassembling Carburetor—Reverse disassembly directions above. Use new gaskets where necessary. Soak new metering rod jet gasket and needle seat gaskets in warm water for 15 minutes before installing. See that all jets and plugs tightened securely.

Adjusting—Check metering rod setting and float level. Adjust carburetor, when installed n engine, as directed in tune-up data on each car model page.

282-S—HUDSON EIGHT, MODELS LL, LT (1934).
309-S—HUDSON SIX, MODEL GH (1935).
310-S—HUDSON EIGHT, MODELS HT, HU, HHU (1935).
329-S—HUDSON SIX, MODEL 63 (1936).
330-S—HUDSON EIGHT, MODELS 64, 65, 66, 67 (1936).
327-S—OLDSMOBILE SIX, MODEL F-36 (1936)—FIRST 17,745 CARS.
339-S—OLDSMOBILE F-36 SERIAL NOS. 217746 TO 274031 AND 275111 UP.
342-S—OLDSMOBILE F-36 SERIAL NOS. 274032 TO 275110.
351-S—OLDSMOBILE SIX, MODEL F-37 (1937)
385-S—OLDSMOBILE SIX, MODEL F-37 (LATE 1937), F-38 (1938)
OLDSMOBILE 6, F-39 '60', G-39 '70' (1939) FIRST CARS.
298-S—PONTIAC EIGHT, MODEL 605 (1935) FIRST CARS.
315-S—PONTIAC EIGHT, MODEL 605 (1935) LATER CARS.
324-S—PONTIAC SIX, DELUXE 36-26-A, MASTER 36-26-B (1936).
322-S—PONTIAC EIGHT, MODEL 36-28 (1936).
340-S—PONTIAC, ALL TAXICAB MODELS (1936).
352-S—PONTIAC SIX, MODEL 37-26CA (1937)
350-S—PONTIAC EIGHT, MODEL 37-28CA (1937)
338-S—REO FLYING CLOUD, MODEL 6-D (1936).
371-S—STUDEBAKER DICTATOR, MODS. 5A, 6A (1937), ENG. No. D-143675 UP
281-S—TERRAPLANE, STD. MODEL K, DELUXE MODEL KU (1934).
309-S—TERRAPLANE, DELUXE SIX MODEL GU (1935).
329-S—TERRAPLANE, CUSTOM MODEL 62 (1936).

NOTE:—All models fitted with Carter Climatic Control (automatic choke), Fast Idle, Unloader and Choke Valve Lock, and Anti-Percolator. See complete article in Carburetion Equipment Section for data on Climatic control, Fast Idle and Unloader. Anti-Percolator adjustment given below.

Nozzle Assembly on 327S, 38S, 39S, 42S, 51S, 85S. Consists of outer 'Slip Nozzle' in primary venturi and inner nozzle seated within this outer nozzle. Do not dismantle nozzle assemblies.

Oldsmobile F-38 Model. Model 385-S carburetor used on cars without automatic Self-shifting Transmission only. See Carter Vacumeter Carburetor article for data on type used with Self-shifting transmission.

Oldsmobile 1939 Models—Later cars use Carter WA1 Models 425-S, 426-S carburetors. See following article for complete data.

TYPE:—Same design as other Carter W1 carburetors except for Climatic Control, Fast Idle and Unloader mounted on carburetor air horn.

IDLE ADJUSTMENT:—Needle valve type controlling fuel mixture. Adjusting screws should be turned in for leaner mixture or out for richer mixture. Do not adjust until engine warmed up so that choke valve wide open and idling at hot or slow idling speed with fast idle bar raised to clear throttle stopscrew. Adjust throttle stopscrew so that idling speed is approximately 350 R.P.M., turn idling screw in until engine begins to miss, then turn screw out slowly until engine fires evenly. Readjust throttle stopscrew if necessary. See tune up instructions on car model pages. Approximate idle screw settings shown in table below.

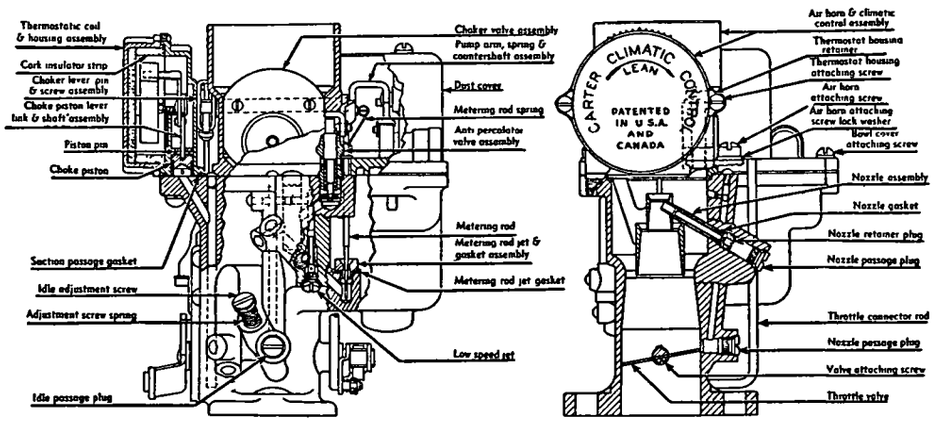
Car Model	Idle Screw Setting	Idle Speed
Hudson (1934-35)	⅜-1 turn open	350 RPM., 7 MPH.
Hudson (1936)	½-1 turn open	350 RPM., 7 MPH.
Oldsmobile (1936-37)	¾-1¼ turn open	350 RPM., 6 MPH.
Oldsmobile (385-S)	1-1½ turns open	350 R.P.M., 6 M.P.H.
Pontiac (All 1935-36)	½-1¼ turn open	360 RPM., 6 MPH.
Pontiac 6 (1937)	¾-1¼ turn open	360 RPM., 6 MPH.
Pontiac 8 (1937)	½-1 turn open	350 RPM., 6 MPH.
Reo	½-1¼ turn open	350 RPM., 6 MPH.
Studebaker	½-1¼ turn open	360 RPM., 6 MPH.
Terraplane (1935)	⅜-1 turn open	350 RPM., 7 MPH.
Terraplane (1936)	½-1 turn open	350 RPM., 7 MPH.

ACCELERATING PUMP:—Low pressure type positively actuated by throttle lever. Fuel drawn into pump cylinder through intake check valve and strainer on upstroke of plunger and discharged through outlet disc check valve to pump jet in carburetor wall on downstroke of plunger when throttle opened.

Adjustment—Pump arm on countershaft under dust cover at top of cylinder provided with three holes for engagement of pump plunger connecting link. Inner hole provides minimum stroke, outer hole medium stroke and upper hole maximum stroke. See tune-up data on car model pages for recommended settings and seasonal changes.
NOTE—Pump countershaft should be lubricated at 5000 mile intervals by removing dust cover screw at top of carburetor and filling screw hole with good grade of graphite grease before replacing screw.

PERFORMANCE:—Should be satisfactory if idle setting and accelerating pump setting correct. See Carter Jet Specification Table and tune-up data on car model pages for standard jet calibrations and any recommended changes.

METERING ROD (ECONOMIZER):—All fuel for main nozzle metered by three-step metering rod linked to pump arm so that rod is raised permitting increased fuel flow through metering jet as throttle is opened. No adjustment provided but metering jet may be changed to secure leaner-than-standard fuel mixtures to compensate for special fuel or high altitude operation (see Jet Specification table). Metering rod setting should be checked whenever metering rods are removed.



To Remove Metering Rod—Take out dust cover screw, lift off dust cover, take off pin spring, turn metering rod one-quarter turn to left to disengage it from arm, lift rod out being careful not to lose disc on rod.

To Check Metering Rod—See that choke valve opened and fast-idle block raised to clear throttle stopscrew, back off stopscrew so that throttle closes tightly. Disconnect throttle connector at pump arm. Use special gauge (see table below for type for each model), insert gauge in place of metering rod so that beveled end seats in metering jet and gauge is held vertically. Rotate pump arm so that metering rod pin rests lightly in lower end of notch in gauge, bend lower end of throttle connector so that upper end centers freely in hole in pump arm. Remove gauge and re-connect throttle connector.

Car Model	Carburetor	Gauge Part No.	Length
Hudson LL, LT	282-S	T-109-15	2.797"
Hudson GH, HT, HU, HHU	309-S, 310-S	T-109-20	2.795"
Hudson 63, 64, 65, 66, 67	329-S, 330-S	T-109-25	2.795"
Oldsmobile	327-S, 339-S, 342-S, 351-S	T-109-25	2.795"
Oldsmobile	385-S	T109-25	2.795"
Pontiac 605	298-S, 315-S	T-109-21	2.718"
Pontiac 1936-37	322-S, 24-S, 40-S, 50-S, 52-S	T-109-26	2.718"
Reo	338-S	T-109-25	2.795"
Studebaker	371-S	T-109-25	2.795"
Terraplane K, KU	281-S	T-109-15	2.797"
Terraplane GU	309-S	T-109-20	2.795"
Terraplane 62	329-S	T-109-25	2.795"

To Install Metering Rod—Insert rod (with disc in place) vertically so that lower end enters metering rod jet, turn rod one-quarter turn to engage pin on pump arm, replace pin spring. See that rod hangs freely, replace dust cover and cover screw.

ANTI-PERCOLATOR:—Saxophone Type (329-S Only). Consists of a vent above the main jet well controlled by a cap linked to the accelerating pump rod so that the vent is opened when the throttle valve is closed to prevent any 'percolating' discharge of fuel through the main jet when the carburetor is hot. The cap must be closed when the throttle is opened.

Adjustment. Anti-percolating cap must be off seat when throttle closed to idling position. Adjust by bending anti-percolating cap up slightly to permit pump arm to depress bracket. Cap must be seated when throttle opened slightly beyond idling position. To adjust, open the throttle valve exactly .030" using a drill rod of the correct size inserted between the throttle edge and carburetor wall on side opposite idle ports to maintain opening, adjust rocker arm so that clearance between rocker arm lip and pump arm is .005-.015". Be careful not to disturb metering rod setting.

ANTI-PERCOLATOR:—Plunger Type. Consists of a spring-loaded plunger type valve which is opened by a lip on the pump arm when the throttle is closed to vent the main jet well and prevent any 'percolating' discharge from the main jet when carburetor is hot. Valve must be closed when throttle is opened (incorrect adjustment will cause flat spots in performance).

Adjustment. Take out dust cover screw and remove dust cover. Back off throttle stopscrew, hold throttle valve tightly closed, adjust lip on pump arm so that anti-percolator valve is depressed so that indicator line on valve stem is flush with top of anti-percolator plug. This adjustment should be made after metering rod setting checked and care taken not to disturb metering rod.

Adjustment (Early Types without Indicator Line). On these models, use tool J-109-29 or drill rod of correct size inserted between throttle valve edge and carburetor wall on side opposite idle ports so that throttle valve opening is exactly .020", adjust lip on pump arm so that clearance between pump arm lip and anti-percolator valve stem is .005-.015".

FLOAT LEVEL:—To check float level, take off float bowl cover, remove gasket, invert cover, measure distance from gasket seat to nearest point on float (top when not inverted and at free end). Float level can be corrected by bending lip of float lever. Settings should be as follows:

Car Model	Carburetor Model	Float Setting
Hudson LL, LT	282-S	13/32"
Hudson all others	309-S, 310-S, 329-S, 330-S	3/8"
Oldsmobile	327-S	1/2"
Oldsmobile	339-S, 342-S, 351-S, 385-S	3/8"
Pontiac all models	298-S, 315-S, 322-S, 324-S, 340-S, 350-S, 352-S	3/8"
Reo	338-S	7/16"
Studebaker	371-S	3/8"
Terraplane all models	281-S, 309-S, 329-S	3/8"

FAST IDLE:—1936 & Studebaker 371-S. Consists of fast idle block linked to the choke valve which drops down behind the throttle stopscrew so that the throttle is held open in the fast idle position when the choke valve is in use (throttle must be opened momentarily to allow fast idle to operate). No adjustment required.

FAST IDLE:—1937-38 Models except Studebaker 371-S. Consists of fast idle cam pivoted directly above the throttle lever so as to serve as a stop for the throttle stopscrew. Fast idle cam is linked to Climatic Control and is rotated to the fast idle position when the carburetor is cold (choke valve closed).

Adjustment. Back off throttle stopscrew, rotate fast idle cam to normal (hot) idling position, turn stopscrew in so that it just contacts first step on fast idle cam with throttle valve seated, use tool T109-41 to bend offset portion of fast idle link so that clearance between inside wall of air horn and lower edge of choke valve is 5/8". Make certain that fast idle linkage does not bind.

CHOKE:—All choke valves are offset type. See article in Carburetion Equipment Section for complete data on automatic choke (Climatic Control).

Unloader (1936 & Studebaker 371-S):—Consists of a curved lip on the fast idle block which opens the choke valve when the throttle valve is opened wide. To adjust, bend the curved lip so that the choke valve opening (distance from lower edge to air horn wall) is 7/16" (329-S, 330-S), 1/4" (322-S, 371-S), 1/2" (324-S, 327-S, 338-S, 339-S, 340-S, 342-S) with throttle valve wide open.

Choke Valve Lock. Consists of a lip on the choke valve lever and lug on fast idle link which prevents choke valve closing when throttle valve is wide open. See that clearance between lip and fast idle lug is 1/16" with both choke valve and throttle valve wide open. Can be adjusted by filing off top edge of fast idle link slightly using care to maintain original contour. See that choke valve is released when throttle valve is closed.

Unloader (1937-38 Models except Studebaker 371-S):—Consists of a cam on the throttle lever which opens the choke valve when the throttle valve is opened wide. To adjust, bend the cam so that the choke valve opening (distance from lower edge of valve to air horn wall) is 3/8" (351-S, 385-S), 1/4" (350-S, 352-S) with throttle valve wide open.

Choke Valve Lock. Consists of a lip on the fast idle link which prevents choke valve closing with throttle valve wide open. To adjust, hold choke valve and throttle valve wide open, bend lip so that clearance between it and throttle lever lock is 1/32". See that choke valve is released when throttle valve closed.

TROUBLE SHOOTING:—Same as for other Carter W1 models. See preceding article.

THROTTLE VALVE SETTING:—'Idle Port' opening is distance from lower edge of throttle valve to lower edge of port with valve closed. 'Vacuum Port' figure is distance from lower edge of port to top edge of valve. Throttle valves are Part No. 2-72 (281-S, 282-S, 298-S, 309-S, 310-S), No. 2-90 (all others).

Car Model	Carburetor	Idle Port	Vacuum Port
Hudson	282S, 309S, 10S, 29S, 30S	.016-.020"	
Oldsmobile	327S	.010-.014"	.041-.047"
Oldsmobile	339S, 42S, 51S, 85S	.010-.014"	.021-.029"
Pontiac	298S	.014-.018"	
Pontiac	322S, 24S, 40S, 50S, 52S	.014-.018"	.022-.027"
Reo	338S	.010-.014"	.041-.047"
Studebaker	371S	.014-.018"	.022-.027"
Terraplane	281S, 309S, 29S	.016-.020"	

NOTE—Throttle valve shims furnished .002" thick (2-93), .005" thick (2-94) to correct throttle valve location.

SERVICING:—Disassembly. Remove dust cover, remove fast idle cam attaching screw and fast idle cam or take out two screws and remove fast idle drop-bar, remove nozzle plug, retainer plug, nozzle and gasket (do not take nozzle assemblies apart). Remove air horn attaching screws and lockwashers (two above, one below), lift off air horn and Climatic Control assembly. Remove pin spring and connector link at top of accelerating pump stem, remove pin spring, unhook metering rod spring, take out metering rod and disc (do not lose disc which is free on metering rod). Remove spring retainers and connector rod springs, remove throttle connector. Remove bowl cover retaining screws and lockwashers, lift off bowl cover, lift off cover gasket. Remove pump arm and countershaft on cover by revolving one-half turn. Remove float and lever assembly, pin and pump cylinder bushing gasket, needle and seat from bowl cover. Remove pump plunger and rod assembly and pump spring (remove nut on stem to disassemble pump plunger). Remove metering rod jet and gasket assembly. Use special 13/32" socket wrench No. 15451 to remove Anti-Percolator valve plug assembly. Remove pump jet passage plug, gasket, and pump jet, loosen screw and remove throttle shaft arm, remove low speed jet, ball check passage plug, strainer, and intake and outlet ball check plug assemblies, throttle valve screws, valves, throttle shaft assembly, idle port plug, and idle adjustment screw. Do not lose copper washers used on low speed jet, ball check assemblies.

Servicing. Wash all parts in gasoline (do not immerse cork gaskets). Replace worn parts (replace metering rod and metering jet as an assembly). Blow out all passages in castings. Use all new gaskets when re-assembling.

Assembly. Reverse disassembly directions above. See that all jets and plugs tightened securely. When replacing throttle valves, install valve with trademark up, insert screws loosely, back off stopscrew so that valve closes tightly, tap valve lightly to centralize it in bore before tightening screws. Use loading tool to install pump plunger and lubricate plunger leather with caster oil. Check float level and metering rod setting as directed above and adjust carburetor when replaced on car.

***411-S—HUDSON '112', 89 (1938) BEFORE ENG. NO. 89-36571.**
***417-S—HUDSON '112', 89 (1938) AFTER ENG. NO. 89-36572**
***437-S—HUDSON, MODELS 90, 91, 92, 98 (1939)—SEE NOTE**
***438-S—HUDSON, MODELS 90, 91, 92, 98 (1939)—SEE NOTE**
398-S—HUPMOBILE SIX, MODEL E-822 (1938)
HUPMOBILE, SENIOR SIX MODEL 922-E (1939)
HUPMOBILE SKYLARK, MODEL 915-R (1939).
388-S—*OLDSMOBILE 6, F-38* WITH SELF-SHIFTING TRANS. (1938)
†364-S—PONTIAC TAXICAB, MODEL 37-26CA (1937)
401-S—PONTIAC SIX, MODEL 38-26DA (1938)
400-S—PONTIAC EIGHT, MODEL 38-28DA (1938)
***397-S—TERRAPLANE, MODELS 80, 81, 88 (1938)**

* These models not fitted with Climatic Control and Fast Idle.
†—Used with special Monarch Governor only.

NOTE:—Hudson 1939. Model 437-S carburetor used on cars with Automatic Clutch, 438-S on other cars. Model 437-S has "slow-closing throttle."

SPECIAL SHOP NOTES:—Hudson 112. To correct Lean Idle complaints on this model, enlarge vent hole in bowl cover by drilling out hole with #38 (.1015") or #39 (.0995") drill.

Pontiac 1938 Surge & Flat Spot Correction—Caused by improper seal between anti-percolator cap and seat which admits air at speeds above idle. Correct by installing new anti-percolator cap and arm assembly 184-14S, rocker arm spring 61-179, and anti-percolator bracket pin 150-89. New cap and rocker arm assembly has same number as earlier type but may be identified by brown leather seal (first type had black leather seal). Adjust anti-percolator after installing new parts. CAUTION—All above parts must be installed as a unit.

Pontiac Taxicab—Model 364-S carburetor has vacuum controlled Metering Rod (not adjustable). This carburetor used only in conjunction with Monarch Governor and special gasket No. 1A-42 must be used between Governor and carburetor (standard gasket must not be used).

Whistling Complaints (all models)—To correct whistle at vacuum spark port, remove vacuum passage plug (on side of body casting near idle adjusting screw), install special bushing No. 38A-35 and new rivet plug.

TYPE:—Same design as other Carter Carburetors (see preceding article) except for new 'Vacumeter' type metering rod control as follows:

Vacumeter Metering Rod Control. Metering rod is linked to stem of spring-loaded vacuum piston and is normally held against stop-pin on pump shaft by manifold vacuum (stop-pin insures correct metering rod position for any throttle opening and will lift metering rod out of metering jet mechanically in same manner as on other Carter Carburetors when throttle is opened). Whenever vacuum decreases due to throttle being opened for acceleration, or added load placed on engine, vacuum piston spring forces piston and metering rod up so that richer mixture is supplied for acceleration and power. As soon as vacuum builds up again, piston pulls metering rod against stop-pin so that correct maximum-economy mixture is supplied.

IDLE ADJUSTMENT.—Idle adjusting screw controls idle fuel mixture and should be turned in for leaner mixture, out for richer mixture. Approximate settings shown in table below. Idle speed controlled by throttle lever stopscrew. Adjustments should be made only with engine warmed up and idling at hot or slow speed (choke valve wide open, fast idle inoperative). See tune up data on car model page for complete tune up adjustment data for each model.

Car Model	Idle Screw Setting	Idling Speed
Hudson 112	¾-1½ turns open	350 R.P.M., 7 M.P.H.
Hudson 90, 91, 92, 98	½-1¼ turns open	7 MPH.
Hupmobile	¾-1¼ turns open	300 R.P.M.
Oldsmobile F-38	½-1 turn open	350 R.P.M., 6 M.P.H.
Pontiac Taxi (1937)	¼-¾ turn open	360 RPM., 6 MPH.
Pontiac 6 38-26DA	¾-1¼ turns open	360 R.P.M., 6 M.P.H.
Pontiac 8 38-28DA	½-1 turn open	350 R.P.M., 6 M.P.H.
Terraplane 80, 81, 88	¼-1 turn open	350 R.P.M., 7 M.P.H.

METERING ROD (ECONOMIZER):—All fuel for main nozzle metered by metering rod and jet. Metering rod operated by vacuum piston with throttle control (see Vacumeter Metering Rod Control description above). No adjustment provided but metering rods may be changed to secure leaner-than-standard fuel mixture to compensate for special fuel or high-altitude conditions. Metering rod setting must be checked whenever metering rods removed or changed.

To Remove Metering Rod—Take out dust cover screw, remove dust cover, free metering rod spring, disengage metering rod from piston link and lift rod out being careful not to lose metering rod disc.

To Check Metering Rod—Install gauge (see table below for correct type for each model) in place of metering rod making certain that beveled end is seated in metering jet and that gauge is vertical. Back off throttle stopscrew so that throttle valve is completely closed. Bend lip of vacuum piston link so that when piston pushed all the way down with lip on link against pump arm stop-pin, metering rod pin rests on shoulder in notch on gauge.

Car Model	Carburetor	Gauge Part No.	Length
Hudson	411-S, 17-S, 37-S, 38-S	T109-25	2.795"
Hupmobile	398-S	T109-25	2.795"
Oldsmobile F-38	388-S	T109-25	2.795"
Pontiac 6 & 8	401-S, 400-S	T109-26	2.718"
Terraplane 80, 81, 88	397-S	T109-25	2.795"

NOTE—Metering rod on 364-S (Pontiac Taxicab) not adjustable. See that vacuum piston operates freely (piston must be clean and dry—do not oil). Use new spring under piston whenever carburetor overhauled.

To Install Metering Rod—Make certain that piston moves freely, install metering rod being careful that lower end enters metering jet and that disc is in place on rod. Engage upper end of rod on piston link pin and install metering rod spring.

NOTE—Whenever vacuum piston removed, check piston spring and replace if weak or length not correct. Piston must be clean and dry and show no evidence of wear.

PERFORMANCE:—Should be satisfactory if idle adjustment and accelerating pump setting correct. See Carter Jet Specification Table and tune up data on car model page for standard jet calibrations and any recommended changes. See Trouble Shooting below.

ACCELERATING PUMP:—Low pressure type. Positively operated by throttle lever through countershaft and linkage under dust cover on float bowl cover. Fuel is drawn into pump cylinder through inlet strainer and ball check valve when throttle is closed and is discharged through outlet ball check valve and pump jet into mixing chamber when throttle is opened for acceleration.

Pump Adjustment—Three holes provided in pump arm on countershaft (under dust cover on float bowl cover) for pump link engagement. Inner hole provides minimum stroke, outer hole medium stroke, upper hole maximum stroke. See tune up data on car model page for recommended setting and seasonal changes. Adjustment accessible after taking out screw and removing dust cover.

Pump Stroke Setting—To check pump stroke, remove dust cover, back off throttle lever stopscrew, hold throttle valve tightly closed, install gauge (see table below for correct type for each model) on flat surface of bowl cover. Top of pump shaft (piston rod) should contact lower edge of gauge arm with pump link connected in lower (medium stroke) hole on arm. Adjust by bending throttle connecting rod at lower angle. If gauge not available, mark pump rod at edge of bowl cover with throttle closed and again with throttle wide open. Distance between marks (pump stroke) should agree with figure in table below.

Universal Pump Stroke Gauge Note—To check pump stroke, mount the gauge No. T109-117S on bowl cover so that projection on gauge rests on top of connector link at pump shaft. Back off throttle stopscrew so that throttle valve tightly closed, note gauge reading, open throttle wide and again note gauge reading. Difference between two readings is pump stroke (in sixty-fourths of an inch) and should agree with figure in table below. Adjust by bending throttle connector rod at lower angle near throttle lever. CAUTION—Check metering rod adjustment (disturbed by this adjustment).

Car Model	Carburetor	Gauge No.	Pump Stroke
Hudson	411-S, 17-S, 37-S, 38-S	T-109-112	7/32"
Hupmobile	398-S	T-109-108	9/32"
Oldsmobile	388-S	T-109-108	19/64"
Pontiac	364-S, 400-S, 401-S	T-109-45	19/64"
Terraplane	397-S	T-109-112	7/32"

Pump Countershaft Lubrication—Every 5000 miles, remove dust cover screw, fill screw hole with good grade of graphite grease, replace screw.

ANTI-PERCOLATOR:—'Saxophone' Type. Consists of vent above main jet well controlled by a cap linked to the accelerator pump rod so that the vent is opened with the throttle closed to prevent any 'percolating' discharge of fuel through the main jet when the carburetor is hot. The cap must close when the throttle is opened.

Adjustment—Remove dust cover, crack throttle valve open by inserting correct size tool or drill rod (see table below) between edge of valve and carburetor wall on side opposite idle port, bend anti-percolator arm so that clearance between it and pump arm is .005-.015" with anti-percolator cap seated.

Car Model	Carburetor	Gauge Part No.	Throttle Opening
Terraplane 80, 81, 88	397-S	-----	.025"
All Others			.030"

FLOAT LEVEL:—To check float level, remove float bowl cover, invert cover, measure from gasket seat (machined surface) of bowl cover to nearest point of float (top at free end). Should be 3/8" (all models). Adjust by bending lip of float lever.

Float Needle Valve & Seat—Furnished only in matched sets as follows:

Car Model	Carburetor	Part No.	Intake Hole
Hudson	411-S, 17-S, 37-S, 38-S	25-33S	#48
Hupmobile	398-S	25-33S	#48
Oldsmobile F-38	388-S	25-75S	#46
Pontiac 6 & 8	364-S, 400-S, 401-S	25-42S	#38
Terraplane 80, 81, 88	397-S	25-33S	#48

THROTTLE VALVE SETTING:—When installing throttle valves, tap valve lightly to centralize it in bore before tightening screws. Check throttle valve setting as shown in table below (idle ports are slotted type), opening for models marked by * is height of idle port above throttle valve. Vacuum port height is distance from lower edge of port to top of throttle valve. Shims furnished .002" thick (2-93), .005" thick (2-94) to correct valve.

Car Model	Carburetor	Idle Port Opening	Vacuum Port Height
Hudson 112	411-S, 417-S	.115-.119"*	
Hudson 90, 91, 92, 98	437-S, 438-S	.016-.020"	
Hupmobile	398-S	.010-.014"	
Oldsmobile F-38	388-S	.132-.136"*	.021-.029"
Pontiac 6 & 8	401-S, 400-S	.014-.018"	.022-.027"
Terraplane 80, 81, 88	397-S	.016-.020"	

FAST IDLE:—**Not used on Hudson and Terraplane Models.** Consists of a fast idle cam pivoted directly above the throttle lever so as to serve as a stop for the throttle stopscrew and linked to choke mechanism. To adjust, back off throttle stopscrew, rotate fast idle cam to normal (hot) idling position, turn stopscrew in so that it just contacts first (upper) step of fast idle cam with throttle valve seated, use Tool T109-41 to bend offset portion of fast idle link so that clearance between inside wall of air horn and lower end of choke valve is 5/8" (all models). Make certain that fast idle linkage does not bind.

THROTTLE CRACKER:—**Hudson and Terraplane Models.** Choke valve and throttle valve interconnected by lever which opens throttle valve .036-.040" when choke valve fully closed. Should not require adjustment.

CHOKE:—**Except Hudson and Terraplane Models.** Carter Climatic Control (automatic choke). See article in Carburetion Equipment Section for complete adjusting and servicing directions. These models fitted with Unloader and Choke Valve Lock which are adjusted as follows:

Unloader:—Consists of a cam on the throttle lever which opens the choke valve (through fast idle linkage) when throttle valve is wide open. To adjust, with throttle valve wide open, adjust cam on throttle lever so that clearance between lower edge of choke valve and wall of air horn is 3/8" (all models except Pontiac), 1/2" (Pontiac 364-S), 5/16" (Pontiac 400-S, 401-S).

Choke Valve Lock:—Prevents choke valve from closing when throttle valve is wide open. To adjust, hold throttle valve and choke valve wide open, bend lip on fast idle link so that clearance between lip and throttle lever lock is 1/32" (all models except Pontiac 400-S, 401-S), 1/16" (Pontiac 400-S, 401-S). See that lock prevents choke valve closing as long as throttle valve is held open and that choke valve released when throttle valve closed.

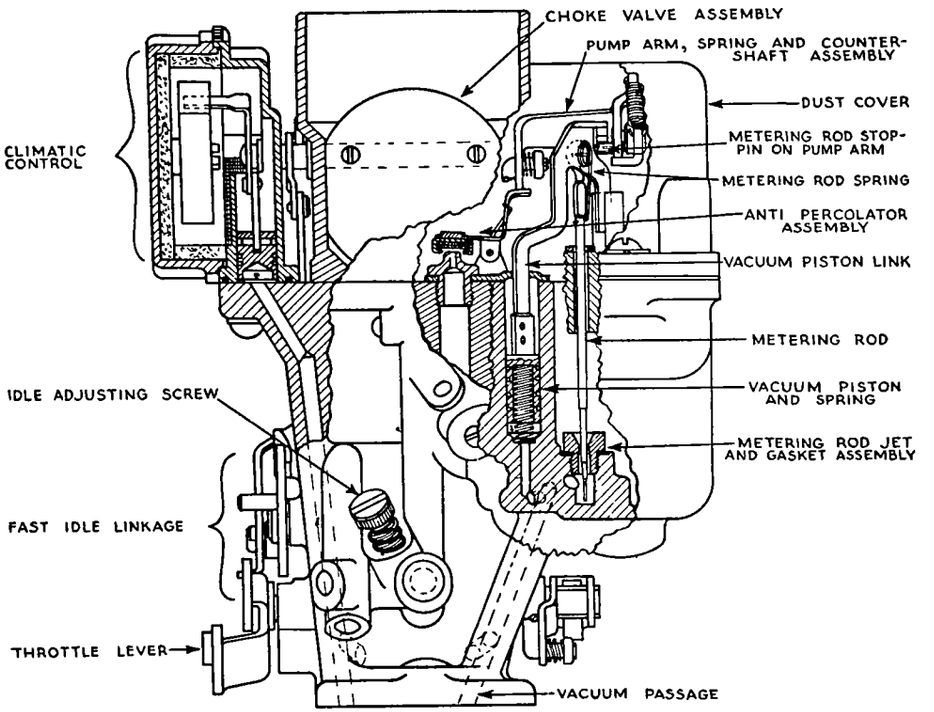
TROUBLE SHOOTING:—**Poor Idling Performance.** If correct adjustment cannot be secured, engine stalls or low speed performance is unsatisfactory, remove low speed idle tube and clean with compressed air. See that idle tube seats air-tight in carburetor casting at top and bottom (always use new tube, do not use tube from any other carburetor). Remove idle adjusting screw and blow out idle channels with air. If idle is rich, see that vacuum piston is clean and moves freely in cylinder and that metering rod linkage is not binding.

Poor Acceleration—Check pump setting, examine pump for damaged or worn plunger leather, bent pump arm or loose plunger, corrosion or sediment in pump cylinder, sticking or leaking ball check valves, dirty intake strainer. If plunger removed from cylinder, use loading tool when installing to avoid damage to plunger leather. If increased resistance felt on throttle lever, remove pump jet and clean with compressed air or replace jet. Make certain that vacuum piston is clean and not worn, that it is free in vacuum cylinder and that spring under piston is in good condition.

Carburetor 'Loads Up'—If carburetor has been in use for sometime, check for wear on float lever lip, reset float level. See that vacuum piston channel is open and that linkage is not binding.

SERVICING:—**Note.** All Hudson and Terraplane models not fitted with Climatic Control and Fast Idle and all servicing directions below for these items should be disregarded.

Disassembly. Take out dust cover screw, remove dust cover, remove fast idle cam screw and cam, remove nozzle plug, nozzle retainer plug, nozzle assembly (use tool J109-55), do not dismantle nozzle assemblies (where inner and outer nozzle used). Take out air horn attaching screws (top and bottom), remove air horn and Climatic Control (see article in Carburetion Equipment Section for Climatic Control servicing). Remove Anti-percolator plug (use wrench T-109-77). Remove anti-percolator and vacuum piston assembly, pin spring connecting plunger shaft and pump arm, link, spring retainers and connector rod springs, throttle connector rod. Take out bowl cover attaching screws, lift off bowl cover and gasket. Revolve pump operating lever and countershaft assembly one-half turn on bowl cover and remove. Remove pump arm and collar assembly and spring, float and lever assembly, pump cylinder bushing gasket, needle seat (needle clipped to float lever by spring clip). Take out vacuum piston spring,



metering rod jet and gasket assembly, pump jet passage plug, pump jet. Loosen screw and remove throttle arm shaft assembly. Remove low speed jet and copper washer, ball check passage plug, ball check plug assemblies, strainer and copper washer. Remove throttle valve screws, valve, shaft and lever assembly. Take out idle port rivet plug, idle adjustment screw and spring.

Servicing—Clean casting and all parts with gasoline (do not immerse cork parts in gasoline), blow out all channels and passages with compressed air, dry all parts with air before reassembling. Check all parts for wear, see that they agree with specifications, replace all worn parts.

Assembling—Use all new gaskets (soak needle seat gasket and metering rod jet gasket in 90 proof alcohol for 15 minutes, install on part and allow to dry before using). When assembling Idle tube see that new copper washer is seated in casting and that tube is tight at top and bottom. Replace bowl cover if warped. Check throttle valve setting (see above), adjust metering rod, Anti-Percolator, Fast Idle, Choke Unloader and Lock, Float level as directed above.

435-S—NASH AMBASS. SIX, MODEL 3920 (1939).
426-S—OLDSMOBILE SIX, F-39 '60', G-39 '70' ('39)—STD. TRANS.
****425-S—OLDSMOBILE SIX, '60' & '70' ('39)—SELF-SHIFTING TRANS.**
433-S—PONTIAC SIX, MODELS 39-25, 39-26 (1939).
432-S—PONTIAC EIGHT, MODEL 39-28 (1939).
******Vacumeter Type Carburetor.

NOTE:—These models have Climatic Control (Automatic Choke), Fast Idle, Unloader, Choke Valve Lock, and Anti-percolator. See Carter Climatic Control article in Carburetion Equipment Section for service data on these units.

SPECIAL SERVICE NOTE:—Whistling Complaints—To correct whistle at vacuum spark port, remove vacuum passage plug (on side of main casting near idle adjusting screw), install special bushing #38A-35 and new rivet plug.

TYPE:—New design single barrel downdraft type. Primary and secondary venturis are mounted in main body casting (not air horn) by two streamlined struts with nozzle directly above one strut on center-line of venturis and float bowl. Float bowl has been designed to eliminate clearance between sides of bowl and float. Bowl cover extends down in bowl to eliminate air space above fuel and float is larger than W1 type. Low speed jet is installed through top of float bowl (no external plug). Anti-percolator seat is cast in bowl cover and complete anti-percolator, pump arm, vacumeter arm (vacumeter types) is mounted on top of bowl cover. Air horn contains only choke valve assembly (choke valve sides not exactly parallel and ridge in air horn serves as stop for valve in wide open position). Lower throttle flange casting contains main (third) venturi and throttle assembly.

Fuel System—Same as for W1 models. Metering rod is controlled by pump arm (426-S, 32-S, 33-S, 35-S), separate vacuum piston (425-S—vacumeter type). See special adjustment directions for each type below.

IDLING ADJUSTMENT:—Adjust carburetor only with engine warmed up and idling at hot or slow idling speed with choke valve wide open and fast idle inoperative. Idle adjusting screw controls fuel mixture and should be turned in for leaner mixture, out for richer mixture. Approximate settings are shown in table below. Idle speed is controlled by throttle lever stopscrew. See car model 'T&E' page for complete carburetor tune up data on each car model.

Car Model	Idle Screw Setting	Idle Speed
Nash 3920	¾-1½ turns open	7-8 MPH.
Oldsmobile F & G-39	½-1½ turns open	6 MPH.†
Pontiac 6 39-25, 26	½-1½ turns open	7 MPH.
Pontiac 8 39-28	½-1½ turns open	7 MPH.

†—Third speed (not High) for Self-Shifting Trans. cars (425-S).

PERFORMANCE:—Should be satisfactory if Idling Adjustment and Accelerating Pump Setting correct. See Carter Jet Specification Table for standard jet calibrations and special lean metering rods (for special operating conditions such as high altitude). See Trouble Shooting below.

ACCELERATING PUMP:—Low pressure type. Positively operated by throttle lever through arm and countershaft assembly on bowl cover. Fuel is drawn into pump cylinder through inlet ball check valve (in bottom of cylinder) when throttle is closed and is discharged through outlet ball check valve and pump jet (in side of mixing chamber opposite secondary venturi) when throttle is opened for acceleration.

Pump Seasonal Adjustment—Three holes provided in pump arm on countershaft for pump link connection. Inner hole provides minimum stroke, lower hole medium stroke, outer hole maximum stroke. See tune up data on car model 'T&E' page for recommended setting and seasonal changes. This adjustment accessible after taking out screw and removing dust bowl cover.

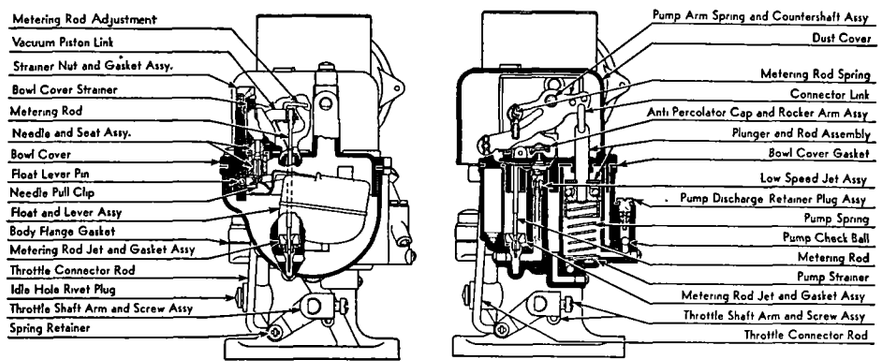
Pump Stroke Adjustment:—To check pump plunger travel, back off throttle lever stopscrew so that throttle valve closes tightly, adjust pump connector link for correct pump stroke as shown in 'Pump Setting' column of table below (see Pump Adjustment above for this connector link adjustment). Install Universal Pump Stroke Gauge T109-117S on ridged portion of bowl cover so that projecting portion of gauge rests on top surface on connector link at pump shaft. Hold gauge vertical and note reading, then open throttle wide and again note reading. Difference between these two readings is pump stroke (in sixty-fourths of an inch) and should agree with 'Pump Stroke' figure in table below. To adjust, bend throttle connector rod at lower angle near throttle lever. CAUTION—Check metering rod adjustment (disturbed by this adjustment).

Car Model	Carburetor	Pump Stroke	Pump Setting
Nash 3920	435-S	27/64"	Long Stroke
Oldsmobile F & G-39	425-S, 26-S	13/64"	Short Stroke
Pontiac 6	433-S	17/64"	Short Stroke
Pontiac 8	432-S	19/64"	Medium Stroke

METERING ROD (ECONOMIZER):—Metering rod and jet assembly meters all fuel for main nozzle (stepped and tapered rod is lifted out of jet as throttle is opened and provides greater fuel flow through jet to nozzle). Metering rods can be changed for special operating conditions such as high altitudes. See Carter Jet Specification Table for standard and leaner-than-standard metering rod calibrations. Check and adjust Metering Rod whenever rods removed and replaced or when pump stroke setting is changed.

Vacumeter Type Note—On these types, metering rod is linked to vacuum piston stem so that rod is controlled by vacuum piston within limits determined by throttle valve opening (lug on pump arm serves as stop for lip on piston link to prevent vacuum piston pulling metering rod down in jet beyond correct point for the particular throttle opening). These models adjusted in special manner (see instructions below).

Metering Rod Adjustment (except Vacumeter Types)—Take out screw and remove dust cover on float bowl cover. Unhook metering rod spring, disengage metering rod from arm on pump shaft, lift out rod being careful not to lose metering rod disc. Install gauge in place of metering rod (see table below for correct gauge for each model) making certain that gauge seats in metering rod jet and is held vertical. Back off throttle lever stopscrew so that throttle valve tightly closed. Clearance between pin in arm on pump shaft and shoulder of notch in gauge should be less than .005" and gauge should not drag on pin. Adjust by bending arm (use extreme care not to bend lower portion of arm to which throttle connector link is attached—this will disturb pump stroke setting). Remove gauge, install metering rod and disk, connect metering rod spring.



Metering Rod Adjustment (Vacumeter Type 425-S)—Remove metering rod (hung on pin on upper end of vacuum piston link) being careful not to lose metering rod disk. Install gauge in place of metering rod (see table below for correct gauge for each model), making certain that gauge seats in metering rod jet and is held vertical. Back off throttle stopscrew so that throttle valve tightly closed. Clearance between pin on piston link and shoulder of notch in gauge should be less than .005" and gauge should not drag on pin. Adjust by bending lip on piston link so that it contacts lug on pump arm (use special tool T109-105). Remove gauge, install metering rod and disc, connect metering rod spring.

Car Model	Carburetor	Metering Rod Gauge No.	Length
Nash 3920	435-S	T109-102	2.468"
Oldsmobile F & G-39	425-S (Vacumeter)	T109-102	2.468"
Oldsmobile F & G-39	426-S	T109-102	2.468"
Pontiac 6 & 8	432-S, 33-S	T109-102	2.468"

ANTI-PERCOLATOR:—Saxophone Key Type. Consists of a main nozzle vent in the bowl cover controlled by a leather-faced, felt-backed metal cap which opens the vent when the throttle is closed to prevent any percolating discharge from the nozzle. The cap must be seated to close the vent when the throttle is opened beyond idling position.

Adjustment—Crack throttle open by inserting special gauge (see table below for gauge for each model) between edge of valve and carburetor wall on opposite idle port. Bend anti-percolator rocker arm (use special tool T109-105) so that clearance between lip on rocker arm and pump arm is .005-.015" (use feeler gauge to check this clearance).

Car Model	Carburetor	Gauge Number	Throttle Opening
Nash 3920	435-S	T109-29	.020"
Oldsmobile F & G-39	425-S, 26-S	T109-29	.030"
Pontiac 6 & 8	432-S, 33-S	T109-29	.030"

NOTE—T-109-29 Gauge used for both .020" and .030" settings.

FLOAT LEVEL:—To check float level, remove float bowl cover, invert cover, measure from top edge of machined projection on cover at free end of float to top of soldered seam. See table below for special checking gauge and float level for each model. Adjust by bending lip of float lever at valve needle.

Car Model	Carburetor	Gauge No.	Float Level
Nash 3920	435-S	T109-80	3/8"
Oldsmobile F & G-39	425-S, 26-S	T109-80	3/8"
Pontiac 6 & 8	432-S, 33-S	T109-83	1/2"

Float Travel—Should be ½" (all models). To check, hold float bowl in normal position, note drop at free end of float. To adjust, bend two small float stop lips at hinge end of float.

Float Needle Valve & Seat—Furnished only in matched sets as follows:

Car Model	Carburetor	Part No.	Intake Hole
Nash 3920	435-S	25-34S	#46
Oldsmobile F & G-39	425-S, 26-S	25-75S	#46
Pontiac 6 & 8	432-S, 33-S	25-42S	#38

THROTTLE VALVE SETTING:—When installing valves, see that trademark is up and on idle port side, install screws loosely, tap valve lightly to centralize it in bore, tighten screws securely. See that throttle valve stopscrew is backed off so that valve closes tightly, check throttle valve setting as shown in table below (idle ports are slotted type). Vacuum port height is distance from top of valve to bottom of port. Shims furnished .002" thick (2-93), .005" thick (2-94) to correct throttle valve position.

Car Model	Carburetor	Idle Port Opening	Vacuum Port Height
Nash 3920	435-S	.137-.141"	
Oldsmobile F & G-39	425-S, 26-S	.158-.162"	.021-.029"
Pontiac 6	433-S	.107-.111"	.022-.027"
Pontiac 8	432-S	.120-.124"	.022-.027"

NOTE—Throttle valves on all models are No. 2-97.

FAST IDLE:—Consists of a fast idle cam pivoted directly above the throttle lever so as to serve as a stop for the throttle stopscrew and linked to the automatic choke mechanism. See Climatic Control article in Carburetion Equipment Section for complete sevicing directions.

Adjustment—To check, turn fast idle cam to normal or slow idle speed position, tighten throttle lever stopscrew until it just seats against cam, rotate cam until stopscrew is against first step of cam (screw must not be on step), check clearance between lower edge of choke valve and air horn wall (use tool T109-85—all models). Distance should be 5/8". To adjust, use tool T109-41 and bend offset portion of fast idle link.

CHOKE:—Offset type plain valve. See article in Carburetion Equipment Section for servicing data on Carter Climatic Control (automatic choke).

Setting—Thermostatic coil housing should be rotated counter-clockwise until mark on thermostatic coil housing is correct number of notches 'rich' from center mark on piston housing as shown in table below.

Car Model	Carburetor	Choke Setting
Nash 3920	435-S	2 Notches Rich
Oldsmobile F & G-39	425-S, 26-S	2 Notches Rich
Pontiac 6 & 8	432-S, 33-S (First—see A)	2 Notches Rich
Pontiac 6 & 8	432-S, 33-S (Later—see B)	1 Notch Rich

(A)—Carburetors with #42 choke heat suction hole.
(B)—Carburetors with #36 choke heat suction hole.

Unloader—Consists of a cam on the throttle lever which opens the choke valve (through fast idle linkage) when throttle is held wide open to correct flooding. To check, hold throttle wide open, check clearance between lower edge of choke valve and air horn wall. See table below for correct clearance and checking gauge on each model. To adjust, bend cam on throttle lever (use Tool T109-41).

Car Model	Carburetor	Gauge No.	Choke Valve Clearance
Nash 3920	435-S	T109-82	31/64"
Oldsmobile F & G-39	425-S, 26-S	T109-85	5/8"
Pontiac 6	433-S	T109-106	7/32"
Pontiac 8	432-S	T109-31	1/4"

Choke Valve Lock—Prevents choke valve closing when throttle valve held wide open. To adjust, hold choke and throttle valves wide open, bend lip at lower end of fast idle link so that clearance between lip and lock on throttle lever is 1/32" (use tool T109-105).

TROUBLE SHOOTING:—**Poor Idling Performance**—If engine stalls while idling, low speed performance is unsatisfactory, or correct adjustment cannot be secured, remove idle tube (low speed jet) and clean with compressed air or install new tube. See that tube seats tightly at shoulder. Remove idle adjusting screw and clean low speed channels with air. If idle is rich, check metering rod linkage for binding and see that rod is not rubbing on dust cover. On Vacumeter types, see that vacuum piston is clean and operates freely.

Poor Acceleration—Check pump seasonal adjustment and pump stroke. Remove and clean or replace pump jet. Examine pump for damaged or worn plunger leather, loose plunger, corrosion or dirt in pump cylinder, ball check valves sticking or leaking. If plunger removed from cylinder, use loading tool when re-installing to avoid damaging plunger leather. On vacumeter types, make certain that vacuum piston is clean and operates freely in cylinder, examine spring under piston.

Carburetor Loads Up or Performance is Poor—Check and adjust float level. See that correct type metering rod installed (replace metering rod and jet as an assembly—check metering rod setting when installed). On vacumeter types, see that vacuum piston operates freely and vacuum channel open and clean.

SERVICING:—**Disassembly**—Take out attaching screw and remove dust cover, remove fast idle cam attaching screw and cam, air horn attaching screws, air horn and gasket (one screw located beneath Climatic Control housing). Take out retainer screws, remove retainers and thermostatic coil housing assembly. Remove piston housing strainer, choke valve screws, choke valve. Loosen screw on choke lever screw and link assembly four full turns, pry lip on lever away from shaft with screwdriver, rotate choke shaft counter-clockwise until piston is free from cylinder and remove assembly. CAUTION—Do not remove pin holding piston housing on air horn casting (these parts must be line-reamed if assembly disturbed). Remove pin spring, spring retainer and retainer spring from throttle connector rod and remove rod. Remove pin spring and connector spring from pump arm. Remove low speed passage plug and gasket (next to anti-percolator). Take out bowl cover attaching screws and lockwashers, remove bowl cover assembly and take off cover gasket. On Vacumeter types, remove vacuum piston from link by rotating it ¼ turn, then remove piston link and metering rod being careful not to lose metering rod disk, disassemble rod from link. On other types, remove metering rod and disk being careful not to damage spring. Remove pump arm, spring, and countershaft assembly by rotating it ½ turn. Remove float and lever assembly, needle and seat assembly, strainer nut and gasket, and strainer. Take out pin and remove anti-percolator cap and rocker arm assembly and spring. Remove pump plunger and rod assembly, pump spring, strainer, and inlet check ball. Remove nozzle passage plug and gasket, nozzle retainer plug, nozzle, nozzle gasket (use tool T109-55 to remove nozzle). Remove metering rod jet and gasket assembly, pump jet passage plug and gasket, pump jet, pump discharge ball retainer, check ball, low speed jet assembly, lower body casting and gasket, idle adjusting screw, spring, idle passage plug, throttle shaft arm and screw assembly. Take out throttle valve attaching screws, remove valve and withdraw throttle shaft.

Servicing:—Clean body castings and all parts with gasoline (do not immerse cork parts in gasoline), blow out all channels and passages in castings and all jets with compressed air, dry all ports with air before reassembling. Check all parts for wear and see that they agree with specifications (see Carter Jet Specification Table), replace all worn parts.

Assembling:—Use all new gaskets (soak metering rod jet gasket and needle seat gasket in 90 proof alcohol for 15 minutes, install on part and allow to dry for 15 minutes before using). Reassemble by reversing disassembly directions given above and note following points:

Body Gasket Caution—Body casting used on early production WA1 carburetors has bosses on vacumeter passage and idle passage holes, later carburetors do not have these bosses. Use Body Gasket No. 121-65 on first carburetors (with bosses), No. 121-72 on later carburetors (without bosses). These gaskets not interchangeable and correct type must be used on each carburetor.

Nozzle Installation—Always use new gasket on nozzle. Use special tool T109-55 to install nozzle. Make certain that flat side of nozzle is upward.

Low Speed Jet—Make certain that hole at lower end is open. Work jet into seat by moving it back and forth, so jet seats tightly in casting at shoulder.

Float Assembly—Engage float needle clip on float lever lip, then install float and needle as an assembly, insert float lever pin. Check float level and float travel (see instructions above).

Choke Valve—Use new screws when installing valve, install screws loosely, tap valve lightly to centralize it in bore, then tighten screws securely. Check choke valve and shaft assembly to make certain it is free (valve should fall open of own weight before climatic control thermostatic spring installed).

Throttle Valve—See Throttle Valve Setting above for installation data.

Pump Shaft Lubrication—Fill dust cover attaching screw hole with graphite grease before installing screw. Do not lubricate other parts of carburetor.

Climatic Control—Install thermostat coil and housing assembly with word 'Climatic' at bottom, turn counter-clockwise to engage thermostatic coil hook on prong, set for correct number of notches rich (see Choke Setting above).

Adjustment—Adjust Idle, Metering Rod, Pump Stroke and setting, Fast Idle, Float Level, Choke Setting, Unloader, and Choke Valve Lock as directed above.

444-S—STUDEBAKER CHAMPION, G (1939)—FIRST CARS—SEE NOTE.
453-S—STUDEBAKER CHAMPION, G (1939)—LATER CARS.

IMPORTANT PRODUCTION CHANGE NOTE:—Model 444-S carburetor (used on first cars) can be brought up to later (453-S) standards by making the following changes: Remove float bowl cover, remove and discard original Float & Lever Assembly (21-45S), Needle & Seat Assembly (25-92S), Bowl Gasket (121-73). Install new type Float & Lever Assembly No. 21-74S, Needle & Seat Assembly No. 25-94S, Bowl Gasket No. 121-25 and set Float Level at ¼" (was ⅜"). These parts furnished in package as Part No. 25-95U. See Service instructions below.

TYPE:—Single barrel, downdraft type. Similar in design to WA1 (see preceding article) except as follows:

Idle System—Idle Orifice Tube (low speed jet) is located in idle well which is fed directly from float bowl (not main nozzle well as on other models) through a drilled passage in the body casting in which the Idle Well Jet is located. Idle well is vented to float bowl by drilled channel in carburetor body. Cross-channel at top of idle tube has two air bleed openings into mixing chamber above main venturi (upper air bleed hole is located ahead of economizer restriction in cross-channel and lower air bleed opening is beyond this restriction). In all other respects idle system is similar to that used on W1 and WA1 carburetors.

Venturi—Double venturi system used with small (primary) venturi located in main body casting above large (main) venturi which is integral with casting.

Choke Control—Climatic Control not used. Choke valve and throttle valves are connected so that throttle opened to fast idle position when choke closed for starting.

IDLE ADJUSTMENT:—Adjust only when engine warmed up and choke valve wide open (fast idle inoperative). Idle adjusting screw controls fuel mixture and should be turned in for leaner mixture, out for richer mixture. Approximate setting of screw should be ¾-1¼ turns open. Idle speed controlled by throttle lever stopscrew and should be set for speed of 600 RPM. or 8 MPH. (high gear speed). See car model 'T&E' page for complete carburetor tune up instructions.

PERFORMANCE:—Should be satisfactory if Idling Adjustment and pump stroke setting correct. See Carter Jet Specification Table for standard jet calibrations and special lean metering rods for special operating conditions such as high altitudes. See Trouble Shooting.

ACCELERATING PUMP:—High pressure type (spring operated). Operated by throttle lever through spring connection between pump operating lever and pump arm (under dust cover on bowl cover). Fuel is drawn into pump cylinder through strainer and inlet ball check valve when throttle is closed and is discharged through outlet ball check valve and pump jet located in side of mixing chamber above main venturi when throttle is opened for acceleration. Pump is not adjustable for seasonal changes.

Pump stroke Adjustment—To check pump plunger travel, remove dust cover on float bowl cover, install Universal Pump Stroke Gauge T109-117S on raised portion of bowl cover so that gauge is vertical and projecting ear rests on top surface of pump shaft. Back off throttle lever stopscrew so that throttle valve tightly closed, note gauge reading. Open throttle wide and again note gauge reading. Difference between two readings is pump stroke (in sixty-fourths of an inch) and should be 12 (pump stroke 3/16" or 12/64"). To adjust, use special bending tool, T109-41, and bend throttle connector link at lower angle near throttle lever. CAUTION—Check metering rod setting (disturbed by this adjustment).

METERING ROD (ECONOMIZER):—Metering rod and jet assembly meters fuel for main nozzle and rod is operated by throttle lever in same manner as on other Carter models. Metering rod mounting on pump operating lever is new and consists of a pin locked in place in a slotted hole in the pump arm by a nut. Metering rods can be changed for special operating conditions such as high altitudes. See Carter Jet Specification Table for standard and lean metering rod calibrations. Check and adjust metering rod whenever rods removed and replaced or when pump stroke setting is changed.

Metering Rod Adjustment—Disconnect choke linkage, take out air horn attaching screws, remove air horn and dust cover. Unhook metering rod spring, remove metering rod being careful not to lose disk on rod at bowl cover. Insert special gauge, T109-26 (2.718") in place of metering rod so that tapered end is seated in metering rod jet and gauge is vertical. Back off throttle lever stopscrew so that throttle valve closes tightly. Metering rod pin on pump operating rod should be even with shoulder of notch in gauge. To adjust, loosen pin nut, shift pin on arm, tighten nut securely (use special wrench T109-76). Remove gauge, install metering rod and disk, install pin spring, connect metering rod spring.

FLOAT LEVEL:—**Note**—Float level on 444-S carburetor was originally set at ⅜" (Gauge T109-80). This should be changed to ¼" when new float and needle valve assembly installed. See Production Change Note above.

Float Level—To check, remove bowl cover and float assembly, invert cover, turn gasket so that machined surface of bowl cover is exposed, measure distance from this bowl cover surface to top of float at free end. Should be ¼" (Gauge No. T109-30—see note above for 444-S. To adjust, bend lip of float lever at point where it contacts valve needle (do not bend float arm).

Float Travel—To check, hold bowl cover and float assembly in normal position. Free end of float should drop ½". To adjust, bend two small float stop lips at hinge end of float.

Needle Valve & Seat Assembly—Furnished only as matched sets, Part No. 21-74S (see Production Change Note above on first 444-S carburetors).

THROTTLE VALVE SETTING:—When installing valves, back off throttle lever stopscrew, see that trademark on valve is on idle port side, use new attaching screws and install screws loosely, tap valve lightly to centeralize it in carburetor bore and tighten screws securely. Check setting.

Setting—With throttle valve closed tight (stopscrew backed off), idle port opening (below lower edge of valve) should be .028-.032" and top of vacuum spark port should be .042-.048" above upper edge of valve. Shims furnished .002" thick (2-93), .005" thick (2-94) to correct valve position.

CHOKE:—Offset type valve with poppet type relief valve. Check choke linkage to see that choke valve closed when control button on instrument panel pulled out and open with control button pushed in (engine not running—choke control is semi-automatic and spring-loaded).

Fast Idle:—Consists of an interconnecting linkage between the choke valve lever and throttle valve lever so that throttle valve is opened to fast idle position with choke valve closed. Should not require adjustment.

TROUBLE SHOOTING:—Poor Idling Performance—If motor stalls while idling, low speed performance is unsatisfactory, or if correct idling adjustment cannot be secured, remove idle well plug and gasket assembly and allow fuel to drain from bowl which will flush out idle well jet. Remove idle well jet and clean with compressed air, remove low speed jet and clean with air, see that jet seats gasoline tight at shoulder in casting when replaced. Check carburetor wall at throttle valve edge for carbon deposits. Remove idle adjusting screw and clean out idle passages with air.

Poor Acceleration—Check pump stroke. Remove and clean or replace pump jet. Examine pump for damaged or worn plunger leather, loose plunger or bent pump arm, sediment or corrosion in pump cylinder, sticking or leaking ball check valves. If pump plunger removed from cylinder, use loading tool to install plunger to avoid damage to plunger leather.

Carburetor Loads up or Performance is Poor—See Production Change Note above for recommended changes on first 444-S carburetor. Check float level, see that correct type metering rod installed and check metering rod setting.

SERVICING:—Disassembly—Remove choke connector link and spring, take out attaching screws and remove air horn assembly. Remove idle well plug and gasket assembly, remove idle well jet. Remove throttle shaft arm and connector rod. Take out screws and remove bowl cover assembly, disassemble parts on bowl cover. Remove low speed jet plug and gasket, low speed jet, idle adjusting screw and spring, metering rod jet and gasket assembly, nozzle passage plug and gasket, nozzle retainer plug, nozzle (use tool T109-55). Take out body casting flange attaching screws, remove flange casting and throttle valve assembly. Remove pump strainer plug and gasket, strainer, inlet ball check valve assembly, outlet ball check valve assembly. Remove pump jet passage plug and gasket, and pump jet. Remove idle port rivet plug. Take out throttle valve attaching screws, remove valve, withdraw shaft and lever assembly. Remove choke control bracket assembly from air horn, take out choke valve attaching screws, remove valve, withdraw choke valve shaft and lever assembly.

Servicing:—Clean body castings and all parts in gasoline, blow out all passages in castings and all jets with compressed air, dry all parts with air before reassembling. Check all parts for wear, see that they agree with specifications (see Carter Jet Specification Table), replace all worn parts.

Reassembly:—Use all new gaskets (soak metering rod gasket and needle seat gasket in 90 proof alcohol for 15 minutes, install on part and allow to dry before using). Reassemble by reversing disassembly directions above and note:

Nozzle Installation—Use new gasket. Use special tool T109-55 to install nozzle and make certain that flat side of nozzle is upward.

Low Speed Jet—Make certain that hole at lower end is open, work jet into seat by moving it back and forth, make certain that jet seats tightly in casting and install jet plug and gasket.

Choke Valve—Centralize valve in air horn by tapping valve lightly before tightening attaching screws.

Throttle Valve—See Throttle Valve Setting above for installation data.

Adjustments—Adjust Idle, Metering Rod, Pump Stroke, Float Level, and choke linkage as directed above.

407-S—CADILLAC V16, SERIES 90 (1938-39)—LEFT HAND CARBURETOR
408-S—CADILLAC V16, SERIES 90 (1938-39)—RIGHT HAND CARBURETOR
373-S—CHRYSLER IMPERIAL, MODEL C14 (1937)
344-S, 377-S—HUDSON SIX, MODEL 73 (1937).
HUDSON EIGHT, MODELS 74, 75, 76, 77 (1937)
TERRAPLANE SUPER SIX, MODEL 72 (1937)
402-S—HUDSON SIX, MODEL 83 (1938)
HUDSON EIGHT, MODELS 84, 85, 87 (1938)
TERRAPLANE, SUPER MODEL 82 (1938)
317-S—HUPMOBILE EIGHT, MODEL 521-O (1935), 621-N (1936).
399-S—HUPMOBILE EIGHT, MODELS 825-H ('38), 925-H ('39)
374-S—LA SALLE, V8, SERIES 37-50 (1937)
392-S—LA SALLE V8, SERIES 38-50 (1938)
423-S—LA SALLE V8, SERIES 39-50 (1939)
436-S—NASH AMBASSADOR EIGHT, MODEL 3980 (1939)
328-S—OLDSMOBILE EIGHT, MODEL L-36 (1936). FIRST 27,334 CARS.
341-S—OLDSMOBILE EIGHT, MODEL L-36 (1936). SERIAL NO. L-127334 UP.
345-S—OLDSMOBILE EIGHT, MODEL L-37 (1937)
367-S—OLDSMOBILE EIGHT, MODEL L-37 (1937) LATER CARS.
386-S—OLDSMOBILE EIGHT, MODEL L-38 (1938)—FIRST CARS
366-S—PACKARD EIGHT, MODEL 120C (1937)—ENG. NO. 112-822 UP

NOTE:—These models fitted with Carter Climatic Control (automatic choke), Fast Idle, Unloader, Choke Valve Lock, and Anti-Percolator. See Carburetion Equipment Section for complete data.

Cadillac V-16 Models. One carburetor used for each cylinder bank. Carburetors must be equalized as well as adjusted (see directions below).

La Salle Idling Adjustment Correction—On first cars equipped with 392-S and 423-S carburetors, if idle adjustment range is insufficient and correct performance cannot be secured, a #54 size drill hole should be drilled in each throttle valve in the 'C' stamped on the idle port side of the valve. Recommended idle adjusting screw setting on La Salle carburetors has been changed from ¼-1 to ½-1¼ turns open.

Chrysler C14—Carter Climatic Control not used on this model (see separate article for Sisson Automatic Choke which is standard equipment). Carter Fast Idle, Unloader, and Anti-Percolator are used.

Oldsmobile L-37—To correct complaints of hesitation on part throttle acceleration at low speed, install new metering rods Part No. 75-224 in place of original No. 75-195 and tune up motor.

Oldsmobile Model 328-S Carburetor. Main nozzle was changed from Part No. 12-203 to No. 12-209. Nozzle gasket No. 20-60 must be used when installing this new type nozzle.

Oldsmobile L-38. This carburetor used on first cars only. Model 389-S Vacumeter type carburetor used on later cars. See separate article for data.

TYPE:—Dual barrel, plain tube, downdraft type. Similar in design to other Carter models except that carburetor has two barrels or mixing chambers and that main nozzles, accelerating pump discharge jets, throttle valves, and idling systems duplicated for each barrel. Anti-Percolator is used.

IDLE ADJUSTMENT:—Engine must be thoroughly warmed up so that choke valve is wide open and Fast Idle is inoperative. Idle adjusting screw provided for each carburetor barrel. Screws control fuel mixture and should be turned in for leaner mixture or out for richer mixture (adjust screws in succession, or start with same opening for each screw and turn both screws same amount simultaneously). See tune up instructions on car model page. Approximate idle settings as follows:

Car Model	Carburetor	Idle Screw Setting	Idle Speed
Cadillac V16	407-S, 408-S	¼-1 turn open	6 M.P.H.
Chrysler C14	373-S	¾-1¼ turn open	7 M.P.H.
Hudson 6 & 8	344-S, 377-S, 402-S	¼- ¾ turn open	7 M.P.H.
Hupmobile	317-S	¾-1¼ turn open	6 M.P.H.
Hupmobile	399-S	¼-1 turn open	6 M.P.H.
La Salle 37-50	374-S	¾-1¼ turn open	6 M.P.H.
La Salle 38-50	392-S	¼-1 turn open	8 M.P.H.
LaSalle 39-50	423-S	½-1¼ turns open	6 MPH.
Nash 3980	436-S	¼-1 turn open	7-8 MPH.
Oldsmobile 8	328-S, 41-S, 45-S, 67-S, 86-S	¾-1¼ turn open	6 M.P.H.
Packard 120C	366-S	½-1¼ turn open	6 M.P.H.
Terraplane 72, 82	344-S, 377-S, 402-S	¼- ¾ turn open	7 M.P.H.

Cadillac V16 Carburetor Equalization—Use mercury column "U" tube connected to ⅛" pipe plug openings in long leg of each intake manifold (do not connect gauge to vacuum balancing tube between carburetors). Disconnect throttle rods, idle engine, note mercury levels in tube. Adjust throttle stopcsrew at each carburetor so that engine idles at 7-8 M.P.H. and mercury column is equal in both tubes. Adjust right hand throttle rod (trunnion with fine threads on rod near carburetor) so that rod can be connected without disturbing throttles or unbalancing mercury levels. Open throttle so that engine runs at 1000 R.P.M. (use foot throttle, not hand throttle), make any necessary re-adjustment to secure equal mercury column levels. If adjustment made, recheck idle setting (idle speed equalization more important and should be favored).

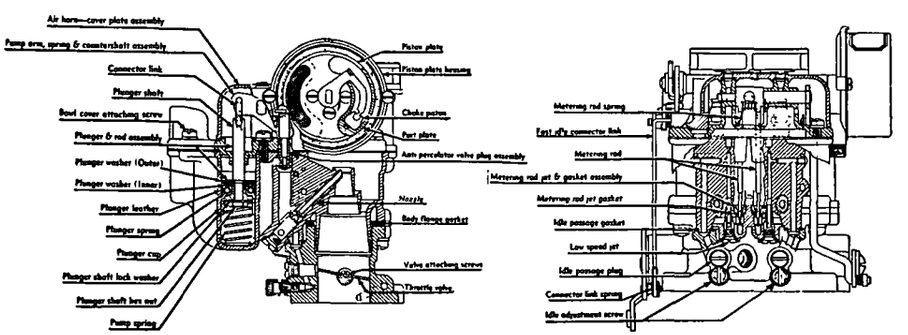
METERING ROD (ECONOMIZER):—Fuel is metered by a stepped metering rod which is raised in the metering jet as the throttle is opened, allowing greater fuel flow to the nozzle. One metering rod used for each carburetor barrel (rods must be same size and must be changed as a unit). No adjustment provided but rods can be changed to secure leaner-than-standard fuel mixture to compensate for special fuel or operating conditions such as high altitude (See Carter Jet Specification Table). Metering rod setting must be checked whenever metering rods are removed or changed.

Metering Rod Removal—On models with integral air horn and dust cover, remove this assembly to expose pump countershaft and metering rods (on models with separate dustcover, take out two retaining screws and remove dust cover only). Remove pin spring from metering rod pin, slide pin out being careful not to lose metering rod springs, lift out metering rods and springs. Remove small brass screw and take out metering rod disk retainers and disks.

Metering Rod Setting—Back off throttle lever stopscrew so that throttle valves tightly closed, loosen anti-percolator arm screw. Install metering rod gauge (see table below for each model) in place of each metering rod, making certain that gauges seat in metering rod jets and are vertical. Install metering rod pin and pin spring in metering rod arm. Press down lightly on pump arm pin rests on shoulders of notches in both gauges (bend arm slightly to equalize if necessary) with clearance of less than .005" between pin and each gauge. Tighten anti-percolator arm screw. Remove gauges and metering rod pin, install metering rods and disks, springs, pin, and pin spring.

Car Model	Carburetor	Metering Rod Gauge	Length
LaSalle 39-50	423-S	T-109-113	2.280"
Nash 3980	436-S	T-109-113	2.280"
All Other Models		T-109-27	2.359"

CAUTION—Anti-percolator must be checked after this adjustment completed.



ACCELERATING PUMP:—Low pressure type (Hudson, Hupmobile, LaSalle, Oldsmobile, Packard), Delayed action type (Chrysler 373-S), High pressure type with spring loaded pump arm (Cadillac, Hupmobile 399-S, Oldsmobile 386-S.)

Adjustment—Some models provided with two holes in pump countershaft arm for pump stem link connection to provide seasonal adjustment. Lower hole provides minimum stroke, upper hole maximum stroke. See tune up data on car model page for recommended setting for each model.

Pump Stroke Setting—Whenever carburetor disassembled, check and adjust pump linkage for correct pump stroke. With pump connector link in place, back off throttle stopscrew, hold throttle tightly closed, install gauge (see table below for type for each model) on flat surface of bowl cover. Top of pump shaft (piston rod) should contact lower edge of gauge arm with pump set for minimum or maximum stroke (see table). Adjust by bending throttle connector rod at lower angle. If gauge not available, mark pump rod at edge of bowl cover with throttle tightly closed and again with throttle wide open. Distance between marks (pump stroke) should agree with figure in table below.

Universal Pump Gauge—This gauge has a graduated plunger (marked in sixty-fourths of an inch) and may be used to check pump travel on all carburetor models. To use gauge, install on rim of bowl cover at pump plunger so that projection on gauge rests on top surface of connector link at pump shaft. Note gauge reading with throttle closed, then open throttle wide and again note

gauge reading. Difference between two readings is pump stroke in 64ths of an inch. Adjust by bending throttle connector rod at lower angle near throttle lever with tool T-109-75. CAUTION—Check Metering Rod Setting and Anti-percolator Adjustment after adjusting pump stroke.

Car Model	Carburetor	Gauge No.	Pump Stroke	Pump Setting
Cadillac V16	407-S, 408-S	T-109-111	19/64"	Max.
Chrysler C14	373-S.	T-109-46	1/4"	Max.
Hudson 6 & 8	344-S, 77-S, 402-S	T-109-47	15/64"	Min.
Hupmobile	399-S	T-109-48	31/64"	Min.
LaSalle	374-S, 392-S	T-109-46	1/4"	Max.
LaSalle	423-S.	*T-109-117S	26/64"	Non-Adj.
Nash	436-S	*T-109-117S	32/64"	Max.
Oldsmobile	345-S, 367-S	T-109-46	1/4"	Max.
Oldsmobile	386-S	T-109-111	19/64"	Max.
Packard	366-S	T-109-48	31/64"	Non-Adj.
Terraplane	344-S, 77-S, 402-S	T-109-47	15/64"	Min.

*—Universal Pump Gauge—See Note

ANTI-PERCOLATOR:—Plunger Type. Consists of two spring-loaded plunger type valves (one for each main jet well) which are opened by anti-percolator arm (linked to metering rod arm) when throttle is closed to vent main nozzles and prevent any 'percolating' discharge when carburetor is hot. Valve must be closed when throttle is open (will cause 'flat spots' if not properly adjusted).

Adjustment—Remove air horn and Climatic Control (see dismantling instructions in Servicing section below). Do not disturb metering rods or pump setting. Back off throttle stopscrew so that throttle valves closed tightly, insert .015" feeler between each anti-percolator stem and lip on anti-percolator arm (Hudson, Terraplane, Cadillac, LaSalle—do not use feeler on Hupmobile, Nash, Oldsmobile). Bend lips on arms until each anti-percolator stem depressed so that indicator line on stem is flush with top of anti-percolator plug. NOTE—Use extreme care to secure equal adjustment for both units.

Hupmobile (317-S)—Set throttle valve so that clearance between edge of valve and carburetor wall on side opposite idling ports is .030" (turn up throttle stopscrew or close throttle on .030" feeler). Bend lips on metering rod arm until clearance between lips and anti-percolator valve stem is .005-.015". In making this adjustment be very careful not to disturb setting of metering rod. See that both anti-percolating units are equalized.

Oldsmobile (First models without Indicator Line)—Throttle valve opening should be .020" (back off throttle stopscrew, insert Carter gauge No. T-109-29, Oldsmobile No. J-512, between throttle valve edge and wall on side opposite idle ports). Adjustment and setting same as for Hupmobile. Reset throttle stopscrew.

FLOAT LEVEL:—To check float level, remove bowl cover and air horn (see Dismantling instructions in Servicing section), invert cover, measure distance from top of float to gasket surface on cover at each side of soldered seam on float. Correct float level by bending lip of lever (do not bend float).

Car Model	Carburetor	Float	Checking Tool
Cadillac V16	407-S, 408-S	13/64"	T109-39
Chrysler C14	373-S	13/64"	T109-39
Hudson 6 & 8	344-S, 377-S, 402-S	15/64"	T109-32
Hupmobile	317-S	5/32"	
Hupmobile	399-S	3/16"	T109-28
La Salle 37-50	374-S	13/64"	T109-39
La Salle 38-50	392-S	3/16"	T109-28
La Salle 39-50	423-S	1/8"	T109- 36
Nash 3980	436-S	3/16"	T109- 28
Oldsmobile	328-S, 341-S	3/16"	T109-28
Oldsmobile	345-S, 367-S, 386-S	9/64"	T109-34
Packard 120C	366-S	1/8"	T109-36
Terraplane 72, 82	344-S, 377-S, 402-S	15/64"	T109-32

Float Needle Valve & Seat Assembly—Furnished only as matched sets.

Car Model	Carburetor	Part Number	Intake Hole Size
Cadillac V16	407-S, 408-S	25-80S	#42
Chrysler C14	373-S	25-59S	#38
Hudson 6 & 8	344-S, 377-S, 402-S	25-59S	#38
Hupmobile	317-S	25-59S	#38
Hupmobile	399-S	25-66S	#34
La Salle	374-S, 392-S	25-59S	#38
La Salle 39-50	423-S	25-59S	#38
Nash 3980	436-S	25-59S	#38
Oldsmobile	328-S, 41-S, 45-S, 67-S	25-59S	#38
Oldsmobile	386-S	25-74S	#38
Packard 120C	366-S	25-66S	#34
Terraplane 72, 82	344-S, 377-S, 402-S	25-59S	#38

FAST IDLE:—Consists of a fast idle lever linked to the throttle valve lever and mounted directly below the fast idle cam on the choke valve shaft. Dashpot assembly (Hudson, Terraplane only) mounted on side of float bowl and linked to outer end of fast idle lever. To adjust, hold choke valve tightly closed, adjust fast idle arm screw so that distance from edge of throttle valve to carburetor wall on side opposite idle port is correct as shown in table below (use special checking gauge to gauge throttle valve opening).

Car Model	Carburetor	Throttle Opening	Checking Gauge
Cadillac V16	407-S, 408-S	.026"	
Chrysler C14	373-S.	.018"	T-109-44
Hudson 6 & 8	344-S, 77-S, 402-S	.018"	T-109-44
Hupmobile	317-S	.018"	T-109-44
Hupmobile	399-S	.030"	T-109-29
LaSalle	374-S, 92-S, 423-S	.030"	T-109-29
Nash	436-S	.015"	T-109-44
Oldsmobile	328-S, 41-S, 45-S, 67-S, 86-S	.018"	T-109-44
Packard	366-S	.018"	T-109-44
Terraplane	344-S, 77-S, 402-S	.018"	T-109-44

CHOKE:—All choke valves are offset type. See article in Carburetion Equipment Section for complete data on automatic choke (Climatic Control).

Unloader:—Consists of a lip on the throttle connector which engages the choke trip lever on the choke valve shaft so that the choke valve is opened when the throttle is opened wide. Check by opening throttle valve wide open, and checking distance between upper edge of choke valve and air horn wall (see table below for distance and checking tool for each model). Adjust by bending lip on fast idle connector link. With correct adjustment, choke valve will be locked open when moved to the wide open position (with throttle valve wide open) and will be released when throttle closed.

Car Model	Carburetor	Checking Tool No.	Distance
Cadillac V16	407-S, 408-S	T109-38	3/16"
Chrysler C14	373-S	T109-31	1/4"
Hudson 6 & 8	344-S, 377-S, 402-S	T109-31	1/4"
Hupmobile	317-S	T109-31	1/4"
Hupmobile	399-S	T109-34	9/64"
La Salle 37-50	374-S	Use Drill Rod	3/16"
La Salle 39-50	423-S	T109- 36	9/64"
Nash 3980	436-S	T109- 34	1/8"
Oldsmobile	328-S, 41-S, 45-S, 67-S, 86-S	T109-31	1/4"
Packard 120C	366-S	T109-31	1/4"
Terraplane 72, 82	344-S, 377-S, 402-S	T109-31	1/4"

THROTTLE VALVE SETTING:—Install valves with trademark 'C' on idle port side, back off throttle stopscrew so that valves close tightly and tap valves lightly to centralize them in carburetor bore before tightening valve screws. Check idle port and vacuum port openings. Shims furnished .002" thick (2-93), .005" thick (2-94) to correct throttle valve locations. With throttle valves tightly closed, idle port opening (or height of top of port above throttle valve as noted) and height of top of vacuum port above valve (except as noted) are as follows:

Car Model	Throttle Valve	Idle Port	Vacuum Port
Cadillac V16	2-98	(A) .127-.133"	None
Chrysler C14	2-92	.009-.015"	.029-.033"
Hudson 6 & 8	2-89	.013-.019"	None
Hupmobile 521-O, 621-N	2-88	.015-.023"	None
Hupmobile	2-92	.016-.022"	None
La Salle	2-92	.009-.015"	None
La Salle 39-50	2-92	(A) .119-.125"	None
Nash 3980	2-89	(A) .162-.168"	None
Oldsmobile	2-92	.009-.015"	(C) .029-.033"
Packard 120C	2-95	(A) .124-.130"	(B) .009-.013"
Terraplane	2-89	.013-.019"	None

(A)—Top of Idle port above throttle valve.

(B)—Height of Bottom of Vacuum Port above throttle valve.

(C)—Height of bottom of Vacuum Port above throttle valve (328-S only).

NOTE—Packard throttle valves have a #49 bleed hole.

TROUBLE SHOOTING:—Poor Idling Performance—If correct idling adjustment cannot be secured, or if engine stalls while idling, remove low speed jet tubes and clean with compressed air, clean out idling passages and ports, see that tube seats airtight at top and bottom.

Acceleration Unsatisfactory—Check pump setting, remove pump jets and check valves and clean with compressed air, examine pump for bent pump arm, loose plunger, damaged or worn plunger leather, corroded cylinder or sediment in cylinder. Use special loading tool to install pump plunger in cylinder to avoid damage to plunger leather.

Carburetor Loading—Check and adjust float level.

SERVICING:—To Disassemble Carburetor—Remove fast idle arm pin and screw assembly, cam and collar assembly, spring and connecting link. Take out two air horn attaching screws (outside), blank disc check (inside under choker valve), remove air horn and automatic choke assembly. Take out pin spring, slide out pin, remove metering rods. Remove throttle connector rod and accelerator pump connecting link. Take out float bowl cover screws, remove cover. Take out float lever pin, remove float and lever assembly, remove float needle valve and seat. Take out pin spring on pump arm spring, loosen clamp screw on metering rod arm, remove pump arm and shaft. Remove body gasket, pump plunger assembly and plunger spring. Use tool J-511 and remove anti-percolator assemblies. Remove metering rod jet and gasket assemblies. Remove pump jet plugs, pump jets and gaskets. Remove body flange assembly, flange gasket, idle passage gaskets, idle adjustment screws and springs, idle passage plug. Take off throttle shaft arm, remove throttle centering screw in face of body flange and throttle valve screws, take out throttle valves and pull shaft out. Take out nozzle retaining plugs being careful not to lose washers, remove nozzles. Remove low speed jets, check valve passage plug and strainer, pump intake check valve plug and housing, pump discharge check valve plug.

NOTE—On Hudson and Terraplane models, disconnect the dashpot connector link before removing air horn. If dashpot plunger removed from cylinder, use special loading tool Part No. T52-19 to install to avoid damage to plunger leather.

Servicing:—Wash all parts in gasoline, blow out all passages in carburetor body and dry with air, replace all worn and damaged parts.

Reassembling Carburetors—Reverse disassembly directions above. Use new gaskets, soaking needle seat gasket, blank check gasket, metering rod jet gasket in warm water for 15 minutes before installing. When assembling throttle valves, hold body flange assembly with intake manifold side down, assemble throttle valves loosely (trademark 'C' on valves down and on idle port side), back off throttle stopscrew so that valves close tightly, tap valves lightly to centralize them in carburetor barrel, tighten valve screws securely, install throttle shaft centering screw and throttle arm. Use special loading tool (J-507) to install pump piston assembly in cylinder to avoid damaging plunger leather. Check float needle valve for tightness after installing. Set float level and adjust carburetor on engine (see above and tune-up data on car model pages).

419-S—BUICK, MODEL 39-40 (1939)—BEFORE SERIAL No. 13388548.
440-S—BUICK, MODEL 39-40 (1939)—AFTER SERIAL No. 13388548.
430-S—HUDSON SIX, MODEL 92 (1939)—LATER CARS.
HUDSON COUNTRY CLUB 6, MODEL 93 (1939)
HUDSON COUNTRY CLUB 8, MODELS 95, 97 (1939)
389-S—OLDSMOBILE EIGHT, MODEL L-38 (1938)—SEE NOTE.
OLDSMOBILE EIGHT '80', MODEL L-39 (1939)

NOTE:—Oldsmobile L-38. This carburetor used on cars with Self-Shifting Transmission (Serial Nos. L-180969 to L-217504) and all cars beginning with Serial No. L-217505. Model 386-S (without Vacumeter control) used on earlier cars. See separate article for 386-S data.

SPECIAL SERVICE NOTES:—Buick Hard Starting—To correct hard starting complaints on these models (with starter control switch mounted on carburetor and operated by accelerator pedal), carefully adjust carburetor linkage so that throttle is wide open when pedal pressed down to floor (mat must be in place when adjustment made or pedal travel will be cut down when mat installed). Full throttle opening is necessary for correct 'unloader' action. Check Unloader Setting (see Choke below). Check starter Vacuum Switch Timing (see separate article on Carter Car Starter.

Buick Cold Performance & Gasoline Mileage Complaints—Small hole in metal plate covering hot air stove (lower right hand corner of plate facing carburetor side of engine) must be kept open as this hole supplies air to stove and automatic choke. If hole is allowed to become clogged, choke will not open fully causing unsatisfactory warming up performance, crankcase dilution, and poor gasoline mileage.

Buick Choke Valve Rattle—To correct rattles at 45-65 MPH. on acceleration, remove choke valve and file both sides of valve for additional .010" side clearance (.013-.017" total, valve closed). Greater clearance will increase cold starting time.

TYPE:—Same design as Single barrel Vacumeter type carburetors (see preceding article) except for dual feature. Carburetor has two independent mixing chambers, main nozzles, metering rods and jets, throttle valves, and idling systems. One accelerating pump (with double discharge jets) and one economizer vacuum piston assembly used for both barrels.

Buick 419-S, 440-S—These models equipped with Carter Car Starter (vacuum switch) mounted on carburetor and operated by throttle valve switch. See separate article on 'Starter Controls' in Electrical Equipment Section

IDLING ADJUSTMENT:—Adjust carburetor only with engine warmed up and idling at hot or slow idling speed (choke valve wide open, fast idle inoperative). Idle adjusting screw provided for each carburetor barrel. Screws control fuel mixture and should be turned in for leaner mixture, out for richer mixture and both screws just be adjusted exactly alike. See table below for approximate settings on each car model. Idle speed controlled by throttle lever stopscrew and should be set for speed shown in table. See car model 'T&E' page for complete carburetor tune up instructions on each car model.

Car Model	Carburetor	Idle Screw Setting	Idle Speed
Buick 39-40	419-S	⅜-1 turn open	7-8 MPH.
Buick 39-40	440-S	½-1¼ turns open	7-8 MPH.
Hudson 6 & 8	430-S	¼-1 turn open	7 MPH.
Oldsmobile	389-S	½-1¼ turns open	6 MPH.†

†—High gear (Std. Trans.), Third gear (Self-shifting Trans.).

PERFORMANCE:—Should be satisfactory if Idling Adjustment and Accelerating Pump Setting correct. See Carter Jet Specification Table for standard jet calibrations and special lean metering rods (for special operating conditions). Both metering rods must be same size and adjusted alike. See Trouble Shooting below.

METERING ROD (ECONOMIZER):—Fuel for main nozzles metered by metering rod and jet (independent rod and jet for each nozzle). Metering rods operated by single vacuum piston with throttle control (stop pin on pump arm limits piston travel so that metering rod lifted in accordance with throttle opening). No adjustment provided but metering rods can be changed to secure leaner-than-standard fuel mixture to compensate for special fuel or high altitude conditions (both rods must be same size and should be changed as a unit). Check metering rod setting whenever rods removed and replaced or when pump stroke setting is adjusted.

To Remove Metering Rods—Take out screws and remove dust cover or remove air horn and dust cover assembly (where these parts integral—see Service data for removal instructions). Remove pin spring from metering rod pin and slide pin from vacuum piston link being careful not to bend metering rod spring. Lift out metering rods, remove brass metering rod disc retainer by taking out brass screw, remove the two small metering rod discs from beneath retainer.

To Check Metering Rods—Back off throttle lever stopscrew so that throttle valves are tightly closed. Install metering rod gauge (see table below) in place of each metering rod making certain that tapered ends are seated in metering rod jets. Install metering rod pin in piston link. Push piston link down until metering rod pin rests lightly on shoulder of notch in each gauge. With throttle valves seated, and vacuum piston held down, bend lip on anti-percolator arm (which extends under metering rod pin) so that lip just touches pin (use adjusting tool T109-105).

To Install Metering Rods—Make certain that discs are in place under disc retainer and that pin spring and metering rod springs are properly connected.

Car Model	Carburetor	Metering Rod Gauge No.	Length
Buick 39-40	419-S, 40-S	T109-113	2.280"
Hudson 6 & 8	430-S	T109-113	2.280"
Oldsmobile	389-S	T109-104	2.312"

ACCELERATING PUMP:—High pressure type (spring operated—pump operating lever and pump arm linked by small coil spring). Inlet ball check valve located in bottom of pump cylinder, outlet ball check valve under retainer plug in main body casting.

Pump Seasonal Adjustment—On some models, pump arm (under dust cover) has two or three holes for pump rod link connection to provide varied pump stroke for seasonal pump requirements. See car model 'T&E' page for recommended settings and seasonal changes.

Pump Stroke Adjustment—On models with integral air horn and dust cover, remove this assembly to expose pump countershaft and connector link (on models with separate dust cover, take out two retaining screws and remove dust cover only). Back off throttle lever stopscrew so that throttle valves tightly closed, check pump seasonal adjustment (connector link must be engaged in hole for correct stroke as shown in table below). Install Universal Pump Stroke Gauge T109-117S on rim of bowl cover at plunger shaft so that projection on gauge rests on top surface of connector link at pump shaft (see gauge note below). Note gauge reading with throttle closed, then open throttle wide and again note gauge reading. Difference between two readings is pump stroke (in sixty-fourths of an inch) and should agree with figure shown in table below. Adjust by bending throttle connector rod at lower angle near throttle lever (use bending tool T109-75). CAUTION—Check metering rod setting and anti-percolator adjustment after adjusting pump stroke.

NOTE—**Pump Gauge Design Change.** On first type pump stroke gauge T109-117S design of indicator arm may make it difficult to check pump stroke on 1939 carburetors (later gauges have different design indicator arm). This new indicator arm No. T109-119 can be installed on old type gauges (or gauge can be returned to factory for arm installation). If arm installed in field, set notch in indicator nut at '8', check arm for projection beyond base of gauge (if arm projects, file flush with base).

Car Model	Carburetor	Pump Stroke	Pump Setting
Buick 39-40	419-S, 40-S	21/64"	Medium Stroke
Hudson 6 & 8	430-S	18/64" (9/32")	Long Stroke
Oldsmobile	389-S	19/64"	Non-Adj.

ANTI-PERCOLATOR:—Plunger Type. Consists of a vent above each main jet well controlled by spring-loaded plunger type valves. Valves are opened by anti-percolator arm connected to throttle when throttle valves are closed to vent nozzles and prevent any 'percolating' discharge when carburetor is hot. Valves must be closed when throttle is opened (incorrect adjustment will cause flat spots).

Adjustment—Make this adjustment after metering rod setting and pump stroke setting have been adjusted (use extreme care not to disturb these settings). On models with integral air horn and dust cover, remove this assembly to expose anti-percolators (on models with separate dust cover, take out two retaining screws and remove dust cover only). Back off throttle lever stopscrew so that throttle valves tightly closed. Adjust by bending lips on anti-percolator arms so that indicator line on each anti-percolator stem is flush with top of anti-percolator plug. Use extreme care to adjust both anti-percolator units alike. NOTE—Anti-percolator not used on later (440-S) Buick carburetor which has anti-percolation vent tube located above each nozzle.

FLOAT LEVEL:—To check float level (with bowl cover assembly removed), remove cover gasket, invert cover, measure from machined gasket seat on cover to top of float (check at both ends of float—settings must be alike). See table below for float level and special checking gauge for each model. To adjust, bend lip on float lever at point where it contacts valve needle (do not bend float or arm).

Car Model	Carburetor	Float Level	Checking Gauge
Buick 39-40	419-S, 40-S	3/16"	T109- 28
Hudson 6 & 8	430-S	3/32"	T109-125
Oldsmobile	389-S	9/32"	T109-126

Needle Valve & Seat—Furnished only in matched sets as shown in table below. When installing assembly on Oldsmobile 389-S, see that clip on needle valve engages float lever.

Car Model	Carburetor	Part Number	Intake Hole
Buick 39-40	419-S, 40-S	25-80S	#42
Hudson 6 & 8	430-S	25-59S	#38
Oldsmobile	389-S	25-74S	#38

THROTTLE VALVE SETTING:—Install valves with trademark 'C' toward idle port side, use new attaching screws, install screws loosely, tap valves lightly to centralize them in bore, then tighten screws securely. Check valve setting with throttle lever stopscrew backed out so that valves tightly closed. Idle port figure is distance from top edge of valve to top of idle port. Vacuum spark port figure is distance from top edge of valve to top (or bottom as noted) of vacuum spark port. Shims furnished .002" thick (2-93), .005" thick (2-94) for throttle valve setting adjustment.

Car Model	Carburetor	Idle Port	Vacuum Spark Port
Buick 39-40	419-S	.060-.066"	(A) .040-.044"
Buick 39-40	440-S	.060-.066"	(A) .052-.056"
Hudson 6 & 8	430-S	.108-.112"	None
Oldsmobile	389-S	.140-.146"	(C) .029-.033"

(A)—Distance to top of port. (C)—Distance to bottom of port.

FAST IDLE:—Consists of a fast idle lever linked to the throttle valve lever and mounted directly below the fast idle cam on the choke valve shaft. To adjust, hold choke valve tightly closed, adjust fast idle arm screw so that clearance between throttle valve and carburetor wall on side opposite idle port is correct as shown in table below (use special checking gauge inserted between throttle valve and wall to check opening).

Car Model	Carburetor	Throttle Opening	Checking Gauge
Buick 39-40	419-S, 40-S	.018"	T109-44
Hudson 6 & 8	430-S	.018"	T109-44
Oldsmobile	389-S	.018"	T109-44

NOTE—T109-44 gauge used for both .015" and .018" settings.

CHOKE:—Carter Climatic Control (automatic choke) is standard. See article in Carburetion Equipment Section for complete servicing and adjusting directions.

Setting—Thermostatic coil housing reference mark should be centered on mark on piston housing (for all models except those shown in table below) or should be rotated counter-clockwise (Rich), clockwise (Lean), the correct number of notches from the center mark as follows:

Car Model	Carburetor	Choke Setting
Buick 39-40	419-S	1 Notch Rich
Buick 39-40	440-S	1 Notch Lean
All Others		Centered

Unloader:—Consists of a lip on the throttle connector which engages the choke trip lever on the choke valve shaft so that the choke valve is opened when the throttle is wide open. To adjust, hold throttle valve wide open, bend lip on fast idle connector link so that clearance between upper edge of choke valve and air horn wall is correct as shown in table below (use specified gauge to check this opening).

Car Model	Carburetor	Unloader Gauge	Clearance
Buick 39-40	419-S	T109-125	3/32"
Buick 39-40	440-S	T109- 28	3/16"
Hudson 6 & 8	430-S	T109- 31	¼"
Oldsmobile	389-S	T109- 31	¼"

Choke Valve Lock:—With unloader properly adjusted, choke valve will be locked in wide open position with throttle valves wide open. Choke valve will be released when throttle valves closed.

TROUBLE SHOOTING:—Same as for other Carter models (see preceding article).

SERVICING:—Disassembly. Remove fast idle arm screw, fast idle arm and spring assemblies. Take out air horn attaching screws (two screws outside, one screw inside under choke valve) and remove air horn and Climatic Control assembly. Remove pin spring and pump connector link, spring retainers and springs to remove throttle connector rod, take out four flange attaching screws and lift off flange, gasket and two idle passage gaskets taking care not to lose vacuum piston spring. Disconnect piston from piston link, lift out metering rod and piston link assembly, disconnect metering rods from link. Remove four bowl cover attaching screws, remove bowl cover and body gasket. Remove metering rod disc retainer and discs, pump plunger and rod assembly, pump spring, pump inlet ball check, metering rod jets and gaskets, anti-percolators (use 13/32" socket wrench T109-66), pump jet passage plugs, pump jets, nozzle plug and gasket assemblies, nozzle retainer plugs and nozzles (nozzles pressed in, use tool No. T109-55), nozzle gaskets, low speed jet and gasket assemblies, pump outlet ball retainer plug and ball (in center of casting next to air horn retaining screw hole), throttle valve attaching screws and throttle valves, throttle centering screw, arm attaching screw, washer, and arm. Remove fast idle spring retainer, spring, connector link, connector link spring, withdraw throttle shaft and lever assembly. Take out idle adjusting screws and springs, remove idle port rivet plugs.

Servicing—Clean castings and all parts with gasoline (no not immerse cork parts in gasoline), blow out all passages with compressed air, check all parts for correct specifications and replace all worn parts. Use all new gaskets when reassembling. Soak needle seat gasket, low speed jet gasket and metering rod jet gasket in 90 proof alcohol for 15 minutes, install and let dry on part before using.

Reassembly—Reassemble in reverse order. Check throttle valves (see Throttle Valves above), make certain that low speed jets seat at both ends and are tight, install nozzles with flat side facing up. Vacuum piston is offset from link and should be installed with large side of piston toward bores. When installing flange assembly on body casting, hold body casting upside down with vacuum piston vertical, place piston spring in piston, then place flange assembly on body casting, guiding piston and spring into cylinder in flange casting. Check metering rods, anti-percolator, pump, and fast idle as directed above.

CARTER DOWNDRAFT CARBURETOR JET SPECIFICATIONS

Car Model	Yr.	Carb. No.	Standard Marking	Standard Part No.	Metering Rod 1 Size Lean Marking	1 Size Lean Part No.	2 Sizes Lean Marking	2 Sizes Lean Part No.	Met. Rod Jet Size	Met. Rod Jet Part No.	Main Nozzle Size	Main Nozzle Part No.	Low Spd. Size	Jet Tube Part No.	Pump Jet Size	Pump Jet Part No.
AUBURN 6-52-X, Y	1934	288-S	64A47	75-112	—	75-114	—	75-115	#43	120-21S	#40	12-189	#72	11-141	#72	48-35
AUBURN 6-53	1935	307-S	64-44	75-76	66-46	75-94	68-48	75-95	#43	120-21S	#40	12-189	#68	11-145	#72	48-35
BUICK 40	Early 1939	419-S	62-54	75-340	63-56	75-362	—	—	.082"	120-65S	②	12-250③	#71	11-161S	#74	48-74
BUICK 40	Late 1939	440-S	——	75-398①	64-56	75-397	—	—	.082"	120-65S	②	12-250	#70	11-163S	#74	48-74
CADILLAC V16 (RH)	'38-39	407-S	62-45	75-307	63-46	75-328	64-47	75-329	.0846"	120-125S	④	12-238	#71	——	#72	48-52
CADILLAC V16 (LH)	'38-39	408-S	62-45	75-307	63-46	75-328	64-47	75-329	.0846"	120-125S	④	12-238	#71	——	#72	48-52
CHEVROLET BA	1932	212-S	56-44	75-49	57-45	75-51	58-46	75-52	#45	120-23S	#40	12-156	#72	11-119S	#72	48-35
" BB	1932	222-S	66-62	75-54	67-63	75-55	68-64	75-56	#45	120-23S	#40	12-156	#72	11-119S	#70	48-36
" BB	1932	222-SA	65-62	75-66	67-63	75-68	68-64	75-69	#45	120-23S	#40	12-162	#72	11-119S	#70	48-36
" BA	1932	235-S	56-44	75-60	57-45	75-61	58-46	75-62	#45	120-23S	#40	12-162	#72	11-119S	#72	48-35
" CB	1933	259-S	62-45	75-67	63-47	75-77	64-48	75-78	.087"	120-41S	#40	12-162	#72	11-119S	#72	48-38
" CC	1933	260-S	62-48	75-84	63-50	75-86	—	—	.087"	120-41S	#40	12-162	#72	11-119S	#72	48-38
CHEVROLET Std.	1934	285-S	66A50	75-102	67A52	75-109	68A53	75-110	.0835"	120-49S	#40-51	12-182, 3	#72	11-138	#72	48-43
CHEVROLET Mstr.	1934	284-S	65A46	75-101	66A50	75-102	67A52	75-109	.089"	120-21S	#31	12-185, 6	#72	11-138	#72	48-43
CHEVROLET Std., Mstr.	'35	284-S	65A46	75-132	66-50	75-102	67-52	75-109	.089"	120-21S	#31	12-185, 6	#72	11-138	#72	48-43
CHEVROLET Fleet (F)	'35	321-S	675-51	75-138	685-54	75-156	—	—	.0835"	120-49S	#31	12-182, 98	#72	11-138	#72	48-43
CHEVROLET Std. Mstr.	1936	319-S	69-42	**75-176	70-46	75-181	71-50	75-182	.095"	120-101S	#31	†12-186	#72	11-138	#72	48-43
CHEVROLET Std. Mstr.	1936	334-S	69-42	***75-176	70-46	75-181	71-50	75-182	.095"	120-101S	#31	†12-186	#72	11-138	#72	48-43
CHEVROLET Fleet (V)	1936	335-S	67-47	75-183	—	—	—	—	.0835"	120-49S	#53	††12-211	#72	11-138	#72	48-43
CHEVROLET All	1937	346-S	69-44	75-193	70-47	75-209	—	—	.094"	120-119S	#31	12-206 (A)	#72	11-138	#72	48-43
CHEVROLET Fleet (V)	1937	358-S	67-47	75-183	68-49	75-187	—	—	.0835"	120-49S	#53	12-213 (B)	#72	11-138	#72	48-43
CHEVROLET All	1938	391-S	69-42	75-290	70-47	75-209	(M)	—	.095"	120-129S	(L)	§§12-236U	#72	11-138	#72	48-43
CHEVROLET Fleet (V)	1938	358-S	67-47	75-183	—	—	—	—	.0835"	120- 49S	#53	12-213	#72	11-138	#72	48-43
CHEVROLET All	1939	420-S	675-40	75-377⑨	67-42	75-342	—	—	.095"	120-129S	⑥	⑧12-236U	#70	11-144⑤	#72	48-43
CHEVROLET Econ (V)	1939	434-S	65-41	75-381⑩	69-43	75-361	—	—	.0835"	120-49S	⑦	⑧12-213	#70	11-144⑤	#72	48-43
CHRYSLER C14	Late 1937	373-S	73-47	75-213	—	—	—	—	#41	120-113S	#30	12-212	#71	11-149S	#70	48-59
ESSEX TERRA 6K	1932	243-S	60-48	75-53	62-48	75-65	62-52	75-71	#50	120-31S	#40	12-169	#71	11-125S	#72	48-35
" " K, KU	1933	267-S	62-45	75-67	—	—	—	—	.087"	120-41S	#40	12-162	#72	11-128S	#72	48-35
" " 8 KT	1933	261-S	64-44	75-76	—	—	—	—	#43	120-21S	#45	12-178	#72	11-128S	#72	48-35
HUDSON LL, T	1934	282-S	63-42	75-107	—	—	—	—	.09525"	120-53S	#30	12-184	#70	11-135	#70	48-36
HUDSON LTS	1934	299-S	62-42	75-120	—	—	—	—	.09275"	120-51S	#30	12-191	#68	11-145	#70	48-36
HUDSON GH-6	1935	309-S	65-40	75-106	68-43	75-100	—	—	.09275"	120-51S	#40	12-190	#70	11-135	#72	48-35
HUDSON HT,HU,HHU-8	'35	310-S	63-42	75-107	65-44	75-127	—	—	.09525"	120-53S	#30	12-191	#70	11-135	#70	48-36
HUDSON 6, 63	1936	329-S	65-40	75-106	68-43	75-100	—	—	.09275"	120-51S	#40	12-190	#70	11-135	#72	48-35
HUDSON 8, 64, 5, 6, 7	1936	330-S	66-42	75-159	68-44	75-164	—	—	#40	120-67S	#30	12-191	#70	11-135	#70	48-36
HUDSON 6, 73	1937	344-S, 77-S	62-49	75-192	63-50	75-198	—	—	#45	120-65S	(N)	12-199	#71	11-149S	#72	48-52
HUDSON 8, 74, 5, 6, 7	1937	344-S, 77-S	62-49	75-192	63-50	75-198	—	—	#45	120-65S	(N)	12-199	#71	11-149S	#72	48-52
HUDSON '112' 89 Early	1938	411-S	72-50	75-336	74-53	75-323	75-56	75-324	.094"	120-119S	#51	12-241	#72	11-141	#70	48-65
HUDSON '112' 89 Late	1938	417-S	72-50	75-336	74-53	75-323	75-56	75-324	.094"	120-119S	#51	12-241	#66	11-158	#70	48-65
HUDSON 83 6	1938	402-S	62-49	75-192	63-50	75-198	64-51	75-298	.082"	120- 65S	(N)	12-199	#71	11-149S	#72	48-52
HUDSON 84, 5, 7, 8	1938	402-S	62-49	75-192	63-50	75-198	64-51	75-298	.082"	120- 65S	(N)	12-199	#71	11-149S	#72	48-52
HUDSON 90, 92, 98	1939	437-S	71-45	75-353	73-49	75-354	75-52	75-355	.0952"	120-53S	⑪	12-252	#70	11-135	#72	48-61
HUDSON 90, 92, 98	1939	438-S	71-45	75-353	73-49	75-354	75-52	75-355	.0952"	120-53S	⑪	12-252	#70	11-135	#72	48-61
HUDSON 92, 3, 5, 7	1939	430-S	62-47	75-348	63-48	75-357	64-49	75-358	.082"	120-65S	⑫	12-248	#69	11-162S	#72	48-72

NOTE:—Metering Rod markings indicate size of Rod. A rod marked '56-44' is .056" in diameter (Economy Step) and .044" (Power Step). On three step rods only the first and last steps are indicated by the marking.

(A) Nozzle Assembly (12-186 Screw Nozzle, 12-196 Slip Nozzle).
(B) Nozzle Assembly (12-211 Screw Nozzle, 12-210 Slip Nozzle).
(L) Screw Nozzle #31, Slip Nozzle .125".
(M) 1 Size Rich—Marked 68-41. Part No. 75-210.
(N) Closed Tip. Top Hole #70 (45° angle), Lower Hole #52 (60° angle).

** Supersedes 75-144 used on first cars.
*** Supersedes 75-171 used on first cars.
† Screw nozzle—Slip nozzle 12-196—.125" also used.
†† Screw nozzle—Slip nozzle 12-210—#40 also used.

①—Supersedes No. 75-371 (63-55).
②—Upper Hole #75, Lower Hole #52.
③—Supersedes No. 12-242.
④—Closed Tip. Top hole #70 (45° Angle), Lower hole #54 (60° Angle).
⑤—Supersedes No. 11-238 (#72).
⑥—Inner (Screw) Nozzle #31, Outer (Slip) Nozzle .125".
⑦—Inner (Screw) Nozzle #53, Outer (Slip) Nozzle #40.
⑧—Nozzle Assembly (Inner & Outer Nozzle).
⑨—Supersedes No. 75-342 (67-42) which becomes 1 Size Lean.
⑩—Supersedes No. 75-361 (69-43) which becomes 1 Size Lean.
⑪—Upper Hole #75, Lower Hole #51.
⑫—Closed Tip. Top hole #70 (45° Angle), Lower hole #52 (60° Angle).

CARTER DOWNDRAFT CARBURETOR JET SPECIFICATIONS

Car Model	Yr.	Carb. No.	Marking	Metering Rod Standard Part No.	1 Size Lean Marking	1 Size Lean Part No.	2 Sizes Lean Marking	2 Sizes Lean Part No.	Size	Met. Rod Jet Part No.	Main Nozzle Size	Main Nozzle Part No.	Low Spd. Jet Tube Size	Jet Tube Part No.	Pump Jet Size	Pump Jet Part No.
HUPMOBILE K	1933	258-S	67-47	75-75	68-49	75-82	69-50	75-83	#49 (C)	120-39S	#45	12-177	#71	11-129S	#72	48-35
HUPMOBILE 421A	1934	258-S	67-47	75-75	68-49	75-82	69-50	75-83	#49 (C)	120-39S	#45	12-177	#72	11-129S	#72	48-35
HUPMOBILE 518D	1935	316-S	66-46	75-140	67-47	75-145	68-48	75-146	#46	120-99S	#40	12-188	#68	11-145	#72	48-35
HUPMOBILE 521-O	1935	317-S	58-50	75-139	59-51	75-150	60-52	75-151	#46	120-69S	#30	12-197	#71	11-140	#72	48-38
HUPMOBILE 618-G	1936	333-S	66-46	75-140	67-47	75-145	68-48	75-146	#46	120-99S	#40	12-188	#68	11-145	#72	48-35
HUPMOBILE 621-N	1936	317-S	58-50	75-139	59-51	75-150	60-52	75-151	#46	120-69S	#30	12-197	#71	11-140	#72	48-38
HUPMOBILE E-822 6	1938	398-S	75-45	75-273	76-49	75-332	78-54	75-333	.098"	120- 67S	#40	12-188	#68	11-145	#72	48-61
HUPMOBILE H-825 8	1938	399-S	—	75-276	—	75-334	—	75-335	.089"	120-103S	#52	12-229	#70	11-157S	#70	48-63
HUPMOBILE R	1939	398-S	75-45	75-273	76-49	75-332	78-54	75-333	.098"	120-67S	#40	12-188	#68	11-145	#72	48-61
HUPMOBILE 922-E	1939	398-S	75-45	75-273	76-49	75-332	78-54	75-333	.098"	120-67S	#40	12-188	#68	11-145	#72	48-61
HUPMOBILE 925-H	1939	399-S	735-61	75-276	74-625	75-344	745-635	75-335	.089"	120-103S	#52	12-229	#70	11-157S	#70	48-63
LA SALLE 37-50	1937	374-S	72-42	75-221	—	75-245	—	75-246	.093"	120-113S	#30	12-212	#71	11-149S	#70	48-59
LA SALLE 38-50	1938	392-S	74-62	75-271	75-63	75-326	76-64	75-327	.093"	120-113S	(P)	12-228	#71	11-149S	#70	48-63
LA SALLE 39-50	1939	423-S	65-52	75-347	66-53	75-388	67-54	75-389	.086"	120-121S	⑫	12-247⑬	#71	11-161S	#72	48-72
NASH 6 3920	1939	435-S	76-40	75-372⑭	77-48	75-384	78-53	75-385	.0995"	120-133S	⑯	12-249	#65	11-165S	#70	48-58
NASH 8 3980	1939	436-S	73-565	75-379⑮	74-60	75-386	75-63	75-387	.0885"	120-107S	⑰	12-251	#70	11-163S	#72	48-61
OLDSMOBILE 6, early	1936	327-S	72-40	*75-175	73-43	75-177	74-47	75-178	#40	120-67S	#31	§§12-205S	#72	11-141	#72	48-43
OLDSMOBILE 6 late	1936	339-S, 42-S	72-40	75-175	73-43	75-177	74-47	75-178	#40	120-67S	#31	§§12-205S	#72	11-141	#72	48-43
OLDSMOBILE 8 early	1936	328-S	70-52	75-158	71-54	75-179	—	75-180	#43	**120-103S	#30	§12-209	#72	11-141	#73	48-50
OLDSMOBILE 8 late	1936	341-S	68-43	75-184	—	—	—	—	.0885"	120-107S	#30	12-212	#71	11-140	#73	48-50
OLDSMOBILE F-37	1937	351-S	77-41	75-194	—	—	—	—	.103"	120-117S	#31	12-208S	#70	11-135	#70	48-58
OLDSMOBILE L-37	1937	345-S	74-35	75-224 (D)	—	—	—	—	#41	120-113S	#30	12-212	#71	11-149S	#70	48-59
OLDSMOBILE " Late	1937	367-S	74-35	75-224	—	—	—	—	#41	120-113S	#30	12-212	#71	11-149S	#70	48-63
OLDSMOBILE 6	1937-38	385-S	77-41	75-194	78-45	75-249	79-50	75-250	.103"	120-117S	#31	§§12-208S	#70	11-135	#70	48-58
OLDSMOBILE 6	1938	388-S (T)	75-41	75-262	76-43	75-316	77-45	75-317	.103"	120-117S	#31	§§12-231S	#70	11-135	#68	48-53
OLDSMOBILE 8	1937-38	386-S	74-35	75-253	75-44	75-251	76-49	75-252	#41	120-113S	#30	12-212	#71	11-149S	#70	48-63
OLDSMOBILE 8	1937-38	389-S	72-52	75-268	73-51	75-318	74-53	75-319	#43	120-103S	(R)	§§12-227S	#70	11-157S	#70	48-63
OLDSMOBILE 60, 70	1939	385-S	77-41	75-194	78-45	75-249	79-50	75-250	.103"	120-117S	#31	⑧12-208S	#70	11-135	#70	48-58
OLDSMOBILE 60, 70	1939	426-S	78-48	75-341	79-50	75-375	80-53	75-376	.1015"	120-15S	⑲	12-244	#68	11-160S	#70	48-58
OLDSMOBILE 60, 70	1939	425-S⑱	79-49	75-350	79-51	75-373	80-54	75-374	.1015"	120-15S	⑳	12-244	#68	11-160S	#70	48-58
OLDSMOBILE 8 80	1939	389-S	72-49	75-268	73-51	75-318	74-53	75-319	.089"	120-103S	㉑	⑧12-227S	#70	11-157S	#70	48-63
PACKARD 120C Late	1937	366-S	62-47	75-228	—	—	—	—	.0846"	120-125S	#30	12-212	#66	11-151S	#72	48-52
PONTIAC 601	1933	255-S	56-44	75-72	58-44	75-81	—	—	#45	120-23S	#40	12-173	#70	11-126S	#74	48-37
" 601	1933	266-S	56-44	75-72	58-44	75-81	—	—	#45	120-23S	#40	12-173	#70	11-126S	#72	48-35
" 601	1933	280-S	64-40	75-98	—	75-99	68-43	75-100	#42	120-47S	#40	12-162	#70	11-135	#72	48-35
PONTIAC 603	1934	283-S	64A40	75-98	—	75-99	68-43	75-100	#42	120-47S	#40	12-162	#70	11-135	#72	48-35
PONTIAC (6) 701	1935	306-S	74-40	75-125	—	—	—	—	#44	120-61S	#40	12-190	#70	11-135	#72	48-35
PONTIAC (6) 701	1935	314-S	74-40	75-125	75-41	75-134	76-42	75-135	#44	120-61S	#40	12-190	#70	11-135	#72	48-35
PONTIAC (8) 605	1935	298-S	74-40	75-125	—	—	—	—	#44	120-61S	#40	12-190	#70	11-135	#72	48-35
PONTIAC (8) 605	1935	315-S	74-40	75-125	75-41	75-134	76-42	75-135	#44	120-61S	#40	12-190	#70	11-135	#72	48-35
PONTIAC (6) 36-26A, B	1936	324-S	74-40	75-125	75-41	75-134	76-42	75-135	#44	120-61S	#40	12-190	#70	11-135	#72	48-49
PONTIAC (6 & 8) Taxi	1936	340-S	76-42	75-135	—	—	—	—	#44	120-61S	#40	12-190	#70	11-135	#72	48-49
PONTIAC (8) 36-28	1936	322-S	74-42	75-160	75-43	75-166	76-44	75-167	.085"	120-105S	#40	12-190	#70	11-135	#72	48-49
PONTIAC 6 37-26	1937	352-S	72-42	75-191	76-44	75-206	77-46	75-207	.08525"	120-123S (H)	#38	12-216	#69	11-142	#68	48-53
PONTIAC 6 Taxicab	1937	364-S	75-70	75-219	—	—	—	—	.086"	120-61S	#38	12-216	#69	11-142	#68	48-53
PONTIAC 8 37-28	1937	350-S	76-42	75-196	77-44	75-204	78-46	75-205	.0905"	120-111S	#35	12-194	#69	11-142	#68	48-53
PONTIAC 38-26DA 6	1938	401-S	75-42	75-277	77-49	75-310	78-51	75-311	.0855"	120-123S	#38	12-216	#69	11-142	#68	48-53

(C) Main Jet No. 166-12 (#55½ drill size) also used.
(D) 75-195 on first cars.
(H) 120-61S on first cars.
(P) Closed Tip. Top Hole #64 (45° angle), Lower Hole #50 (60° angle).
(R) Slip Nozzle #35. Inner Nozzle #31.
(T) Used only on Cars with Automatic Transmission.

* Supersedes 75-157 used on first cars.
** Superseded by 120-107S (.0885").
§§ Nozzle Assembly (Inner & Outer Nozzles).
§ Supersedes 12-203 used on first cars.

⑧—Nozzle Assembly (inner & Outer Nozzle).
⑫—Closed Tip. Top hole # 70 (45° Angle), Lower hole # 52 (60° Angle).
⑬—Superseded by No. 12-228.
⑭—Supersedes No. 75-351 (76-48).
⑮—Supersedes No. 75-352.
⑯—Closed Tip. Top hole #75 (45° Angle), Lower hole #49 (70° Angle).
⑰—Closed Tip. Top hole—None. Lower hole #54 (60° Angle).
⑱—Used on cars with Self-shifting Transmission only.
⑲—Upper Hole #72, Lower Hole #46.
⑳—Outer (Slip) Nozzle #35, Inner Nozzle #31.
㉑—Closed Tip. Top hole #65 (45° Angle), Lower hole #40 (60° Angle).

CARTER DOWNDRAFT CARBURETOR JET SPECIFICATIONS

Car Model	Yr.	Carb. No.	Metering Rod Jet: Standard Marking	Standard Part No.	1 Size Lean Marking	1 Size Lean Part No.	2 Sizes Lean Marking	2 Sizes Lean Part No.	Size	Met. Rod Jet Part No.	Main Nozzle Size	Main Nozzle Part No.	Low Spd. Jet Tube Size	Low Spd. Jet Tube Part No.	Pump Jet Size	Pump Jet Part No.
PONTIAC 38-28DA 8	1938	400-S	76-42	75-196	77-44	75-204	78-46	75-205	.0905"	120-111S	#35	12-194	#69	11-142	#68	48-53
PONTIAC 6 39-25, 26	1939	433-S	71-42	75-346	72-44	75-368	73-46	75-369	.096"	120-17S	㉑	12-246	#71	11-161S	#72	48-61
PONTIAC 8 39-28	1939	432-S	78-41	75-349	79-43	75-366	80-45	75-367	.104"	120-131S	⑯	12-249	#69	11-162S	#72	48-61
REO Flying Cloud 6-D	1936	338-S	77-43	75-174	—	—	—	—	#38	120-15S	#31	§§12-208S	#70	11-135	#72	48-43
STUDEBAKER 5A, 6A	1937	371-S (E)	71-42	75-222 (G)	72-46	75-225	73-50	75-226	#41	120-47S (J)	#35	12-194	#68	11-145 (K)	#68	48-53
STUDEBAKER 5A, 6A	1937	371-S (F)	72-46	75-225	73-50	75-226	—	75-227	#41	120-47S (J)	#35	12-194	#68	11-145 (K)	#68	48-53
STUDEBAKER Ch. G	1939	444S, 53S	78-48	75-393	79-51	75-394	795-54	75-395	.081"	120-85S	.0935"	12-254	#69	11-162S	#72	48-61
TERRAPLANE K, KU	1934	281-S	65A40	75-106	—	—	—	—	.09275"	120-51S	#40	12-162	#70	11-135	#72	48-35
TERRAPLANE KS	1934	295-S	65A40	75-119	—	—	—	—	.09275"	120-51S	#40	12-190	#70	11-135	#72	48-35
TERRAPLANE G	1935	311-S	65-40	75-119	68-43	75-100	—	—	.09275"	120-51S	#40	12-190	#70	11-135	#72	48-35
TERRAPLANE GU	1935	309-S	65-40	75-106	68-43	75-100	—	—	.09275"	120-51S	#40	12-190	#70	11-135	#72	48-35
TERRAPLANE Del 61	1936	331-S	65-40	75-119	68-43	75-100	—	—	.09275"	120-51S	#40	12-190	#70	11-135	#72	48-45
TERRAPLANE Cst 62	1936	329-S	65-40	75-106	68-43	75-100	—	—	.09275"	120-51S	#40	12-190	#70	11-135	#72	48-35
TERRAPLANE 70, 71	1937	348-S	66-52	75-189	68-54	75-201	—	—	.0952"	120-53S	#40	12-190	#70	11-135	#72	48-35
TERRAPLANE 72	1937	344-S, 77-S	62-49	75-192	63-50	75-198	—	—	#45	120-65S	(N)	12-199	#71	11-149S	#72	48-52
TERRAPLANE 80,81,88	1938	397-S	69-52	75-285	71-54	75-286	73-56	75-287	.09525"	120- 53S	#40	12-190	#69	11-142	#72	48-61
TERRAPLANE 82 Super	1938	402-S	62-49	75-192	63-50	75-198	64-51	75-298	.082"	120- 65S	(N)	12-199	#71	11-149S	#72	48-52

⑯—Closed Tip. Top hole #75 (45° Angle), Lower Hole #49 (70° Angle).
㉑—Closed Tip. Top hole #65 (45° Angle), Lower Hole #40 (60° Angle).

(E) Standard Air Cleaner.
(F) Heavy Duty oil-bath Air Cleaner.
(G) 75-212 (.069"-.065"-.044") on first cars.
(J) Superseded by No. 120-17S.
(K) 11-135 on first cars.
(N) Closed Tip. Top Hole #70 (45° angle), Lower Hole #52 (60° angle).

CARTER (BB) UPDRAFT CARBURETOR JET SPECIFICATIONS

Car Model	Yr.	Carb. No.	Main Metering Screw: Flow	Standard Part No.	1 Size Lean Part No.	2 Sizes Lean Part No.	Main Nozzle Size	Main Nozzle Part No.	Stepup Jet Power Orifice Size	Stepup Jet Power Orifice Part No.	Idle Orifice Tube Size	Idle Orifice Tube Part No.	Idle Passage Tube	Pump Size	Valve Part No.
CHEVROLET COE. Tr'k	1937	367-S	.258-62cc.	159-53	5%	159-32	10%	159-15	#33	12-166	.0275"	162-16	.0236"	123-16	123-12	.0925"	149-19S
CHEVROLET "	1938-39	412-S	.236-40cc.	159-50	5%	159-20	10%	159-21	#33	12-166	.0275"	162-16	.022"	123-32	123-12	.0925"	149-19S
CHEVROLET "	Late '39	447-S	.236-40cc.	159-50	5%	159-20	10%	159-21	#33	12-166	.0275"	162-16	.022"	123-32	123-12	.0925"	149-19S
CHRYSLER CI	1932	6A1	222cc.	159-15	—	159-16	—	159-17	#30	12-160	.023"	162-10	.0256-.0275"	123-14	123-12	159-11	149-15S
" CI	1932	6B1	222cc.	159-15	—	159-16	—	159-17	#30	12-160	.023"	162-10	.0256-.0275"	123-14	123-12	159-11	149-15S
" CI	1932	6B2	222cc.	159-15	—	159-16	—	159-17	#33	12-166	.032"	162-13	.024"	123-16	123-12	——	149-19S
DE SOTO SC	1932	6B	222cc.	159-15	—	159-16	—	159-17	#30	12-160	.023"	162-10	.0256-.0275"	123-14	123-12	159-11	149-15S
" SC	1932	6B1	222cc.	159-15	—	159-16	—	159-17	#30	12-160	.023"	162-10	.0256-.0275"	123-14	123-12	159-11	149-15S
" SC	1932	6B2	222cc.	159-15	—	159-16	—	159-17	#33	12-166	.032"	162-13	.024"	123-16	123-12	——	149-19S
DODGE DL	1932	6A2	222cc.	159-15	—	159-16	—	159-17	#33	12-166	.032"	162-13	.024"	123-16	123-12	——	149-19S
" DL	1932	6B2	222cc.	159-15	—	159-16	—	159-17	#33	12-166	.032"	162-13	.024"	123-16	123-12	——	149-19S
PLYMOUTH PB	1932	4A2	222cc.	159-15	—	159-16	—	159-17	#30	12-164	.0197"	162-12	.0256-.0275	123-14	123-12	159-11	149-18S
" PB	1932	4A3	222cc.	159-15	—	159-16	—	159-17	#33	12-166	.0256"	162-14	.0236"	123-16	123-12	——	149-23S

Main Metering Screw column 'Flow' indicates capacity in cubic centimeters per minute. Do not gauge these jets with wire drills.

376-S—CHEVROLET CAB-OVER-ENGINE EXPORT TRUCK (1937)
412-S—CHEVROLET CAB-OVER-ENGINE TRUCK (1938-39)
447-S—CHEVROLET CAB-OVER-ENGINE TRUCK (LATE 1939)
4-A2—PLYMOUTH, MODEL PB (1932), MOTORS NOS. PB-1001 TO 32668.
4-A3—PLYMOUTH, MODEL PB (1932), MOTORS NOS. PB-32669 UP.
6-A2—DODGE SIX, MODEL DL (1932) (WITHOUT VACUUM CLUTCH CONTROL).
6-A1, 6-B1, 6-B2—CHRYSLER SIX, MODEL CI (1932).
6-B, 6-B1—DE SOTO SIX, MODEL SC (1932, TO MOTOR NO. 17543.
6-B2—DE SOTO SIX, MODEL SC (1932), AFTER MOTOR NO. 17543.
6-B2—DODGE SIX, MODEL DL (1932) (VACUUM CLUTCH CONTROL).

TYPES:—Plain tube updraft type with throttle operated accelerating pump and vacuum operated 'step-up' device (economizer). Fuel for main nozzle is metered by main metering jet (under float bowl) and power orifice or step-up jet (for high speed or wide open throttle operation with step-up valve open). There are two idling ports, a lower or non-adjustable port (below the throttle), and an upper port (above throttle in closed throttle position) which is controlled by the idling adjustment screw. Idling adjustment and accelerating pump adjustment (summer and winter setting) are the only point requiring attention.

IDLE ADJUSTMENT:—Needle valve type operating on fuel mixture. Engine must be warmed up before adjustment is made. With engine warm and running, close throttle, adjust throttle stop screw so that engine idles at approximately 300 to 375 R.P.M. Turn the idle adjusting screw in or clockwise until engine begins to miss (mixture too lean), then turn screw slowly out or counter-clockwise until engine fires smoothly. Idling screw controls fuel mixture (turn screw in for leaner mixture, out for richer mixture). Setting should be approx. ½-1¼ turns open. Check idle speed after completing adjustment and readjust throttle stop screw if necessary. Do not idle engine below 300 R.P.M.

NOTE:—If correct idling adjustment cannot be secured or engine stalls while idling, take out idling adjustment screw and lower idle port plug and see that ports are clear, remove idle passage tube and idle jet tube and clean with compressed air.

ACCELERATING PUMP:—Low pressure delayed action type. Accelerating pump is connected to throttle shaft lever and discharges fuel through main nozzle when throttle is opened. Pump discharge is metered by pump metering jet in pump valve cage assembly (separate pump metering jet used on 4A2, 6A1, 6B, 6B1—see illustration).

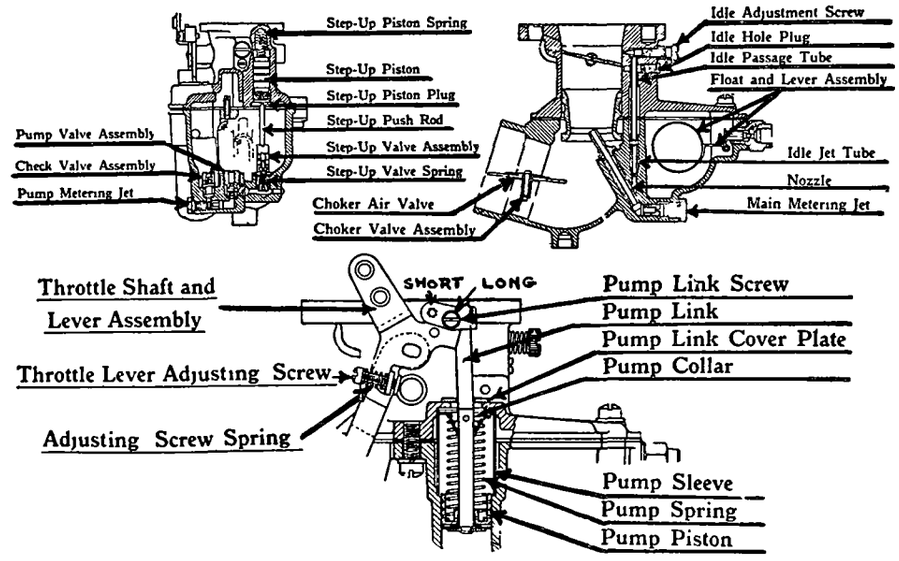
Adjustment:—Pump link screw should be engaged in outer hole in throttle lever (long pump stroke) for winter driving or cold temperatures. Engage screw in inner hole (short pump stroke) for summer driving (hot climates), high altitudes, or high test gasoline.

NOTE:—If acceleration is unsatisfactory, check pump setting (above), remove main metering jet, pump metering jet, check valve assembly, and pump valve assembly and clean with compressed air.

PERFORMANCE AND ECONOMY:—All jets are 'fixed' type (non-adjustable). Main metering screw is flow-tested and rated in accordance with capacity. It should not be gauged for size with wire drills. Main metering screw can be changed to secure leaner-than-standard fuel mixtures to compensate for special fuels or operating conditions such as high altitude (see Specifications). If performance and economy are not satisfactory, examine step-up valve cage assembly, see that ball check is free and seats properly, that valve cage is screwed tight against its seat, that step-up piston is not binding, and that step-up push rod moves freely in upper and lower guides. Check float level.

VACUUM STEP-UP (ECONOMIZER):—Consists of a step-up valve assembly controlled by a vacuum piston. Vacuum piston is normally held at top of stroke by manifold vacuum so that step-up valve is closed. At high speeds or for wide open throttle operation, the drop in manifold vacuum allows the spring (above piston in cylinder) to force the vacuum piston down and open the step-up valve. Additional fuel then flows through valve and power orifice jet to main nozzle.

NOTE—When installing carburetor on manifold make certain that correct gasket used on carburetor flange (gasket has four slots) so that vacuum step-up channel in carburetor mounting flange is open. Fuel consumption will be excessive if this hole is cut off.



FLOAT LEVEL:—To check float level, take off float bowl cover (upper carburetor body casting), remove gasket, hold lip of float lever firmly against needle valve, place a metal rule across top of float bowl and check distance from top of float (not float seam) to top of bowl edge. Float should be flush with top of bowl to 1/32" max. below top of bowl with gasket removed (except 412-S, 47-S), 1/32-1/16" below top edge of bowl (412-S, 47-S). Level can be adjusted by bending lip of float lever (not bracket). To raise float level, bend lip of lever toward needle valve. To lower float level, bend lip of float lever toward float.

CHOKE:—Carburetors have interconnected choke valve and throttle valve levers so that throttle valve is opened slightly when carburetor is choked. Throttle is returned to closed position when choke valve is opened wide. Choke valve is fitted with a compensating or relief poppet valve to prevent overchoking. Adjust choke linkage so that choke valve is fully closed with choke control button pulled all the way out and wide open with choke button pushed in.

E6C1—CHRYSLER, SIX CYLINDER, MODELS CA, CB (1934).
E6F1—CHRYSLER AIRSTREAM SIX, MODEL C6 (1935)—FIRST CARS
E6A—DE SOTO, MODEL SD (1933), FIRST CARS.
E6A3—DE SOTO, MODEL SD 1933), MOTOR NOS. SD-11788 UP.
E6A4—DE SOTO, MODEL SD (1933), MOTOR NOS. SD-12346 UP.
E6B1—DE SOTO, MODEL SE (1934).
E6F1—DE SOTO, AIRSTREAM MODEL SF (1935)—FIRST CARS
DE SOTO, AIRFLOW MODEL SG (1935)—FIRST CARS
E8A—DODGE, EIGHT CYLINDER, MODEL DO (1933).
C6A—PLYMOUTH, MODEL PC (1933), MOTOR NOS. PC-1311 TO PC-31413.
C6A2—PLYMOUTH, MODEL PC (1933), MOTOR NOS. PC-31413 TO PC-81145.
C6A3—PLYMOUTH, MODEL PC (1933), MOTOR NOS. PC-81145 TO PC-87788.
PLYMOUTH. DELUXE MODEL PD (1933), MOTOR NOS. 37121 TO 60489.
C6A4—PLYMOUTH, MODEL PC (1933), MOTOR NOS. PC-87788 UP.
PLYMOUTH, DELUXE MODEL PD (1933), MOTOR NOS. 60489 UP.
C6B1—PLYMOUTH, STD. & DELUXE MODELS PF, PG, PE (1934).
B6A1, B6A2—PLYMOUTH, ECON. MODEL (1934)—WITHOUT GOVERNOR
B6C1, B6C2—PLYMOUTH, ECON. MODEL (1934)—WITH GOVERNOR
C6D1—PLYMOUTH, STD. & DELUXE MODEL PJ (1935)—FIRST CARS.
B6E1—PLYMOUTH, ECON. BUSINESS & FLEET MODEL PJ (E) (1935)
303S—REO, FLYING CLOUD MODEL 6A (1935) SERIAL NOS. 6A100 TO 251
304S—REO, FLYING CLOUD MODEL 6A (1935) SERIAL NOS 6A251 TO 2038
320S—REO, FLYING CLOUD MODEL 6A (1935) SERIAL NOS. 6A2038 UP

NOTE:—On Models C6A, C6A2, E6A, E8A, the accelerating pump discharges through the main discharge nozzle. On all other models a separate pump discharge jet is used and the accelerating pump discharges through this jet.

TYPE:—Plain tube downdraft type with throttle operated accelerating pump and vacuum operated 'step-up' device (economizer). Fuel is metered by main metering screw under float chamber and by power orifice or step-up jet (for high speed or wide open throttle operation with step-up valve open). There are two idling ports, an upper port (above the throttle valve) and a lower port (below valve when throttle is closed) which is controlled by idling adjustment screw. Idle adjustment and accelerating pump adjustment (summer and winter setting) are the only points requiring attention.

IDLING ADJUSTMENT:—Needle valve type operating on fuel mixture. Engine must be warmed up before adjustment is made. With engine warm and running, close throttle, adjust throttle shaft dog adjusting screw so that engine idles at approximately 300 R.P.M. or 6 M.P.H. Turn idling adjusting screw in or clockwise until engine begins to miss (mixture too lean), then turn screw slowly out or counter-clockwise until engine fires evenly. Adjusting screw controls fuel mixture and should be turned in to secure leaner mixture and out for richer mixture. Correct setting for adjusting screw is shown on table below. Check idling speed after completing adjustment and readjust as necessary. Do not idle engine at less than 300 R.P.M.

Car Model	Carburetor	Idle Screw Setting
Chrysler, DeSoto ('34)	E6B1, E6C1	½-1¼ turns open
Chrysler, DeSoto ('35)	E6F1	¼-1 turn open
DeSoto (1933)	E6A	½-1¼ turns open
DeSoto (1933)	E6A3, E6A4	⅝-1¼ turns open
Dodge 8 (1933)	E8A	⅝-1¼ turns open
Plymouth (1933-34)	C6A, 2, 3, 4, C6D1	½-1 turn open
Plymouth (1934)	B6A1, A2, C1, C2	½-1¼ turns open
Plymouth (1935)	B6E1, C6D1	¼-1 turn open
Reo (1935)	303-S, 304-S, 320-S	¼-¾ turn open

NOTE:—If correct idling adjustment cannot be secured, engine stalls while idling, or low speed operation is unsatisfactory, take out idle hole plug and idle adjustment screw and see that ports are not clogged, take out idle passage and jet tubes and clean with compressed air. See note below.

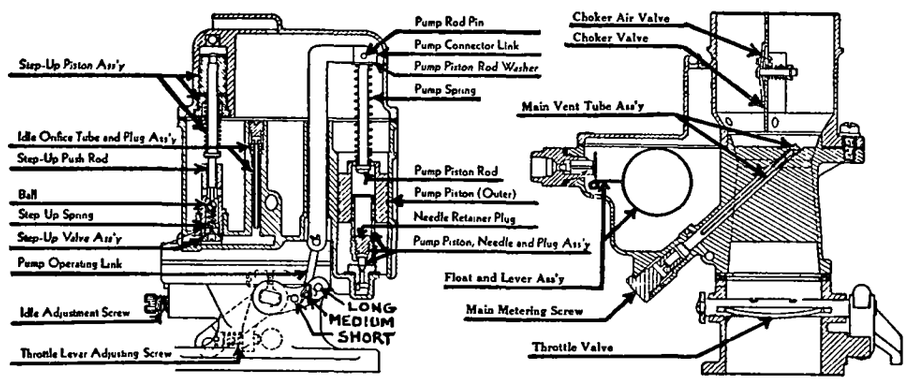
IMPORTANT NOTE:—Air horn casting (upper body casting) must be tight fit on main body casting at the step-up vacuum passage joint to prevent gasoline being drawn down into this passage which will cause stalling at idling or low speeds. Where this trouble is experienced, manufacturer advises that a step-up passage bushing, Part No. 38A-26, be installed in the main body casting and the air horn casting reassembled with TWO Part No. 121-17 body gaskets. The bushing must be in perfect alignment with the passages in both castings.

ACCELERATING PUMP:—Accelerating pump is connected to throttle shaft lever and discharges fuel through a pump jet located in the venturi when the throttle is opened, supplying the extra fuel required for acceleration. Pump lever on throttle valve shaft has two or three holes for engagement of pump operating link to secure varied pump stroke. Pump operating link pin should be engaged in outer or end hole, providing maximum pump stroke for winter driving or extreme cold temperatures. Pin should be engaged in inner hole, providing minimum pump stroke for summer driving (hot climates), high altitudes, or high test gasoline. Center hole in lever provides an intermediate pump stroke and should be used for normal temperature ranges.

NOTE:—If acceleration is unsatisfactory, check pump setting (above), remove and clean jets and valves as follows:

First Type—Discharging through Main Jet. Remove main metering jet, pump metering jet, check valve, and pump valve assembly. Clean with compressed air.

Later Type—With separate Pump Jet. Remove main metering jet and pump discharge jet and clean with compressed air. Examine pump piston needle and seat assembly and clean or replace.



PERFORMANCE AND ECONOMY:—All jets are 'fixed' type (non-adjustable). Main metering screw is flow-tested and rated in accordance with capacity. It should not be gauged for size with wire drills. Main metering screw can be changed to secure leaner-than-standard fuel mixture to compensate for special fuels or operating conditions such as high altitudes (see specifications). If performance and economy are not satisfactory, examine step-up valve cage assembly, see that ball check is free and seats properly, that valve cage is screwed tight against its seat, that step-up push rod moves freely in upper and lower guides, and that step-up piston is not binding Check float level.

FLOAT LEVEL:—To check float level, take off float bowl cover (upper carburetor body casting), remove gasket, hold lip of float lever firmly against needle valve and measure distance from top edge of float bowl to top of float (not soldered seam). Use special gauge Part No. 1522-B (5/64") or 15222 (1/64") to check float level or place a straightedge or metal rule across top of float bowl and measure distance from lower edge of rule to float. Distances should be as follows:

Car Model	Carburetor	Float Setting
Chrysler, DeSoto ('34-35)	E6B1, C1, F1	5/64"
DeSoto (1933)	E6A	1/16"
DeSoto (1933)	E6A3, 4	5/64"
Dodge 8 (1933)	E8A	1/16"
Plymouth (1933)	C6A	1/16"
Plymouth ('33-34-35)	All Models	5/64"
Reo (1935)	303-S, 304-S, 320-S	1/64"

Float level can be corrected by bending lip of float lever (not the bracket). To lower float level, bend lip of float lever toward needle valve. To raise float level, bend lip of float lever toward float.

1933-35 TYPE CONT.

CHOKE:—Choke valve is fitted with poppet type relief valve to prevent overchoking. Choke valve and throttle valve are interconnected so that throttle is opened to 'fast idle' position when choke valve is more than one-half closed. Throttle valve returns to closed position when choke valve is opened NOTE—This "Fast Idle" not used on Models B6A1, B6A2, B6C1, B6C2, B6E1 (Plymouth Economy Carburetors).

THROTTLE VALVE SETTING:—When installing throttle valves, see that distance from throttle valve edge to top or bottom of upper idle port is correct as shown in following table.

Car Model	Carburetor	Idle Port Height
Chrysler	E6C1	.004-.008"①
Chrysler	E6F1	.076-.080"②
DeSoto	E6A3, A4, B1, C1	.004-.008"①
DeSoto	E6F1	.076-.080"②
Plymouth	C6A	.005-.009"②
Plymouth	C6A2	.013-.017"②
Plymouth	C6A3, A4; C6B1; B6A1, A2; B6C1, C2; B6E1	.013-.017"①
Plymouth	C6D1	.080-.084"②
Reo	303-S, 304-S, 320-S	.008-.012"③

①—To Bottom of Idle Port. ②—To Top of Idle Port.
③—Actual Idle Port Opening with throttle valve tightly closed.

PLYMOUTH SPECIAL INSTRUCTIONS:—Manufacturer advises that the Model C6A carburetor used on the first Plymouth cars can be brought up to C6A2 specifications (as used on later cars) by changing following parts. All parts listed must be changed at the same time.

	Part No.
Idle Port Restriction Plug	11B-53
Main Vent Tube and Plug Assembly	145-18S
Pump Spring	61-78
Pump Valve Cage Assembly	149-29S
Pump Piston	160-16
Pump Rod, Plate, and Rod Assembly	161-16S

TROUBLE SHOOTING:—Poor Idling Performance—If correct adjustment cannot be secured, engine stalls, or low speed performance is unsatisfactory, take out idle hole plug and idle adjusting screw, examine ports and clean with air, take out idle passage tube and idle jet tube and clean with air.

Acceleration Unsatisfactory—Check pump setting, remove main metering jet and pump discharge jet, clean with air. Examine pump piston needle and seat assembly, replace if necessary.

High Speed Operation & Economy Unsatisfactory—Disassemble and examine Step-up valve cage assembly, see that ball-check is free and seats properly, that valve cage is screwed tight against its seat, that step-up piston is not sticking and push-rod moves freely in upper and lower guides. Check float level.

SERVICING:—To Disassemble Carburetor—Remove air horn (upper body casting) attaching screws, lift off air horn, remove step-up piston push-rod, drain carburetor, remove float lever pin and plug assembly, remove float needle valve and seat assembly, unscrew and remove step-up valve assembly and any ball-checks in carburetor bowl, remove pin spring on pump link at throttle lever, remove pump link, remove pump rod and piston assembly (pull out from above), remove pump piston assembly (inner piston, needle, plug) by inverting carburetor and catching parts as they fall out (do not drop this assembly or needle will be damaged), remove pump piston needle seat and gasket assembly being careful not to lose steel ball, remove idle orifice tube assembly, remove pump jet plug and pump jet being careful not to damage jet with screwdriver, remove main metering screw, main vent tube and plug assembly, idle adjustment screw and spring, and idle hole plug. Take out throttle valve body attaching screws, lift off main body casting, remove gasket, remove step-up piston assembly and small gasket under piston, remove power orifice jet from assembly being careful not to lose ball and spring in assembly.

Servicing—Wash all parts and body in gasoline, blow out all passages in body and dry with air. Replace all worn and damaged parts.

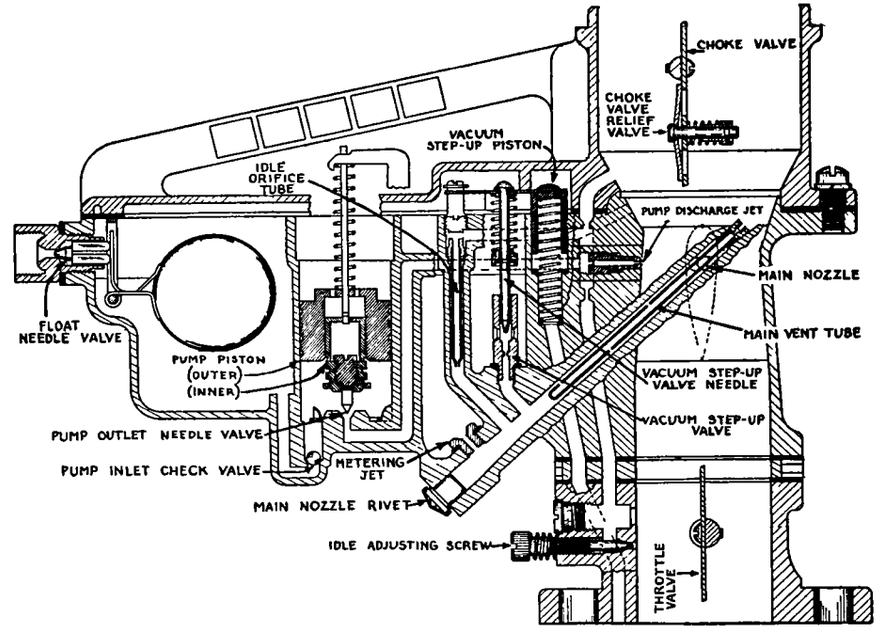
Reassembling Carburetor—Assemble in reverse order from disassembly instructions, use new gaskets soaking metering jet gasket and step-up jet gasket in water for 15 minutes before installing. See that all jets and plugs are tightened securely. In assembling step-up valve assembly, insert steel ball in housing first, then spring, finally screw in jet. When replacing steel ball in pump cylinder see that ball is not placed in center hole in pump cylinder. See that small inner pump piston moves freely in outer piston and install pump assembly by turning carburetor down on one side and guiding connector link in guide and piston in cylinder (do not allow inner piston to drop out of outer piston). When replacing air horn (upper body) casting see that bushing is in place in step-up vacuum passage. This bushing should be installed on all carburetors not originally equipped. Check float level and adjust carburetor on engine.

1935-36 TYPE

E6F2—CHRYSLER, AIRSTREAM SIX MODEL C6 (1935) AFTER 18,268 CARS.
DE SOTO, AIRSTREAM MODEL SF (1935) AFTER 15,846 CARS.
DE SOTO, AIRFLOW MODEL SG (1935) AFTER 4,788 CARS.
E6G1—CHRYSLER AIRSTREAM SIX, MODEL C7 (1936).
DE SOTO AIRSTREAM SIX, MODEL S1 (1936).
DE SOTO AIRFLOW SIX, MODEL S2 (1936).
C6D2—PLYMOUTH, STD. & DELUXE MODEL PJ (1935) AFTER 145,872 CARS.
C6E1—PLYMOUTH, STD. & DELUXE P1, P2 (1936) BEFORE ENG. NO. 269323.
C6E2—PLYMOUTH, STD. & DELUXE P1, P2 (1936) AFTER ENG. NO. 269323.
B6F1—PLYMOUTH, 'ECONOMY' MODELS P1, P2 (1936).
B6G1—PLYMOUTH, ECONOMY MODELS P1, P2 (1936)

NOTE:—On Plymouth models with standard carburetors (C6E1, C6E2), main metering screw was changed in production from Part No. 159-56S to No. 159-58S. Fuel economy on first cars equipped with this 159-56S (262-266cc.) jet will be improved by installing the new type 159-58S (248-252cc.) jet.

Chrysler, De Soto, Plymouth Altitude Economy. Standard vacuum step-up springs (61-118, 61-146, 61-135) when used at altitudes over 3000' will actuate step-up valve at speeds of 45-55 MPH. To correct poor gasoline mileage or economy complaints for altitude operation, install new Vacuum Step-up Spring No. 61-134 (this spring will operate vacuum step-up valve at car speeds of 66-68 MPH).



TYPE:—Plain tube downdraft type similar to previous designs except for main metering jet and Vacuum Step-up Device design as follows:

Main Metering Jet—New type tapered jet located in float bowl and controlling fuel flow through passage between bowl and nozzle channel. Jet can be removed through bowl after it has been unscrewed (fitted with hexagonal head). Jet is tapered and should not be gauged for size with wire drills. Lower end of nozzle channel (where metering screw formerly located) now closed by blank rivet.

Vacuum Step-Up Device. Vacuum cylinder now located in main body casting. Vacuum piston stem and power orifice needle valve stem connected by piston plate (see illustration). Idle orifice tube has an extension on its head which acts as a guide for the piston plate. Step-up needle valve should be seated with approximately 1/64-1/32" clearance between stem and piston plate when vacuum piston down at end of stroke (see adjustment below).

IDLING ADJUSTMENT:—Idle adjustment screw controls fuel discharge through lower idle port and should be turned in for leaner mixture or out for richer mixture. To adjust with engine warm and idling, set throttle stopscrew so that idling speed is approximately 300 R.P.M. or 6 M.P.H. Turn idling adjusting screw in or clockwise until engine begins to miss, then turn screw out slowly until

1935-36 TYPE CONT.

engine fires smoothly. Readjust throttle stopscrew to correct idling speed if necessary. See tune up instructions on car model pages. Approximate idling screw settings are as follows:

Car Model	Carburetor	Idle Screw Setting
Chrysler all models	E6F1, E6F2, E6G1	¼-1 turn open
De Soto all models	E6F1, E6F2, E6G1	¼-1 turn open
Plymouth PJ, PJ(E)	B6E1, C6D1	¼-1 turn open
Plymouth PJ, P1, P2	C6D2, C6E1, C6E2, B6F1	⅛-¾ turn open

ACCELERATING PUMP:—Delayed action type positively operated by throttle valve shaft. Fuel drawn into pump chamber past piston needle on upstroke of piston and discharged through pump jet in side of venturi on downstroke (when throttle opened for acceleration). Pump piston constructed in two sections, inner or lower piston carrying inlet valve needle, and outer or upper piston being linked to pump rod through spring. Outer piston lags behind (compressing spring) when throttle opened suddenly and subsequent piston movement when spring expands continues piston movement and draws out pump discharge.

Adjustment—Pump lever on throttle shaft provided with three holes for pump rod link engagement. Inner hole (short radius) provides minimum pump stroke and outer hole (long radius) maximum stroke. See tune-up on car model page for recommended settings and changes for seasonal requirements on each car model.

VACUUM STEP-UP (ECONOMIZER):—New design (see description above). See that needle valve is seated and that clearance between needle valve stem and piston plate is 1/64-1/32" with piston down at the end of its stroke (piston spring compressed). Adjust by bending piston plate slightly. This clearance must be maintained to insure needle valve seating and prevent fuel discharge through power orifice at low speeds or when throttle is not wide open. See that needle works freely in the guide and does not stick on its seat. Acceleration and high speed performance will be unsatisfactory if needle does not open when throttle is wide open.

PERFORMANCE & ECONOMY:—All jets are fixed (non-adjustable). Main metering screw flow-tested and rated in accordance with capacity. Do not check size with wire drills. Main metering screw can be changed to secure leaner-than-standard fuel mixture (high altitude calibration) for special fuels and operating conditions. See Carter (B & B) Jet Specification Table.

FLOAT LEVEL:—To check float level, take off float bowl cover (upper body casting), hold lip of float lever firmly against needle valve, use special gauge (see table below) to check float height (not soldered seam). To adjust, bend lip of float lever toward needle valve to lower float level, or away from needle valve to raise float level.

Car Model	Carburetor Model	Float Level	Checking Gauge
Chrysler (all)	E6F1, E6F2, E6G1	5/64"	1522-B
De Soto (all)	E6F1, E6F2, E6G1	5/64"	1522-B
Plymouth (all)	C6D2; C6E1, E2; B6F1	5/64"	1522-B

THROTTLE VALVE SETTING:—When installing throttle valves, see that distance from top edge of valve to top of upper idle port "Idle Port Height" is correct as shown in following table.

Car Model	Carburetor	Idle Port Height
Chrysler, DeSoto	E6F2, E6G1	.081-.085"
Plymouth	C6D2	.080-.084"
Plymouth	C6E1, E2; B6F1, B6G1	.085-.089"

CHOKE:—Choke valve mounted off-center and choke control connected through spring providing semi-automatic action. Poppet type relief valve mounted on choke valve to prevent over-choking.

FAST IDLE:—Throttle valve stopscrew stop-cam pivoted below throttle shaft and linked to choke lever so that throttle opened to fast idle position when choke valve in use. Linkage should not require adjustment.
NOTE—This Fast Idle not used on B6F1, B6G1 Plymouth Economy models.

TROUBLE SHOOTING:—Same as for previous models. See preceding article.

SERVICING:—Same as for previous models (see preceding article) except that entire vacuum step-up device located in main body casting and not disturbed by removal of air horn. Use care in installing step-up jet (excessive pressure will distort orifice and change fuel flow rate).

1937-39 TYPE

CHRYSLER ROYAL, MODEL C16 (1937)

E6I1—ENGINE NUMBERS C16-1001 TO 4073.
E6K1—ENGINE NUMBERS C16-4074 TO 4318.
E6K2—ENGINE NUMBERS C16-4319 TO 11151.
E6K3—ENGINE NUMBERS C16-11153 TO 23802.
E6K4—ENGINE NUMBERS C16-23803 AND UP.

DE SOTO, MODEL S3 (1937)

E6I1—ENGINE NUMBERS S3-1001 TO 3967.
E6K1—ENGINE NUMBERS S3-3968 TO 4289.
E6K2—ENGINE NUMBERS S3-4290 TO 11156.
E6K3—ENGINE NUMBERS S3-11157 TO 22087.
E6K4—ENGINE NUMBERS S3-22088 AND UP.

PLYMOUTH STANDARD & DELUXE MODELS P3, P4 (1937)

C6F1—ENGINE NUMBERS P4-1001 TO 10497.
C6F2—ENGINE NUMBERS P4-10498 TO 88610.
C6F3—ENGINE NUMBERS P4-88611 TO 96179.
C6F4—ENGINE NUMBERS P4-96180 TO 136611.
C6F5—ENGINE NUMBERS P4-136612 AND UP.
C6H1—ALL MODELS (1937)—SEE NOTE.
B6F1—ALL MODELS WITH ECONOMY ENGINE (1937)
B6G1—ALL MODELS WITH ECONOMY ENGINE (1937)—SEE NOTE.

1938 Car Models

E6M1—CHRYSLER ROYAL, MODEL C18 (1938)
DE SOTO SIX, MODEL S5 (1938)
E6L1—DE SOTO TAXICAB (1938)
C6J1—PLYMOUTH, DELUXE MODEL P6 (1938)
B6H1—PLYMOUTH, ECONOMY MODELS P5, P6 (1938)
B6J1—PLYMOUTH, ECONOMY MODELS WITH GOVERNOR (1938)

1939 Car Models

E6N1—CHRYSLER ROYAL, MODEL C22 (1939)—FIRST CARS.
DE SOTO, MODEL S6 (1939)—FIRST CARS.
E6N2—CHRYSLER ROYAL, MODEL C22 (1939)—LATER CARS.
DE SOTO, MODEL S6 (1939)—LATER CARS.
D6A1—PLYMOUTH, MODELS P7, P8 (1939)—FIRST CARS.
D6A2—PLYMOUTH, MODELS P7, P8 (1939)—LATER CARS.
B6K1—PLYMOUTH, P7, P8 ECONOMY MODELS (1939)
B6M1—PLYMOUTH, P7, P8 ECONOMY MODELS (1939)
BBR1-439-S—PLYMOUTH REPLACEMENT CARBURETOR—SEE NOTE.

SPECIAL NOTES (1937):—Models B6G1, C6H1. These models used only on engines where crankcase is ventilated through carburetor.

Chrysler, De Soto, Plymouth Altitude Economy. Standard vacuum step-up springs (61-118, 61-146, 61-135) when used at altitudes over 3000' will actuate step-up valve at speeds of 45-55 MPH. To correct poor gasoline mileage or economy complaints for altitude operation, install new Vacuum Step-up Spring No. 61-134 (this spring will operate vacuum step-up valve at car speeds of 66-68 MPH).

1937 Carburetor Changes:—Similar design. To bring earlier models up to performance standard of later models and to correct complaints of poor acceleration on part throttle at speeds of 10-15 M.P.H. make changes as follows:

E6K1, E6K2—Replace original Pump Check Needle 17-34 with new type 17-35 (this type has relief on stem). Replace Pump Plunger Assembly 64-40S with new type 64-41S (see installation instructions below).

C6F1, C6F2, C6F3—Replace original Pump Spring No. 61-144 with new type 61-145. Replace Pump Check Needle No. 17-34 with new type 17-35 (relieved stem). Replace Pump Plunger Assembly No. 64-40S with new type 64-41S as follows:

To Remove Pump Plunger Assembly—Remove pump operating link (throttle lever connector), pull pump plunger assembly and connector link from carburetor. Move connector link to point where plunger assembly will rotate 90° on pump plunger stem, remove plunger assembly from link. Replace pump spring with new type (Plymouth only) before connecting new plunger assembly.

Metering Jets on All Models—Main metering jets on these models have been changed to secure better performance and fuel economy. See Carter B & B Jet Specification table following for latest jet calibrations.

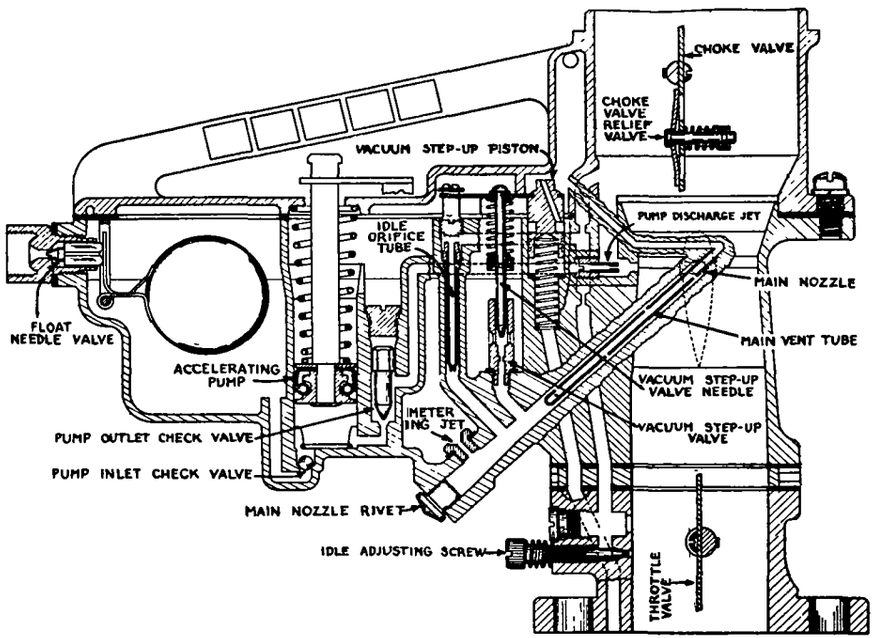
SPECIAL NOTES (1938):—Plymouth Econ. Models. Approximately first 25 cars shipped with wrong type gasket under carburetor flange (1A-32 gasket with four small holes used instead of 1A-33 with four slots). This gasket will cause mileage complaints. Check gasket and install correct type.

Plymouth Models—If ragged performance noted at 20-30 M.P.H. or lack of power at 10 M.P.H. with ¾ throttle opening, make certain that engine is warming up properly and that water temperature is at least 160°F. Carburetor jet calibration set for maximum mileage and engine temperature is important.

SPECIAL NOTES (1939):—Models E6N2, D6A2. Same as types used on first 1939 cars except for the following parts which are used on the later models only: Body Flange Assembly 1-264S (E6N2), 1-262S (D6A2); Throttle Shaft & Arm Assembly 3-363S (E6N2), 3-362S (D6A2); Throttle Lever Assembly 4-343S (all), Throttle Shaft Dog 4A-79 (E6N2), 4A-78 (D6A2); and new Throttle Centering Spring Washer 136-55 (all).

Model BBR1-439-S—This model replaces carburetors used on 1933-38 Plymouth cars as follows: C6A, C6A2, C6A3, C6A4, C6B1, C6D1, C6D2, C6E1, C6E2, C6F1, C6F2, C6F3, C6F4, C6F5, C6J1. Adjustment specifications for this model given below and complete jet data in Carter (B&B) Jet Specification Table.

All Models. Whenever body gasket No. 121-69 (between the main body casting and air horn and bowl cover casting) is removed for carburetor servicing, use new gasket when reassemblying. This is important to prevent air leaks at this point which will affect carburetor economy (carburetors are 'balanced' type with bowl vented through air horn).



TYPE:—Plain tube, downdraft type with throttle operated accelerating pump and vacuum operated step-up device (economizer). Similar to previous design except for Accelerating Pump, Main Vent, and Vacuum Step-up design as follows:

Accelerating Pump (Except E6I1, B6F1, G1). Delayed action type. Pump has a single piston with leather seal (similar to design used on other Carter models). Pump stem is loose on pump connector and plunger is forced down by conical spring in body above plunger. Outlet check needle is now located in pump discharge channel at side of pump cylinder (not incorporated in pump piston). Inlet ball check valve located at bottom of pump cylinder as in earlier models.

NOTE—See preceding article (1936) type) for data on accelerating pump used on B6F1, B6G1, E6I1 carburetors.

Main Vent—Main nozzle now air bled from bowl vent. Main vent tube is new design and is installed from bottom (rivet plug at lower end of nozzle under float bowl must be removed to get at vent tube). See special directions in Servicing section.

Vacuum Step-up (Economizer)—Vacuum piston chamber located in main body casting with upper end opening in bowl vent and lower end connected through channel to manifold at carburetor flange. Step-up jet or power orifice valve now needle type connected to vacuum piston plate so that needle is raised to open valve and permit fuel flow through power orifice.

1939 Models:—Float bowl is vented through balance tube cast in air horn to provide uniform fuel-air ratio regardless of air cleaner condition. The bowl cover seal is important with this type construction (see special service note above). Pump jet design has been changed slightly, a rivet is used to close the pump jet passage (instead of a screw) and spring above discharge ball check not used.

Plymouth D6A1, D6A2—Flange size has been increased to 1½". For this reason, these models not interchangeable with previous types (see BBR1-S note).

Fuel System (Idling):—Fuel taken from main nozzle well up through Idle Orifice tube (metered by restriction in tube) to cross-channel in which it is mixed with air admitted through idle air bleed opening in carburetor wall above venturi. From this point fuel mixture is taken down through channel to discharge ports at throttle edge (lower port only for closed throttle idling, both ports for low speed).

Driving Range—Fuel for main nozzle metered by main metering jet in float bowl. Main nozzle air bled by main vent tube in upper end of nozzle which connects with air vent leading to bowl vent. Lower end of nozzle closed by blank rivet.

High Speed & Wide Open Throttle Operation—Vacuum piston, which is normally at lower end of stroke with piston spring compressed, will be forced up by spring when manifold vacuum falls off, raising the step-up rod or needle and opening the valve, permitting additional fuel to flow through the power orifice (step-up jet) to the main nozzle.

IDLING ADJUSTMENT:—Idle adjusting screw controls fuel discharge through lower idle port and should be turned in for leaner mixture, out for richer mixture. Approximate idle screw settings given in table below. Adjust only with engine warmed up so that choke valve is wide open and fast idle inoperative. Idle speed controlled by throttle lever stopscrew. See car model 'T&E' page for complete carburetor tune up instructions.

Car Model	Carburetor	Idle Setting	Idle Speed
Chrysler, DeSoto	E6I1	¼-1 turn open	6 M.P.H.
DeSoto Taxicab	E6L1	½-1¼ turn open	6 M.P.H.
Chrysler, DeSoto	All Others	½-1¼ turn open	6 M.P.H.
Plymouth Econ	B6F1, H1, J1	¼-¾ turn open	6 M.P.H.
Plymouth	All Others	½-1¼ turn open	6 M.P.H.

ACCELERATING PUMP:—New type (see description above). Pump discharge jet now located in antechamber behind main venturi but discharges through hole in venturi wall directly into mixing chamber.

Adjustment—Three holes provided in throttle lever for pump connector link engagement. Inner hole provides minimum stroke, center hole medium stroke, outer hole maximum stroke. See tune up data on car model page for recommended settings.

Pump Stroke Adjustment—To check, remove air horn and float bowl cover assembly, back off throttle stopscrew so that throttle valve closes tightly, connect pump connector link in correct hole of throttle lever (see table below), install Universal Pump Stroke Gauge T109-117S on bowl so that indicator lip on gauge rests on top of pump plunger shaft. Note gauge reading, then open throttle wide and again note gauge reading. Difference between two readings is pump stroke (in sixty-fourths of an inch) and should agree with table below. To adjust, bend horizontal portion of connector link.

Car Model	Carburetor	Pump Stroke	Pump Setting
Chrysler, DeSoto	E6M1, E6L1	④ 27/64"	Medium
Chrysler, DeSoto	E6N1, E6N2	26/64"	Medium
Plymouth	C6J1	④ 25/64"	Medium
Plymouth	D6A1, D6A2	24/64"	Medium
Plymouth Econ	B6H1, J1, K1	④ 20/64"	Medium
Plymouth Rplmt	BBR1-439-S	24/64"	Medium

④—Use Gauge No. T-109-115.

PERFORMANCE:—Performance should be satisfactory if idling adjustment and accelerating pump setting correct. Main metering jet is non-adjustable type (jets are flow-tested and should not be gauged with wire drills). Leaner main metering jets available for special fuel or operating conditions such as high altitude but are not recommended for use at lower altitudes (these jets will give greater fuel economy but with some loss of power and performance).

VACUUM STEP-UP ECONOMIZER:—Consists of vacuum piston operated step-up or by-pass valve controlling fuel flow through power orifice to main nozzle. No adjustment required but setting should be checked when carburetor dismantled to insure complete closing of valve when vacuum piston held down at lower end of stroke by manifold vacuum.

Step-up Valve Setting—With vacuum piston down at bottom of stroke, clearance between piston plate and head of step-up valve needle should be 1/64-1/32" (needle is loose in plate and is spring-loaded by spring on stem under plate). Adjust by bending piston plate slightly.

Vacuum Step-Up Spring—When servicing carburetor, make certain that correct step-up spring installed as follows: No. 61-135 (E6N1, E6N2, B6K1, BBR1-439S), No. 61-146 (D6A1, D6A2), No. 61-134 (B6M1).

NOTE—No. 61-146 step-up spring used on first B6K1 & BBR1-439S carburetors.

FLOAT LEVEL:—To check float level, remove air horn (integral with float bowl cover), use special gauge No. 1522-B, placing gauge on top edge of bowl with lugs extending down toward float on either side of soldered seam. Press lip of float lever against needle valve, float should contact both lugs on gauge. Adjust by bending float lever lip slightly at point where it contacts valve needle (do not bend float arm). If gauge not used, top of float (not soldered seam) should be 5/64" plus or minus 1/64" (all models except B6M1), 5/32" plus or minus 1/64" (B6M1—do not use gauge) below top edge of bowl with needle valve seated.

Float Needle Valve & Seat. Furnished only in matched sets. Part No. 25-61S (#42 drill size intake hole) used on all 1937 models and first 1938 models. Part No. 25-82S (#44 drill size intake hole) used on later 1938 and all 1939 models except B6M1. No. 25-77S used on B6M1.

CHOKE:—Choke valve offset type. Fitted with poppet type relief valve. See article in Carburetion Equipment Section for data on Sisson Automatic Choke control.

FAST IDLE:—Consists of a throttle shaft dog (throttle stopscrew stop) pivoted below throttle shaft and linked to choke valve lever so that throttle is opened to fast idle position when choke valve closed for starting. No adjustment required.

NOTE—This Fast Idle not used on B6F1, B6G1, B6H1, B6J1, B6K1, B6M1 Plymouth Economy models.

THROTTLE VALVE SETTING:—Throttle valve setting when fully closed is shown in table below. Idle Port Height is distance from top of upper idle port (ports are keyhole type) to top of throttle valve. Vacuum Port Height is distance from top of port (ports are slotted type) to top of throttle valve. Shims furnished .002" thick (No. 2-93), .005" (No. 2-94) for throttle valve adjustment.

Car Model	Carburetor	Idle Port Height	Vacuum Port Height
Chrysler, DeSoto	E6I1; E6K1,2,3,4	.081-.085"	④ .010"
Chrysler, DeSoto	E6L1, E6M1	.088-.092"	.035-.041"
Chrysler, DeSoto	E6N1, E6N2	.088-.092"	.035-.041"
Plymouth	C6F1,2,3,4,5; C6H1	.118-.122"	④ .015"
Plymouth.	C6J1, BBR1-439-S	.118-.122"	.035-.041"
Plymouth	B6F1, B6G1	.085-.089"	
Plymouth	D6A1, D6A2	.118-.122"	④.003-.009"
Plymouth	B6H1, J1, K1, M1	.096-.100"	.035-.041"

④—From lower edge of port to top edge of throttle valve

SERVICING:—Disassembly. Disconnect fast idle rod, take out air horn attaching screws, lift off air horn and float bowl cover (upper casting). Take out float pin spring and pin, lift out float, remove float needle valve. Disconnect pump connector link at throttle lever, push out pump plunger assembly. Take out vacuum step-up piston assembly (piston, plate, and step-up valve needle). Remove step-up jet being extremely careful not to distort jet which may change power orifice jet size. Remove idle orifice tube. Remove main metering jet. Main vent tube cannot be taken out unless blank rivet at lower end of main nozzle is first removed.

Servicing. Wash all parts except cork gaskets in gasoline. Blow out all jets and channels in body casting with compressed air. Replace all worn or damaged parts.

Assembly. Use new gaskets. Reverse disassembly directions above. Use extreme care when tightening step-up jet not to use excessive pressure which may distort power orifice jet size. Check vacuum step-up setting (see Economizer section above), check float level, adjust carburetor when installed on engine.

Main Nozzle Servicing:—Use tool No. T-109-42 to remove rivet at lower end of main nozzle, No. T-109-70 to install new rivet after installing new Vent Tube (vent tube must be removed and installed from lower end of nozzle).

Balance Tube—When servicing carburetor make certain that balance tube in air horn is open and clean. Always use new gasket between body casting and air horn to insure air tight joint at bowl cover. Any air leak at bowl cover will upset 'balance' feature and affect fuel economy.

Vacuum Step-up Passage—Passage opens on carburetor mounting flange and special gasket (with slots which register with this vacuum passage hole) must be used when installing carburetor on manifold. Shutting off of this vacuum passage hole will cause excessive fuel consumption.

TROUBLE SHOOTING:—Poor Idling Performance. Remove idle adjusting screw and idle hole plug, remove Idle Orifice Tube, blow out tube and channels in body with compressed air. If carburetor loads up, check float level.

Acceleration Unsatisfactory. Remove pump jet and clean with compressed air, or replace jet. Disassemble pump and check for damaged or worn plunger leather, sediment or corrosion in cylinder, clogged inlet ball check valve. Use care in installing pump plunger not to damage plunger leather. Check step-up jet needle to see that it is clean and straight and moves freely in guide. Bent needle or one with eccentric point will stick on seat and will not open at wide open throttle.

Excessive Richness or Poor Gas Mileage. Check Vacuum step-up setting and see that needle seats in valve to prevent fuel flow through power orifice at part-throttle. Excessive richness at speeds above 50 M.P.H. may be caused by clogged main vent tube.

CARTER (B & B) DOWNDRAFT CARBURETOR JET SPECIFICATIONS

Car Model	Yr.	Carb. No.	Main Metering Jet Standard Flow	Main Metering Jet Standard Part No.	Main Metering Jet 1 Size Lean Less	Main Metering Jet 1 Size Lean Part No.	Main Metering Jet 2 Sizes Lean Less	Main Metering Jet 2 Sizes Lean Part No.	Main Vent Air Bleed Size	Tube Assem. Part No.	Stepup Jet Power Orifice Size	Stepup Jet Power Orifice Part No.	Idle Orifice Tube Size	Idle Orifice Tube Part No.	Pump Jet Assembly. Jet Size	Pump Jet Assembly. Part No.
CHRYSLER CA, CB	1934	E6C1	278-282cc.	159-40	—	159-22	—	159-23	.0315"	145-14S	.0374"	162-18	.0276"	123-18S	.0354"	48-44
CHRYSLER C6	1935	E6F1	280-284cc.	159-51	—	159-52	10%	159-53	.0315"	145-14S	.0374"	162-18	.0276"	123-18S	.0354"	48-44
CHRYSLER C6 Late	1935	E6F2	282-286cc.	159-63S	—	159-59S	10%	159-61S	.0315"	145-14S	#63	149-43S	.0276"	123-21S	.0354"	48-44
CHRYSLER C-7	1936	E6G1	282-286cc.	159-63S	5%	159-59S	10%	159-61S	.0315"	145-14S	#63	149-43S	.0276"	123-21S	.0354"	48-44
CHRYSLER C16 Early	1937	E6I1	282-286cc.	159-63S	5%	159-59S	10%	159-61S	.0315"	145-14S	#63	149-43S	.0276"	123-21S	.0354"	48-44
CHRYSLER C16	1937	E6K1,2,3,4		159-59S†	5%	159-61S	10%	159-66S	.0315"	145-13	#63	149-43S	.0276"	123-21S	.0374"	48-57S
CHRYSLER C18	1938	E6M1	268-272cc.	159-59S	5%	159-61S	10%	159-66S	.0315"	145-13	#63	149-43S	.0276"	123-31S	.0374"	48-57S
CHRYSLER C22	1939	E6N1, N2	268-272cc.	159-59S	5%	159-61S	10%	159-66S	.0315"	145-13	#63	149-43S	.0276"	123-31S	.0374"	48-75
DE SOTO SD	1933	E6A	266-270cc.	159-22	5%	159-23	10%	159-19	.0315"	145-14S	.0315"	162-13	.0276"	123-18S	#52	149-29S
" SD	1933	E6A3	266-270cc.	159-22	5%	159-23	10%	159-19	.0315"	145-14S	.0315"	162-13	.0276"	123-18S	.0354"	48-40
" SD	1933	E6A4	252-256cc.	159-23	5%	159-19	10%	159-20	.0315"	145-14S	.0315"	162-13	.0276"	123-18S	.0354"	48-40
DE SOTO SE	1934	E6B1	278-282cc.	159-40	—	159-22	—	159-23	.0315"	145-14S	.0374"	162-18	.0276"	123-18S	.0354"	48-44
DE SOTO SF,SG	1935	E6F1	280-284cc.	159-51	—	159-52	10%	159-53	.0315"	145-14S	.0374"	162-18	.0276"	123-18S	.0354"	48-44
DE SOTO SF,SG Late	1935	E6F2	282-286cc.	159-63S	—	159-59S	10%	159-61S	.0315"	145-14S	#63	139-43S	.0276"	123-21S	.0354"	48-44
DE SOTO S1, S2	1936	E6G1	282-286cc.	159-63S	5%	159-59S	10%	159-61S	.0315"	145-14S	#63	149-43S	.0276"	123-21S	.0354"	48-44
DE SOTO S3 Early	1937	E6I1	282-286cc.	159-63S	5%	159-59S	10%	159-61S	.0315"	145-14S	#63	149-43S	.0276"	123-21S	.0354"	48-44
DE SOTO S3	1937	E6K1,2,3,4		159-59S†	5%	159-61S	10%	159-66S	.0315"	145-13	#63	149-43S	.0276"	123-21S	.0374"	48-57S
DE SOTO S5	1938	E6M1	268-272cc.	159-59S	5%	159-61S	10%	159-66S	.0315"	145-13	#63	149-43S	.0276"	123-31S	.0374"	48-57S
DE SOTO S5 Taxi	1938	E6L1	268-272cc.	159-59S	5%	159-61S	10%	159-66S	.0315"	145-13	#63	149-43S	.0276"	123-31S	.0374"	48-57S
DE SOTO S6	1939	E6N1, N2	268-272cc.	159-59S	5%	159-61S	10%	159-66S	.0315"	145-13	#63	149-43S	.0276"	123-31S	.0374"	48-75
DODGE DO	1933	E8A	300-304cc.	159-26	—	159-27	—	159-28	.0315"	145-14S	.0335"	162-15	.0276"	123-18S	#52	149-29S
PLYMOUTH PC	1933	C6A	240-244cc.	159-19	—	159-33	—	159-34	.0315"	145-14S	.0256"	162-14	.0276"	123-18S	#52	149-25S
" PC	1933	C6A2	230-234cc.	159-32	5%	159-33	10%	159-34	.0315"	145-18S	.0276"	162-16	.0276"	123-18S	#52	149-29S
" PC, PD	1933	C6A3,4	230-234cc.	159-32	5%	159-33	10%	159-34	.0315"	145-18S	.0275"	162-16	.0276"	123-18S	.0315"	48-39
PLYMOUTH Econ. (C)	1934	B6A1,2	154-158cc.	159-38	—	—	—	—	.0315"	‡‡145-20S	.0236"	162-10	.0276"	123-18S	.0276"	48-42
PLYMOUTH Econ. (D)	1934	B6C1,2	154-158cc.	159-38	—	—	—	—	.0315"	‡‡145-20S	.0236"	162-10	.0276"	123-18S	.0276"	48-42
PLYMOUTH PE,PF,PG	1934	C6B1	230-234cc.	159-32	—	159-33	—	159-34	.0315"	145-18S	.0276"	162-16	.0276"	123-18S	.0315"	48-39
PLYMOUTH PJ	1935	C6D1	262-266cc.	159-48	—	159-49	—	159-50	.0315"	145-18S	#62	162-22	.0276"	123-18S	.0315"	48-39
PLYMOUTH PJ Late	1935	C6D2	262-266cc.	159-56S	—	159-58	—	159-60S	.0315"	145-25S	#65	149-41S	.0276"	123-21S	.0315"	48-39
PLYMOUTH PJ(E)	1935	B6E1	154-158cc.	159-38	—	—	—	—	.0315"	145-18S	.0236"	162-10	.0276"	123-18S	.0276"	48-42
PLYMOUTH P1, P2	1936	C6E1,2	248-252cc.	159-58S††	5%	159-60S	10%	159-64S	.0315"	145-25S	#65	149-41S	.0276"	123-21S	.0315"	48-39
PLYMOUTH Econ. Eng.	1936	B6F1	160-164cc.	159-68S	—	159-69S	—	—	.0315"	145-25S	#71	149-50S	.0276"	123-21S	.0276"	48-39
PLYMOUTH P3, P4	1937	C6F1,2,3,4,5,C6H1		159-58S‡	5%	159-60S	10%	159-64S	.0315"	145-28*	#63	149-43S§	.0276"	123-21S	.0335"	48-55S
PLYMOUTH P3 Econ.	1937	B6F1, G1	160-164cc.	159-68S	5%	159-69S	—	—	.0315"	145-25S	#71	149-50S	.0276"	123-21S	.0276"	48-39
PLYMOUTH P6 (A)	1938	C6J1	248-252cc.	159-58S	5%	159-60S	10%	159-64S	.0315"	145-29	#63	149-43S	.0276"	123-31S	.0315"	48-67S
PLYMOUTH P6 (B)	1938	C6K1	248-252cc.	159-58S	5%	159-60S	10%	159-64S	.0315"	145-29	#63	149-43S	.0276"	123-31S	.0315"	48-67S
PLYM'TH P5,6 Econ (C)	1938	B6H1	152-156cc.	159-69S	—	—	—	—	.0295"	145-24	#71	149-50S	.0276"	123-31S	.0236"	48-69S
PLYM'TH P5,6 Econ (D)	1938	B6J1	160-164cc.	159-68S	—	—	—	—	.0295"	145-24	#71	149-50S	.0276"	123-31S	.0236"	48-69S
PLYMOUTH P7, P8	1939	D6A1, A2	254-258cc.	159-61S	5%	159-66S	10%	159-82S	.0315"	145-17	#63	149-43S	.0276"	123-31S	.0315"	48-73
PLYMOUTH Econ.	1939	B6K1	160-164cc.	159-68S	—	—	—	—	.0295"	145-24	.0236"	149-60S	.0276"	123-37S	.0236"	48-77S
PLYMOUTH Econ.	1939	B6M1	168-172cc.	159-70S	—	—	—	—	.0315"	145-33	.0236"	149-60S	.0276"	123-38S	.0236"	48-81
PLYMOUTH Replmt.	'33-38	BBR1-439S	248-252cc.	159-58S	5%	159-60S	10%	159-64S	.0315"	145-17	#63	149-43S	.0276"	123-31S	.0315"	48-73
REO 6A	1935	303S	240-244cc.	159-19	—	159-10	—	159-15	.0394"	145-23S	.0335"	162-15	.0276"	123-18S	.0315"	48-39
REO 6A	1935	304S	268-272cc.	159-46	—	159-53	—	159-54	.0315"	145-14S	.0345"	162-17	.0276"	123-18S	.0354"	48-40
REO 6A	1935	320S	268-272cc.	159-46	—	159-53	—	159-54	.0315"	145-14S	.0394"	162-19	.0276"	123-18S	.0315"	48-39

† 268-272cc. No. 159-76S (262-268cc) and 159-63S (282-286cc) used on first cars.

†† No. 159-56S (262-266cc) used on first cars.

‡ 248-252cc. No. 159-75S (244-248cc) and 159-56S (262-266cc) used on first cars.

‡‡ No. 145-18S used on Models B6A1 and B6C1.

(A) Cars without Crankcase Ventilator.

(B) Cars with Crankcase Ventilator.

(C) Cars without Governor.

(D) Cars with Governor.

§ 149-56S on first cars.

* 145-17 on first cars.

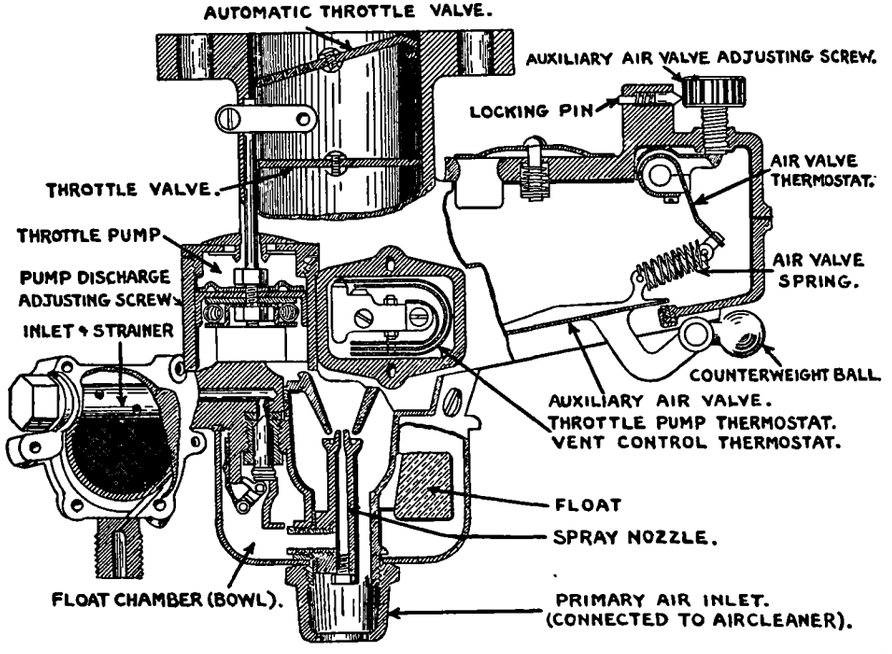
NOTE:—C6H1 and B6G1 used only on Plymouth cars where crankcase ventilated through carburetor.

CADILLAC V8, SERIES 355 (1931), 355B (1932), 355C (1933).
LA SALLE V8, SERIES 345 (1931), 345B (1932), 345C (1933).

TYPE:—Air valve updraft type with positively operated pneumatic accelerating pump (throttle pump). All fuel is metered by spray nozzle located in center of primary air passage. Auxiliary air valve in air horn is controlled by air valve spring and thermostat and is adjustable.

1932-33 Type. Air cleaner added with main air intake elbow bolted over air valve and a smaller elbow leads from the main air intake to the primary intake at the bottom of the bowl. Auxiliary air valve adjustment screw is located on top of carburetor body in same position as before.

PRELIMINARY ADJUSTMENT:—Check choke control linkage to see that choke lever on carburetor is against stop when choke control button is pulled all the way out. With carburetor fully choked see that free movement of air valve tip is 1/16-3/32" at room temperatures (65-80°F.). If this requires adjustment, take out air valve cover screws, lift cover slightly and unhook air valve spring (if air valve spring is stretched or distorted it must be replaced), remove cover, loosen two screws on bracket carrying thermostatic arm, turn shaft slightly and tighten screws, replace air valve spring.



AIR VALVE ADJUSTMENT:—With engine warm and idling at approximately 300 R.P.M. turn adjusting screw to right or clockwise until engine speed decreases or engine begins to roll, then turn screw to left or counter-clockwise until speed decreases or engine begins to miss. Correct setting should be midway between these points. Setting can be determined accurately by counting the number of notches on the adjusting screw between extreme rich and extreme lean positions and then turning screw back one-half this number of notches. With air intake elbow removed setting can be checked by pressing lightly up and down on air valve counterweight. If setting is correct, engine speed should decrease slightly in each case. If engine speed increases when counterweight is pressed up, setting is too lean. If engine speed decreases when counterweight is pressed up and increases when counterweight is pressed down, setting is too rich. In making the air valve adjustment the adjusting screw should be turned one or two notches at a time and the engine performance noted.

THROTTLE PUMP:—Throttle pump discharges air in pump chamber into float chamber when throttle is opened, increasing the pressure above the gasoline and causing an increased fuel discharge from the spray nozzle. Throttle pump thermostat opens at 74-78°F., providing a vent for part of the pump discharge and decreasing the float bowl pressure. A second thermostat controlling a float chamber vent is set to open at 125-130°F. (or 115-120°F. with high-test gasoline. Thermostats should not require adjustment.

Adjustment:—Throttle pump adjusting screw (by-pass needle valve) on side of pump cylinder should be turned down against its seat for normal operating conditions. For hot weather operation or with high test gasoline, adjusting screw can be backed off 2-3 turns. To make this adjustment loosen lock nut and turn adjusting screw counter-clockwise. Adjusting screw must be turned seven full turns to completely open by-pass valve.

AUTOMATIC THROTTLE:—Carburetors are fitted with an automatic (spring loaded) throttle valve above the regular throttle valve. Automatic throttle should not require adjustment and a special tool or testing spring must be used to check setting. With carburetor off the engine and held horizontally with the test tool clipped to the edge of the automatic throttle valve, the weight of the tool should be sufficient to open throttle to within 1/32" of the stop pin. If it does not and throttle shaft is free, loosen the two screws on the spring housing at the end of the throttle shaft and turn the center adjusting screw clockwise to increase spring tension or counter-clockwise to decrease spring tension. Tighten locking screws and check setting.

FLOAT LEVEL:—Float level should be 7/16-15/32" above flange on central tube of carburetor body. To check float level with carburetor off engine, remove float bowl, invert carburetor, take off gasket on float bowl seat, measure distance from bottom of float (bottom when not inverted) to top edge of flange on central tube of carburetor body (float bowl seat). This distance should be 7/16-15/32". Correct float level by bending hinge bracket.

CHOKE:—Adjust choke linkage so that choke lever on carburetor is against stop when choke button on instrument panel is pulled all the way out.

CADILLAC V-12, MODEL 370 (1930-31).
CADILLAC V-16, MODEL 452 (1930-31).

TYPE:—Twin installation consisting of two carburetors of the same design as used on V-8 model (see previous article). One carburetor is used to supply fuel for each bank of cylinders. Carburetors must be equalized as well as adjusted in order to assure smooth running.

NOTE:—Throttle pump on these carburetors has been changed slightly and throttle pump thermostat is mounted on the pump body under a flat cover. Thermostat is set to operate at 75-80°F.

PRELIMINARY ADJUSTMENT:—Same as for V8 type (see preceding article). Idle speed should be set for 320 RPM. and can be checked by taking off oil filler cap and noting rocker arm which should move 40 times in 15 seconds at 320 R.P.M.

AIR VALVE ADJUSTMENT:—With engine warm and idling at 320 R.P.M. adjust air valve on each carburetor by turning adjusting screw to right or clockwise until engine speed decreases or engine begins to roll, then turn screw to left or counter-clockwise until speed decreases or engine begins to miss. Final setting should be midway between these points.

EQUALIZING ADJUSTMENT:—Use special Cadillac Equalizing Gauge, Part No. 109626. Gauge consists of a 'U' tube partly filled with mercury and with a rubber tube connected to each leg of the tube. These tubes should be connected to the intake manifolds after the vacuum lines on the manifolds have been disconnected. Gauge should be hung on one of the radiator tie rods so that it hangs vertically with the mercury level in the tubes even when the engine is not running. With the gauge in place, disconnect the throttle rod on the right hand carburetor, idle engine at 320 R.P.M. and note mercury level in tubes. If engine speed is exactly 320 R.P.M. (rocker arm will move 40 times in 15 seconds) and mercury levels are even, the carburetor adjustment is correct. If mercury levels are even but engine speed is greater than 320 R.P.M., turn both throttle stop screws out evenly. If mercury levels are not equal and engine idles too fast, back off the throttle stop screw on the carburetor feeding the bank on which the mercury level is lower. If mercury levels are not even and engine speed is too slow, turn up throttle stop screw on carburetor feeding bank on which mercury level is higher. Continue adjustment until mercury levels are even and engine speed is exactly 320 R.P.M.

Check air valve setting by turning adjusting screw clockwise until engine slows down from a too rich mixture, then turn screw counter-clockwise, counting the notches on the adjusting screw until engine slows down from a too lean mixture, then turn screw back exactly one-half this number of notches. Recheck idling speed and mercury level in gauge. Adjust length of right hand throttle rod so that it can be connected without disturbing position of carburetor throttle valve, connect rod. Open throttle and run engine at 1000 R.P.M. Check mercury levels in gauge. If columns are not equal, readjust right hand carburetor throttle rod slightly. Close throttle and idle engine. Check mercury levels and readjust if necessary.

Ford Part No. 78-9510—Marked '94'
AA1-120-1—FORD '85', ALL PASS. & TRUCK MODELS (1938)
Ford Part No. 91A-9510-A2—Marked '94'
AA-1-120-2—FORD '85' PASS. CAR MODEL 91-A (1939)
FORD '85' & '95' COMM'L. & TRUCK MODELS (1939)
MERCURY MODEL 99-A (1939)
Ford Part No. 922A-9510-A
FORD '60' MODELS (1939)—SOME CARS (SEE NOTE)
Ford Part No. 86H-9510-A2—Marked 'LZ'
AA1-121-1—LINCOLN ZEPHYR, MODEL 86H (1938)
Ford Part No. 86H-9510-A2—Marked 'LZ'
AA-1-121-2—LINCOLN-ZEPHYR MODEL 96-H (1939)

NOTE:—Stromberg Model EE-7/8 and EE-1 used on some Ford '60' (1939) and '85' (1938) cars. See Stromberg carburetor article for data on these types.

TYPE:—Dual or double barrel, plain tube, downdraft type with throttle operated accelerating pump and vacuum controlled economizer (power jet).

Fuel System (Idling):—Fuel for idling taken from main jet well up through Idle Tube (which meters the fuel) to cross-passage in main nozzle bar where it is mixed with air admitted through Idle Air Bleed drilled passage in top of nozzle bar. Fuel mixture flows from this cross-passage down through channel to idle ports at throttle edge. For closed throttle idling, all fuel discharged through lower idle port (below throttle) and controlled by Idle Adjusting Needle. As soon as throttle is opened, additional fuel is discharged through upper idle port also. Independent idle system used for each carburetor barrel.

Driving Range—At intermediate speeds, fuel metered by metering jet at lower end of main jet well flows through cross-passage in main nozzle bar to antechamber at center where it is mixed with air admitted through air bleed opening in side of cross-channel and through Nozzle Air Bleed Plug which is screwed in top of nozzle bar. Fuel mixture is then discharged through main nozzle opening below nozzle bar into throat of venturi.

High Speed & Wide Open Throttle Operation—At high speed or whenever throttle opened sufficiently so that vacuum decreases, economizer valve spring opens economizer valve allowing additional fuel to flow directly from float bowl to main jet well (by-passes metering jet). This fuel metered by economizer restriction which is small drilled passage at well end of economizer fuel channel.

IDLE ADJUSTMENT:—Idle adjusting needle or screw for each carburetor barrel controls fuel discharge from lower idling port. Screws should be turned in for leaner mixture or out for richer mixture and should be adjusted equally. Setting should be approximately ⅞ turn open from inner seated position. Idle speed controlled by throttle lever stopscrew and should be set for 6-7 M.P.H. idling speed. See tune up data on car model page for complete adjusting directions on car.

METERING JETS:—Main metering jets are non-adjustable type located in float bowl and accessible by removing plug on side of float bowl opposite each jet. Jets should be changed only to compensate for special operating conditions such as high altitude. See Chandler-Groves Jet Specification table for standard and leaner jet data.

ECONOMIZER:—Consists of a spring-loaded, vacuum diaphragm controlled, by-pass valve assembly screwed in lower face of main body casting so that valve extends into float bowl (diaphragm assembly fits in recess in throttle valve body casting and vacuum passage in casting connects diaphragm chamber with carburetor barrel below throttle valve). Vacuum economizer set at factory to open when vacuum decreases to 8½-9" of HG. (corresponding to engine speed of 3800 R.P.M.). No adjustment provided.

ACCELERATING PUMP:—Pump cylinder and piston located in float bowl, operated by inverted 'L' shaped pump rod linked to throttle lever. Fuel is drawn into pump cylinder through inlet ball check valve at lower end when throttle is closed and is discharged through outlet check valve and pump discharge nozzle when throttle opened for acceleration (nozzle is located at upper edge of venturis and has two discharge holes so that fuel is discharged equally into each carburetor barrel). Pump piston connection to pump rod is through a driving spring on the piston stem which prevents loading up engine when throttle opened suddenly and also prolongs pump discharge (spring compressed at beginning of piston travel, expands at end of travel).

Capacity—As shown in table below in cc. per 10 strokes. Throttle lever stop-screw must be backed off to allow throttle to close completely and pump link must be connected in center hole.

Car Model	Carburetor	Pump Capacity
Ford '38	AA-1-120-1	14-18 cc.
Ford '39, Mercury	AA-1-120-2	9-13 cc.
Lincoln-Zephyr	AA-1-121-1, AA-1-121-2	14-18 cc.

Adjustment—Three holes provided in throttle lever for pump link connection. Upper hole (short radius) provides minimum stroke, lower hole (long radius) maximum stroke. Center hole is normal setting. See tune up data on car model page for recommended settings.

NOTE—Pump link locked in lower end of pump rod by spring-loaded snap lock. Pull link shaft out of pump rod to disengage lock.

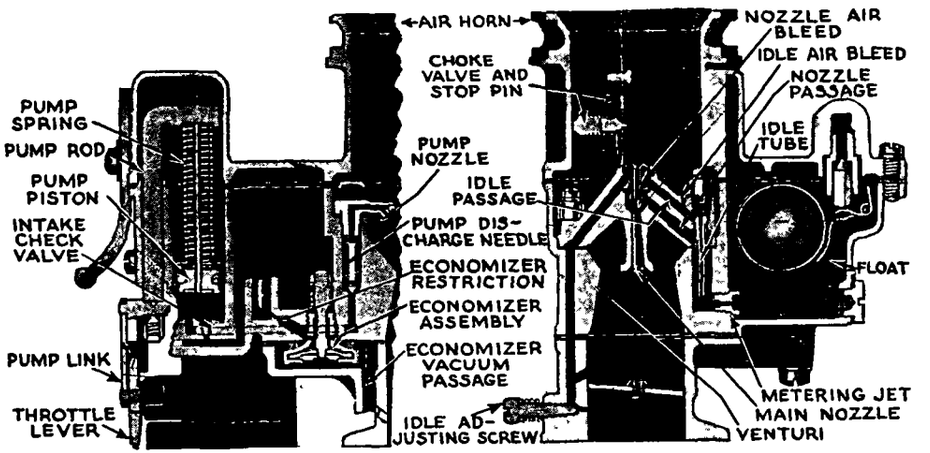
FLOAT LEVEL:—Fuel Level. Should be 21/32-23/32" (Ford '38-39, Mercury, Lincoln-Zephyr '39), 19/32-21/32" (Lincoln-Zephyr '38) below top edge of bowl with 3 lbs. pressure (engine idling). If glass tube type gauge used to check fuel level, be sure to allow for capillary attraction in tube.

Float Level. To check float level with air horn and bowl cover and float assembly removed, invert cover, measure distance from flanged face (gasket seat) on bowl cover to bottom of float (not soldered seam). Should be 1⅜-1 11/32" (Ford '38-39, Mercury, Lincoln-Zephyr '39), 1 5/16-1 9/32" (Lincoln-Zephyr '38). Correct by bending both float arms equally.

Float Needle Valve & Seat—Part No. 18R-2A. Replace as matched set.

CHOKE:—Offset type with poppet type relief valve to prevent over-choking.

THROTTLE-KICKER (STARTING):—Consists of a spring loaded lever pivoted on side of carburetor casting so as to contact cam on choke lever at upper end and throttle lever at lower end (through throttle stopscrew which is mounted on this starting lever). Lever is rotated by choke lever cam when choke valve



closed for starting and opens throttle to starting position. No adjustment required.

TROUBLE SHOOTING:—Poor Idling Performance. Make certain that entire engine tuned up, check idle setting. If idle is lean, check for air leaks at manifold, check gaskets between carburetor throttle valve body and bowl casting. Remove idle adjusting needle and Idle Tubes, blow out channels with air, clean idle tubes with air. If idle is rich, check Vacuum Economizer valve, see that valve is seating properly, and that diaphragm is not leaking. Check gasket between throttle valve body and bowl casting (vacuum chamber must be airtight).

Poor Running Performance. Check carburetor body gaskets, see that all carburetor body bolts are tight. Check metering jets for size. Blow out metering jet channel and main nozzle channels with compressed air. Check fuel level.

Poor Acceleration Performance. Check pump cylinder and channels for dirt which will prevent check-valves seating. See that piston leather is in good condition, check piston driving spring. To dismantle pump for cleaning (with air horn casting off carburetor), disconnect pump link, remove pump rod and piston assembly, inlet ball retaining spring and ball, discharge nozzle, and outlet check needle. Blow out all channels with compressed air. If pump is working properly, a fine, solid, steady stream should be discharged from each nozzle port at instant throttle is snapped open.

Poor High Speed Performance. Check engine compression, breaker contacts and gap, spark plug gaps first. Check vacuum economizer valve, remove economizer and blow out economizer channels and restrictions with compressed air. Check fuel level and float travel. Check fuel pump pressure.

Poor Economy or Gasoline Mileage. Check all parts of car which may cause this complaint (engine, valves, dragging brakes, etc.). Check fuel level and fuel pump pressure. Check metering jets for size. Manufacturer does not recommend use of leaner metering jets to secure fuel economy.

Code Mark MODEL—AOC-2

1-AA, 1-AB, 1-AC, 1-AD—PACKARD SIX, MODEL 115C (1937)

1-MA, 1-MB—PACKARD SIX, EXPORT MODELS 115C (1937)

1-BA—PACKARD SIX, MODEL 1600 (1938)—BEFORE APRIL 1, 1938

MODEL—A-2

A-2-3—PLYMOUTH, COMMERCIAL MODEL PT-50 (1937)

PLYMOUTH, STANDARD MODEL P3 (1937)—AFTER MARCH 10, 1937

Code mark identification is stamped on spacer above idle adjusting screw (AOC-2), on venturi (A-2).

NOTE:—Model AOC-2 (Packard) fitted with built-in Automatic Choke. See article on Chandler-Groves Automatic Choke in Carburetion Equipment Section for complete adjustment instructions. Both models fitted with Fast Idles.

Plymouth. Economy models fitted with Carter (B&B) Carburetors. See Carter (B&B) Carburetor article for data on these types.

PACKARD CHANGES:—On cars before Eng. No. 5735, insufficient float travel caused by float stop being too high may lower top speed or cause running out of gasoline at high speeds. To correct this complaint, file a slot ¼" wide and 3/64" deep, 3/32" from the end of the left hand float support arm as viewed from needle valve end of float assembly. Service floats designed to correct this trouble available on even-exchange basis under Part No. 16R-72A. This trouble should not be experienced on cars after Engine No. 5735.

Models marked 1AA or 1AB (On Venturi). These models can be brought up to 1-AC standards (see below for later 1-AD) by removing and discarding the Part No. 23R-19 Pump Discharge Needle valve and installing new Upper Pump Discharge Needle (23R-1), Lower Pump Discharge Needle (23R-2), and Pump Discharge Needle Spring (23R-7) in its place; and also removing and discarding the Part No. 37R-235 Pump Discharge Retainer Stud and installing the new Pump Discharge Needle Stud (37R-2). A new Pump Piston and Plunger Assembly (30R-5A) is available which replaces all of the following parts: Pump Piston (30R-172), Pump Piston Plunger (32R-158, 7R-155), Pump Piston Plunger Spring (38R-173). The new main body and plug assembly (6R-17A) as used on the later 1-AC type carburetor may be installed on 1-AA and 1-AB carburetors, if desired, providing the new type Idling Tube (14R-38-3) is installed in place of the original type (14R-38). To bring these 1-AA and 1-AB carburetors up to later 1-AD standards after all changes listed above have been made, follow same procedure as given below for modernizing 1-AC types.

Model 1-AC. To bring this type up to later 1-AD standards, remove original metering jet and install new .058" jet (22R-1). Remove and discard original air horn gasket and install new vented type gasket (8R-16). Drill a ¼" extra air vent in air horn 1 15/16" to left of center air horn attaching screw and 15/16" up from lower flange (carburetor viewed from side with throttle lever to left and automatic choke assembly to right). Remove original throttle body to float chamber gaskets and install 3 new No. 8R-15 gaskets without spacer.

Models 1-AD, 1-BA. These models identical except for float chamber vent in air horn. Air horns are interchangeable and later (1-BA) type only stocked for service.

TYPE:—Plain tube, downdraft type with throttle operated accelerating pump and vacuum controlled economizer. Float bowl is concentric, entirely surrounding carburetor body. Float consists of two curved sections on opposite side of float bowl and linked together by float lever with float needle valve midway between them.

Fuel System (Idling):—Fuel for idling taken from main antechamber above main discharge nozzle through idling tube in end of antechamber and then down through channel to idling ports opposite throttle. The idling tube meters this fuel. For closed throttle idling, fuel is discharged through the lower idle port below the throttle valve and is controlled by the idle adjusting screw. Upper idle port (above the throttle valve) serves as an air bleed. As soon as the throttle is cracked open for low speed running, additional fuel is discharged through this upper port also.

Driving Range:—At intermediate speeds, the fuel in the antechamber is discharged through the main discharge nozzle located directly below the antechamber. This fuel is metered by the main metering jet located in the antechamber fuel channel from the float bowl. Jet is accessible by removing the large plug under the float bowl. Air bleed holes are drilled in top of antechamber wall.

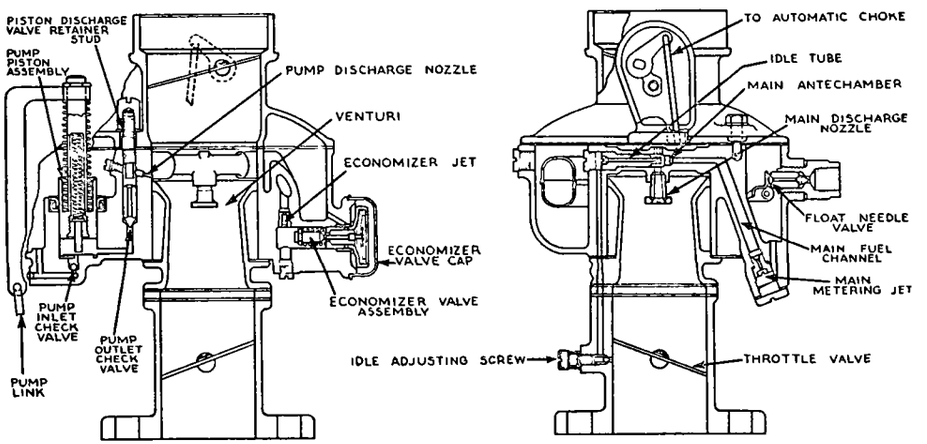
High Speed & Wide Open Throttle Operation:—When the throttle is wide open, the drop in vacuum allows the economizer valve spring to open the valve allowing additional fuel to flow into the antechamber fuel channel above the main metering jet. This fuel is metered by the economizer jet located in the vertical channel leading to the main fuel channel. Jet is accessible by taking out plug in main body casting at lower end of economizer channel.

IDLE ADJUSTMENT:—Idle adjusting screw controls fuel discharge from lower idling port. Screw should be turned in for leaner mixture and out for richer mixture. Idle speed controlled by throttle lever stopscrew. Adjustments should be made only when engine warmed up so that choke valve is wide open and fast idle inoperative. See tune up data on car model page for complete adjustment directions on car.

METERING JET:—Main metering jet is non-adjustable fixed type. Jets should be changed only to compensate for special operating conditions such as high altitudes (5% and 10% leaner metering jets are available). See Jet Specification Table below for standard jet calibrations.

ECONOMIZER:—Consists of a spring loaded, vacuum diaphragm controlled bypass valve assembly located under a small round cap on the side of the carburetor body casting. No adjustment required. Set at factory to open with 4-6" vacuum in manifold. Cover forms vacuum chamber and must be kept tight.

ACCELERATING PUMP:—Fuel is drawn into pump chamber through inlet ball check valve on the upstroke of the piston and is discharged through the outlet check valve and the pump discharge nozzle at the upper end of the venturi on the downstroke of the piston when the throttle is opened. Pump rod connection to pump piston is through a driving spring on the piston stem. This permits prompt delivery of the accelerating charge but the spring is opposed by the plunger spring within the piston stem, which is compressed when the pump plunger contacts the bottom of the pump well, so that the accelerating charge is prolonged.



Capacity—As shown in table below in cc. per 10 strokes. Throttle lever stopscrew must be backed off to allow throttle to close completely when pump capacity is being checked.

Car Model	Carburetor	Pump Capacity
Packard Six 115C	1-AA, 1-AB, 1-AC, 1-AD	9-11 cc.
Packard Six Export	1-MA, 1-MB	8-10 cc.
Packard Six 1600	1-BA	9-11 cc.
Plymouth P3, PT-50	A-2-3	11-14 cc.

Adjustment—Three holes provided in throttle lever for pump rod link connection. Center hole is normal setting. Inner hole (short radius) provides minimum stroke and outer hole (long radius) maximum pump stroke. See tune up data on car model page for recommended settings.

FLOAT LEVEL:—Fuel level in float bowl set at 17/32" below top edge (gasket seat) of bowl with gasket removed. With this setting, top of float at free end should be 5/32" below top edge of bowl with float needle valve closed. Float level can be corrected by bending float lever at needle valve slightly.

NOTE—See instructions above (Packard Changes) to correct insufficient float travel on first cars.

CHOKE:—Choke valve is offset on shaft. Model A-2 fitted with poppet-type relief valve. No relief valve used on Model AOC-2.

FAST IDLE:—Model A-2. Consists of a throttle lever stopscrew stop cam which is linked to the choke valve so that the rotation of the cam when the choke valve is closed for cold starting opens the throttle to the fast idle position. No adjustment required.

Model AOC-2. Consists of a throttle lever stopscrew stop cam mounted on the automatic choke thermostatic coil floating shaft so that the cam tends to rotate, opening the throttle to the fast idle position, when the engine is cold (throttle must be opened momentarily to permit thermostatic coil to close choke valve and rotate fast idle cam). See article on Automatic Choke in Carburetion Equipment Section.

THROTTLE VALVE SETTING:—Model AOC-2. Throttle valve should be flush with the #60 drill size idle discharge holes when completely closed and should cover one-third of the #50 drill size vacuum spark control hole.

Model A-2. Throttle valve should be flush with the #60 drill size idle discharge ports and should be .005" below the #60 vacuum spark control hole when completely closed.

TROUBLE SHOOTING:—Over-choking or Flooding. Throttle should be opened once only to place fast idle and automatic choke in operation. Repeated operation of the throttle will cause accelerating pump to flood carburetor. To correct flooded carburetor, open throttle wide (throttle lever will open choke valve halfway). If flooding continues, check choke valve and linkage for binding, check automatic choke setting and thermostatic spring coil action, check vacuum piston.

Engine continues to fast-idle when warm. See that vacuum piston is free and vacuum passage to carburetor barrel is open, check small spring on floating shaft and lever assembly which causes fast idle cam to follow as choke valve opens, check thermostatic spring coil setting, see that heat passage to thermostat is open and that correct gasket used between thermostat assembly and carburetor body. Check action of manifold heat control thermostat.

Poor Idling Performance. Take out idle discharge plug and idling tube, blow out tube and idling passages with compressed air. If idle setting is rich and cannot be cut down, check vacuum economizer valve, see that valve is seated properly, diaphragm is not leaking, and that cover is tight. Do not disassemble valve as this will destroy factory setting.

Poor Running Performance. Remove metering jet plug and metering jet, check metering jet size, blow out main metering channel and main discharge channel with compressed air. Check fuel level (see note above to correct faulty high speed performance due to insufficient float travel on first cars). Check vacuum economizer valve. Take out economizer jet plug, blow out jet and fuel channel with compressed air.

Poor Acceleration Performance. Check pump setting (see recommended settings in tune up data on car model page). Examine pump inlet ball check valve and outlet check valve, blow out pump passages with compressed air, run wire drill or wire not to exceed #70 size through pump discharge jet passage in body. Be careful not to damage pump piston seal assembly when working on pump (this must be installed at the factory or a new carburetor body installed).

CHANDLER-GROVES CARBURETOR JET SPECIFICATIONS

Car Model	Year	Carburetor Model	Venturi Assembly Size	Venturi Assembly Part No.	Main Metering Jet Size	Main Metering Jet Part No.	Main Disch. Nozzle Size	Main Disch. Nozzle Part No.	Economizer Jet Size	Economizer Jet Part No.	Idle Tube Size	Idle Tube Part No.	Pump Nozzle
FORD '85' Models	Late 1938	AA-1-120-1	15/16"	—	.050"⑤	22R-40-50	—	21R-2,6	—	—	#71	14R-1A	#70①
FORD '85' Models	1939	AA-1-120-2	15/16"	—	.050"③	22R-40-50	—	21R-34, 35	—	—	54cc.	14R-1A	#69④
LINCOLN ZEPHYR	Late 1938	AA-1-121-1	15/16"	—	.051"⑥	22R-40-51	—	21R-2,6	—	—	#71	14R-1A	#70②
LINCOLN-ZEPHYR 96H	1939	AA-1-121-1	15/16"	—	.051"⑦	22R-40-51	—	21R-34, 35	—	—	64cc.	14R-9A	#69④
MERCURY 99A	1939	AA-1-120-2	15/16"	—	.050"③	22R-40-50	—	21R-34, 35	—	—	54cc.	14R-1A	#69④
PACKARD Six 115C	1937	AOC-2-1AA	1 3/16"	45R-238	.060"	22R-40-60	.147"⑧	21R-22	.047"	24R-51	#52	14R-38	#70
PACKARD Six 115C	1937	AOC-2-1AB	1 3/16"	45R-238	.060"	22R-40-60	.147"⑧	Intgrl.	.047"	24R-51	#52	14R-38	#70
PACKARD Six 115C	1937	AOC-2-1AC	1 3/16"	45R-238	.059"	22R-40-59	.147"⑧	Intgrl.	.045"	24R-51	#52	14R-38-3	#70
PACKARD 115C Exp.	1937	AOC-2-1MA	1 5/32"	45R-277	.059"	22R-40-59	.147"⑧	21R-22	.044"	24R-51	#52	14R-38-1	#71
PACKARD 115C Exp.	1937	AOC-2-1MB	1 5/32"	45R-277	.059"	22R-40-59	.147"⑧	Intgrl.	.044"	24R-51	#52	14R-38-1	#71
PACKARD Six 115C	Late 1937	AOC-2-1AD	1 3/16"	45R-238	.058"⑨	22R-40-58	—	Intgrl.	.047"	24R-51	#52	14R-38-3	#70
PACKARD Six 1600	Early 1938	AOC-2-1BA	1 3/16"	45R-238A	.058"⑨	22R-40-58	—	Intgrl.	.047"	24R-51	#52	14R-38-3	#70
PACKARD Six 1600	1938	AOC-25-119-1, 3	1 7/32"	45R-4A	.062"⑩	22R-40-62	—	Intgrl.	—	—	—	—	#69
PACKARD Six 1600	Late 1938	AOC-25-119-4	1 7/32"	45R-4A	.062"⑩	22R-40-62	—	Intgrl.	.045"	24R-51	—	—	#69
PACKARD Six 1700	1939	AOC-25-119-4A, 5	1 7/32"	45R-4A	.061"⑪	22R-40-61	—	Intgrl.	.046"	24R-51	—	—	#69
PLYMOUTH Std. P3	1937	A-2-3	1⅛"	45R-70A	.055"⑫	22R-40-55	.147"⑧	Intgrl.	.041"	24R-5147	#52	14R-38-2	#69
PLYMOUTH Comm. PT50	1937	A-2-3	1⅛"	45R-70A	.055"⑫	22R-40-55	.147"⑧	Intgrl.	.041"	24R-5147	#52	14R-38-2	#69
PLYMOUTH P5, PT57	1938	A-25-117-1	1 5/32"	45R-3	.057"⑬	22R-40-57	.147"⑧	Intgrl.	—	—	—	—	#70

①—Part No. 21R-10A.
②—Part No. 21R-28A.
③—1 Size Lean—.048"—22R-40-48.
④—Part No. 21R-42A.
⑤—5% Lean—.048"—22R-40-48. 10% Lean—.047"—22R-40-47.
⑥—5% Lean—.049"—22R-40-49. 10% Lean—.048"—22R-40-48.
⑦—1 Size Lean—.049"—22R-40-49.
⑧—Center feed hole. Four #56 side holes also used.
⑨—5% Lean—.057"—22R-40-57. 10% Lean—.056"—22R-40-56.
⑩—5% Lean—.061"—22R-40-61. 10% Lean—.060"—22R-40-60.
⑪—5% Lean—.060"—22R-40-60. 10% Lean—.059"—22R-40-59.
⑫—5% Lean—.054"—22R-40-55. 10% Lean—.052"—22R-40-52.
⑬—5% Lean—.056"—22R-40-56. 10% Lean—.054"—22R-40-54.

Code Mark **MODEL—AOC-25**

119-1, 119-3, 119-4—PACKARD SIX, MODEL 1600 (LATE 1938) SEE NOTE.

119-4A, 119-5—PACKARD SIX, MODEL 1700 (1939)

MODEL—A-25

A-25—PLYMOUTH, STANDARD MODEL P-5, COMMERC'L MODEL PT-57 ('38)

Code mark identification is stamped on carburetor directly above idle adjusting screw (AOC-25), on venturi (A-25).

PACKARD CHANGES:—These carburetors used after approximately April 1, 1938. First type (119-1) should be brought up to later (119-3) standards as directed below to correct complaints of running out of fuel at high speed after engine has warmed up. Later type (119-4) has new design main body casting (Part No. 24R-51) and separate Economizer Jet (No. 24R-51, Size .045"). This new main body casting need not be installed on earlier 119-1 and 119-3 carburetors.

119-1 Carburetor Changes to correct Running out of Fuel at High Speed Complaints:—Remove original No. 18R-266A Float Needle & Seat Assembly and replace with new type No. 18R-5A which has a .104" orifice. Remove and discard original No. 33R-13A pump link and install new longer type No. 33R-282A link which is marked with figure '1' on face. Connect this pump link in center hole on throttle lever.

TYPE:—Plain tube, downdraft type similar in design to the 'AOC-2' carburetors used on previous Packard models except for new metering jet location and nozzle design as follows:

Metering Jet location—Jet installed in wall between float bowl and fuel channel to nozzle. Accessible by removing plug on side of float bowl (see illustration).

Nozzle Design—Vertical fuel channel (from main metering jet and economizer jet) closed by plug at upper end. Idle tube is pressed in cross-channel above nozzle (antechamber) and end of channel is closed by plug. Economizer jet is screwed in bottom of economizer recess under economizer assembly (119-4 and later types).

Accelerating Pump—New type with single driving spring (inner spring not used). Outlet check valve design is new with return vent to bowl above valve controlled by a separate ball check valve.

IDLING ADJUSTMENT:—Adjust only with engine warm so that Automatic Choke and Fast Idle inoperative (choke valve wide open, throttle stopscrew resting on lowest step of fast idle cam). Set throttle lever stopscrew for correct 5 MPH. idling speed. Turn idle adjusting screw in for leaner mixture, out for richer mixture (this screw controls fuel discharge through lower idle discharge port). Recheck idling speed adjustment. See car model tune up page for complete adjustment instructions.

METERING JET:—Main metering jet is non-adjustable type located in float bowl and accessible from outside by removing plug on side of bowl. Jets should be changed only for special operating conditions such as high altitudes (5% and 10% lean jets available). See Chandler-Groves Jet Specification Table for data.

ECONOMIZER:—Consists of a spring-loaded vacuum diaphragm controlled by-pass valve assembly located under a small round cap on the side of the carburetor casting. Set at factory to open with 4-6" (Packard), 8¼" (Plymouth) of vacuum in manifold. No adjustment provided. See that cover over vacuum unit is tight.

ACCELERATING PUMP:—Fuel is drawn into pump cylinder through inlet check valve on upstroke of piston and is discharged through outlet check valve and discharge port located in carburetor wall at top of edge of venturi on the downstroke of the piston when the throttle is opened for acceleration. Pump piston is spring loaded by spring on piston rod below pump rod connection. A return vent to the float bowl is located at the upper end of the pump discharge channel (above the outlet check valve) and is controlled by a separate ball check valve.
Capacity—As shown in table below in cc. per 10 strokes (throttle lever stopscrew must be backed off to allow throttle to close completely when pump is checked) with pump rod link connected as indicated.

Car Model	Carburetor	Pump Capacity	Pump Setting
Packard 1600	119-1, 3	9-11 cc	Outer Hole
Packard 1600	119-4	12-16 cc	Center Hole
Packard 1700	119-4A, 5	14-18 cc	Center Hole
Plymouth P5, PT57	A-25	12-15 cc	Center Hole

Adjustment—Three holes provided in throttle lever for pump rod link connection. Center hole (medium stroke) is normal connection. Outer hole (long radius —maximum stroke) provides maximum pump discharge, inner hole (short radius—minimum stroke) minimum discharge. See car model tune up page for recommended settings and seasonal changes.

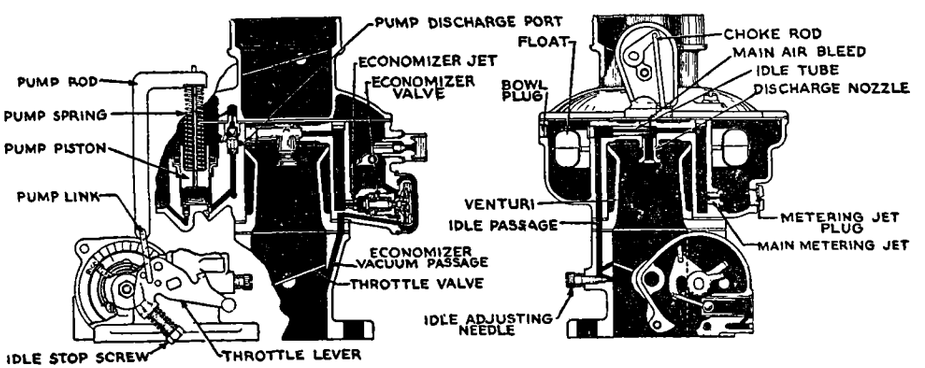
FAST IDLE:—**Packard.** Stepped fast idle cam mounted on the automatic choke lever shaft and serving as a stop for the throttle lever stopscrew. No adjustment required. See article on Chandler-Groves Automatic Choke and Fast Idle in Carburetion Equipment Section for complete servicing directions.

Plymouth. Consists of a fast idle lever linked to the choke valve lever and serving as a stop for the throttle lever stopscrew. This lever is rotated when choke valve closed for cold starting so that throttle valve is opened to fast idle position. No adjustment required.

FLOAT LEVEL:—**Fuel Level**—Should be 17/32" below top edge of float bowl (gasket seat) with engine idling and fuel pump pressure of 2 lbs.
Float Level—Tops of floats at free ends should be 3/16" below gasket surface of float bowl with float needle valve closed. Adjust by bending float arms. Make certain that both floats are uniform (bend both arms equally).

Needle Valve & Seat—No. 18R-5A (Packard—see note below for 119-1 type), No. 18R-4A (Plymouth). Furnished only in matched sets. Do not use excessive pressure when installing assembly.

Packard Note—This 18R-5A should be installed on 119-1 carburetors to replace original 18R-266A to correct complaints of running out of fuel at high speed.



CHOKE:—**Packard Models.** Chandler-Groves automatic type mounted integrally on carburetor. See article in Carburetion Equipment Section for servicing data.
Service Note—On cars with Overdrive, long side of choke valve must clear carburetor air horn by .005" with valve fully closed.

Choke Setting—Reference mark on thermostat plate should be lined up with punchmark on housing. To adjust, loosen screw and shift thermostat plate. Setting may be varied 5 graduations for better warming up performance.

CHOKE:—**Plymouth.** Offset butterfly type with poppet type relief valve to prevent over-choking. See article in Carburetion Equipment Section on Sisson Automatic choke (when used).

THROTTLE VALVE SETTING:—**Model AOC-25.** Throttle valve should be flush with the two #60 idle discharge ports when completely closed and should cover 1/3 of the #50 vacuum spark control port.

Model A-25. Throttle valve should be flush with the #60 idle discharge port and should be .005" below the #60 vacuum spark control port when fully closed.

FORD NO. 18-9510—FORD V-8, MODEL 18 (1932).

40-9510—FORD, MODEL V-8-112 (1933).

TYPE:—Expanding air valve downdraft type. Two hinged air valves or vanes located in air intake in upper body of carburetor engage a spring loaded aspirating tube so that aspirating tube is lowered as vanes open. Aspirating tube is attached to fuel metering orifice tube so that orifice is withdrawn from metering pin and fuel supply automatically increased as vanes open to admit more air. Fuel is automatically and correctly proportioned to air for all positions of throttle valve. The choke lever on the carburetor rotates the starting sleeve (conventional choke valve is not used), causing ports in the sleeve to line up with passages in the carburetor body and holding the air vanes closed (through a spring-operated lever). With carburetor fully choked the starting sleeve opens a passage in the carburetor wall terminating in a port below the edge of the throttle so that fuel is drawn from the float chamber through the pump cylinder and the hollow stem of the fuel pump and discharged through this priming port. The throttle button on the dash must be kept closed when the engine is started (kicker rod on lever connecting throttle and pump will open throttle slightly—see adjustment below). Accelerating pump and power jet are built in this 'auxiliary unit'. Metering pin adjustment and kicker rod clearance (for starting) are the only points requiring adjustment.

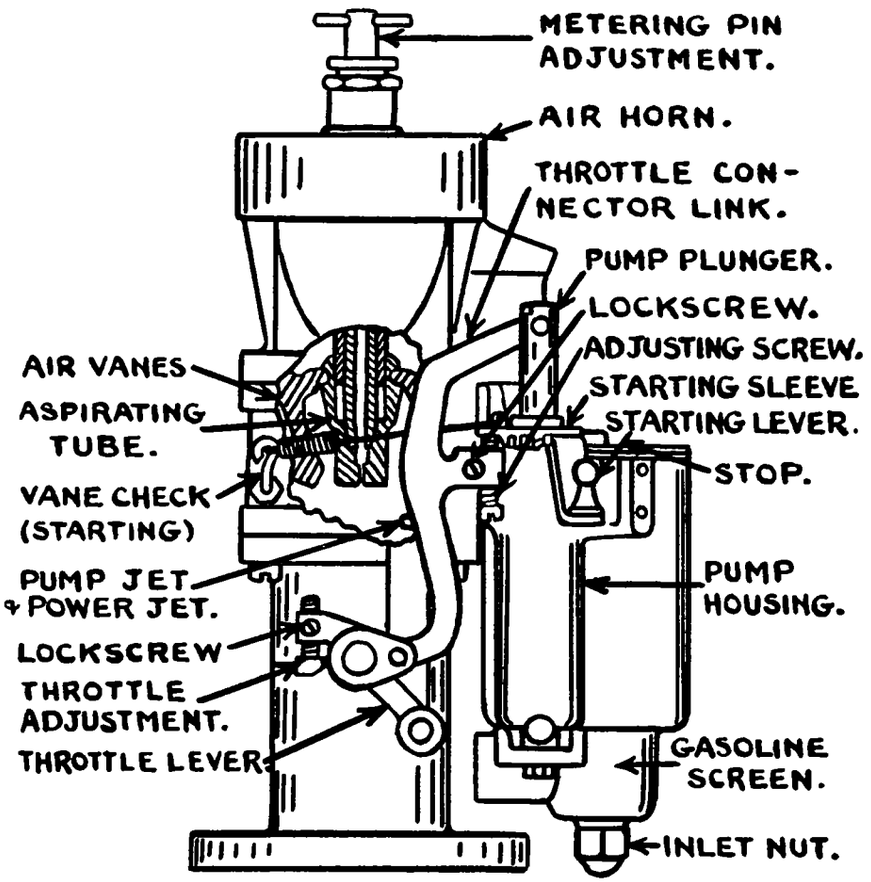
IDLE ADJUSTMENT:—If carburetor is completely out of adjustment, make a preliminary setting of metering pin by turning pin down until air vanes just begin to open and then back off exactly 5 (Model 18) or 3½ (V-8-112) full turns. Metering pin is at top of carburetor under air cleaner and air cleaner must be removed in order to make adjustments. Warm up engine thoroughly, see that all manifold connections are tight and that there are no air leaks. Adjust idle throttle plate adjusting screw until engine runs at approximately 5 M.P.H. with throttle button closed (loosen lock screw before turning adjusting screw). Then turn down metering pin (to right or clockwise) until engine speed decreases or engine begins to miss, indicating that mixture is too lean, then back off metering pin (turn to left or counter-clockwise) until engine fires smoothly. This adjustment should be made slowly allowing at least 30 seconds at each setting to note engine performance. Metering pin operates on fuel mixture and should be turned in for leaner mixture and out for richer mixture.

THROTTLE PLATE STARTING POSITION (KICKER ROD ADJUSTMENT:—This setting does not change in service and should not require adjustment unless carburetor has been tampered with. To check adjustment with carburetor off the engine, insert .020" feeler between throttle valve and carburetor wall on side opposite priming port, loosen lock screw and adjust choke cam adjusting screw so that throttle plate is in correct position to secure this .020" throttle opening with choke lever all the way to the rear and starting sleeve lug against the stop on the float bowl cover.

ACCELERATING PUMP:—When the throttle is opened quickly the down stroke of the accelerating pump plunger and piston forces gasoline from the chamber below the piston up through the hollow stem of the pump plunger and out through the discharge nozzle into the carburetor barrel directly below the lower end of the aspirating tube. This provides the extra fuel needed for quick acceleration. Accelerating pump is not adjustable and does not require attention.

POWER JET:—At speeds above 65 M.P.H. or when the throttle is held open, additional fuel is drawn up through the hollow stem of the accelerating pump plunger and discharged through the power jet. Power jet is controlled by the position of the accelerating pump plunger and is air vented through the upper holes in the plunger at partial throttle so that no fuel is drawn through the jet.

FLOAT LEVEL:—Fuel level in float bowl should be 1 3/16" (plus or minus 1/16") below the top edge of the float bowl. Float level should not require adjustment and if fuel level indicates that float assembly has been tampered with this should be corrected by installing new parts rather than changing settings.



HIGH COMPRESSION ENGINES:—Metering pin specifications have been changed to improve high speed performance on the new Model V-8-112 with higher compression aluminum head. The size of the accelerating pump has also been increased from ⅝ to 11/16" diameter of pump piston. When high compression aluminum heads are installed on the previous Model 18 the accelerating pump need not be changed unless this improved acceleration performance is desired but the metering pin must be changed to the new type, Part No. 18-9525-AR.

Metering Pin Specifications

Carburetor	Standard Metering Pin	High Altitude Metering Pin
18-9510	18-9525-AR	18-9525-BR
40-9510	40-9525	18-9525-AR

GRAHAM SIX, MODEL 58 (1932).
GRAHAM BLUE STREAK EIGHT, MODEL 57 (1932).
GRAHAM SIX, MODEL 65 (1933).
GRAHAM EIGHT, MODELS 64, 57-A (1933).
PACKARD, MODELS 8-26, 33, 40, 45 (1931).
PACKARD LIGHT EIGHT, MODEL 900 (1932).
PACKARD STANDARD EIGHT, MODELS 901, 902 (1932).
PACKARD DE LUXE EIGHT, MODELS 903, 904 (1932).

TYPE:—Expanding air valve updraft type with auxiliary unit consisting of starting device or priming jet, accelerating pump, and power jet. Main metering unit consists of two hinged air valves or vanes which engage an aspirating tube so that aspirating tube is raised as vanes open. Aspirating tube is attached to a spring loaded metering orifice tube so that orifice is withdrawn from metering pin and fuel supply automatically increased as vanes open to admit more air. Fuel is automatically and correctly proportioned to air for all positions of the throttle valve.

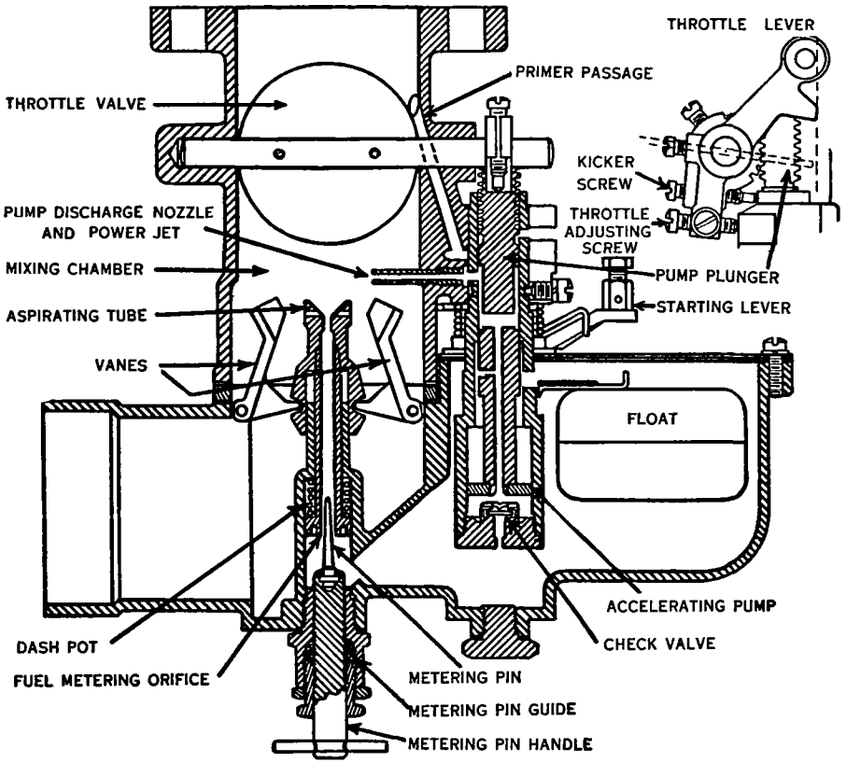
When carburetor is choked for starting, choke lever on carburetor rotates starting sleeve (pump housing) holding the main air vanes closed through a spring operated lever and lining up passages in the upper end of the pump housing and carburetor body so that fuel is drawn up through the hollow stem of the accelerating pump and discharged through a priming port above the throttle valve directly into the mixing chamber. Throttle valve must be kept closed when engine is started (kicker-rod on throttle lever will open throttle correct amount for starting—see adjustment below). Metering pin adjustment and kicker-rod clearance (for starting) are the only points requiring attention.

METERING PIN ADJUSTMENT:—Metering pin should not be adjusted until engine has been thoroughly warmed up. With engine warm and running, close throttle and adjust throttle lever stop screw until engine idles at approximately 5-6 M.P.H. Turn metering pin under carburetor up or clockwise until engine speed decreases and engine begins to miss, then turn metering pin down or counter-clockwise until engine fires smoothly. This adjustment should be made slowly so that metering pin will not be turned beyond the point where smooth running is secured. Metering pin operates on fuel mixture and should be turned in to secure leaner mixture and out for richer mixture. This is the only mixture adjustment on the carburetor.

KICKER ROD (STARTING) ADJUSTMENT:—This setting does not change in service and should not require adjustment unless carburetor has been tampered with. Clearance between kicker rod screw (directly above throttle stop screw) and milled flat on pump housing should be .020-.025" with throttle closed and choke in running position (choke control button pushed in). The kicker rod screw opens the throttle slightly when carburetor is choked for starting.

ACCELERATING PUMP:—Accelerating pump piston is operated by the throttle valve through a gear-and-rack engagement or directly by a lever on the throttle shaft. When the throttle is opened the downstroke of the accelerating pump plunger and piston forces fuel from the well below the piston up through the hollow stem of the plunger and through the discharge nozzle or power jet into the carburetor mixing chamber. This provides the extra fuel required for acceleration. Accelerating pump is not adjustable. If acceleration performance is not satisfactory or if 'flat' spots are experienced, check valve assembly at lower end of accelerating pump should be removed and cleaned.

POWER JET:—Power jet is controlled by position of accelerating pump plunger. With throttle less than one-half open, power jet is air vented through holes in the pump housing and carburetor body so that no fuel is discharged through the jet. From half open position up to wide open throttle this upper air vent is closed by the pump plunger and fuel is drawn up from the accelerating well and discharged through the power jet. Fuel flow is controlled by a lower air bleed hole in the pump plunger. All fuel for accelerating pump and power jet is metered by the jet in the check valve assembly. Power jet is not adjustable.



FLOAT LEVEL:—Fuel level in float chamber is 13/16-15/16" below the top of the float chamber. Carburetor is not sensitive to fuel level and should not require adjustment. If fuel level indicates that float level has been tampered with, this should be corrected by replacing such parts as are necessary to secure correct fuel level.

CHOKE CONTROL:—Adjust choke linkage so that starting sleeve is rotated until choke lever on carburetor is against stop screw on float chamber cover when choke control button on instrument panel is pulled all the way out. This is very important in order to line up priming port passages properly for starting. The conventional choke valve is not used.

X-8244—CADILLAC V8, MODEL 355-D, SERIES 10, 20, 30 (1934-35).
MOD. 51—CADILLAC V12, MODEL 370-B ('32), 370-C ('33), 370-D ('34-35).
CADILLAC V12, SERIES 80, 85 (1936). SERIES 37-85 (1937).—
CADILLAC V16, MODEL 452-B ('32), 452-C ('33), 452-D ('34-35).
CADILLAC V16, SERIES 90 (1936). SERIES 37-90 (1937).

NOTE:—The V-12 and V-16 cars are equipped with two carburetors each. One carburetor is used for each cylinder bank. Carburetors must be equalized as well as adjusted in order to assure smooth running. Complete adjustment procedure given below should be followed closely. One carburetor only used on V8 model and equalizing instructions not necessary for this model.

TYPE:—Expanding air valve updraft type with auxiliary unit consisting of starting device or priming jet, accelerating pump and power jet. Main metering unit consists of two hinged air valves or vanes which engage an aspirating tube so that aspirating tube is raised as vanes open. Aspirating tube is attached to a spring-loaded metering orifice tube so that orifice is withdrawn from metering pin and fuel supply automatically increased as vanes open to admit more air. Fuel is automatically and correctly proportioned to air for all positions of the throttle valve.

When carburetor is choked for starting, choke lever on carburetor rotates starting sleeve (pump housing) holding the main air vanes closed through a spring-operated lever and lining up passages in the upper end of the pump housing and carburetor body so that fuel is drawn up through the hollow stem of the accelerating pump and discharges through a priming port above the throttle valve directly into the mixing chamber. Throttle valve must be kept closed when engine is started (kicker rod on throttle lever will open throttle correct amount for starting—see adjustment below). Metering pin adjustment and kicker rod clearance (for starting) are the only points requiring attention.

NOTE—Automatic choke must be made inoperative by blocking choke arm in 'off' or down position while making adjustments as lifting the hood may lower temperature sufficiently to cause slight choke action and prevent correct setting being secured.

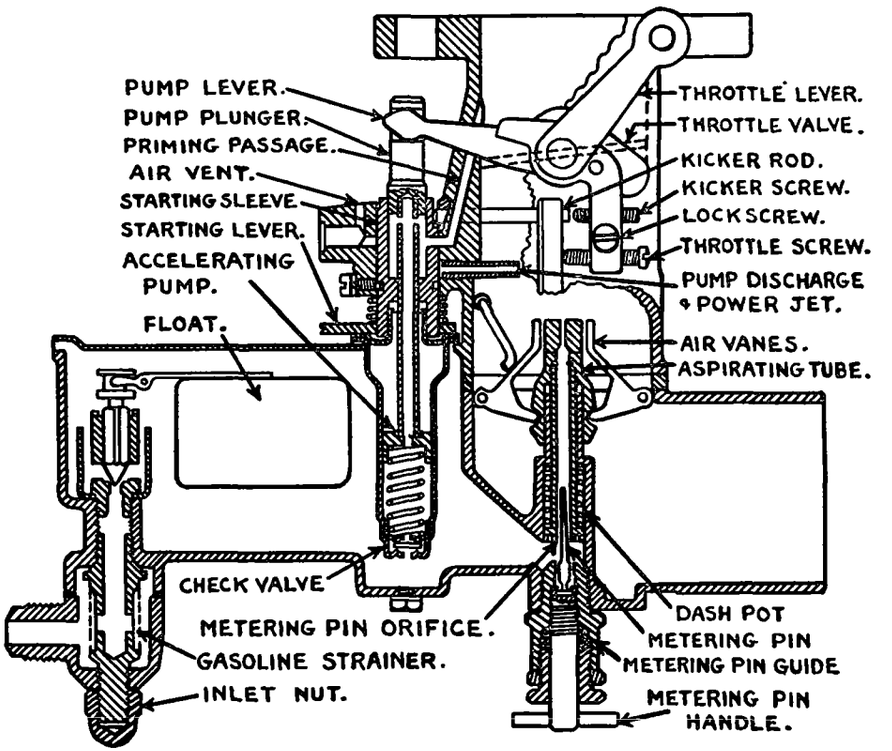
PRELIMINARY ADJUSTMENT:—See that starting sleeve on carburetor is rotated so that choke lever is against stop on float chamber cover when choke control button on instrument panel is pulled out. This is important in order to line up priming port passages in pump housing and carburetor body for starting. If carburetors are completely out of adjustment, turn metering pin up until it just seats in aspirating tube orifice and then back metering pin off exactly 2¾ turns (V8), 3½ turns (V12, V16 '32-33 models), 4 turns (V12, V16 '34-37 models). Run engine until thoroughly warmed up close throttle, check idling speed. If speed not 320 R.P.M., adjust as follows:

IDLING ADJUSTMENT:—Idling speed is controlled by throttle lever stop screw. With carburetor off the engine, adjustment can be checked by using a feeler gauge to check distance between edge of throttle valve and carburetor wall. Turn stopscrew until this clearance is .004" (feeler not more than ⅛" wide). with throttle closed. To adjust on the engine, turn stop screw until engine speed is 320 R.P.M. This can be checked on the V-12 and V-16 models by removing oil filler cap on valve cover on one cylinder bank and noting rocker arm movement. Rocker arm should move 40 times in 15 seconds with engine running at 320 R.P.M.

METERING PIN (IDLING) ADJUSTMENT:—Metering pin of each carburetor should be adjusted by turning pin up or clockwise until engine begins to miss or speed decreases and then turning pin down or counter-clockwise until engine fires smoothly. This adjustment should be made slowly so that point of smoothest running is accurately determined. Final setting should be not more than ¼ turn past this point (slightly rich setting which will avoid any possibility of 'popping' back). Release automatic choke arm. Standard metering pins are listed in table below (optional metering pins not supplied).

Car Model	Metering Pin Size
V8 (all models)	#14
V12 (all models)	#12
V16 (all models)	#14

EQUALIZING CARBURETORS:—Using Gauge—Use equalizing gauge consisting of a 'U' tube partly filled with mercury which should be hung vertically on one of the radiator brace rods and connected to each intake manifold. A piece of rubber tubing is connected to each leg of the 'U' tube and special fittings can be secured so that the other end of the tubing can be connected to the vacuum fittings on the manifold after the brake booster and windshield wiper lines have been disconnected. Disconnect right hand carburetor throttle rod. With equalizing gauge in place, idle engine and note mercury level in tube. If mercury level is at same height in both legs of the tube, and engine idles at 320 R.P.M. (check rocker arm to see that it operates 40 times in 15 seconds), carburetors are correctly equalized. If mercury level is even and engine idles too fast, back off throttle stop screw in each carburetor an equal amount until correct speed is secured. If mercury levels are not equal and engine idles too fast, back off the throttle stop screw on the carburetor feeding the bank on which the mercury level is lower. If mercury levels are not equal and engine speed is too slow, turn up the throttle stop screw on the carburetor feeding the bank on which the mercury level is higher. With correct adjustment engine should idle at exactly 320 R.P.M. and mercury level should be equal in both tubes. Adjust right hand carburetor throttle rod so that it can be connected without disturbing position of throttle valve, connect rod, open throttle so that engine speed is 1000 R.P.M., check mercury levels, adjust by changing right hand carburetor throttle rod slightly. Recheck mercury level at idling speed.



Equalizing—Without Gauge:—If gauge not available, disconnect coil wire for right hand block, idle engine on left hand block cylinders, adjust metering pin for left hand carburetor (see above), set throttle stopscrew so that engine just turns over without stalling. Connect coil wire, disconnect wire for left hand block, repeat adjustment for right hand carburetor. Idle engine on all cylinders, check idling speed.

KICKER ROD (STARTING) ADJUSTMENT:—With carburetor off engine and choke in open position, check clearance between edge of throttle valve and carburetor wall (throttle must be closed). Adjust by turning kicker screw in in or out until clearance (measured by feeler gauge) is .017" (V8), .005-.010" (V12, V16 '32-33 models), .013" (V12, V16 '34-37 models).

FLOAT LEVEL:—Fuel level in float chamber should be 13/16-15/16" below top edge of float chamber. Carburetor is not sensitive to fuel level and should not require adjustment. Replace parts to correct float level.

AUTOMATIC CHOKE:—All models are fitted with a semi-automatic choke which is designed to control choke during the warming up period. Manual choke control should be used in the usual manner to start a cold engine but should be pushed in immediately when the engine starts. See complete article on operation and checking of Automatic Choke.

NOTE:—On all carburetors built after April 1936, a new type Main Nozzle, Float Needle Valve, Float Bowl Vent, and Accelerating Pump Lever mechanism has been used as follows:

Main Nozzle. New nozzle is capped over at outlet end and has three discharge holes which should point downward when nozzle is in place. This nozzle opens into a straight tube instead of an auxiliary venturi. Float level must be 5/8" for this new nozzle. Old and new type nozzles are not interchangeable and must be used in carburetors designed for them.

Float Needle Valve. New type needle valve is 1/8" longer and seat is deeper than old type. Interchangeable as an assembly with old type float valve and seat. Be sure that float level set at 9/16" for old type nozzle or 5/8" for new type nozzle.

Float Bowl Vent. Pitot tube type opening into air horn at upper end and open to atmosphere at lower end beside float bowl. For extremely dusty operating conditions, lower end of tube may be closed off by using plug not to exceed 1/4" in length unless engine runs lean with plug in place. Plug length must not exceed 1/4" or vent to bowl will be cut off.

Accelerating Pump. New piston and stem assembly Part No. 42-21602. Has spring assembled above piston. Interchangeable with old assembly. When installing new type pump, piston must be held up in pump cylinder against piston spring pressure while upper body is being assembled on float body to prevent spring forcing piston out of cylinder and damaging piston leathers (always use loading tool when installing piston to avoid damage to leathers).

Accelerating Pump Lever Assembly. Part No. 173-22272. Provides a heavy initial pump discharge which tapers off toward close. May be used to replace old assembly with either old or new type pump piston assembly. Use new pump link. See accelerating pump adjustment below for adjustment instructions.

TYPE:—Plain tube, downdraft type with throttle operated accelerating pump and vacuum controlled economizer (metering pin and jet). Venturi system is four-driving-range type consisting of main venturi in carburetor body and triple auxiliary venturi assembly extending upward from main venturi throat. Main nozzle discharges into throat of smallest venturi. Float bowl is circular and entirely surrounds carburetor body with circular float hinged at point directly below float needle valve seat.

Fuel System (First Type Idling System):—Fuel taken from main nozzle well through coil-spring type filter 'SS' and idle feed plug (metering jet) 'L1' into chamber surrounding idle tube 'G1.' From this chamber the fuel is drawn upward and enters the tube through the small hole at the upper end where it is mixed with air admitted through idle air bleed plug 'F1.' From this point the fuel mixture flows down through the idle tube to the discharge ports at the throttle edge. For closed throttle idling, fuel mixture is discharged through lower port and is controlled by idle adjusting screw 'N.' Upper idle ports above throttle serve as additional air bleeds. When the throttle is opened for low speed running, additional fuel is discharged through these ports also.

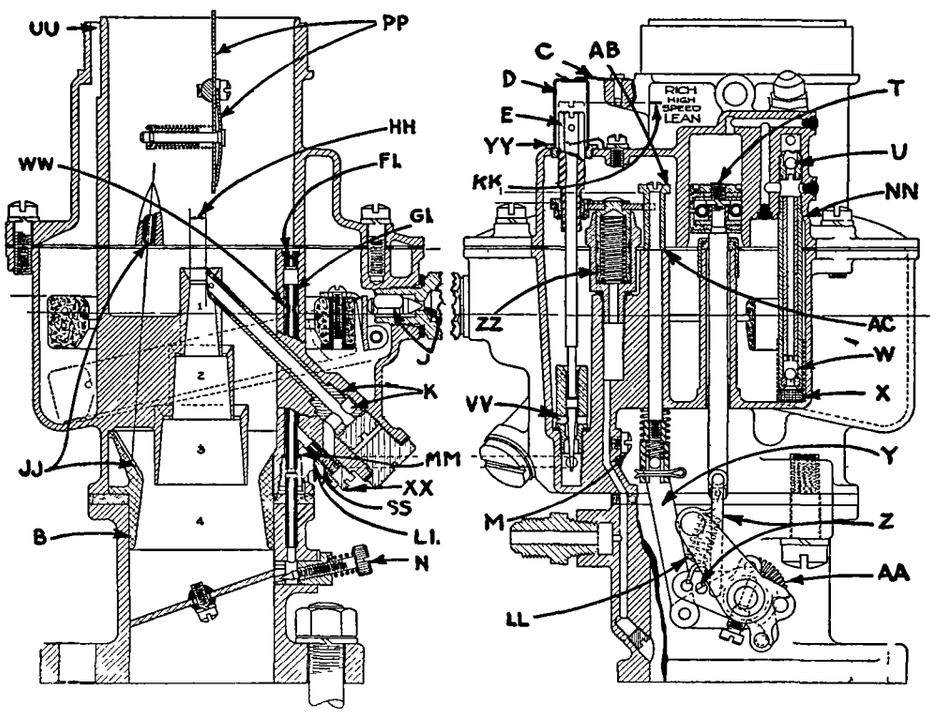
(New Type Idling System):—New type idling tube is open at upper end and feed hole has been discontinued (first type tube was tight ft in body at top and bottom and feed hole served as auxiliary metering device; when new type tube used all metering is done by idle feed plug). Idle tube now has restriction 'WW' at upper end. New type idle air bleed plug which is screwed in vertical hole in body also used (first type tipped toward barrel). Old type idle tubes should be replaced by new type and idle feed plug changed at the same time (furnished as a unit).

Driving Range:—Fuel for main nozzle 'K' flows through metering orifice 'VV' and is metered by metering pin 'E.' Metering pin is controlled by vacuum piston 'ZZ' and will be held down in the orifice, providing maximum economy, at speeds below 60 M.P.H. except when throttle is opened for acceleration. Whenever the throttle is opened suddenly, the drop in vacuum allows the spring to force the vacuum piston upward, lifting the metering pin, and allowing a greater fuel flow to the nozzle.

Power Range:—At speeds above approximately 60 M.P.H. or whenever the manifold vacuum drops to 5" or less, the spring within the vacuum piston forces the piston up to the limit of its stroke (shown as 'RR') until the metering pin arm strikes the power plunger stop 'AB.' This raises the metering pin in the orifice and permits maximum fuel flow to the nozzle. On some models the power plunger is connected to the throttle lever by the link 'Y' so that the plunger is raised to increase the vacuum piston stroke when the throttle is opened wide for maximum power. See Power Setting section below for vacuum piston stroke adjustment.

IDLING ADJUSTMENT:—Warm up engine before making adjustments. With engine hot and idling with throttle closed and manual spark control retarded, adjust throttle stopscrew so that idling speed is not less than 5-6 M.P.H. Turn idle adjusting screw 'N' out until engine begins to roll (too rich), then turn screw in until engine begins to miss or die (too lean), finally turn screw out approximately 1/4 turn so that engine fires smoothly. Readjust throttle stopscrew for correct idling speed.
NOTE—Final setting of idle adjusting screw should be 1/2 - 1 1/2 turns open from the inner seated position.

HIGH SPEED ADJUSTMENT:—All models fitted with high speed (metering pin) adjustment and factory setting should be followed. To check setting (engine must not be running), slide spring 'C' to one side and remove dust cap 'D.' Top of metering pin should be even with line 'KK' on air horn and metering pin slot should be in line with punch marks on float bowl cover (not shown).



Metering pin setting can be varied slightly to improve car performance but must not be turned as much as one turn from factory setting. Turn metering pin in (clockwise) for leaner mixture or out (counter-clockwise) for richer mixture. Metering pin is kept from turning in service by spring tension on guide washer 'YY.'

VACUUM ECONOMIZER:—No adjustment required. To check vacuum economizer action with engine idling and dust cap 'D' removed, snap throttle open approximately one-fourth. Metering pin 'E' will immediately rise to top of travel. Action should be fast and metering pin should not stick. Replace dust cap. See Power Setting Adjustment below.

POWER SETTING ADJUSTMENT:—Full power mixture determined by height of power plunger sleeve below stop 'AB' which controls vacuum piston stroke 'RR.' To change factory setting (shown in table below), add shims at lower end of plunger sleeve (point 'AC') for longer piston travel and richer power mixture, or reduce length of sleeve at this same point for shorter travel and leaner power mixture. On standard 1 1/4" and 1 1/2" carburetors with 1 9/32" venturi and #6 metering pin (marked by six rings on rod), minimum metering pin travel should be .050" (#55 drill approximately) and maximum travel must never exceed .106" (#36 drill). Minimum travel provides power mixture slightly richer than range mixture (power mixture must never be leaner than range mixture). Maximum travel provides standard full power mixture.

Throttle Control type. When throttle control of the power plunger is used, metering pin travel 'RR' is relatively short and additional travel is provided near the wide open throttle position by the lifting of the plunger. With this type control, power mixture setting is changed in same manner as directed above and same limit applies to maximum travel (.106").

ACCELERATING PUMP:—Pump piston 'T' is inverted and linked to throttle lever by link 'Z.' Fuel is drawn through screen 'X,' inlet ball check valve 'W' and tube 'NN' into pump chamber on the downstroke of the piston and is discharged through outlet ball check valve 'U' and pump discharge jet 'CC' into groove 'JJ' in main venturi on the upstroke of the piston when the throttle is opened for acceleration. Accelerating charge is determined by pump link setting, and rate of delivery controlled by pump discharge jet.

Adjustment (First Type). Connect pump link 'Z' in inner hole of throttle lever (as shown) for minimum charge, or in center hole for greater charge. Wear take-up spring 'LL' must always be connected in outer hole. Check spring action to see that last ⅛" of pump lever travel before throttle closes, opens spring coils. If spring tension is greater (coil open sooner), carburetor will not return to idle uniformly or excessive accelerator pedal spring tension will be required. If spring has less tension, play in linkage will not be taken up and pump action will be sluggish.

Adjustment (Later Type). See that entire pump mechanism operates freely without sticking and that pump piston spring returns piston to lower end of stroke so that pump link moves outward away from throttle shaft until it is stopped by the stopscrew in the lever when the throttle is closed. This stopscrew is normally assembled in the middle hole providing medium initial pump discharge. Move stopscrew to inner hole (nearer throttle shaft) for less pump discharge or to outer hole for greater pump discharge.

Discharge Jet Setting—Pump discharge jet stream must strike groove 'JJ' in main venturi 'B.' Check by sighting down barrel with air cleaner removed while operating pump. To correct stream aim, remove cap at upper end of jet, mark top of jet on side toward which tip must be bent to correct stream, remove jet, bend slightly at point about ¼" above tip being careful not to deform tip, replace jet and check action. See that gasket is in place under cap and that cap is tightened securely to prevent leaking at this point.

NOTE—Special loading tool must be used to install pump piston in cylinder and pump should not be dismantled except when necessary. When carburetor is being dismantled, disconnect pump link and spring so that pump piston and stem can be lifted off with the top assembly. See instructions in servicing section for pump piston installation.

FLOAT LEVEL:—Top of float at free end 'A' should be 9/16" (all carburetors with old type Nozzle), ⅝" (carburetors with new Nozzle—see note above) below top edge or gasket seat of bowl with float needle valve seated. To check float level, see that valve seat is tight in body (hold with wrench while tightening), and press lever against valve stem. To correct float height, bend float lever. Do not press or pull up on float as this will break float lever joint.

CHOKE:—Offset type fitted with poppet type relief valve. Throttle lever stopscrew stop lever linked to choke valve so that lever is tilted and opens throttle slightly when choke valve closed for cold starting. No adjustment required.

VACUUM SPARK CONTROL & GOVERNOR:—Connections provided on some models for vacuum spark control line connection. See table below for size of vacuum control hole in carburetor wall 'AD' and portion of hole not covered by throttle valve when in closed position 'AE.'

Connection for vacuum line around governor (necessary for vacuum economizer operation when governor installed) provided on all models. When governor installed, vacuum line should be connected between manifold and connector 'P' on carburetor, blank plug at 'P' should be removed, and plug installed at 'S' (as shown) to block off passage below throttle.

SERVICING:—Use special screwdrivers ground to fit the idle feed plug, idle tube, idle air bleed plug, main nozzle plug, accelerating pump outlet check valve, and metering pin orifice when removing and replacing these parts to avoid damage or burrs which will restrict fuel flow or metering pin travel.

Idle Feed Plug Spring. Spring compression with plug tight is designed to form fuel passage between coils small enough to trap all dirt. Plug 'XX' below the spring should extend 1/32" out from body casting when in tight for correct spring compression. Shellac should be used on plug threads but not on the inner end of the plug.

Idle Tube. First type idle tube crimped at upper end so that tight connection made in casting at upper and lower end when tube pulled up tight against gasket 'MM.' Check these joints when assembling this type tube. Leaks will cause rich idle mixture.

Main Nozzle. To remove nozzle after taking out nozzle plug, drive tapered punch or drift into lower end of nozzle lightly, pull nozzle out. When installing nozzle see that longer point is upward and that correct gasket is installed in body so that nozzle clearance 'HH' in venturi is correct (first type only).

Vacuum Economizer. Fiber gasket in suction cylinder below piston acts as stop for piston travel. This gasket must be in place when piston is installed.

Accelerating Pump. Piston assembly consists of two leathers (cupped in opposite directions), expanding spring and spacing washers. To dismantle assembly, insert ⅛" rod or drill in link hole to hold stem, use Model R metering pin wrench to unscrew top washer. Replace parts in same order (see illustration). If new leathers used, install extra spacing washer under lockwasher. Clearance between pump leathers when compressed to cylinder diameter must be 1/64 - 3/64". Check by installing one pump loading tool on each leather, cupping leathers toward each other. This loading tool, Part 112-11752, must be used to install pump piston in cylinder to avoid incorrect positioning of the leathers which will interfere with pump action.

Pump Check Valves. Inlet check valve assembly is screwed into upper carburetor casting and must be tight. Use shellac sparingly on last few threads only. Outlet check valve must be screwed tightly in casting. Use extreme care to keep all dirt out of pump chamber and check valve assembly.

TROUBLE SHOOTING:—Idle Lean. Idle feed plug too small, idle air bleed plug too large, idle tube hole (first type) too small, idle feed plug spring compression too great, idle passages clogged, or air leak at joint between body castings. To clean passages, take out idle adjusting screw 'N' and blow out channel with compressed air, or disassemble carburetor and blow out all passages and jets. See that two special 1/16" gaskets used between throttle barrel casting and bowl casting and that this joint tight to prevent air leaks.

NOTE—If idle adjusting screw must be set leaner than standard for satisfactory idle and mixture is too lean at the 'Off-idle' point (just before main nozzle comes in), do not correct this condition by a richer metering pin (high speed) adjustment but change the idle air bleed plug to a smaller (#54 or 55 drill) size.

Idle Rich. Idle feed plug too large, idle air bleed plug too small, idle tube (first type) hole too large or tube loose in casting at upper end.

Range and Power Performance Lean. Incorrect metering pin setting, spacer gasket left out of vacuum piston cylinder or vacuum piston stroke too short, metering pin orifice burred or clogged, main nozzle fuel channels clogged. Blow out all fuel channels and examine air cleaner to see that dirt or charred felt has not dropped into float bowl through vent (bowl is vented into air cleaner around air horn).

Range and Power Performance Rich. Metering pin setting incorrect, vacuum piston stroke too great, metering pin orifice lose in casting, float level incorrect.

Model Number	Venturi	Metering Pin Number First	Metering Pin Number Later	Power Plunger Assembly	Idle Air Bleed Plug Old Style Size	Idle Air Bleed Plug Old Style No.	Idle Air Bleed Plug New Style Size	Idle Air Bleed Plug New Style No.	Metering Pin 'RR' Spacing (Drill Size)
DD-1	1 9/32"	4	9	3	#54	1	#53	5	#42
DD-2	1 9/32"	4	9	4	#54	1	#53	5	#47
DD-4	1 9/32"	4	9	4	#54	1	#53	5	#47
DD-5	1 9/32"	4	9	3	#53	3	#52	6	#42
DD-6	1 3/8"	6	12	4	#53	3	#52	6	#45
DD-7	1 9/32"	4	9	3	#54	1	#53	5	#42
DD-8	1 9/32"	4	9	4	#54	1	#53	5	#47
DD-9	1 9/32"	4	9	3	#53	3	#53	5	#42
DD-10	1 9/32"	4	9	3	#53	3	#52	6	#42
DD-14	1 9/32"	4	9	3	#53	3	#53	5	#42
DD-15U	1 9/32"	4	9	4	#53	3	#52	6	#47
DD-16U	1 9/32"	4	4	6	#53	3	#52	6	#60†
DD-17U	1 9/32"	4	4	6	#53	3	#52	6	#60†
DD-18U	1 9/32"	4	9	3	#53	3	#52	6	#42
DD-19U	1 3/8"	6	12	4	#53	3	#52	6	#45
DD-20U	1 3/8"	6	12	4	#53	3	#52	6	#45
DD-21U	1 7/16"	6	6	2	#53	3	#52	6	#36
DD-22U	1 7/16"	6	6	2	#53	3	#52	6	#36
DD-23U	1 7/16"	6	6	2			#52	6	#36
DD-24U	1 9/32"	4	9	3			#52	6	#42
DD-26U	1 9/32"	4	4	6			#52	6	#60†
DD-28	1 3/8"	12	12	3			#52	6	#42
DD-29	1 3/8"	12	12	3			#52	6	#42

NOTE—Metering pin numbers were changed on July 25, 1936. Numbers given above as 'First' type apply prior to this date, and 'Later' type subsequently.

(†) These models fitted with throttle operated power plunger (Link 'Y') which provides .078" (#47 drill) additional travel.

Model	Flange Size	For Use On:
F Standard	1¼"	Chevrolet 1932-39, Plymouth 1933-38 etc.
F Oversize	1¼"	Dodge, Pontiac, Oldsmobile etc.
G	1½"	Dodge, Plymouth 1939, DeSoto, etc.

TYPE:—Mechanical air valve, single barrel, downdraft type. Air valve (above venturi, similar to choke valve in conventional plain tube carburetor—see illustration) is linked to throttle valve by spring-loaded connector so that both valves open and close together. This action results in a higher suction in the mixing chamber at all speeds and throttle openings so that satisfactory atomization of the fuel is secured with a single jet or main nozzle (separate idling system, power jets, etc. not used). Spring-loaded feature of air valve connector link provides slight richening action (drop in vacuum will allow spring to close air valve slightly) for warming up and part throttle acceleration. With warm engine and constant throttle opening, spring is collapsed so that air valve and throttle valve operate together mechanically.

Fuel System:—All fuel for main nozzle is metered by a variable-slot type metering pin operated mechanically by the throttle valve (pin linked to throttle valve and lifted in well as throttle is opened so that deeper section of slot permits greater fuel flow through channel to nozzle). Nozzle bar (controlled by 'Altitude Adjustment' screw) has two discharge openings and is normally set for richest or maximum discharge with openings horizontal in venturi. Turning the nozzle bar tends to lessen flow from one of the openings and leans the mixture (see Altitude Adjustment below). All fuel is discharged through these main nozzle bar openings.

IDLING ADJUSTMENT:—Idle speed controlled by throttle lever stopscrew. Adjust by turning screw in (clockwise) for faster idling speed, out for slower idling speed. If carburetor being installed, or if performance unsatisfactory, check Air Valve Adjustment and adjust metering pin as follows:

METERING PIN ADJUSTMENT:—Remove spring type metal plug on top of air horn above metering pin, operate engine at idling speed, insert screwdriver through metering pin plug hole, turn metering pin adjusting screw clockwise to richen mixture until engine begins to roll or is rough, then turn screw counter-clockwise slowly to lean mixture until engine fires smoothly. Recheck idling speed after completing this adjustment. Warm up engine and check air valve adjustment as directed below.

AIR VALVE ADJUSTMENT:—To Check Setting—With engine warm, open throttle so that speed is equivalent to 30 MPH. and note performance. If engine misses and does not run smoothly, air valve setting is too lean and should be adjusted as follows: Loosen locknut, turn knurled adjusting sleeve on air valve connector link counter-clockwise about ¼ turn, recheck performance. This adjustment will lean mixture at idling speed and metering pin adjusting screw should be turned clockwise slightly to compensate for this change. CAUTION—If air valve set too tight, mixture will be too lean for good performance; if air valve set too loose, mixture will be too rich for good economy or gasoline mileage.

Adjustment—Air valve should not require attention unless thrown out of adjustment by tampering or wear. To adjust, back out throttle lever stopscrew so that throttle valve closes completely. Hold throttle valve closed, loosen locknut and turn knurled adjusting sleeve on air valve connector link counter-clockwise (viewed from above) until air valve has appreciable play or lost motion (check by tapping air valve down against connector link spring), then turn sleeve clockwise until this play is taken up and air valve closes lightly against air horn wall, tighten locknut.

NOTE—When carburetor installed on car and throttle stopscrew adjusted to open throttle slightly for correct idling speed, air valve will have slight amount of play (by compressing connector link spring) to provide for proper warming up and acceleration performance. Air valve adjustment should be adjusted only when throttle stopscrew has been backed off so that throttle valve tightly closed.

ALTITUDE OR WIDE OPEN THROTTLE ADJUSTMENT:—Adjusting handle on side of carburetor casting controls position of nozzle bar openings. Standard factory setting with adjusting handle rotated counter-clockwise to limit of lockscrew slot provides maximum nozzle discharge or richest setting. Adjustment may be changed to lean the load and high speed part throttle mixture for operation in high altitudes as directed below. This adjustment tilts nozzle bar so that fuel flow from one opening is restricted (when nozzle bar turned 90° upper opening serves as air bleed for fuel discharged through lower opening).

Adjustment—Loosen lockscrew on adjusting handle, move handle to right (counter-clockwise) slightly to lean mixture, tighten lockscrew. Standard factory setting with handle rotated clockwise to limit of lockscrew slot provides richest mixture.

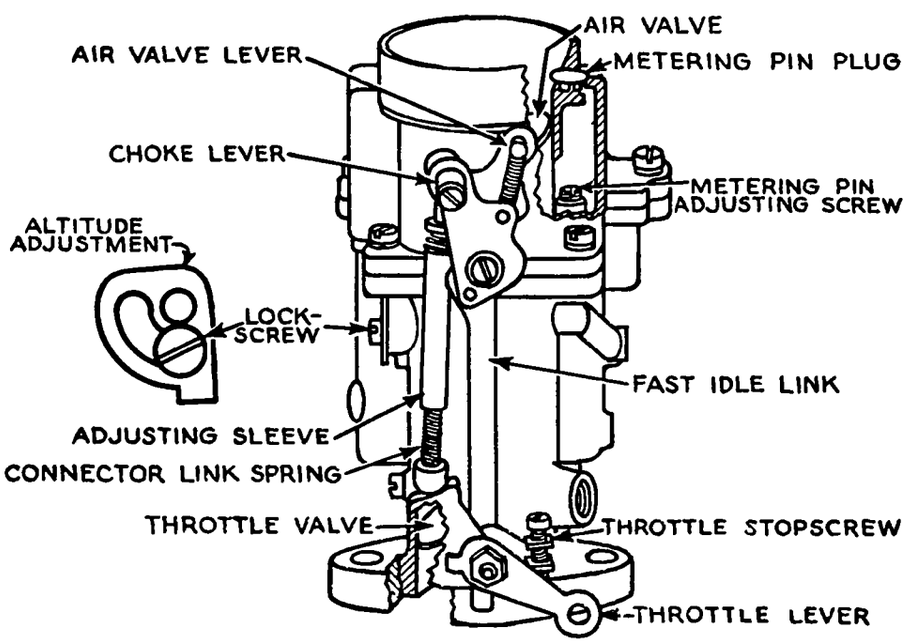
FLOAT LEVEL:—To check float level, remove choke lever, unhook choke spring from air valve lever, remove four screws from air horn and float bowl cover, remove and invert cover so that weight of float holds needle valve closed, measure distance from gasket seat on bowl cover to bottom of float (top when inverted). Distance should be 1⅝" (Model F Std. 1¼" carburetors), 1 17/32" (Model F Oversize & Model G 1½" carburetors). To adjust, bend float lever at point where it is attached to float.

NOTE—Idle may be affected if cover not replaced in exactly same position (clearance at cover screws permits slight cover shifts). Correct by changing metering pin adjustment slightly.

CHOKE CONTROL FOR STARTING:—Consists of a choke lever on the carburetor controlled by a button on the instrument panel. Choke lever is linked to the throttle valve lever by a flat link and to the air valve lever by a spring so that the throttle is opened to a fast idle position (advanced from 7½ MPH. to approximately 17 MPH.) and the spring tension tends to hold the air valve closed when the instrument panel button is pulled out for starting. Choke control is not adjustable.

SERVICING NOTES:—Metering Pin Installation—Make certain that metering pin installed with slot toward outer side of carburetor (it is possible to reverse pin which would prevent correct operation, pin is prevented from turning in well in operation).

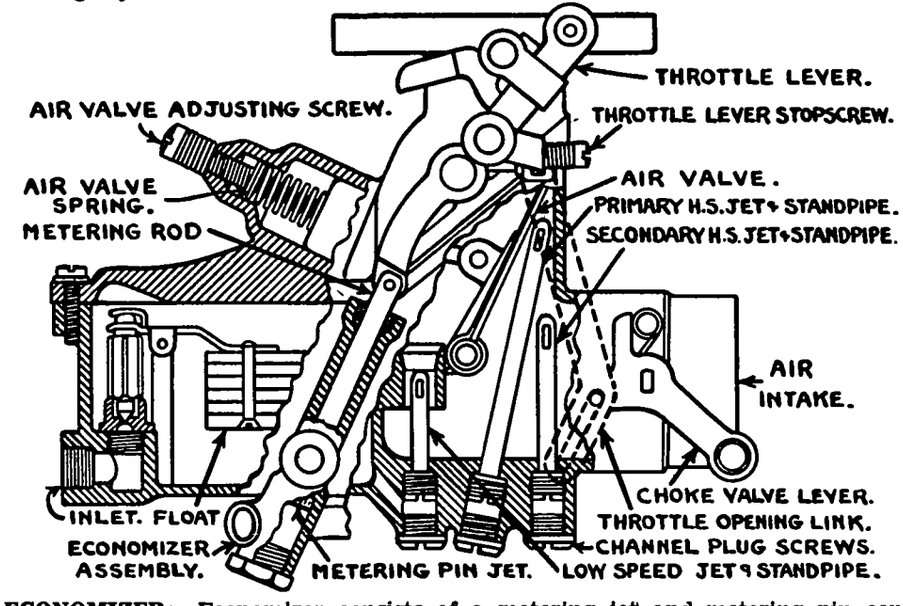
Float Bowl Cover Installation—Check metering pin adjustment after installing bowl cover (slight shift in cover position may affect idle performance).



AC-10-1530—CONTINENTAL BEACON, MODEL C-400 (1933).
CONTINENTAL FOUR, MODEL 41 (1934).

TYPE:—Automatic air valve updraft type with fixed jets and thottle operated economizer. Low speed jet is located in small venturi in mixing chamber. Primary and secondary jets are located directly under automatic air valve. All jets are of the 'fixed opening' type and are non-adjustable. Automatic air valve is controlled by a dash pot plunger and spring in the housing directly under the air valve adjusting screw. The air valve adjusting screw regulating the air valve spring tension is the only adjustment on the carburetor.

ADJUSTMENT:—Engine should be thoroughly warmed up before adjustment is made. With engine warm and running, adjust throttle stop adjusting screw so that engine runs at approximately 6 M.P.H. (correct idling speed). If engine stops or hesitates and stumbles, turn air valve adjusting screw in slightly. To adjust air valve turn air valve adjusting screw to the left or out slowly until engine begins to miss or hesitate, indicating that mixture is too lean. Then turn adjusting screw to the right or in until engine fires smoothly (turn screw 1/16 turn at a time until correct setting is secured). Check setting by quickly opening throttle about one-half and then allowing it to snap back to closed position. If engine stalls, indicating a too lean mixture, turn air valve adjusting screw to right or in slightly. If engine rolls, indicating a too rich mixture, turn adjusting screw to left or out slightly.



ECONOMIZER:—Economizer consists of a metering jet and metering pin connected to the throttle lever. The fuel supply to the primary and secondary jets is controlled by the economizer at all speeds below 50 M.P.H. to assure maximum economy. At speeds above 50 M.P.H. or with wide open throttle the economizer permits a greater fuel flow for maximum power. Economizer is entirely automatic and requires no attention. No adjustments are provided.

PERFORMANCE AND SPECIFICATIONS:—Performance should be satisfactory throughout entire driving range if air valve adjustment has been made correctly. Jets should be changed only for permanent operation at elevations greater than 3000 feet. See Marvel Jet Specification table for standard and high altitude calibrations. Jet heights and clearances are given in table below:

Carburetor	Jet Heights		Jet Clearance
	H.S. Jet	Inter. H.S. Jet	L.S. Nozzle	H.S Jet from Wall
10-1530	2 3/16"	1 25/64"	59/64"	.020"

CHOKE:—Choke valve is provided with a relief poppet valve and is interconnected with the throttle lever so that throttle is opened slightly when carburetor is choked. Choke linkage should be adjusted so that choke valve is fully closed with choke button on instrument panel pulled out and fully open with choke button pushed in.

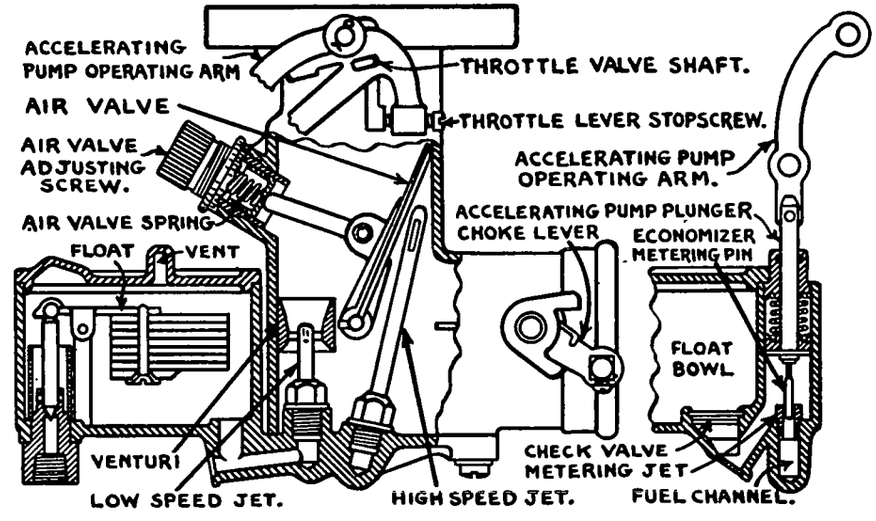
FLOAT LEVEL:—Float chamber is sealed and is vented through an air tube in the carburetor air horn. This prevents mixture becoming richer if air cleaner is allowed to become clogged. To check float level, take off float chamber cover (upper carburetor body), being careful not to damage air valve mechanism, measure distance from top of float to top edge of float chamber bowl. Correct setting should be 11/32" with float valve held closed by pressing up on float lever. Float valve and float valve seat should be replaced as matched sets and not individually.

MODEL AA-3S

10-992—PONTIAC, MODEL 402 (1932).

TYPE:—Air valve updraft type with throttle operated accelerating pump and economizer. All jets are 'fixed' type and not adjustable. Low speed jet is located in venturi at one side of the air valve. High speed jet and intermediate high speed jet (10-992 only) are located in mixing chamber directly below air valve and operate when air valve opens. Air valve is controlled by a dashpot plunger and spring in the air valve adjusting screw. Air valve adjusting screw is the only point requiring attention.

ADJUSTMENT:—Engine must be thoroughly warmed up before adjustments are made. Make a preliminary adjustment by turning air screw in or out until outer end is flush with end of ratchet. With engine warm and running,



close throttle, adjust throttle stop screw so that engine idles at about 10 M.P.H., then turn air screw in or clockwise until engine rolls (mixture too rich), turn screw out or counter-clockwise until engine begins to miss (mixture too lean), then turn air screw in until engine fires smoothly. Final setting should be midway between the extreme rich and extreme lean positions. Readjust throttle stop screw to secure correct idling speed. Do not idle engine below 5 M.P.H.

ECONOMIZER:—Economizer consists of a metering rod attached to the lower end of the accelerating pump plunger and operated by the throttle. At partial throttle or low speeds (up to approximately 50 M.P.H.) the larger diameter section of the metering pin will partially close the metering pin jet opening so that the fuel flow to the high speed and intermediate high speed jets is restricted, assuring maximum economy. At high speeds or with wide open throttle the metering pin is depressed so that the smaller diameter section of the pin permits a greater fuel flow through the metering pin jet for full power operation. Economizer is not adjustable and should not require attention.

PERFORMANCE AND SPECIFICATIONS:—Performance should be satisfactory throughout entire driving range if air valve adjustment has been made correctly. Jets should be changed only for permanent operation at eleva-

tions greater than 4000 feet. See Marvel Jet Specification table for standard and high altitude calibrations. Jet heights and clearances are given in table below:

Carburetor	Jet Heights		Jet Clearance
	H.S. Jet	Inter. H.S. Jet	L.S. Nozzle H.S Jet from Wall
10-955	2.562-2.596"	———	1 3/8" .084"
10-992	2.733-2.767"	1.826-1.860"	1 3/8" .012"

ACCELERATING PUMP:—Accelerating pump is operated by throttle lever and discharges additional fuel through high speed jets when throttle is opened. A check valve in the bottom of the float chamber prevents the fuel discharged by the pump flowing back into the float bowl. Accelerating pump is not adjustable and should not require attention.

FLOAT LEVEL:—The top of the float should be 11/32" below the top edge of the float bowl. To check float level, take off bowl cover and gasket, see that float needle valve is seated, measure distance from top of float to top edge of bowl.

CHOKE:—Choke valve is held in position on its shaft by a spring which permits choke valve to open slightly when engine begins to fire, preventing over-choking and assisting in warming up. See that choke linkage is adjusted so that choke valve is closed with choke control button on instrument panel pulled out and wide open with choke control button pushed in.

MODELS ED, TD (1932-33)

ED-1S—10-1515—BUICK, MODEL 33-50 (1933).
ED-2S—10-1518—BUICK, MODEL 33-60 (1933).
ED-3—10-1514—BUICK, MODELS 33-80, 33-90 (1933).
TD-1S—10-982 —BUICK, MODEL 32-50 (1932).
TD-2S—10-1501—BUICK, MODEL 32-60 (1932)
TD-3—10-1503—BUICK, MODELS 32-80, 32-90 (1932)

TYPE:—Automatic air valve updraft type with throttle operated economizer and a special Marvel Heat Control. The 1931-32 Buick models have a throttle operated, dash regulated heat control (see description below). The 1933 Buick models are fitted with an automatic thermostatic heat control and the dash regulator is not used (see special article on Heat Controls). Carburetor models 'TD' and 'ED' are dual types with two independent mixing chambers, jet assemblies, air valves and throttle valves (throttle valves will not require synchronization). Both air valves on dual carburetors are controlled by a single air valve screw and instructions given below on adjustment apply to all models.

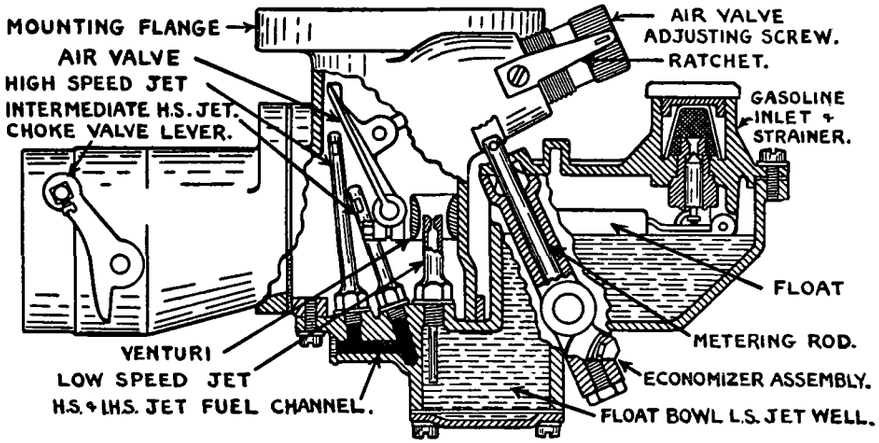
All jets are 'fixed' type and non-adjustable. Low speed jet is located in venturi at side of air valve and is fed directly from the float chamber (1932 and 1933 models have a deeper well under the jet and jet is provided with a quill which extends down into the well). Primary and secondary high speed jets are located directly under air valve and operate when air valve opens. These jets are fed by fuel metered through economizer metering jet which restricts fuel for partial throttle operation. Air valve is controlled by air valve spring and dashpot built in air valve adjusting screw. Air valve adjustment is only point on carburetor requiring attention.

ADJUSTMENT:—Engine must be warmed up before adjustment is made. On 1930-32 cars place heat control button on dash in 'on' position in warming up engine and leave the control in this position while adjustment is being made. This is important. Make a preliminary adjustment of air valve adjusting screw by turning screw in or out until end of screw is flush with end of ratchet, warm up engine, close throttle, retard spark, adjust throttle stop screw if necessary to keep engine from stalling. Turn air valve adjusting screw to left or counter-clockwise until engine hesitates or misses, indicating that mixture is too lean, then turn screw slowly in or clockwise until engine fires smoothly. Check adjustment by opening throttle part way and then snapping it closed. If engine stalls (mixture too lean), turn screw in or clockwise slightly. If engine rolls (mixture too rich), turn screw out or counter-clockwise slightly.

PERFORMANCE AND SPECIFICATIONS:—Performance should be satisfactory throughout entire driving range if air valve adjustment has been made correctly. Air valve spring length should not be changed and spring should be replaced if it has been tampered with. Jets should be changed only for permanent operation at elevations greater than 3000 feet. See Marvel Jet Specification table for standard and high altitude jet calibrations. Jet heights and clearances are given in table below:

Carburetor	Jet Heights		Jet Clearance
	H.S. Jet	Inter. H.S. Jet	L.S. Nozzle H.S Jet from Wall
10-982	2.424-2.454"	1.614-1.644"	1 9/32" .014"
10-1501	2.332-2.362"	1.866-1.896"	1 9/32" .027"
10-1503	2.9877-3.0189"	1.985-2.015"	1 3/8" .012"
10-1514	2.9877-3.0189"	1.985-2.015"	1 3/8" .012"
10-1515	2.424-2.454"	1.642-1.672"	1 9/32" .014"
10-1518	2.332-2.362"	1.866-1.896"	1 9/32" .027"

ECONOMIZER:—Economizer consists of a metering jet and metering pin connected to the throttle lever. Fuel supply for high speed jets is controlled by economizer for all partial throttle positions to assure maximum economy. At high speeds or with wide open throttle economizer permits a greater fuel flow for maximum power. Economizer is entirely automatic, is not adjustable and requires no attention.



FLOAT LEVEL:—Needle valve assembly on all T & TD carburetor models is mounted in the bottom of the float bowl casting. Float level on these models should be 19/64" below the top edge of the float bowl casting with the gasket removed. Measure distance from top edge of bowl to top surface of float cork with needle valve held closed. On 1933 Type 'ED' carburetors, needle valve assembly is mounted on float bowl cover. To check float level on these models, take off float cover, remove gasket, invert cover and measure distance from gasket seat on cover to top of float (top when not inverted). Correct setting should be 1 3/16". Do not attempt to change float level by bending float lever.

HEAT CONTROL:—Carburetor header on all models is jacketed for exhaust gas heating. Exhaust gas flow through the header is controlled by a throttle operated rod through a cam and lever actuated rod. The amount of heat applied for closed throttle and part-throttle positions is determined by the position of the cam controlled by the dash regulator lever. As the throttle is opened the damper valve is turned so that the heat is gradually decreased. Heat control operation is an operating adjustment and should not require attention except that the dash regulator lever must be placed in the 'Heat On' position when the carburetor is being adjusted.

CHOKE:—Adjust choke linkage so that choke valve is fully closed with choke control button on instrument panel pulled all the way out and wide open with choke control button pushed in.

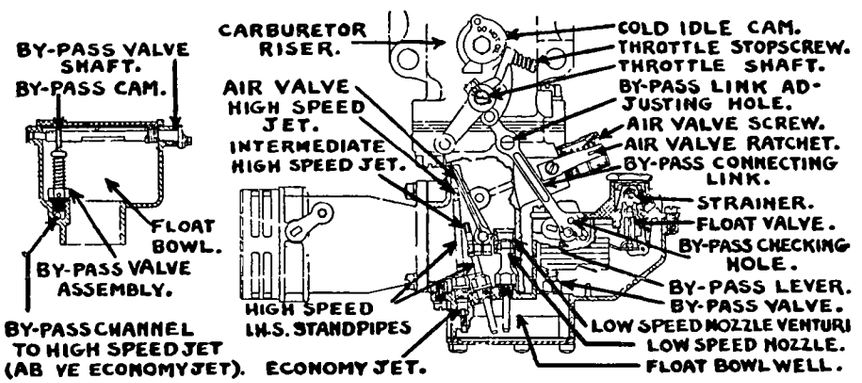
ED1S 10-1577—BUICK, MODEL 50 (1934-35).
ED2S 10-1579—BUICK, MODEL 60 (1934-35).
ED3 10-1581—BUICK, MODEL 90 (1934-35).

Delco-Remy Carburetor Control Model 498-C (Automatic Choke) used on all models. See separate article for complete data on Automatic Choke.

TYPE:—Automatic air valve, updraft, dual type with 'fast idle', throttle operated economizer, and Marvel Heat Control (automatic thermostatic control). Carburetors have independent mixing chambers, jet assemblies, air valves, and throttle valves (throttle valves are mounted on the same shaft and do not require synchronization). Both air valves are controlled by a single dashpot and adjusting screw assembly so that both carburetor barrels are adjusted simultaneously.

All jets are 'fixed' type and non-adjustable. Low speed jet is located in venturi at side of air valve and is fed directly from the float bowl well. High Speed and Intermediate High Speed jets are located directly under air valve and operate when air valve opens. Intermediate high speed jet is fed directly from the float bowl well in the same manner as the low speed jet. High speed jet is fed with fuel metered by Economy Jet located directly below high speed jet standpipe for all intermediate speeds, but additional fuel is by-passed to the high speed jet by the throttle-operated economizer for high speed or full-throttle operation (economizer is normally closed and does not meter fuel for high speed jets as in previous Buick carburetor designs). Adjust idle screw for correct idling speed of 8 M.P.H. See separate article on 'Fast Idle'.

ADJUSTMENT:—Engine must be thoroughly warm when adjustments are made. If necessary, make a preliminary adjustment of air valve screw by turning screw in or out until end of screw is flush with end of ratchet, warm up engine, close throttle, allow engine to idle. Turn air valve adjusting screw to left or counter-clockwise until engine hesitates or misses, indicating that mixture is too lean, then turn screw in or clockwise slowly (three or four notches at a time) until engine runs smoothly. Check adjustment by opening throttle slightly and then snapping it closed. If engine stalls (mixture too lean), turn air screw in or clockwise slightly. If engine rolls (mixture too rich), turn screw out or counter-clockwise slightly.



PERFORMANCE AND SPECIFICATIONS:—Performance should be satisfactory throughout entire driving range if air valve adjustment has been made correctly. Air valve spring length should be exactly 1½". Replace spring if it has been tampered with or if length is not 1½". Jets should be changed only for permanent operation at elevations greater than 3000 feet. See Marvel Jet Specification table for standard and high altitude jet calibrations. Jet heights and clearances are given in table below:

Car Model	Jet Heights				Jet Clearance
	H.S. Jet	Inter. H.S. Jet	L.S. Nozzle		H.S. Jet from Wall
50 (Before 4046593)	2 20/64"	1 20/64"	1 9/32"		.014"
50 (After 4046593)	2 36/64"	1 30/64"	1 9/32"		.014"
60 (Before 4044891)	2 14/64"	1 34/64"	1 9/32"		.027"
60 (After 4044891)	2-21/64"	1 38/64"	1 9/32"		.027"
90 (Before 4043022)	3"	1 44/64"	1 3/8"		.011"
90 (After 4043022)	3"	1 55/64"	1 3/8"		.011"

ECONOMIZER:—Economizer consists of a by-pass valve which supplies additional fuel to the high speed jets when the car is operated at high speeds or with wide open throttle (heavy pulling or acceleration). This fuel from the by-pass valve enters the lower end of the high speed jet standpipe directly above the economy jet which meters all fuel for the high speed jet for part-throttle operation when by-pass valve is closed. Economizer is not adjustable and should not require attention except when carburetor is disassembled and by-pass valve cut-in point setting has been lost.

To set cut-in point, disconnect lower end of by-pass valve connecting link, back off idle screw until it is clear of cold idle control cam, move idle screw lever to extreme idle position. Hold the lever in this position, then turn by-pass valve shaft lever counter-clockwise until the cam on the shaft makes contact with the by-pass valve (this point will be felt as the shaft is turned). Hold the by-pass valve shaft lever in this position and adjust length of connecting link by expanding or contracting the shaft at the hole near the upper end until the checking hole in the lower end of the link (directly above regular shaft hole in link) fits freely over small end of by-pass valve shaft lever stud. Then connect the by-pass lever stud in the regular connecting hole on the link and replace the cotter pin. A special tool is available for adjustment of connecting link. With this tool the hole in the link should be expanded at right angles to link axis to shorten the link length, or parallel to the link axis to lengthen the link.

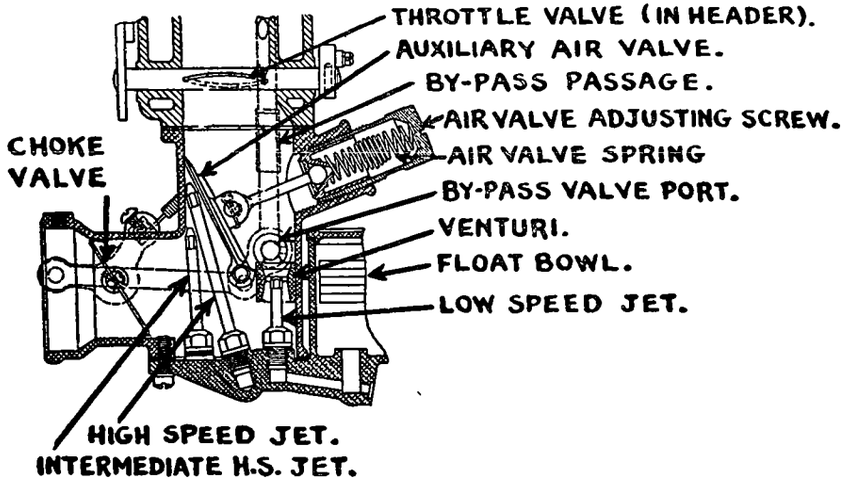
FLOAT LEVEL:—To check float level, take off float cover, invert and measure distance from gasket seat on float cover to top of float cork (bottom when not inverted). This distance should be 1 7/32".

CHOKE:—Choke valve is conventional butterfly type mounted in air horn (off-center pivot) and is controlled by the automatic choke mechanism. See special article on Delco-Remy Carburetor Control Model 498-C.

MODELS VE-3, VH4

VE-3—10-995—ESSEX, SUPER SIX MODEL (1932)—FIRST CARS
10-1505—ESSEX SUPER SIX MODEL (1932)—LATER CARS.
10-1533—HUDSON SUPER SIX MODEL (1933).
VH-4—10-989—HUDSON, GREATER EIGHT MODEL (1932)
10-1536—HUDSON GREATER EIGHT MODEL (1933).

TYPE:—Automatic air valve updraft type with throttle operated economizer (all models), accelerating pump (VE-3 only) and Marvel Heat Control. Heat control on Essex and Hudson 1932-33 models is automatic thermostatic type (see Heat Control section below).



ADJUSTMENT:—Make a preliminary adjustment by turning air valve screw in or out until end of screw is flush with end of ratchet spring. Warm up engine thoroughly. With engine warm and running, close throttle and allow engine to idle. Turn air valve screw in or clockwise until engine begins to roll (mixture too rich), turn screw out until engine begins to

hesitate or miss (mixture too lean), then turn screw slowly in until engine fires smoothly. Adjust throttle lever stop screw for correct idling speed (7 M.P.H. on Hudson-Essex models).

PERFORMANCE AND SPECIFICATIONS:—Performance should be satisfactory throughout entire driving range if air valve adjustment has been made correctly. Air valve spring length should not be changed and spring should be replaced if it has been tampered with. Jets should be changed only for permanent operation at elevations greater than 4000 feet. Standard and high altitude jet calibrations are shown in Marvel Jet Specification table. Jet heights and clearances are shown in table below:

Carburetor	Jet Heights		Jet Clearance
	H.S. Jet	Inter. H.S. Jet	L.S. Nozzle H.S Jet from Wall
10-989	2.964-2.997"	2.485-2.515"	1 9/32" .018"
10-995	2.746-2.776"	1.883-1.923"	1 1/4" .030"
10-1505	2.746-2.776"	1.883-1.923"	1 1/4" .030"
10-1533	2.746-2.776"	1.883-1.923"	1 1/4" .030"
10-1536	2.964-2.997"	2.485-2.515"	1 9/32" .018"

ECONOMIZER:—Economizer consists of metering jet and metering pin connected to throttle lever (metering pin is part of accelerating pump plunger assembly on VE-3). Fuel supply for high speed jets is controlled by economizer at all partial throttle positions to assure maximum economy. At high speeds (60 M.P.H. on VE-3 or 65-70 M.P.H. on VH-4) or with wide open throttle, economizer permits greater fuel flow for maximum power. Economizer is not adjustable and does not require attention.

ACCELERATING PUMP:—VE-3 Model. Not adjustable. Accelerating pump is operated by throttle lever and discharges fuel to high speed jets when throttle is opened for acceleration. A check valve in the pump intake channel prevents fuel discharged by the pump flowing back into the float bowl.

FLOAT LEVEL:—To check float level on all models, take off float bowl cover, remove gasket, measure distance from top edge of bowl to top of float with needle valve held closed. Should be 11/32" (Essex), 19/64" (Hudson).

HEAT CONTROL:—Carburetor header on all models is jacketed for exhaust gas heating (exhaust gas flow through jacket controlled by automatic thermostat). No adjustment required.

CHOKE:—Choke valve is held in position on choke valve shaft by a spring which allows choke to open against spring tension when engine begins to fire, preventing over-choking and assisting in warming up. Choke valve shaft also operates by-pass idling valve through a connecting lever. Adjust choke linkage so that choke valve is fully closed when choke control button on instrument panel is pulled all the way out and wide open with button pushed in.

MARVEL UPDRAFT CARBURETOR JET SPECIFICATIONS

			Standard Parts Nos.				High Altitude Parts Nos.						
Car Model	Yr.	Carb. No.	Low Speed Nozzle	Int. High Spd. Jet	High Speed Jet	Metering Pin Jet	Low Speed Nozzle	Int. High Speed Jet	High Speed Jet	Metering Pin Jet	Air Spring	M. P. Assem.	Tail Clearance
BUICK 32-50	1932	10-982	47- 95-B	49- 90-E-22	49- 75-C-18	84-091-C	47- 85-B	49-85- E-22	49- 70-C-20	84-091-C	24-316	173-528	.008-.012"
" 32-60	1932	10-1501	47-100-B	49- 85-E-22	49- 80-C-20	84-091-C	47- 90-B	49- 85-E-22	49- 70-C-20	84-091-C	24-315	173-528	.018-.022"
" 32-80, 90	1932	10-1503	47-115-B	49-120-E-16	49-105-C-26	84-093-C	47-110-B	49-110-E-16	49- 90-C-20	84-093-C	24-214	173-528	.018-.022"
BUICK 33-50	1933	10-1515	47-100-B	49-100-E-24	49- 80-C-18	84-100-C	47-90 -B	49-90- E-22	49-75- C-20	84-100-C	24-316	173-606-B	.008-.012"
" 33-60	1933	10-1518	47-100-B	49- 85-E-22	49- 80-C-20	84-098-C	47- 90-B	49-85- E-22	49-70- C-20	84-098-C	24-315	173-605-B	.018-.022"
" 33-80, 90	1933	10-1514	47-120-B	49-115-E-16	49-105-C-26	84-098-C	47-110-B	49-110-E-16	49- 90-C-20	84-098-C	24-214	173-604-B	.018-.022"
BUICK 50	Early 1934	10-1577	47-105-B	49- 85-E-16	49- 80-C-18	49- 70A10†	47-105-B	49- 70-E-26	49- 75-C-28	49-70A10†	24-315	——	.008-.012"
*BUICK 50	Early 1934	10-1577	47-105-B	49- 85-E-16	49- 80-C-18	49- 70A10†	47- 95-B	49- 70-E-26	49- 75-C-28	49-75A10†	24-315	——	.008-.012"
BUICK 60	Early 1934	10-1579	47-110-B	49- 70-E-16	49- 80-C-18	49- 70A10†	47-110-B	49- 70-E-20	49- 75-C-20	49-70A10†	24-315	——	.018-.022"
*BUICK 60	Early 1934	10-1579	47-110-B	49- 70-E-16	49- 80-C-18	49- 70A10†	47-100-B	49- 70-E-20	49- 70-C-18	49-70A10†	24-315	——	.018-.022"
BUICK 90	Early 1934	10-1581	47-115-B	49- 95-E-16	49-125-C-26	49-105A10†	47-120-B	49- 80-E-28	49-110-C-26	49-80A10†	24-316	——	.018-.022"
*BUICK 90	Early 1934	10-1581	47-115-B	49- 95-E-16	49-125-C-26	49-105A10†	47-110-B	49- 80-E-16	49- 70-C-20	49-90A10†	24-316	——	.018-.022"
BUICK 50 (A)	'34-35	10-1577	47-105-B	49- 75-E-26	49- 80-C-33	49- 75A10†	47-105-B	49- 70-E-26	49- 75-C-28	49-75A10†	24-318	——	.008-.012"
*BUICK 50 (A)	'34-35	10-1577	47-105-B	49- 75-E-26	49- 80-C-33	49- 75A10†	47- 95-B	49- 70-E-26	49- 75-C-28	49-75A10†	24-318	——	.008-.012"
BUICK 60 (B)	'34-35	10-1579	47-110-B	49- 75-E-20	49- 85-C-24	49- 75A10†	47-110-B	49- 70-E-20	49- 75-C-20	49-75A10†	24-318	——	.018-.022"
*BUICK 60 (B)	'34-35	10-1579	47-110-B	49- 75-E-20	49- 85-C-24	49- 75A10†	47-100-B	49- 70-E-20	49- 70-C-18	49-75A10†	24-318	——	.018-.022"
BUICK 90 (C)	'34-35	10-1581	47-120-B	49- 85-E-28	49-120-C-26	49- 90A10†	47-120-B	49- 80-E-20	49-110-C-26	49-80A10†	24-316	——	.018-.022"
*BUICK 90 (C)	'34-35	10-1581	47-120-B	49- 85-E-28	49-120-C-26	49- 90A10†	47-110-B	49- 80-E-16	49- 70-C-20	49-90A10†	24-316	——	.018-.022"
CONT. BEACON	'33-34	10-1530	49- 85-A-10	49- 90-E-22	49- 70-C-16	84-084-C	49-85- A-10	49-90- E-16	49- 70-C-16	84-084-C	24-415	173-607	.016-.020"
ESSEX SS	1932	10-995	49-120-A-10	49-140-E-24	49-100-C-28	84-101-B	49-120-A-10	49-120-E-24	49-85- C-28	84-101-B	24-414	173-577	.007-.011"
"	Late '32	10-1505	49-120-A-10	49-140-E-24	49-100-C-28	84-101-B	——	——	——	84-101-B	24-414	173-577	.007-.011"
HUDSON 8	1932	10-989	47-150-A	49-250-E-24	49-100-C-28	84-092-C	47-150-A	49-215-E-24	49-85 -C-28	84-092-C	24-214	173-528	.010-.014"
HUDSON SS	1933	10-1533	49-120-A-10	49-140-E-24	49-100-C-28	84-101-B	49-120-A-10	49-120-E-24	49-85- C-28	84-101-B	24-414	173-577	.007-.011"
" 8	1933	10-1536	47-150-A	49-250-E-24	49-100-C-28	84-092-C	47-150-A	49-215-E-24	49-85- C-28	84-092-C	24-214	173-589	.010-.014"
PONTIAC 402	1932	10-992	49-110-A-10	49-180-E-20	49-120-C-26	84-101-B	49-110-A-10	49-140-E-20	49-105-C-26	84-101-B	24-416	173-583	.010-.014"
" 302	1932	10-993	47-150-56	49-270-E-28	49-230-C-28	84-138-B	47-150-56	49-230-E-28	49-195-C-28	84-138-B	24-214	173-588	.008-.013"

†—Economizer Jet—no metering pin and jet used on these models. *—Cars with Duplex Air Cleaner.

(A) After #4046593. (B) After #4044891. (C) After #4043022.

B—10-1549—CONTINENTAL FLYER, MODEL 60 (1933)
B—10-1545—CONTINENTAL ACE, MODEL 81 (1933)
B—10-1603—LAFAYETTE, MODEL 110 ('34), 3510 ('35), 3610 ('35-36).
B2SU—10-1673—GRAHAM CRUSADER, MODELS 80, 80A (1936).
B2SU—10-1690—GRAHAM, 80, 80A ('36) ENG. NO. 309995 UP.
B2SU—10-1690—GRAHAM CRUSADER, MODEL 85 (1937)
B2—10-1678—GRAHAM CAVALIER, MODELS 90, 90A (1936).
B2—10-1691—GRAHAM, 90, 90A ('36) ENG. NO. 207235 (90), 215764 (90A) UP.
B2—10-1691—GRAHAM CAVALIER, MODEL 95 (1937)
B3—10-1680—GRAHAM SUPERCHARGER, MODEL 110 (1936).
B3—10-1692—GRAHAM, 110 (1936) ENGINE NO. 108175 UP.
B3—10-1744—GRAHAM SUPERCHARGER, MODELS 116, 120 (1937)

NOTE:—1936 Graham. Production changes made in jet calibrations for all models. These new jets should be installed on earlier carburetors (before Serial No. given) to correct performance complaints as follows:

Crusader Model B2SU-10-1673—Changes made beginning with Serial No. 5093894 (stamped on flange of die casting above idle adjustment). To correct lean part-throttle performance on earlier models, change Idle Air Vent No. 49-79H (.079") to new smaller size No. 49-63H, (.063").

Cavalier Model B2-10-1678—Changes made beginning with Serial No. 5092447. To correct lean part-throttle performance on earlier models, change Idle Air Vent No. 49-79H to new smaller size No. 49-71H and change matched Metering-Pin and Jet No. 280-1108F to new size No. 280-1109F. For better acceleration performance, change standard pump setting from No. 3 hole in pump lever to No. 2 hole.

Supercharger Model B3-10-1680—Beginning with Serial No. 5090942, Power Jet changed from 49-890T to 49-660T and Main Nozzle from 47-100J to 47-125J. Beginning with Serial No. 6002388, Complete Pump Assembly changed from 149-539 to 149-540. To correct lean action at high speeds, change Power Jet and Main Nozzle as above and change pump setting to No. 2 hole in lever (No. 1 standard setting as specified for first cars was incorrect and should have been No. 2). Not necessary to change pump assembly to correct performance. (On cars with new pump assembly, pump standard setting is No. 3 hole). Vacuum Spring No. 24-275 was changed to No. 24-225 after first 300 cars.

Choke Valve on all Models—Choke valve control modified to include double end finger which kicks choke valve off the open position when dash control lever pulled out, and returns choke valve to off position when control pushed in. Not intended to be installed on earlier models but obviates service check to see that spring-controlled choke valves operate freely on first carburetors to insure complete opening and closing.

1937 Graham:—Production changes made for increased gasoline economy. These same changes (new vacuum step-up spring and new power jet) should be installed on cars prior to Serial No. 217175 (Cavalier 95), 132010 (Schgd. 116), 120069 and 110988 (Schgd. 120). Part numbers for each model given below (new spring is light brass color). See Marvel Jet Specification Table for complete jet calibration. Check metering rod when making these changes.

	Vacuum Step-up Spring.		Power Jet.	
Model.	Old Part No.	New Part No.	Old Part No.	New Part No.
95	24-361	24-225	49-700-T	49-600-T
116, 120	24-361	24-225	49-760-T	49-730-T

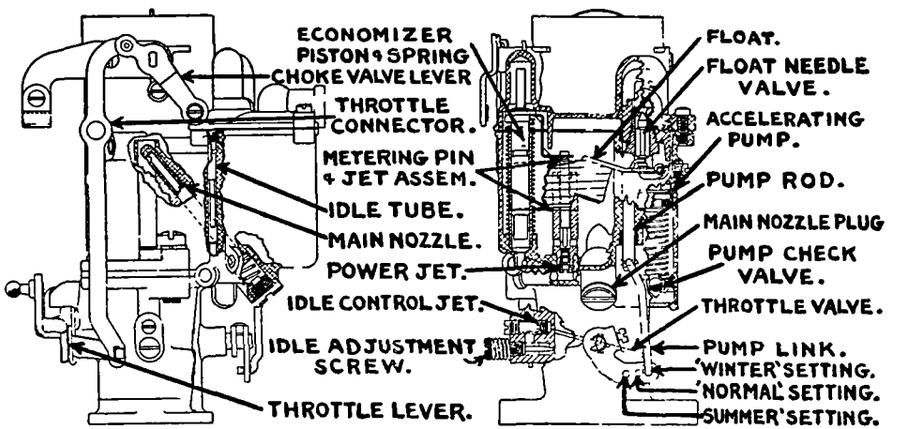
To install these parts, loosen clampscrew and move air cleaner adapter to one side, disconnect gasoline line at float bowl, take out float bowl screws and remove cover, lift out economizer plunger and spring assembly. Remove metering pin housing from carburetor body, install new power jet in metering pin housing, re-install metering pin housing in carburetor making certain that gasket is in place, use new spring when installing economizer. See that economizer is clean and works freely.

TYPE:—Plain tube, downdraft type with throttle operated accelerating pump and vacuum economizer or 'step-up device'. All fuel is metered by metering pin and jet and power jet (in lower end of metering jet assembly). Metering pin is controlled by vacuum economizer piston (see Economizer Section below). Fuel for idling is taken from the main nozzle channel up through the idle tube to a cross passage in which the idle air vent jet is located. The fuel mixture is then taken down through a passage and discharged through two ports opposite the throttle edge. The lower idle port (controlled by the idle adjusting needle) supplies all fuel for closed throttle idling, the upper port (above the throttle edge when the throttle is closed) acting as an additional air bleed. When the throttle is opened slightly the upper port comes into action and all fuel for car speeds up to approximately 18 M.P.H. is supplied by the idle system. The main nozzle comes into action at about 18 M.P.H. and acts in conjunction with the idle system at speeds up to 35 M.P.H. At speeds greater than 35 M.P.H. all fuel is supplied by the main nozzle. Idling adjusting needle and accelerating pump (seasonal setting) are the only points requiring attention.

ACCELERATING PUMP:—Positively actuated by throttle valve lever. Fuel drawn into pump chamber through ball-check valve on upstroke of piston (when throttle closed) and discharged through ball-check outlet valve and pump discharge jet (in upper mixing chamber) on downstroke of piston (when throttle opened for acceleration). Outlet valve normally held closed by cylindrical plunger in channel above ball. On Graham models, pump piston is spring-loaded and free on shaft so that some lag occurs when throttle opened suddenly and spring action to return piston to seat lengthens pump discharge period. This feature not used on LaFayette carburetor.

Adjustment—Pump lever on throttle valve shaft provided with four holes for pump rod link engagement. Holes numbered 1 to 4 out from shaft (#1 minimum stroke, #4 maximum stroke). See Note above and tune-up data on car model page for standard setting and adjustments for seasonal requirements on each car model.

IDLING ADJUSTMENT:—Idle adjusting screw controls fuel discharge from lower idle port (closed throttle idling fuel feed). Screw should be turned in for leaner mixture and out for richer mixture. See tune-up instructions for each car model for adjustment on engine.



PERFORMANCE & JET SPECIFICATIONS:—Performance should be satisfactory throughout entire operating range if idling adjustment and accelerating pump settings are correct. See Note above and Marvel Jet Specification Table for jet calibrations and changes to improve performance. 'High Altitude Jet' calibrations intended for permanent operation at elevations greater than 3000 feet only.

ECONOMIZER:—Economizer consists of a metering pin and jet controlled by a vacuum piston. The lower end of the vacuum piston chamber is connected to the carburetor barrel below the throttle valve. For all part-throttle positions, manifold vacuum will hold the piston at the lower end of the stroke (against the tension of the piston spring) so that the metering pin is held in position in the metering pin jet, limiting the fuel flow. When the throttle is opened, the fall in vacuum will allow the spring to force the piston upward, lifting the metering pin in the jet and permitting a greater fuel flow to the nozzle for acceleration and full power operation. The spring is calibrated to allow maximum economy (metering pin in jet) for all car speeds up to 65 M.P.H. on level road.

Metering Pin Timing Height. To check metering pin timing height (which controls economizer action), remove float bowl cover, hold vacuum piston down on seat (lower end of stroke with metering pin in metering jet), measure distance from top of metering pin to top of metering pin housing. This should be 13/64". Adjust by bending metering pin fork or lifter.

FLOAT LEVEL:—To check float level, remove float bowl cover, remove cover gasket, invert cover, measure distance from gasket seat on cover to bottom of float at free end. Should be 1 27/64" (B—Continental), 1⅜" (all others).
Float Valve & Seat Assembly:—Part No. 233-524 (B, B2, B2SU), 233-527 (B3-10-1680), 233-530 (B3-10-1744). Furnished only as matched sets.

MODELS B, B2, B2SU, B3 CONT.

THROTTLE VALVE SETTING:—Manufacturer recommends replacement of Throttle valve Body Assembly, Part No. 227-45 (B-10-1549), 227-49 (B-10-1545), 227-529 (B-10-1603), 227-551 (B2SU-10-1673), 227-557 (B2SU-10-1690), 227-552 (B2-10-1678 & 1691), 227-553 (B3-10-1680), 227-558 (B3-10-1744) whenever throttle valves or shaft require replacement.

CHOKE:—Choke valve offset on shaft. Choke lever linked to shaft by coiled spring so that choke valve action is spring-controlled and automatic during warming up period. See that choke valve operates freely throughout range to insure choke valve following lever when dash control is manipulated.
NOTE—On Graham models two fingers are incorporated in choke lever, one of which 'kicks' choke valve off the open position when dash control lever pulled out, and the second returns choke valve to open position when dash control pushed all the way in.

FAST IDLE LINKAGE:—Throttle lever stopscrew stop-plate pivoted on throttle shaft and linked to choke valve lever so that throttle is opened to fast idle position when choke valve is in use. Linkage should not require adjustment.

MODELS BB, BD, BD1S

BB-1—10-1633—BUICK, MODEL 34-40 (1934).
BD-1—10-1749—BUICK, MODEL 40 (1937)—STANDARD AIR CLEANER.
10-1750—BUICK, MODEL 40 (1937)—HEAVY DUTY AIR CLEANER.
BD-1S—10-1751—BUICK, MOD. 60, 80, 90 (1937)—STANDARD AIR CLEANER.
10-1752—BUICK, MOD. 60, 80, 90 (1937)—HEAVY DUTY AIR CLEANER.

NOTE:—These carburetors not interchangeable as different jet calibrations used when equipped with Heavy Duty (oil-bath) Air Cleaner. Whenever air cleaners are changed in the field, matched Metering Pin-and-Jet and Power Jet must be changed. See Marvel Jet Specification Table for standard and high altitude jet calibrations for each model.

TYPE:—Plain tube, downdraft, dual type with 'Cold Idle' (fast idle) control, throttle operated accelerating pump, and vacuum economizer or 'step-up' device. Carburetors have two independent mixing chambers, main nozzle systems, idle systems, and throttle valves (valves mounted on same shaft and will not require synchronization). A single accelerating pump and vacuum economizer (metering pin and metering jet) serve both carburetor barrels.

Fuel System:—The main nozzles are fed directly from the float bowl through the 'bowl feed jet' and also through the metering pin-and-jet (economy device). Main nozzle is air-bled through a separate nozzle air vent within the mixing chamber. Fuel for idling is taken from the main nozzle channel below the metering pin and jet through the idle fuel channel and is metered by the idle jet. This fuel is mixed with air admitted through the primary air vent in the cross passage and the fuel mixture is then taken down through a passage to the idle ports opposite the throttle valve. The lower idle port below the throttle (when throttle is closed) is controlled by the idle adjusting needle and supplies all fuel for closed-throttle idling, the secondary idle air vent and upper idle port (in which the idle control jet is located) acting as additional air-bleeds. As soon as the throttle is opened slightly, the upper idle port discharges additional fuel. All fuel for car speeds up to 18 M.P.H. is supplied by the idle system. At this point the main nozzle comes into action and supplies more fuel progressively up to 40 M.P.H. when fuel delivery from the idle ports ceases, the main nozzle then supplying all fuel. At speeds above 75 M.P.H. or whenever the throttle is wide open, fuel supply for main nozzles is automatically increased by the economizer action (see economizer below).

Fuel Drop Collectors (BB-1 only):—Mounted on main nozzle (see illustration). Designed to even out nozzle delivery so that main nozzle action is smoother at speeds below 25 M.P.H.

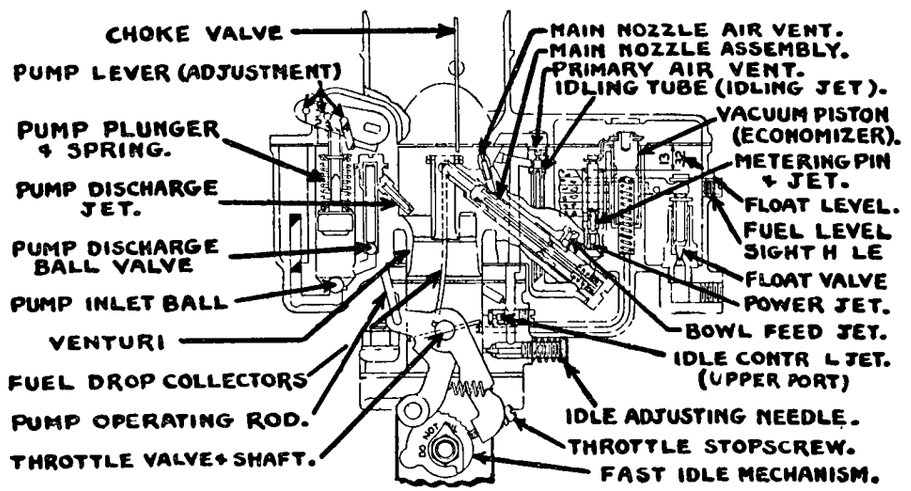
IDLE ADJUSTMENT:—Needle valve type controlling fuel mixture. Engine must be warm when adjustments are made (cold idle not operative). With engine thoroughly warm and running, close throttle, adjust throttle stop screw so that engine speed is equivalent to 7-8 M.P.H. Adjust idle adjusting needle for each carburetor barrel in turn. Turn idle adjusting needle in or clockwise until engine hesitates or misses (mixture too lean), then turn needle out or counter-clockwise until engine rolls (mixture too rich), finally turn needle in just enough to eliminate rolling. This will give the richest setting possible without rolling and will give smoother road performance than a leaner setting. Correct setting should be ½-¾ turn open. After adjusting both idle adjustment needles, check idling speed and readjust throttle stop screw to correct idling speed (7-8 M.P.H.). See tune up data on car model pages.

PERFORMANCE:—Performance should be satisfactory throughout entire driving range if idling adjustment has been correctly made and accelerating pump setting and vacuum economizer operation are correct. All metering jets are 'fixed' type and non-adjustable. Jets should be changed only for permanent operation at elevations greater than 3000 feet.

ACCELERATING PUMP:—Accelerating pump is operated by the throttle valve lever and discharges fuel through a pump discharge jet into the mixing chamber when the throttle is opened. The pump follow-up spring above the pump plunger prolongs the pump discharge.

Adjustment:—Pump outer lever on countershaft above accelerating pump has four holes (numbered 1-2-3-4) for pump link connection. #1 (outer) provides maximum stroke, #4 (inner) minimum stroke. See tune up data on car model page for recommended setting and seasonal changes.

ECONOMIZER:—Economizer consists of a metering pin and jet controlled by a vacuum piston. The lower end of the vacuum piston chamber is connected to the carburetor barrel below the throttle valve. For all part-throttle positions, manifold vacuum will hold the piston down at the lower end of its stroke (against the tension of the piston spring) so that the metering pin is held in position in the metering jet, limiting the fuel flow for maximum economy. When the throttle is opened, the fall in vacuum allows the spring to force the piston upward, lifting the metering pin in the jet and permitting a greater fuel flow for acceleration and full power operation. This fuel metered by Power Jet located in the bottom of the metering pin and jet assembly. Spring is calibrated to provide maximum economy (metering pin in the jet) for car speeds up to 75 M.P.H.



Metering Pin Timing Height. To check metering pin timing height (which controls economizer action), remove float bowl cover, hold vacuum piston down on seat (lower end of stroke with metering pin in metering jet), measure distance from top of metering pin to top of metering pin guide and jet assembly. This distance should be 13/64". Adjust by bending metering pin fork or lifter.

FLOAT LEVEL:—With engine idling, fuel level in float bowl should be ¾" below top face of bowl, or 1/16" below the center of the sight hole in the side of the bowl (sight hole closed normally by a plug). To check float level, remove float bowl cover, hold float up by hand with needle valve seated, measure distance from top face of float bowl to top of float cork. Distance should be 13/32".

Float Valve & Seat Assembly. Part No. 233-525 (BB-1, BD-1), 233-531 (BD1S). Furnished only in matched sets.

THROTTLE VALVE SETTING:—Manufacturer recommends replacement of throttle valve body assembly, Part No. 227-527 (BB-1), 227-543 (BD-1), 227-564 (BD-1S) whenever throttle valves or shaft require servicing due to wear or damage.

CHOKE:—Choke valves offset type. Stop pin in air horn limits travel in wide open position. All models fitted with Delco-Remy Carburetor control (automatic choke) and Buick Cold Idle Control. See articles in Carburetion Equipment Section for complete adjustment instructions.

C-2—10-1802 NASH AMBASSADOR SIX, MODEL 3820 (1938)
10-1808—GRAHAM, STD. & SPEC. MODEL 96 (1938-39)
C-3—10-1809—GRAHAM, SUPERCHARGER MODEL 97 (1938-39)

TYPE:—Plain tube, Downdraft, single barrel type with throttle operated accelerating pump and vacuum economizer or 'step-up' device. These models have improved mixing chamber design and triple venturi with main nozzle discharging into throat of top (smallest) venturi. Clearance between nozzle tip and opposite wall of small venturi should be .083" (Graham), .060" (Uash) plus or minus .010".

Fuel System (Idling & Low Speed):—Fuel for idling taken from lower end of main nozzle through Idle Fuel Passage and up through Idle Tube to Idle Emulsion Passage in which it is mixed with air admitted through Primary Idle Air Inlet (above tube) and Idle Air Vent Jet (at end of passage and opening into air horn above venturi). Fuel mixture then taken down through Idle Emulsion Channel and discharged through Primary Idle Delivery Port below throttle valve. This port is controlled by Idle Adjusting Needle. As soon as the throttle valve is opened slightly additional fuel is discharged through Secondary Idle Delivery Port above the throttle edge. Idle system supplies all fuel for closed throttle idling and car speeds up to 18 M.P.H. except when engine operated under load.

18-65 M.P.H.—At 18 M.P.H. (or at lower speed if throttle opened sufficiently to reduce manifold vacuum), the greater suction at the main nozzle brings this nozzle into operation and the idle discharge decreases so that at car speeds of approximately 35 M.P.H. and above all fuel is discharged by the main nozzle. Fuel for main nozzle is metered by metering pin-and-jet (vacuum economizer) and in addition a definite amount of fuel is by-passed directly to the nozzle by the Range Adjustment Needle Valve (Graham models only—Range adjustment not used on Nash carburetor).

High Speed, Full Throttle, or Heavy Load Operation:—Whenever manifold vacuum decreases due to these conditions, vacuum piston step-up spring forces piston up, lifting metering pin from jet and permitting greater fuel flow to nozzle. Fuel is then metered by Power Jet at lower end of nozzle. Springs are calibrated to allow metering pin to remain in jet for car speeds up to 65 M.P.H. under normal conditions to insure maximum economy.

IDLE ADJUSTMENT:—Idle adjusting needle controls fuel mixture and should be turned in for leaner mixture, out for richer mixture. Idle speed controlled by throttle stopscrew and should be set for 6-7 M.P.H. idling speed. Adjust carburetor only when engine warmed up so that choke valve is wide open (On Graham models, throttle cracking or fast idle mechanism linked to choke valve so that throttle valve is opened slightly when choke valve in use). See Tune up data on car model page for complete adjustment data.

PERFORMANCE:—Should be satisfactory throughout entire operating range if idle adjustment and accelerating pump setting are correct (See Range Adjustment for Graham). Jets are non-adjustable and should be changed only for permanent operation at elevations greater than 3000 feet. See Marvel Jet Specification Table for standard jet calibrations and recommended altitude changes on all models.

ACCELERATING PUMP:—Operated by rod and link connected to pump lever on throttle shaft. Fuel drawn into pump cylinder through inlet screen and inlet ball check valve at bottom of cylinder and discharged through outlet ball check valve and pump discharge jet in carburetor mixing chamber wall when throttle opened for acceleration. Pump plunger is spring loaded on rod so that it lags when throttle opened very suddenly and spring provides follow up to prolong pump delivery. On Nash model, a return spring is located in the pump cylinder below the plunger.

Adjustment (Graham)—Pump lever on throttle shaft has four holes for pump link engagement. #2 hole is standard for normal temperatures. Connect link in inner (#1) hole for minimum stroke in extremely hot weather or with high-test fuel, #3 hole for cold weather, #4 (outer) hole for maximum accelerating charge in extremely cold weather.

Adjustment (Nash)—Pump lever on throttle shaft has three holes for pump link engagement. Center (#2) connection is standard for normal temperatures. Connect link in inner (#1) hole for minimum stroke for extremely hot weather or high test fuel, or in outer (#3) hole for maximum stroke for extremely cold weather or low test fuel.

ECONOMIZER:—Consists of metering pin-and-jet assembly operated by vacuum piston in float bowl. Vacuum piston normally held down in cylinder against tension of vacuum step-up spring (in cylinder below piston) so that metering pin restricts fuel flow through jet. When manifold vacuum decreases, spring forces piston up and lifts metering pin out of jet.

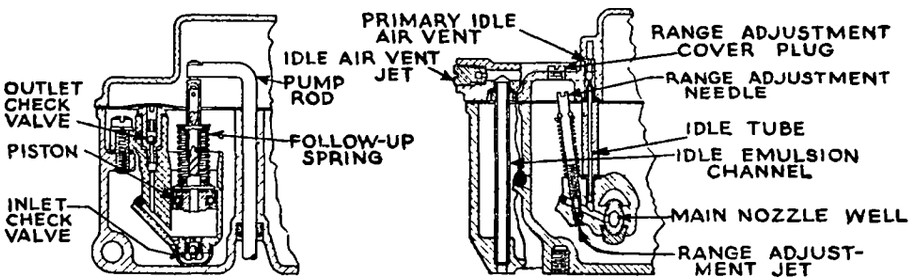
Adjustment—To check metering pin timing height, remove bowl cover, hold vacuum piston down on seat against spring tension, measure distance from top of metering pin to top of guide housing. Should be 13/64". Adjust by bending metering pin lifter.

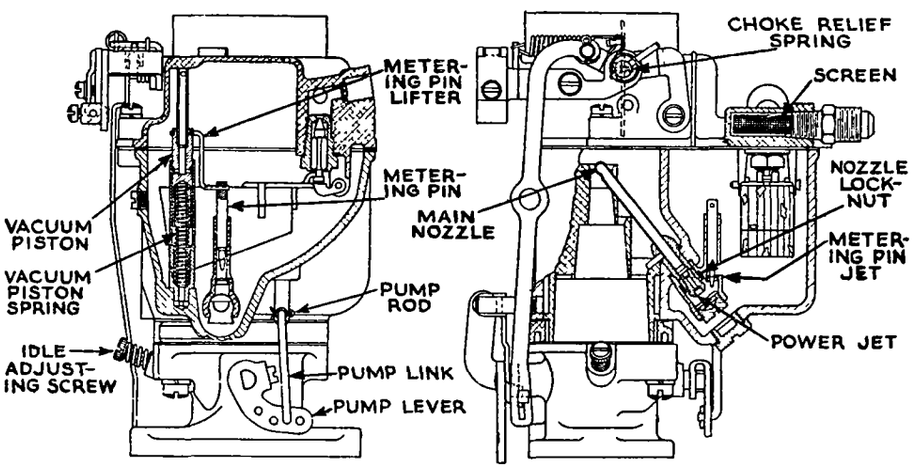
RANGE ADJUSTMENT (Graham Models Only):—Consists of an adjustable needle valve in the float bowl. Accessible by removing air cleaner and taking out small plug on top of bowl cover. Use special adjusting tool M-70 or small screwdriver inserted through plug hole to turn range needle.

Adjustment:—Wide open position approximately 1 turn off seat. Set at factory at two turns open. To secure leaner-than-standard setting, turn range needle down until it is seated (do not use excessive force or needle and seat will be damaged), turn needle back to one turn open position, then turn down slightly to secure desired setting as directed below.

Normal Altitude Setting (Up to 3000 ft.)—Range needle setting should be approximately one-half turn open.

High Altitude (Over 3000 ft.)—Setting should be less than one-half turn open and needle may be closed entirely if necessary. Above 6000 ft. and on Pacific Coast, next size leaner metering pin can be installed (see Jet Specification Table).





FLOAT LEVEL:—Fuel Level—With engine idling, fuel level in float bowl should be even with the lower edge of the fuel level inspection hole in the side of the float bowl (remove screw in inspection hole to check fuel level).

Float Height—To check, remove bowl cover and float assembly with gasket, invert and measure from gasket surface to nearest point on float. Should be 19/32" (all models). Float should be level (equal height across entire float). NOTE—For high temperatures or high-test fuel, float height may be set at 5/8".

Float Valve & Seat—Furnished only as matched sets as follows: No. 233-540 (Graham, all models), 233-539 (Nash).

CHOKE VALVE:—Offset type. Fitted with spring loaded flapper type relief valve to prevent overchoking. On Graham models choke valve operates throttle cracking or fast idle mechanism.

Fast Idle (Graham)—Throttle lever stopscrew stop plate pivoted on throttle shaft and linked to choke valve so that throttle is opened slightly when choke valve is in use. Should not require adjustment.

MODELS C2, C3 CONT.

TROUBLE SHOOTING:—Hard Starting when Hot—May be caused by fuel collecting on throttle valves due to leak at nozzle seat. Make certain that float bowl vents are clear and that nozzle is tight (see nozzle servicing below).

Poor Acceleration Performance—If acceleration unsatisfactory at 10-15 MPH. with wide open throttle, dismantle accelerating pump and check for free plunger travel. If plunger does not move freely examine pump bore for roughness particularly at lower end and refinish with finest grade of emery cloth (wrap emery cloth on ½" round wooden stick). Clean out dirt before reassembling.

Rich Mixture—May be caused by loose metering pin housing, loose nozzle, or cracked nozzle retaining nut which will allow fuel to leak past metering jet. See nozzle servicing below.

SERVICING:—Throttle Valves. Throttle valve should not be replaced separately (except as emergency) as upper idle discharge port originally located after throttle valve installed and distance above valve is important. Throttle valve and shaft assembly is furnished for service.

Main Nozzle—When installing nozzle see that retainer gasket is in place between nozzle flange and seat in body. Use tool H-63 to tighten retaining nut at lower end of nozzle being careful that excessive force is not used which will crack nut and permit leaks at this point. Clearance between nozzle tip and opposite wall of small venturi should be .083" (Graham models), .060" (Nash) plus or minus .010". Greater clearance indicates that nozzle gasket left out, less clearance that nozzle not tight on seat.

Metering Pin Housing & Jet—Jet is part of assembly and is not ordinarily changed (metering pin only changed for altitude correction). To tighten or replace housing, use special tool M-68 to press assembly in place. See that nozzle retainer gasket is in place around nozzle in body recess when installing housing. Check metering pin timing height.

MODELS CD-1B, CD-2B

CD-1B—10-1796 BUICK, MODEL 40 (1937-38) STD. AIR CLEANER
10-1797 BUICK, MODEL 40 (1937-38) HEAVY DUTY AIR CLEANER
CD-2B—10-1798 BUICK, MODELS 60, 80, 90 (1938) STD. AIR CLEANER
10-1799 BUICK, 60, 80, 90 (1938) HEAVY DUTY AIR CLEANER

NOTE:—These models not interchangeable (special jet calibration used with heavy duty air cleaners). See Marvel Jet Specification Table for complete jet data.

Buick 40 (1937)—Late 1937 cars equipped with this CD carburetor. All data same as for 1938 model except for float level.

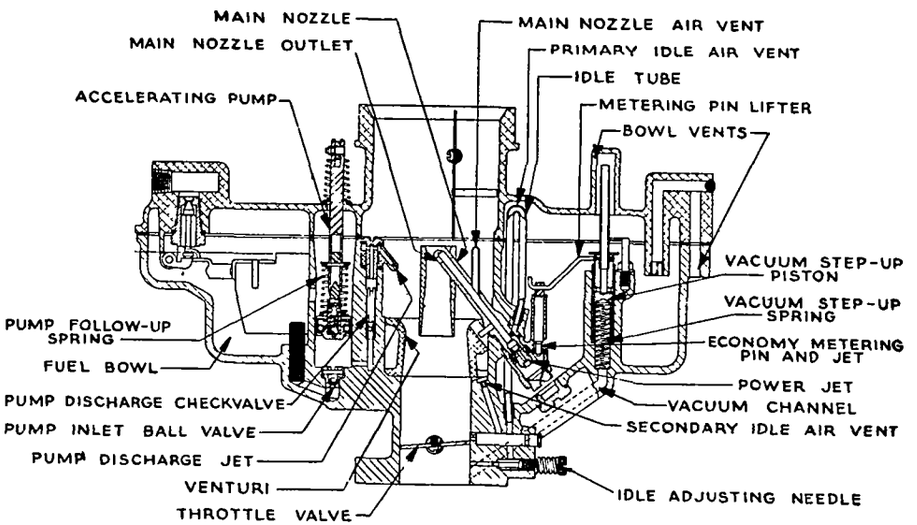
TYPE:—Plain tube, Downdraft, Duplex or dual type with throttle operated accelerating pump, vacuum economizer or 'step-up' device, and special double float design. These carburetors have double mixing chambers with independent main nozzle and metering systems, throttle valves, and idling systems. A single vacuum piston operates both metering rods (economizer), and a single accelerating pump is used with a double discharge jet assembly. Carburetors are fitted with Buick Cold Idle Control (fast idle) and Delco-Remy Carburetor Control (automatic choke).

Fuel System (Idling & Low Speed):—Fuel for idling taken from lower end of main nozzle through Idle Fuel Orifice and flows up Idle Tube (inverted 'U' design) where it is mixed with air admitted through Primary Idle Air Vent (at top of idle tube 'U'). Fuel mixture then flows down through idle tube to Idle Emulsion Channel where additional air is admitted through Secondary Idle Air Vent (in carburetor wall at lower edge of venturi). For closed throttle idling, this fuel mixture is discharged through Primary Idle Delivery Port below the throttle and is controlled by the Idle Adjusting Needle. As soon as the throttle valve is opened slightly, additional fuel is discharged through the Secondary Idle Delivery Port at the throttle edge (a third discharge port is located directly above the Secondary Port on the Model CD-1B only). Idle system supplies all fuel for closed throttle idling and car speeds up to 18 M.P.H. except when engine operating under load.

18-75 M.P.H.—At 18 M.P.H. (or at lower speeds if throttle opened sufficiently to reduce manifold vacuum), the greater suction at the main nozzle brings this nozzle into operation and the idle discharge decreases so that at speeds of 40 M.P.H. and above all fuel is discharged by the main nozzle. Fuel for main nozzle is metered by metering pin-and-jet (vacuum economizer) and is mixed with air admitted to the nozzle bore through the Main Nozzle Air Vent which projects up into the air stream. Main nozzle tip is closed and the outlet is located on the underside of the tip in the small auxiliary venturi. Clearance between nozzle tip and wall of small venturi should be .100-.120".

High Speed, Full Throttle, or Heavy Load Operation:—Whenever manifold vacuum decreases due to these conditions, vacuum piston spring forces piston up, raising metering pins from jets and permitting greater fuel flow to nozzles. Fuel is then metered by Power Jet at lower end of nozzle. Springs are calibrated to allow metering pin to remain in jet for car speeds up to 75 M.P.H. under normal conditions to insure maximum economy.

IDLE ADJUSTMENT:—Idle adjusting needles control fuel mixture and should be turned in for leaner mixture, out for richer mixture. Setting should be approximately ¾-1 turn open (if screws turned in to determine 'closed' position, use light pressue only to avoid ringing seats which will prevent correct operation). Idle speed controlled by throttle stopscrew and should be set for 7-8 M.P.H. hot or slow idling speed (cold idle control and automatic choke inoperative). Make adjustments only with engine warmed up so that Cold Idle and Automatic Choke inoperative. See Tune Up data on car model page for complete instructions. For Fast Idle data, see Buick Cold Idle article in Carburetion Equipment Section.



Buick 40 With Self-Shifting Transmission—Idle speed should be set at 5-6 MPH. in third gear. Transmission throttle control lever linkage must be checked whenever carburetor throttle linkage is disconnected or changed. See adjustment instructions in Buick Self-Shifting Transmission article in Mechanical Equipment Section.

PERFORMANCE:—Should be satisfactory throughout entire operating range if Idling Adjustment, Accelerating Pump Setting, and Metering Pin Timing Height are correct. Jets are non-adjustable and should be changed only for permanent operation at elevations greater than 3000 feet. See Marvel Jet Specification Table for complete standard and altitude jet calibrations.

ACCELERATING PUMP:—Operated by walking beam and lever connected to throttle lever. Fuel drawn into pump chamber through inlet screen and ball check valve at bottom of cylinder when throttle valve closed and discharged through outlet check valve and pump discharge jet assembly into each mixing chamber when throttle opened for acceleration. Pump plunger is spring loaded on rod so that it lags when throttle opened suddenly and spring provides follow up to prolong pump delivery. A spring loaded ball check valve in the pump plunger opens and by-passes some fuel back into float bowl when pump is operated rapidly preventing excessive delivery which would load up engine (by-pass valve normally remains seated so that all fuel is discharged through pump jets).

Adjustment—Walking beam provided with three holes for throttle lever rod connection. Center (#2) hole is normal setting for all year operation. Connect rod to outer (#3) hole for minimum stroke when using high test fuel or for extremely hot weather, inner (#1) hole for maximum stroke when using low test fuel or for extremely cold weather when performance is unsatisfactory with standard setting.

ECONOMIZER:—Consists of twin metering pin-and-jet assemblies operated by vacuum piston in float bowl. Vacuum piston normally held down in cylinder against tension of vacuum step-up spring (below piston in cylinder) so that metering pins restrict fuel flow through jets. When manifold vacuum decreases, spring forces piston up lifting metering pins out of jets.

MODELS CD-1B, CD-2B CONT.

Adjustment—To check Metering Pin Timing Height, remove bowl cover, hold vacuum piston down on seat against step-up spring tension, measure distance from top of each metering pin to top of metering pin guide. Should be 13/64" and groove on pin should line up with top of guide housing. Adjust by bending metering pin lifter. Both pins must be adjusted alike.

FLOAT LEVEL:—Fuel Level—With engine idling, fuel level should be 11/16" (CD-1B), ¾" (CD-2B) below top edge of bowl or even with lower edge of fuel level inspection hole in left front face of bowl (remove screw from inspection hole to check fuel level).

Float Height—To check, remove bowl cover and float assembly, invert cover, measure from bowl cover gasket to closest surface of float. Should be ¼" (Buick 40 '37), 3/16" (Buick 40 '38), ¼" (Buick 60, 80, 90). See that floats are centered in bowl and that all burrs and rough edges which might interfere with free float travel are removed. Both floats must be set alike.

Float Valve & Seat—Furnished only as matched sets, Part No. 233-537 (CD-1B), 233-538 (CD-2B).

Float Bowl Vent:—Bowl vented to outside through port on side of vacuum piston stem housing on bowl cover and also through two inverted 'U' channels in cover which are open to atmosphere through holes in gasket and main body casting flange (baffle located at inner end of channels in bowl). These bowl vents must be kept clear and open.

TROUBLE SHOOTING:—Lean Idle—May be caused by dirt in idle fuel channels. Can be cleaned by opening throttle so that engine runs at about 35 MPH., removing one idle adjusting needle and quickly closing needle hole with a finger. This will increase suction so that dirt on needle seat will be removed. Wipe off adjusting needle, replace and adjust, repeat for second needle.

Hard Starting when hot—May be caused by percolation or fuel collecting on throttle valves due to leak at nozzle seat. Make certain that float bowl vents are clear (see Float section above) and that nozzle is tight (see nozzle servicing below).

Poor Acceleration—If acceleration is unsatisfactory at 10-15 MPH. with wide open throttle, dismantle accelerating pump by removing bowl cover, pump discharge jets, pump discharge check valve, metering pins and vacuum piston assembly and check pump for free travel. If pump plunger does not move freely, examine pump bore for rough finish particularly at lower end. If wall is not perfectly smooth, refinish with finest grade of emery cloth (use stick ½" in diameter with emery cloth wrapped around one end). Wash out all dirt before reassembling. Check metering pin setting (see Economizer above) and pump discharge jet position (see servicing directions below).

Throttle Sticking—May be caused by insufficient clearance between automatic choke and throttle shaft. Can be corrected by installing extra gasket between carburetor body and choke housing.

No Fuel in Float Bowl—Check idle tubes to see that they are down tight on seats (leak at seat will allow fuel to drain from bowl to throttle chamber). See Idle Tube servicing below.

Rich Mixture—May be caused by loose metering pin housing, loose nozzle or cracked nozzle retaining nut which will allow fuel to leak past metering jet. See nozzle servicing below.

SERVICING:—Main Nozzles. Nozzles stamped 'R' or 'L' and must be installed in correct barrel. See that nozzle retainer gasket is installed between nozzle flange and seat in body. Use tool H-63 to tighten retaining nut at lower end of nozzle being careful that excessive force is not used which will crack nut and permit leaks at this point. Clearance between nozzle tip and opposite wall of auxiliary venturi should be 7/64" or .100-.120" (all Buick models). If this distance too great, gasket under nozzle has been left out. If distance too small, nozzle is not down tight on seat.

Metering Pin Housing & Jet—Jet is part of assembly and is not ordinarily changed (metering pin change only for altitudes). To tighten or replace housings, use special tool M-68 to press assembly in place. Make certain that nozzle retainer gasket is in place around nozzle in body recess when installing housing assembly. Check metering pin timing height.

Idle Tubes—Inverted 'U' type. Tube ends which seat in recesses in body casting must be firmly seated (for correct tube height) and tight (to prevent leaks which will drain bowl). When renewing idle tubes see that all traces of original lead washer used to seal tubes are removed, use special Idle Tube Peening Tool M-62 and Idle Tube Seating Tool M-69 to insure tight seat. Check tube height which should be 37/64" over-all above gasket seat on top of body casting.

Pump Discharge Jets—Consists of a single die-casting with double discharge holes and is held in place by screw at top. When installing, make certain that gasket is in place under screw head, see that discharge holes are open and clean, check delivery hole position with special gauge tool M-64.

MODEL DO

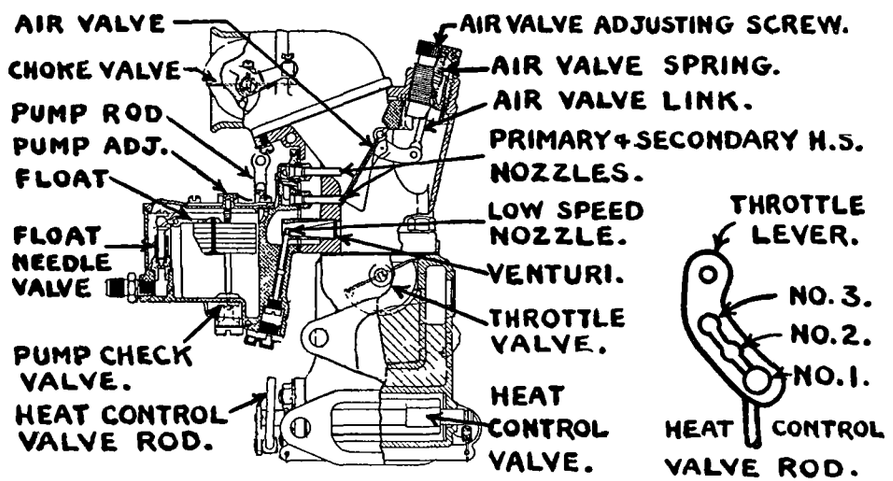
10-993—PONTIAC EIGHT, MODEL 302 (1932).

TYPE:—Air valve downdraft type with throttle operated accelerating pump and economizer and Marvel heat control (adjustable throttle control). Carburetor header in which throttle valve is located is divided by a central wall and a vane on the throttle valve so that fuel mixture is divided between the two sections of the intake manifold, each section supplying four cylinders (V or line 8 type engines). Header is jacketed for exhaust gas heating, the amount of exhaust deflected through the header jacket being controlled by the throttle operated heat control valve.

All jets are 'fixed' type and non-adjustable. Primary and secondary high speed jets or nozzles are located in upper part of mixing chamber above the air valve. Low speed or idling nozzle is located below the air valve in a venturi or fixed air opening. Automatic air valve is controlled by a dash pot plunger and spring assembled in the air valve adjusting screw.

ADJUSTMENT:—Heat control must be placed in No. 1 position (see instructions below) and engine thoroughly warmed up before adjustment is made. Make a preliminary adjustment of the air valve screw by turning screw in or out until end is flush with the end of the ratchet. With engine warm and running, close throttle and allow engine to idle. Adjust throttle stop screw so that idling speed is approximately 5-6 M.P.H. Turn air valve adjusting screw in or clockwise until engine begins to roll (rich mixture), then turn screw out or counter-clockwise until engine begins to miss (lean mixture), finally turn screw in slowly until engine fires smoothly. Check adjustment by quickly opening throttle about halfway and then closing it. If engine misses or stalls, setting is too lean and adjusting screw should be turned in slightly. If engine rolls, setting is too rich and adjusting screw should be turned out slightly. Final setting should be with adjusting screw approximately flush with the end of the ratchet.

ECONOMIZER:—All fuel for primary and secondary discharge nozzles is metered by metering pin jet. For all partial throttle positions (car speeds below 55-60 M.P.H.) the larger diameter section of the metering pin attached to the lower end of the accelerating pump plunger will partially close the metering pin jet and restrict the fuel flow. At high speed or with wide open throttle the metering pin will be pressed down so that a smaller diameter section is in the metering pin jet and the fuel flow will be increased. Economizer is not adjustable and does not require attention.



PERFORMANCE:—Carburetor performance should be satisfactory throughout entire driving range if air valve adjustment (above) is correct and heat control setting is correct. Jets should be changed only to compensate for high altitudes when car is operated permanently at elevations greater than 4000 feet. See Marvel Jet Specification table for standard and high altitude jet calibrations. Jet heights and clearances are shown in table below:

Carburetor	Jet Heights		
	Primary (with Jet)	Secondary (with Jet)	L.S. Standpipe
10-993	3 5/32"	2 29/32"	2 3/64"

ACCELERATING PUMP:—Accelerating pump plunger shaft and piston disc are forced down when throttle is opened, discharging a portion of the fuel in the pump chamber through the primary and secondary high speed jets. Some of the fuel is allowed to escape through holes in the disc into the upper pump cylinder. This fuel is discharged by the pump plunger which falls freely on the plunger shaft by reason of its weight, thus prolonging the pump discharge. The pump discharge is controlled by the check valve in the channel between the float chamber and the pump. When pump adjustment is in 'summer' position this check valve remains open so that the fuel discharged by the accelerating pump flows back into the float chamber. With pump adjustment in 'winter' position this check valve is closed so that pump discharges through the jets into the mixing chamber.

Adjustment:—Accelerating pump check valve control lever is located on float chamber cover adjacent to pump plunger shaft. Control lever should be turned so that pointer is opposite 'Winter' on cover for winter driving or cold temperature ranges. For summer driving pointer should be turned to 'Summer' position so that practically all the pump discharge is by-passed back to the float chamber.

FLOAT LEVEL:—Float level should be 15/32" below top edge of float chamber with cover and gasket removed. To check level, measure distance from top edge to top of float on mixing chamber side (away from needle valve).

HEAT CONTROL:—Heat control valve is operated by throttle valve lever so that heat control valve is always open with wide open throttle. Position of heat control valve (amount of heat) at closed throttle and rapidity with which valve opens is controlled by engagement of control valve operating rod on throttle valve lever. Control valve rod should be engaged in end hole on lever (No. 1 position) providing maximum heat for winter driving or cold weather. Center hole on lever (No. 2 position) should be used for moderate temperature ranges. Inner hole on lever (No. 3 position) should be used for extremely hot weather or high test gasoline.

CHOKE:—Choke valve is held in position on its shaft by a spring which will allow choke to open slightly against spring tension when engine begins to fire, preventing over-choking. Choke linkage should be adjusted so that choke valve is closed when choke control button is pulled all the way out and wide open when choke control button is pushed in.

MARVEL DOWNDRAFT CARBURETOR JET SPECIFICATIONS

			Standard Parts Nos.			High Alt. Parts Nos.							
Car Model	Yr.	Carb. No.	Metering Pin & Jet	Power Jet	Vac. Step-up Spring	Metering Pin & Jet	Power Jet	Vac. Step-up Spring	Main Nozzle	Idle Air Vent	Idle Tube Assembly	Float Valve & Seat	Pump Disch. Jet
BUICK 40	1934	(†)10-1633	280-1109	49-500-J	24-286	280-1107	49-450-J	24-286	47-115-D		49-578-K	233-525	49-24-N
BUICK 40 (A)	1937	BD1-10-1749	280-1107E	49-500-J	24-286	280-1105E	49-450-J	24-286	47-1115-F	—	49-578-K	233-525	49-24-N
BUICK 40 (B)	1937	BD1-10-1750	280-1103E	49-330-J	24-286	280-1101E	49-270-J	24-286	47-1115-F	—	49-578-K	233-525	49-24-N
BUICK 60, 80, 90 (A)	1937	BD1S-10-1751	280-1105E	49-460-J	24-286	280-1103E	49-400-J	24-286	47-1115-F	—	49-578-K	233-531	49-24-N
BUICK 60, 80, 90 (B)	1937	BD1S-10-1752	280-1104E	49-360-J	24-286	280-1101E	49-300-J	24-286	47-1115-F	—	49-578-K	233-531	49-24-N
BUICK 40 (C)	1938	CD1B-10-1796	173-105P‡	49-270-Z	24-286	173-106P‡	49-230-Z	24-448	47-534&5	—	229-525&6	233-537	49-116
BUICK 40 (D)	1938	CD1B-10-1797	173-106P‡	49-240-Z	24-286	173-107P‡	49-210-Z	24-448	47-534&5	—	229-525&6	233-537	49-116
BUICK 60, 80, 90 (C)	1938	CD2B-10-1798	173-101P‡	49-340-Z	24-461	173-103P‡	49-300-Z	24-286	47-563&4	—	229-525&6	233-538	49-134
BUICK 60, 80, 90 (D)	1938	CD2B-10-1799	173-102P‡	49-310-Z	24-461	173-104P‡	49-270-Z	24-286	47-563&4	—	229-525&6	233-538	49-134
CONT. FLYER	1933	10-1549	280-1105	49-450-J	24-275	280-1103	49-300-J	24-275	47-85-C	49-H-57	49-587-I	233-524	49-47
CONT. ACE	1933	10-1545	280-1109	49-290-F	24-225	280-1107	49-250-F	24-225	47-110-C	49-H-47	49-587-I	233-524	49-47
GRAHAM 80, 80A	1936	B2-SU-10-1673	280-1104F	49-460-T	24-275	280-1103F	49-390-T	24-275	47-85-C	49-63-H	49-578-S	233-524	49-28-R
GRAHAM 80, 80A (E)	1936	B2SU-10-1690	280-1104F	49-540-T	24-275	280-1103F	49-390-T	24-275	47-85-K	49-86-H	49-578-V	233-524	49-28-R
GRAHAM 90, 90A	1936	B2-10-1678	280-1109F	49-610-T	24-361	280-1107F	49-470-T	24-225	47-110-H	49-71-H	49-578-S	233-524	49-31-R
GRAHAM 90, 90A (F)	1936	B-2-10-1691	280-1110F	49-700-T	24-361	280-1108F	49-460-T	24-275	47-110-M	49-71-H	49-578-V	233-524	49-31-R
GRAHAM SC. 110	1936	B3-10-1680	280-1116F	49-660-T	24-225	280-1112F	49-500-T	24-225	47-125-J	49-71-H	49-578-S	233-527	49-31-R
GRAHAM SC. 110 (G)	1936	B3-10-1692	280-1112F	49-760-T	24-225				47-140-L	49-71-H	49-578-V	233-527	49-31-R
GRAHAM 85	1937	B2SU-10-1690	280-1104F	49-540-T	24-275	280-1103F	49-390-T	24-275	47-85-K	49-86-H	49-578-V	233-524	49-28-R
GRAHAM 95	1937	B2-10-1691	280-1110F	49-600-T§	24-275††	280-1108F	49-460-T	24-275	47-110-M	49-71-H	49-578-V	233-524	49-31-R
GRAHAM 116, 120	1937	B3-10-1744	280-1109F	49-730-T§§	24-275††	280-1107F	49-560-T	24-275	47-140-L	49-71-H	49-578-V	233-530	49-31-R
GRAHAM 96	1938-39	C2-10-1808	173-107T‡	49-360-Z	24-286	173-108T‡	49-340-Z	24-448	47-515	49-49-H	229-144	233-540	49-024-Z
GRAHAM 97	1938-39	C3-10-1809	173-103T	49-540-Z	24-261	173-104T‡	49-520-Z	24-286	47-562	49-75-H	229-144	233-540	49-024-Z
LA FAYETTE 110	1934	10-1603	280-1107	49-490-J	24-275	280-1106	49-450-J	24-371	47-1100-C	49-63-H**	49-578-I	233-524	49-31-P
LA FAYETTE 35, 3610 '34-36		10-1603	280-1107	49-490-J	24-275	280-1106	49-450-J	24-371	47-1100-C	49-63-H**	49-578-I	233-524	49-31-P
NASH Amb. 6 3820	1938	C2-10-1802	173-097S‡	49-560-Z	24-286	173-100S‡	49-500-Z		47-560	49-63-H	229-533‡‡	233-539	49-024-Z

(A) Std. Air Cleaner. Idle Control Jet 49-35-G, Bowl Feed Jet 49-110-M, and Nozzle Air Vent Jet 49-145-C-16 also used on these models.
(B) Heavy duty Air Cleaner. Same Idle Control Jet, Bowl Feed Jet, Nozzle Air Vent Jet as above.
(C) Standard Air Cleaner.
(D) Heavy Duty Air Cleaner
(E) After Engine No. 309995.
(F) After Engine No. 207235 (90), 215764 (90A).
(G) After Engine No. 108175.

** Idle Air Vent No. 49-47-H for high altitude operation.
† Bowl Feed Jet 49-110-M and Idle Control Jet 49-35-G also used.
†† 24-361 on first cars (should be changed to above type).
§ 49-700-T on first cars (should be changed to above type).
§§ 49-760-T on first cars (should be changed to above type).
‡‡ Idle Emulsion Tube & Collar No. 229-534 also used.
‡ Metering Pin only. Jet No. 84-502-G also used.

DUESENBERG, MODEL J (1931-32-33)

REO ROYALE EIGHT, MODELS 8-31, 35, 52 (1932), N-1, N-2 (1933)

STUTZ, MODEL DV-32 (1933)

TYPE:—Duplex or dual updraft air valve type with throttle operated accelerating pump. Main nozzle is located in venturi (fixed air intake) and is fed by fuel metered by lift needle valve. Needle valve lift lever is controlled by auxiliary air valve and needle valve is lifted in valve seat as air valve opens, permitting a greater fuel flow to the nozzle. For starting and warming up the dash control shifts the pivot upon which the lift lever rotates so that the needle valve is lifted, resulting in a richer mixture. There is an idle adjustment for each carburetor barrel and these adjustments must be carefully equalized when the carburetor is adjusted. On later models separate 'equalizing' adjustments are provided (see illustration). The range adjustment and power adjustment control both carburetor barrels.

IDLING ADJUSTMENT:—Engine must be thoroughly warmed up before adjustments are made. Each idling adjustment must be made separately. With the engine properly warmed up, disconnect spark plug wires leading to plugs in the four end cylinders (1, 2, 7, 8) and ground these leads to the engine block. Turn up the throttle stop screw (idling speed adjustment) slightly so that engine will not stall and allow engine to idle on the other four cylinders (3, 4, 5, 6). Retard spark, check idling adjustment by depressing air valve 1/32-1/16". If engine stops immediately, setting is too lean. If engine speeds up, setting is too rich. Adjust inner idling adjustment screw (controlling barrel feeding the four middle cylinders) and repeat test. With correct setting, engine should turn over several revolutions when air valve is depressed 1/32-1/16" before beginning to stop. Idling adjustment screw raises and lowers needle valve seat through a gear-and-worm engagement and should be turned clockwise for leaner mixture and counter-clockwise for richer mixture. After completing adjustment, connect spark plug wires on cylinders 1, 2, 7, 8 and disconnect spark plugs in cylinders 3, 4, 5, 6, grounding the cables to the engine block. Repeat the test as given above and adjust outer idling adjustment screw controlling the barrel feeding the end cylinders.

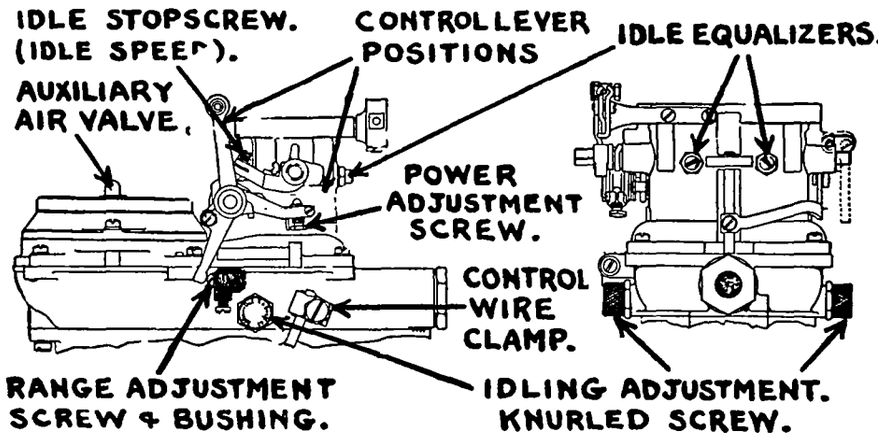
After adjusting each idling adjustment screw, connect all the spark plugs and idle the engine on all eight cylinders. Adjust throttle stop screw for correct idling speed (approximately 5-6 M.P.H.). With the engine idling at the correct speed and firing on all eight cylinders, check idling setting by depressing air valve 1/32-1/16". If setting is too rich, turn both idling adjustment screws in or clockwise slightly. If setting is too lean, turn both screws out or counter-clockwise slightly. Both screws should be turned the same amount (one or two notches) and the test repeated.

Idling Equalizers. On some models with the idling adjustment screws placed on the side of the carburetor barrel, as shown, or on the bottom of the carburetor body, equalizing adjustments are provided (see illustration). On Reo models where this adjustment is provided, the engine should be idled on four cylinders (as above) with throttle closed and spark advanced. After the idling adjustment for the barrel feeding the cylinders which are firing has been made (adjustment screws on bottom of carburetor are limited to less than one turn—do not try to force screws beyond this point), one of the disconnected spark plug wires should be arranged so as to form a small spark gap to the head and the engine speed noted by counting the number of sparks occurring in 30 seconds. The correct number of sparks should be 60 in 30 seconds and if the number counted is not within two of this figure, the lock nut on the equalizing adjustment should be loosened and the equalizing screw turned out or counter-clockwise to increase the number or in or clockwise to decrease the number. When the number of sparks is within two of the correct number (60 in 30 seconds) and the idling adjustment is correct, the second carburetor barrel should be adjusted in the same manner.

RANGE ADJUSTMENT:—This adjustment affects performance in the driving range (20-40 M.P.H.). Carburetor setting in this range is made leaner by turning the range adjustment screw to the left or counter-clockwise and richer by turning the screw to the right or clockwise. The correct factory setting is with the screw turned in so that the head of the screw is flush with the end of the bushing. Whenever the range adjustment is changed it will be necessary to check the idling adjustment.

POWER ADJUSTMENT:—On first models (without reference pin) correct setting of power adjustment screw is secured when the head of the screw is 7/32" from the arm in which the screw is mounted. On later models a reference pin is located at the side of the screw and the screw should be turned in so that the head of the screw is flush with the end of the pin. Power adjustment screw should be turned to the right or clockwise for a richer mixture and to the left or counter-clockwise for a leaner mixture. For high altitudes the power adjustment screw can be turned down (counter-clockwise to lean mixture) 3-5 turns.

ACCELERATING PUMP:—Accelerating pump is operated by the throttle lever and raises fuel in the pump cylinder when the throttle is opened. This fuel is discharged through a cross-passage to a port in the throat of the small venturi. Pump discharge is metered by the size of this cross-passage and the height of the pump overflow which permits excess fuel to flow back into the float bowl. Pump discharge can be changed only by changing the cross-passage and pump cylinder. Pump does not require attention.



FLOAT LEVEL:—Distance from top of float to carburetor body should be 25/64-27/64" with float needle valve seated. Float level can be changed by bending the float lever slightly.

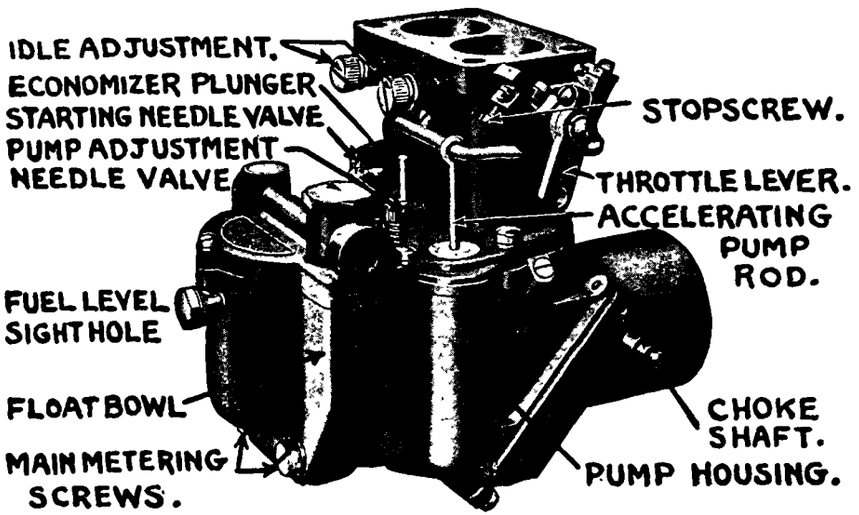
DASH CONTROL:—Dash control linkage should be adjusted so that control lever on carburetor is down as far as it will go when the dash control button on the instrument panel is pulled all the way out. When the control lever is up as far as it will go (running position) the dash control button should be slightly out from the instrument panel (1/16-1/8").

U-3—FRANKLIN, SERIES 16 (1932)
UU-3—DUESENBERG, SUPERCHARGED MODEL SJ (1933-37)

NOTE:—Model U-3 is single barrel, UU-3 dual or double barrel model. Both types adjusted alike except that only one idle adjusting screw used on U-3.

TYPE:—Twin updraft plain tube type with positively operated accelerating pump and economizer (connected to throttle lever) and auxiliary control needle valve connected to choke lever for starting. There are two carburetor barrels with independent main discharge jets, main metering jets, throttle valves, and idling adjustments. Throttle valves operate on the same shaft and will not require synchronization. All fuel for main discharge jets is metered by main metering jets under float bowl (except for high speed or wide open throttle operation). Metering jets are 'fixed' type. Idling adjstments and accelerating pump adjustment (needle valve type) are the only points requiring attention.

IDLING ADJUSTMENT:—Needle valve type operating on fuel mixture. There are two idling ports in each barrel. The upper idling port (controlled by idling adjusting screw) is above the throttle and supplies the fuel for idling with closed throttle. The lower idling port (non-adjustable) operates in conjunction with the upper port at low car speeds of approximately 10-18 M.P.H.



Adjustment:—Engine must be thoroughly warmed up before idling adjustment is made. With engine warm and running, close throttle and allow engine to idle (adjust throttle lever stop screw if necessary to keep engine running). Turn inner idling screw (toward engine) down until it seats, cutting off fuel supply for four cylinders and allowing engine to idle on remaining four cylinders. Adjust idling screw of the other carburetor barrel until engine fires smoothly. Then turn inner adjusting screw out until engine fires smoothly on all eight cylinders.

Idling adjustment can be made without cutting out four cylinders by adjusting each idling screw individually by turning idling screw in until engine begins to miss or is rough and then turning the screw out until engine fires smoothly. This point can also be determined by turning screw in until engine begins to miss and out until engine begins to roll and finally setting the screw midway between these points. Idling screws operate on fuel mixture and should be turned in to secure leaner mixture and out for richer mixture. Throttle lever stop screw should be readjusted after idling adjustment has been completed to secure correct idling speed if necessary.

HIGH SPEED ADJUSTMENT AND ECONOMIZER:—Main metering jets are of the 'fixed' type and not adjustable. Metering jet size is stamped on the outer face of the jet in decimal fractions of an inch. Jets should be changed only to compensate for special fuels or operating conditions, such as high altitudes.

Economizer is operated by accelerating pump lever. At all positions of partial throttle economizer needle valve will be closed so that all fuel for main discharge jets will be supplied by main metering jets. When the throttle is opened the pump lever depresses the economizer needle plunger, opening the economizer valve and allowing additional fuel to flow through the economizer by-pass jet to the main discharge jets. Economizer should not require adjustment but setting may be checked by noting throttle opening when economizer needle valve begins to open. To check, close throttle valve on drill rod of size indicated in table below, inserting drill between edge of throttle valve and carburetor wall, so that throttle is held open. Note whether economizer needle valve begins to open at this point.

Car Model	Economizer Setting (Throttle Opening)
Franklin 16	11/32" drill
Duesenberg SJ	5/32" drill

ACCELERATING PUMP (U-3):—Accelerating pump operated by lever on throttle shaft. When the throttle is opened the pump piston sleeve is forced down, discharging the initial quantity of fuel required for acceleration through the central hollow stud and the pump metering jet to the main discharge jet. At the same time the pump piston is forced down on the central stud, compressing the pump piston spring and the pump discharge is prolonged for several seconds by the piston returning to its seat at the top of the stud and discharging the remaining fuel in the pump chamber. Standard pump capacity in cubic centimeters (cc.) per 10 strokes of the pump plunger is 8-11 cc.

Adjustment:—Pump discharge is metered by pump reducer (pump metering jet). This jet is of the 'fixed' type and is not adjustable so that pump discharge can be changed only by replacing this jet. To determine whether pump discharge is satisfactory for the particular operating conditions of the engine, run engine until it is well warmed up, close throttle and allow engine to idle. Open throttle quickly and note engine performance. If engine hesitates or misses, pump discharge may be too small. If engine stumbles in picking up speed, pump discharge may be too large. A more satisfactory check may be made by running car at about 5 M.P.H. in high gear on a level road and noting performance when quickly accelerated.

ACCELERATING PUMP (UU-3):—Accelerating pump operated by throttle lever supplies an extra charge of fuel to the main discharge jet when the throttle is opened. Accelerating pump discharge is regulated by a needle valve in the pump discharge channel. Needle valve adjusting screw is located on float bowl cover adjacent to pump.

Adjustment:—Average setting for accelerating pump adjusting screw is ½ turn open (summer) to 3 turns open (winter). To check pump setting, run engine until well warmed up, close throttle and retard spark. Accelerate engine by opening throttle quickly and note engine performance. If engine hesitates, pump setting is too small and adjusting screw should be turned out slightly. If engine stumbles in picking up speed, pump setting is too large and adjusting screw should be turned down (or in) slightly. Check setting by operating car in high gear on a level road at approximately 5 M.P.H. and open throttle suddenly. Ir car hesitates, setting is too small. If car stumbles, setting is too large. This will be particularly noticeable as engine warms up.

FLOAT LEVEL (U-3):—Fuel level in float bowl set exactly 9/16" below top edge of float chamber (without gasket) when engine is not running. Float level can be changed to correct fuel level by bending float lever at the corner between the float and the needle valve. To check float level measure distance from gasket seat on float chamber cover (with gasket removed) to top of float at center. This distance should be 3/64" on all carburetors.

FLOAT LEVEL (UU-3):—Fuel level in float bowl must be even with bottom of the sight hole in the float chamber casting with the engine not running. To check fuel level, remove plug in sight hole directly above metering jets and see that fuel level is ¾" below top edge of float bowl or distance from top edge of float to gasket seat on cover is 15/64". Float level can be changed if necessary to correct fuel level by bending the float lever at the corner between the float and the needle valve.

CHOKE:—Choke valve linkage should be adjusted so that choke valve is closed tight when choke control button on instrument panel is pulled all the way out and wide open with choke control button pushed in. The choke valve is connected to an auxiliary control valve for starting. This linkage should be checked to see that clearance between choke lever cam and operating lever is sufficient so that needle valve is seated when choke valve is open. Auxiliary needle valve should start to open when choke valve is 10-15° from the wide open position.

UR-2—ROCKNE, MODELS 65, 75 (1932), 10-31 (1933).
STUDEBAKER SIX, MODEL 55 (1932), DICT. A (1934).
UR-23—STUDEBAKER DICTATOR, MODEL A (1934).
URO-2—AUBURN, MODEL 8-100 (1932), 8-101 (1933).
FRANKLIN, SERIES 16-B (1933), 19-A, B (1934).
FRANKLIN, SERIES 18 (1933), 18-B, C (1934).
GRAHAM STANDARD EIGHT, MODEL 67 (1934).

NOTE:—See separate articles on Stromberg Automatic Choke and Fast Idle mechanisms for complete data where they are used. Model UR-23 Studebaker Dictator fitted with built-in automatic choke and fast-idle. In all cases where fast-idle mechanisms are used, carburetor adjustments should not be made until engine is thoroughly warmed up and idling speed has returned to hot or 'slow' idle with choke valve wide open.

TYPE:—Plain tube updraft type with positively operated accelerating pump and vacuum economizer. Some models are fitted with a 'throttle-cracking' device connected to the choke valve lever for starting (see data below). Main discharge jet is air bled to control mixture so that fuel flow through jet is restricted at partial throttle (high vacuum) and increased at open throttle (low vacuum). All fuel for main discharge jet is metered by main metering jet under float bowl (except for high speed or open throttle when additional fuel is by-passed through economizer by-pass jet). Idle adjustment and accelerating pump adjustment (summer-normal-winter setting) are the only points requiring attention.

IDLING ADJUSTMENT:—Air bleed type operating on air. Engine must be thoroughly warmed up before idling adjustment is made. With engine warm and running, close throttle and allow engine to idle (adjust throttle lever stop screw if necessary to keep engine from stalling). Turn idling adjusting screw out until engine begins to hesitate or miss, then turn screw in until engine fires smoothly and maximum speed is attained. Idling screw operates on air and should be turned out for leaner mixture and in for richer mixture. After idling adjustment has been completed readjust throttle stop screw if necessary to secure correct idling speed.

If correct idling adjustment cannot be secured, take out idle discharge hole plug and clean out idling ports with compressed air. The idling tube can also be taken out and cleaned with air if the carburetor is disassembled.

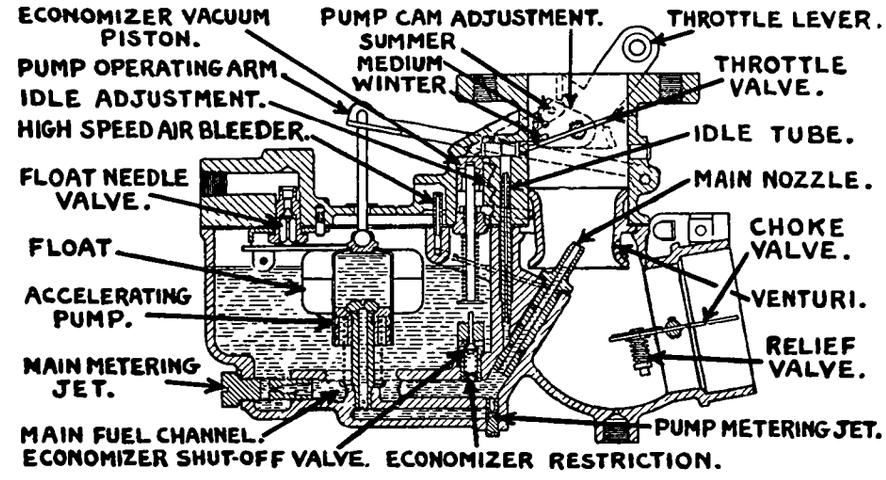
HIGH SPEED ADJUSTMENT AND ECONOMIZER:—Main metering jet is of the 'fixed' type and is not adjustable. Jet size is stamped on outer face of jet in decimal fractions of an inch. Jets should be changed only to compensate for special fuel or operating conditions of the engine such as high altitudes.

Economizer is controlled by a vacuum piston. At intermediate speeds below 60 M.P.H. or partial throttle positions, economizer valve remains closed so that all fuel for main discharge jet is metered by main metering jet. When the throttle is opened the economizer needle plunger is forced down, opening the economizer valve, and allowing additional fuel to flow through the economizer restriction (by-pass jet) to the discharge jet. Economizer is not adjustable and should not require attention.

ACCELERATING PUMP:—Accelerating pump is operated by a lever and cam on the throttle valve shaft. The pump reducer or metering jet located on the bottom of the carburetor meters the fuel discharged by the pump. Pump capacity in cubic centimeters (cc.) per 10 strokes, with pump adjustment set as indicated is given in table below.

Car Model	Carburetor	Pump Setting	Pump Capacity
Auburn 8-100, 101	URO-2	Maximum	10-14 cc.
Franklin 16, 18	URO-2	Maximum	10-14 cc.
Graham 67	URO-2	Maximum	13-17 cc.
Rockne 65, 75, 10-31	UR-2	Maximum	7-10 cc.
Studebaker 55, Dict. A	UR-2	Medium	7-10 cc.
Studebaker Dict. A	UR-23	Medium	7-10 cc.

Adjustment:—Pump operating cam on throttle valve lever has three holes to secure varied pump stroke. The center hole providing a medium pump stroke should be used for ordinary temperature ranges and ordinary gasoline. The upper connecting hole providing a minimum pump stroke should be used for hot weather or high test gasoline. Lower connecting hole providing maximum pump stroke should be used for very low temperatures.



FLOAT LEVEL:—Fuel level in float chamber is set at exactly 9/16" below the top edge of the float chamber (gasket removed) with engine not running. Float level can be changed to correct fuel level by bending float lever at the corner between the float and the needle valve. To check float level, measure distance from gasket seat on float chamber cover (gasket removed) to top of float at the center (when lever is attached to top of float) or to bottom of float at the center (where lever is attached to bottom of float). Models marked 'T' (top) and 'B' (bottom) in table below.

Car Model	Carburetor	Float Height
Auburn 8-100, 101	URO-2	9/32" (T)
Franklin, 16, 18	URO-2	1 11/32" (B)
Graham 67	URO-2	11/64" (T)
Rockne 65, 75, 10-31	UR-2	1 5/16" (B)
Studebaker 55	UR-2	23/64" (T)
Studebaker Dict. A	UR-2, UR-23	1 5/16" (B)

THROTTLE-CRACKING DEVICE:—On some URO-2 carburetors choke valve and throttle are connected so that throttle valve is opened slightly with choke valve fully closed to facilitate starting. This can be checked by fully closing choke valve and noting throttle position. To set 'throttle-cracking' linkage, insert a drill rod between the edge of the throttle valve and the carburetor barrel, close throttle against the drill, loosen adjusting screws on linkage, close choke tightly and tighten adjusting screws. Check adjustment to make certain that choke valve opens completely.

Car Model	Throttle-Cracking (drill size)
Auburn 8-100, 101	#56 drill
Graham 67	#58 drill go—#54 no go

CHOKE:—Choke valve is fitted with relief poppet valve to prevent over-choking. Adjust choke valve linkage so that choke valve is closed tightly with choke control button on instrument panel pulled all the way out and wide open with control button pushed all the way in.

HUPMOBILE EIGHT, C, L, 218, 221, 222-F, 226-I (1932)
HUPMOBILE EIGHT, 322-F, 326-I (1933), 422-F, 426-I (1934)
NASH, MODELS 980, 1080 (1932), 1180 (1933)
NASH, MODELS 990, 1090 (1932), 1190 (1933), 1290 (1934)
PIERCE ARROW EIGHT, MODELS 41, 42, 43 (1931), 54 (1932)
STUDEBAKER DICTATOR 8, MODEL 72 (1932)
STUDEBAKER COMMANDER 8, MODEL 82 (1932)
STUDEBAKER PRESIDENT 8, MODELS 81, 91 (1932)

TYPE:—Twin updraft type with accelerating pump and vacuum economizer. There are two carburetor barrels with independent main discharge jet assemblies and throttle valves (throttle valves operate on the same shaft so that synchronization of throttles is not necessary). Barrels are fed from the main metering jet channels so that all fuel for main discharge jets is metered by main metering jets (under float bowl) and controlled by the vacuum economizer. Main discharge jets are air bled (by tubes on discharge jets in mixing chamber) to control mixture so that fuel flow through jets is restricted at partial throttle (high vacuum) and increased at open throttle (low vacuum). An independent idle adjustment is provided for each carburetor barrel. The idle adjustment and accelerating pump adjustment are the only points requiring attention.

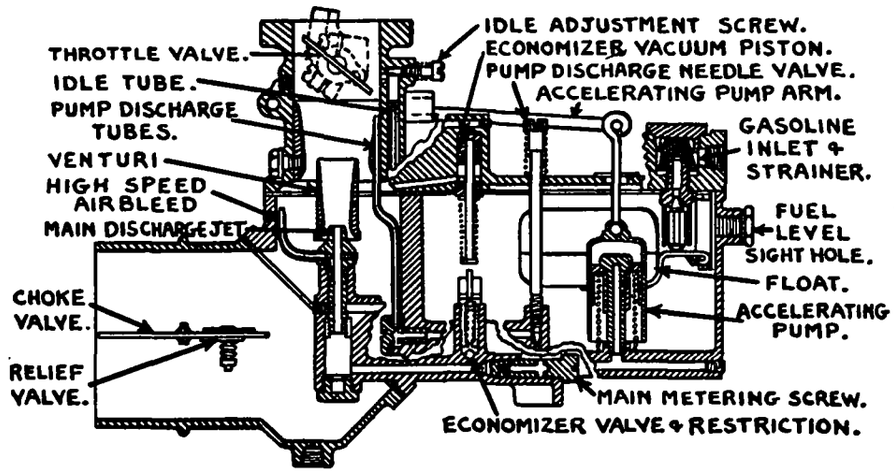
IDLE ADJUSTMENT:—Needle valve type operating on gasoline. There are two idle ports in each carburetor barrel, an upper port (controlled by idle adjustment needle valve) which supplies fuel for car speeds of 5-10 M.P.H. and a lower port (non-adjustable) which operates in conjunction with the upper port to supply fuel for car speeds of 10-20 M.P.H. Both idle ports operate in conjunction with the main discharge jet to supply fuel for speeds of 20 M.P.H. to appproximately 30 M.P.H. when all fuel is supplied by the main discharge jet.

Adjustment:—If carburetor is out of adjustment, turn both idling adjustment screws in until they seat and then back off 2 or 3 turns. Start engine and adjust throttle lever stop screw until engine runs at approximately 5-6 M.P.H. Run engine until it is thoroughly warmed up. Turn in idling screw on inner carburetor barrel until it seats. This will cut off fuel supply to four cylinders on eight cylinder engines so that engine will fire on four cylinders. Adjust idling screw of outer barrel until engine fires smoothly. Then turn out idling screw on inner barrel until engine fires smoothly on all eight cylinders. Readjust throttle lever stop screw if necessary to secure correct idling speed.

If is not desired to adjust one barrel at a time with engine firing on four cylinders, adjust each idling adjustment individually by turning idling screw in until engine begins to miss or is rough and then turn screw out until engine fires smoothly. This point can also be determined by turning screw in until engine begins to miss and then out until engine begins to roll. The correct setting should be midway between these points. Idling screws operate on gasoline mixture and turning screw in or clockwise causes a leaner mixture and out or counter-clockwise a richer mixture.

HIGH SPEED ADJUSTMENT AND ECONOMIZER:—Main metering jets are fixed and cannot be adjusted. Metering jet size is stamped on the outer face of the jet in decimal fractions of an inch. To determine whether jet size is too small for particular operating conditions of the engine, with engine running at speed above 20-30 M.P.H., gradually close choke valve and note whether engine speed increases. If engine picks up speed as choke is closed the main metering jet is clogged or is too small. Clean jet with compressed air and repeat test.

At speeds up to 60 M.P.H. vacuum in economizer piston chamber (chamber is connected to carburetor barrel) will be sufficient to hold piston up against economizer spring tension so that economizer valve will remain closed. At speeds of 60-70 M.P.H. the drop in vacuum will allow spring to force piston downward, opening economizer valve and allowing additional fuel to flow past the economizer valve seat and through the economizer jet to the main metering jet channels. Economizer does not require attention.



ACCELERATING PUMP:—Pump is operated through a cam-and-lever arrangement by the throttle shaft and discharges fuel through the pump discharge tube in each carburetor barrel when the throttle is opened. Pump discharge is controlled by an adjustable needle valve located in the pump discharge channel so that all fuel discharged by the pump passes through this valve. Standard pump capacity with adjustment needle valve open 2 turns is 16-19 cubic centimeters per 10 strokes. Pump travel is 21/32". Pump capacity on models which are not standard is given in table below.

Car Model	Pump Capacity	Pump Travel	Adjusting Valve
Hupmobile C, 226 ('32)	14-17 cc	½"	1¼ turn open
Hupmobile 222-F ('32)	14-18 cc	21/32"	1½ turn open
Hupmobile L (1932)	16-19 cc	½"	2 turns open
Hupmobile 322, 422	14-18 cc	21/32"	1 turn open
Hupmobile 326, 426	14-18 cc	21/32"	1 turn open
Nash 980, 1080, 1180	———	21/32"	2 turns open
Nash 8, 9, 10, 11, 1290	11-12 cc	21/32"	1⅛ turn open
Studebaker 62, 72 ('32)	11-13 cc	25/32"	¾ turn open
Studebaker 81, 91 ('33)	7-10 cc	25/32"	½ turn open

Adjustment:—Accelerating pump adjusting needle valve is located on float chamber cover directly below idling adjustments. Correct setting for normal conditions should be 1-1½ turns open. To check throttle pump setting, retard spark, run engine at idling speed and note performance when throttle is opened. If engine hesitates opening is too small and needle valve

should be backed out or opened slightly. If engine stumbles in picking up speed opening is too large and needle valve should be turned down slightly. Check adjustment by operating car at speed of 5 M.P.H. on level road in high gear. Open throttle suddenly and note performance. If car hesitates, setting is too small. If car stumbles, setting is too large. This will be particularly noticeable as engine warms up.

FLOAT LEVEL:—There is a float level sight hole closed by a plug on the side of the float chamber. With the engine not running gasoline level in float chamber should be even with the lower edge of the sight hole. To correct float level, take off top half of carburetor body by taking out body connecting screws and accelerating pump adjusting needle valve. To raise float level, bend float lever arm at the corner where it touches float and float needle valve so that float is raised the desired amount. To lower float level, hold float lever tight against needle valve and bend float downward. Top of float should be approximately 15/64" below top face of float bowl cover (gasket removed) with float needle seated.

CHOKE:—Choke valve is fitted with a relief poppet valve which opens when engine begins to fire so that engine will continue to run. Choke linkage should be adjusted so that choke valve is fully closed with choke button on instrument panel pulled all the way out and fully open when button is pushed all the way in.

STROMBERG UPDRAFT CARBURETOR JET SPECIFICATIONS

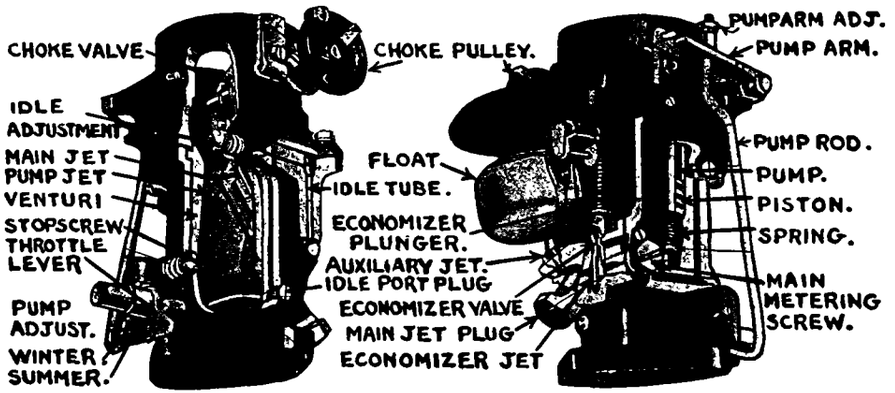
Car Model	Year	Carb. No.	Main Metering Jet Size	Main Metering Jet Part No.	By-Pass Jet Size	By-Pass Jet Part No.	Main Disc. Jet Size	Main Disc. Jet Part No.	H. S. Bleeder Size	H. S. Bleeder Part No.	Idle Tube Size	Idle Tube Part No.	Pump Reducer or Discharge Tube Size	Pump Reducer or Discharge Tube Part No.
AUBURN 8-100, 101	1932-3	URO-2	.063"	P-12512	.030"	P-15405	#26	P-15376	#70	P-15379	#68	P-15375	#59	P-17144
CUNNINGHAM V-9,10	31-34	UUR-2	.054"	P-15494	Red.	#70	P-13127	#30	P-13829	#70	—	#70	P-15476	#65	P-15491
DUESENBERG SJ	'33-37	UU-3	.060"	P-13395L	.045"	P-12768	A26-B18	P-15764	#54	P-12359	#68	P-15775	#65	P-15491
FRANKLIN 16	1932	U-3	.073"	P-12512	.049"	P-12768	A34-B28	P-14739	#64	P-12870	#68	P-12744	#57	P-14053
FRANKLIN 16B, 18	1933	URO-2	.064"	P-12512	.030"	P-15405	#24	P-15376	#70	P-15379	#68	P-15375	#60	P-15749
FRANKLIN 18, 19	1934	URO-2	.064"	P-12512	.030"	P-15405	#24	P-15376	#70	P-15379	#68	P-15375	#60	P-15749
GRAHAM 67 Std. 8	1934	URO-2	.061"	P-15384	.056"	P-15405	#30	P-19513	#56	P-15379	#68	P-15375	#56	P-19515
HUPMOBILE 222-F	1932	UUR-2	.044"	P-15494	.028"	P-15405	#30	P-13829	#70	—	#70	P-15476	#70	P-15491
" I-226	1932	UUR-2	.047"	P-15494	.020"	P-15405	#28	P-13829	#70	—	#70	P-15476	#70	P-15491
HUPMOBILE "F"	1933	UUR-2	.043"	P-15494	.020"	P-15405	#28	P-13829	#70	—	#70	P-15476	#70	P-15491
" I-326, 426	1933-4	UUR-2	.047"	P-15494	.020"	P-15405	#28	P-13829	#70	—	#70	P-15476	#70	P-15491
NASH 9,10,1190	1932-33	UUR-2	.047"	P-15494	.050"	P-15405	#30	P-13829	#70	—	#70	P-15476	#70	P-15491
" 9-80	1932	UUR-2	.043"	P-13395	.042"	P-15405	#40	P-13829	#70	—	#70	P-15476	#74	P-15491
" 10-80, 11-80	1932	UUR-2	.047"	P-15494	.050"	P-15405	#40	P-13829	#70	—	#70	P-15476	#74	P-15491
NASH 1290	1934	UUR-2	.049"	P-15494	.050"	P-15405	#30	P-13829	#70	—	#70	P-15476	#70	P-15491
PIERCE ARROW 41,2,3	1931	UUR-2	.050"	P-15494	Red.	#68	P-13127	#30	P-13829	#70	—	#70	P-16135	#65	P-15491
PIERCE ARROW 54	1932	UUR-2	.050"	P-15494	.093"	P-15405‡	#30	P-13829	#70	—	#68	P-16135	#65	P-15491
ROCKNE 65, 75	1932	UR-2	.054"	P-15384	.036"	P-15405	#32	P-15376	#65	P-15379	#68	P-15375	#70	P-15857
ROCKNE 10-31	1933	UR-2	.054"	P-15384	.036	P-15405	#32	P-15376	#65	P-15379	#68	P-15375	#68	P-15870
STUDEBAKER 55	1932	UR-2	.054"	P-15384	.036"	P-15405	#32	P-15376	#65	P-15379	#68	P-15375	#70	P-15857
" 62,71	1932	UUR-2	.046"	P-15494	Red.	#72	P-13127	#30	P-13829	#70	—	#70	P-15476	#65	P-15491
" 81, 91	1932	UUR-2	.050"	P-15494	Red.	#70	P-13127	#30	P-13829	#70	—	#70	P-15476	#65	P-15491
STUDEBAKER Dict. A	1934	UR-23	.054"	P-15384	.036"	P-15405	#32	P-15376	#65	P-15379	#68	P-18971	#68	P-15870
" A	1934	UR-2	.054"	P-15384	.036"	P-15405	#32	P-15376	#65	P-15379	#68	P-15375	#68	P-15870

‡—#68 Part No. 13127 Reducer also used.

DXR-2—HUPMOBILE SIX, SERIES 216 (1932).
NASH EIGHT, MODEL 9-70 (1931-32).
DXR-3—CHRYSLER EIGHT, MODEL CP (1932).
DODGE EIGHT, MODEL DK (1932).

TYPE:—Plain tube downdraft type with positively operated accelerating pump and vacuum controlled economizer. Main discharge jet is located at an angle in the venturi and is air bled by means of a high speed air bleed tube mounted vertically on the jet near the tip. Main metering jet is located under float chamber and meters all fuel for main discharge jet except for high speed or wide open throttle operation (when economizer by-pass jet valve is open). Idle adjustment and accelerating pump adjustment (summer and winter setting) are the only points requiring attention.

IDLE ADJUSTMENT:—Needle valve type operating on air. Engine must be thoroughly warmed up before adjustment is made. With engine warm and running, close throttle and allow engine to idle. Adjust idling adjustment screw until engine fires smoothly and speed is at maximum for the throttle position (turn idling screw out until engine begins to miss and then turn screw in until engine fires smoothly). Idling screw operates on air and should be turned out or counter-clockwise for leaner mixture and in or clockwise for richer mixture. Adjust throttle lever stop screw after completing idling adjustment, if necessary, to secure correct idling speed.



NOTE:—If correct idling adjustment cannot be secured take out idle discharge plug and blow out idle ports with compressed air. The idling tube can also be removed and cleaned with compressed air if carburetor is disassembled.

HIGH SPEED ADJUSTMENT AND ECONOMIZER:—All fuel metered by main metering jet and auxiliary jet. Jets are "fixed" type and not adjustable. Jet size is stamped on outer face of jet in decimal fractions of an inch. Jets should not be changed except to compensate for special fuels or operating conditions, such as high altitude.

Economizer needle valve remains closed, preventing any fuel flowing through economizer restriction (by-pass jet) for partial throttle operation. At high speed or wide open throttle the drop in vacuum will allow the economizer plunger spring to force the plunger down, opening the economizer needle valve, and allowing additional fuel to flow through the by-pass jet to the main discharge jet. Economizer is not adjustable and does not require attention.

ACCELERATING PUMP:—Pump is similar in design to that used on 'U' type carburetors except that pump lever is positively connected to throttle lever and operates when throttle is opened. Throttle valve plate has two (DXC) or three (DXR) holes for engagement of pump operating rod to provide varied pump stroke. Center hole providing medium pump stroke should be used for standard gasoline and normal temperature ranges. Engage pump rod in end hole (right hand) to provide minimum pump stroke for summer operation in hot climates. Engage pump rod in end hole (left hand) to provide maximum pump stroke for winter operation or extremely cold temperatures. The nut on the upper end of the pump rod is used to adjust the automatic shut-off valves on the Model DXC-3 carburetors.

Pump Capacity (CC. per 10 strokes)

Car Model	Carburetor	Pump Capacity	Setting
Chrysler CP	DXR-3	25 cc.	Maximum
Dodge DK	DXR-3	25 cc.	Maximum
Hupmobile 216	DXR-2	15-17 cc.	Medium
Nash 9-70	DXR-2	27 cc.	Medium

FLOAT LEVEL:—Fuel level in float bowl is set at 5/8" below the top edge of the float chamber with engine not running. To check float level with carburetor disassembled, measure distance from gasket seat on float bowl cover (with gasket removed) to top of float at center. This distance should be 13/64". Float level can be changed by bending float lever at the corner between the float and the needle valve. To lower float level, bend float down. To raise float level, hold lever tight against needle valve and bend float up toward cover.

CHOKE:—Choke valve is fitted with a relief poppet valve which will open when engine begins to fire. Adjust choke linkage so that choke valve is fully closed when choke button on instrument panel is pulled all the way out and wide open when choke button is pushed all the way in.

STROMBERG DOWNDRAFT CARBURETOR TYPE DX & DD JET SPECIFICATIONS

Car Model	Year	Carb. No.	Main Metering Jet Size	Main Metering Jet Part No.	Aux. Metering Jet Size	Aux. Metering Jet Part No.	By-Pass Jet Size	By-Pass Jet Part No.	Main Disc. Jet Size	Main Disc. Jet Part No.	H. S. Bleeder Size	H. S. Bleeder Part No.	Pump Nozzle Size	Pump Nozzle Part No.
CHRYSLER CP	1932	DXR-3	Blank	P-16400	.066"	P-16232	.063"	P-16403	#33	P-16319	#60	P-12870	#68	P-14786
" CH, CL	1932	DD-3	Blank	P-13395	.056"	P-16362	.040"	P-12465	—	—	#70	P-14334	#66	P-14786
DODGE DK	1932	DXR-3	Blank	P-16400	.058"	P-16362	.024"	P-16403	#33	P-16319	#65	P-12870	#68	P-15879
HUPMOBILE 216	1932	DXR-2	.030"	P-12512	.052"	P-16362	.034"	P-15405	#33	P-16319	#60	P-12870	#70	P-15879
LINCOLN V-8	1931	DD-3	.043"	P-15926	#70	—	.046"	P-15927	—	—	#70	P-14334	#68	P-14786
" V-8	1931	DD-3	.030"	P-15926	.054"	—	.046"	P-15927	—	—	#70	P-14334	#68	P-14786
" V-8	1932	DD-3	.030"	P-15926	.044"	P-15432	.046"	P-15927	—	—	#70	P-14334	#68	P-14786
" V-12	1932-3	DD-3	Blank	P-15926	.058"	P-16362	.046"	P-15927	—	—	#60	P-14334	#68	P-14786
MARMON 16	'31-33	DDR-3	.050"	P-13395L	—	—	—	P-15405	#33	P-14332	#70	P-14334	#66	P-15879
NASH 9-70	1931	DXR-2	.034"	P-12512	.048"	P-16362	.034"	P-15405	#33	P-16319	#56	P-12870	#68	P-15879

DD-3—CHRYSLER, IMPERIAL EIGHT MODEL CH (1932)
CHRYSLER CUSTOM IMPERIAL, MODEL CL (1932).
LINCOLN V-8 MODEL (1931). V8 MODEL (1932-33).
LINCOLN MODEL V12 (1932), V-12-145 (1933).
DDR-3—MARMON, SIXTEEN CYLINDER MODEL (1931-32-33).

TYPE:—Dual barrel plain tube downdraft type with vacuum controlled accelerating pump and economizer. There are two carburetor barrels with independent main metering jets, auxiliary jets (Lincoln), main discharge jets, throttle pump jets, throttle valves and idling adjustments. Throttle valves operate on separate shafts and are geared together so that both throttles are operated by a lever on one shaft (throttle valves will not require adjustment until factory setting has been tampered with). Main metering jets and auxiliary jets (when used) are located at bottom of float chamber and meter all fuel flowing to main discharge jets except for high speed or wide open throttle operation (when economizer will by-pass additional fuel). Main discharge jets are mounted at an angle in the venturi and are air bled by high speed air bleed tubes mounted vertically on the jets near the tip. Idle adjustments and accelerating pump adjustment are the only points requiring attention.

IDLING ADJUSTMENT:—Needle valve type operating on air. Engine must be thoroughly warmed up before idling adjustment is made. With engine warm and running, close throttle and allow engine to idle. Adjust inner idling adjusting screw (left hand) until fastest and smoothest running position is found (turn screw out until engine begins to hesitate or miss and then turn screw in until engine fires smoothly). Adjusting screws operate on air and should be turned out for leaner mixture and in for richer mixture. Adjust outer or right hand idling adjustment screw controlling the other carburetor barrel similarly. If necessary readjust inner idling screw slightly to secure smooth running. Idling adjustments should be set slightly rich. Correct idling adjustment cannot be secured if throttles are not synchronized. If engine does not fire smoothly with both idling adjustments correctly set, the adjusting screw on the right hand barrel throttle shaft should be turned clockwise to open right hand barrel throttle valve, or counter-clockwise to close throttle valve (relative to throttle valve in left hand barrel). It will not be necessary to change this adjustment unless factory setting has been tampered with. After idling setting has been completed, adjust throttle lever stop screw, if necessary, for correct idling speed.

On engines with two ignition coils where ignition for four cylinders or one bank of 'V' type engines is provided by one coil, ignition can be cut off for the cylinders fed by one carburetor barrel by disconnecting one coil primary lead or grounding the coil high tension lead to the engine block. The engine will then idle on the remaining cylinders fed by the second carburetor barrel and the idling adjustment for this barrel can then be made. After each carburetor barrel has been adjusted in this manner, engine should be idled on all cylinders and any necessary readjustment made to secure smooth running.

If correct idling adjustment cannot be secured, remove idle discharge plugs and blow out idle ports with compressed air. Idling tubes can also be removed and cleaned with compressed air if carburetor is disassembled.

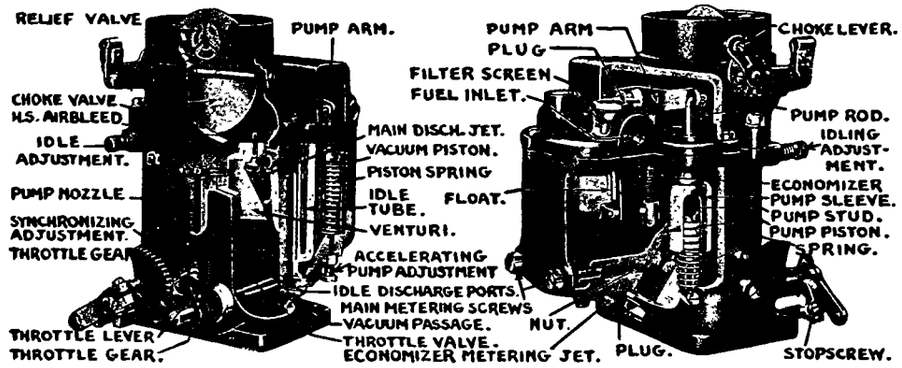
HIGH SPEED ADJUSTMENT AND ECONOMIZER:—All fuel for speeds up to approximately 60 M.P.H. is metered by main metering jet or main metering jet and auxiliary jets on Lincoln. Jets are of the 'fixed' type and are not adjustable. Jet size is stamped on outer face of jet in decimal fractions of an inch. Jet sizes should be changed only to compensate for fuel changes or operating conditions, such as high altitude. Lincoln jets have been changed in service and on some models main metering jet is plugged and all fuel is metered by auxiliary jets in bottom of float chamber (see Lincoln Specifications below).

At car speeds up to approximately 60 M.P.H. economizer needle plunger is held against its seat by the tension of the spring on the plunger so that no fuel can flow through by-pass jet (economizer restriction) and all fuel for main discharge jets is metered by main metering jets and auxiliary jets. At speeds above 60 M.P.H. or with wide open throttle, the drop in vacuum in the vacuum piston chamber will allow the vacuum piston spring to force the piston up, depressing the economizer needle plunger, opening the economizer valve and permitting additional fuel to flow through the by-pass jet to the main discharge jets. Economizer is not adjustable.

ACCELERATING PUMP:—Accelerating pump design and operation is exactly the same as on 'D' type carburetors (see article on DX-3 Carburetor) except on Marmon Model DDR-3, where accelerating pump is positively connected to throttle shaft lever. Pump capacity in cubic centimeters (cc.) per 10 strokes is given in table below:

Car Model	Carburetor	Pump Capacity	Pump Stroke
Chrysler CH, CL	DD-3	20 cc.	23/64"
Lincoln V-8	DD-3	25 cc.	23/64"
Lincoln V-12	DD-3	22 cc.	23/64"
Marmon 16	DDR-3	25 cc.	¾"

Adjustment:—For all DD Carburetors. Accelerating pump stroke is adjustable by means of an adjusting screw and lock nut on the bottom of the vacuum piston housing. Pump stroke is set for normal operating conditions at the factory. To increase pump stroke for cold weather operation, loosen lock nut and turn adjusting screw down or counter-clockwise. To decrease pump stroke for hot weather, loosen lock nut and turn adjusting screw up or clockwise. Tighten lock nut after making adjustment. To check pump setting, run engine at idling speed with retarded spark, open throttle quickly and note engine performance. If engine hesitates, pump stroke should be increased by turning adjusting screw down slightly. If engine stumbles in picking up speed, pump stroke should be decreased by turning adjusting screw up slightly. In making this adjustment, adjusting screw should be changed one turn at a time and setting checked. A more satisfactory test can be made by running the car in high gear on a level road at approximately 5 M.P.H. and noting performance when quickly accelerated.



FLOAT LEVEL:—Fuel level in float bowl is set exactly 1" below top edge of float chamber on Chrysler models. To check float level with carburetor disassembled, measure distance from gasket seat on float bowl cover (with gasket removed) to the top of the float at the center. Correct setting should be 13/32" (Chrysler) or 15/32" (Lincoln). Float level can be corrected by bending float lever at the corner between the float and the needle valve.

CHOKE:—Choke valve is fitted with a relief poppet valve which opens when engine begins to fire. Choke linkage should be adjusted so that choke valve is fully closed with choke button on instrument panel pulled all the way out and wide open with choke button pushed all the way in.

LINCOLN SPECIFICATIONS:—On 1931 Lincoln carburetors main metering jet size was changed from .043 to .030. The Lincoln factory advised that on early carburetors (marked .043) where trouble was experienced, the hole in end of the main metering jets should be closed with solder and the auxiliary jets changed from .070 to .054 (auxiliary jets are located in the bottom of float chamber under float). Main discharge jet plugs were also replaced with a plug having a tube extending down into the well. This change was made by replacing the retainer plug with one threaded on the inside so that the main discharge jet tube could be screwed in place. These tubes were drilled with a #60 hole on the side directly below the threaded end. First cars equipped with the discharge jet tubes did not have this hole and these tubes should be replaced where vapor lock is experienced. Lincoln Part Nos. for these parts are as follows:

Main Discharge Jet Retainer Plug.....Part K-2222—2 required.
Main Discharge Jet Tube (#60 hole).....Part K-2223—2 required.
Auxiliary Metering Jet (Size .054).....Part K-2189—2 required.

On 1932 Lincoln models the carburetor used on the V-8 engine is equipped with main metering jets and auxiliary jets in the bottom of the float chamber. On the V-12 model the main metering jets are replaced with blank plugs (not marked) and all fuel is metered through the auxiliary jets (called main metering jets).

EX-2—AUBURN TWELVE, MODEL 12-160 (1932).
AUBURN TWELVE, MODEL 12-161 (1933).
AUBURN TWELVE, MODEL 12-165 (1933).

TYPE:—Twin installation consisting of two single barrel, downdraft, plain tube carburetors with inter-connected throttle and choke controls. Each carburetor supplies one bank of the 'V' type engine. Carburetors are similar to other 'E' type carburetors in design, operation and adjustment except that throttles must be synchronized as part of idle adjustment and choke control must be adjusted so that both choke valves open and close together.

IDLE ADJUSTMENT:—Throttle shaft connecting throttles of right and left hand carburetors is provided with an adjustment so that throttles can be synchronized. This is part of idling adjustment. Engines must be warmed up before idling adjustment is made. With engine warm and running, close throttle, disconnect primary lead of coil supplying ignition for right hand cylinder bank (or ground high tension lead to engine), adjust throttle lever stop screw of left hand carburetor so that engine idles somewhat fast, unlock adjusting screw at right hand end of throttle connecting shaft, back out adjusting screw and throttle lever stop screw of right hand carburetor until throttle valve of right hand carburetor is closed, then adjust idling adjusting screw of left hand carburetor by turning screw in or out until smoothest running position is found. Idling screw operates on fuel mixture and should be turned in to secure leaner mixture and out for richer mixture. Then unlock adjusting screw at left hand end of throttle connecting shaft and turn screw out until compression of spring under this screw is sufficient to hold right hand carburetor throttle valve closed, lock adjusting screw. Connect ignition for right hand cylinder bank and disconnect ignition for left hand bank. Adjust throttle lever stop screw of right hand carburetor for correct engine speed, adjust idling screw of right hand carburetor by turning screw in or out until smoothest running position is found. Then turn up adjusting screw at right hand end of connecting shaft until it just touches the throttle lever. Note speed of right hand cylinder bank, cut off ignition for right hand bank, connect ignition for left hand bank and note idling speed. If speed is not the same for both banks this should be equalized by turning throttle lever stop screws on each carburetor, being careful that the adjusting screw at the right hand end of the connecting shaft is in contact with the throttle lever at all times. After adjustment is completed this screw should be locked.

1933 Auburn Model 12-165. On this model a new type throttle connecting shaft is used consisting of an independently mounted cross shaft connected to the throttle valve of each carburetor through a short adjustable rod with ball and socket connections. On this type throttles are synchronized by increasing or decreasing the length of the left hand rod (adjusting the idle for each bank separately as above).

HIGH SPEED ADJUSTMENT AND ECONOMIZER:—Metering jets are of the 'fixed' type and are not adjustable. See Stromberg Jet Specification table for standard jet sizes. Jets should be changed only to compensate for special operating conditions such as high altitudes or special fuels.

Economizer is built in lower end of accelerating pump and is operated by pump piston as in other 'E' type carburetors. Economizer should not require adjustment but setting can be checked by noting throttle opening at instant pump piston rests on seat of economizer by-pass jet (less over-travel). Throttle opening should be 3/8". Check by inserting 3/8" drill rod between edge of throttle valve and carburetor wall. Pump must be set for maximum stroke.

ACCELERATING PUMP:—Similar in design and operation to pump used on other 'E' type carburetors. Throttle shaft lever has two holes for engagement of pump rod to provide for varied pump stroke. Pump rod should be connected in inner hole (shorter radius) providing shorter pump stroke for normal temperatures or summer operation. Outer hole (longer radius) providing maximum pump stroke should be used for winter operation.

Pump capacity should be 11-14 cubic centimeters for 10 strokes with pump set for maximum stroke (winter setting).

FLOAT LEVEL:—Fuel level in float chamber is set at exactly 9/16" below top edge of float bowl with gasket removed. Float level can be changed to correct fuel level by bending float lever at the point where it is connected to the float.

CHOKE:—Choke valves must be synchronized so that they open and close together. With choke valves wide open and choke control button pushed in toward dash, connect choke control operating wire securely to each choke valve lever. Pull out control button to limit of travel and see if both choke valves are closed tightly. If one valve is not closed, loosen the clamp screw, close choke valve tightly and tighten screw.

EX-2—PIERCE ARROW 12, MODELS 51, 52, 53 (1932).
EX-32—PIERCE ARROW 12, MODELS 1236, 42, 47 (1933), 1240A, 48A (1934), 1245, 55 (1935), 1602, 3 (1936), 1702, 3 (1937), 1802, 3 (1938).

This is a double installation with one carburetor being used for each cylinder bank (Twelve cylinder, Vee type engine). Carburetors are fitted with Fast Idles and Automatic Choke.

TYPE:—Single barrel, plain tube, downdraft type. Design and operation entirely similar to other 'E' type carburetors. Special adjustment instructions are necessary in order to equalize idle setting and idle speed on each carburetor and to synchronize throttle valves and choke valves. Complete directions are given below. Engine must be warmed up so that choke valve is wide open and engine idling at hot or slow idling speed when adjusting.

IDLING ADJUSTMENT:—Adjust one carburetor at a time. Cut out the six cylinders of the other bank by grounding the high tension lead of the coil firing that bank. Idle adjustment screw controls fuel mixture (turn screw in or clockwise for leaner mixture, out or counter-clockwise for richer mixture). Turn adjusting screw on carburetor feeding cylinders which are firing in or out until engine fires smoothly. Then check idling speed by taking out plug in exhaust manifold and counting explosions or form small gap by disconnecting one high tension lead at spark plug and count sparks. Adjust throttle lever stopscrew so that there are 37-39 explosions in 15 seconds. Recheck idling adjusting screw setting (this must be reset if idling speed has been changed). After adjusting each carburetor for smoothest firing position of idling screw and correct idling speed of 37-39 explosions in 15 seconds, connect both coils, idle engine on all twelve cylinders and check throttle valve synchronization.

Throttle Valve Synchronization—Use mercury tube equalizing gauge, Pierce Arrow Part #HMJ-477, or pull throttle open slightly and note whether both throttle valves leave the idle stop at the same instant. If they do not, turn the adjusting screw located on the upper right hand side of the cross shaft connecting the two carburetor throttle valves in or out until throttles open simultaneously (if throttles do not open together the increased tension on the rod as the second throttle begins to open can be felt.

HIGH SPEED ADJUSTMENT AND ECONOMIZER:—Metering jets are of the fixed type and are not adjustable. See Stromberg Jet Specification Table.

Economizer is built in lower end of accelerating pump and is operated by pump piston as in other 'E' type carburetors. Economizer should not require adjustment but setting can be checked by noting throttle opening at point where pump piston rests on seat of economizer by-pass jet (less over-travel). Check by inserting drill rod of size noted in table below between throttle valve edge and carburetor wall. Pump must be set for maximum stroke.

Carburetor Model	Economizer Setting
EX-2	3/8"
EX-32	27/64"

Adjustment—Take out cotter pin and turn adjusting nut at top of pump piston stem. See that cotter pin replaced to lock adjustment.

ACCELERATING PUMP:—Adjustable in usual manner by shifting pump rod to inner or outer hole in throttle valve lever. Use inner hole for normal summer temperatures and outer hole, providing maximum pump stroke, for winter temperatures. See tune up instructions on car model page for recommended settings. Pump capacity in cc. per 10 strokes with pump set for maximum or minimum stroke is noted below.

Carburetor	Pump Capacity	Pump Setting
EX-2	11-14 cc	Maximum
EX-32	12-14 cc	Minimum

FLOAT LEVEL:—Fuel level in float bowl is set at 9/16" below top edge of bowl. Adjustable by bending lever at point where it is attached to the float.

Needle Valve & Seat Assembly:—Furnished only as matched sets.

Carburetor	Part Number	Size
EX-2	P-17237	.130"
EX-32	P-18913-K	.113"

CHOKE:—Type 'C' automatic choke control is used (see separate article). Choke valve fitted with relief poppet valve to prevent over-choking. Check choke valves to see that both valves are fully closed for cold starting (if one valve is not closed, loosen clampscrew, close valve, tighten clampscrew).

THROTTLE VALVE SETTING:—Throttle valve type and setting shown in table below. Upper lip of throttle valve should be this distance below lower edge of upper idle port with valve fully closed.

Carburetor	Throttle Valve	Setting
EX-2	P-6454—18½°	.012"
EX-32	P-5436—20°	.012"

SERVICE PARTS:—Gasket Set—J-4364G.

E-2—NASH, MODELS 9-70 (1931), 10-60 (1932).
EC-2—OLDSMOBILE, MODEL F-32 (1932).
EC-22—OLDSMOBILE, MODEL F-33 (1933).
EX-2—REO FLYING CLOUD, MODEL S-1 (1932).
EX-22—AUBURN, MODEL 653 (1935)—LATER CARS.
AUBURN SIX, MODEL 654 (1936-37)
DODGE, MODELS DP (1933), DR, DS (1934), DU (1935).
GRAHAM SIX CYLINDER, MODELS 68 (1934), 74 (1935).
NASH, MODELS 11-20, 11-30 (1933), '400' SERIES 35, 36-40 (1935-36).
OLDSMOBILE, MODELS F-34 (1934), F-35 (1935).
STUDEBAKER, MODEL 56 (1933).
EX-32—AUBURN, MODELS 8-105 (1933), 850-X (1934), SUPERCHGD. 851 (1935).
AUBURN SUPERCHARGED MODEL 852 (1936-37)
CHRYSLER, MODELS CO, CT, CQ (1933), CU (1934), CZ, C1 (1935).
GRAHAM SUPERCHARGED, MODELS 67, 69 (1934), 75 (1935).
HUPMOBILE, MODELS 417-W, 421-J (1934), 517-W, 521-J (1935).
NASH TWIN IGNITION SIX, MODELS 12-20 (1934), 3520 (1935).
NASH AMBASSADOR SIX, MODEL 3620 (1936), 3720 (1937)
REO FLYING CLD., MODELS S-2, 3, 4 (1932-33-34), ROYALE S-7 (1935).

NOTE:—Where Automatic Chokes or any type fast-idle mechanism is used, see separate articles for complete data. In all cases where fast-idle mechanisms are used, carburetor adjustments should not be made until engine is thoroughly warmed up and idling speed has returned to hot or 'slow' idle with choke valve wide open. Adjustments on the Supercharged Auburn and Graham models are made in same manner as on other car models.

TYPE:—Plain tube downdraft type with positively operated accelerating pump and economizer (connected to throttle valve). Main discharge jet is located at an angle in the venturi and is air bled by means of an air bleed hole drilled in the auxiliary venturi support. Main metering jet is located directly under main discharge jet and meters all fuel for discharge jet. Accelerating pump and economizer discharge fuel into mixing chamber through pump discharge nozzle located within primary venturi. Idling adjustment and accelerating pump adjustment (summer and winter setting) are the only points requiring attention.

IDLING ADJUSTMENT:—Needle valve type controlling fuel mixture (screw turned in for leaner mixture and out for richer mixture). Engine must be thoroughly warm and idling at slow or hot idle speed with choke valve wide open when adjustments are made. With engine warm, close throttle, adjust throttle lever stopscrew until engine speed is approximately 6-7 M.P.H. Turn idling adjustment screw in or clockwise until engine lags or fires irregularly, turn screw out until engine begins to roll, then turn screw in slowly until engine fires smoothly and speed is at maximum. Check idling speed, and, if necessary, readjust throttle stopscrew. See tune-up data on each car model page for complete instructions.

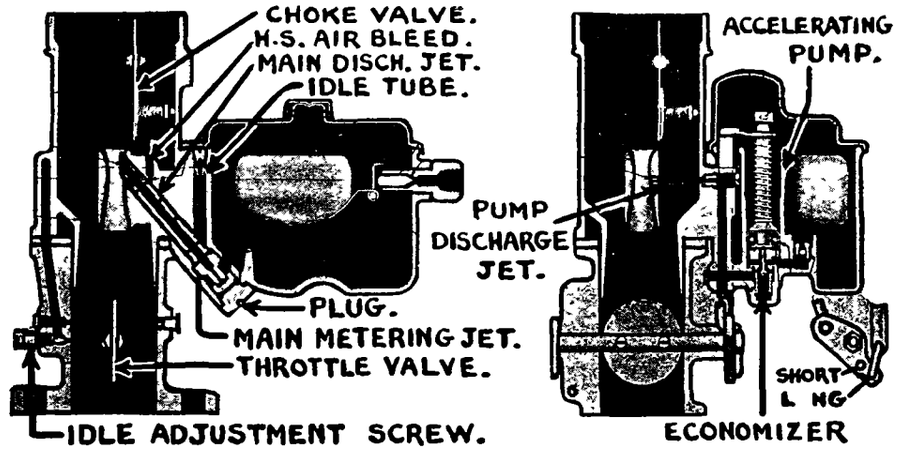
NOTE:—There are two idling ports, an upper idling port (for low speed) above the throttle valve, and a lower port (for idling with closed throttle) below the throttle valve. The idling adjusting screw controls the fuel mixture supply for the lower port. If correct idling adjustment cannot be secured or if low speed operation is unsatisfactory, take out idling adjustment screw and upper idling port plug and blow out ports with compressed air. The idle tube located in the carburetor body can also be taken out and cleaned with compressed air.

HIGH SPEED ADJUSTMENT AND ECONOMIZER:—Main metering jet which meters all fuel for main discharge jet is of the 'fixed' type and is not adjustable. Jets should not be changed except for special fuels or to compensate for special operating conditions such as high altitude (permanent operation at elevations greater than 3000 feet). See table at end of Stromberg section for standard jet calibration.

Economizer is built in lower end of accelerating pump and is operated by pump piston. At speeds above 60 M.P.H. or with wide open throttle, economizer needle valve pin will be forced down, opening the economizer valve, and allowing additional fuel to flow through the valve and be discharged into the mixing chamber through the pump discharge nozzle. Economizer is correctly set at the factory and the adjustment should not be changed. If carburetor is disassembled, the position of the adjustment nut (at upper end of pump piston rod) should be noted so that adjustment will not be changed when pump is reassembled. Economizer setting can be checked by noting throttle valve opening when pump piston rests on by-pass valve seat (less over-travel) with pump set for maximum stroke. Check throttle opening by placing a 3/8" drill (EX-22), 27/64" drill (EX-32) between throttle valve edge and carburetor wall. Exceptions to these standard settings are given in table below:

Car Model	Carburetor	Economizer Setting	Pump Setting
Graham Six 74	EX-22	11/32"	Max.
Nash 9-70, 1060	E-2	3/8"	Max.
Nash 3540, 3640	EX-22	23/64"	Max.
Oldsmobile F-32	EC-2	11/32"	Max.
Oldsmobile F-33	EC-22	7/16"	Max.
Oldsmobile F-34, F-35	EX-22	27/64"	Max.
Reo S-1	EX-2	11/32"	Max.

Adjustment—Take out cotter pin in adjusting nut at top of pump piston stem, turn nut, see that cotter pin replaced to lock adjustment.



ACCELERATING PUMP:—Accelerating pump piston rod is connected to a pump operating rod under float cover (pump in float bowl). On the upstroke of the pump piston gasoline is drawn from the float chamber through the pump check valve into the pump chamber. On the downstroke of the piston when the throttle is opened, this fuel is forced out through the economizer needle valve and discharged through the pump discharge nozzle into the mixing chamber. The closing of the check valve prevents fuel flowing back into the float chamber. When the throttle is held open the economizer needle valve is opened by the pump piston and additional fuel is discharged through the pump nozzle. This fuel is metered by the pump discharge nozzle. Standard pump capacity is 19-21 cubic centimeters per 10 strokes with pump set for maximum stroke. Exceptions to this standard capacity are shown in table below. Letter 'S' indicates that pump should be operated slowly.

Car Model	Carburetor	Pump Capacity	Pump Setting
Auburn 653, 654	EX-22	17-19 cc.	Max.
Chrysler CO, CU, CZ, C-1	EX 32	17-19 cc.	Max.
Dodge DP	EX-22	17-19 cc.	Max.
Dodge DR, DS	EX-22	12-14 cc.	Medium
Dodge DU	EX-22	15-19 cc. (S)	Medium
Graham 68, 74	EX-22	17-19 cc.	Max.
Graham 67, 69, 75	EX-32	20-25 cc.	Max.
Nash 9-70, 10-60	E-2	11-14 cc.	Max.
Nash 11-30, 12-20, 3520	EX-22, 32	17-19 cc.	Max.
Nash 3540, 3640	EX-22	18-22 cc.	Max.
Nash 3620	EX-32	17-19 cc.	Max.
Nash 3720	EX-32	13-17 cc. (S)	Min.
Oldsmobile F-32	EC-2	13 cc.	—
Oldsmobile F-34	EX-22	13-15 cc.	Max.
Oldsmobile F-35	EX-22	13-15 cc. (S)	min.
Reo S-1	EX-2	20-23 cc.	Max.
Reo S-2, 3, 4, 7	EX-32	17-19 cc.	Max.
Studebaker 56	EX-22	17-19 cc.	Max.

E-2, EC-2, EC-22, EX-2, EX-22, EX-32 CONT.

Adjustment—Throttle lever has two or three holes for engagement of pump rod link to provide minimum (inner hole), medium (center hole), maximum (outer hole) stroke. See tune-up data on car model page for recommended settings and changes for seasonal requirements.

FLOAT LEVEL:—Fuel level in float bowl (distance from surface of fuel to top edge or gasket seat on bowl) is set at the factory at 9/16" (E, EC, EX-2, (EX-32), 5/8" (EX-22). Exceptions to these standard settings are given in table below. Float height can be changed to correct fuel level by bending float lever at the point where it is attached to the float.

Car Model	Carburetor	Fuel Level
Auburn 850X, 851, 852	EX-32	5/8"
Chrysler CU	EX-32	5/8"
Chrysler CZ, C1	EX-32	5/8"
Hupmobile 417-W, 517-W	EX-32	5/8"
Hupmobile 421-J, 521-J	EX-32	5/8"
Nash Six 1220, 3520	EX-32	5/8"
Nash 3720	EX-32	3/4"
Oldsmobile F-35	EX-32 (second type)	19/32"

THROTTLE VALVE SETTING:—When installing throttle valves, see that "setting" shown in table below (distance from upper lip of throttle valve to lower edge of upper idle port) is correct with throttle valve tightly closed.

Car Model	Carburetor	Throttle Valve	Setting
Auburn Six	EX-22	P-6454—18½°	.012"
Auburn Eight	EX-32	P-5436—20°	.012"
Chrysler (all)	EX-32	P-5436—20°	.012"
Dodge (all)	EX-22	P-6454—20°	.018"
Graham	EX-22	P-6454—20°	.018"
Graham	EX-32	P-5436—20°	.012"
Hupmobile (all)	EX-32	P-5436—20°	.012"
Nash	E-2	P-6454—18½°	.012"
Nash	EX-22	P-6454—18½°	.012"
Nash	EX-32	P-5436—20°	.012"
Oldsmobile	EC-2	P-6454—18½°	.012"
Oldsmobile	EC-22	P-6454—18½°	.012"
Oldsmobile	EX-22	P-6454—18½°	.018"
Reo	EX-2	P-6454—18½°	.012"
Reo	EX-32	P-5436—20°	.012"
Studebaker	EX-22	P-6454—18½°	.012"

NOTE—All Settings are plus or minus .004".

THROTTLE CRACKING DEVICE:—On some models a linkage between the throttle valve and choke valve is provided so that the throttle valve is opened slightly when the choke valve is completely closed. Adjust linkage to provide the throttle valve opening in table below with carburetor fully choked (wire drills should be inserted between throttle valve and carburetor wall, throttle valve closed against drill, linkage adjusted so that choke valve is completely closed).

Car Model	Carburetor Model	Throttle Opening
Graham Model 68	EX-22	.060" (#53 drill)
Graham Model 74	EX-22	.073" (#49 drill)
Graham Model 69, 75	EX-32	#52 drill (go) #48 drill (no go)

Auburn 654—Throttle stopscrew stop-cam pivoted above valve shaft. Should not require adjustment. See that stopscrew rests on high point of cam with choke valve fully closed.

Auburn Schgd. 852—Adjust linkage so that when choke valve fully closed, #52 drill may be passed between throttle valve edge and carburetor wall but #48 drill will be 'no go'.

CHOKE:—Valve is provided with a relief poppet valve which will open when engine begins to fire and will prevent over-choking. On cars with conventional choke control, see that choke linkage is adjusted so that choke valve is fully closed with choke button pulled all the way out and wide open with choke control button pushed all the way in.

SERVICE PARTS:—Gasket Sets—No. J-4182-G (E-2, EC-2, EX-2), J-4362-G (EC-22), J-4362-G (EX-22 except Auburn, Dodge DR, DS, DU), J-4533-G (EX-22—Auburn), J-4387-G (EX-22—Dodge DR, DS, DU), J-4364-G (EX-32 except Chrysler C1), J-4537-G (EX-32—Chrysler C1).

MODELS EXV-2, EXV-3

EXV-2—DODGE SIX, MODEL DU (1935).
DODGE SIX, MODELS D2 (1936), D5 (1937), D8 (1938)
GRAHAM SIX, MODEL 74 (1935).
EXV-3—CHRYSLER AIRSTREAM EIGHT, MODEL CZ (1935).
CHRYSLER AIRSTREAM EIGHT, MODEL C8 (1936).
CHRYSLER AIRFLOW EIGHT, MODEL C9 (1936).

NOTE:—Dodge 1937-38. Leaner metering jets for altitudes greater than 3000 ft. as follows: 5%—.057", 10%—.055", 15%—.054", 20%—.052". These leaner jets may be used at lower altitudes for greater fuel economy with material reduction in speed and power although this is not recommended by factory.

TYPE:—Plain tube downdraft type with positively actuated accelerating pump (connected to throttle lever) and vacuum controlled by-pass or economizer.

Fuel System (Idling & Low Speed):—Fuel for idling taken from main jet well up through idling tube which meters the fuel into cross channel in which it is mixed with air admitted through the Idle Air bleeder. From this cross channel fuel mixture is taken down through channel to discharge ports at throttle edge.

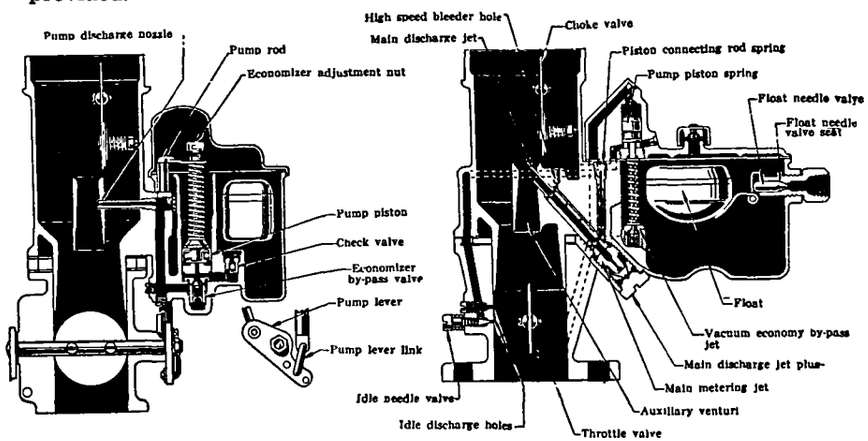
Driving Range:—As the throttle is opened, the idling system drops out and all fuel is discharged by the main discharge jet located directly above the main metering jet and discharging into the small auxiliary venturi. Main jet is air bled by the high speed air bleed passage drilled in the auxiliary venturi support directly above the discharge jet.

High Speed and Wide Open Throttle Running:—At speeds above 65 M.P.H. or whenever the throttle is held open, the drop in vacuum above the spring loaded vacuum piston allows the spring to force the piston down, opening the economizer by-pass valve, so that additional fuel metered by the by-pass jet flows to the main discharge jet.

IDLE ADJUSTMENT:—Adjusting screw controls fuel discharge from lower port and should be turned in for leaner mixture and out for richer mixture. Adjustment should not be made until engine is warmed up so that choke valve is wide open (automatic choke used). See tune-up data on car model page for complete adjustment instructions.

METERING JETS:—Main metering jet is non-adjustable fixed type and should be changed only for special operating conditions such as high altitudes (see Note above and Stromberg Jet Specification Table for standard jet calibrations).

ECONOMIZER:—Consists of by-pass valve and jet controlled by special vacuum piston with vacuum chamber connected through channel in carburetor body to manifold below throttle. By-passes fuel around main metering jet to main discharge jet for wide open throttle or high speed operation. No adjustment provided.



ACCELERATING PUMP:—Pump piston rod linked positively to throttle lever. Fuel is drawn into pump cylinder through check valve in intake channel from float bowl on upstroke of piston and is discharged through outlet (by-pass) valve to pump jet located in side of auxiliary venturi on downstroke of piston when throttle valve opened for acceleration. Pump capacity in cc. per 10 strokes when set for medium stroke (middle hole) and operated slowly is shown in table below.

Car Model	Carburetor	Pump Capacity
Dodge (all models)	EXV-2	15-19 cc.
Chrysler CZ ('35), C8, C9 ('36)	EXV-3	15-19 cc.
Graham 74 (1935)	EXV-2	10-14 cc.

MODELS EXV-2, EXV-3 CONT.

Adjustment—Throttle lever provided with three holes for engagement of pump rod link to provide varied pump stroke as follows: inner hole—minimum stroke; center hole—medium stroke; outer hole—maximum stroke. See tune-up data on car model page for recommended setting on each car model.

FLOAT LEVEL:—Fuel level in float bowl set at 5/8" below top edge or gasket seat of bowl. Float level can be changed to correct fuel level by bending lever at the point where it is attached to the float.

Needle Valve & Seat Assembly—Furnished only as matched sets. Type and size for each model as follows:

Model	Part No.	Size
EXV-2	P-20774	.093"
EXV-2 (Graham)	P-18916	.093"
EXV-3	P-20887	.101"

CHOKE:—Choke valve provided with relief poppet valve to prevent over-choking. When Sisson Automatic Choke used with this carburetor, see article in Carburetion Equipment Section for Automatic Choke adjustment.

THROTTLE CRACKER:—Graham Model 74—On this model, throttle lever stop-screw stop-cam is linked to choke valve so that throttle is opened to fast-idle position when carburetor is choked for starting. Linkage should not require adjustment. Throttle lever stopscrew should rest on high point of fast idle cam with throttle valve cracked open .073" when choke valve is fully closed.

THROTTLE VALVE SETTING:—Throttle valve type and setting (distance from top lip of valve to lower edge of upper idle port with valve closed) is shown in table below. Vacuum spark control hole should be flush with the upper lip of throttle valve or the distance shown in the table above the valve.

Carburetor	Throttle Valve Part No.	Setting	Vacuum Spark Hole Size	Location
EXV-2	P-6454—20°	.018"	#50	Flush
EXV-3	P-5436—20°	.012"	#50	Flush

SERVICE PARTS:—Gasket Set—J-4608G.

MODELS EX-23, E-33

EX-23—GRAHAM SPECIAL SIX, MODEL 73 (1935).
OLDSMOBILE SIX, MODEL F-34 (1934).
STUDEBAKER DICTATOR, MODELS 1A, 2A (1935). 3A, 4A (1936).
STUDEBAKER DICTATOR, MODELS 5A, 6A (1937).
E-33—STUDEBAKER COMMANDER, MODEL B (1934).

NOTE:—On Studebaker models, for increased fuel economy with slight performance loss, main metering jet may be replaced with one-size-smaller metering jet. The two-size-smaller jet should be used only for high altitude operation. See table below. Metering jet must be changed to smaller size as indicated whenever standard Copper-mesh type Air Cleaner is replaced by Heavy Duty Oil-bath type.

Model	Carburetor	Main Metering Jet Standard	1st Lean	2nd Lean
Comm. B (1934)	E-33	.061"	.059"	.057"
Dict. 1A, 2A ('35)	EX-23	.058"	.056"	.054"
Dict. 3A, 4A ('36)	EX-23	.058"	.056"	.054"
Dict. 5A, 6A ('37)†	EX-23	.057"	.056"	.054"
Dict. 5A, 6A ('37)‡	EX-23	.055"	.054"	.052"

†—Standard Air Cleaner. ‡—Heavy Duty Oil-Bath Air Cleaner.

This model is fitted with a built-in Automatic Choke (vacuum piston in throttle valve body, thermostatic spring coil mounted separately on manifold) and a Fast Idle. See separate article in 'Stromberg Automatic Choke and Integral Fast Idle' for complete data on these units.

TYPE:—Single barrel, plain tube, downdraft type. Design and operation entirely similar to other 'E' type carburetors except for Automatic Choke and Fast Idle mechanism. Engine must be warmed up so that choke valve is wide open and engine idling at slow or hot idling speed when adjustments are made. Fast Idle design requires that throttle be opened to 20 M.P.H. position before starting a cold engine in order to allow choke valve to close and Fast Idle mechanism to become operative.

IDLING ADJUSTMENT:—With engine warm and idling at slow or hot idling speed, set throttle lever stopscrew for 7-8 M.P.H. idling speed. Idle adjustment controls fuel mixture and should be turned in for leaner mixture or out for richer mixture. Turn screw in until engine begins to miss or run irregularly, turn screw out until engine begins to roll, then turn screw in slowly until engine fires smoothly and speed is at maximum. Check idling speed and, if necessary, readjust throttle stopscrew for 8 M.P.H. idling speed. See tune-up chart on car model page for specific instructions.

HIGH SPEED ADJUSTMENT AND ECONOMIZER:—Metering jets are of the 'fixed' type and are not adjustable. See Stromberg Jet Specification table for standard jet sizes. Jets should be changed only to compensate for special operating conditions such as high altitudes or special fuel.

Economizer is built in lower end of accelerating pump and is operated by pump piston. Economizer should not require adjustment but setting can be checked by noting throttle opening (insert a drill rod of proper size between edge of throttle valve and carburetor wall) when pump piston rests on economizer by-pass jet seat (less over-travel) with pump set for minimum or maximum stroke as noted.

Car Model	Carburetor	Economizer Setting	Pump Setting
Graham 73 (1935)	EX-23	3/8" drill	Maximum
Oldsmobile F-34 ('34)	EX-23	27/64" drill	Maximum
Studebaker Dict. ('35)	EX-23	3/8" drill	Maximum
Studebaker Dict. ('36)	EX-23	7/16" drill	Maximum
Studebaker Dict. ('37)	EX-23	7/16" drill	Maximum
Studebaker Comm. ('35)	E-33	7/32" drill	Minimum

Adjustment. Remove cotter pin in adjustment nut at upper end of pump piston stem, turn nut. Be sure that cotter pin replaced to lock adjustment. When dismantling pump for servicing, do not disturb this nut to avoid necessity of resetting Economizer.

ACCELERATING PUMP:—Similar in design to that used on other 'E' type carburetors. Fuel is drawn into pump chamber through intake ball check valve on upstroke of piston and is discharged through outlet (by-pass) valve and pump discharge nozzle opening into side of small auxiliary venturi when the throttle is opened for acceleration. Pump capacity in cc. per 10 strokes when pump is operated slowly is shown in table below. Pump should be set for maximum or minimum stroke, as noted, when making this test.

Car Model	Carburetor	Pump Capacity	Pump Setting
Graham Model 73	EX-23	17-19 cc.	Maximum
Oldsmobile F-34	EX-23	13-15 cc.	Maximum
Studebaker Dict. '35	EX-23	13-15 cc.	Maximum
Studebaker Dict. '36-37	EX-23	17-19 cc.	Medium
Studebaker Comm.	E-33	11-13 cc.	Minimum

Adjustment. Three holes provided in throttle valve lever for pump rod link engagement. Center hole providing medium stroke is normal setting. Inner hole provides minimum stroke and outer hole maximum stroke. See tune-up data on car model page for recommended settings.

FLOAT LEVEL:—Fuel level in float bowl with engine idling (3 lbs. pressure) is shown in table below. Float level can be changed to correct fuel level by bending float lever at the corner where it is attached to the float.

Car Model	Carburetor	Fuel Level
Graham Model 73	EX 23	5/8"
Oldsmobile F-34	EX-23	19/32"
Studebaker Dict.	EX-23	5/8"
Studebaker Comm.	E-33	3/4"

Needle Valve & Seat Assembly—Furnished only as matched sets. Assembly part number and size for each model as follows:

Model	Part Number	Size
EX-23 (Graham, Oldsmobile)	P-18916	.093"
E-33 (Studebaker Comm.)	P-18916	.093"
EX-23 (Studebaker Dict)	P-21518	.093"

CHOKE:—Choke valve fitted with poppet type relief valve. See article in Carburetion Equipment Section for complete data on the built-in Automatic Choke and integral Fast idle.

THROTTLE VALVE SETTING:—Throttle valve type and setting (distance from upper lip of valve to lower edge of upper idle discharge port with throttle valve fully closed shown in table below.

Car Model	Carburetor	Throttle Valve	Setting
Graham 73 (1935)	EX-23	P-6454-18½°	.018"
Oldsmobile F-34 ('34)	EX-23	P-6454-18½°	.018"
Studebaker Comm. ('35)	E-33	P-5436 -20°	.012"
Studebaker Dict. ('35-36)	EX-23	P-6454-18½°	.012"
Studebaker Dict. ('37)	EX-23	P-22673-18½°	.012"

SERVICE PARTS:—Gasket Set—J-4384G (Ex-23), J-4366G (E-33).

EE-7/8—FORD V8 '60,' MODELS 73, 74, 75 (1937)
FORD V8 '60', MODELS 82A, 82C, 82Y (1938)—SEE NOTE
FORD V8 '60', MODELS 922A, 922C, 92Y (1939)—SEE NOTE
EE-1—AUBURN EIGHT, MODELS 850Y (1934), 851 (1935), 852 (1936-37)
BUICK SPECIAL EIGHT, MODEL 40 (1934-35-36).
FORD, V8 MODEL (1934-35)
FORD, V8 MODELS 68, 67, 51 (1936)—SEE NOTE
FORD V8 '85,' MODELS 77, 78, 79 (1937)—SEE NOTE.
FORD V8 '85', MODELS 81A, C, Y, T, U; 817T (1938)—SEE NOTE
LINCOLN ZEPHYR, MODELS H (1936), HB (1937)
LINCOLN-ZEPHYR, MODEL 86H (1938)—SEE FORD NOTE
NASH AMBASS. EIGHT, MODELS 3580 ('35), 3680 ('36), 3780 ('37)
NASH AMBASS. EIGHT, MODEL 3880 (1938)
NASH-LAFAYETTE, MODEL 3910 (1939)
OLDSMOBILE EIGHT, MODELS L-34 ('34), L-35 ('35)
STUDEBAKER COMMANDER, MODEL 1B (1935)
STUDEBAKER PRESIDENT, MODELS 1C (1935), 2C (1936), 3C (1937)

NOTE:—1936 Ford—Carburetor changed in production from Ford Part No. 48-9510-D to Part No. 67-9510-A. This new carburetor has smaller main metering jet and venturi and gives better fuel economy. An additional model (Ford Part No. SE-67-9510) is available as optional equipment and has smaller main metering jet and venturi than regular 67-9510-A. This model intended for light work such as house-to-house delivery. See Stromberg Jet Specification table.

1937-38. Part numbers for carburetors used on '60' and '85' and service for which intended listed below. Carburetors with same prefix (52 or 67) are similar except for main metering jet size. See Stromberg Jet Specification Table

Service	'60' Models	'85' Models
Normal Altitudes	52-9510-B	67-9510-A
5000-10000 ft.	52-9510-C	67-9510-B
10000-15000 ft.	52-9510-D	67-9510-C
Over 15000 ft.	52-9510-E	67-9510-D

1938 Ford '85' & Lincoln Zephyr. Chandler-Groves dual carburetors also used on these models. See Chandler-Groves Carburetor article for data.

1939 Ford '60' Model. Chandler-Groves (Ford) carburetor used on some cars. See article on Chandler-Groves AA-1 Dual Carburetor for data.

Buick Model 40—The standard main metering screw (.048—Part No. 19442) must be replaced with slightly smaller (.044") metering jet when installing the optional Triplex Air Cleaner.

Nash Ambass. 3780—Smaller main metering jet used when optional Heavy duty Oil-bath Air Cleaner installed. Main metering jets should be changed when this cleaner installed in the field.

Studebaker 2C, 3C. For increased fuel economy with slight performance loss, standard main metering jet (.047"—Part No. P-19442) may be replaced by one-size-smaller (.045") metering jet. The two-size-smaller jet (.043") should be used only for high altitudes. Main metering jets for both carburetor barrels must be same size and should be replaced as a unit.

Automatic Chokes & Fast Idles—See separate article for data on these units

TYPE:—Duplex or dual barrel, plain tube, downdraft type. Similar in design to other 'E' type carburetors except that each carburetor barrel has independent main discharge jets, main metering jets, throttle valves and idling adjustments. Throttle valves are mounted on the same shaft and do not require synchronization. Accelerating pump is positively operated by the throttle lever through a 'walking beam' linkage on the carburetor body casting. Idling adjustment and accelerating pump adjustment (some models only) are the only points requiring attention.

IDLING ADJUSTMENT:—Needle valve type controlling fuel mixture. Adjusting screws control discharge through lower or closed throttle discharge ports below throttle valves (upper ports also discharge fuel when throttle is opened slightly) and should be turned in for leaner mixture or out for richer mixture. Engine must be warmed up when adjustments are made. With engine warm and idling with closed throttle (adjust throttle stopscrew, if necessary so that idle speed is approximately 5-7 MPH), adjust each idle adjusting screw in turn by turning screw in until engine begins to hesitate or miss, and out until engine begins to roll, and then turning screw in slowly until engine fires smoothly. Final setting should be approximately midway between the missing (lean) and rolling (rich) positions. After adjusting both screws, recheck idling speed. See tune-up data on car model pages for complete adjustment instructions on each car model.

NOTE—On Nash model, idle speed should be set not lower than 7 MPH., and if engine tends to stall when coasting (when cruising gear used continuously), speed can be advanced up to 9 MPH.

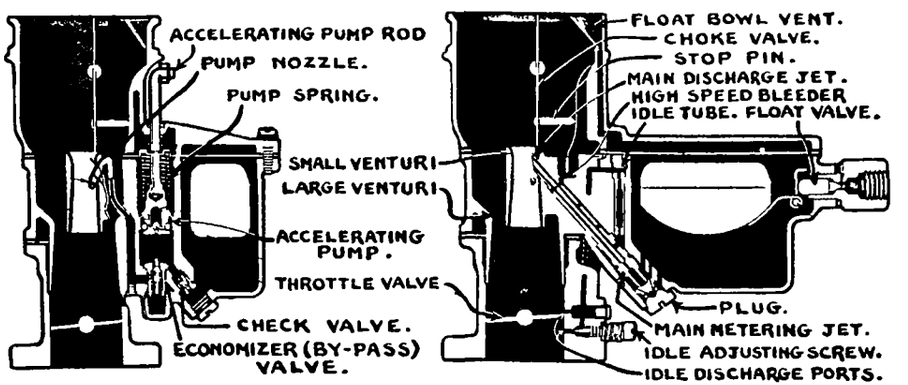
If correct idling adjustment cannot be secured, take out idling adjusting screws and upper idling port plugs and clean out idling ports with compressed air. The idling tubes located in the upper carburetor body can also be taken out and cleaned with compressed air.

METERING JETS:—Main metering jets (2 used) are non-adjustable fixed type and should be changed only for special operating conditions such as high altitudes. See Notes above for special recommendations and Stromberg Jet Specification Table for standard jet calibrations. Both main metering jets must be the same size and should be changed as a unit.

ECONOMIZER:—Built in lower end of the accelerating pump and is operated by the pump piston. At speeds above 65 M.P.H. or with wide open throttle, economizer needle valve is forced down, opening the economizer valve so that additional fuel flows through this valve and is discharged through the pump discharge nozzle. Economizer should not require attention but setting can be checked by noting throttle opening when pump piston contacts by-pass valve seat (economizer). Throttle valve opening at this point as checked by drill passed between throttle valve edge and carburetor wall is shown in table below.

Car Model	Economizer Setting
Auburn (all models)	21/64"
Buick 40 ('34-35-36)	21/64"
Ford (all models) EE-7/8 Carb.	9/32"
Ford (all models) EE-1 Carb.	5/16"
Lincoln Zephyr	15/32"
Nash (all models)	7/32"
Oldsmobile (all models)	21/64"
Studebaker (all models)	21/64"

Adjustment—No adjustment provided but pump arm (walking beam) may be bent slightly to correct economizer action.



ACCELERATING PUMP:—Accelerating pump is operated through a walking beam linkage by the throttle valve lever. Pump chamber is filled with fuel (flowing through check-valve) when throttle is closed. When the throttle is opened, this fuel is discharged through the pump discharge nozzle in each carburetor barrel. The check-valve prevents the fuel flowing back into the float bowl. When the throttle is held open, the pump piston opens the economizer by-pass valve so that fuel flows straight through the pump chamber to the discharge nozzles. No adjustment is ordinarily provided for the accelerating pump but on some models a summer and winter setting is provided (see adjustment below). Pump capacity in cc. per 10 strokes when operated slowly is shown in table below. Pump setting should be as indicated.

Car Model	Pump Capacity	Pump Setting
Auburn (all models)	17-21 cc	Maximum
Buick (all models)	18-22 cc	Not Adj.
Ford 1934-35-36	13-17 cc	Not Adj.
Ford '60' EE-7/8	9-13 c.c	Max.
Ford '85' EE-1	17-21 c.c	Max.
Lincoln Zephyr (1936-37)	18-22 cc	Not Adj.
Lincoln Zephyr (1938)	15-19 cc	Maximum
Nash (1935-37)	21-25 cc	Maximum
Nash-Lafayette 3910	23-27 cc	Minimum
Nash (1938)	10.5-21.5 c.c.	Max.
Oldsmobile (all models)	17-21 cc	Not Adj.
Studebaker (all models)	14-18 cc	Not Adj.

MODELS EE-7/8, EE-1 CONT.

Adjustment:—Two holes (ball studs on Ford and Lincoln Zephyr) provided on throttle lever for pump rod connection. Inner hole (short radius) provides minimum stroke, outer hole (long radius) maximum stroke. See tune up data on car model page for recommended setting and seasonal changes.

NOTE—First Ford carburetor not provided with accelerator pump adjustment.

FLOAT LEVEL:—Fuel level in float bowl set at 15/32" below top edge or gasket surface of bowl with 3 lbs. pressure (engine idling) for all models except as noted below. Float height can be changed to correct fuel level by bending float lever at the point where it is attached to the float.

Car Model	Carburetor	Fuel Level
Nash 35, 36, 37, 38-80	EE-1	½"

Needle Valve & Seat Assembly—Furnished only as matched sets. Assembly number for each model as follows:

Car Model	Part No.	Size
Auburn (all)	19867	.113"
Buick (all)	P-21659	.093"
Ford (all Carb.)	P-20287	.098"
Lincoln Zephyr	P-20287	.098"
Nash (all)	P-19867	.113"
Nash-Lafayette 3910	P-20256	.093"
Oldsmobile (all)	P-19867	.113"
Studebaker 1935-36	P-21519	.101"
Studebaker 1937	P-21519	.101"

CHOKE:—Choke valves offset type. Check hand choke controls to see that choke valve is fully closed when dash control button pulled and is wide open when control button pushed all the way in.

THROTTLE VALVE SETTING:—Throttle valves for all models are 5° type and should be set so that upper lip of valve is .030" plus or minus .004" below lower edge of upper idle port with throttle valve closed (all models except Oldsmobile 1935), .010" (Oldsmobile 1935). Vacuum port height above throttle valve should be .041" plus or minus .004" on Buick models. On Studebaker models, the two #50 vacuum ports should be flush with the throttle valve.

SERVICE PARTS:—**Gasket Set.** Part No. J-4780-G (Studebaker 1936-37), J-4383-G (Auburn, Ford '85', Lincoln Zephyr 1936-37, Nash 1935-36, Oldsmobile 1934, Studebaker 1935), J-4539-G (Nash 1937-38), J-4599-G (Buick), J-5334-G (Lincoln Zephyr 1938).

MODELS EE-14, EE-15, EE-25

EE-14—GRAHAM EIGHT, MODEL 72 (1935)
PACKARD, MODELS 120 (1935), 120B (1936), 120C (1937)
PACKARD EIGHT, MODELS 1601, 1A, 2 (1938)
EE-15—CORD, MODELS 810 (1936), 812 (1937)
LA SALLE, MODELS 35-50 (1935), 36-50 (1936)
EE-25—CADILLAC V8, MODELS 36-60, 70, 75 (1936)

NOTE—These models fitted with an Automatic Choke (thermostatic coil mounted on manifold, vacuum piston built in carburetor body), and a new type Fast Idle incorporating a by-pass passage around the throttle valve controlled by the vacuum piston. See Fast Idle paragraph below and separate article on Automatic Choke for complete data. Engines must be warmed up so that choke valve is wide open and Fast Idle by-pass closed by vacuum piston when adjustments are made.

TYPE:—Duplex or dual barrel, plain tube, downdraft type. Similar in design to other EE type carburetors except for fast idle and choke control vacuum piston and by-pass passage (see note under Fast Idle paragraph for special directions necessary for disassembling carburetor to avoid damage to vacuum piston linkage). All specifications and adjustments for these models same as given for Model EE-1 (preceding article) except as noted below.

IDLE ADJUSTMENT:—Idle adjusting screw provided for each carburetor barrel. Operation and adjustment same as for EE-1 (previous article). See tune-up data on car model page for adjustment instructions on each car model.

FAST IDLE MECHANISM:—The vacuum piston in the cylinder in the carburetor body casting is linked to the choke valve. When the engine is cold, the vacuum piston is raised to the upper end of its stroke by the closing of the choke valve, so that the by-pass passage around the throttle valve is open and the cross channel from the idle fuel channel which terminates in the by-pass passage is uncovered. In this position an extra quantity of fuel mixture will be drawn from the idle fuel channel and discharged into the manifold below the throttle valve, providing a fast idle when the engine begins to fire. When vacuum builds up in the manifold, the vacuum piston will be drawn down until the side port in the piston is uncovered, admitting air into the cylinder below the piston and stopping the further movement. This partial stroke of the piston opens the choke valve slightly when the engine begins to fire but does not cut off the fuel mixture flow through the by-pass passage. As the engine warms up and the choke valve opens, the vacuum piston completes its stroke, cutting off the cross-channel and closing the by-pass passage so that fuel is supplied in the usual manner by the lower idling port (with throttle closed) and the upper idling port (when throttle is opened).

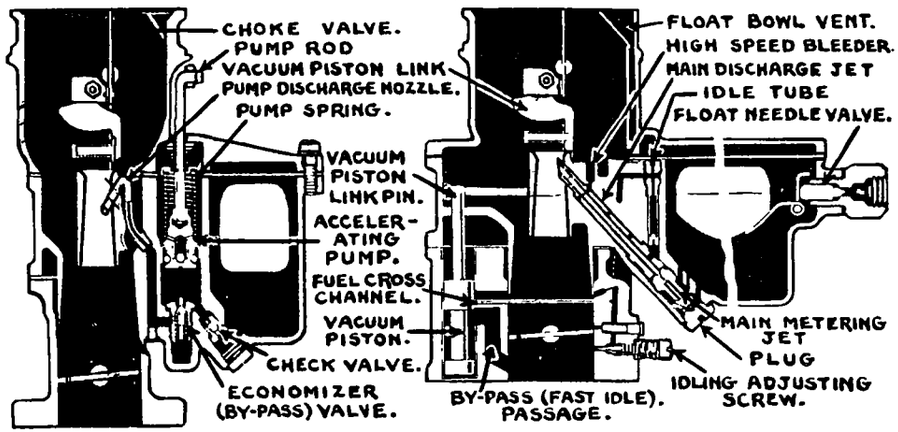
NOTE—In disassembling carburetor, when the air horn and float bowl cover is to be removed, take out cover screws, raise upper assembly straight up until the pin in the upper end of the vacuum piston is exposed, take out this pin. Upper assembly can then be removed. Do not disturb the nut at the upper end of the vacuum piston link (on choke valve bracket). This is set at the factory and must not be changed.

METERING JETS:—Main metering jets (2 used) are non-adjustable type and should be changed only for special operating conditions such as high altitudes. See Stromberg Jet Specification Table for standard jet calibration.

ECONOMIZER:—To check Economizer setting, check throttle valve opening with wire drill passed between edge of throttle valve and carburetor wall with throttle at point where pump piston contacts economizer by-pass valve seat less over-travel). Settings shown in table below (On Cadillac Model EE-25, pump rod must be engaged in end hole in pump lever). No adjustment provided but pump lever may be bent slightly to correct operation.

Car Model	Carburetor Model	Economizer Setting
Cadillac V8	EE-25	21/64"
Cord	EE-15	21/64"
Graham	EE-14	21/64"
La Salle 35-50	EE-15	9/32"
La Salle 36-50	EE-15	21/64"
Packard	EE-14	21/64"

ACCELERATOR PUMP:—Similar in design to type used on other EE carburetors. Fuel is drawn into pump chamber through intake ball check valve on upstroke of piston and discharged through outlet (by-pass) valve and pump discharge nozzle in auxiliary venturi on the downstroke of the piston when throttle valve opened for acceleration. Pump capacity in cc. per 10 strokes when operated slowly is shown in table below. No adjustment provided.



Car Model	Carburetor Model	Pump Capacity
Cadillac V8	EE-25	18-22 cc.
Cord	EE-15	17-21 cc.
Graham	EE-14	17-21 cc.
La Salle 35-50, 36-50	EE-15	15-19 cc.
Packard	EE-14	17-21 cc.

FLOAT LEVEL:—Fuel level in float bowl is 15/32" with 3 lbs. pressure (EE-14, EE-15), ⅝" with 5 lbs. pressure (EE-25) below top edge of bowl. Float height can be changed to correct fuel level by bending float lever at the point where it is attached to the float.

NOTE—See special instructions in note under Fast Idle section to avoid damaging vacuum piston linkage when removing float bowl cover.

Needle Valve & Seat Assembly—Furnished only as matched sets. Part number and size for each type as follows:

MODELS EE-14, EE-15, EE-25 CONT.

Model	Part Number	Size
EE-14 (Graham, Packard '35)	P-22090	113"
EE-14 (Packard 1936-37)	P-22089	101"
EE-14 (Packard 1938)	P-23509	101"
EE-15 (Cord)	P-19867	113"
EE-15 (LaSalle 35-50)	P-19867	113"
EE-15 (LaSalle 36-50)	P-22487	113"
EE-25 (Cadillac)	P-19867	113"

CHOKE:—(EE-14)—Thermostatic spring coil mounted separately on manifold and linked to choke valve shaft lever by rod. See separate article for adjustments.

(EE-15, EE-25)—Thermostatic spring coil mounted on carburetor at end of choke valve shaft and liked directly to shaft. Spring coil controlled by electric heating coil in case which is connected to ignition switch. The 'Triple-Range' hand choke control is not used on Cord. See separate article for adjustments.

THROTTLE SETTING:—Throttle valve type and setting (distance from upper lip of throttle valve to lower edge of upper idle port with valve closed) shown in table below. Vacuum Spark Control Port location indicates height of lower edge of hole above throttle valve lip when closed.

Model	Throttle Valve Part No.	Throttle Valve Setting	Vacuum Spark Control Port Size	Vacuum Spark Control Port Location
EE-14 (Graham)	P-20720-5°	.030"	#58	.040"
EE-14 (Packard 1935)	P-20874-5°	.030"		
EE-14 (Packard 1936)	P-20874-5°	.020"		
EE-14 (Packard '37)	§P-20874-5°	.030"	#50	Flush
EE-14 (Packard '38)	‡P-23357-5°	.030"	#50	Flush
EE-15 (Cord)	P-19435-5°	.030"		
EE-15 (LaSalle)	(†) P-20720-5°	.010"	#58	.041"
EE-25 (Cadillac)	P-19850-5°	.030"	#56	.031"

(†)—Throttle valve has #53 hole. Vacuum spark control used only in 1936.
(§)—Right hand only. Left hand throttle valve P-22735-5°.
(‡)—Right hand only. Left hand throttle valve P-23347-5°.

SERVICE PARTS:—Gasket Set—J-4540G (EE-14, EE-15), J-4609G (EE-25).

MODEL EE-16

A-18341—PACKARD '120' EIGHT, MODELS 1701, 1A, 2 (1939)

THROTTLE GUARD NOTE:—All cars with Overdrive Transmission fitted with vacuum diaphragm type throttle guard designed to prevent engine stalling when free-wheeling in the 0-20 MPH. range. See separate article for complete Throttle Guard adjusting and servicing data.

TYPE:—Duplex or dual barrel, plain tube, downdraft type similar in design to 'EE' carburetor used on previous Packard model except for entirely new design Automatic Choke and Fast Idle as follows:

Automatic Choke—Thermostatic coil and vacuum piston type with assembly mounted directly on carburetor air horn and linked to choke valve lever within choke housing (no external linkage used as on previous model). Thermostat actuated by exhaust manifold heat through external heat tube connected between thermostat cover and hot air stove on manifold.

Fast Idle—Consists of a special stepped fast idle cam linked to the choke valve and serving as a stop for the fast idle lever adjusting screw (on opposite end of throttle shaft from regular throttle lever and stopscrew which regulates hot or slow idling speed).

IDLING ADJUSTMENT:—Adjust only with engine warm so that Automatic Choke and Fast Idle inoperative (choke valve wide open, fast idle screw on lowest step of fast idle cam) and engine idling at hot or slow idling speed. Make certain that some clearance exists between fast idle adjusting screw and fast idle cam (on opposite end of throttle shaft from idling speed adjusting screw). Set throttle lever stopscrew for correct 6 MPH. idling speed. Turn idling adjusting screw for each carburetor barrel (both screws must be adjusted alike) in for leaner mixture or out for richer mixture. These screws control fuel discharge from lower (closed throttle) idling ports. Recheck idling speed adjustment. See car model tune up page for complete adjustment instructions. Check Fast Idle setting (below).

METERING JETS:—Main metering jets are non-adjustable type located under plug at lower end of each discharge jet. Jets should be changed only for special operating conditions such as high altitudes. See Stromberg Jet Specification table for complete jet data.

ECONOMIZER:—By-pass valve and jet located at bottom of pump cylinder which is operated by pump piston so as to permit continuous discharge from pump nozzle when throttle valve is wide open. Should not require attention but setting can be checked by noting throttle opening when pump piston rests on by-pass valve seat (less over-travel). Throttle opening should be 7/32" (plus or minus 1/64"). Check by inserting drill rod of correct size between throttle valve edge and carburetor wall.

Adjustment—Loosen locknut and turn adjusting clevis on pump rod (linking throttle lever and pump 'walking beam') slightly.

ACCELERATING PUMP:—Similar to design used on previous 'EE' carburetors with spring-loaded relief valve in piston head and duration spring on rod above piston (light spring above duration spring is dust washer retainer). A strainer screen has been added below the intake check valve (see Note below).

Capacity—17-21 cc. (slow), 11-15 cc. (Fast) per 10 strokes of the pump.

Adjustment—No adjustment provided.

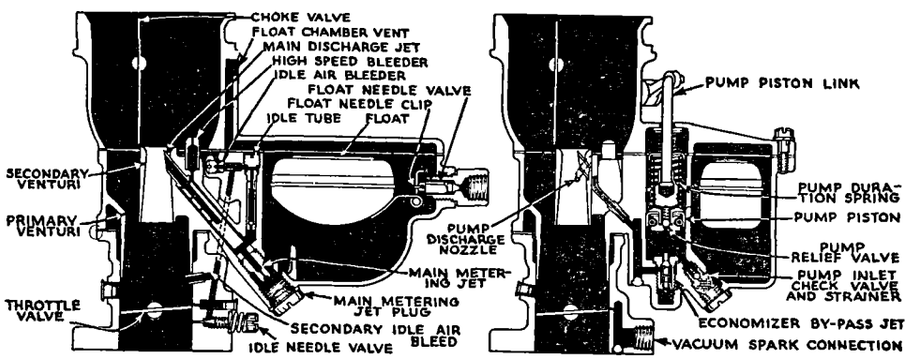
Pumping Servicing Note—Strainer screen located in plug below pump intake check valve should be removed and cleaned frequently to insure satisfactory pump operation.

FAST IDLE & CHOKE RELEASE:—Check and adjust as directed below. See article in Carburetion Equipment Section for complete servicing directions.

Fast Idle Speed—With throttle lever stopscrew set for correct hot or slow idle speed of 6 MPH., turn fast idle adjusting screw (on fast idle lever—do not confuse this screw with throttle lever stopscrew on opposite end of throttle valve shaft) in until it just contacts lowest step of fast idle cam, being careful not to exert pressure on screw or fast idle lever, then back screw out exactly ½ turn.

Fast Idle Setting—After setting both slow idle speed (throttle lever stopscrew adjustment) and fast idle speed (fast idle adjusting screw adjustment above), see that choke valve is wide open and close throttle valve completely so that throttle stopscrew is against stop on body. Hold throttle valve in this position and close valve by hand until fast idle screw strikes step on fast idle cam (do not force choke valve beyond this position which will bind fast idle rod or distort fast idle cam spring). Measure choke valve opening at this point by inserting drill rod between upper edge of valve and air horn wall. Opening should be 35/64". Adjust by bending fast idle rod at elbow near upper end.

Choke Release—Open throttle to wide open position so that choke valve is opened by ear on fast idle lever which contacts lug on fast idle cam. Measure choke valve opening by inserting drill rod between valve edge and air horn wall. Distance should be .156-.187" (11/64" drill). Adjust by bending ear on fast idle lever using extreme care not to damage fast idle rod and fast idle cam spring.



FLOAT LEVEL:—Fuel Level—Should be 15/32" below top edge of float bowl with engine running idling. Adjust by bending float lever arm at point where it is attached to the float.

Float Needle Valve & Seat—Part No. P-23509. Furnished only in matched sets. When installing assembly make certain that needle valve has one corner down and is clipped to float lever.

Float Bowl Vent—Bowl vented to atmosphere through opening on side of air horn wall directly below air cleaner collar.

THROTTLE VALVE SETTING:—Throttle valves are No. P-23347 (Left), P-23357 (Right) 5° type. To check throttle valve setting, back off throttle stopscrew so that valves are tightly closed, measure distance from upper edge of throttle valve to lower edge of upper idle port. Should be .030" plus or minus .004".

CHOKE:—Stromberg automatic integral type. See article in Carburetion Equipment Section for complete servicing directions.

Choke Setting—Inverted 'V' mark on thermostat cover scale should coincide with reference mark on top of choke housing. To adjust, loosen three cover screws and rotate thermostat cover assembly.

CAUTION—When connecting heat tube to thermostat cover, do not use excessive pressure which may rotate cover and change setting.

EE-2—FRANKLIN TWELVE, MODELS 17 (1932), 17B (1933-34).
NASH EIGHT, SERIES 10-70 (1932), 11-70 (1933).
OLDSMOBILE EIGHT, MODEL L-32 (1932).
EE-22—BUICK, CENTURY 60, ROADMASTER 80, LIMITED 90 (1936).
CHRYSLER, AIRFLOW MODELS CU, IMPERIAL CV (1934).
CHRYSLER, IMPERIAL C2, CUSTOM IMPERIAL C3 (1935).
CHRYSLER, IMPERIAL C10, CUST. IMPERIAL C11 (1936)
CHRYSLER, AIRFLOW MODEL C17 (1937)
HUPMOBILE EIGHT, MODELS 427-T (1934), 527-T (1935).
LINCOLN, MODELS V-12-136 (1933), V-12-136, 145 (1934-35).
LINCOLN, V12 MODEL (1936-37-38-39)
NASH ADVANCED EIGHT, SERIES 1280 (1934), 3580 (1935).
OLDSMOBILE EIGHT, MODEL L-33 (1933).
PACKARD EIGHT, MODELS 1001, 2 (1933), 1100, 1, 2 (1934).
PACKARD SUPER EIGHT, MODELS 1003, 4 (1933), 1103, 4, 5 (1934).
STUDEBAKER, COMMANDER 73, PRES. 82, SPDWY. PRES. 92 (1933).
STUDEBAKER, PRESIDENT MODEL C (1934).
EE-3—CHRYSLER CUSTOM IMPERIAL, CL* (1933), CW (1934), CW* (1935).
DUESENBERG, MODEL J (1933-34-35-36-37)
PACKARD TWELVE, 905-6 ('32), 1005-6 ('33), 1106-7 ('34), 1207-8 ('35).
PACKARD TWELVE, 1407,8 ('36), 1507,8 ('37), 1607,8 ('38), 1707,8 ('39)
PIERCE ARROW EIGHT, MODELS 836 ('33), 836A, 840A ('34), 845 ('35).
PIERCE ARROW EIGHT, 1601 ('36), 1701 ('37), 1801 ('38)
STUTZ, MODEL DV-32 (1932-33-34)

NOTE:—On Buick models, standard main metering jets (.052"—Part No. P-17004) must be replaced by smaller (.051") jets when optional Triplex Air Cleaner is installed.

SPECIAL SERVICE NOTES:—**Packard Twelve.** On early 1938 and all previous 12 cylinder models, idling performance can be improved by installing tapered 3° shim Part No. 242311 between carburetor and manifold so that carburetor float bowl is level. Install shim with thin end toward radiator with gasket No. 242312 on top and bottom of shim. All cars after Engine No. A-600166 have carburetor flange on manifold machined at an angle to secure this effect.

TYPE:—**Dual barrel plain tube downdraft type. These models are similar in design to other 'E' type carburetors except that each carburetor barrel has independent main discharge jets, main metering jets, throttle valves and idling adjustments. Throttle valves are mounted on a single shaft and will not require synchronization. Accelerating pump is positively operated by the throttle through a 'walking beam' connection mounted on the carburetor upper body. Idling adjustment and accelerating pump adjustment (summer and winter setting) are the only points requiring attention.**

NOTE—Some models are fitted with Automatic Chokes and Fast Idles. See separate articles for complete data on Stromberg Fast Idles and Type 'C' Automatic Choke, and Sisson Automatic Choke. On these models engines must be thoroughly warmed up so that choke valve is wide open and engine idling at slow or hot idling speed when adjustments are made.

IDLING ADJUSTMENT:—Two needle valves controlling fuel mixture. Engine must be thoroughly warmed up before idling adjustment is made. With engine warm and running, close throttle and allow engine to idle. Adjust inner (left hand) idling adjustment screw for smoothest and fastest running position by turning idling screw in until engine begins to miss and speed decreases, then turn screw out until engine begins to roll, finally turn screw in until engine fires smoothly (final setting should be approximately half way between missing and rolling points). Adjust outer (right hand) idling adjustment screw in the same manner. Idling screw operates on fuel mixture and should be turned in for leaner mixture and out for richer mixture. See tune-up data on car model page for complete adjustment instructions on each car model.

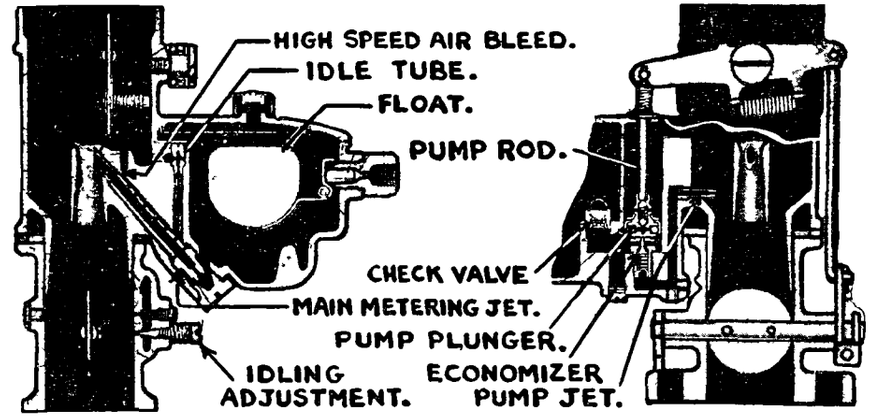
On 'V' type engines with two ignition coils where one coil furnishes ignition for one bank, ignition can be cut off for one bank by disconnecting the coil primary or grounding the coil high tension lead to the engine block so that the engine will idle on the remaining cylinders. The idle adjustment for the carburetor barrel feeding the cylinders which are firing can then be adjusted. The coil should then be reconnected and the other coil disconnected so that the engine will fire on the cylinders of the other bank. The idle adjustment for the carburetor barrel feeding this bank can then be adjusted. After both idling adjustments have been completed in this manner, engine should be idled on all cylinders and any necessary readjustment made to secure smooth running. The throttle stop screw can then be adjusted to secure correct idling speed.

Pierce Arrow—Manufacturer recommends that idling speed be set at 37-39 explosions in 15 seconds (check by removing inspection plug in exhaust manifold) and idling adjustment then made by disconnecting and grounding spark plug cables on end cylinders (1, 2, 7, 8) while inner barrel adjustment is made. Then ground cables on cylinders 3, 4, 5, 6 while adjusting outer barrel. Finally idle engine on all eight cylinders and recheck idling speed. This same method of adjustment may be used on other car models.

Chrysler—Manufacturer recommends that an initial setting be made by turning both screws in until they seat and then backing screws off exactly one turn. Adjustment should then be made by turning both screws in or out simultaneously and exactly the same amount. This method may be used on other car models.

If correct idling adjustment cannot be secured, take out idle adjusting screw and upper idling port plug and clean out idling ports with compressed air. The idling tubes located in the carburetor body can also be taken out and cleaned with compressed air.

HIGH SPEED ADJUSTMENT AND ECONOMIZER:—Main metering jets which meter all fuel for main discharge jets are of the 'fixed' type and not adjustable. Jet size is stamped on the jet in decimal fractions of an inch. Jets should be changed only to compensate for special fuels or operating conditions such as high altitudes.



Economizer is built in lower end of accelerating pump and is operated by pump piston. At speeds above 70 M.P.H. or with wide open throttle, economizer needle valve is forced down, opening the economizer valve, so that additional fuel flows through the valve and is discharged into the mixing chamber through the pump discharge nozzle. Economizer should not require attention but setting can be checked by noting throttle opening (pass wire drill of correct size between edge of throttle valve and carburetor wall) at point where pump piston contacts economizer by-pass valve seat with pump set for maximum stroke. Settings are as follows:

Car Model	Carburetor	Economizer Setting
Buick (first cars)	EE-22	3/16"
Buick (after No. 2873362)	EE-22	15/64"
Chrysler CU, CV, C2, C3	EE-22	21/64"
Chrysler CL*, CW, CW*	EE-3	7/32"
Chrysler C10, C11, C17	EE-22	21/64"
Duesenberg J	EE-3	7/32"
Franklin 17, 17B	EE-2	9/32"
Hupmobile 427, 527	EE-22	1/4"
Lincoln, all Twelves	EE-22	21/64"
Nash 1070, 1170	EE-2	13/64"
Nash 1280, 3580	EE-22	1/4"
Oldsmobile L-32	EE-2	13/64"
Oldsmobile L-33	EE-22	1/4"
Packard, all Eights	EE-22	21/64"
Packard, all Twelves	EE-3	7/32"
Pierce Arrow, all Eights	EE-3	7/32"
Studebaker 73, 82, Pres. C	EE-22	1/4"
Studebaker Speedway Pres. 92	EE-22	21/64"
Stutz DV-32	EE-3	3/16"

NOTE—On Buick carburetors, economizer is adjusted by loosening locknut and turning pump operating rod in or out of connector at throttle lever.

ACCELERATING PUMP:—Accelerating pump is operated through a walking beam arrangement by the throttle lever. Pump chamber is filled with fuel from the float chamber (flowing through the pump check valve) when the throttle is closed. When the throttle is opened, this fuel is discharged through the economizer valve and the pump discharge nozzle into the mixing chamber. Check valve prevents fuel being discharged back into the float chamber. When the throttle is held open, the piston opens the economizer needle valve so that fuel flows straight through the pump and is discharged through the pump nozzle. The pump discharge nozzle meters this fuel. Pump capacity in cc. per 10 strokes when pump is operated slowly is given in table below. Pump should be set for maximum (Max.) or minimum (Min.) stroke as indicated.

Car Model	Carburetor	Pump Capacity	Pump Setting
Buick 60, 80, 90	EE-22	23-27 cc.	Max.
Chrysler CU, CV, C2, C3	EE-22	20-24 cc.	Min.
Chrysler CL*, CW, CW*	EE-3	20-22 cc.	Min.
Chrysler C10, C11, C17	EE-22	20-24 cc.	Max.
Duesenberg J	EE-3	20-22 cc.	Min.
Franklin 17, 17B	EE-2	28-32 cc.	Max.
Hupmobile 427, 527	EE-22	20-24 cc.	Max.
Lincoln, all Twelves	EE-22	20-24 cc.	Max.
Nash 1070, 1170	EE-2	14 cc.	—
Nash 1280	EE-22	20-24 cc.	Max.
Nash 3580	EE-22	17-22 cc.	Max.
Oldsmobile L-32	EE-2	17 cc.	Min.
Oldsmobile L-33	EE-22	17 cc.	Min.
Packard, all Eights	EE-22	20-24 cc.	Max.
Packard, all Twelves	EE-3	22-24 cc.	Min.
Pierce Arrow, all Eights	EE-3	14-18 cc.	Max.
Studebaker 73, 82, Pres. C	EE-22	18-22 cc.	Max.
Studebaker Spdwy. Pres. 92	EE-22	20-24 cc.	Max.
Stutz DV-32	EE-3	20-22 cc.	Min.

Adjustment:—Throttle lever has two holes for engagement of pump rod to provide varied pump stroke. Inner hole (shorter radius) providing short pump stroke should be used for average temperatures or summer operation. Outer hole providing maximum pump stroke should be used for winter operation. See tune-up data on car model page for specific settings and recommended seasonal changes.

FLOAT LEVEL:—Fuel level in float bowl is set at 9/16" below top edge of float bowl with 3 lbs. pressure (engine idling). See table below for exceptions to this standard setting. Float level can be changed to correct fuel level by bending float lever at the point where it is attached to the float.

Car Model	Carburetor Model	Fuel Level
Buick 60, 80, 90	EE-22	5/8"
Chrysler CU, CV, C2, 3, 10, 11, 17	EE-22	5/8"
Nash 1280, 3580	EE-22	5/8"
Oldsmobile L-33	EE-22	21/32"
Studebaker 73, 82, Pres. C	EE-22	5/8"
All others	EE-22, EE-3	9/16"

CHOKE:—See special article on Stromberg Automatic Choke. Choke valve is provided with a relief poppet valve to prevent over-choking. On cars with conventional choke control, see that choke valve is fully closed with choke control button on instrument panel pulled all the way out and wide open with choke button pushed in.

THROTTLE VALVE SETTING:—Throttle valve type number (2 used) and setting (distance from upper lip of throttle valve to lower edge of upper idle port with valve closed) as follows. On Chrysler model, lower edge of #56 Vacuum Spark Control Port should be .031" plus or minus .004" above throttle valve when closed.

Carburetor.	Throttle Valve No.	Setting.
EE-2 (all except below)	P-17018	.003"
Franklin 17, 17B	P-17018 #53 hole	.003"
EE-22 (all except below)	P-17018—5°	.030"
Chrysler (all)	P-17018—5°	.040"
EE-3 (all except below)	P-17371—5°	.030"
Packard ('37-38-39)	P-17371—5°	.053"

SERVICE PARTS:—Gasket Set—J-4363G (EE-22), J-4469G (EE-22 Chrysler), J-4365G (all EE-3).

EE-23—LA SALLE, MODEL 350 SERIES 50 (1934-35) PACKARD EIGHT, MODELS 1200, 1, 2 (1935), 1400, 1, 2 (1936) PACKARD SUPER EIGHT, MODELS 1203, 4, 5 (1935), 1403, 4, 5 (1936) PACKARD SUPER EIGHT, MODELS 1500, 1, 2 (1937) PACKARD SUPER EIGHT, MODELS 1603, 4, 5 (1938) PACKARD SUPER EIGHT, MODELS 1703, 3A, 5 (1939) REO ROYALE EIGHT, MODEL N-2 (1934)

NOTE—These models are fitted with a built-in Automatic Choke (vacuum piston in throttle valve body, thermostatic spring coil mounted separately on manifold) and an integral Fast Idle. See separate article for complete data on these units. Engines must be thoroughly warmed up so that choke valve is wide open and engine idling at slow or hot idling speed when adjustments are made.

TYPE:—Duplex or dual barrel, plain tube, downdraft type. Similar in design to other 'EE' type carburetors except for Fast Idle and vacuum piston in carburetor body (see separate articles). All specifications and adjustments for these models same as given for Models EE-22 carburetors (following article) except as noted below. Fast Idle design requires that throttle be opened to 20 M.P.H. position before starting a cold engine in order to allow choke valve to close and fast idle mechanism to operate.

IDLING ADJUSTMENT:—Idle adjusting screw provided for each barrel. Operation and adjustment same as for EE-22 (following article). See tune-up data on car model page for adjustment instructions.

METERING JETS:—Main metering jets (2 used) are non-adjustable type and should be changed only for special operating conditions such as high altitude. See Stromberg Jet Specification Table for standard jet calibration.

ECONOMIZER:—To check economizer setting, check throttle valve opening by passing wire drill between edge of throttle valve and carburetor wall with throttle at point where pump piston just contacts economizer by-pass valve seat. Throttle openings are shown in table below.

Car Model	Economizer Setting	Pump Setting
La Salle 350	3/16"	Max.
Packard all models	9/32"	Max.
Reo Royale 8	21/64"	Max.

ACCELERATING PUMP:—Adjustable in usual manner by changing position of pump link rod in throttle valve lever. Engage rod in inner hole (minimum pump stroke) for normal summer temperatures, or in outer hole (maximum pump stroke) for winter temperatures. Pump capacity in cc. per 10 strokes when operated slowly is shown in table below. Pump should be set for minimum (Min.) or maximum (Max.) stroke as noted.

Car Model	Pump Capacity	Pump Setting
La Salle 350	12-14 cc.	Min.
Packard all models	14-18 cc.	Min.
Reo Royale 8	18-22 cc.	Max.

FLOAT LEVEL:—Fuel level in float bowl is set at 5/8" below top edge of bowl with 3 lbs. pressure (engine idling). Float height can be changed to correct fuel level by bending float lever at point where it is attached to the float. NOTE—When installing float needle valve, one corner of the triangular needle valve should be placed down.

Needle Valve & Seat Assembly—Furnished only as matched sets. Assembly part number and size for each model as follows:

Car Model	Part Number	Size
LaSalle	P-20256	.093"
Packard (all models)	P-22091	.130"
Reo	P-18914	.130"

CHOKE:—Choke valves are fitted with a relief poppet valve. See separate article for data on Automatic Choke mechanism.

THROTTLE VALVE SETTING:—Throttle valves (2 used) are Part No. P-17018—5° and should be set so that upper lip of valve is .030" plus or minus .004" below lower edge of upper idle port when closed. Vacuum Spark Control Port (#56 hole) lower edge should be .015" plus or minus .004" above throttle lip when closed. NOTE—Throttle valve setting for Packard Super Eight (1937-38-39) models should be .020" plus or minus .004".

SERVICE PARTS:—Gasket Set—J-4385G.

AX-2 —LAFAYETTE, MODEL 3610 (1936)
NASH '400', MODEL 3640-A (1936)
NASH-LAFAYETTE, MODEL 3710 (1937)
NASH-LAFAYETTE, MODEL 3810 (1938)

TYPE:—Single barrel, plain tube, downdraft type with throttle operated accelerating pump and economizer. AX type similar in design to previous EX type with minor differences in construction (see illustration).

Fuel System (Idling and Low Speed):—Fuel for idling taken from main jet well up through idling tube which meters the fuel and into a cross-channel in which it is mixed with air admitted through idle air bleeder opening. Fuel mixture then taken down through channel to the discharge ports. For closed throttle idling, fuel is discharged through lower port below throttle valve and is controlled by the idle adjusting screw. In this position, upper port above throttle valve serves as an additional air bleed. When the throttle is cracked open for low speed running, fuel is discharged through the upper port also.

Driving Range (15-65 M.P.H.):—At approximately 15-20 M.P.H., the idling system drops out and all fuel is supplied by the main discharge jet located directly above the main metering jet and discharging into the small auxiliary venturi. Main discharge jet is air bled by the high speed air bleeder located in the air passage in the auxiliary venturi support above the discharge jet.

High Speed and Wide Open Throttle:—At speeds above 65 M.P.H. or whenever the throttle is held open, the economizer by-pass valve located at the bottom of the accelerating pump well is opened by the pump piston and additional fuel, metered by the by-pass jet, is discharged through the pump discharge nozzle in the side of the auxiliary venturi.

IDLING ADJUSTMENT:—Idle adjusting screw controls fuel discharge from lower idle port and should be turned in for leaner mixture, or out for richer mixture. Idle speed controlled by throttle lever stopscrew. See tune up instructions on car model page for adjustment instructions on car.

METERING JETS:—Main metering jet is non-adjustable fixed type and should be changed only for special operating conditions such as high altitudes. See Jet Specification Table for standard jet calibration.

ECONOMIZER:—Consists of by-pass valve and jet at lower end of accelerating pump well. Should not require adjustment but setting can be checked by noting throttle valve opening when pump piston rests on seat of by-pass jet (less overtravel) with pump set for maximum (Max) or minimum (Min) stroke as noted. Check by passing wire drill of size noted between edge of throttle valve and carburetor wall.

Car Model	Economizer Setting	Pump Setting
Lafayette 3610	5/16"	Max.
Nash 3640-A	21/64"	Max.
Nash-Lafayette	27/64"	Max.

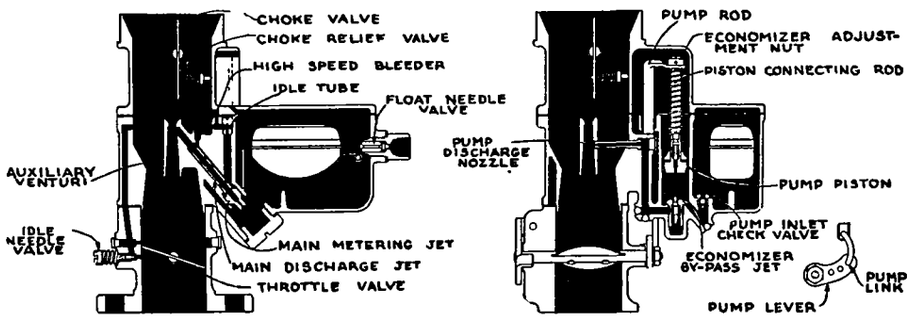
Adjustment—Take out cotter pin in adjusting nut at top of pump piston stem, turn nut. Be sure that cotter pin replaced to lock adjustment. Do not disturb this nut when disassembling carburetor to avoid necessity of resetting economizer.

ACCELERATING PUMP:—Similar in design to type used on previous carburetor models. Fuel is drawn into pump chamber through inlet ball check valve on up-stroke of piston and is discharged through outlet (by-pass) valve and pump discharge nozzle on the downstroke of the pump piston when the throttle is opened for acceleration.

Capacity—Capacity in cc. per 10 strokes with pump set for maximum (Max) or minimum (Min) stroke is noted in table below. Letter (S) indicates pump should be operated slowly.

Car Model	Pump Capacity	Pump Setting
Lafayette 3610	22-26 cc. (S)	Max.
Nash 3640-A	18-22 cc. (S)	Max.
Nash-Lafayette	18-22 cc. (S)	Max.

Adjustment—Three holes provided in throttle valve lever for pump rod link engagement. Inner hole (short radius) provides minimum stroke, center hole normal stroke, outer hole (long radius) maximum stroke. See tune up instructions on car model page for recommended settings and seasonal changes.



FLOAT LEVEL:—Fuel level in float bowl set at 5/8" below top edge of bowl with 3 lbs. pressure (engine idling). Float height can be changed to correct fuel level by bending lever at the point where it is attached to the float.

Needle Valve & Seat Assembly—Furnished only as matched sets, Part No. P-21918. Intake hole size—.093".

CHOKE:—Choke valve fitted with poppet type relief valve. Adjust linkage so that choke valve is fully closed with choke button pulled out and wide open with button pushed all the way in.

THROTTLE VALVE SETTING:—Throttle valves should be set so that upper lip of valve is .012" plus or minus .004" below lower edge of upper idle discharge port with valve fully closed.

Carburetor Type	Throttle Valve Part No.
AX-2	P-6454—18½°

SERVICE PARTS:—**Gasket Set—J-4611-G** (all AX-2 models).

TROUBLE SHOOTING:—**Poor Idling Performance.** Take out idle adjusting screw, blow out discharge ports and fuel channel. If carburetor disassembled, blow out cross-channel, clean idling tube.

Poor Acceleration. Check pump setting (see recommended setting on car model page), examine pump inlet check valve and outlet by-pass valve. Clean pump discharge nozzle and blow out channel.

Poor Running Performance. Remove plug below metering jet, clean metering jet and main discharge nozzle. See that high speed air bleeder is open. Check metering jet size (see Jet Specifications).

NUMBER **MODEL AAO-161**

A-18371—STUDEBAKER PRESIDENT, MODELS 4C (1938), 5C (1939)

NOTE:—This carburetor has a built-in Fast Idle and Automatic Choke (thermostatic coil mounted on air horn and connected directly to choke valve shaft). See Fast Idle section below and article in Carburetion Equipment section for complete data on Automatic Choke.

Jet Changes for Increased Fuel Economy:—If greater fuel economy is desired, standard main metering jets may be changed to first smaller size (.045") with slight loss in performance. Second smaller size jets (.043") should only be used for operation at high altitudes. Both main metering jets should be changed at the same time and must be same size. See Stromberg Jet Specification Table for complete jet data.

TYPE:—Aircraft, duplex, downdraft type with throttle operated accelerating pump and economizer. Carburetor has single air intake, accelerating pump, economizer, and float bowl but has two independent mixing chambers or barrels. Venturi, main discharge jet, main metering jet, throttle valve, accelerating pump discharge nozzle, and idling system duplicated for each barrel. Float bowl is aircraft type (encircling carburetor barrels) with baffles to prevent surging and twin floats mounted at opposite ends of bowl. Float valve is clipped to lever midway between floats.

Fuel System (Idling & Low Speed):—Fuel for idling taken from main jet well up through Idle Tube (which meters this fuel) to cross-passage in which it is mixed with air admitted through Idle Air Bleeder opening into mixing chamber above venturi. Fuel mixture then taken down through channel to Fast Idle cross-channel (see Fast Idle) and idle discharge ports (Secondary Idle Air Bleeder opening into mixing chamber below venturi admits additional air into fuel mixture channel). For closed throttle idling all fuel is discharged through lower port below throttle edge and is controlled by the idle adjusting screw (upper port serves as additional air bleed). As soon as the throttle valve is opened, fuel is discharged through upper port also.

Driving Range (Below 75 MPH). At about 20 MPH. idling system drops out and all fuel then metered by main metering jets and discharged through main discharge jets opening into small auxiliary venturis. Main discharge jets are air-bled by High Speed Bleeder located directly above discharge jets in auxiliary venturi supports.

High Speed & Wide Open Throttle Operation. At speeds above 75 MPH. or whenever throttle held wide open, economizer by-pass jet located at bottom of accelerating pump well is held open by the pump piston and additional fuel, metered by the by-pass jet, is supplied by the pump discharge nozzles.

IDLING ADJUSTMENT:—Must be made only with engine warmed up so that Fast Idle and Automatic Choke inoperative. Idle adjusting screws (one for each barrel) control fuel discharge and should be turned in for leaner mixture, out for richer mixture. Idle speed controlled by throttle stopscrew and should be set for 7-8 MPH. hot or slow idle. See tune up instructions on car model page for complete data.

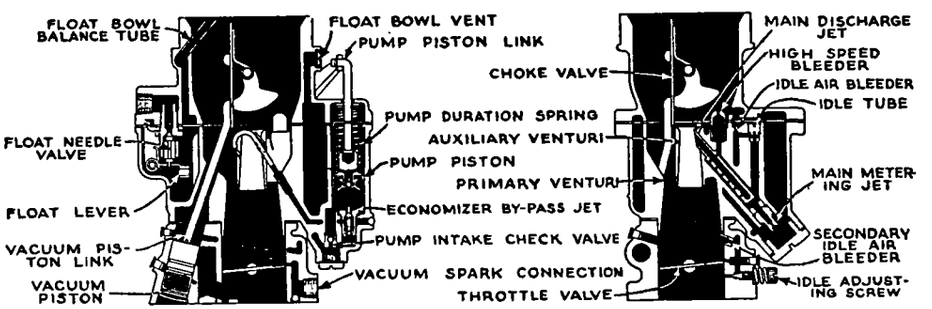
FAST IDLE MECHANISM:—Similar to design used on other models (air passage around throttle valve controlled by vacuum piston linked to choke valve) but does not operate in same manner. Air passage opens into side of vacuum piston cylinder so that air is by-passed around throttle valve whenever port on side of piston registers with air passage opening (piston is hollow with open end at top, upper end of cylinder opens into mixing chamber above venturi). The cross-passage from the idle fuel channel through which fuel is drawn for fast idling opens into the side of the vacuum piston cylinder at the upper end (piston slotted at this point) and is never closed off (serves as idle air bleeder when fast idle not operating). Vacuum chamber is located at lower end of cylinder below piston and is connected to the carburetor barrel below the throttle by a special drilled passage. When the choke is closed for cold starting, the vacuum piston is drawn up to the top of its stroke, opening the fast idle passage, so that air and fuel mixture (drawn through cross-passage from idle channel) are delivered below the throttle valve. When the engine begins to fire, manifold vacuum draws the piston down partially, opening the choke valve slightly against the tension of the automatic choke thermostatic spring, but without closing off the fast idle passage around the throttle. Air flow through fast idle passage restricts air bleed action of the idle fuel cross-passage so that idle discharge is richer than normal to compensate for this additional air flow. When the engine warms up and the thermostatic spring unwinds, opening of the choke valve allows vacuum piston to complete its stroke, cutting off fast idle passage so that all air flows past throttle valve, and air bleed action of cross-passage reduces idle fuel discharge to normal richness. Engine then idles at hot or slow idle speed. No adjustment required.

IMPORTANT NOTE—Whenever air horn and float bowl cover assembly is removed, take out choke valve screws first, freeing valve from shaft, so that valve, link and piston assembly is not disturbed. If this is not done, vacuum piston link assembly may be damaged. When vacuum piston removed, see that it is installed with slot on side toward idle fuel cross-passage port.

METERING JETS:—Main metering jets are non-adjustable type. See Note above for recommended changes for increased fuel economy and Stromberg Jet Specification Table for complete jet calibrations.

ECONOMIZER:—By-pass valve and jet located at bottom of accelerating pump cylinder and operated by pump piston. Should not require adjustment but setting can be checked by noting throttle valve opening when pump piston rests on seat of by-pass valve (less over-travel) with pump set for minimum stroke. Should be 5/16" (plus or minus 1/64"). No adjustment provided but pump 'walking-beam' lever can be bent slightly to correct opening. NOTE—When re-installing lever make certain that ball end is toward carburetor.

ACCELERATING PUMP:—Operated by throttle lever through 'walking-beam' linkage. Fuel is drawn into pump chamber through inlet ball check valve when throttle is closed and is discharged through outlet check valve (economizer by-pass valve) and pump discharge nozzle in each carburetor barrel when throttle opened for acceleration. Piston is spring-loaded on pump rod to prolong pump discharge (sudden throttle opening will compress spring allowing piston to lag, subsequent expansion of spring prolongs piston movement and pump discharge). A spring loaded relief valve located in the piston head will by-pass some fuel and prevent engine loading up when throttle opened suddenly (this valve normally closed).



Capacity—16-20 cc. per 10 strokes when operated slowly with pump set for minimum stroke.

Adjustment—Two holes provided in throttle lever for pump link engagement. Inner hole (short radius) provides minimum stroke, outer hole (long radius) maximum stroke. See tune up instructions on car model page for recommended settings.

FLOAT LEVEL:—**Fuel Level.** Should be 5/8" below top surface of float bowl with 3 lbs. pressure (engine idling) or even with the lower edge of the inspection hole on the side of the bowl (take out plug to check level).

Float Height—Use special service tool, T-24971, to set floats. Remove air horn and float cover assembly (see Note in Fast Idle section for instructions to avoid damage to fast idle mechanism), invert cover, install tool on gasket. Tool guid will also check float travel (floats must be free and not rub on bowl). Adjust floats by bending float lever. If tools not used, top of floats should be 1 11/32" above gasket on cover.

Float Valve & Seat—Part No. P-22499. Furnished only as matched set.

Float Bowl Vents—Bowl vented to outside through screened opening on side of air horn. Also vented through balance tube in air horn directly below air cleaner.

THROTTLE VALVE SETTING:—When installing valves see that distance from top edge of valve to lower edge of upper idle port is .020" plus or minus .004".

CHOKE:—Valve is offset type, operated by thermostatic spring coil coupled directly to choke valve shaft. See article in Carburetion Equipment Section for complete data.

SERVICE PARTS:—Gasket Set—No. J-5318-G.

AA-1—BUICK SPECIAL, MODEL 37-40 (1937)
AA-2—BUICK CENTURY, MODEL 37-60 (1937)
BUICK ROADMASTER, MODEL 37-80 (1937)
BUICK LIMITED, MODEL 37-90 (1937)

NOTE:—Smaller main metering jets must be used on all models when equipped with optional Heavy Duty oil-bath type Air Cleaners. See Metering Jet section below.

Cold Idle Control:—Buick type similar to design used on previous models. See article in Carburetion Equipment Section for adjustment instructions.

Automatic Choke:—New type Delco-Remy Model 490-A Carburetor Control. Not similar to type used on previous models. See article in Carburetion Equipment Section for adjustment instructions.

TYPE:—Aircraft type, duplex downdraft carburetor with throttle actuated accelerating pump and economizer. Carburetor has single air intake, float chamber and accelerating pump but has two independent mixing chambers or barrels. Venturi, main discharge jet, main metering jet, throttle valve, accelerating pump discharge nozzle and idling system duplicated for each barrel. Float bowl is new design fitted with baffles to prevent surging and has twin floats mounted at opposite ends of bowl chamber. Float valve is clipped to lever midway between floats.

Fuel System (Idling and Low Speed):—Fuel for idling is taken from the main jet well up through the idling tube which meters the fuel and is mixed with air admitted through the upper (small) hole in the idling tube. From this point the fuel mixture is taken down through a channel to the discharge ports. Additional air is admitted through the idle air bleeder in the passage leading from the lower end of the primary venturi. For closed throttle idling, fuel mixture is discharged through lower discharge port below the throttle and is controlled by the idle adjusting screw. In this position, the upper port above the throttle edge serves as an additional air bleed. When the throttle is opened for low speed running, additional fuel is discharged through this upper port also.

Driving Range (22-75 M.P.H.):—At approximately 22 M.P.H. the idling system drops out and all fuel is supplied by the main discharge jet located directly above the main metering jet and discharging into the small auxiliary venturi. Main nozzle is air bled by the high speed air bleeder located directly above the nozzle in the auxiliary venturi support.

High Speed & Wide Open Throttle Running:—At speeds above 75 M.P.H. or whenever the throttle is held open, the economizer by-pass valve located at the bottom of the accelerating pump well is held open by the pump piston and additional fuel, metered by the economizer by-pass jet, is discharged through the pump discharge nozzle.

IDLING ADJUSTMENT:—Idle adjusting screw for each barrel controls fuel discharge from lower idling port. Screws should be turned in for leaner mixture and out for richer mixture. Approximate settings are 1⅜ turns open (Series 40), 1¼ turns open (Series 60, 80, 90) from inner or closed position. Both screws must be set alike. Idle speed controlled by throttle lever stopscrew and should be set for 7-8 M.P.H. idling speed with engine warmed up (choke valve open and Cold Idle Control inoperative). See tune up instructions on car model page for complete adjustment instructions on car.

METERING JETS:—Main metering jets are non-adjustable fixed type. Jets should be changed only for special operating conditions such as high altitude. Smaller main metering jets must be used on all models when equipped with optional Heavy Duty oil-bath type Air Cleaner. Standard and altitude calibrations for each model and each type air cleaner are as follows (see Jet Specification Table for other parts):

Model	Air Cleaner	Under 3500 ft.	3500 to 9000 ft.	9000 ft. and over
37-40	Std.	.049"	.046"	.044"
37-40	Heavy Duty	.045"	.042"	.040"
37-60, 80, 90	Std.	.052"	.049"	.047"
37-60, 80, 90	Heavy Duty	.051"	.048"	.046"

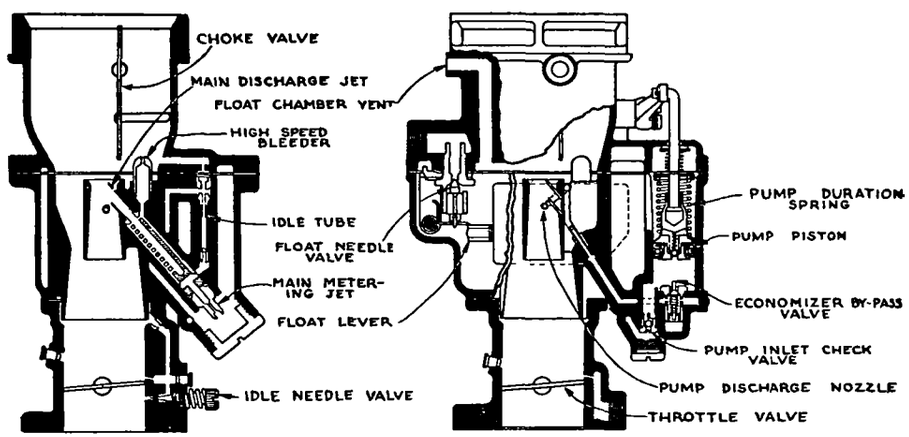
These jets are new type (Part No. P-22660) and must not be interchanged with other types. May be identified by groove on jet shank. Use special wrench T-24924 to assemble jets.

NOTE—Whenever main discharge jet located above main metering jet is removed, new lead gasket must be used in carburetor body to insure a good seal when the jet is replaced.

ECONOMIZER:—Consists of by-pass valve and jet at lower end of accelerating pump well. Should not require adjustment but setting can be checked by noting throttle valve opening when pump piston rests on seat of by-pass jet (less over-travel) with pump set for maximum stroke. Throttle opening should be 9/64" (Series 40), 13/64" (Series 60, 80, 90) plus or minus 1/64". Check opening by passing wire drill between edge of throttle valve and carburetor wall.

ACCELERATING PUMP:—Similar in design to type used on previous models. Fuel is drawn into pump chamber through ball check valve on upstroke of piston and is discharged through by-pass valve and pump discharge nozzle on downstroke of piston when throttle is opened for acceleration.

Capacity:—Capacity in cc. per ten strokes with pump set for maximum stroke should be 22-28 cc. (Series 40), 28-32 cc. (Series 60, 80, 90) when pump is operated slowly.



Adjustment:—Pump should be set for maximum stroke (rod connected in long radius or left hand hole in throttle lever) for normal operation. When highly volatile fuels are used and acceleration charge is too rich causing 'staggering', pump rod may be shifted to right hand or short radius hole providing shorter pump stroke. This setting does not affect economizer action.

FLOAT LEVEL:—Fuel level in float bowl is set at 5/8" below top surface of bowl with 3 lbs. pressure (engine idling). A sight hole closed by a plug is provided on the side of the bowl to check fuel level which should be even with the bottom of the threads in the sight hole with the engine idling. To check float level with carburetor disassembled, use special service tool SER-292, inverting cover and installing tool on cover gasket. Top of floats when inverted should be even with tops of guides. Guides also locate floats so that they will not rub on sides of bowl when reassembled. Float level can be corrected by bending float lever arm. If special tool not used, top of float should be 1 11/32" above gasket surface.

NOTE—Float height on first carburetors set at 1 13/32". Specifications changed to 1 11/32" due to variation in float weights.

CHOKE VALVE:—Offset type with stop pin to limit travel in full open position. No relief valve used. Choke valve shaft linked directly to Automatic Choke by flexible shaft protected by housing.

THROTTLE VALVE SETTING:—Throttle valves are 5° type Part No. P-20874 (Series 40), P-22447 (Series 60, 80, 90). Must be set so that upper lip of valve is .022" plus or minus .004" below lower edge of upper idle discharge port. Lower edge of vacuum spark control port should be .041" (Series 40), .085" (Series 60, 80, 90) plus or minus .004" above upper edge of throttle valve with valve fully closed.

SERVICE PARTS:—Gasket Set—No. J-4781-G (AA-1), J-4782-G (AA-2).

AA-25—CADILLAC V-8, SERIES 37-60, 65, 70, 75 (1937)
CORD, SUPERCHARGED MODEL 812 (1937).
LA SALLE V8, SERIES 37-50 (1937)

NOTE:—This type carburetor fitted with built-in Fast Idle and Automatic Choke. See Fast Idle section below and separate article in Carburetion Equipment Section on Stromberg Automatic Choke for adjustment instructions.

TYPE:—Aircraft type, duplex downcraft carburetor. Similar in design to other AA types (see previous article) except for Fast Idle and Automatic Choke. Separate Idle Air Bleeder and air bleed hole in idle tube not used, idle system is air bled by bleed hole drilled in air horn casting above idle fuel channel.

IDLING ADJUSTMENT:—Idle adjusting screw for each barrel controls fuel discharge from lower idle port. Screws should be turned in for leaner mixture and out for richer mixture and should be set alike. Idle speed controlled by throttle lever stopscrew and should be set for 7-8 M.P.H. idling speed with engine warmed up so that choke valve wide open and Fast Idle inoperative. See tune up instructions on car model page for complete adjustment with carburetor in car.

METERING JETS:—Main metering jets are non-adjustable fixed type and should be changed only for special operating conditions such as high altitudes. See Jet Specification Table for standard jet calibration. These jets are new type, Part No. P-22660, and must not be interchanged with other types. May be identified by groove on jet shank. Use special wrench T-24924 when assembling jets.
NOTE—Whenever main discharge jet located directly above main metering jet is removed. New lead gasket must be used in carburetor body to insure a good seal when jet is replaced.

ECONOMIZER:—Similar to design used on other AA carburetor types. Check setting by noting throttle opening when pump piston rests on by-pass jet seat (less over-travel) with pump set for maximum stroke. Thottle opening should be 21/64" plus or minus 1/64". Check by passing wire drill between edge of throttle valve and carburetor wall.

ACCELERATING PUMP:—Similar to design used on other AA carburetor types.
Capacity—18-22 cc. per 10 strokes with pump set for minimum stroke.
Adjustment—Two holes provided in throttle lever for pump rod connection. Inner hole (short radius) provides minimum stroke, outer hole (long radius) maximum. See car model tune up page for recommended settings.

FAST IDLE MECHANISM:—Consists of an air passage around the throttle valve and a cross-channel from the idle fuel channel opening into this passage so that additional fuel for idling is discharged at this point (providing a fast idle without opening the throttle valve) whenever the vacuum piston is up far enough to open the passage. Vacuum piston is linked to choke valve and will be raised to the top of its stroke when the choke valve is closed for cold starting. When the engine begins to fire, the manifold vacuum pulls the piston down partially (vacuum chamber below piston connected to lower end of passage below throttle by hole in piston wall), opening the choke valve slightly but not cutting off the fast idle passage and fuel port. As the engine warms up and the automatic choke thermostatic spring unwinds, the opening of the choke valve allows the vacuum piston to complete its stroke, cutting off the fast idle passage. All fuel is then supplied by the regular idling ports and the engine idles at the warm or slow idling speed. No adjustment is required.
NOTE—Whenever carburetor is to be disassembled, take out choke valve screws freeing valve from shaft before removing air horn. This is necessary to prevent damage to vacuum piston link assembly.

FLOAT LEVEL:—Fuel level in float bowl set at 5/8" below top surface of bowl with 3 lbs. pressure (engine idling) or even with the bottom of the threads in the bowl sight hole (on side of bowl, closed normally by a plug). To check level with carburetor disassembled, use special service tool SER-292 inverting cover and installing tool on cover gasket. Top of floats when inverted should be even with top of guides. Guides also locate floats so that they will not rub on sides of bowl when reassembled. Correct float level by bending float lever arm. If special tool not used, top of float should be 1 11/32" above gasket surface (first carburetors set at 1 13/32" but specifications changed to allow for float weight variations).
NOTE—See note under Fast Idle above for special directions when removing float bowl cover to avoid damage to choke valve and fast idle vacuum piston

THROTTLE VALVE SETTING:—Throttle valves are 5° type, Part No. P-22752. Must be set so that upper lip of valve is .022" (Cadillac, LaSalle), .040" (Cord) plus or minus .004" below lower edges of upper idle discharge port. No vacuum spark control port is used on this model.

CHOKE:—Automatic Choke is special built-in type with electrical heating coil. See article in Carburetion Equipment Section for complete data.

SERVICE PARTS:—Gasket Set—No. J-4387-G.

NUMBER MODEL AAV-25

A-18672—CADILLAC V8, SERIES 37-60, 65, 75 (1938)

NOTE:—This carburetor has a built-in Fast-Idle and Automatic Choke (thermostatic coil mounted on air horn and connected directly to choke valve shaft). See Fast Idle section below and article in Carburetion Equipment section for complete data.

TYPE:—Aircraft type, duplex downdraft carburetor. Same design as other AAV types (see previous article) except for Fast Idle and Automatic Choke.

IDLING ADJUSTMENT:—Idle adjusting screw for each barrel controls fuel discharge from lower idle port. Screws should be turned in for leaner mixture, out for richer mixture, and should be set alike. Idle speed controlled by throttle lever stopscrew and should be set for 6 MPH. idling speed with engine warmed up so that fast idle and automatic choke are inoperative. See tune up instructions on car model page for complete data.

METERING JETS:—Main metering jets are non-adjustable type and should be changed only for special operating conditions such as high altitudes. See Jet Specification table for complete jet data.
NOTE—Whenever main discharge jet (located directly above main metering jet) is removed, new lead gasket must be used in carburetor body on discharge jet seat to insure a god seal when jet is replaced.

ECONOMIZER:—Vacuum controlled by-pass jet type. Same design as on other AAV carburetor types. No adjustment required.

ACCELERATING PUMP:—Same design as on other AAV carburetor types (see previous article).
Capacity—18-22 cc. per 10 strokes with pump set for minimum stroke.
Adjustment—Two holes provided in throttle lever for pump link engagement. Inner hole (short radius) provides minimum stroke, outer hole (long radius) maximum stroke. See tune up instructions on car model page for recommended setting.

FAST IDLE MECHANISM:—Consists of an air passage around the throttle valve (controlled by vacuum piston in passage) and a cross-channel from the idle fuel channel opening into this passage so that additional fuel is discharged below the throttle valve providing a fast idle without opening the throttle whenever the passage is open. Vacuum piston is linked to choke valve and will be raised to the top of its stroke when choke valve is closed for cold starting. This opens fast idle passage. When engine begins to fire, manifold vacuum pulls piston down slightly (vacuum chamber below piston open to manifold through hollow piston and port at lower end of relieved portion of piston, piston will stop when large port at upper end of piston is uncovered). This action opens the choke valve slightly but does not cut off the fast idle action. As the engine warms up and the thermostatic spring coil unwinds (coil operated by electric heating element), the opening of the choke valve allows the vacuum piston to complete its stroke closing off the fuel channel and fast idle passage. All fuel is then supplied by the regular idle discharge ports and the engine idles at warm or slow idle speed. No adjustment is required.
IMPORTANT NOTE—Whenever air horn and float bowl assembly is removed, take out choke valve screws freeing valve from shaft first so that valve, link, and vacuum piston assembly is not disturbed. If this is not done, vacuum piston link assembly may be damaged.

FLOAT LEVEL:—Fuel Level. Should be 5/8" below top surface of float bowl with 3 lbs. pressure (engine idling) or even with the bottom of the sight hole on the side of the float bowl (take out inspection hole plug to check level).
Float Height—Use special service tool, T-24971, when setting float heights. Remove air horn and bowl cover assembly, invert, install tool on cover gasket. Tops of tool vertical guides should be flush with tops of floats. Guides will also check float travel (float must not rub on sides of bowl and must have free travel throughout range). Adjust float height by bending float lever. If tool not used, top of float should be 1 11/32" above gasket on cover.
Float Valve & Seat—Part No. P-22499. Furnished only as matched sets.
Float Bowl Vent—Bowl vented to outside through hooded opening at upper end of overflow pipe on bowl cover beside air horn. Also vented through channel and port opening into air horn above choke valve.

THROTTLE VALVE SETTING:—Part No. P-23537. Set valves so that distance from upper lip of valve to lower edge of upper idle discharge port is .030" (plus or minus .004").

CHOKE:—Choke valve offset type. Automatic choke control is special Stromberg built-in type with new spring linkage to hold choke valve closed for starting. See article in Carburetion Equipment section for complete data.

SERVICE PARTS:—Gasket Set—No. J-5320-G.

NUMBER **MODEL AAV-1.**

A-18681—BUICK, MODEL 40 (1938) STD. AIR CLEANER
A-18691—ABOVE MODEL WITH HEAVY DUTY AIR CLEANER

MODEL AAV-2.

A-18682—BUICK, MODELS 60, 80, 90 (1938) STD. AIR CLEANER
A-18692—ABOVE MODEL WITH HEAVY DUTY AIR CLEANER
A-18782—CHRYSLER IMPERIAL, MODEL C-19 (1938)
A-18792—CHRYSLER CUST. IMPERIAL, C-20 (1938)
A-18792—CHRYSLER IMPERIAL, MODEL C23 (1939)
CHRYSLER CUSTOM IMPERIAL, MODEL C24 (1939)

MODEL AAOV-1.

A-18431—CHRYSLER IMPERIAL, MODEL C-14 (1937)
A-18441—CHRYSLER CUST. IMPERIAL, C-15 (1937)

NOTE:—Buick carburetors not interchangeable as special jet calibrations used when heavy duty air cleaners are installed. See Stromberg Jet Specification Table for complete jet specifications for each type.

Buick Model 40 with Self-shifting Transmission—Idle speed should be set at 5-6 MPH. in third gear. Transmission throttle control lever linkage setting must be checked whenever carburetor throttle linkage is disconnected or changed. See adjustment instructions in Buick Self-shifting Transmission article in Mechanical Equipment Section.

Chrysler Metering Jets—These jets are new type, Part No. P-22660, and must not be interchanged with other types. May be identified by groove on shank. Use special wrench T-24924 to install these jets.

TYPE:—Aircraft type, duplex downdraft carburetor with throttle actuated accelerating pump and vacuum controlled economizer. Carburetor has single air intake, float chamber and accelerating pump but has two independent mixing chambers or barrels. Venturi, main discharge jet, main metering jet, throttle valve, accelerating pump discharge nozzle, and idling system duplicated for each barrel. Float bowl is new design fitted with baffles to prevent surging and has twin floats mounted at opposite ends of bowl chamber which encircles carburetor body. Float valve is clipped to lever midway between floats.

Fuel System (Idling and Low Speed):—Fuel for idling is taken from the main jet well up through the idling tube which meters the fuel and is mixed with air admitted through the idle air bleed hole in the cross channel. From this point the fuel mixture is taken down through a channel to the discharge ports. For closed throttle idling, the fuel mixture is discharged through the lower port below the throttle and is controlled by the idle adjusting screw. In this position the upper port above the throttle valve serves as an additional air bleed. When the throttle is opened for low speed running, additional fuel is discharged through this upper port also.

Driving Range (22-75 M.P.H.):—At approximately 22 M.P.H. the idling system drops out and all fuel is supplied by the main discharge jet located directly above the main metering jet and discharging into the small auxiliary venturi. Main nozzle is air bled by the high speed air bleeder located directly above the nozzle in the auxiliary venturi support.

High Speed and Wide Open Throttle Running:—At speeds above 75 M.P.H. or whenever the throttle is held open, the drop in vacuum above the spring loaded vacuum piston allows the spring to force the piston down so that the piston stem opens the by-pass valve located directly below the piston assembly. This allows additional fuel, metered by the by-pass jet, to flow to the main discharge nozzle.

IDLING ADJUSTMENT:—Idle adjusting screw for each barrel controls fuel discharge from lower idling port. Screws should be turned in for leaner mixture and out for richer mixture and must be set alike. Idle speed controlled by throttle lever stopscrew and should be set for 7 M.P.H. idling speed with engine warmed up (choke valve wide open and fast idle inoperative). See tune up instructions on car model page for complete adjustment instructions on car.

METERING JETS:—Main metering jets are non-adjustable fixed type. Jets should be changed only for special operating conditions such as high altitude. See Jet Specification Table for standard jet calibrations for all models.

NOTE—Whenever main discharge jet located directly above main metering jet is removed, new lead gasket must be used in carburetor body to insure a good seal when jet is replaced.

ECONOMIZER:—Consists of by-pass valve and jet controlled by special vacuum piston and by-passes fuel to main discharge jet around main metering jet when vacuum drops sufficiently to allow spring to force piston down. Economizer is set to open by-pass valve when vacuum drops to 5-7" of HG. corresponding to car speed of 70-75 M.P.H. No adjustment provided (replace vacuum piston and spring assembly).

ACCELERATING PUMP:—Operated by throttle lever through 'walking beam' linkage. Fuel is drawn into pump chamber through inlet ball check valve when throttle is closed and is discharged through outlet check valve and pump discharge nozzle in each carburetor barrel when throttle is opened for acceleration. Piston is spring loaded on pump rod to increase duration of pump discharge (sudden throttle opening will cause piston to lag, compressing pump spring, expansion of spring prolongs piston movement and pump discharge). A spring loaded relief valve located in head of pump piston will by-pass some fuel if accelerating pump operated rapidly to prevent loading up engine (this valve normally closed so that all fuel is discharged to nozzles).

SERVICE PARTS:—**Gasket Set**—No. J-5320-G.

Capacity—With pump link connected as indicated, and pump operated slowly (S), fast (F), capacity in cc. per 10 strokes should be as follows:

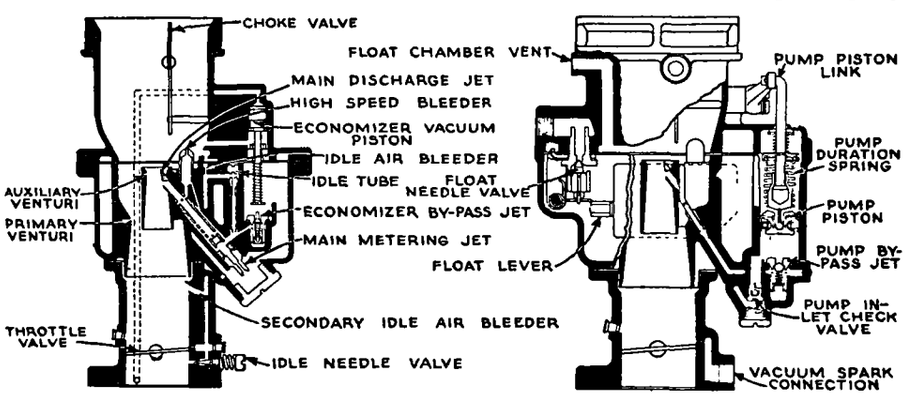
Car Model	Carburetor	Pump Capacity	Setting
Buick	AAV-1	9-12 (F), 17-20 (S)	Medium
Buick	AAV-2	15-18 (F), 21-24 (S)	Medium
Chrysler	AAOV-1	21-25 (F), 27-31 (S)	Maximum
Chrysler C19	AAV-2	7-11 (F), 23-27 (S)	Maximum
Chrysler C20, C23, C24	AAV-2	21-25 (F), 27-31 (S)	Maximum

Adjustment (Buick)—Three holes provided in throttle lever for pump link engagement. Center hole (medium stroke) is standard for normal fuels and temperatures. No. 1 (upper hole) provides minimum stroke, No. 3 (lower hole) maximum stroke. See tune up data on car model page for recommended settings.

Adjustment (Chrysler)—Two holes provided in throttle lever for pump link engagement. Inner hole (short radius) provides minimum stroke, outer hole (long radius) maximum stroke. See tune up data on car model page for recommended settings.

FAST IDLE:—**Buick Models**—Buick Cold Idle Control. See article in Carburetion Equipment Section for complete data.

Chrysler Models—Consists of a rotary cam linked to the choke valve which serves as throttle lever stopscrew stop. Cam is rotated to fast idle position when choke valve closed for cold starting so that throttle valve is held open slightly.



Adjustment—To check setting, hold stopscrew against first step of fast idle cam and check choke valve opening with ⅛" drill rod inserted between edge of choke valve and air horn wall. If opening not correct, adjust rod length (turn ball joint end on rod). Open throttle wide and again check choke valve opening with 7/32" rod. If opening not correct, bend extended arm of fast idle cam slightly.

FLOAT LEVEL:—**Fuel Level.** Should be 19/32" (Buick), 5/8" (Chrysler) below top edge of float bowl with 3 lbs. pressure (engine idling) or approximately even with bottom of inspection hole on side of bowl (take out plug).

Float Height—Use special service tool, T-24971 when setting floats. Remove air horn and float cover assembly, invert, mount tool on cover gasket. Tool guides will also check float travel (floats must be free and not rub on bowl). Adjust floats by bending float lever. If tool not used, top of floats should be 1 11/32" above gasket on cover.

Float Valve & Seat—Part No. P-22499 (all models). Furnished only as matched sets.

Float Bowl Vent:—Bowl vented to outside through opening in side of air horn directly below air cleaner collar.

MODELS AAV-1, AAV-2, AAOV-1 CONT.

THROTTLE VALVE SETTING:—When installing throttle valves, they must be set so that distance from upper edge of throttle valve to lower edge of upper idle port is correct as shown in table below.

Car Model	Throttle Valve Part No.	Setting
Buick 40 (AAV-1)	P-20874—5°	.022"
Buick 60, 80, 90 (AAV-2)	P-22447—5°	.022"
Chrysler (all AAV-2)	P-22752—5°	.022"
Chrysler C14 (AAOV-1)	P-22806—5°	.040"
Chrysler C15 (AAOV-1)	P-22806—5°	.030"

Allowable variation for settings is plus or minus .004".

CHOKE—Buick Models. Choke valve is offset type with stop pin to limit travel in wide open position. Automatic choke is Delco-Remy type linked directly to choke valve shaft. See article in Carburetion Equipment Section for complete data.

Chrysler Models. Sisson Automatic Choke is standard equipment. See article in Carburetion Equipment Section for complete data.

SERVICE PARTS:—Gasket Set—No. J-5317-G (Buick AAV-1), J-5321-G (Buick AAV-2), J-4784-G (Chrysler AAOV-1), J-5316-G (Chrysler AAV-2).

Number MODEL—AAV-26

A-18972—BUICK, MODELS 39-60, 39-80, 39-90 (1939)

A-18982—ABOVE MODELS WITH HEAVY DUTY AIR CLEANER.

A-18962—CADILLAC V8, SERIES 39-60S, 61, 75 (1939)

NOTE:—Buick Models. Carburetor used on cars with heavy duty (oil-bath type) air cleaner has special jet calibration and is not interchangeable with standard model. See Stromberg Jet Specification table for complete jet calibrations for each model.

TYPE:—Aircraft type, duplex, downdraft carburetor. Similar in design to 'AAV' carburetors used on previous Buick and Cadillac models except for the new design Automatic Choke and Fast Idle as follows:

Automatic Choke—Thermostatic coil and vacuum piston type. Assembly is mounted on carburetor air horn and linked to the choke valve lever within the choke housing. Thermostat actuated by exhaust manifold heat through external heat tube connected between thermostat cover and hot air stove on manifold. No electric coil used (as on previous Cadillac models).

Fast Idle—Consists of a special fast idle lever and adjusting screw mounted on the throttle valve shaft and a fast idle cam linked to the choke valve.

See Article in Carburetor Section for complete Automatic Choke and Fast Idle servicing directions.

IDLING ADJUSTMENT:—Adjust only with engine warmed up so that Automatic Choke and Fast Idle inoperative (choke valve wide open, stopscrew on lowest step of fast idle cam) and engine idling at hot or slow idling speed. Make certain that some clearance exists between fast idle adjusting screw and fast idle cam (on opposite end of throttle shaft from regular idling speed adjusting screw). Set throttle lever stopscrew for correct 7-8 MPH. (Buick), 7-8 MPH. (Cadillac) idling speed. Turn idle adjusting screw for each carburetor barrel (both screws must be set alike) in for leaner mixture or out for richer mixture. These screws control fuel mixture discharge from lower (closed throttle) idle discharge ports. Recheck idle speed adjustment. See car model tune up page for complete adjustment instructions. Check Fast Idle setting (see below).

Buick Note—If vacuum gauge used for idle adjustment, turn both idle adjusting screws out evenly in the 'rich' direction until vacuum reading is 1" lower than maximum.

METERING JETS:—Main metering jets are non-adjustable type located under plug at lower end of each nozzle. Jets should be changed only for special operating conditions such as high altitude (see Buick note above and Stromberg Jet Specification Table for complete jet data).

NOTE—Whenever main discharge nozzles are removed, use extreme care to remove all traces of old lead gasket from carburetor body and shoulder on nozzle. Use new lead gasket when installing nozzle to insure good seal between nozzle and body.

ECONOMIZER:—Consists of a by-pass valve and jet in the carburetor main body controlled by a vacuum piston in a cylinder in the air horn casting. Economizer by-passes fuel around main metering jets to main nozzles when vacuum in manifold decreases sufficiently so that piston is forced down by spring. No adjustment required.

NOTE—Use special tool T-24733 to remove vacuum power piston No. P-22803.

Setting—Vacuum piston opens valve with manifold vacuum of 5-6" of HG. corresponding to car speed of 70-75 M.P.H.

ACCELERATING PUMP:—Similar to design used on other 'AAV' carburetors with spring-loaded relief valve in piston head and duration spring on rod above piston (light spring above duration spring in dust washer retainer) except that strainer has been added below intake check valve (see Note below).

Capacity—Pump capacity per 10 strokes fast (F), slow (S) is shown in table below. Pump must be set for correct stroke (see Adjustment) as shown in table.

Car Model	Carburetor	Pump Capacity	Pump Setting
Buick	AAV-26	15-18 cc. (F), 21-24 cc. (S)	Center
Cadillac	AAV-26	14-18 cc. (F), 18-22 cc. (S)	Minimum

Adjustment (Buick)—Three holes provided in throttle lever for pump rod engagement. Center hole is recommended setting for normal operating conditions. Engage rod in inner hole (short radius) for minimum pump discharge, outer hole (long radius) for maximum discharge.

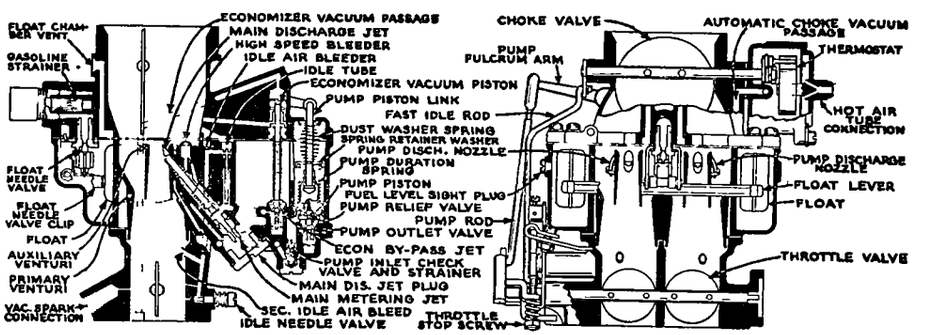
Adjustment (Cadillac)—Two holes provided in throttle lever for pump rod engagement. Inner hole (minimum stroke) is normal setting. Outer hole provides maximum stroke and should be used when greater acceleration discharge required.

Pump Servicing Note—Strainer screen located in plug below pump intake check valve should be removed and cleaned frequently to insure satisfactory pump operation.

FAST IDLE & CHOKE RELEASE:—Check and adjust as directed below. See article in Carburetion Equipment Section for complete servicing directions.

Fast Idle Setting—After setting the slow idle speed (as given above), see that choke valve is wide open and close throttle valves completely so that throttle stopscrew is against stop on body. Hold throttle valve in this position and close choke valve by hand until stopscrew strikes first step on fast idle cam (do not force choke valve beyond this position which will bind fast idle rod or distort fast idle cam spring), measure choke valve opening at this point by inserting drill rod between upper edge of valve and air horn wall. This distance should be 5/16" (Buick), .102"-#38 drill (Cadillac). Adjust by bending fast idle rod slightly.

Choke Release—Open throttle to wide open position so that choke valve is opened by ear on fast idle lever contacting lug on fast idle cam. Measure choke valve opening with special gauge T-25057 (Buick), T-25056 (Cadillac) or by inserting drill rod between upper edge of choke valve and air horn wall. Distance should be .156-.187" (11/64" drill) on all models. Adjust by bending ear on fast idle lever using extreme care not to damage fast idle rod and fast idle cam spring.



FLOAT LEVEL:—**Fuel Level**—Should be 19/32" (Buick), 5/8" (Cadillac) below gasket surface of float bowl or 1/32" above bottom of level sight hole on side of bowl (Buick), even with bottom of hole (Cadillac). Remove plug to check fuel level.

Float Height—Use special service tool T-24971 to check floats. Remove air horn and bowl cover assembly, invert cover and place tool on gasket. Top of floats should be 1/32" below tops of vertical guides (Buick), even with tops of guides (Cadillac) and sides of floats should be tangent to tool guides without any drag (to provide clearance between floats and bowl). Use extreme care to adjust both floats alike.

Float Valve & Seat—Part No. P-22499. Furnished only as matched sets. When installing, make certain that needle valve is clipped to float lever.

Float Bowl Vent—Bowl vented through opening on side of air horn directly below air cleaner collar.

MODEL AAV-26 CONT.

THROTTLE VALVE SETTING:—Throttle valves are No. P-24169—5° (Buick), No. P-24172—5° (Cadillac). To check valve setting, back off throttle stopscrew so that valves are tightly closed, insert #58 drill in idle port and in vacuum port (Buick), #56 drill in idle port only (Cadillac—no vacuum spark port used), measure distance from throttle valve edge to drill. See table below for settings—all figures are plus or minus .004".

Car Model	Carburetor	Idle Port Distance	Vacuum Spark Port
Buick	AAV-26	.020"	.055"
Cadillac	AAV-26	.040"	None

CHOKE:—Stromberg automatic integral type. See article in Carburetion Equipment Section for complete servicing directions.

Choke Setting—Inverted 'V' mark on thermostat cover scale should coincide with reference mark on top of choke housing. To adjust, loosen three cover screws, rotate thermostat cover assembly.
CAUTION—When connecting heat tube to thermostat cover connection, do not use excessive pressure which may rotate cover and change choke setting.

NUMBER MODEL BXO-26

A-18652—STUDEBAKER, SIX MODEL 7A, COMMANDER 8A (1938)
STUDEBAKER, COMMANDER MODEL 9A (1939)

NOTE:—This model fitted with integral Fast Idle and Automatic Choke (thermostatic coil mounted on air horn and linked directly to choke valve shaft). See article in Carburetion Equipment Section for complete data.

Jet Changes for Increased Fuel Economy—Where greater fuel economy is desired, standard main metering jet may be changed to first smaller size (.058") with slight loss in performance. Second smaller size (.056") should only be used for high altitudes. See Stromberg Jet Specification Table for complete jet data.

TYPE:—Plain tube, downdraft type with throttle operated accelerating pump and economizer.

Fuel System (Idling & Low Speed):—Fuel for idling taken from main jet well up through Idle Tube (which meters the fuel) to cross-passage in which it is mixed with air admitted through Idle Air Bleeder (located at opposite end of cross-passage). Fuel mixture is then taken down through channel to discharge ports at throttle edge. For closed throttle idling, all fuel is discharged through lower port below throttle and is controlled by Idle Needle Valve or adjusting screw (upper port serves as an air bleeder). When the throttle is opened for low speed running, additional fuel is discharged through this port also.

Driving Range (Below 65 MPH.)—As throttle is opened and suction on main discharge jet increases, this jet begins to supply fuel and the idle system drops out. Fuel for main discharge jet is metered by main metering jet located at lower end of discharge jet. Discharge jet is air bled by High Speed Bleeder located directly above jet in auxiliary venturi support.

High Speed & Wide Open Throttle Operation—At speeds above 65 MPH. or whenever throttle held wide open, economizer by-pass valve located at bottom of accelerating pump cylinder is held open by the pump piston so that additional fuel (metered by the by-pass jet) is discharged through the pump discharge nozzle opening in the throat of the small auxiliary venturi.

IDLING ADJUSTMENT:—Must be made only when engine warmed up so that Fast Idle and Automatic Choke inoperative. Idle adjusting screw controls fuel mixture and should be turned in for leaner mixture, out for richer mixture. Idle speed controlled by throttle stopscrew and should be set for 7-8 MPH. idling speed. See tune up data on car model page for complete instructions.

METERING JETS:—Main metering jet is non-adjustable type. See Note above for recommended changes for increased fuel economy and Stromberg Jet Specification Table for complete jet calibrations.

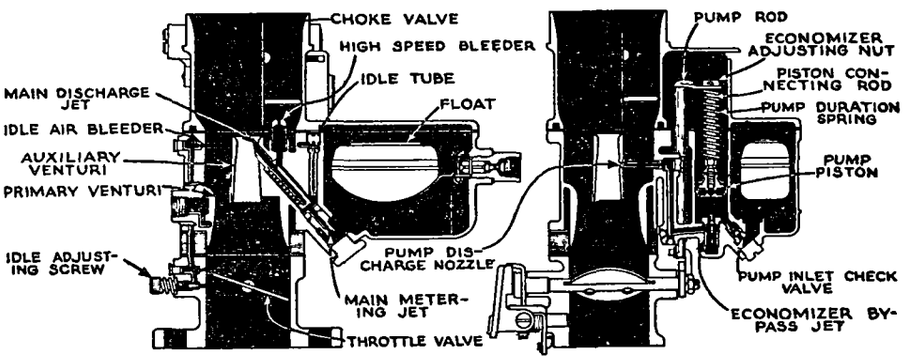
ECONOMIZER:—By-pass valve and jet located at bottom of accelerating pump cylinder and operated by pump piston. Should not require attention but setting can be checked by noting throttle opening when pump piston rests on seat of by-pass valve (less over-travel) with pump set for medium stroke (link engaged in middle hole on lever). Should be 13/32" (plus or minus 1/64").

Adjustment—To adjust, remove cotter pin and turn adjusting nut at upper end of pump piston stem. Make certain that cotterpin replaced to lock setting. NOTE—When dismantling carburetor, do not disturb this nut to avoid necessity of resetting economizer when carburetor is assembled.

ACCELERATING PUMP:—Operated by throttle lever through vertical pump rod concealed under float bowl cover. Fuel is drawn into pump chamber through inlet screen and ball check valve when throttle is closed and is discharged through outlet check valve (economizer by-pass valve) and pump discharge nozzle in throat of auxiliary venturi when throttle is opened for acceleration. Pump rod is spring loaded on pump stem so that with sudden throttle openings piston will lag slightly, compressing the spring, and the subsequent expansion of the spring will prolong pump delivery. A spring-loaded relief valve in the piston head will by-pass some fuel to prevent loading up engine when throttle is opened suddenly (this valve normally closed).

Capacity—17-22 cc. per 10 strokes when operated slowly with pump set for medium stroke (pump link in center hole).

Adjustment—Three holes provided in throttle lever for pump link engagement. Inner hole (short radius) provides minimum stroke, center hole medium stroke, outer hole (long radius) maximum stroke. See tune up data on car model page for recommended settings.



FLOAT LEVEL:—Fuel Level. Set at 5/8" below top edge of float bowl with 3 lbs. pressure (engine idling). Can be adjusted by bending float arm at point where it is attached to float. NOTE—Float fulcrum pin is retained by clip seated in float seat recess. When installing pin, see that clip is seated and engages notches at each end of fulcrum pin.

Float Valve & Seat—No. P-21918. Furnished only in matched sets.

Float Bowl Vent—Bowl is vented to outside atmosphere through slot at upper end of pump rod housing on bowl cover.

THROTTLE VALVE SETTING:—Valve is No. P-23282. Should be set so that distance from upper edge to lower edge of upper idle port is .010" plus or minus .004".

CHOKE:—Valve is offset type fitted with stop pin to limit motion in wide open position. Operated by thermostatic spring coil connected directly to choke valve shaft. See article in Carburetion Equipment Section for complete data.

SERVICE PARTS:—**Gasket Set**—No. J-5319-G.

Number **MODEL—BXV-3**
A-18073—DODGE, MODEL D11 (1939)

TYPE:—Single barrel, plain tube, downdraft type with throttle operated accelerating pump and vacuum controlled economizer. Float bowl is vented through tube in air horn below air cleaner.

Fuel System (Idling and Low Speed):—Fuel for idling taken from main jet well up through Idling Tube which meters the fuel to a cross-channel in which it is mixed with air admitted through Idle Air Bleed (air bleed passage opens into carburetor barrel below choke valve). Fuel mixture then taken down through channel to discharge ports at the throttle edge. For closed throttle idling, fuel discharged through lower port below throttle valve and controlled by idle adjusting screw (uppor port above throttle valve serves as additional air bleed). As soon as throttle is cracked open for low speed running, additional fuel is discharged from this upper port also.

Driving Range (Below 65 MPH.)—As throttle is opened, suction increases on main discharge jet and this jet supplies fuel, the idling system dropping out. Fuel for main discharge jet is metered by main metering jet located at lower end of discharge jet. Discharge jet is air bled by High Speed Bleeder located directly above jet on auxiliary venturi support.

High Speed and Wide Open Throttle Operation—At speeds above 65 MPH. or whenever throttle held wide open so that manifold vacuum falls off, spring on vacuum piston forces piston down and opens by-pass valve. Fuel metered by the by-pass jet then flows directly to the main discharge jet.

IDLING ADJUSTMENT:—Idle adjusting screw controls fuel discharge from lower idle port and should be turned in for leaner mixture, out for richer mixture. Adjust only with engine warmed up so that choke valve wide open and fast idle inoperative. Idle speed controlled by throttle lever stopscrew and should be set for 7-8 MPH. hot idle speed. See car model tune up page for adjusting instructions.

METERING JET:—Main metering jet is non-adjustable type and should be changed only for special operating conditions such as high altitude. See Stromberg Jet Specification table for complete jet data.

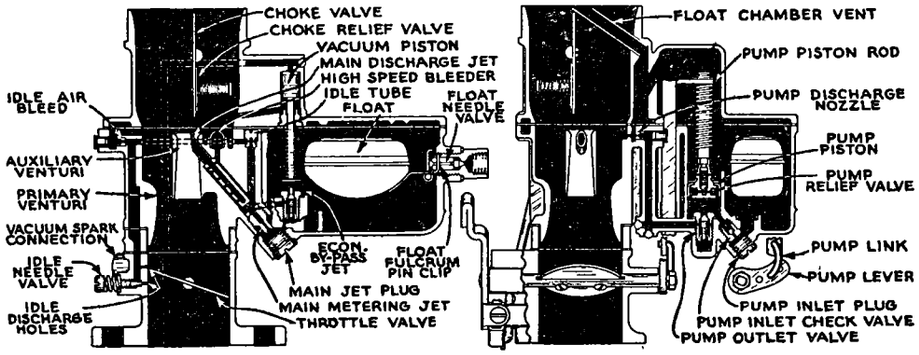
ECONOMIZER:—Vacuum piston type. Consists of a vacuum piston in a cylinder in the air horn casting which controls the by-pass valve and jet assembly in the main body casting. No adjustment required. Economizer is set to open valve with vacuum of 4-6" of HG. in manifold.

ACCELERATING PUMP:—Operated by throttle lever through vertical pump rod under float bowl cover. Fuel is drawn into pump chamber through strainer screen and inlet ball check valve and is discharged through outlet valve and pump discharge nozzle located in side of mixing chamber above main venturi when throttle opened for acceleration. Pump piston has ball type relief valve in piston head and duration spring on piston rod (spring compressed on sudden throttle openings, subsequent spring expansion prolongs pump discharge).

Capacity—Pump capacity in cc. per 10 strokes with pump set for medium stroke (link in center hole of throttle lever) should be 11-14 ccs.

Adjustment—Three holes provided in throttle lever for pump link connection. Link engaged in center hole provides normal setting, outer hole (long radius) provides maximum pump discharge, inner hole (short radius) minimum discharge. See car model tune up page for recommended seasonal changes.

Pump Servicing Note—Strainer screen located in pump inlet in bottom of float bowl should be cleaned at frequent intervals to insure satisfactory pump performance.



FAST IDLE:—Consists of a cam pivoted directly below the throttle lever shaft and linked to the choke valve. Cam serves as stop for throttle lever stopscrew and opens throttle to fast idle position when choke valve is closed for starting. No adjustment required but stopscrew should be at high point of cam with choke valve fully closed.

FLOAT LEVEL:—Fuel Level—Should be 5/8" below top edge of float bowl with engine idling. Adjust by bending float lever arm at point where it is attached to float.

Needle Valve & Seat Assembly—Part No. P-24063. Furnished only as matched set. When installing float or needle valve make certain that spring clip is properly engaged in notches on float fulcrum pin.

CHOKE:—Valve is offset type with poppet type relief valve.

Automatic Choke—Sisson. See article in Carburetion Equipment Section for adjustment and servicing instructions.

THROTTLE VALVE SETTING:—Part No. P-24059 (20° type).

SERVICE PARTS:—Gasket Set—No. J-5409-G.

STROMBERG DOWNDRAFT CARBURETOR JET SPECIFICATIONS

Car Model	Year	Carb. No.	Venturi Size	Main Metering Jet Size	Main Metering Jet Part No.	By-Pass Jet Size	By-Pass Jet Part No.	Main Discharge Jet Size	Main Discharge Jet Part No.	H.S. Bldr.	Idle Tube Size	Idle Tube Part No.	Idle Air Bld. Jet Size	Idle Air Bld. Jet Part No.	Pump Discharge Nozzle Size	Pump Discharge Nozzle Part No.
AUBURN 12-160, 1, 5	'32-33	EX-2(2)	1 3/32"	.055"	P-17004	.060"	P-16965	#28	P-17005	#70	#66	P-17076	#54	P-15477	#70	P-17020
AUBURN 8-105	1933	EX-32	1 3/16"	.060"	P-17004	4#56	P-18149	#28	P-18548	#70	#70	P-17007	#50	P-15477	#70	P-18126
AUBURN 8-50X	1934	EX-32	1 3/16"	.057"	P-17004	4#56	P-18149	#28-32	P-19702	#70	#70	P-17007	#50	P-15477	#68	P-18126
AUBURN 850-Y	1934	EE-1	1 1/32"	.050"	P-19442	1#61	P-19724	#36	P-19440	#65	#70	P-19424	#42	—	#60	—
AUBURN 653	1935	EX-22	1 3/32"	.057"	P-17004	4#56	P-18149	#32	P-20638	#70	#68	P-22042	#54	P-15477	#70	P-18126
AUBURN 851	1935	EE-1	1 1/32"	.050"	P-19442	1#61	P-19724	#36	P-19440	#65	#70	P-19424	#42	—	#60	—
AUBURN Superch. 851	1935	EX-32	1⅜"	.082"	P-17004	4#56	P-18149	#28	P-17167	#70	#68	P-17228	#56	P-15477	#66	P-18126
AUBURN 654	1936-37	EX-22	1 3/32"	.057"	P-17004	4#56	P-18149	#32	P-20638	#70	#68	P-22042	#54	P-15477	#70	P-18126
AUBURN 852	1936-37	EE-1	1 1/32"	.050"	P-19442	1#61	P-19724	#36	P-19440	#65	#70	P-19424	#42	—	#60	—
AUBURN Superch. 852	1936-37	EX-32	1⅜"	.082"	P-17004	4#56	P-18149	#28	P-17167	#70	#68	P-17228	#56	P-15477	#66	P-18126
BUICK 34-40, 35-40	'34-35	EE-1	1 1/32"	.049"*	P-19442	1#64	P-19523	#32-36	P-20420	#70	#55-70	P-20419	#54	—	#65	—
BUICK 40	1936	EE-1	1 1/32"	*.048"	P-19442	1#64	P-19523	#32-36	P-21530	#70	#55-60	P-21528	#54	—	#65	—
BUICK 60, 80, 90	1936	EE-22	1 3/16"	†.052"	P-17004	1#65	P-20467	#28	P-21682	#70	#55-60	P-21557	#58	—	#65	—
BUICK 40	1937	AA-1	1 1/32"	⊙	P-22660	1#66/	P-20623	#28-36	P-22661	#70	#55-70	P-22431	#58	—	#65	—
BUICK 60, 80, 90	1937	AA-2	1 3/16"	⊙⊙	P-22660	1#63	P-19447	#28-32	P-22428	#64	#55-68	P-22807	#54	—	#65	—
BUICK 40 (A)	1938	AAV-1	1 1/32"	.047"	P-19442	1#62	P-23361	#28	P-23315	#65	#60	P-23325	#70.(C)	—	#65	P-23245, 6
BUICK 40 (B)	1938	AAV-1	1 1/32"	.045"	P-19442	1#66	P-23606	#28	P-23315	#65	#60	P-23325	#70.(C)	—	#65	P-23245, 6
BUICK 60, 80, 90 (A)	1938	AAV-2	1 1/8"	.051"	P-19442	1#57	P-23348	#28	P-23315	#65	#60	P-23325	#70.(C)	—	#65	P-23245, 6
BUICK 60, 80, 90 (B)	1938	AAV-2	1 1/8"	.049"	P-19442	1#57	P-23348	#28	P-23315	#65	#60	P-23325	#70.(C)	—	#65	P-23245, 6
BUICK, 60, 80, 90①	1939	AAV-26	1 1/8"	.052"③	P-19442	1#57	P-23348	#28	P-23315	#65	#60	P-23325	#60⑤	—	#65	P-23245, 6
BUICK 60, 80, 90②	1939	AAV-26	1 1/8"	.050"④	P-19442	1#57	P-23348	#28	P-23315	#65	#60	P-23325	#60⑤	—	#65	P-23245, 6
CADILLAC V-8, 60, 70, 75	1936	EE-25	1 3/16"	.058"	P-17004	4#56	P-18149	#36	P-18338	#67	#70	P-17007	#42	P-15477	#56	—
CADILLAC 60, 65, 70, 75	1937	AA-25	1⅛"	.051"	P-22660	1#63	P-19447	#28-36	P-22603	#65	#70	P-23110	#40	—	#65	—
CADILLAC 60, 60S, 65, 75	1938	AAV-25	1 1/8"	.050"	P-19442	1#52	P-23667	#32	P-23567	#63	#66	P-23527	#60.(D)	—	#70	P-23516, 7
CADILLAC 60S, 61, 75	1939	AAV-26	1 1/8"	.050"	P-19442	1#63	P-21197	#32	P-23567	#70	#64	P-24009	#52⑥	—	#65	P-23245, 6
CHRYSLER CO, CT	1933	EX-32	1 3/16"	.057"	P-17004	4#56	P-18149	#28	P-18548	#70	#70	P-17007	#54	P-15477	#70	P-18126
CHRYSLER CQ	1933	EX-32	1 5/16"	.065"	P-17004	4#56	P-18149	#28	P-17167	#70	#70	P-17007	#54	P-15477	#68	P-18126
CHRYSLER CL*	1933	EE-3	1 3/16"	.061"	P-17004	.060"	P-16965	#36	P-17969	#65	#70	P-17007	#48	P-15477	#66	P-17454
CHRYSLER CU	1934	EX-32	1 5/16"	.065"	P-17004	4#56	P-18149	#28	P-17167	#70	#70	P-17007	#56	P-15477	#68	P-18126
CHRYSLER CU, CV	1934	EE-22	1 3/32"	.053"	P-17004	1#53	P-19481	#28-36	P-19840	#65	#72	P-18264	#46	P-15477	#71	P-18852
CHRYSLER CW	1934	EE-3	1 3/16"	.058"	P-17004	.060"	P-16965	#30	P-20236	#70	#70	P-19579	#42	P-15477H	#66	P-17454
CHRYSLER CZ	1935	EX-32	1 5/16"	.067"	P-17004	4#56	P-18126	#28	P-20877	#70	#70	P-17007	#56	P-15477	#64	P-18126
CHRYSLER CZ	1935	EXV-3	1 3/16"	.067"	P-17004	1#54	P-21197⑦	#28	P-20877	#70	#70	P-17007	#56	P-15477	#68	P-18126
CHRYSLER C-1	1935	EX-32	1 5/16"	.065"	P-17004	4#56	P-18149	#28	P-20877	#70	#70	P-17007	#56	P-15477	#64	P-18126
CHRYSLER C-2, C-3	1935	EE-22	1 3/32"	.053"	P-17004	1#53	P-19481	#28-36	P-19840	#65	#72	P-18264	#46	P-15477	#71	P-18852
CHRYSLER CW*	1935	EE-3	1 3/16"	.058"	P-17004	.060"	P-16965	#30	P-20236	#70	#70	P-19579	#42	P-15477H	#72	P-17454
CHRYSLER C-8	1936	EXV-3	1 3/16"	.060"	P-17004	1#54	P-21197⑦	#28	P-21326	#65	#70	P-19424	#54	P-15477	#64	P-17020
CHRYSLER C-9	1936	EXV-3	1 5/16"	.065"	P-17004	1#54	P-21197⑦	#28	P-20877	#70	#70	P-19424	#56	P-15477	#64	P-17020
CHRYSLER C-10, 11	1936	EE-22	1 3/32"	.053"	P-17004	1#53	P-19481	#28-36	P-19840	#65	#72	P-18264	#46	P-15477	#71	P-18852
CHRYSLER C-14	1937	AAOV-1	1 1/32"	.047"	P-22660	1#56	P-21657⑦	#36	P-22795	#70	#70	P-19424	#40	—	#60	—
CHRYSLER C-15	1937	AAOV-1	1⅛"	.049"	P-22660	1#54	P-21197⑦	#36	P-22795	#70	#70	P-19424	#44	—	#60	—
CHRYSLER C-17	1937	EE-22	1 3/32"	.053"	P-17004	1#53	P-19481	#28-36	P-19840	#65	#72	P-18264	#46	P-15477	#71	P-18852
CHRYSLER C-19	1938	AAV-2	1 1/32"	.047"	P-22660	1#56	P-21657	#36	P-22795	#70	#70	P-19424	#40	—	#60	P-23245, 6
CHRYSLER C-20	1938	AAV-2	1 1/8"	.049"	P-22660	1#54	P-21197	#36	P-22795	#70	#70	P-19424	#42	—	#60	P-23245, 6
CHRYSLER C23, C24	1939	AAV-2	1 1/8"	.049"	P-22660	1#54	P-21197	#36	P-22795	#70	#70	P-19424	#42	—	#65	P-23245, 6
CORD 810	1936	EE-15	1 1/32"	.050"	P-19442	1#57	P-20854	#32-36	P-20853	#65	#70	P-21778	#42	—	#65	—
CORD 812	1937	EE-15	1 1/32"	.050"	P-19442	1#57	P-20854	#32-36	P-20853	#65	#70	P-21778	#42	—	#65	—
CORD Superch. 812	1937	AA-25	1⅛"	.057"	P-22660	2#55	P-22898	#28-36	P-22603	#70	#70	P-19874	#40	—	#60	P-22900, 1

①—Standard Air Cleaner. ②—Heavy Duty (oil-bath) Air Cleaner.
③—Alt. under 3000 ft., .050" (3000-9000 ft.), .048" (Over 9000 ft.).
④—Alt. under 3000 ft., .048" (3000-9000 ft.), .046" (Over 9000 ft.).
⑤—Main Body Bleeder. #32 Throttle Body Bleeder.
⑥—Main Body Bleeder. #36 Throttle Body Bleeder.
⑦—By-pass Jet in Vacuum Economizer.

⊙ Under 3500 feet—(Std. air cleaner .049", Heavy Duty oil-bath air cleaner .045"), 3500-9000 feet (Std. air cl. .046", Heavy Duty air cl. .042"), Over 9000 feet (Std. air cl. .044", Heavy Duty air cl. .040").

(C) Main Body Bleeder. #32 Throttle Body Bleeder.
(D) Main Body Bleeder. #36 Throttle Body Bleeder.
* .045" or .044" with Triplex Air Cleaner.
† .051" with Triplex Air Cleaner.
/ #70....P-21020 with heavy duty air cleaner.

⊙⊙ Under 3500 feet—(Std. air cleaner .052", Heavy Duty oil-bath air cleaner .051"). 3500-9000 feet—(Std. air cl. .049", Heavy Duty air cl. .048"). Over 9000 feet—(Std. air cl. .047", Heavy Duty air cl. .046").

STROMBERG DOWNDRAFT CARBURETOR JET SPECIFICATIONS

Car Model	Year	Carb. No.	Venturi Size	Main Metering Jet Size	Main Metering Jet Part No.	By-Pass Jet Size	By-Pass Jet Part No.	Main Discharge Jet Size	Main Discharge Jet Part No.	H. S. Bldr.	Idle Tube Size	Idle Tube Part No.	Idle Air Bld. Jet Size	Idle Air Bld. Jet Part No.	Pump Discharge Nozzle Size	Pump Discharge Nozzle Part No.
DODGE DP	1933	EX-22	1 5/32"	.058"	P-17004	4#56	P-18149	#28-36	P-18226	#70	#70	P-17007	#56	P-15477	#69	P-18126
DODGE DR, DS	1934	EX-22	1 5/32"	.058"	P-17004	4#56	P-18149	#28-36	P-18226	#70	#70	P-17007	#55	P-15477	#66	P-18126
DODGE DU	1935	EX-22	1 5/32"	.058"	P-17004	4#56	P-18149	#28-36	P-18226	#70	#70	P-17007	#55	P-15477	#65	P-18126
DODGE D-2	1936	EXV-2	1 5/32"	.058"	P-17004	1#54	P-21197,	#28-36	P-18226	#70	#70	P-17007	#53	P-15477	#70	P-17020
DODGE D-5	1937	EXV-2	1 5/32"	.058"•	P-17004	1#54	P-21197,	#28-36	P-18226	#70	#70	P-17007	#50	P-15477	#70	P-17020
DODGE D-8	1938	EXV-2	1 5/32"	.058"	P-17004	1#55	P-23676	#28-36	P-23638	#70	#70	P-19424	#50	P-15477	#50	P-17020
DODGE D11	1939	BXV-2	1 5/32"	.058"	P-19442	1#54	P-21197	#28-36	P-24036	#68	#70	P-21778	#54	——	#70	P-24067
DUESENBERG J	'33-35	EE-3	1 3/8"	.076"	P-17004	.080"	P-16965	#36	P-17015	#65	#70	P-17007	#46	P-15477L	#63	P-17454
DUESENBERG J	1936-37	EE-3	1⅜"	.076"	P-17004	.080"	P-16965	#36	P-17015	#65	#70	P-17007	#46	P-15477L	#63	P-17454
FORD V-8, 112	1934	EE-1	1 1/32"	.048"	P-19442	1#63	P-19447	#36	P-19440	#65	#70	P-19424	#42	——	#60	——
FORD V-8	1935	EE-1	1 1/32"	.048'	P-19442	1#63	P-19447	#36	P-19440	#65	#70	P-19424	#40	——	#60	——
FORD V-8, 68	1936	EE-1 (1)	1 1/32"	.048"	P-19442	1#63	P-19447	#36	P-19440	#65	#70	P-19424	#40	——	#60	——
FORD V-8, 68, 67	1936	EE-1 (2)	31/32"	.045" (G)	P-19442	1#65	P-20467	#36	P-19440	#65	#70	P-19424	#40	——	#60	——
FORD V-8, 51, 67	1936	EE-1 (3)	13/16"	.035"	P-19442	1#71	P-21642	#36	P-19440	#65	#70	P-19424	#38	——	#60	——
FORD 73, 74, 75	1937	EE-⅞(5)	⅞"	.037"	P-19442	1#68	P-21018	#36	P-19440	#65	#70	P-19424	#40	——	#60	——
FORD 77, 78, 79	1937	EE-1 (2)	31/32"	.045" (G)	P-19442	1#65	P-20467	#36	P-19440	#65	#70	P-19424	#40	——	#60	——
FORD 73, 74, 75	1937	EE-⅞(4)	13/16"	.035" (F)	P-19442	1#71	P-21642	#36	P-19440	#65	#70	P-19424	#38	——	#60	——
FORD '60' Models	1938	EE-⅞(4)	13/16"	.035" (F)	P-19442	1#71	P-21642	#36	P-19440	#65	#70	P-19424	#38	——	#60	——
FORD '85' Mdls. Early	1938	EE-1 (2)	31/32"	.045" (G)	P-19442	1#65	P-20467	#36	P-19440	#65	#70	P-19424	#40	——	#60	——
FORD '60' Models	1939	EE-⅞	13/16"	.035"⑦	P-19442	1#71	P-21642	#36	P-19440	#65	#70	P-19424	#38	——	#60	P-19429
FRANKLIN 17, 17B	1933	EE-2	1 3/32"	.062"	P-17004	.060"	P-16965	#36	P-17015	#70	#70	P-17007	#50	P-15477	#68	P-18213
GRAHAM 68	1934	EX-22	1 5/32"	.061"	P-17004	4#56	P-18149	#32	P-19546	#70	#70	P-17007	#54	P-15477	#68	P-18126
GRAHAM 69	1934	EX-32	1 5/16"	.069"	P-17004	4#56	P-18149	#28	P-19798	#70	#70	P-17007	#56	P-15477	#65	P-18126
GRAHAM 74	1935	EX-22	1 1/32"	.050"	P-17004	4#56	P-18149	#32	P-19546	#70	#70	P-17007	#60	P-15477	#68	P-18126
GRAHAM 74	1935	EXV-2	1 1/32"	.050"	P-17004	4#56	P-21076‡	#32	P-20228	#70	#70	P-19874	#60	P-15477	—	——
GRAHAM 73	1935	EX-23	1 5/32"	.061"	P-17004	4#56	P-18149	#32	P-20969	#70	#70	P-17007	#54	P-15477	#66	P-18126
GRAHAM 72	1935	EE-14	1 1/32"	.048"	P-19442	1#64	P-19523	#32	P-20940	#70	#55	P-20419	#54	——	#65	——
GRAHAM Superch. 75	1935	EX-32	1 5/16"	.069"	P-17004	4#56	P-18149	#28	P-19798	#70	#70	P-17007	#56	P-15477	#65	P-18126
HUPMOBILE 417, 517-W	'34-35	EX-32	1 3/16"	.059"	P-17004	4#56	P-18149	#28	P-20886	#70	#70	P-17007	#54	P-15477	#70	P-18126
HUPMOBILE 421, 521-J	'34-35	EX-32	1 5/16"	.068"	P-17004	4#56	P-18149	#28	P-17005	#70	#70	P-17007	#52	P-15477	#70	P-18126
HUPMOBILE 427, 527-T	'34-35	EE-22	1 3/32"	.053"	P-17004	4#56	P-18149	#28-36	P-18413	#65	#70	P-17007	#42	P-15477	#74	P-18852
LA FAYETTE 3610	1936	AX-2	1⅛"	.057"	P-19442	2#56	P-21776	#32	P-21766	#70	#70	P-21778	#53	——	#64	P-21944
LA SALLE 350	'34-35	EE-23	1 1/32"	.049"	P-17004	1#63	P-19953	#36	P-18338	#68	#72	P-18264	#42	P-15477	#60	——
LA SALLE 35-50	1935	EE-15	1 1/32"	.050"	P-19442	1#65	P-20467	#32-36	P-20753	#67	#55	P-21161	#50	——	#65	——
LA SALLE 36-50	1936	EE-15	1 1/32"	.046"	P-19442	1#65	P-20467	#32-36	P-20753	#67	#55	P-21161	#50	——	#65	——
LA SALLE 37-50	1937	AA-25	1⅛"	.051"	P-22660	1#63	P-19447	#28-36	P-22603	#65	#70	P-23110	#40	——	#65	——
LINCOLN V-12-136	1933	EE-22	1 3/32"	.057"	P-17004	1#53	P-19481	#36	P-18338	#65	#70	P-17007	#46	P-15477K	#70	P-18852
LINCOLN V-12-145	'33-34	EE-22	1 3/32"	.057"	P-17004	1#53	P-19481	#36	P-18483	#65	#70	P-17007	#46	P-15477L	#70	P-18852
LINCOLN V-12-136, 45	1934	EE-22	1 3/16"	.057"	P-17004	1#53	P-19481	#28-36	P-19364	#65	#70	P-17007	#46	P-15477K	#67	P-18852
LINCOLN V-12	1935	EE-22	1 3/16"	.058"	P-17004	1#53	P-19481	#28-36	P-19364	#65	#70	P-17007	#46	P-15477K	#67	P-18852
LINCOLN V-12	1936	EE-22	1 3/16"	.057"	P-17004	4#56	P-18149	#28-32	P-21799	#70	#70	P-17007	#44	P-15477K	#65	P-18852
LINCOLN V-12	1937	EE-22	1 3/16"	.057"	P-17004	4#56	P-18149	#28-32	P-21799	#70	#70	P-17007	#44	P-15477K	#65	P-18852
LINCOLN V12	1938	EE-22	1 3/16"	.057"	P-17004	4#56	P-18149	#28-32	P-21799	#70	#70	P-17007	#44	P-15477K	#65	P-18852
LINCOLN V12	1939	EE-22	1 3/16"	.057"	P-17004	4#56	P-18149	#28-32	P-21799	#70	#70	P-17007	#44	P-15477K	#65	P-18852
LINCOLN Zephyr	1936	EE-1	31/32"	.046"	P-19442	1#60	P-20752	#32-36	P-21317	#65	#70	P-19424	#40	——	#60	——
LINCOLN ZEPHYR HB	1937	EE-1	31/32"	.046"	P-19442	1#60	P-20752	#32-36	P-21317	#65	#70	P-19424	#40	——	#60	——
LINCOLN ZEPHYR Early	1938	EE-1	31/32"	.046"	P-19442	1#60	P-20752	#32-36	P-21317	#65	#70	P-19424	#40	——	#60	——
NASH 9-70	1931	E-2	1 3/32"	.054"	P-17004	.060"	P-16965	#28	P-17005	#70	#70	P-17007	#51	P-15477	#70	P-17020
NASH 10-60	1932	E-2	1 3/32"	.054"	P-17004	.060"	P-16965	#28	P-17005	#70	#66	P-17076	#51	P-15477	#70	P-17020
NASH 10-70, 11-70	'32-33	EE-2	1 1/32"	.050"	P-17004	.060"	P-16965	#36	P-17015	#70	#70	P-17007	#50	P-15477	#73	P-17021
NASH 11-20	1933	EX-22	1 5/32"	.054"	P-17004	4#56	P-18149	#32	P-18241	#70	#70	P-17007	#54	P-15477	#68	P-18126

(1) Ford No. 48-9510-D.
(2) Ford No. 67-9510-A. Carburetor marked '97'.
(3) Ford No. SE-67-9510.
(4) Ford No. 52-9510-B. Carburetor marked '81'.
(5) Special Service. Ford No. 52-9510. Marked '52'.
⑦—Under 5000'. .033" (5000-10000'), .032" (10000-15000'), .031" (Over 15000').

(F) Std. Altitude. .033" (5000-10000'), .032" (10000-15000'), .031" (Over 15000').
(G) Std. Altitude. .043" (5000-10000'), .041" (10000-15000'), .039" (over 15000').
• 5%lean—.057", 10% lean—.055", 15% lean—.054", 20% lean—.052".
, By-Pass Jet in Vacuum Economizer.
‡ P-21198 (By-Pass Jet in Vacuum Economizer).

STROMBERG DOWNDRAFT CARBURETOR JET SPECIFICATIONS

Car Model	Year	Carb. No.	Venturi Size	Main Metering Jet Size	Main Metering Jet Part No.	By-Pass Jet Size	By-Pass Jet Part No.	Main Discharge Jet Size	Main Discharge Jet Part No.	H.S. Bldr.	Idle Tube Size	Idle Tube Part No.	Idle Air Bld. Jet Size	Idle Air Bld. Jet Part No.	Pump Discharge Nozzle Size	Pump Discharge Nozzle Part No.
NASH 11-30	1933	EX-22	1 5/32"	.057"	P-17004	4#56	P-18149	#32	P-18241	#70	#70	P-17007	#53	P-15477	#68	P-18126
NASH 12-20	1934	EX-32	1 3/16"	.061"	P-17004	4#56	P-18149	#32	P-18241	#70	#70	P-17007	#50	P-15477	#67	P-18126
NASH 12-80	1934	EE-22	1 1/32"	.050"	P-17004	4#56	P-18149	#36	P-17969	#70	#72	P-17007	#42	P-15477	#71	P-18852
NASH 3520	1935	EX-32	1 3/16"	.064"	P-17004	4#56	P-18149	#32	P-20885	#70	#70	P-17007	#50	P-15477	#67	P-18126
NASH 35, 3640	1935	EX-22	1 5/32"	.057"	P-17004	4#56	P-18149	#32	P-20885	#70	#70	P-17007	#54	P-15477	#64	P-18126
NASH 3580	1935	EE-22	1 1/32"	.050"	P-17004	4#56	P-18149	#36	P-17969	#70	#70	P-17007	#42	P-15477	#71	P-18852
NASH 3580	1935	EE-1	1 1/32"	.048"	P-19442	1#63	P-19447	#32-36	P-20853	#70	#55	P-20419	#54	——	#65	——
NASH 3620	1936	EX-32	1 3/16"	.064"	P-17004	4#56	P-18149	#32	P-20885	#70	#70	P-17007	#50	P-15477	#67	P-18126
NASH 3640-A	1936	AX-2	1⅛"	.056"	P-19442	2#56	P-21776	#32	P-21766	#70	#68	P-21962	#53	——	#59	P-21944
NASH 3680	1936	EE-1	1 1/32"	.048"	P-19442	1#63	P-19447	#32-36	P-20853	#70	#55	P-20419	#54	——	#65	——
NASH 3720	1937	EX-32	1 3/16"	.062"	P-17004	4#56	P-18149	#32	P-19546	#70	#70	P-17007	#44	P-15477	#61	P-22926
NASH 3780	1937	EE-1	1 1/32"	.048"☆	P-19442	1#63	P-19447	#32-36	P-20853	#70	#55	P-20419	#54	——	#65	P-20435, 6
NASH 3880	1938	EE-1	1 1/32"	.048"	P-19442	1#63	P-19447	#32-36	P-20853	#70	#70	P-20149	#54	——	#65	——
NASH-LA FAYETTE 3710	1937	AX-2	1⅛"	.056"	P-19442	2#56	P-21776	#32	P-21766	#70	#68	P-21962	#53	——	#59	P-21944
NASH-LAFAYETTE 3810	1938	AX-2	1 1/8"	.056"	P-19442	2#56	P-21776	#32	P-21766	#70	#68	P-21962	#53	——	#59	P-21944
NASH-LAFAYETTE 3910	1939	EE-1	31/32"	.044"	P-19442	1#60	P-20752	#32	P-24155	#65	#70	P-24157	#52⑧	——	#70	P-24156
OLDSMOBILE F-32	1932	EC-2	1 5/32"	.056"	P-17004	.060"	P-16965	#28	P-17005	#70	#70	P-17007	#56	P-15477	#64	P-17020
OLDSMOBILE L-32	1932	EE-2	1 1/32"	.052"	P-17004	.060"	P-16965	#36	P-17015	#70	#70	P-17007	#50	P-15477	#73	P-18213
OLDSMOBILE F-33	1933	EC-22	1 5/32"	.057"	P-17004	1#56	P-18149	#32	P-18241	#70	#70	P-17007	#54	P-15477	—	P-18126
OLDSMOBILE L-33	1933	EE-22	1 1/32"	.049"	P-17004	1#65	P-18344	#36	P-18338	—	#72	P-18264	#42	P-15477	—	——
OLDSMOBILE F-34	1934	EX-22, 23	1 5/32"	.058"	P-17004	4#56	P-18149	#28-32	P-19702	#70	#72	P-19773	#54	P-15477	#66	P-18126
OLDSMOBILE L-34	1934	EE-1	1 1/32"	.049"	P-19442	1#64	P-19523	#36	P-19704	#65	#70	P-19874	#42	——	#60	——
OLDSMOBILE F-35	1935	EX-22	1 5/32"	.059"	P-17004	4#56	P-18149	#28-32	P-20748	#70	#68	P-20627	#56	In I. Tube	#66	P-18126
OLDSMOBILE L-35	1935	EE-1	1 1/32"	.049"	P-19442	1#63	P-19447	#32-36	P-20753	#70	55-68	P-20772	#50	——	#65	——
PACKARD 905, 6	1932	EE-3	1 3/16"	.064"	P-17004	.080"	P-16965	#36	P-17815	#65	#70	P-17007	#46	P-15477L	#60	P-17769
PACKARD 1001, 2	1933	EE-22	1 3/32"	.055"	P-17004	.060"	P-18149	#36	P-17993	#65	#70	P-17007	#42	P-15477K	#70	P-18852
PACKARD 1003, 4	1933	EE-22	1 3/16"	.060"	P-17004	.060"	P-18149	#36	P-17993	#70	#70	P-17007	#42	P-15477K	#70	P-18852
PACKARD 1005, 6	1933	EE-3	1 3/16"	.058"	P-17004	.060"	P-16965	#28-36	P-18413	#65	#70	P-17007	#46	P-15477L	#65	P-17769
PACKARD 1100, 1, 2	1934	EE-22	1 3/32"	.055"	P-17004	.060"	P-18149	#36	P-17993	#65	#70	P-17007	#42	P-15477K	#70	P-18852
PACKARD 1103, 4, 5	1934	EE-22	1 3/16"	.060"	P-17004	.060"	P-18149	#36	P-17993	#70	#70	P-17007	#42	P-15477K	#70	P-18852
PACKARD 1107, 8	1934	EE-3	1 3/16"	.058"	P-17004	.060"	P-16965	#28-36	P-20647	#65	#70	P-17007	#46	P-15477L	#65	P-17769
PACKARD 120	1935	EE-14	1 1/32"	.048"	P-19442	1#62	P-20911	#32-36	P-20753	#65	#70*	P-20419	#50	——	#65	——
PACKARD 1200, 1, 2	1935	EE-23	1 3/32"	.052"	P-17004	1#64	P-20823	#28-36	P-19364	#65	#70	P-17007	#42	P-15477	#60	——
PACKARD 1203, 4, 5	1935	EE-23	1 3/16"	.056"	P-17004	1#54	P-20895	#28-36	P-19364	#65	#70	P-17007	#44	P-15477	#60	——
PACKARD 1207, 8	1935	EE-3	1 5/16"	.060"	P-17004	.060"	P-16965	#28	P-20647	#65	#70	P-17007	#44	P-15477L	#62	P-17769
PACKARD 120-B	1936	EE-14	1 1/32"	.048"	P-19442	1#60	P-20752	#32-36	P-20853	#65	#55	P-21794	#50	——	#65	——
PACKARD 1400, 1, 2	1936	EE-23	1 3/32"	.052"	P-17004	1#64	P-20823	#28-36	P-19364	#65	#70	P-17007	#42	P-15477K	#60	——
PACKARD 1403, 4, 5	1936	EE-23	1 3/16"	.056"	P-17004	1#54	P-20895	#28-36	P-19364	#65	#70	P-17007	#44	P-15477K	#60	——
PACKARD 1407, 8	1936	EE-3	1 5/16"	.060"	P-17004	.060"	P-16965	#28	P-20647	#65	#70	P-17007	#44	P-15477	#60	——
PACKARD 120C	1937	EE-14	1 1/32"	.047"	P-19442	1#63	P-19447	#32-36	P-20853	#65	#55	P-22941	#44	——	#65	——
PACKARD 1500, 1, 2	1937	EE-23	1 3/32"	.050"	P-17004	1#64	P-20823	#28-36	P-19364	#65	#70	P-17007	#42	P-15477K	#60	——
PACKARD 1506, 7, 8	1937	EE-3	1 5/16"	.068"	P-17004	.070"	P-16965	#32	P-22755	#70	#70	P-22737	#54	P-15477L	#60	——
PACKARD 1601, 1A, 2	1938	EE-14	1 1/32"	.047"	P-19442	1#57	P-20854	#32	P-23346	#65	—	P-23646	#60	P-23649	#65	——
PACKARD 1603, 4, 5	1938	EE-23	1 3/32"	.050"	P-17004	1#64	P-20823	#28-36	P-19364	#65	#70	P-17007	#42	P-15477K	#60	——
PACKARD 1607, 8	1938	EE-3	1 5/16"	.068"	P-17004	1#70	P-16965	#32	P-22755	#70	#70	P-22737	#54	P-15477L	#60	——
PACKARD 1701, 1A, 2	1939	EE-16	1 1/32"	.047"	P-19442	1#57	P-20854	#32	P-23346	#65	#55	P-23646	#60⑨	——	#65	P-23808, 9
PACKARD 1703, 3A, 5	1939	EE-23	1 3/32"	.051"	P-17004	1#64	P-20823	#28-36	P-19364	#65	#70	P-17007	#42	P-15477K	#60	P-20232
PACKARD 1707, 8	1939	EE-3	1 5/16"	.068"	P-17004	.070"	P-16965	#32	P-22755	#70	#70	P-22737	#54⑩	P-15477L	#60	P-20232
PIERCE ARROW 51, 2, 3	1933	E-2(2)	1 3/32"	.055"	P-17004	.060"	P-16965	#28	P-17167	#70	#70	P-17007	#48	P-15477	#66	P-17020
" " 54	1933	EE-3	1 3/16"	.060"	P-17004	.060"	P-16965	#28	P-18969	#70	#70	P-17007	#41	P-15477	#72	P-17454
" " 836A, 40A	1934	EE-3	1 3/16"	.060"	P-17004	.060"	P-16965	#28	P-18969	#70	#70	P-17007	#41	P-15477	#72	P-17454
" " 1236, 39	1933	EX-32	1 3/16"	.057"	P-17004	4#56	P-18149	#28	P-17005	#70	#70	P-17007	#48	P-15477K	#68	P-18126
" " 1240A, 48A	1934	EX-32	1 3/16"	.057"	P-17004	4#56	P-18149	#28	P-17005	#70	#70	P-17007	#48	P-15477K	#68	P-18126

⑧—Throttle Body Bleeder. #60 Idle Tube Bleeder.
⑨—Main Body Bleeder. #38 Throttle Body Bleeder.
⑩—#56 Throttle Body Bleeder also used.

☆ .047" with oil-bath type air cleaner.

STROMBERG DOWNDRAFT CARBURETOR JET SPECIFICATIONS

Car Model	Year	Carb. No.	Venturi Size	Main Metering Jet Size	Main Metering Jet Part No.	By Pass Jet Size	By Pass Jet Part No.	Main Discharge Jet Size	Main Discharge Jet Part No.	H. S. Bldr.	Idle Tube Size	Idle Tube Part No.	Idle Air Bld. Jet Size	Idle Air Bld. Jet Part No.	Pump Discharge Nozzle Size	Pump Discharge Nozzle Part No.
PIERCE ARROW 845	1935	EE-3	1 3/16"	.058"	P-17004	.060"	P-16965	#28	P-18969	#70	#70	P-17007	#41	P-15477	#68	P-17454
PIERCE ARROW 1245,55	1935	EX-32(2)	1 3/16"	.057"	P-17004	4#56	P-18149	#28	P-17005	#70	#70	P-17007	#48	P-15447K	#68	P-18126
PIERCE ARROW 1601	1936	EE-3	1 3/16"	.058"	P-17004	.060"	P-16965	#28	P-18969	#70	#70	P-17007	#41	P-15477	#68	P-17454
PIERCE ARROW 1602, 3	1936	EX-32(2)	1 3/16"	.057"	P-17004	4#56	P-18149	#28	P-17005	#70	#70	P-17007	#48	P-15477K	#68	P-18126
PIERCE ARROW 1701	1937	EE-3	1 3/16"	.058"	P-17004	.060"	P-16965	#28	P-18969	#70	#70	P-17007	#41	P-15477	#68	P-17454
PIERCE ARROW 1702, 3	1937	EX-32 (2)	1 3/16"	.057"	P-17004	4#56	P-18149	#28	P-17005	#70	#70	P-17007	#48	P-15477K	#68	P-18126
PIERCE ARROW 1801	1938	EE-3	1 3/16"	.058"	P-17004	1#60	P-16965	#28	P-18969	#70	#70	P-17007	#41	P-15477	#68	P-17454
PIERCE ARROW 1802, 3	1938	EX-32(2)	1 3/16"	.057"	P-17004	4#56	P-18149	#28	P-17005	#70	#70	P-17007	#48	P-15477K	#68	P-18126
REO S-1, 2	1932	EX-2	1 5/32"	.056"	P-17004	.060"	P-16965	#28	P-17005	#70	#70	P-17007	#56	P-15477	#64	P-17020
REO S-3	1933	EX-22	1 5/32"	.056"	P-17004	4#56	P-18149	#28	P-17005	#70	#70	P-17007	#56	P-15477	#70	P-18126
REO S-3	1933	EX-32	1 3/16"	.059"	P-17004	4#56	P-18149	#28	P-18548	#70	#70	P-17007	#55	P-15477	#69	P-18126
REO S-4	'33-34	EX-32	1 3/16"	.056"	P-17004	4#56	P-18149	#28-32	P-19702	#70	#70	P-19579	#54	P-15477	#70	P-18126
REO Royale 8	1934	EE-23	1 3/16"	.055"	P-17004	1#63	P-18149	#28-36	P-19364	#65	#70	P-17007	#46	P-15477	#60	——
REO Royale 7-S	1935	EX-32	1 3/16"	.056"	P-17004	4#56	P-18149	#28-32	P-19702	#70	#70	P-19579	#54	P-15477	#70	P-18126
STUDEBAKER 56	1933	EX-22	1 3/32"	.054"	P-17004	4#56	P-18149	#28	P-18115	#70	#70	P-17007	#56	P-15477	#70	P-18126
STUDEBAKER 73, 82	1933	EE-22	1 1/32"	.052"	P-17004	4#56	P-18149	#36	P-17969	#70	#70	P-17007	#42	P-15477	#74	P-18852
STUDEBAKER 92	1933	EE-22	1 3/16"	.062"	P-17004	4#56	P-18149	#36	P-17993	#70	#70	P-17007	#46	P-15477	#70	P-18852
STUDEBAKER B	1934	E-33	1 5/16"	.061"	P-17004	4#56	P-18149	#30	P-19130	#70	#70	P-17007	#56	P-15477	#67	P-18126
STUDEBAKER C	1934	EE-22	1 1/32"	.054"	P-17004	4#56	P-18149	#36	P-17969	#70	#70	P-17007	#42	P-15477	#74	P-18852
STUDEBAKER Dict.	1935	EX-23	1 3/32"	.058"	P-17004	4#56	P-18149	#32	P-20638	#70	#68	P-20636	#54	In I. Tube	#69	P-18126
STUDEBAKER Comm.	1935	EE-1	1 1/32"	.047"	P-19442	1#63	P-19447	#32-36	P-20646	#70	#70	P-20614	#44	——	#65	——
STUDEBAKER Pres.	1935	EE-1	1 1/32"	.047"	P-19442	1#63	P-19447	#32-36	P-20646	#70	#70	P-20614	#44	——	#65	——
STUDEBAKER 3A, 4A	1936	EX-23	1 5/32"	.058"	P-17004	4#56	P-18149	#28-32	P-21687	#70	#52	P-21688	#55	——	#66	P-18126
STUDEBAKER 2C	1936	EE-1	1 1/32"	.047"	P-19442	1#63	P-19447	#32-36	P-20646	#70	#70	P-20614	#44	——	#65	——
STUDEBAKER 5A, 6A	1937	EX-23	1 5/32"	†	P-17004	4#56	P-18149	#28-32	P-21687	#70	#52	P-21688	#55	——	#66	P-18126
STUDEBAKER 3-C	1937	EE-1	1 1/32"	††	P-19442	1#63	P-19447	#32-36	P-20646	#70	#70	P-20614	#44	——	#65	P-20435, 6
STUDEBAKER 7A, 8A	1938	BXO-26	1 3/16"	(H)	P-19442	2#56	P-21776	#28-36	P-23264	#70	#70	P-21778	#54	——	#64	——
STUDEBAKER 4C Pres.	1938	AAO-161	1 1/32"	(J)	P-22660	1#65	P-20467	#36	P-23485	#60	—	P-21962	#66 (E)	——	#65	——
STUDEBAKER Comm. 9A	1939	BXO-26	1 3/16"	.059" ⑪	P-19442	2#56	P-21776	#28-36	P-23264	#70	#70	P-21778	#54	P-20470	#64	P-23262
STUDEBAKER Pres. 5C	1939	AAO-161	1 1/32"	.047" ⑫	P-22660	1#65	P-20467	#36	P-23485	#60	#68	P-21962	#66 ⑬	——	#65	P-21561
STUTZ DV-32	'32-33	EE-3	1 1/8"	.058"	P-17004	.060"	P-16965	#36	P-17015	#65	#70	P-17007	#48	P-15477	#62	P-17454
STUTZ DV-32	'33-34	EE-3	1 1/8"	.059"	P-17004	.060"	P-16965	#36	P-17015	#65	#70	P-17007	#48	P-15477	#62	P-17454

(E) Main Body Bleeder. #50 Throttle Body Bleeder.
(H) .059" Std., .058" First smaller (Econ), .056" Second smaller (Alt.).
(J) .047" Std., .045" First smaller (Econ), .043" Second smaller (Alt.).

⑪—.059" Std., .058" First Smaller (Econ.), .056" Second Smaller (Alt.).
⑫—.047" Std., .045" First Smaller (Econ.), .043" Second Smaller (Alt.).
⑬—Main Body Bleeder. #38-50 Throttle Body Bleeders.

† Std. air cleaner—.058" Prod., .056" 1st Smaller, .054" 2nd Smaller. Heavy Duty oil-bath type air cleaner—.055" Prod., .054" 1st Smaller, .052" 2nd Smaller.
†† .047" Prod., .045" 1st Smaller, .043" 2nd Smaller.

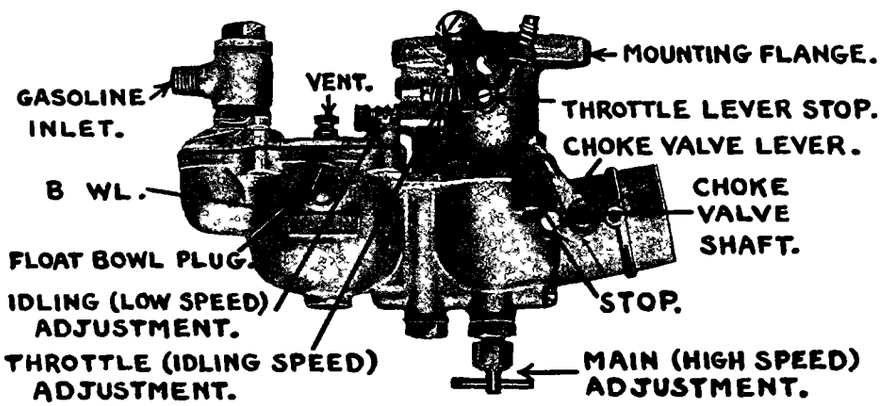
M-10A—AUSTIN, BANTAM MODEL (1932-33-34-35)
M-10B—BANTAM, MODEL 60 (1937-38)
M-10BX—BANTAM, MODEL 60 (1939)

NOTE:—Models M-10B and M-10BX are same general design as Model M-10A and are adjusted in the same manner.

TYPE:—Plain tube updraft type. Carburetor has two adjustments. The main or high speed needle valve controls the fuel for the main nozzle. The idle or low speed adjustment screw controls the fuel mixture for the idle discharge ports in the wall of the mixing chamber opposite the throttle edge. Adjustments should be made in the order given below.

PRELIMINARY ADJUSTMENT:—Turn main or high speed adjustment needle valve in or clockwise until it is seated, then open or back off needle valve exactly 1½ turns. Turn idling or low speed adjusting screw in or clockwise until it is seated, then back off adjusting screw ½ turn. Start engine and run until it is thoroughly warmed up.

MAIN (HIGH SPEED) ADJUSTMENT:—With engine warm and running, open throttle until engine speed is approximately 30 M.P.H. Turn main adjusting needle valve in or clockwise until engine begins to slow down for want of fuel. Then slowly turn adjusting handle out or counter-clockwise until engine runs smoothly. The correct setting should be approximately ⅛-¼ turn from the first position. This adjustment should be made slowly and needle valve should not be opened beyond the point where smooth running and power is secured in order to assure maximum economy.



IDLING (LOW SPEED) ADJUSTMENT:—With engine running, close throttle and adjust throttle lever stop screw so that idling speed is somewhat faster than normal. Turn idling adjustment screw in or clockwise until engine begins to miss, then turn screw slowly out or counter-clockwise until engine fires smoothly. Adjusting screw controls fuel mixture and should be turned in for leaner mixture and out for richer mixture. After completing adjustment, adjust throttle lever stop screw to secure correct idling speed.

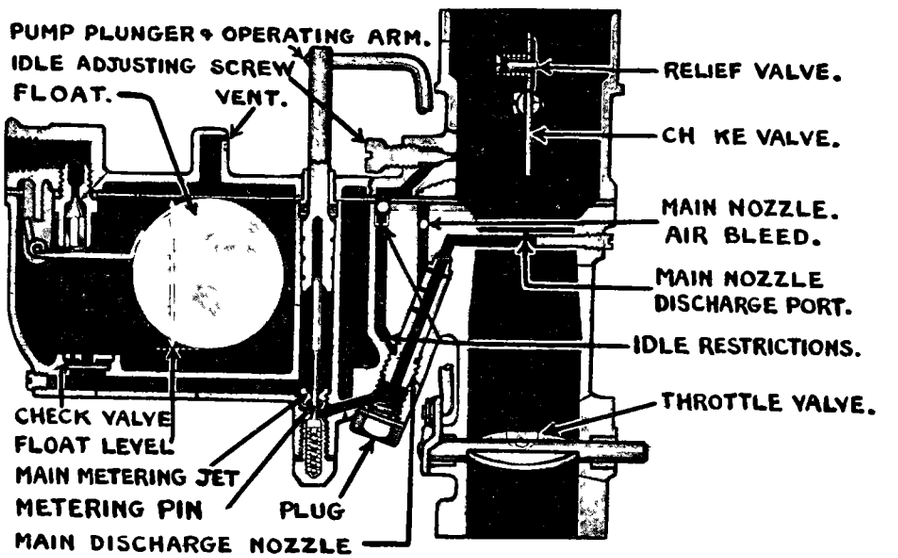
CHOKE CONTROL:—Choke valve is held in place on choke valve shaft by a spring which allows choke valve to open slightly when engine begins to fire, preventing over-choking. Adjust choke linkage so that choke valve is closed (engine not running) when choke control button on instrument panel is pulled all the way out and wide open with control button pushed in.

MODELS D-1A, D-1D

D-1A—WILLYS FOUR, MODEL 77 (1933-34).
D-1D—WILLYS FOUR, MODEL 77 (1935).

TYPE:—Plain tube downdraft type with throttle operated accelerating pump and economizer (metering rod and metering jet assembly). Fuel for main nozzle (located above a plug at the side of the barrel) is metered by a metering pin and jet assembly at the bottom of the accelerating pump. Metering pin is pressed down by accelerating pump piston, permitting an increased fuel flow for high speed or wide open throttle operation. Main nozzle is air bled by a vent tube and hole in the carburetor body casting. Fuel for idling is taken from the main nozzle well up through the idle channel riser and is metered by restrictions at the bottom and top of the channel. The idle passage at the top of the idle channel is air bled by a vent in the carburetor barrel below the choke valve. This vent is controlled by the idle adjustment screw. Fuel mixture is taken down through a passage in the body casting and discharged through two ports opposite the throttle edge (closed throttle position). Idle adjustment is the only point requiring attention.

IDLE ADUSTMENT:—Make a preliminary adjustment of the idle adjusting screw by turning screw in or clockwise until it is seated, then turn screw out or counter-clockwise exactly 1¼ turns. Run engine until it is thoroughly warmed up, close throttle, adjust throttle lever stop screw so that engine runs at correct idling speed. Turn idle adjusting screw out or counter-clockwise until engine begins to miss (mixture too lean), then turn screw in slowly until engine fires smoothly. Idle screw operates on air and should be turned out for leaner mixture and in for richer mixture. Check idling speed and readjust throttle stop screw if necessary. Correct idling speed should be 7 M.P.H.



ACCELERATING PUMP:—Accelerating pump cylinder is supplied with fuel from main fuel channel under float bowl and discharges through metering jet to main nozzle when throttle is opened. A check valve in the bottom of the float chamber prevents fuel being discharged back into the float bowl. Accelerating pump should not require adjustment.

ECONOMIZER:—Metering pin in metering jet is pressed up by a spring below the pin for partial throttle operation so that the larger diameter section of the pin restricts the fuel flow through the jet. The upper end of the metering pin stem is engaged in a hole in the accelerating pump plunger so that the metering pin is pressed down when the throttle is opened, the smaller diameter section of the metering pin then permitting a larger fuel flow through the metering jet. Metering pin and jet assembly is not adjustable and should not require attention.

FLOAT LEVEL:—To check float level, take off float bowl cover (upper casting), invert cover, measure distance from gasket face to bottom of float (bottom when not inverted). This distance should be 1 25/32". Float level can be corrected by bending float lever. See that float lever stop permits full travel f float.

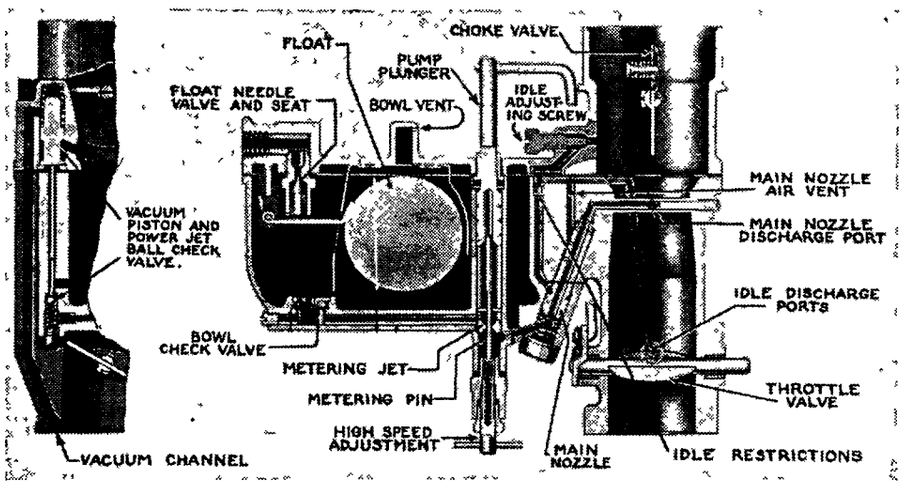
CHOKE:—Choke valve is fitted with relief poppet valve to prevent over-choking. Check choke linkage to see that choke valve is fully closed when choke control button on dash is pulled all the way out and wide open when choke control button is pushed in.

D-1E—WILLYS, MODEL 77 (1936).

NOTE:—New power jet permits leaner settings than used previously.

TYPE:—Plain tube downdraft type with positively actuated accelerating pump connected to throttle lever and vacuum controlled power jet. Similar in design to type used previously on this model except that metering pin adjustment and power jet have been added. Fuel for main nozzle metered by adjustable metering pin and jet (high speed adjustment handle below carburetor). Additional fuel by-passed to nozzle when vacuum controlled power jet ball check valve open. Fuel for idling taken from main nozzle up through channel in which idle metering restrictions located to cross passage connected to idle air vent and then down through channel to discharge ports at throttle edge. Idle adjusting screw controls idle air vent opening. Adjustments should be made in order given below.

PRELIMINARY ADJUSTMENT:—If carburetor out of adjustment, make a preliminary setting by turning main high speed adjustment handle out or counter-clockwise two full turns. Turn idle adjusting screw in or clockwise until it is seated, then back screw off one turn. This will allow engine to be started and warmed up so that adjustments can be made correctly.



HIGH SPEED ADJUSTMENT:—Open throttle so that engine speed is 25-30 M.P.H., turn main adjustment handle up or clockwise until engine slows down, then back adjustment off until engine speed is at maximum, finally turn adjustment up approximately three quarters of a turn to insure maximum economy. See tune-up instructions on car model page.

IDLING ADJUSTMENT:—After completing high speed adjustment, close throttle and allow engine to idle, turn idle adjusting screw out or counter-clockwise until engine misses, then turn screw in until engine fires evenly. Check by opening throttle momentarily to clear manifold and then noting performance. Adjust throttle stopscrew for 7 M.P.H. idling speed. See tune-up instructions on car model page.

POWER JET:—Power jet vacuum piston normally held at upper end of stroke by manifold vacuum so that spring-loaded ball check valve is closed. Drop in vacuum when throttle opened wide allows spring to force piston down, opening check valve, and allowing fuel to flow through power jet to main nozzle. Power jet should not require attention.

ACCELERATING PUMP:—Pump plunger located in metering jet well and connected to throttle lever so that plunger is forced down discharging fuel in well through main nozzle and main nozzle discharge port. When throttle is held open plunger contacts metering pin extension depressing metering pin (metering pin spring mounted in high speed adjustment handle to permit this action) allowing greater fuel flow through metering jet to main nozzle for full power operation. Accelerating pump should not require adjustment.

FLOAT LEVEL:—To check float level, remove float bowl (integral with air horn), invert cover, measure from gasket seat on cover to bottom of float. This distance should be 1 25/32". Float level can be corrected by bending float lever at point where it is attached to float.

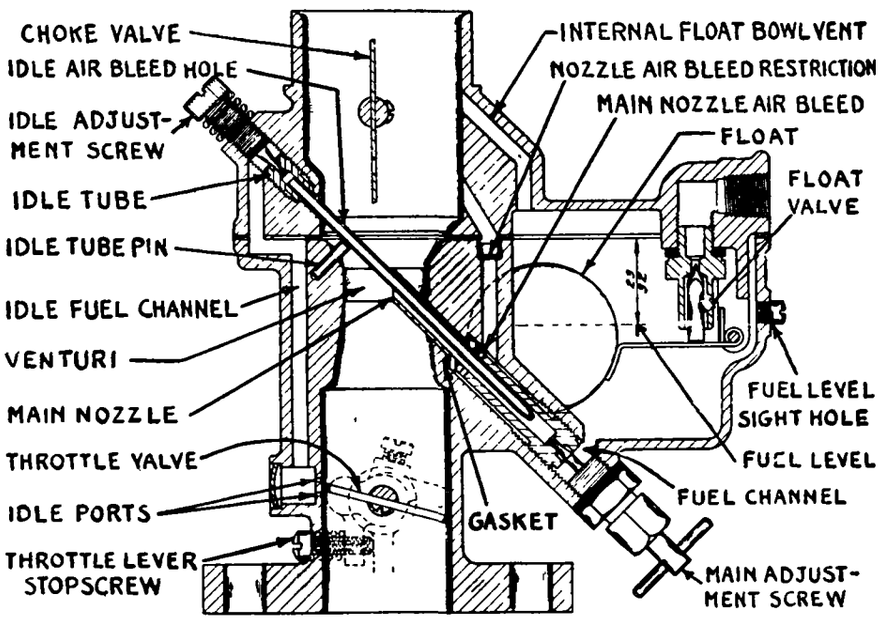
CHOKE:—Choke valve provided with relief poppet valve to prevent over-choking. Check linkage to see that valve opens and closes fully.

DY-1A—CROSLEY, MODEL A (1939-40)

TYPE:—Single barrel, plain tube, downdraft type with high speed (Main) and low speed (Idle) adjustments.

Fuel System (Idling & Low Speed):—Fuel is metered by restriction at lower end of Idle Tube and flows up through tube (located in main nozzle—see illustration) where it is mixed with air admitted through Idle Air Bleed hole in side of idle tube. Fuel mixture is controlled by Idle Adjusting Screw (at upper end of tube) and flows through Idle Fuel Supply Channel in carburetor casting to Idle Discharge Ports at the throttle edge. For closed throttle idling, all fuel is discharged through lower port. As soon as the throttle is opened for low speed running, additional fuel is discharged through upper port also. Idle system supplies all fuel for car speeds up to approximately 18 M.P.H.

Speeds above 18 M.P.H.—At approximately 18 M.P.H., throttle valve opening causes reduced suction on idle ports and increased suction on main nozzle so that fuel is discharged at main nozzle and idle system drops out. Fuel for main nozzle is metered by Main Adjustment Screw and is mixed with air admitted through holes in nozzle from main nozzle air bleed channel opening into air horn above choke valve. This air is metered by Main Nozzle Air Bleed Restriction located in air bleed channel at top of carburetor main casting.



ADJUSTMENT:—Make adjustments in order as listed below. Preliminary adjustment will allow engine to be started and warmed up (other adjustments should not be made until engine thoroughly warm).

Preliminary Adjustment:—Close Main Adjustment Screw by turning to right (clockwise) until it is lightly seated, then back screw out exactly two complete turns. Close Idle Adjustment Screw by turning to right (clockwise) until it is lightly seated, then back screw out exactly one complete turn. Start engine and run until thoroughly warmed up.

Main (High Speed) Adjustment:—With engine warm and running, open throttle so that engine speed is 30-35 M.P.H. Turn Main Adjustment Screw in or clockwise slowly (¼ turn at a time) until engine slows down due to lack of fuel, then back screw out very slowly (⅛ turn at a time) until maximum speed is secured. Correct setting will be approximately 1½ turns open (first 1000 cars), 1¾-2 turns open (later cars) of screw from inner seated position.

Idle (Low Speed) Adjustment:—Set throttle lever stopscrew so that engine runs at faster than normal idling speed. Close throttle. Turn Idle Adjustment Screw in or clockwise to lean mixture until engine begins to miss, then back screw out slowly until engine fires smoothly. Clear manifold by opening throttle momentarily, then recheck idle setting. Correct setting will be approximately ¾-1¼ turns of the screw from the inner seated position. Set throttle lever stopscrew for idling speed of 7 M.P.H. when pulling car in high gear.

MODEL DY-1A CONT.

PERFORMANCE:—Should be satisfactory for operation at altitudes less than 5000 feet if adjustments correctly made as directed above. If performance not satisfactory, check adjustments and tune up engine (see car model T&E page for tune up data). See Trouble Shooting Section below.

FLOAT LEVEL:—**Fuel Level**—Should be 23/32" below top edge of float bowl or just below lower edge of inspection hole on side of float bowl (remove inspection hole plug to check level).

Float Level—To check, invert upper body assembly (air horn and float bowl cover with complete float mechanism), measure from face of body gasket to top of raised seam on each float. Distance should be 1 27/64". To adjust, bend each float lever arm **using extreme care to secure equal setting for both floats.** DISASSEMBLY CAUTION—Before taking off Upper Body Assembly (to check or adjust float level), remove Idle Adjustment Screw, Spring and Idle Tube to avoid damage to tube and main nozzle when upper body assembly lifted off.

Inlet Needle Valve & Seat—Part No. 06287 (matched set).

CHOKE:—Plain butterfly type. Adjust choke linkage so that choke valve is wide open when dash control button is pushed all the way in.

TROUBLE SHOOTING:—**Engine Stalls**—Check idle speed setting, tighten throttle stop retaining screw, check idling or low speed adjustment, see that idle adjustment screw not ringed, clean idle tube and idle fuel channels with air, check float level (see Fuel Level Note below).

Flatness on Acceleration—Check Idle (Low Speed) and Main (High Speed) Adjustments, check float level (if engine loads up, see Fuel Level Note below), clean idle tube and idle fuel channels with air.

Performance Unsatisfactory—Tune up engine (see car model T&E page for tune up data), check all carburetor adjustments.

Fuel Level Note—If fuel level in float bowl rises above setting, dismantle needle valve, clean needle valve and seat with a soft clean cloth, reseat needle valve by tapping with finger several times while turning needle around. Reset float level. If level not maintained, install new needle valve and seat.

SERVICING:—Before removing Upper Body Assembly (air horn and float bowl cover), remove Idle Adjustment Screw and spring, unscrew and remove Idle Tube through adjusting screw hole—this is important to avoid damage to tube and nozzle when upper assembly lifted off. Idle tube positioning pin in main body casting is not removable. Main nozzle outlet and gasket are staked in main body casting and cannot be removed (nozzle base can be removed through main adjustment screw plug hole after adjustment screw assembly removed). Blow out all jets and channels with compressed air—do not use wires or drills to clean passages. See that float bowl vent to air horn is open and clean.

Reassembly—Replace all worn or damaged parts with genuine Tillotson service parts. Use all new gaskets and replace parts in same order as removed. See that nozzles and plugs are tight. Set float level and adjust carburetor.

MODEL U-1A

U-1A—WILLYS, MODEL 37 (1937), 38 (1938), 48 (1939).

TYPE:—New design, Triple Flexible or Expanding Automatic Venturi, downdraft type. Venturi system consists of a three stage or triple venturi system which insures high velocity at nozzles for all speeds. Air flow through main venturi is cut off at speeds below 35 M.P.H. by the flexible reeds which close against the outer wall of the intermediate venturi so that all air flows through small venturi and intermediate venturi and velocity at tip of primary nozzle (in throat of small venturi) is at maximum. With reeds closed, no suction is applied to secondary nozzle. When reeds open, secondary nozzle comes into action and fuel is discharged through both nozzles.

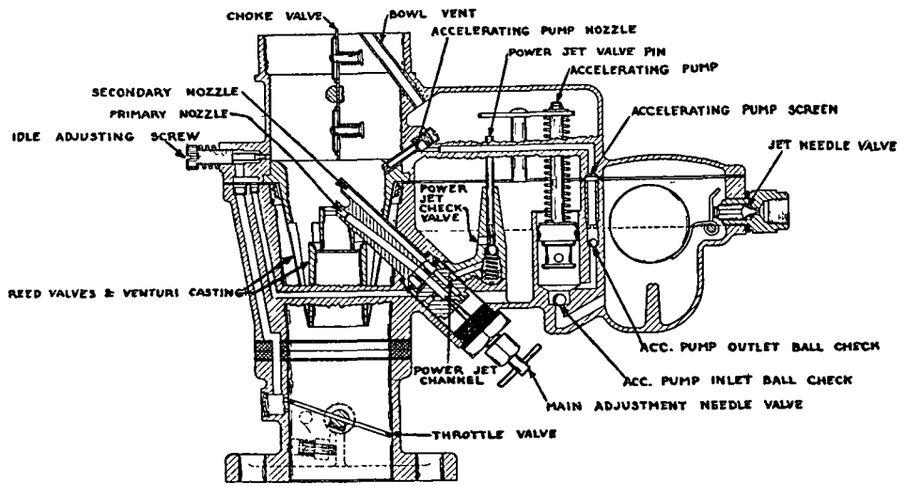
Fuel System (Closed Throttle Idling & Low Speed):—Fuel is taken from primary nozzle well up through fuel channel to cross-passage at air horn flange and mixed with air admitted through air intake port located in carburetor wall at top edge of main venturi. Idle adjusting screw controls this air port. Fuel metered by restriction at top of fuel channel, and fuel mixture metered by restriction at top of channel leading to discharge ports at throttle edge. For closed throttle idling, fuel mixture is discharged through lower port below the throttle. When throttle is opened for low speed running, additional fuel is discharged through top (low speed) port also.

Driving Range (20 M.P.H. & Above):—At approximately 20 M.P.H. when air velocity through small venturi is at maximum, fuel metered by the main adjustment needle valve in the nozzle base is drawn up through nozzle passage and discharged through primary (lower) nozzle. At approximately 35 M.P.H. air velocity flexes the four Velocity Control Reeds to the open position so that air flows through main venturi and suction at tip of secondary (upper) nozzle in main air stream is sufficient to bring this nozzle into action supplementing the discharge of the primary nozzle. Fuel for secondary nozzle is metered by restriction in fuel channel in nozzle base.

High Speed & Full Power Operation:—When throttle opened beyond ¾ open position, power jet valve pin is depressed by extension on accelerating pump stem yoke, opening power jet ball check valve, and permitting additional fuel to flow through power jet channel to secondary nozzle.

ADJUSTMENT:—For complete carburetor adjustment, Main adjustment needle valve and Idle adjusting screw must be adjusted in order as given below. If carburetor completely out of adjustment so that engine can not be warmed up, make preliminary adjustment as follows.

Preliminary Adjustment:—Close main adjustment needle valve by turning clockwise or in, lightly, until seated, then back out exactly 3 full turns. Close idle adjusting screw by turning clockwise or in until seated, then back out exactly ¾ turn. Start engine and run until warm.



Main Adjustment:—Open throttle valve so that engine speed is 30-35 M.P.H., turn main adjustment in or clockwise slowly until engine speed falls off due to lack of fuel, then turn main adjustment slowly out until engine picks up and maximum speed is obtained, finally turn main adjustment in ⅜ turn (this setting will give best performance and economy). Final setting is approximately 2⅜ turn open.

Idle Adjustment:—Close throttle, adjust throttle stopscrew so that idling speed is slightly faster than normal. Turn idle adjusting screw counter-clockwise or out until engine begins to miss, then turn screw in until engine fires smoothly. Open throttle momentarily to clear manifold and recheck idle setting. Final setting should be approximately 1 turn open. Set throttle stopscrew so that idling speed is 7 M.P.H.

PERFORMANCE:—Should be satisfactory if carburetor correctly adjusted as directed above. No changes required for operation at altitudes up to 5000 feet.

POWER JET:—Consists of ball type check valve operated by accelerating pump and supplying additional fuel to secondary nozzle (see Fuel System above). No adjustment required.

ACCELERATING PUMP:—Fuel drawn into pump chamber through intake ball check valve (at lower end of pump cylinder) on upstroke of piston and discharged through outlet ball check valve and pump channel screen to pump nozzle on downstroke of piston when throttle opened for acceleration. Pump nozzle located in carburetor wall at upper edge of main venturi. Accelerating pump is not adjustable and should not require attention.

FLOAT LEVEL:—Fuel level in float bowl set at ¾" below top edge of bowl or approximately even with the top of the float lever pivot pin with the engine idling. To check float level, remove air horn casting and gasket. Correct float level by bending float lever.

NOTE—Bowl is vented in air horn and float bowl cover must be tight.

CHOKE VALVE:—Manual control type. Fitted with two spring-controlled poppet-type relief valves to prevent overchoking. See that choke valve is fully closed with dash control button pulled out and wide open when dash control button pushed all the way in.

U-1B—WILLYS-OVERLAND, MODEL 39 (1939)

TYPE:—High velocity, triple flexible expanding or automatic venturi type with venturi and reed design similar to that used on Model U-1A (Willys). Main nozzle and metering jet design (fixed type—no high speed adjustment) is new and operates as follows:

Fuel System (Closed Throttle Idling & Low Speed):—Fuel for idling is taken through side holes in main metering jet and channel to mixing chamber at idle adjusting screw (fuel metered by restriction at top of channel) where is mixed with air admitted through two bleeder openings (upper hole has restriction and leads to air horn above venturi assembly, lower hole leads to mixing chamber below venturi—see illustration) and controlled by the idle adjusting screw. Fuel mixture is then taken down through vertical channel (with restriction at upper end) to idle discharge ports at the throttle edge. For closed throttle idling, fuel mixture is discharged through lower port only. As soon as throttle is cracked open, additional fuel is discharged through top port. Idle system supplies fuel for car speeds up to 18 M.P.H.

Driving Range (18-60 M.P.H.):—At speeds above approximately 18 M.P.H., air velocity at nozzle tip in small venturi is suffcient to bring this nozzle into action, the fuel discharged through this nozzle being metered by the fixed metering jet at the nozzle base. The flexible reed valves are calibrated to maintain maximum velocity at nozzle tip (closed at low speed, open automatically at higher speeds) and correct air-fuel ratio throughout the entire driving range. Whenever throttle is opened for acceleration, additional fuel is discharged through accelerating pump nozzle above venturi (see Accelerating Pump below).

High Speed or Wide Open Throttle Operation:—At speeds above 60 M.P.H. or when throttle more than ¾ open, power jet valve plunger depressed by pump arm and opens power jet valve so that additional fuel is discharged through power jet in carburetor wall at top of venturi assembly. There is an air bleed at the top of the power jet fuel channel.

Main Nozzle Note—All fuel discharged by main nozzle through lower opening in nozzle tip. Upper opening in nozzle tip is not used. Use great care not to damage either opening in nozzle tip when servicing main nozzle as change in shape will alter air flow past nozzle and change discharge characteristics.

IDLE ADJUSTMENT:—With engine warmed up and choke valve wide open, set throttle lever stopscrew for slightly faster than normal idle speed, turn idle adjusting screw counter-clockwise (out) until engine begins to miss, then turn screw clockwise slowly until engine fires smoothly. Final setting should be approximately 1 turn open from inner seated position. Adjust throttle lever stopscrew for idle speed of 7 M.P.H. in high gear. See car model 'T&E' page for complete carburetor tune up instructions.

NOTE—If carburetor out of adjustment, turn idle screw in until it is seated, then back screw out exactly ¾ turn. Warm up engine and adjust as directed above.

PERFORMANCE:—Should be satisfactory if idle adjustment correctly made. Main metering jet is fixed type and no high speed adjustment provided. Standard metering jet should be satisfactory for operation at altitudes up to 3000 feet. For permanent operation at altitudes greater than 3000 ft., install high altitude metering jet (nozzle base) marked 'ALT'.

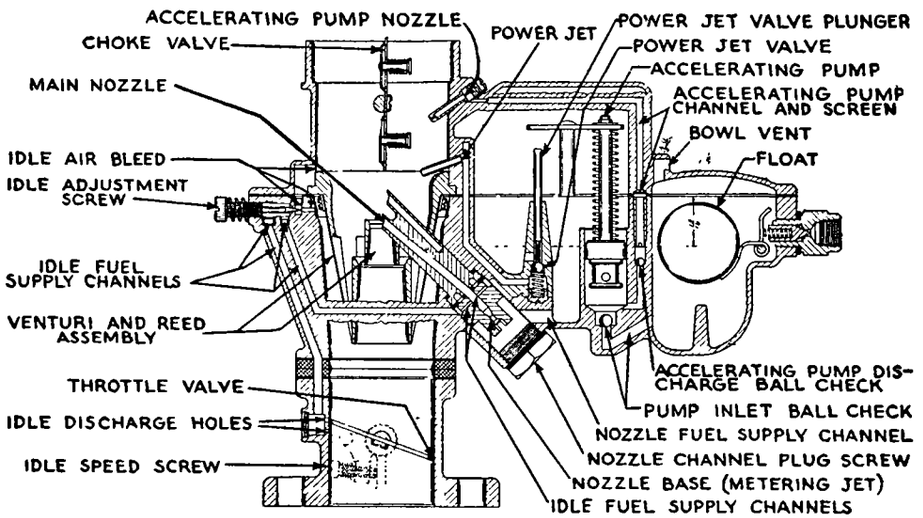
ACCELERATING PUMP:—Fuel is drawn into pump cylinder through intake ball check valve (in bottom of cylinder) when throttle is closed, and is discharged through outlet ball check valve, strainer (in plug at bowl cover flange) and pump jet in air horn when throttle is opened for acceleration. Upper section of pump piston is spring-loaded on stem to provide a prolonged pump discharge. **Adjustment**—On models where two holes provided in pump lever, engage link in hole nearest throttle shaft if flatness encountered on acceleration.

POWER JET:—Consists of a ball check valve controlling fuel discharge through power jet in carburetor wall above venturi and operated by accelerating pump arm (see Fuel System 'High Speed' above). No adjustment required.

FLOAT LEVEL:—Should be 13/16" below top edge (gasket seat) of bowl with engine running. To check float level, remove air horn and bowl cover assembly, remove gasket, use height gauge to measure actual fuel level below top edge of bowl. Do not press on float lever when checking (valve needle is spring-loaded which will permit some float movement with valve closed). To adjust, bend float lever slightly.
NOTE—When installing needle valve or float make certain that small spring is in place in hollow stem of valve needle. This spring is intended to minimize float movement and float level changes on rough roads.

CHOKE:—Manual control type, fitted with two poppet type relief valves. See that choke linkage properly adjusted to open and close choke valve fully.

SERVICING:—When servicing carburetor, blow out all channels and jets with compressed air (do not use wires or drills in jets or restrictions). Use extreme care not to bend valve reeds (if necessary to remove reeds, install short thick reed first and longer thin reed on outside). See that power jet valve ball seats tightly to prevent fuel discharge through power jet at intermediate speeds (check by



noting jet with engine running) and that plunger installed with small end down against valve ball. Make certain that pump plunger leather is good condition and contacts pump cylinder wall at all points (replace complete plunger assembly if leather worn or damaged). To remove nozzle, take out plug below metering jet, clean threads in casting thoroughly with compressed air, use socket wrench to remove metering jet, then remove nozzle from below taking great care not to damage threads in casting (if necessary, tap nozzle lightly on solid portion between upper and lower nozzle openings on upper end).

Reassembly—Replace all worn or damaged parts with genuine Tillotson service parts, use all new gaskets and re-install parts in same order as removed. Check gasoline level and idle adjustment as directed above.

TROUBLE SHOOTING:—**Motor stalls when idling**—Tighten throttle lever retaining screw and locknut, check idle adjustment. Remove idle adjusting screw, blow out all idling system channels and restrictions, clean metering jet with compressed air. Check fuel level. Tighten air horn and bowl cover retaining screws and carburetor mounting bolts, see that gaskets at these points are in good condition.

Flat Spots—Remove pump jet plug, clean pump jet and channels with compressed air. Remove air horn and bowl cover assembly, clean pump strainer (in pump outlet channel at air horn flange).

MODEL J

J-1A—WILLYS SIX, MODELS 97, 98-D (1931).
J-1B—WILLYS SIX, MODEL 6-90 (1932).
WILLYS SIX, STREAMLINE MODEL 6-90A (1932-33).
J-3B—WILLYS KNIGHT, MODEL 95 (1931).

TYPE:—Plain tube updraft type with throttle operated accelerating pump and power jet. Fuel for main discharge nozzle (mounted at an angle in the venturi) is metered by the main adjustment needle valve on the bottom of the carburetor. Main nozzle is air bled through an external air vent in the carburetor wall. Fuel for idling is taken from the main discharge nozzle well up through the idling tube (low speed jet) and is discharged through two ports in the mixing chamber opposite the throttle edge. Upper or idling discharge port is located above the throttle (closed position), while lower or low speed port is located under the throttle edge. Idling discharge passage is air bled through an air vent controlled by the idling adjustment screw. Idling adjustment screw and main adjustment needle are the only points requiring attention. Adjustment should be made in the order given below.

For idling with closed throttle, all fuel is supplied by the upper (idling) discharge port. At car speeds up to 10 M.P.H. fuel is supplied by both the idling and low speed discharge ports (upper and lower ports). At car speeds from 10-18 M.P.H. fuel is supplied by these ports and by the main discharge nozzle. For car speeds from about 18 M.P.H. up to approximately ¾ throttle, all fuel is supplied by main nozzle. With wide open throttle the main nozzle discharge is supplemented by the power jet outlet located in the side of the venturi.

PRELIMINARY ADJUSTMENT:—Turn main adjustment needle valve (high speed adjustment) up or clockwise until it is seated, then turn back or counter-clockwise exactly 2½ complete turns. Turn idling screw in or clockwise until it is seated, then turn screw out or counter-clockwise ¾ turn. Start engine and run until thoroughly warmed up.

HIGH SPEED ADJUSTMENT:—Open throttle until engine speed is approximately 30 M.P.H., see that spark control is advanced. Turn main adjustment needle up or clockwise until engine begins to slow down for want of fuel, then turn needle slowly down (counter-clockwise) until engine picks up speed and runs smoothly. This adjustment must be made slowly so that needle will not be turned beyond point where smooth running is secured in order to assure maximum economy.

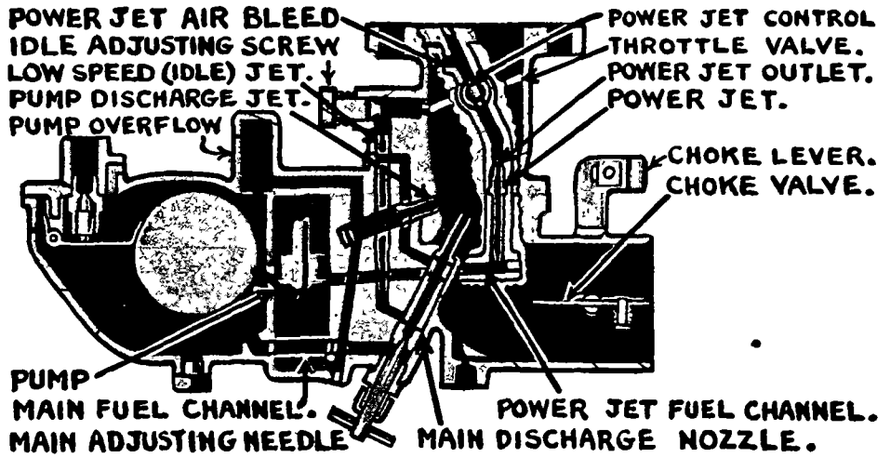
IDLING ADJUSTMENT:—Close throttle, retard spark, adjust throttle lever stop screw so that idling speed is slightly faster than normal. Turn idling adjustment screw out or counter-clockwise until engine begins to miss (mixture too lean), then turn screw slowly in or clockwise until engine fires smoothly. Set throttle stop screw for correct idling speed of approximately 5 M.P.H. Open throttle momentarily, close throttle and check idling adjustment.

ACCELERATING PUMP:—Accelerating pump is operated by the throtle lever and discharges fuel through a pump discharge nozzle in the wall of the venturi when the throttle is opened. Pump discharge is metered by the nozzle and excess fuel delivered by the pump flows into an overflow chamber at the top of the float bowl, from which it is returned to the float chamber. Pump should not require adjustment.

POWER JET:—Fuel for the power jet is taken from the float bowl and is metered by the power jet located in the fuel channel riser. The power jet discharge port is located in the venturi wall directly above the power jet. Power jet riser passage has an air bleed or vent hole controlled by the throttle shaft (a hole drilled through the throttle shaft acts as a valve in the air passage). With throttle less than ¾ open, the power jet discharge port is air vented so that no fuel is discharged through the power jet. With throttle from ¾ to wide open, the hole in the throttle shaft is turned so that the air vent is shut off and additional fuel is discharged through the power jet discharge port. Power jet is not adjustable.

FLOAT LEVEL:—To check float level, take off float bowl cover (upper casting), invert cover, measure distance from face of gasket to bottom of float (bottom when not inverted). This distance should be 1 13/16". To set float level bend float lever. See that float travel is 5/16" and bend float lever stop so that float is free to move this distance.

CHOKE:—Choke valve is fitted with relief poppet valve to prevent over-choking. Adjust choke linkage so that choke valve is fully closed with choke control button on instrument panel pulled all the way out, and wide open with choke button pushed in.



MODEL W

W-5D—WILLYS EIGHT, MODEL 8-88 (1932)
WILLYS EIGHT, STREAMLINE MODEL 8-88A (1932-33).

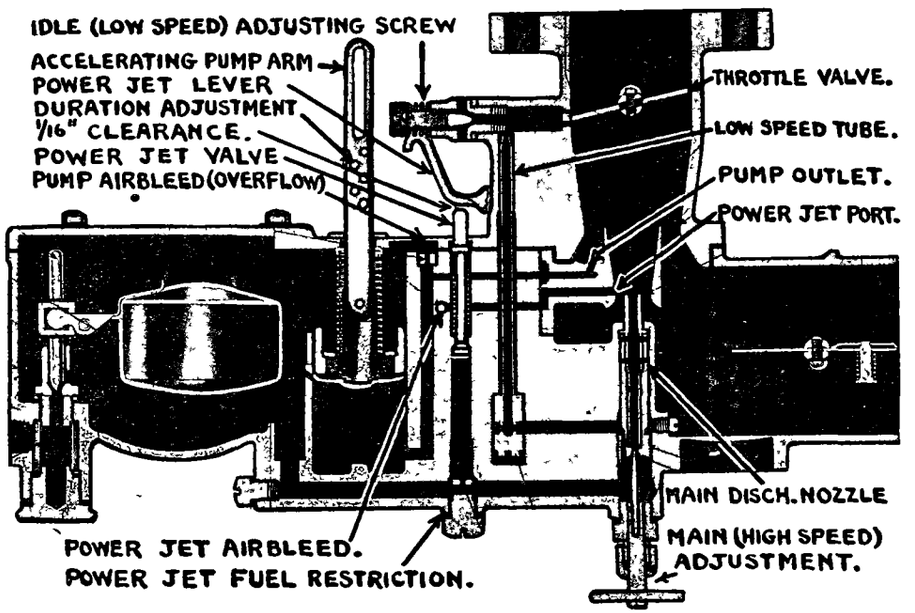
TYPE:—Plain tube updraft type with throttle operated accelerating pump and power jet. All fuel for main discharge nozzle in small venturi is metered by main nozzle restriction and main adjusting screw located at bottom of carburetor. Main nozzle is air bled by an air passage with three air vents. These air vents are located in the throat of the main or large venturi, in the mixing chamber below the venturi, and in the carburetor wall (outside vent hole through a plug). Idling fuel is taken through a by-pass hole in the lower end of the main nozzle to the low speed tube or by-pass and is discharged through two ports in the carburetor wall opposite the throttle edge (closed throttle position). The idling passage at the upper end of the low speed tube is air vented and this air vent is controlled by the idling adjusting screw. The idling screw adjustment and the main adjusting needle position (high speed adjustment) are the only points requiring attention. Adjustments should be made in the order given below.

PRELIMINARY ADJUSTMENT:—Before starting the engine, close the main adjusting needle (under carburetor) by turning to the right or clockwise until it is seated, then back off or open needle by turning to the left or counter-clockwise exactly 2½ full turns. Close idling adjustment screw by turning to the right or clockwise until it is seated, then open by turning screw to the left or counter-clockwise exactly ¾ turn. Start engine and run until it is thoroughly warmed up.

HIGH SPEED ADJUSTMENT:—Retard spark, open throttle until engine speed is equivalent to 25 M.P.H. Turn the main adjusting needle up or clockwise until engine begins to slow down. Then turn needle down or counter-clockwise until speed picks up and engine runs smoothly (this should not be more than ⅛-¼ turn from first position. This adjustment must be made slowly and the needle should not be turned beyond the point where good power and free running is secured in order to assure maximum economy.

IDLING ADJUSTMENT:—After completing high speed adjustment, close throttle, adjust throttle stop screw so that idling speed is somewhat fast. Turn idling adjustment screw to left or out until engine begins to miss (mixture too lean), then turn screw slowly in or clockwise until engine fires smoothly. Adjust throttle stop screw for correct idling speed. Open throttle and speed up engine, close throttle, recheck idling adjustment.

ACCELERATING PUMP:—Accelerating pump plunger and piston is operated by the throttle lever and discharges fuel through a discharge hole in the small venturi support arm when the throttle is opened. Pump discharge riser passage is connected to the float chamber at its upper end and excess fuel delivered by the pump flows through the air bleed restriction (at the top of the passage) back to the float chamber. This vent also serves as an air bleed for the discharge port when the pump is not operating. Accelerating pump should not require adjustment. Pump plunger link is provided with a series of holes (duration adjustment) on some types or the connector link has an adjustable stop screw.



POWER JET:—Clearance between face of operating lever and power jet valve plunger should be 1/16" with throttle closed and choke valve wide open. The operating lever is connected to the choke valve so that the power jet valve is open with the choke valve closed (at all positions of choke valve except when wide open). This assists in starting and warming up the engine. Power jet valve is also opened by the throttle lever when throttle is wide open, permitting an extra fuel discharge for full power operation. Fuel for the power jet is taken from the main fuel channel through a metering restriction and up through the power jet valve to a discharge port in the throat of the small venturi. The discharge passage is air bled to control the fuel discharge through the power jet. Power jet is not adjustable except for clearance between operating valve plunger and operating lever (above).

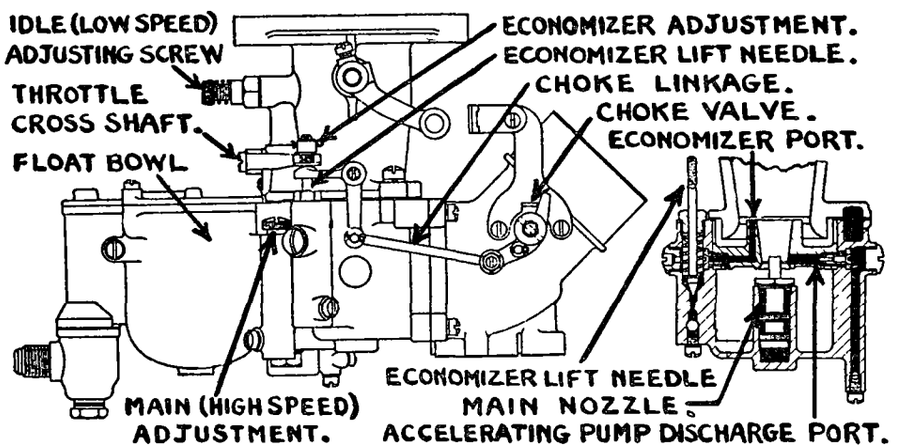
FLOAT LEVEL:—Gasoline level in float bowl should be ¾" below top edge of bowl. To check level, take off bowl cover, remove gasket, measure fuel level from top edge of bowl. Float level can only be changed by changing position of the spool on the needle valve stem. Float lever should not be bent.

CHOKE:—Choke valve is connected to power jet valve operating lever so that power jet valve is opened when choke valve is closed (see Power Jet for adjustment of linkage). Choke valve is fitted with a relief poppet valve to prevent over-choking. Check choke control linkage to see that choke valve is fully closed with choke control button on instrument panel pulled out and wide open with button pushed in.

MODEL V

V-5B—WILLYS KNIGHT, MODEL 66-D (1932)
WILLYS KNIGHT, STREAMLINE MODEL 66-E (1932-33).

TYPE:—Plain tube updraft type with throttle operated accelerating pump and economizer (power jet). All fuel for main discharge nozzle is metered by high speed adjusting needle (located on top of carburetor at left of economizer valve plunger or lift needle). Main nozzle is air bled by an air passage with three air vents. Air vents are located in the mixing chamber below the large venturi, in the large venturi slightly above the venturi throat, and in the carburetor wall (external air vent). Fuel for idling is taken from the lower end of the main nozzle through a cross passage to the low speed or by-pass tube and is discharged through two ports in the carburetor wall opposite the throttle edge (closed throttle position). Upper idling discharge port is above the throttle edge while the lower port is practically closed by the throttle edge with the throttle closed tight. Idling passage at the upper end of the low speed tube is air bled and this air vent is controlled by the idling adjustment screw. Idling screw adjustment and high speed adjustment are the only points requiring attention. Adjustments should be made in the order given below.



PRELIMINARY ADJUSTMENT:—Turn high speed adjusting needle down or clockwise until it is seated, then open needle by turning to left or counterwise exactly 2¾ full turns. Turn idling adjustment screw in or clockwise until it is seated, then back off screw by turning to left or counter-clockwise exactly ¾ turn. Start engine and run until thoroughly warmed up.

HIGH SPEED ADJUSTMENT:—Retard spark, open throttle until engine speed is equivalent to 25 M.P.H. Turn the main adjusting needle down (clockwise) until engine begins to slow down for want of fuel, then turn needle slowly back (counter-clockwise) until engine picks up speed and runs smoothly. This adjustment must be made slowly and needle should not be turned beyond the point where good power and free running is secured in order to assure maximum economy.

IDLING ADJUSTMENT:—Close throttle, adjust throttle stop screw so that idling speed is faster than normal. Turn idling adjustment screw to left or out until engine begins to miss (mixture too lean), then turn screw to right or in until engine fires smoothly. Adjust throttle stop screw for correct idling speed (8 M.P.H.).

ACCELERATING PUMP:—Accelerating pump piston is operated by the throttle lever and discharges fuel through a discharge port in the throat of the small venturi when the throttle is opened. Pump discharge is metered by acceleration well nozzle and excess fuel delivered by pump flows into an expansion chamber in the carbruetor body directly above the nozzle. Pump should not require adjustment.

TILLOTSON MODEL V CONTINUED

ECONOMIZER (POWER JET):—Economizer lift needle (shut-off valve stem) is connected to choke valve and throttle valve so that valve is opened when carburetor is choked (to assist in starting and warming up engine) and also when throttle is wide open (providing extra fuel for full power operation). Fuel for power jet is taken from main fuel channel and is metered by economizer fuel restriction below the economizer valve. Economizer passage (above the valve) has an external air vent or air bleed to control fuel discharge through the discharge port in the top edge of the small venturi.

Adjustment:—Clearance between throttle operated cross lever and adjusting nut must be .040" with throttle closed and choke valve wide open. To adjust, close throttle, see that choke is wide open and that economizer lift needle is seated, turn adjustment nut on upper end of lift needle to right or left until clearance between lower face of adjusting nut and upper surface of throttle operated cross lever is .030-.040".

FLOAT LEVEL:—Gasoline level in float bowl should be 15/16" below top edge of float bowl. To check level, take off bowl cover, remove gasket, measure fuel level from top edge of bowl. Float level can only be changed by shifting position of spool on needle valve stem. Do not bend the float lever.

CHOKE:—Choke valve is interconnected with economizer lift needle (power jet shut-off valve) so that valve is opened when carburetor is choked. There must be suficient play in the connecting levers so that lift needle is seated when choke valve is wide open. Adjust choke valve linkage so that choke valve is fully closed when choke control button on instrument panel is pulled out, and wide open when choke button is pushed in.

WINFIELD MODELS S, SR

DESCRIPTION:—Winfield carburetors are made in both updraft and downdraft types. These models are entirely similar in throttle chamber and fuel metering system design, the principal difference being that an individual float bowl design is used for each type. The fuel system is made up of a conventional idling system and a unique type of intermediate and high speed discharge jets or spray bars built in the carburetor throat at the throttle valve. The hollow spray bars through which the fuel is fed are located at right angles to the air flow in concentric recesses within the throttle body. An air duct for each spray bar is located at the nose of the throttle body and some of the air is diverted through this duct, around the spray bars, and then out through the discharge port in the side of the throttle body with the atomized fuel. The throttle valve is mouned at the end of the throttle body and is roughly wedge-shaped so that fuel discharge from the intermediate spray bar begins before the high speed spray bar comes into action. Fuel is discharged by both spray bars with the throttle wide open.

Idling:—The idling system has two discharge ports opposite the blunt end of the throttle valve. When the throttle is fully closed, the lower discharge port is cut off by the throttle valve so that fuel is discharged only by the upper port. When the throttle is cracked open, additional fuel is discharged by the lower port and as the throttle is opened, the intermediate spray bar comes into action. Idling fuel mixture is controlled by the idling adjusting screw and idling speed is controlled by the throttle stopscrew in the usual manner. Adjustment directions are given below.

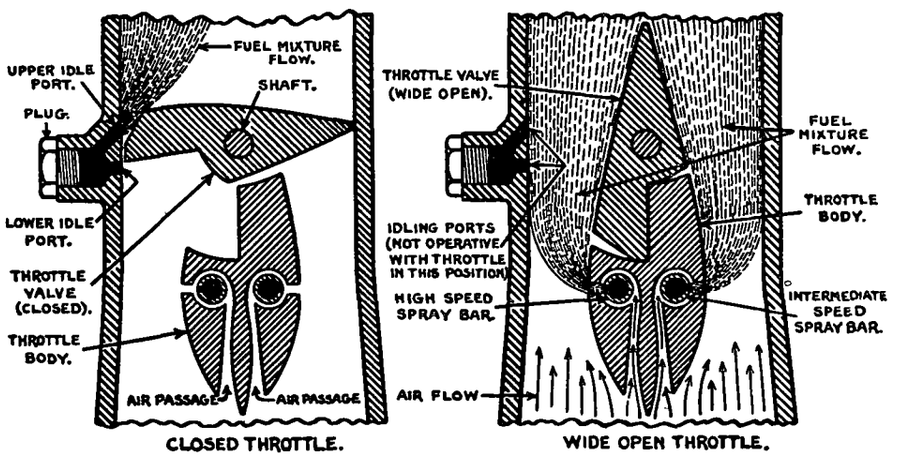
Accelerating Pump:—An accelerating pump is installed on Model SR carburetors. See adjustment directions below.

Float Level:—A sight hole closed by a plug is located on the float bowl. To check fuel level, remove plug with car standing on level floor. Fuel level should be even with the bottom of the inner thread in the sight hole.

ADJUSTMENT:—Model SR. This data furnished through courtesy of Winfield Carburetor Company, Ltd., 3053 Treadwell Street, Los Angeles.

Accelerating Pump Adjustment:—The pump adjustment governs the accelerating mixture. It operates just the reverse of the other three adjustments Turning to the right gives a richer rather than leaner mixture. The richest accelerating mixture is obtained when the pump adjustment is screwed completely against its seat. This setting should rarely, if ever, be used. The leanest setting is obtained when the adjustment is open about three complete turns. The correct setting is usually about one-half to one and one-half complete turns open. The leanest pump adjustment setting that gives positive and smooth acceleration without hesitation or spitting back should be used. In cold weather a richer pump adjustment may be used to advantage than in hot weather.

Idling Adjustments. Open idling adjustment one-half turn. Before any attempt is made at adjustments, the motor must have been running until it is thoroughly warmed up. Check the float level to see that the gasoline level is at the bottom of the inner thread of the inspection hole; otherwise the adjustment will be incorrect. The idling adjustment consists of two settings; the idling mixture and the idling speed, which are considered separately. With the spark fully retarded and the throttle closed, keep turning the idle adjustment in or out until a point is reached where the engine idles smoothly. For a richer idling mixture, screw the idle adjustment out. For a leaner idling mixture, screw the idle adjustment in. The idling speed is regulated by the throttle stop adjusting screw. Set the idling speed of the motor with the spark advanced.



WINFIELD THROTTLE CHAMBER.

Intermediate Adjustments. After the idling speed adjustment has been made, the intermediate speed adjustment should be made. Open the intermediate needle approximately two turns. The intermediate adjustment is made from this point. Set the throttle at approximately one-third open. Have the spark retarded about one-half or set at a point where there is an appreciable slowing down of the motor. This adjustment should be made at approximately 1800 R.P.M. of the motor. The intermediate and high speed adjustments control the amount of gasoline admitted to the spray bar and not the amount of air. Turning the needle down or clockwise cuts down the supply of gasoline and turning it up or counter-clockwise increases the supply of gasoline. The most efficient intermediate adjustment will be obtained when the adjusting needle is set four notches under the number of notches that will still give the greatest number of revolutions per minute of the motor with the hand throttle set in a fixed position.

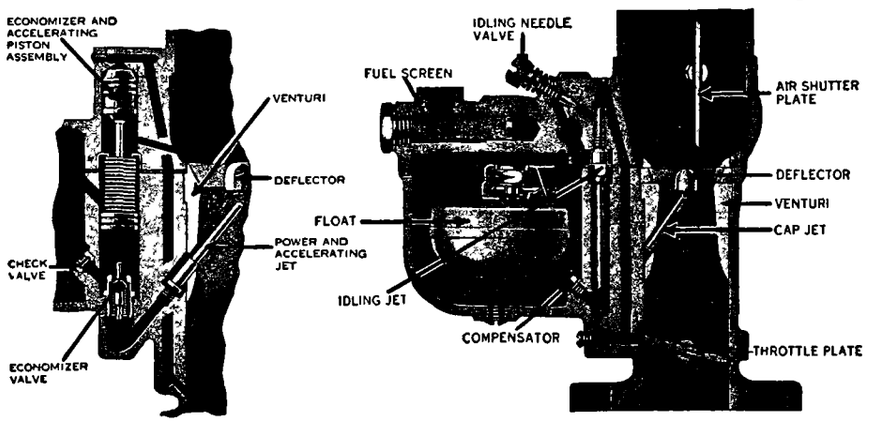
High Speed Adjustment. After the idling and intermediate adjustments have been completed, the high speed adjustments should be set. The high speed adjustment should be opened approximately two turns for 4 cyl. motors, 2½ turns for 6 cyl. motors, and 3 turns for 8 cyl. motors. It will generally be found when setting the adjustment by notches that on 4 cyl. motors the high speed adjustment should be set approximately four notches more than the intermediate adjustment. On 6 cyl. motors, set the high speed needle 8 notches more than the setting of the intermediate, and on all eight cylinder motors set the high speed adjustment 12 notches more than the setting of the intermediate adjustment.

MODELS IN154½X, IN155, IN155½, IN156B, IN157.

IN155½—REO FLYING CLOUD SIX, MODEL S (1932).

TYPE:—Plain tube downdraft type with vacuum controlled accelerating pump and economizer. Discharge jets are located in venturi directly under a cone shaped deflector and fuel is discharged against the concave lower surface of the deflector and is then carried into the air stream. Main jet is fed directly from the float bowl. Idle jet located in idle well is fed by fuel flowing through compensator jet. Fuel for idling is metered by idling jet. The idle passage at the top of the idle jet is air bled by a vent leading to the float chamber and this vent is controlled by the idling adjustment screw. From this idle passage the fuel mixture is taken down through a passage in the carburetor body and discharged opposite the throttle edge. The idle operates only with closed throttle or at low speeds and the fuel from the idle well is discharged through the cap jet in the mixing chamber with the throttle open. Idle adjustment is the only point requiring attention.

IDLING ADJUSTMENT:—Engine must be thoroughly warmed up before adjustment is made. With engine warm and running, turn idling adjustment out or counter-clockwise until engine begins to miss or is rough (mixture too lean), then turn screw slowly in or clockwise until engine fires smoothly. Adjusting screw controls air and should be turned out for leaner mixture and in for richer mixture. Adjust throttle lever stop screw for correct idling speed. Recheck idling adjustment. Correct setting should be between 1-3 turns open. If carburetor is entirely out of adjustment a preliminary setting may be made by turning idling screw in until it is seated and then backing screw off 1½ turns. This will allow engine to be warmed up.



ACCELERATING PUMP AND ECONOMIZER:—Accelerating pump and economizer are controlled by vacuum piston. The chamber above the vacuum piston is connected to the carburetor barrel below the throttle so that the vacuum in the manifold will hold the piston up for all partial throttle positions. When the throttle is opened for acceleration the collapse of the vacuum will allow the piston to fall, discharging the fuel in the pump cylinder through the economizer valve to the power and accelerating jet in the mixing chamber. A check valve prevents the fuel flowing back into the float bowl.

Economizer valve at lower end of accelerating pump is spring loaded and prevents fuel being discharged through the power jet when the throttle is closed. When the throttle is opened for acceleration or is held open for full power operation the economizer valve is opened by the piston, allowing fuel to flow to the power jet. Accelerating pump and economizer discharge is metered by the discharge jet. Accelerating pump and economizer are not adjustable and do not require attention.

FLOAT LEVEL:—Fuel level in float bowl is set at ⅝" below the top edge of the bowl. This can be checked by a special gauge, Part No. C-4088, which is designed to be attached to the drain hole at the bottom of the bowl. Float level should not require adjustment. Float hinge must not be bent.

CHOKE CONTROL:—Choke valve is offset and is held in position with relation to choke valve lever by a spring. The spring allows the choke valve to open slightly when engine begins to fire, preventing over-choking and assisting in warming up. Adjust choke linkage so that choke valve is fully closed when choke control button is pulled all the way out (engine not running) and wide open with choke control button pushed in.

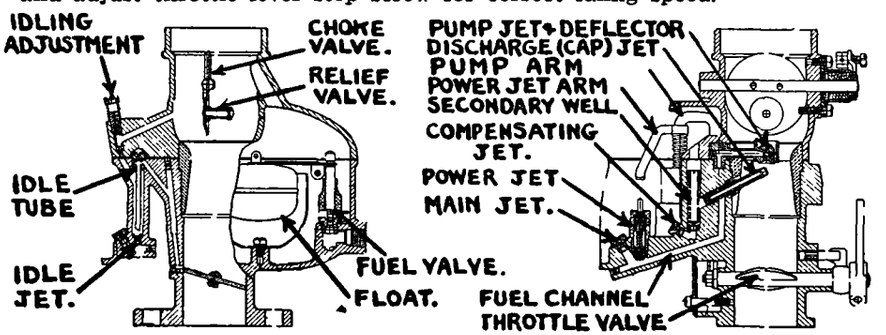
MODELS IN175, IN175½, IN175½XI.

IN175—REO FLYING CLOUD, MODELS S-1, S-3, S-5 (1932).

IN175½XI—REO FLYING CLOUD, MODELS S-1, S-3, S-5 (1933).

TYPE:—Plain tube updraft type with throttle operated accelerating pump and power jet. Discharge jets (cap jet) are located in venturi directly under a cone shaped deflector and fuel is discharged against the concave lower face of the deflector. Main jet is located in float bowl. On some models a main jet adjusting needle valve by-passes some fuel past the main jet. Compensating jet (in float bowl) meters fuel flowing to secondary well and idling tube. Secondary well is air vented at the top. Fuel for idling is taken up through the idling tube located in the idling well and is discharged through ports opposite the throttle edge. The idling well is air bled by a vent in the upper part of the carburetor barrel (below the choke valve) and this vent is controlled by the idling adjustment screw. This idling adjustment is the only point requiring attention.

IDLE ADJUSTMENT:—Engine must be thoroughly warmed up before adjustment is made. With engine warm and running, close throttle, turn idling adjustment screw out or counter-clockwise until engine begins to miss or is rough, then turn screw slowly in or clockwise until engine fires smoothly. Adjusting screw controls air and should be turned in for richer mixture and out for leaner mixture. After completing adjustment, check idling speed and adjust throttle lever stop screw for correct idling speed.



POWER JET:—Power jet consists of a shut-off valve in the float chamber which is opened by an arm on the accelerating pump rod when the throttle is wide open. This permits fuel to be by-passed through the valve past the main jet for full power operation. This fuel is metered by the restriction in the lower end of the power jet assembly. Power jet should not require attention.

ACCELERATING PUMP:—Accelerating pump is operated by the throttle lever. Fuel is drawn into the pump cylinder through a ball-check valve from the float bowl when the throttle is opened and is discharged through another ball-check valve to the discharge port in the deflector assembly in the venturi. Pump discharge is metered by the discharge opening in the deflector. Pump should not require attention.

FLOAT LEVEL:—Fuel level in float bowl should be 45/64" below the top edge of the float bowl when tested with a 6' head on the intake. This is equivalent to 1½ pounds pressure.

CHOKE CONTROL:—Choke valve is fitted with a relief poppet valve to prevent over-choking and to assist in warming up. See that choke linkage is adjusted so that choke valve is closed with choke control button on instrument pulled all the way out and wide open with control button pushed in.

STUTZ SIX, MODEL LAA (1932-33)
STUTZ EIGHT, MODEL SV-16 (1932-33-34)

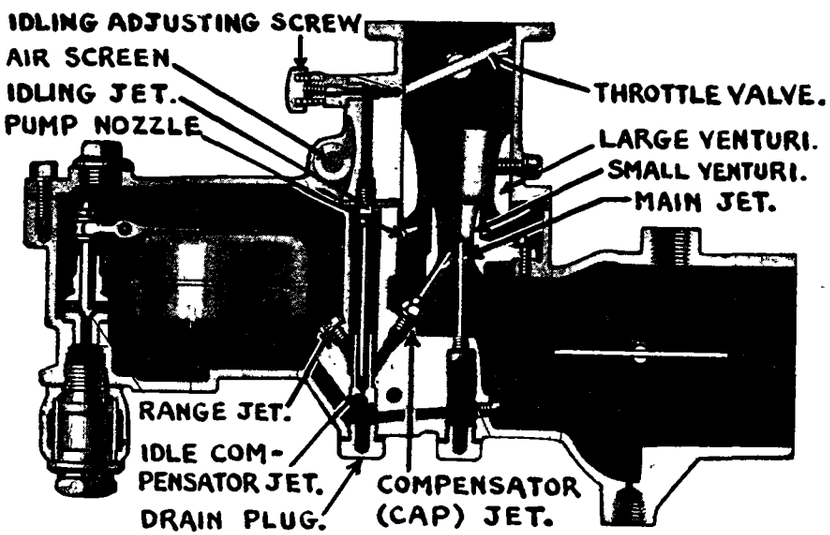
TYPE:—105-DS.—Dual barrel or duplex updraft plain tube type with accelerating pump connected to throttle lever. Carburetor barrels have independent metering and discharge jet assemblies, idle adjustments, and throttle valves (throttle valves are mounted on the same shaft and will not require synchronization). All jets are fixed or non-adjustable type. Main jet (high speed jet) located in secondary venturi is fed by fuel flowing directly from float chamber through a channel to a well under the jet. Idle jet located in idle well is fed by fuel from main jet channel through the idle compensator jet (forming the bottom of the well) and also by the range compensator jet (in float chamber). Cap jet located in secondary venturi is fed from the idling well and will take all fuel from range compensator jet and overflow from idle compensator jet at driving speeds (idle jet discharge is operative only during closed throttle idling and low speed driving). Idle discharge tube (above idling jet) is air bled and the air bleed is controlled by the idling adjustment screw. This is the only point requiring attention.

IDLING ADJUSTMENT:—Engine must be warmed up before idling adjustment is made. With engine warm and running, close throttle and allow engine to idle, adjust throttle lever stop screw if necessary to keep engine from stalling. Then adjust each idling screw, turning screw out or counterclockwise until engine begins to miss or speed falls off, and then turning screw in or clockwise until engine fires smoothly. Idle adjustment screws operate on air and must be turned out to secure leaner mixture and in for richer mixture. After each idling screw has been adjusted and engine fires smoothly on all eight cylinders, adjust throttle lever stop screw to secure correct idling speed.

If correct idling adjustment cannot be secured, clean out idle compensator jet (under plug on bottom of carburetor) with compressed air, take out idle adjustment screw assembly and blow out idle port. Idle jet can also be cleaned with compressed air if carburetor is disassembled (jet is screwed in upper carburetor body). If low speed operation is unsatisfactory clean out range compensator jet in float chamber.

PERFORMANCE:—All jets are of the 'fixed' type. Jets should not be changed except to compensate for special fuel or operating conditions, such as high altitude. Manufacturer recommends that jets not be changed unless car is operated permanently at elevations greater than 6000 feet.

ACCELERATING PUMP:—Not adjustable. Accelerating pump discharges fuel into pump discharge chamber when throttle is opened. This fuel feeds the pump discharge jet located below the primary venturi in each carburetor barrel. Discharge jet or nozzle is air vented. Excess fuel discharged into pump discharge chamber when throttle is quickly opened overflows and escapes back into float chamber. Pump discharge chamber will maintain fuel level until fuel is all discharged through pump jet or until throttle is closed when fuel remaining in discharge chamber will be sucked back into the pump cylinder by the pump plunger. Accelerating pump is not adjustable.



FLOAT LEVEL:—Fuel level in float chamber should stand ¾" below top edge of float bowl with engine not running. Float level should not require adjustment. Float level can only be changed by changing position of spool on float needle valve stem and float lever should not be bent.

CHOKE CONTROL:—Choke linkage should be adjusted so that choke valve is fully closed when choke control button on instrument panel is pulled all the way out and wide open when choke control button is pushed all the way in.

ZENITH JET SPECIFICATIONS

Stutz 6 Cylinder Models LA, LAA (1932-33)

Part	Size	Part No.
Venturi	23	C-4307
Main Jet	20X6	D-4306
Idle Compensator	18X1	D-4141X1
Range Compensator	10	D-1015
Idle Jet	11	D-4137
Accelerator Jet	18	D-5643
Cap Jet	26	D-4138
Needle Valve and Seat Assembly	69	D-2418

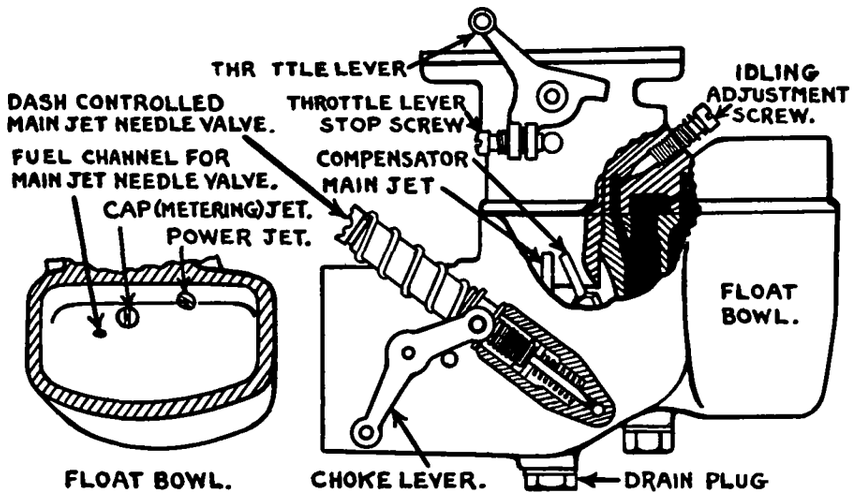
Stutz 8 Cylinder Model (1931-34)

Part	Size	Part No.
Venturi	24	C-4307
Main Jet	24X6	D-4306
Idle Compensator	17X1	D-4141X1
Range Compensator	11	D-1015
Idle Jet	11	D-4137
Accelerator Jet	20	D-5643
Cap Jet	26	D-4138
Needle Valve and Seat Assembly	69	D-2418

MODEL A (1928-29-30-31).

MODEL B (1932-33).

TYPE:—Plain tube updraft type with main jet and compensating jets located in venturi and power jet. All jets non-adjustable except dash-controlled main jet adjusting valve. All fuel for main, compensating and idling jets passes through a cap jet located in the bottom of the float chamber. The main jet adjusting valve is located in a channel which by-passes fuel past the cap jet, providing additional fuel for starting. The compensating jet is



located in a well connected to the idling well and has several holes drilled through the lower end of the jet quill. This acts as an air bleed when the fuel level in the idling well drops below this point. The idling jet is located in a chamber which is air vented. The idle port is directly under the throttle edge (closed throttle position) and the throttle valve is notched at this point. The idling adjusting screw controls the air vent at the top of the idling well in which the idling jet quill projects. This idling adjustment is the only point requiring attention.

IDLE ADJUSTMENT:—With engine thoroughly warmed up, close throttle (push throttle button in) and adjust throttle plate stop screw so that engine idles fast enough to prevent stalling. Adjust idling air adjustment screw until engine fires smoothly without rolling or missing. Adjusting screw operates on air and should be turned in to secure richer mixture and out to lean mixture. Correct setting is 1¼-1¾ turns open. Readjust throttle plate stop screw if necessary to secure correct idling speed. If correct idling adjustment cannot be secured, disassemble carburetor and clean idling jet and cap jet (in float chamber) with compressed air. If idling and low speed performance are unsatisfactory, remove and clean compensating jet.

POWER JET:—Power jet consists of a power jet tube (assembled in upper carburetor body) extending down into a well in the lower casting. Fuel flowing into this well is metered by the power jet located in the side of the float chamber. The upper end of the power jet tube terminates in a port in the carburetor wall directly above the venturi. The tube is air vented past a flat portion of the throttle shaft through a hole in the throttle shaft boss on the carburetor casting. At all points up to 2/3 full throttle this air vent is open and air is drawn through the power jet port into the carburetor barrel. From 2/3 throttle opening to full throttle the flat portion of the shaft is turned away from the hole, closing the air vent and causing gasoline to be drawn up and discharged through the power jet port. This provides the additional fuel required for full-throttle operation. The power jet is not adjustable and requires no attention. If engine performance is not satisfactory at full-throttle, disassemble and clean power jet (in float chamber) and power jet tube with compressed air.

MAIN JET ADJUSTING VALVE:—Main jet adjusting valve (dash-controlled) is combined with choke control. Choke control button should be turned to left or counter-clockwise to open main jet adjusting valve and enrich mixture for starting. Correct opening is approximately one full turn and button should be turned to right to close valve as soon as engine warms up. This is an operating adjustment and does not require servicing.

FLOAT LEVEL:—Fuel level in float bowl should be ⅝" (A), 33/64" (B) below the top edge of the float bowl. Should not require adjustment. Do not bend float lever hinge.

CHOKE:—Choke valve is operated by pulling out choke control button on dash. Choke valve is spring controlled and will open as soon as the control button is released.

JET SPECIFICATIONS

Model A (1928-29-30-31)

Type		Ford Part No.
Main Jet		A-9534-B
Cap Jet		A-9538-B
Idling Jet		A-9542
Compensator Jet	(#19)	A-9575-R
Intake Needle Valve & Seat Assembly		A-9564-A

Model B (1932-33)

Type	Standard	Part No.	High Altitude
Main Jet	B-9534-A		B-9534-B
Cap Jet	B-9538		B-9538
Idling Jet	B-9542		B-9542
Compensator Jet	(#18) B-9575-A		(#17) B-9575-B
Power Jet	B-9594		B-9594
Intake Needle Valve & Seat	B-9564		B-9564

420-S—CHEVROLET, ALL PASS, CARS & TRUCKS (1940)—SEE NOTE
434-S—CHEVROLET, ALL MODELS WITH ECON. ENGINE ('40)—SEE NOTE
***398-S—HUPMOBILE, SKYLARK MODEL R (1940)**
*—Vacumeter type Carburetor with Carter Climatic Control.
These Carburetors same as used on corresponding 1939 cars except as noted.

NOTE:—Chevrolet Model 420-S—Economizer jet on 1940 carburetor is .062-.063" (was .059-.060").
Chevrolet Model 434-S—This carburetor same as 1939 type and has stop-pin which limits throttle opening to half-throttle (approximately 45 MPH. top speed).
Chevrolet Cab-over-Engine & Doubl Duti Panel Trucks—These models use Carter (BB) Model 447-S updraft carburetor. See separate article for data.

SPECIAL SERVICE NOTES:—Chevrolet Rich or Lean Complaints, 'Popping-back' through Carburetor (1939-40 Engines)—Caused by bakelite metering rod hold cover sticking to rod or sticking to top of metering rod disc stop (this stop used on late 1939 and all 1940 carburetors—should be installed on first 1939 carburetors as directed in 1939 Supplement) resulting in rich mixture (poor economy) at low speeds and lean mixture or popping-back through carburetor at high speeds. To correct this complaint, remove metering rod disc stop, open throttle wide, disconnect metering rod pin spring, turn metering rod and lift rod and disc out. Clean metering rod and disc thoroughly, clean hole in disc with #47 drill (.078"), reassemble rod, disc, and stop. CAUTION—Disc hole larger than #47 drill will cause rich mixture.
Chevrolet Running Backward (when key turned off)—To correct these complaints, check idle speed and set stopscrew for speed not to exceed 7 MPH. Check throttle valve and make certain that it is not sticking, check throttle valve spring tension. Check manifold heat control valve and thermostatic spring. Make certain that valve is not binding and that spring is wound up not more than enough to slip free end over manifold pin (approx. ½ turn).
Whistling Complaints (all models)—To correct whistle at vacuum spark port, remove vacuum passage plug (on side of body casting near idle adjusting screw), install special bushing No. 38A-35 and new rivet plug.

IDLE ADJUSTMENT:—Adjust only with engine warmed up so that choke valve is wide open and fast idle inoperative. Idle adjusting screw controls fuel mixture and should be turned in for leaner mixture, out for richer mixture. Approximate settings shown in table below. Idle speed controlled by throttle lever stopscrew and should be set for speed shown in table. See car model 'T&E' page for complete carburetor tune up data on each car model.

Car Model	Idle Screw Setting	Idle Speed
Chevrolet	1-2 turns open	7 MPH.
Hupmobile	¾-1¼ turns open	6 MPH.

PERFORMANCE:—Should be satisfactory if idling adjustment and accelerating pump adjustment correctly made. See Carter Jet Specification Table for standard jet calibration and recommended changes for special operating conditions (lean metering jets, etc.).

ACCELERATING PUMP:—Low pressure type positively actuated by throttle lever. Fuel is drawn into pump cylinder through intake check valve and strainer when throttle is closed and is discharged through outlet check valve and pump jet in wall of mixing chamber when throttle opened for acceleration.
Adjustment—Three holes provided in pump arm (under dust cover on float bowl cover) for pump rod link engagement. Inner hole provides minimum stroke, Outer hole medium stroke, upper hole maximum stroke. See car model 'T&E' for recommended settings and seasonal changes.
Note—Lubricate pump countershaft by filling dust cover attaching screw hole with graphite grease at 5000 mile intervals.

METERING ROD (ECONOMIZER):—Metering rod and jet assembly meters all fuel for main nozzle (stepped and tapered rod is lifted out of jet as throttle is opened to provide greater fuel flow through jet to nozzle). Metering rods can be changed for special operating conditions such as high altitudes. See Carter Jet Specification Table for standard and special lean metering rods for each model. Check and adjust metering rods whenever rods removed and replaced or when pump stroke is adjusted (vacumeter types).
Vacumeter Type Note—On these models, metering rod is linked to vacuum piston stem so that rod is controlled by vacuum piston within limits determined by throttle valve opening (pin on pump arm serves as stop for piston stem to prevent piston pulling metering rod down in jet beyond the correct point for the particular throttle opening). These models adjusted in special manner.
Metering Rod Adjustment (Chevrolet)—Take out dust cover screw, remove dust cover, remove pin spring, turn metering rod ¼ turn to disengage it from pump arm pin, lift rod out being careful not to lose metering rod spring and disc (see Special Service Notes above for disc retainer on Chevrolet models). Back off throttle stopscrew so that throttle valve tightly closed, install metering rod gauge T109-25 (2.795") in place of rod being careful that gauge is vertical and tapered end seats in metering rod jet. If metering rod pin does not rest on bottom of notch on gauge with pump arm connector rod centered freely in pump arm hole, remove connector rod and bend until this setting secured. Remove gauge and re-install metering rod, make certain that disc in place on rod and that pin spring properly connected.
Metering Rod Adjustment (Hupmobile Vacumeter Types)—Take out dust cover screw, remove dust cover, disengage pin spring, remove metering rod being careful not to lose metering rod disc. Back off throttle stopscrew so that throttle valve tightly closed, install metering rod gauge T109-25 (2.795") in place of rod being careful that gauge is vertical and tapered end seated in metering rod jet. Push vacuum piston and stem down and bend lip on stem (which contacts stop pin on pump arm) so that metering rod pin on piston stem rests in notch on gauge. Remove gauge and replace metering rod. See that vacuum piston is clean and operates freely in cylinder.

ANTI-PERCOLATOR:—Saxophone Key Type (398-S). Consists of a main nozzle well vent in the float bowl which is controlled by a cap mounted on a rocker arm and actuated by the pump arm so as to open the vent when the nozzle is closed to prevent any 'percolating' discharge from the main nozzle. Valve must be closed when throttle is open (incorrect adjustment will cause flat spots and poor performance.
Adjustment—Open throttle valve exactly .030" (use T109-29 gauge or .030" drill rod placed between lower edge of throttle valve and carburetor wall), bend lip on anti-percolator arm so that clearance between lip and pump arm is .005-.015" (measure with feeler gauge).

FAST IDLE:—**398-S**—Consists of a fast idle cam mounted directly above the throttle lever (serving as a stop for the throttle valve) and linked to the automatic choke mechanism.
Adjustment—Back off throttle lever stopscrew, rotate fast idle cam to normal (slow) idling position, turn stopscrew in so that it is seated against (not on) first step of fast idle cam with throttle valve fully closed, bend offset portion of fast idle link with special tool T109-41 so that clearance between lower edge of choke valve and carburetor wall is ⅝". Make certain that linkage does not bind after adjustment.

FLOAT LEVEL:—To check float level, remove bowl cover and float assembly, invert cover, remove gasket, measure from gasket seat on cover to top of float at free end. Distance should be ½" (Chevrolet 420-S, 434-S), ⅜" (Hupmobile). To adjust, bend lip of float lever at point where it contacts valve needle (do not bend float arm).
Needle Valve & Seat—Furnished only in matched sets, Part No. 25-33S—#48 intake hole (all models).

THROTTLE VALVE SETTING:—When installing valves, use new attaching screws and install screws loosely, tap valve lightly to centralize it in bore, then tighten attaching screws securely.
Setting—Check with stopscrew backed off so that throttle valve tightly closed. Idle port opening is opening of lower port (below throttle valve) except as noted. Vacuum spark port is height of bottom of port above upper edge of throttle valve. Shims furnished .002" thick (2-93), .005" thick (2-94) to adjust throttle valve position.

Car Model	Carburetor	Idle Port Opening	Vacuum Spark Port
Chevrolet	420-S, 34-S	(A) .047-.051"	None
Hupmobile	398-S	.010-.014"	None

(A)—Top of lower idle port above top edge of throttle valve.

CHOKE:—Chevrolet—Semi-automatic type with offset valve (same as for 1939).
Hupmobile 398-S—Carter Climatic Control (automatic choke). See article on Carter Climatic Control in Carburetion Equipment Section for complete servicing data.
Setting—Thermostatic coil housing should be set so that center point of scale is lined up with mark on piston housing.
Unloader—Consists of a cam on the throttle lever which opens the choke valve (when throttle valve wide open) to correct flooding. To adjust, hold throttle wide open, bend cam on throttle lever so that clearance between lower edge of choke valve and air horn wall is ⅜".
Choke Valve Lock—Prevents choke valve closing when throttle valve wide open. To adjust, hold choke and throttle valves wide open, bend lip on fast idle link so that clearance between lip and throttle lever lock is 1/32".

SERVICING:—These carburetors serviced in same manner as previous W1 types. ***See Carter 'Type W1' and 'Type W1 with Climatic Control' carburetor articles in Carburetor Section of manual for complete data.***

468-S—STUDEBAKER CHAMPION, MODEL 2G (1940)
450-S—WILLYS, MODEL 440 SPEEDWAY & DELUXE (1940)

NOTE:—Studebaker Champion Model 453-S (Late 1939) Changes—To improve cold starting and warming up performance on cars equipped with this 453-S carburetor, install the following parts (furnished in Unit Package No. 14-236U); Choke Control Lever & Shaft Assembly No. 14-255S, Choke Valve Screws (2) No. 39-10, Pin Spring 150A-10, Tube Clamp Assembly No. 62-114S, Choke Link No. 117-74, Choke Lever Spring No. 61-213, Inspection Tag No. 107-14. CAUTION—This inspection tag has new model number 453-SA stamped on it and tag should be used to replace old tag to indicate that these new parts have been installed.

Willys Model 450-S—This carburetor can be used for replacement purposes on 1937-38-39 Willys cars.

TYPE:—Same design at previous WO models (as used on 1939 Studebaker Champion).

ADJUSTMENT:—Adjust only with engine warmed up and choke valve wide open (fast idle inoperative). Idle adjusting screw controls fuel mixture and should be turned in for leaner mixture, out for richer mixture. Approximate settings shown in table below. Idle speed controlled by throttle lever stopscrew and should be set for speed shown in table. See car model 'T&E' page for complete carburetor tune up data for each car model.

Car Model	Idle Screw Setting	Idle Speed
Studebaker	¾-1¼ turns open	8 M.P.H.
Willys	½-2½ turns open	8 M.P.H.

PERFORMANCE:—Should be satisfactory if Idling Adjustment and pump stroke setting correct. See Carter Jet Specification Table for standard jet calibrations and special lean metering rods for special operating conditions such as high altitudes. See Trouble Shooting.

ACCELERATING PUMP:—High pressure type (spring operated). Operated by throttle lever through spring connection between pump operating lever and pump arm (under dust cover on bowl cover). Fuel is drawn into pump cylinder through strainer and inlet ball check valve when throttle is closed and is discharged through outlet ball check valve and pump jet location in side of mixing chamber above main venturi when throttle is opened for acceleration. Pump is not adjustable for seasonal changes.

Pump Stroke Adjustment—To check pump plunger travel, remove dust cover on float bowl cover, install Universal Pump Stroke Gauge T109-117S on raised portion of bowl cover so that gauge is vertical and projecting ear rests on top surface of pump shaft. Back off throttle lever stopscrew so that throttle valve tightly closed, note gauge reading. Open throttle wide and again note gauge reading. Difference between two readings is pump stroke (in sixty-fourths of an inch) and should be 12/64" (Studebaker), 17/64" (Willys). To adjust, use special bending tool, T109-41, and bend throttle connector link at lower angle near throttle lever. CAUTION—Check metering rod setting (disturbed by this adjustment).

METERING ROD (ECONOMIZER):—Metering rod and jet assembly meters fuel for main nozzle and rod is operated by throttle lever in same manner as on other Carter models. Metering rod mounting on pump operating lever is new and consists of a pin locked in place in a slotted hole in the pump arm by a nut. Metering rods can be changed for special operating conditions such as high altitudes. See Carter Jet Specification Table for standard and lean metering rod calibrations. Check and adjust metering rod whenever rods removed and replaced or when pump stroke setting is changed.

Metering Rod Adjustment—Disconnect choke linkage, take out air horn attaching screws, remove air horn and dust cover. Unhook metering rod spring, remove metering rod being careful not to lose disk on rod at bowl cover. Insert special gauge, T109-26 (2.718") in place of metering rod so that tapered end is seated in metering rod jet and gauge is vertical. Back off throttle lever stopscrew so that throttle valve closes tightly. Metering rod pin on pump operating rod should be even with shoulder of notch in gauge. To adjust, loosen pin nut, shift pin on arm, tighten nut securely (use special wrench T109-76). Remove gauge, install metering rod and disk, install pin spring, connect metering rod spring.

FLOAT LEVEL:—**Note**—Float needle valve stem is hollow and has a spring installed in this hole to take up clearance between valve and float lever. Use extreme care when checking float level not to compress this spring, which would cause float level to bet set too low, and make certain that spring is in place when needle valve and float are installed.

Float Level—To check, remove bowl cover and float assembly, invert cover, turn gasket so that machined surface of bowl cover is exposed, measure distance from this machined surface to top of float at free end. Should be ¼" (Studebaker 468-S), ⅜" (Willys 450-S). To adjust, bend lip of float lever at point where it contacts valve needle (do not bend float arm). CAUTION—Use extreme care not to compress spring in needle valve stem when checking float level. Allow float to hang freely on inverted cover.

Float Travel—To check, hold bowl cover and float assembly in normal position. Free end of float should drop ½". Adjust by bending two small float stop lips at hinge end of float.

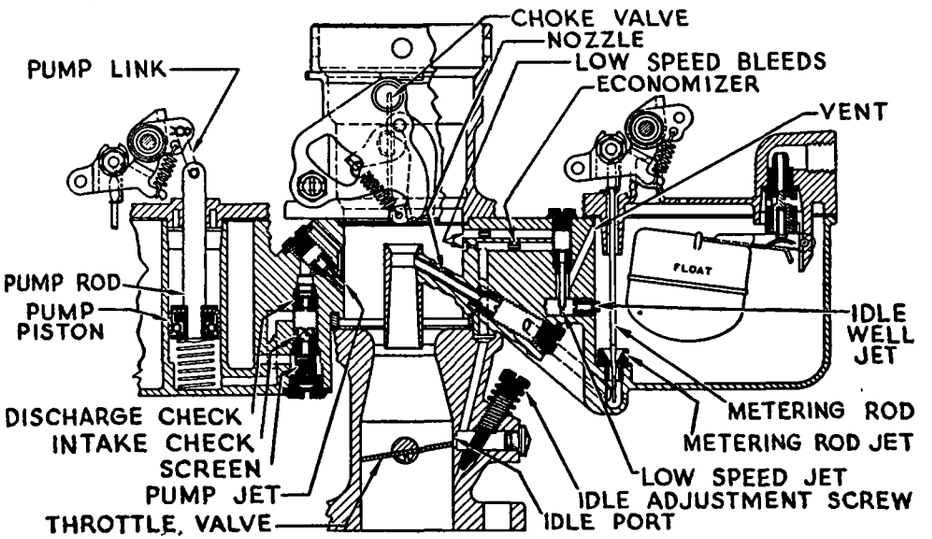
Needle Valve & Seat—Furnished only in matched sets as follows:

Car Model	Carburetor	Part No.	Intake Hole Size
Studebaker	468-S	25-94S	#48
Willys	450-S	25-93S	#53

THROTTLE VALVE SETTING:—When installing valves, back off throttle lever stopscrew, see that trademark on valve is on idle port side, use new attaching screws and install screws loosely, tap valve lightly to centralize it in carburetor bore, tighten screws securely, check valve setting.

Setting—With throttle valve closed tightly (stopscrew backed off), idle port opening (above or below valve as noted) and height of vacuum spark port (top of port above valve) should be correct as shown in table below. Shims furnished .002" thick (2-93), .005" thick (2-94) to correct throttle valve location.

Car Model	Carburetor	Idle Port Opening	Vacuum Port Height
Studebaker	468-S	.028-.032" (below valve)	.072-.078"
Willys	450-S	.086-.090" (above valve)	.056-.062"



CHOKE:—Offset type valve with poppet type relief valve. Check choke linkage to see that choke valve closed when control button on instrument panel pulled out and open with control button pushed in (engine not running—choke control is semi-automatic and spring-loaded).

Fast Idle:—Consists of an interconnecting linkage between the choke valve lever and throttle valve lever so that throttle valve is opened to fast idle position with choke valve closed. Should not require adjustment.

TROUBLE SHOOTING:—Poor Idling Performance—If motor stalls while idling, low speed performance is unsatisfactory, or if correct idling adjustment cannot be secured, remove idle well plug and gasket assembly and allow fuel to drain from bowl which will flush out idle well jet. Remove idle well jet and clean with compressed air, remove low speed jet and clean with air, see that jet seats gasoline tight at shoulder in casting when replaced. Check carburetor wall at throttle valve edge for carbon deposits. Remove idle adjusting screw and clean out idle passages with air.

Poor Acceleration—Check pump stroke. Remove and clean or replace pump jet. Examine pump for damaged or worn plunger leather, loose plunger or bent pump arm, sediment or corrosion in pump cylinder, sticking or leaking ball check valves. If pump plunger removed from cylinder, use loading tool to install plunger to avoid damage to plunger leather.

Carburetor Loads up or Performance is Poor—Check float level, see that correct type metering rod installed and check metering rod setting.

SERVICING:—These carburetors serviced in same manner as WO models used on previous car models. ***See 'Carter Downdraft Type WO' carburetor article in Carburetor Section of manual (or 1939 Supplement) for complete data.***

472-S—GRAHAM, CUST. & DELUXE 108 (1940)
473-S—GRAHAM, CUST. & DELUXE SCHGR. 107 (1940)
***454-S—HUDSON SIX, 40T TRAVELER, 40P DELUXE (1940)**
HUDSON COMMERCIAL CARS, MODELS 40, 48 (1940)
435-S—NASH SIX, MODEL 4020 (1940)—SEE NOTE
***466-S—OLDSMOBILE 6, '60' F-40, '70' G-40 (1940) WITH STD. TRANS.**
***467-S—OLDSMOBILE 6, '60' F-40, '70' G-40 (1940) HYDRA-MATIC TRANS.**
463-S—PONTIAC SIX, MODELS 40-25, 40-26 (1940)—SEE NOTE
462-S—PONTIAC EIGHT, MODEL 40-28 (1940)—SEE NOTE
***410-S—STUDEBAKER COMMANDER, MODEL 10A (1940)—SEE NOTE**
*—Vacumeter type carburetor.

These carburetors same as types used on previous models except as noted below.

SPECIAL SERVICE NOTES & PRODUCTION CHANGES:—Nash Loading or Warming up slowly—Check hot air tubing. See that tubing not kinked at bends or pinched at point where it enters coil housing. See that tube tight in coil housing and hot air stove connection.

Hudson Models—Carburetors are installed with **eight** gaskets between carburetor and mounting pad on manifold. When installing carburetor, place four gaskets between manifold and heat deflector, four additional gaskets between deflector and carburetor. NOTE—Governor plate is installed between two top gaskets on new cars during breaking in period—when governor plate removed, gasket between plate and carburetor must be replaced so that total of four gaskets used between heat deflector and carburetor.

Pontiac 463-S, 462-S—To correct complaints of hesitating when starting in second gear, change pump link to lower hole in arm and plunger shaft. **463-SP, 462-SP**—Later carburetors have new type 64-70S accelerating pump rod and plunger (superseding first type 64-67S). These carburetors marked with 'SP' suffix at factory.

Studebaker Commander—Stromberg Model BXO-26 carburetor also used on this model. See separate article for this Stromberg data.

TYPE:—Same design as previous WA1 models except as noted below. All models have Carter Climatic Control (automatic choke). See Climatic Control article in Carburetion Equipment Section for complete servicing data.

Hudson Model 454-S—This model has special 'Trip Lever' mounted on fast idle link which must be checked after fast idle and other adjustments are made. See Trip Lever Adjustment below.

IDLING ADJUSTMENT:—Adjust carburetor only with engine warmed up and idling at hot or slow idling speed with choke valve wide open and fast idle inoperative. Idle adjusting screw controls fuel mixture and should be turned in for leaner mixture, out for richer mixture. Approximate settings are shown in table below. Idle speed is controlled by throttle lever stopscrew. See car model 'T&E' page for complete carburetor tune up data on each car model.

Car Model	Idle Screw Setting	Idle Speed
Graham 107, 108	½-1½ turns open	7-8 MPH.
Hudson 40, 48	¾-1½ turns open	7 MPH.
Nash 4020	¾-1½ turns open	7-8 MPH.
Oldsmobile F & G-40	½-1½ turns open	6 MPH.
Pontiac 6 & 8	¾-1½ turns open	7 MPH.
Studebaker 10A	½-1¼ turns open	8 MPH.

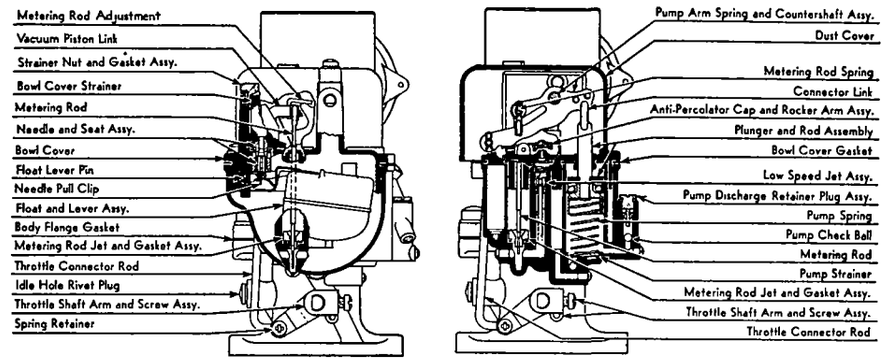
ACCELERATING PUMP:—Low pressure type. Positively operated by throttle lever through arm and countershaft assembly on bowl cover (except Pontiac which is operated by a spring-loaded arm).

Pump Seasonal Adjustment—Three holes provided in pump arm on countershaft for pump link connection (except Pontiac—2 holes in both arm and pump stem). Inner hole provides minimum stroke, lower hole medium stroke, outer hole maximum stroke. See tune up data on car model 'T&E' page for recommended setting and seasonal changes. This adjustment accessible after taking out screw and removing dust bowl cover.

Pump Stroke Adjustment:—To check pump plunger travel, back off throttle lever stopscrew so that throttle valve closes tightly, adjust pump connector link for correct pump stroke as shown in 'Pump Setting' column of table below (see Pump Adjustment above for this connector link adjustment). Install Universal Pump Stroke Gauge T109-117S on ridged portion of bowl cover so that projecting portion of gauge rests on top surface on connector link at pump shaft. Hold gauge vertical and note reading, then open throttle wide and again note reading. Difference between these two readings is pump stroke (in sixty-fourths of an inch) and should agree with 'Pump Stroke' figure in table below. To adjust, bend throttle connector rod at lower angle near throttle lever. CAUTION—Check metering rod adjustment (disturbed by this adjustment).

Car Model	Carburetor	Pump Stroke	Pump Setting
Graham	472-S, 473-S	19/64"	Medium Stroke
Hudson 40, 48	454-S	12/64"	Short Stroke
Nash 4020	435-S	27/64"	Long Stroke
Oldsmobile F & G-40	466-S, 467-S	13/64"	Short Stroke
Pontiac 6	463-S	11/64"	Short Stroke
Pontiac 8	462-S	14/64"	Short Stroke
Studebaker 10A	410-S	18/64"	Medium Stroke

METERING ROD (ECONOMIZER):—Metering rod and jet assembly meters all fuel for main nozzle (stepped and tapered rod is lifted out of jet as throttle is opened and provides greater fuel flow through jet to nozzle). Metering rods can be changed for special operating conditions such as high altitudes. See Carter Jet Specification Table for standard and leaner-than-standard metering rod calibrations. Check and adjust Metering Rod whenever rods removed and replaced or when pump stroke setting is changed.



Vacumeter Type Note—On these types, metering rod is linked to vacuum piston stem so that rod is controlled by vacuum piston within limits determined by throttle valve opening (lug on pump arm serves as stop for lip on piston link to prevent vacuum piston pulling metering rod down in jet beyond correct point for the particular throttle opening). These models adjusted in special manner (see instructions below).

Metering Rod Adjustment (except Vacumeter Types)—Take out screw and remove dust cover on float bowl cover. Unhook metering rod spring, disengage metering rod from arm on pump shaft, lift out rod being careful not to lose metering rod disc. Install gauge No. T109-102 (2.468") in place of metering rod making certain that gauge seats in metering rod jet and is held vertical. Back off throttle lever stopscrew so that throttle valve tightly closed. Clearance between pin in arm on pump shaft and shoulder of notch in gauge should be less than .005" and gauge should not drag on pin. Adjust by bending arm (use extreme care not to bend lower portion of arm to which throttle connector link is attached—this will disturb pump stroke setting). Remove gauge, install metering rod and disk, connect metering rod spring.

Metering Rod Adjustment (Vacumeter Type)—Remove metering rod (hung on pin on upper end of vacuum piston link) being careful not to lose metering rod disk. Install gauge No. T109-102 (2.468") in place of metering rod making certain that gauge seats in metering rod jet and is held vertical. Back off throttle stopscrew so that throttle valve tightly closed. Clearance between pin on piston link and shoulder of notch in gauge should be less than .005" and gauge should not drag on pin. Adjust by bending lip on piston link so that it contacts lug on pump arm (use special tool T109-105). Remove gauge, install metering rod and disc, connect metering rod spring.

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ANTI-PERCOLATOR:—Saxophone Key Type. Consists of a main nozzle vent in the bowl cover controlled by a leather-faced, felt-backed metal cap which opens the vent when the throttle is closed to prevent any percolating discharge from the nozzle. The cap must be seated to close the vent when the throttle is opened beyond idling position.

Adjustment—Crack throttle open by inserting special gauge No. T109-29 (use .030" end for all models except Nash 435-S, .020" end for Nash) between edge of valve and carburetor wall on side opposite idle port. Bend anti-percolator rocker arm (use special tool T109-105) so that clearance between lip on rocker arm and pump arm is .005-.015" (use feeler gauge to check this clearance).
NOTE—T-109-29 Gauge used for both .020" and .030" settings.
Pontiac Note—Anti-percolator may also be adjusted after throttle stopscrew has been set for 7 MPH idle speed (turn screw in until it just contacts lowest step of fast idle cam, then turn screw in additional ½ turn) by rotating fast idle cam until stopscrew rests on highest step of arm and then bending the anti-percolator rocker arm until it just touches pump arm. Reset idle speed adjustment.

FLOAT LEVEL:—To check float level, remove float bowl cover, invert cover, measure from top edge of machined projection on cover at free end of float to top of soldered seam. See table below for float level on each model. Adjust by bending lip of float lever at valve needle.

Car Model	Carburetor	Float Level
Graham 107, 108	472-S, 473-S	3/8"
Hudson 40, 48	454-S	3/8"
Nash 4020	435-S	3/8"
Oldsmobile F & G-40	466-S, 467-S	3/8"
Pontiac 6 & 8	463-S, 462-S	7/16"
Studebaker 10A	410-S	¼"

Float Travel—Should be ½" (all models). To check, hold float bowl in normal position, note drop at free end of float. To adjust, bend two small float stop lips at hinge end of float.
Float Needle Valve & Seat—Furnished only in matched sets as follows:

Car Model	Carburetor	Part Number	Intake Hole
Hudson 40, 48	454-S	25-33S	#48
Nash 4020	435-S	25-34S	#46
Oldsmobile F & G-40	466-S, 467-S	25-75S	#46
Pontiac 6 & 8	463-S, 462-S	25-42S	#38
Studebaker 10A	410-S	25-34S	#46

THROTTLE VALVE SETTING:—When installing valves, see that trademark is up and on idle port side, install screws loosely, tap valve lightly to centralize it in bore, tighten screws securely. See that throttle valve stopscrew is backed off so that valve closes tightly, check throttle valve setting as shown in table below (idle ports are slotted type). Vacuum port height is distance from top of valve to bottom of port. Shims furnished .002" thick (2-93), .005" thick (2-94) to correct throttle valve position.

Car Model	Carburetor	Idle Port Opening	Vacuum Port Height
Hudson 40, 48	454-S	.120-.124"	.021-.029"
Nash 4020	435-S	.137-.141"	None
Oldsmobile F & G-40	466-S, 467-S	.158-.162"	.0-.004"
Pontiac 6 & 8	463-S, 462-S	.107-.111"	.022-.027"
Studebaker 10A	410-S	.010-.014"①	.054-.059"

①—Port opening below valve (on all other models, port opening above valve).

FAST IDLE:—Consists of a fast idle cam pivoted directly above the throttle lever so as to serve as a stop for the throttle stopscrew and linked to the automatic choke mechanism. See Climatic Control article in Carburetion Equipment Section for complete servicing directions.

Adjustment—To check, turn fast idle cam to normal or slow idle speed position, tighten throttle lever stopscrew until it just seats against cam, rotate cam until stopscrew is against first step of cam (screw must not be on step), check clearance between lower edge of choke valve and air horn wall (use tool T109-85 —all models). Distance should be 5/8". To adjust, use tool T109-41 and bend offset portion of fast idle link.

TRIP LEVER:—Hudson Model 454-S—Should be adjusted after all other choke linkage adjustments have been made. This trip lever not used on other carburetor models.

Adjustment—Hold choke valve tightly closed with pin on fast idle cam resting at bottom of slot in fast idle link. Bend trip lever stop on fast idle link so that clearance between fast idle cam and lip on trip lever is .010".

CHOKE:—Plain type offset valve. See Climatic Control article in Carburetion Equipment Section for automatic choke servicing data.

Setting—Thermostatic coil housing should be set so that reference mark centered on scale on piston housing for all models except those listed in table below, and should be rotated counter-clockwise (Rich) or clockwise (Lean) for these special models as shown. To adjust, loosen two thermostatic coil housing attaching screws, rotate housing.

Car Model	Carburetor	Choke Setting
Graham 107	473-S	1 Notch Rich
Nash 4020	435-S	2 Notches Rich
Oldsmobile F & G-40	466-S only	2 Notches Rich
Pontiac 6 & 8	463-S, 462-S	1 Notch Rich
Studebaker 10A	410-S	1 Notch Rich
All Others		Centered

Unloader—Consists of a cam on the throttle lever which opens the choke valve (through fast idle linkage) when throttle is held wide open to correct flooding. To check, hold throttle wide open, check clearance between lower edge of choke valve and air horn wall. See table below for correct clearance and checking gauge on each model. To adjust, bend cam on throttle lever (use Tool T109-41).

Car Model	Carburetor	Gauge Number	Choke Valve Clearance
Graham 107, 108	472-S, 473-S	——	½"
Hudson 40, 48	454-S	T109-81	7/16"
Nash 4020	435-S	T109-82	31/64"
Oldsmobile F & G-40	466-S, 467-S	T109-81	7/16"
Pontiac 6	463-S	T109-80	3/8"
Pontiac 8	462-S	T109-31	¼"
Studebaker 10A	410-S	T109-31	¼"

Choke Valve Lock—Prevents choke valve closing when throttle valve held wide open. To adjust, hold choke and throttle valves wide open, bend lip at lower end of fast idle link so that clearance between lip and lock on throttle lever is 1/32" (use tool T109-105).

TROUBLE SHOOTING:—Poor Idling Performance—If engine stalls while idling, low speed performance is unsatisfactory, or correct adjustment cannot be secured, remove idle tube (low speed jet) and clean with compressed air or install new tube. See that tube seats tightly at shoulder. Remove idle adjusting screw and clean low speed channels with air. If idle is rich, check metering rod linkage for binding and see that rod is not rubbing on dust cover. On Vacumeter types, see that vacuum piston is clean and operates freely.

Poor Acceleration—Check pump seasonal adjustment and pump stroke. Remove and clean or replace pump jet. Examine pump for damaged or worn plunger leather, loose plunger, corrosion or dirt in pump cylinder, ball check valves sticking or leaking. If plunger removed from cylinder, use loading tool when re-installing to avoid damaging plunger leather. On vacumeter types, make certain that vacuum piston is clean and operates freely in cylinder, examine spring under piston.

Carburetor Loads Up or Performance is Poor—Check and adjust float level. See that correct type metering rod installed (replace metering rod and jet as an assembly—check metering rod setting when installed). On vacumeter types, see that vacuum piston operates freely and vacuum channel open and clean.

SERVICING:—These carburetors serviced in same manner as WA1 models used on previous cars. *See 'Carter Downdraft Type WA1' carburetor article in Carburetor Section of manual (or 1939 Supplement) for complete instructions.*

***440-S—BUICK, SERIES 40-40, 50 (1940)—BEFORE FEBRUARY FIRST**
***474-S—BUICK, SERIES 40-40, 50 (1940)—AFTER FEBRUARY FIRST**
***448-S—BUICK, SERIES 40-60, 70, 80, 90 (1940)**
407-S—CADILLAC V16, SERIES 40-90 (1940)—LEFT HAND CARBURETOR
408-S—CADILLAC V16, SERIES 40-90 (1940)—RIGHT HAND CARBURETOR
488-S—GRAHAM, HOLLYWOOD SUPERCHARGER 109 (1940)
***430-SV—HUDSON SIX, MODELS 41, 43 (1940) FIRST CARS—SEE NOTE**
***461-S—HUDSON SIX, MODELS 41, 43 (1940) No. 3136 UP**
***455-S—HUDSON EIGHT, MODELS 44, 45, 47 (1940)**
***460-S—LA SALLE V8, SERIES 40-50, 52 (1940)**
458-S—NASH-LAFAYETTE, MODEL 4010 (1940)
465-S—NASH EIGHT, MODEL 4080 (1940)
***389-S—OLDSMOBILE 8, '90' L-40 (1940) WITH STD. TRANS.**
***471-S—OLDSMOBILE 8, '90' L-40 (1940) HYDRA-MATIC TRANS.**
469-S—PONTIAC TORPEDO EIGHT, MODEL 40-29 (1940)—SEE NOTE
409-S—STUDEBAKER PRESIDENT, MODEL 6C (1940)
*—Vacumeter type Carburetor.

NOTE:—Buick Models—These cars also use Stromberg carburetors Model AAV-16 (40, 50), AAV-26 (60, 70, 80, 90). See separate article for Stromberg data.

Cadillac V16—These carburetors same types as used on 1939 cars.

Hudson Six Model 430-SV—This carburetor same type as used on 1939 cars (430-S) with Vacuum Spark Port added. Used on first cars only.

Studebaker President—Stromberg Model AAO-161 carburetor (same as 1939 type) also used on this model. See separate article for Stromberg data.

SPECIAL SERVICE NOTES & PRODUCTION CHANGES:—Buick Models—These carburetors have Carter Car Starter Model 192-10U mounted on carburetor and operated by throttle valve shaft. See Carter Car Starter article in Electrical Equipment Section for adjustment and servicing data on this unit.

Buick 474-S—This carburetor used on cars after February 1, 1940, and has been changed from earlier 440-S type as follows: Choke Thermostatic Coil changed to new 'G' type (set at 1 Notch Lean), New type Spring-loaded Blocking Cam Type Unloader with Fast Idle Cam No. 181-49-S, and #40 choke suction hole. Fast idle setting should be .018" and Unloader setting 3/16" (see adjustment directions below).

Hudson (All Models)—Carburetors are installed with **eight** gaskets between carburetor and mounting pad on manifold. When installing carburetor, place four gaskets between manifold and heat deflector, four additional gaskets between deflector and carburetor. NOTE—Governor plate is installed between two top gaskets on new cars during breaking in period—when governor plate removed, gasket between plate and carburetor must be replaced so that total of four gaskets used between heat deflector and carburetor.

Nash-Lafayette 458-S—To correct warming up complaints, new Air Horn & Climatic Control Assembly No. 6-334S (replacing 6-357S) and Thermostatic Coil & Housing Assembly No. 170K64S (replacing 170B64S) should be installed. When this change made by dealers, new Hot air stove and tube assembly is also installed. NOTE—New thermostatic coil housing must be set on center index point (first type coil was set 1 Notch Rich).

Nash 465-S Loading or Warming up slowly—Check hot air tubing. See that tubing not kinked at bends or pinched at point where it enters coil housing. See that tube tight in coil housing and hot air stove connections.

Oldsmobile 389-S—This model changed from type used on 1939 cars as follows: Relief passage to outside is now #38 drill size (was #42), Vacuum Piston & Pin Assembly (pin spun into piston) is Part No. 160-69S (replaces 160-63 piston and 150-82 pin).

Oldsmobile 389-S, 471-S Float Level Change—Float level should be set at 3/8" (was 9/32"). This new setting supersedes both the original 9/32" figure and the previously recommended setting of 13/32" (to correct hard starting).

Pontiac 469-S Poor Starting or Leanness during warm-up—To correct complaints of hard starting when cold or lean mixture during warming up period climatic control setting on carburetors with first type thermostatic coil (marked 170G16S on coil housing) should be changed to 4 Notches Rich. Later carburetors with new type thermostatic coil (marked 170F16S) must be set 1½ Notches Rich—see Pontiac Changes following.

Pontiac 469-S Metering Rod & other changes—Metering rod changed to new type No. 75-443 (replaces 75-424) and new rods released for 1 Size Lean and 2 Sizes Lean also—See Carter Jet Specification Table for complete metering rod data. Special metering rod gauge T109-27 must be used to check these new rods (gauge T109-104 used for first type rods). Relief passage to outside changed to #38 drill size (was #42) and new choke valve No. 7-113 used (replaces No. 7-90), new Trip Lever No. 14-219 (replaces 14-220—requires special Unloader Setting as given below), and new type Thermostatic Coil No. 170F16S (replaces 170G16S but has same standard setting as first type of 1½ Notches Rich). See note above for special setting of first type thermostatic coil only to correct hard starting and excessive leanness when cold.

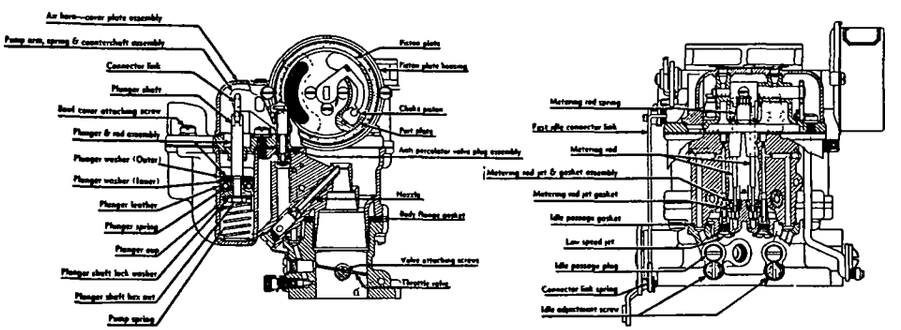
NOTE—All carburetors equipped with the new type metering rod (75-443) and trip lever are marked '469-SM' for identification.

TYPE:—Same design as previous Carter WDO dual models (Standard and Vacumeter types) with Climatic Control (automatic choke), Fast Idle, Anti-Percolator, Unloader and Choke Valve Lock. See Climatic Control article in Carburetion Equipment Section for complete servicing directions on these units.

IDLING ADJUSTMENT:—Adjust carburetor only with engine warmed up and idling at hot or slow idling speed (choke valve wide open, fast idle inoperative). Idle adjusting screw provided for each carburetor barrel. Screws control fuel mixture and should be turned in for leaner mixture, out for richer mixture and both screws just be adjusted exactly alike. See table below for approximate settings on each car model. Idle speed controlled by throttle lever stopscrew and should be set for speed shown in table. See car model 'T&E' page for complete carburetor tune up instructions on each car model.

Car Model	Carburetor	Idle Screw Setting	Idle Speed
Buick (all)	440-S, 48-S, 74-S	½-1¼ turns open	7-8 M.P.H.
Cadillac V16	407-S, 408-S	¼-1 turn open	7-8 M.P.H.
Graham 109	488-S	½-1½ turns open	7-8 M.P.H.
Hudson 6	430-SV, 461-S	¼-1¼ turns open	7 M.P.H.
Hudson 8	455-S	½-1½ turns open	7 M.P.H.
LaSalle	460-S	½-1½ turns open	7-8 M.P.H.
Nash-Lafayette	458-S	¼-1¼ turns open	7-8 M.P.H.
Nash 4080	465-S	½-1½ turns open	7-8 M.P.H.
Oldsmobile L-40	389-S, 471-S	½-1¼ turns open	6 M.P.H.†
Pontiac 40-29	469-S	¼-1¼ turns open	7 M.P.H.
Studebaker 6C	409-S	¼-1¼ turns open	8 M.P.H.

†—High Gear (Std. Trans.), 375 R.P.M. (Cars with Hydra-matic Trans.).



PERFORMANCE:—Should be satisfactory if Idling Adjustment and Accelerating Pump Setting correct. See Carter Jet Specification Table for standard jet calibrations and special lean metering rods (for special operating conditions). Both metering rods must be same size and adjusted alike. See Trouble Shooting below.

METERING ROD (NON-VACUMETER TYPES):—Fuel metered by stepped metering rods (separate rod and jet used for each carburetor barrel) which are raised in metering rod jets as throttle is opened to permit greater fuel flow to nozzles. Metering rods used for both barrels must be same size and must be adjusted alike. Metering rods can be changed for special operating conditions such as high altitude (see Carter Jet Specification Table for standard and special lean metering rods). Setting should be checked whenever metering rods removed and replaced or when pump stroke setting is adjusted.

Metering Rod Removal—On models with integral air horn and dust cover, remove this assembly to expose pump countershaft and metering rods (on models with separate dustcover, take out two retaining screws and remove dust cover only). Remove pin spring from metering rod pin, slide pin out being careful not to lose metering rod springs, lift out metering rods and springs. Remove metering rod disks (remove small brass screw, take out metering rod disk retainer, lift disks out).

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Metering Rod Setting—Back off throttle lever stopscrew so that throttle valves tightly closed, loosen anti-percolator arm screw. Install metering rod gauge (see table below for each model) in place of each metering rod, making certain that gauges seat in metering rod jets and are vertical. Install metering rod pin and pin spring in metering rod arm. Press down lightly on pump arm. Pin should rest on shoulders of notches in both gauges (bend arm slightly to equalize if necessary) with clearance of less than .005" between pin and each gauge. Tighten anti-percolator arm screw. Remove gauges and metering rod pin, install metering rods and disks, springs, pin and pin spring, hook metering rod springs on rods.

CAUTION—Anti-percolator must be checked after this adjustment completed.

Car Model	Carburetor	Metering Rod Gauge No.	Length
Cadillac V16	407-S, 408-S	T109-27	2.359"
Graham 109	488-S	T109-113	2.280"
Nash-Lafayette	458-S	T109-113	2.280"
Nash 4080	465-S	T109-113	2.280"
Pontiac 40-29	469-S	See Note	
Studebaker 6C	409-S	T109-27	2.359"

Pontiac Note—Use gauge No. T109-104 on carburetors with first type metering rods (75-424, 75-439, 75-440), gauge No. T109-27 for carburetors with later type rods (75-443, 75-444, 75-445). Carburetors with these later type metering rods are marked '469-SM'.

METERING ROD (VACUMETER TYPES):—Fuel for nozzles metered by metering rod and jet (independent rod and jet for each nozzle). Metering rods operated by single vacuum piston with throttle control (stop pin on pump arm limits piston travel so that metering rod lifted in accordance with throttle opening). No adjustment provided but metering rods can be changed to secure leaner-than-standard fuel mixture to compensate for special fuel or high altitude conditions (both rods must be same size and should be changed as a unit). Check metering rod setting whenever rods removed and replaced or when pump stroke setting is adjusted.

To Remove Metering Rods—Take out screws and remove dust cover or remove air horn and dust cover assembly (where these parts integral—see Service data for removal instructions). Remove pin spring from metering rod pin and slide pin from vacuum piston link being careful not to bend metering rod spring. Lift out metering rods, remove brass metering rod disc retainer by taking out brass screw, remove the two small metering rod discs from beneath retainer.

To Check Metering Rods—Back off throttle stopscrew so that throttle valves tightly closed. Install metering rod gauge (see table below) in place of one metering rod making certain that tapered end of gauge is seated in metering rod jet. Install metering rod pin in piston link, press piston and link down until metering rod pin contacts lip on anti-percolator arm. With piston down and throttle valve seated, clearance between metering rod pin and shoulder of notch in gauge should be less than .005". To adjust, bend lip on anti-percolator arm.

To Install Metering Rods—Make certain that discs are in place under disc retainer and that pin spring and metering rod springs are properly connected.

Car Model	Carburetor	Metering Rod Gauge No.	Length
Buick (all)	440-S, 474-S, 448-S	T109-113	2.280"
Hudson (all)	430-SV, 461-S, 455-S	T109-113	2.280"
La Salle	460-S	T109-113	2.280"
Oldsmobile	389-S, 471-S	T109-104	2.312"

ACCELERATING PUMP:—High pressure type with spring operation (pump operating lever and pump arm linked by small coil spring) except Studebaker Model 409-S which is Low Pressure type. Inlet ball check valve located in bottom of pump cylinder, outlet ball check valve under retainer plug in main body casting.

Pump Seasonal Adjustment—On some models, pump arm (under dust cover) has two or three holes for pump rod link connection to provide varied pump stroke for seasonal pump requirements. See car model 'T&E' page for recommended settings and seasonal changes.

Pump Stroke Adjustment—On models with integral air horn and dust cover, remove this assembly to expose pump countershaft and connector link (on models with separate dust cover, take out two retaining screws and remove dust cover only). Back off throttle lever stopscrew so that throttle valves tightly closed, check pump seasonal adjustment (connector link must be engaged in hole for correct stroke as shown in table below). Install Universal Pump Stroke Gauge T109-117S on rim of bowl cover at plunger shaft so that projection on gauge rests on top surface of connector link at pump shaft. Note gauge reading with throttle closed, then open throttle wide and again note gauge reading. Difference between two readings is pump stroke (in sixty-fourths of an inch) and should agree with figure shown in table below. Adjust by bending throttle connector rod at lower angle near throttle lever (use bending tool T109-75). CAUTION—Check metering rod setting and anti-percolator adjustment after adjusting pump stroke.

Car Model	Carburetor	Pump Stroke	Pump Setting
Buick (all)	440-S, 474-S, 448-S	21/64"	Medium Stroke
Cadillac V16	407-S, 408-S	16/64"	Long Stroke
Graham 109	488-S	34/64"	Long Stroke
Hudson (all)	430-SV, 461-S, 455-S	18/64"	Long Stroke
La Salle	460-S	26/64"	Non-Adj.
Nash-Lafayette	458-S	32/64"①	Long Stroke
Nash 4080	465-S	32/64"	Long Stroke
Oldsmobile	389-S, 471-S	19/64"	Non-Adj.
Pontiac 40-29	469-S	19/64"	Non-Adj.
Studebaker 6C	409-S	16/64"	Long Stroke

①—21/64" with link in inner hole (short stroke).

ANTI-PERCOLATOR:—Plunger Type (except Buick). Consists of a vent above each main jet well controlled by spring-loaded plunger type valves. Valves are opened by anti-percolator arm connected to throttle when throttle valves are closed to vent nozzles and prevent any 'percolating' discharge when carburetor is hot. Valves must be closed when throttle is opened (incorrect adjustment will cause flat spots).

Buick Models—Buick carburetors have suction type anti-percolators which are pressed in carburetor casting and require no adjustment. CAUTION—Do not remove these suction type anti-percolators, correct tube position is extremely important for proper operation.

Adjustment—Make this adjustment after metering rod setting and pump stroke setting have been adjusted (use extreme care not to disturb these settings). On models with integral air horn and dust cover, remove this assembly to expose anti-percolators (on models with separate dust cover, take out two retaining screws and remove dust cover only). Back off throttle lever stopscrew so that throttle valves tightly closed. On models listed in table below, insert special gauge (or feeler gauge of thickness listed) between anti-percolator stems and lips on anti-percolator arms—**do not use any gauge on other models.** Bend lips so that center of indicator line on each anti-percolator stem is flush with top of anti-percolator plug. Use extreme care to secure same adjustment on both anti-percolator units.

Car Model	Carburetor	Checking Gauge	Thickness
Cadillac V16	407-S, 408-S	T109-72	.015"
LaSalle	460-S	T109-72	.015"
Oldsmobile	471-S only		.010"
Studebaker 6C	409-S		.010"
All Others		None	None

FLOAT LEVEL:—To check float level (with bowl cover assembly removed), remove cover gasket, invert cover, measure from machined gasket seat on cover to top of float (check at both ends of float—settings must be alike). See table below for float level and special checking gauge for each model. To adjust, bend lip on float level at point where it contacts valve needle (do not bend float or arm).

Car Model	Carburetor	Float Level	Checking Gauge
Buick (all)	440-S, 474-S, 448-S	3/16"	T109-28
Cadillac V16	407-S, 408-S	13/64"	T109-39
Graham 109	488-S	3/16"	
Hudson (all)	430-SV, 461-S, 455-S	3/32"	T109-125
LaSalle	460-S	1/8"	
Nash-Lafayette	458-S	3/16"	
Nash 4080	465-S	3/16"	
Oldsmobile	389-S, 471-S	3/8"①	T109-126
Pontiac 40-29	469-S	5/16"	
Studebaker 6C	409-S	3/16"	

①—Was 9/32". New setting of 3/8" also supersedes 13/32" setting to correct hard starting when hot.

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Needle Valve & Seat—Furnished only in matched sets as shown in table below. When installing assembly on Oldsmobile and Pontiac carburetors, see that clip on needle valve engages float lever.

Car Model	Carburetor	Part Number	Intake Hole Size
Buick 40, 50	440-S, 474-S	25-80S	#42
Buick 60, 70, 80, 90	448-S	25-59S	#38
Cadillac V16	407-S, 408-S	25-80S	#42
Hudson 6	430-SV, 461-S	25-59S	#38
Hudson 8	455-S	25-59S	#38
La Salle	460-S	25-98S	#38
Nash-Lafayette	458-S	25-80S	#42
Nash 4080	465-S	25-59S	#38
Oldsmobile	389-S	25-74S	#38
Oldsmobile	471-S	25-100S	#38
Pontiac 40-29	469-S	25-74S	#38
Studebaker 6C	409-S	25-59S	#38

THROTTLE VALVE SETTING:—Install valves with trademark 'C' toward idle port side, use new attaching screws, install screws loosely, tap valves lightly to centralize them in bore, then tighten screws securely. Check valve setting with throttle lever stopscrew backed out so that valves tightly closed. Idle port figure is distance from top edge of valve to top of idle port. Vacuum spark port figure is distance from top edge of valve to top (or bottom as noted) of vacuum spark port. Shims furnished .002" thick (2-93), .005" thick (2-94) for throttle valve setting adjustment.

Car Model	Carburetor	Idle Port Opening	Vacuum Spark Port
Buick 40, 50	440-S, 474-S	.060-.066"	①.052-.056"
Buick 60, 70, 80, 90	448-S	.117-.123"	①.056-.060"
Cadillac V16	407-S, 408-S	.127-.133"	None
Hudson 6	430-SV, 461-S	.108-.112"	②.029-.033"
Hudson 8	455-S	.133-.137"	None
La Salle	460-S	.135-.141"	②.033-.037"
Nash-Lafayette	458-S	.060-.066"	②.033-.037"
Nash 4080	465-S	.162-.168"	None
Oldsmobile	389-S, 471-S	.140-.146"	②.029-.033"
Pontiac 40-29	469-S	.140-.146"	②.052-.056"
Studebaker 6C	409-S	③.009-.015"	②.029-.033"

①—Top of valve to bottom of port. ②—Top of valve to top of port.
③—Opening below lower edge of valve.

FAST IDLE:—Consists of a fast idle lever linked to the throttle valve lever and mounted directly below the fast idle cam on the choke valve shaft. To adjust, hold choke valve tightly closed, adjust fast idle arm screw so that clearance between throttle valve and carburetor wall on side opposite idle port is correct as shown in table below (use special checking gauge inserted between throttle valve and wall to check opening).

Car Model	Carburetor	Throttle Opening	Checking Gauge
Buick 40, 50	440-S, 474-S	.018"	T109-44
Buick 60, 70, 80, 90	448-S	.012"	See Note
Cadillac V16	407-S, 408-S	.026"	T109-114
Hudson (all)	430-SV, 461-S, 455-S	.018"	T109-44
La Salle	460-S	.023"	T109-149
Nash-Lafayette	458-S	.026"	T109-114
Nash 4080	465-S	.015"	T109-44
Oldsmobile	389-S	.018"	T109-44
Oldsmobile	471-S	.015"	T109-44
Pontiac 40-29	469-S	.010"	See Note
Studebaker 6C	409-S	.018"	T109-44

Note—Gauge No. T109-44 used for both .015" and .018" settings.

Buick 448-S Note—To make this adjustment, back off throttle stopscrew so that throttle valves tightly closed, hold choke valve closed, back off fast idle adjusting screw so that it clears high point of fast idle cam, turn fast idle screw in until there is a slight drag on the cam, then turn screw in ½ turn additional (this will give correct throttle opening of .012").

Hudson Note—Fast idle can also be adjusted on these models as follows: With throttle stopscrew set for correct idle speed of 7 MPH, open throttle so that clearance between stopscrew and stop on carburetor casting is .030", hold choke valve closed, turn fast idle screw in until it contacts fast idle cam.

Pontiac 469-S Note—If gauge not available for this adjustment, adjust in same manner as Buick 448-S (above), except that screw should be turned in additional ⅝ turn (for .010" throttle opening).

CHOKE:—Carter Climatic Control (automatic choke) is standard. See article in Carburetion Equipment Section for complete servicing and adjusting directions.

Setting—Thermostatic coil housing reference mark should be centered on mark on piston housing (for all models except those shown in table below) or should be rotated counter-clockwise (Rich), clockwise (Lean), the correct number of notches from the center mark as follows:

Car Model	Carburetor	Choke Setting
Buick 40, 50	440-S, 474-S	1 Notch Lean
Buick 60, 70, 80, 90	448-S	3 Notches Rich
Graham 109	488-S	1 Notch Rich
Nash-Lafayette	458-S	See Note
Nash 4080	465-S	1 Notch Rich
Pontiac 40-29	469-S	See Note
Studebaker 6C	409-S	1 Notch Rich
All Others		Centered

Nash-Lafayette Note—Carburetors with first type thermostatic coil (170B64S) should be set 1 Notch Rich. Carburetors with second type thermostatic coil (170K64S—used to improve warming up performance) should be centered.

Pontiac Note—Carburetors with first type thermostatic coil (marked 170G16S on housing) were set 1½ Notches Rich but setting should be changed to 4 Notches Rich to correct complaints of hard starting when cold and leanness while warming up. Carburetors with second type thermostatic coil (marked 170F16S on housing) should be set 1½ Notches Rich.

Unloader:—*Consists of a lip on the throttle connector which engages the choke trip lever on the choke valve shaft so that the choke valve is opened when the throttle is wide open. To adjust, hold throttle valve wide open, bend lip on fast idle connector link so that clearance between upper edge of choke valve and air horn wall is correct as shown in table below (use specified gauge to check this opening).*

Car Model	Carburetor	Unloader Gauge	Clearance
Buick (all)	440-S, 474-S, 448-S	T109-28	3/16"
Cadillac V16	407-S, 408-S	T109-28	3/16"
Graham 109	488-S	——	11/64"
Hudson (all)	430-SV, 461-S, 455-S	T109-31	¼"
La Salle	460-S	T109-39	13/64"
Nash-Lafayette	458-S	T109-28	3/16"
Nash 4080	465-S	T109-34	9/64"
Oldsmobile	389-S	T109-31	¼"
Oldsmobile	471-S	T109-28	3/16"
Pontiac 40-29	469-S	T109-31	¼"
Pontiac 40-29	469-SM (See Note)	T109-28	3/16"
Studebaker 6C	409-S	T109-28	3/16"

Pontiac Note—These carburetors have new metering rods (above) and are marked '469-SM'.

Choke Valve Lock:—With unloader properly adjusted, choke valve will be locked in wide open position with throttle valves wide open. Choke valve will be released when throttle valves closed.

TROUBLE SHOOTING:—Same as for other Carter models (see preceding article).

SERVICING:—These carburetors serviced in same manner as previous models. ***See Carter 'Dual Type WDO with Climatic Control' and 'Dual Vacumeter Type' Carburetor articles in Carburetor Section of manual (or 1938 Supplement) for complete data.***

1940 CARTER DOWNDRAFT CARBURETOR JET SPECIFICATIONS

Car Model	Yr.	Carb. No.	Metering Rod Standard Marking	Metering Rod Standard Part No.	Metering Rod 1 Size Lean Marking	Metering Rod 1 Size Lean Part No.	Metering Rod 2 Sizes Lean Marking	Metering Rod 2 Sizes Lean Part No.	Met. Rod Jet Size	Met. Rod Jet Part No.	Main Nozzle Size	Main Nozzle Part No.	Low Spd. Jet Tube Size	Low Spd. Jet Tube Part No.	Pump Jet Size	Pump Jet Part No.
BUICK 40, 50	1940	440S, 74S	635-56	75-398	64-56	75-397	—	—	.082"	120-65S	②	12-250	#70	11-163S	#74	48-74
BUICK 60, 70, 80, 90	1940	448-S	67-49	75-380	—	—	—	—	.082"	120-65S	②	12-250	#68	11-160S	#74	48-92
CADILLAC V16	1940	407-S, 8-S	62-45	75-307	63-46	75-328	64-47	75-329	.0846"	120-125S	④	12-238	#71	——	#72	48-52
CHEVROLET All	1940	420-S	675-40	75-377	69-43	75-342	—	—	.095"	120-129S	⑥	⑧12-236U	#70	11-144	㉞ #72	48-43
CHEVROLET Econ (V)	1940	434-S	65-41	75-381	67-42	75-361	—	—	.0835"	120-49S	⑦	⑧12-213	#70	11-144	㉞ #72	48-43
GRAHAM 108	1940	472-S	72-40	75-452	——	——	—	—	.099"	120-94S	—	—	—	——	—	——
GRAHAM 107	1940	473-S	76-32	75-453	——	——	—	—	.1015"	120-14S	—	—	—	——	—	——
GRAHAM 109	1940	488-S	765-53	75-460	——	——	—	—	.0935"	120-136S	—	—	—	——	—	——
HUDSON 40T, 40P, 48	1940	454-S	72-44	75-407	74-46	75-410	76-48	75-411㉓	.096"	120-17S	㉒	12-261	#70	11-163S	#70	48-87
HUDSON 41, 43...Early	1940	430-SV	62-47	75-348	63-48	75-414	64-49	75-358	.082"	120-65S	⑫	12-248	#69	11-162S	#72	48-72
HUDSON 41, 43...Late	1940	461-S	63-52	75-404	64-53	75-414	65-54	75-415㉗	.082"	120-65S	⑫	12-248	#69	11-162S	#74	——
HUDSON 44, 45, 47	1940	455-S	625-46	75-405	635-47	75-418	645-48	75-419㉘	.086"	120-121S	⑫	12-248	#66	11-167S	#74	——
HUPMOBILE R	1940	398-S	75-45	75-273	76-49	75-332	78-54	75-333	.098"	120-67S	#40	12-188	#68	11-145	#72	48-61
LA SALLE 40-50, 52	1940	460-S	66-53	75-403	67-54	75-422	68-55	75-423	.086"	120-121S	㉕	12-259	#71	11-161S	#72	——
NASH 6 4020	1940	435-S	76-40	75-372	77-48	75-384	78-53	75-385	.0995"	120-133S	⑯	12-249	#65	11-165S	#70	48-58
NASH 8 4080	1940	465-S	765-58	75-406	775-61	75-433	785-63	75-434	.0935"	120-137S	⑫	12-248	#70	11-163S	#72	48-61
NASH-LAFAYETTE	1940	458-S	70-575	75-408	72-60	75-431	725-615	75-432	.086"	120-121S	⑫	12-262	#71	11-161S	#75	——
OLDSMOBILE 60, 70	1940	466-S	79-54	75-430	80-59	75-435	075-63	75-436	.1015"	120-15S	㉚	12-264	#68	11-169S㉟	#72	48-72
OLDSMOBILE 60, 70	1940	467-S⑱	79-54	75-430	80-59	75-435	075-63	75-436	.1015"	120-15S	㉚	12-264	#68	11-169S㉟	#72	48-72
OLDSMOBILE 8 90	1940	389-S	72-49	75-268	73-51	75-318	74-53	75-319	.089"	120-103S	⑳	⑧12-227S	#70	11-157S	#70	48-63
OLDSMOBILE 8 90	1940	471-S⑱	72-49	75-268	73-51	75-318	74-53	75-319	.089"	120-103S	⑳	⑧12-227S	#70	11-157S	#70	48-63
PONTIAC 6 40-25, 26	1940	463-S	72-42	75-401	73-44	75-427	74-46	75-428	.0995"	120-133S	㉛	12-260	#69	11-162S	#72	48-61
PONTIAC 8 40-28	1940	462-S	71-39	75-409	72-41	75-425	73-43	75-426	.0995"	120-133S	㉜	12-263	#68	11-160S	#72	48-61
PONTIAC 8 40-29	1940	469-S	㉝	75-443	—	75-444	—	75-445	.089"	120-103S	②	12-265	#71	11-149S	#70	48-63
STUDEBAKER Ch. 2G	1940	468-S	78-48	75-393	79-51	75-394	795-54	75-395	.081"	120-85S	.0935"	12-254	#69㉖	11-162S	#72	48-61
STUDEBAKER 6 10A	1940	410-S	705-425	75-337	72-46	75-330	73-50	75-331	.098"	120-67S	#45	12-239	#67	11-168S	#70	48-58
STUDEBAKER 8 6C	1940	409-S	70-47	75-312	71-49	75-321	72-51	75-322	.0885"	120-107S	#30㉙	12-212	#70	11-157S	#73	48-60
WILLYS 440	1940	450-S	695-56	75-390	705-585	75-399	—	—	.078"	120-79S	.096"	12-255	#70㉔	11-163S	#73	48-84

②—Closed Tip. Top hole #75 (45° angle), Lower hole #52 (60° angle).
④—Closed Tip. Top hole #70 (45° angle), Lower hole #54 (60° angle).
⑥—Inner (Screw) Nozzle #31, Outer (Slip) Nozzle .125".
⑦—Inner (Screw) Nozzle #53, Outer (Slip) Nozzle #40.
⑧—Nozzle Assembly (Inner & Outer Nozzle).
⑫—Closed Tip. Top hole #70 (45° angle), Lower hole #52 (60° angle).
⑯—Closed Tip. Top hole #75 (45° angle), Lower hole #49 (70° angle).
⑱—Used on cars with Hydra-Matic Drive only.
⑳—Outer (Slip) Nozzle #35, Inner Nozzle #31.
㉒—Closed Tip. Top hole #75 (45° angle), Lower hole #48 (70° angle).
㉓—Three Sizes Lean—78-50. Part No. 75-412.
㉔—Idle Well Jet #61 drill. Part No. 43-67.
㉕—Closed Tip. Top hole #63 (45° angle), Lower hole #50 (60° angle).
㉖—Idle Well Jet #56 drill. Part No. 43-68.
㉗—Three Sizes Lean—66-55. Part No. 75-416.
㉘—Three Sizes Lean—655-49. Part No. 75-420.
㉙—Nozzle retainer plug size #52 drill.
㉚—Closed Tip. Top hole #75 (45° angle), Lower hole #46 (70° angle).
㉛—Closed Tip. Top hole #65 (45° angle), Lower hole #46 (60° angle).
㉜—Closed Tip. Top hole #65 (45° angle), Lower hole #43 (60° angle).
㉝—Was 70-47 Part No. 75-424 (Std.), 71-49 No. 75-439 (1 Size Lean), 72-51 No. 75-440 (2 Sizes Lean).
㉞—Was 11-138.
㉟—Was 11-160S.

1940 CARTER (BB) UPDRAFT CARBURETOR

Car Model	Yr.	Carb. No.	Flow	Main Metering Screw Standard Part No.	Main Metering Screw 1 Size Lean Part No.	Main Metering Screw 2 Sizes Lean Part No.	Main Nozzle Size	Main Nozzle Part No.	Stepup Jet Power Orifice Size	Stepup Jet Power Orifice Part No.	Idle Orifice Tube Size	Idle Orifice Tube Part No.	Idle Passage Tube	Pump Size	Valve Part No.
CHEVROLET C-O-E Trk '40	1940	447-S	236-40cc.	159-50	5%	159-20	10%	159-21	#33	12-166	.0275"	162-16	.022"	123-32	123-12	.0925"	149-19S

447-S—CHEVROLET CAB-OVER-ENGINE & DUBL DUTI PANEL TRUCK MODELS (1940)

This Carburetor same design as used on 1939 Cab-over-Engine models.

SPECIAL SERVICE NOTES:—Carburetor Gasket Caution—When installing carburetor on engine, use special slotted flange gasket 1A-41 and make certain that vacuum power cylinder port in carburetor mounting flange opens into this slot. If this port covered, carburetor mixture will be rich and gasoline consumption will be high.

Access to Carburetor for Adjustment & Servicing—See Chevrolet Shop Notes in 'M' Section for engine cover removal instructions.

ADJUSTMENT & SERVICING:—Same as for 1939 model. See 'Carter (BB) Updraft Carburetor' in 'C' Section of manual (or 1939 Supplement) for complete instructions and adjust carburetor to following specifications:

Idle Setting—Adjust idle screw for smooth idle (½-1¼ turns open). Set throttle stopscrew for idle speed of 300-375 R.P.M.

Accelerating Pump—Connect plunger in inner hole (short stroke) of throttle lever for summer operation, outer hole (long stroke) in winter.

Float Level—Top of float should be 1/32-1/16" below top edge of bowl with needle valve seated (remove bowl cover gasket when checking).

E6S1, 1*—CHRYSLER 6, C25 ROYAL & WINDSOR (1940) FIRST CARS
E6S2—CHRYSLER 6, MODEL C25 ROYAL & WINDSOR (1940) LATER CARS
E6N2—DE SOTO, MODEL S7 CUSTOM & DELUXE (1940) FIRST CARS
E6N3—DE SOTO, MODEL S7 CUSTOM & DELUXE (1940) LATER CARS
D6A2—PLYMOUTH, P9 ROADKING, P10 DELUXE (1940)
D6C2—PLYMOUTH, P9, P10 (1940) WITH AUTOMATIC CHOKE
B6P1—PLYMOUTH, P9, P10 ECONOMY MODELS (1940)
These carburetors same design as 1939 types except as noted below.

PRODUCTION CHANGES:—**Chrysler E6S1, E6S1*—**Model E6S1 carburetor used on first cars may be brought up to later E6S2 standards by installing new Metering Jet No. 159-89S (replaces 159-87S), and Idle Orifice Tube No. 123-39S (replaces 123-31S). Both of these parts must be installed together and this special Idle Orifice Tube 123-39S should not be used on E6S2 carburetors (use 123-31S).
E6S1* Note—Carburetors on which the above changes have been made at the factory are marked E6S1* on bowl cover for identification.
Chrysler Jet Changes—Main metering jet calibration has been changed (different parts used on E6S1, E6S1* and E6S2). See Carter (B&B) Jet Specification Table for complete data.
De Soto Jet Changes—Main metering jet calibration has been changed. See Carter (B&B) Jet Specification Table for complete data.

SPECIAL SERVICE NOTES:—Whenever body gasket 121-69 (between main body casting and air horn and bowl cover casting) is removed for carburetor servicing, use new gasket when reassembling. This is important to prevent air leaks at this point which will affect carburetor economy (carburetors are 'balanced' type with bowl vented through air horn).

IDLING ADJUSTMENT:—Idle adjusting screw controls fuel discharge through lower idle port and should be turned in for leaner mixture, out for richer mixture. Approximate idle screw settings given in table below. Adjust only with engine warmed up so that choke valve is wide open and fast idle inoperative. Idle speed controlled by throttle lever stopscrew. See car model 'T&E' page for complete carburetor tune up instructions.

Car Model	Carburetor	Idle Setting	Idle Speed
Chrysler	E6S1, S1*, S2	½-1½ turns open	6 MPH
De Soto S7	E6N2, N3	½-1¼ turns open	6 MPH
Plymouth	D6A2, C2	½-1¼ turns open	6 MPH
Plymouth Econ.	B6P1	½-1½ turns open	6 MPH

ACCELERATING PUMP:—Delayed action type. Same design as in 1939.
Seasonal Adjustment—Three holes provided in throttle lever for connector link engagement. Inner hole provides minimum stroke, center hole medium stroke, outer hole maximum stroke. See car 'T&E' page for recommended settings.
Pump Stroke Adjustment—To check, remove air horn and float bowl cover assembly, back off throttle stopscrew so that throttle valve closes tightly, connect pump connector link in correct hole of throttle lever (see table below), install Universal Pump Stroke Gauge T109-117S on bowl so that indicator lip on gauge rests on top of pump plunger shaft. Note gauge reading, then open throttle wide and again note gauge reading. Difference between two readings is pump stroke (in sixty-fourths of an inch) and should agree with table below. To adjust, bend horizontal portion of pump connector link.

Car Model	Carburetor	Pump Stroke	Pump Setting
Chrysler	E6S1, S1*, S2	26/64"	Medium Stroke
De Soto	E6N2, N3	26/64"	Medium Stroke
Plymouth	D6A2, C2	24/64"	Medium Stroke
Plymouth Econ.	B6P1	19/64"	Medium Stroke

VACUUM STEP-UP (ECONOMIZER):—No adjustment required but setting should be checked when carburetor reassembled after servicing to insure step-up valve closing. To check, push vacuum piston down in cylinder to end of stroke, check clearance between piston plate and head of step-up valve needle stem. Clearance should be 1/64-1/32". To adjust, bend piston plate slightly.
Vacuum Step-Up Spring—When servicing carburetor, make certain that correct step-up spring installed as follows: No. 61-135 (all models except B6P1), No. 61-134 (B6P1 only).

FLOAT LEVEL:—To check float level, remove air horn (integral with float bowl cover), use special gauge No. 1522-B, placing gauge on top edge of bowl with lugs extending down toward float on either side of soldered seam. Press lip of float lever against needle valve, float should contact both lugs on gauge. Adjust by bending float lever lip slightly at point where it contacts valve needle (do not bend float arm). If gauge not used, top of float (not soldered seam) should be 5/64" (plus or minus 1/64") on all models.
Float Needle Valve & Seat—Triangular type. Furnished only in matched sets as follows: No. 25-82S—#44 Intake Hole (all models except B6P1), No. 25-77S—#48 Intake Hole (Model B6P1 only).

THROTTLE VALVE SETTING:—When installing valves, insert attaching screws loosely, back throttle stopscrew off, tap valves lightly to centralize in bore, then fasten screws securely.
Setting—With throttle stopscrew backed off so that valve tightly closed, distance from top edge of valve to top of upper idle port should agree with 'Idle Port' figure in table below, and distance from top of valve to top of vacuum spark port should agree with 'Vacuum Spark Port' figure (except as noted).

Car Model	Carburetor	Idle Port Opening	Vacuum Spark Port
Chrysler	E6S1, S1*, S2	.088-.092"	.035-.041"
De Soto	E6N2, N3	.088-.092"	.035-.041"
Plymouth	D6A2, C2	.118-.120"	①.003-.009"
Plymouth Econ.	B6P1	.130-.134"	.035-.041"

①—Bottom of port above top edge of valve (top of port on other models).

CHOKE:—Offset type with poppet relief valve. Choke control on Plymouth models (without Automatic Choke) is semi-automatic (spring-loaded). Sisson Automatic choke Std. on Chrysler & De Soto, optional on Plymouth.
Fast Idle—Consists of a throttle shaft dog (throttle lever stop) pivoted below throttle shaft and linked to choke valve lever so that throttle opened to fast idle position when choke valve closed for starting. No adjustments required. NOTE—This Fast Idle not used on Plymouth B6P1 Economy Carburetor.

SERVICING:—Same as for carburetors used on previous models. ***See Carter (B&B) Downdraft Type Carburetor article in Carburetor Section of manual (or 1938 supplement) for complete data and note following points:***
Balance Tube—When servicing carburetor make certain that balance tube in air horn is open and clean. Always use new gasket between body casting and air horn to insure air tight joint at bowl cover. Any air leak at bowl cover will upset 'balance' feature and affect fuel economy.
Vacuum Step-up Passage—Passage opens on carburetor mounting flange and special gasket (with slots which register with this vacuum passage hole) must be used when installing carburetor on manifold. Shutting off of this vacuum passage hole will cause excessive fuel consumption.
Clogged Main Vent Tube—Will cause excessive richness at speeds above 50 MPH. To replace tube, use tool T109-42 to remove rivet plug beneath float bowl, then remove old vent tube and install new tube with tool T109-70. Make certain that tube seats tightly, install new rivet plug.

1940 CARTER (B&B) DOWNDRAFT CARBURETOR JET SPECIFICATIONS

Car Model	Yr.	Carb. No.	Main Metering Jet Standard Flow	Main Metering Jet Standard Part No.	Main Metering Jet 1 Size Lean Less	Main Metering Jet 1 Size Lean Part No.	Main Metering Jet 2 Sizes Lean Less	Main Metering Jet 2 Sizes Lean Part No.	Main Vent Air Bleed Size	Tube Assem. Part No.	Stepup Jet Power Orifice Size	Stepup Jet Power Orifice Part No.	Idle Orifice Tube Size	Idle Orifice Tube Part No.	Pump Jet Assembly. Jet Size	Pump Jet Assembly. Part No.
CHRYSLER C25	1940	E6S1	296-300cc	159-87S①	5%	159-63S	10%	159-59S	.0315"	145-13	.0413"	149-56S	.0276"	123-31S①	.0374"	48-75
CHRYSLER C25	1940	E6S1★	312-316cc	159-89S	5%	159-87S	10%	159-63S	.0315"	145-13	.0413"	149-56S	.0295"	123-39S	.0374"	48-75
CHRYSLER C25	1940	E6S2	312-316cc	159-89S	5%	159-87S	10%	159-63S	.0315"	145-13	.0413"	149-56S	.0276"	123-31S	.0374"	48-75
DE SOTO S7	1940	E6N2, N3	282-284cc	159-63S③	5%	159-59S④	10%	159-61S⑤	.0315"	145-13	#63	149-43S	.0276"	123-39S②	.0374"	48-75
PLYMOUTH P9, P10	1940	D6A2, C2	254-258cc	159-61S	5%	159-66S	10%	159-82S	.0315"	145-17	#63	149-43S	.0276"	123-31S	.0315"	48-73
PLYMOUTH Econ.	1940	B6P1	168-172cc	159-70S	—	—	—	—	.0315"	145-39	.0236"	149-60S	.0276"	123-41S	.0236"	48-81

①—Install No. 159-89S and 123-39S to bring this E6S1 up to E6S2 Standards.
②—Supersedes 123-31S used on first cars.
③—Supersedes 159-59S (now 1 Size Lean).
④—Supersedes 159-61S (now 2 Sizes Lean).
⑤—Supersedes 159-66S (now 3 Sizes Lean).

AA ⅞—Ford No. 922A-9510-A
FORD, ALL MODELS WITH '60' ENGINE (1940)

AA1—Ford No. 91A-9510-A
FORD, ALL '85' PASS. CAR MODELS (1940)
FORD, ALL '85' & '95' TRUCK MODELS (1940)
MERCURY, MODEL 09A (1940)

AA1—Ford No. 06H-9510
LINCOLN-ZEPHYR, MODEL 06H (1940)

NOTE:—Lincoln-Zephyr carburetor is new larger (1" type).

TYPE:—Dual or double barrel, plain tube, downdraft type. Carburetors are same design as used on corresponding 1939 car models except that Lincoln-Zephyr model is larger (1").

IDLE ADJUSTMENT:—Idle adjusting screw for each carburetor barrel controls fuel discharge through lower (closed throttle idling) port. Screws should be turned in for leaner mixture, out for richer mixture. Setting should be approximately ⅝-⅞ turns open from inner seated position. Manufacturer recommends that vacuum gauge be used for this adjustment and each idle screw adjusted in turn to secure highest steady reading of gauge. Idle speed controlled by throttle lever stopscrew and should be set for 5-7 MPH speed. See car model 'T&E' page for complete adjustment directions on car.

METERING JETS:—Main metering jets are non-adjustable type located in float bowl and acessible by removing plug on side of float bowl opposite each jet. Jets should be changed only to compensate for special operating conditions such as high altitude. See Chandler-Groves Jet Specification table for standard and leaner jet data.

ECONOMIZER:—Consists of a spring-loaded, vacuum diaphragm controlled, by-pass valve assembly screwed in lower face of main body casting so that valve extends into float bowl (diaphragm assembly fits in recess in throttle valve body casting and vacuum passage in casting connects diaphragm chamber with carburetor barrel below throttle valve). Vacuum economizer set at factory to open when vacuum decreases to 8½-9" of HG. (corresponding to engine speed of 3800 RPM). No adjustment provided.

ACCELERATING PUMP:—Pump cylinder and piston located in float bowl, operated by inverted 'L' shaped pump rod linked to throttle lever. Fuel is drawn into pump cylinder through inlet ball check valve at lower end when throttle is closed and is discharged through outlet check valve and pump discharge nozzle when throttle opened for acceleration (nozzle is located at upper edge of venturis and has two discharge holes so that fuel is discharged equally into each carburetor barrel). Pump piston connection to pump rod is through a driving spring on the piston stem which prevents loading up engine when throttle opened suddenly and also prolongs pump discharge (spring compressed at beginning of piston travel, expands at end of travel).

Capacity—As shown in table below in cc. per 10 strokes. Throttle lever stop-screw must be backed off to allow throttle to close completely and pump link must be connected in center hole.

Car Model	Carburetor	Pump Capacity
Ford '60'	922A-9510-A	9-13 cc.
Ford '85', Mercury	91A-9510-A	9-13 cc.
Lincoln-Zephyr	06H-9510	14-18 cc.

Adjustment—Three holes provided in throttle lever for pump link connection (these holes numbered 1-2-3 from throttle valve shaft outward). Inner (#1) hole provides minimum stroke, Center (#2) hole medium stroke, Outer (#3) hole maximum stroke. Recommended setting is #1 hole (Summer), #2 hole (Winter), #3 hole (Extreme cold weather). See car model 'T&E' page for settings.

NOTE—Pump link is locked in lower end of pump rod by a spring-loaded snap lock. To disengage lock, pull link shaft out of pump rod.

FLOAT LEVEL:—Fuel Level—Fuel level in bowl should be 11/16" ± 1/32" (Ford Models 922A-9510-A, 91A-9510-A), 19/32" ± 1/32" (Lincoln-Zephyr Model 06H-9510) below top edge (gasket seat) on bowl with 3 lbs. pressure (engine idling). If glass tube or other sight level indicator used to check level, use extreme care to eliminate all errors caused by capillary action of fuel in indicator tube.

Adjustment—Level can be adjusted by bending float arm at point where it contacts needle valve. Use extreme care to keep float level.

Float Needle Valve & Seat—Furnished in matched sets only as follows: Ford Part No. 78-9564 (All Ford & Lincoln-Zephyr carburetors).

CHOKE:—Offset type with poppet type relief valve to prevent over-choking.

THROTTLE-KICKER (STARTING):—Consists of a spring loaded lever pivoted on side of carburetor casting so as to contact cam on choke lever at upper end and throttle lever at lower end (through throttle stopscrew which is mounted on this starting lever). Lever is rotated by choke lever cam when choke valve closed for starting and opens throttle to starting position. No adjustment required.

TROUBLE SHOOTING:—Poor Idling Performance. Make certain that entire engine tuned up, check idle setting. If idle is lean, check for air leaks at manifold, check gaskets between carburetor throttle valve body and bowl casting. Remove idle adjusting needle and Idle Tubes, blow out channels with air, clean idle tubes with air. If idle is rich, check Vacuum Economizer valve, see that valve is seating properly, and that diaphragm is not leaking. Check gasket between throttle valve body and bowl casting (this gasket seals vacuum chamber which must be air tight).

Poor Running Performance. Check carburetor body gaskets, see that all carburetor body bolts are tight. Check metering jets for size. Blow out metering jet channel and main nozzle channels with compressed air. Check fuel level.

Poor Acceleration Performance. Check pump cylinder and channels for dirt which will prevent check-valves seating. See that piston leather is in good condition, check piston driving spring. To dismantle pump for cleaning (with air horn casting off carburetor), disconnect pump link, remove pump rod and piston assembly, inlet ball retaining spring and ball, discharge nozzle, and outlet check needle. Blow out all channels with compressed air. If pump is working properly, a fine, solid, steady stream should be discharged from each nozzle at instant throttle is snapped open.

Poor High Speed Performance. Check engine compression, breaker contacts and gap, spark plug gaps first. Check vacuum economizer valve, remove economizer and blow out economizer channels and restrictions with compressed air. Check fuel level and float level. Check fuel pump pressure.

Poor Economy or Gasoline Mileage. Check all parts of car which may cause this complaint (engine, valves, dragging brakes, etc.). Check fuel level and fuel pump pressure. Check metering jets for size. Manufacturer does not recommend use of leaner metering jets to secure fuel economy.

1940 CHANDLER-GROVES CARBURETOR JET SPECIFICATIONS

Car Model	Year	Carburetor Model	Venturi Size	Main Metering Jet Size	Main Metering Jet Part No.	Main Discharge Nozzle Part Number Left Hand	Main Discharge Nozzle Part Number Right Hand	Nozzle Air Bleed Plug Part No.	Economizer Assembly Part No.	Idle Tube Size	Idle Tube Part No.	Pump Nozzle Size	Pump Nozzle Part No.
FORD '60' Models	1940	922A-9510-A	.81"	.043"①	922A-9533-A	922A-9921,23	922A-9920,22	78-9924	78-9904	54cc.	78-9542	#72	922A-9577
FORD '85' Models	1940	91A-9510-A	.94"	.050"②	78-9533-A	91A-9921,23	91A-9920,22	78-9924	78-9904	54cc.	78-9542	#69	91A-9577
LINCOLN-ZEPHYR Early	1940	86H-9510-A2	.94"	.051"③	86H-9533	78-9922	78-9923	78-9924	96H-9904	64cc.	86H-9542	#69	91A-9577
LINCOLN-ZEPHYR Late	1940	06H-9510	1.00"	.053"④	06H-9533	06H-9922	06H-9923	78-9924	96H-9904	64cc.	86H-9542	#69	91A-9577
MERCURY	1940	91A-9510-A	.94"	.050"②	78-9533-A	91A-9921,23	91A-9920,22	78-9924	78-9904	54cc.	78-9542	#69	91A-9577

NOTE—All Part Numbers in above table are Ford Part Numbers.

①—Under 5000 ft. .041" (5000-10000 ft.) Part No. 922A-9533-B. .039" (10000-15000 ft.). .037" (Over 15000 ft.).

②—Under 5000 ft. .048" (5000-10000 ft.) Part No. 78-9533-B. .046" (10000-15000 ft.) Part No. 78-9533-C. .044" (Over 15000 ft.) Part No. 78-9533-D.

③—Under 5000 ft. .049" (5000-10000 ft.). .047" (10000-15000 ft.). .045" (Over 15000 ft.).

④—Under 5000 ft. .051" (5000-10000 ft.). .045" (10000-15000 ft.). .043" (Over 15000 ft.).

Number **MODEL AAV-16**

A-19181—BUICK, SERIES 40-40, 50 (1940)

MODEL AAV-26

A-19182—BUICK, SERIES 40-60, 70, 80, 90 (1940)

A-19192—BUICK, ABOVE MODELS WITH HEAVY DUTY AIR CLEANER.

A-19212—CADILLAC V8, SERIES 40-60S, 62, 72, 75 (1940)

A-19172—PACKARD SUPER 8, '160' 1803, 4, 5; '180' 1806, 7, 8 (1940)

NOTE:—**Buick Models**—Carter WDO Type 440-S (40, 50), 448-S (60, 70, 80, 90) carburetors also used on these models. See Carter 'WDO' carburetor article for data on these types.

Buick 60, 70, 80, 90 Models—Carburetor used on cars with Heavy Duty (oil-bath) type air cleaner has special jet calibration and is not interchangeable with standard type. See Stromberg Jet Specification Table for complete data.

Buick Starting Switch—Delco-Remy Vacuum Switch No. 1990127 is mounted on carburetor and operated by throttle valve shaft. See article in Electrical Equipment Section for servicing data on this unit.

TYPE:—Aircraft type, duplex, downdraft carburetor similar to previous AAV-26 models (Model AAV-16 is new smaller carburetor of same design).

IDLE ADJUSTMENT:—Adjust only when engine warmed up so that Automatic Choke and Fast Idle inoperative (choke valve wide open, stopscrew on lowest step of fast idle cam). Set throttle stopscrew for correct 7-8 MPH (Buick, Cadillac), 6 MPH (Packard), idle speed. Turn each idle adjusting screw (one screw for each barrel, both screws must be adjusted alike) in until engine begins to miss, then turn screw out until engine begins to roll, finally turn screw in slowly until engine fires smoothly. These screws control fuel mixture discharge from lower (closed throttle) idle port. Recheck idle speed and readjust throttle stopscrew if necessary. See car model 'T&E' page for complete adjustment instructions. Check Fast Idle setting (see below).

Buick Note—If vacuum gauge used for idle adjustment, turn both idle adjusting screws out evenly in the 'rich' direction until vacuum reading is 1" lower than maximum.

METERING JETS:—Main metering jets are non-adjustable type located under plug at lower end of each nozzle. Jets should be changed only for special operating conditions such as high altitude (see Buick note above and Stromberg Jet Specification Table for complete jet data).

NOTE—Whenever main discharge nozzles are removed, use extreme care to remove all traces of old lead gasket from carburetor body and shoulder on nozzle. Use new lead gasket when installing nozzle to insure good seal between nozzle and body. Use tool T-19099 to remove main jet plug, tool T-24924 to remove and install main metering jet, tool T-24967 to remove and install main discharge jet.

ECONOMIZER:—Consists of a by-pass valve and jet in the carburetor main body controlled by a vacuum piston in a cylinder in the air horn casting. Economizer by-passes fuel around main metering jets to main nozzles when vacuum in manifold decreases sufficiently so that piston is forced down by spring. No adjustment required.

NOTE—Use special tool T-24733 to remove vacuum power piston.

Setting—Vacuum piston opens valve with manifold vacuum of 4-6" of HG. corresponding to car speed of 65-70 M.P.H.

ACCELERATING PUMP:—Similar to design used on other 'AAV' carburetors with spring-loaded relief valve in piston head and duration spring on rod above piston (light spring above duration spring in dust washer retainer) except that strainer has been added below intake check valve (see Note below).

Capacity—Pump capacity per 10 strokes fast (F), slow (S) is shown in table below. Pump must be set for correct stroke (see Adjustment) as shown in table.

Car Model	Carburetor	Pump Capacity	Pump Setting
Buick 40, 50	AAV-16	11-15 cc. (F), 15-19 cc. (S)	Center
Buick 60, 70, 80, 90	AAV-26	10-14 cc. (F), 15-19 cc. (S)	Center
Cadillac	AAV-26	13-17 cc. (F), 18-22 cc. (S)	Minimum
Packard	AAV-26	22-25 cc. (S)	Maximum

Adjustment—Three holes (Buick), two holes (Cadillac, Packard), provided in throttle lever for pump rod engagement. Inner hole (short radius) provides minimum stroke, center hole medium stroke, outer hole (long radius) maximum stroke. See car model 'T&E' page for recommended settings and changes for seasonal requirements.

Pump Servicing Note—Strainer screen located in plug below pump intake check valve should be removed and cleaned frequently to insure satisfactory pump operation.

FAST IDLE & CHOKE RELEASE:—Check and adjust as directed below. See Stromberg Automatic Choke (with integral Fast Idle) article in Carburetion Equipment Section for description and complete servicing instructions.

Fast Idle Setting (Buick):—Close choke valve against #53 drill rod (insert drill between upper side of valve and air horn wall), check clearance between ear on locking lever on throttle valve shaft and lug on loose lever on fast idle cam stud (this lever linked to fast idle cam by torsion spring). These levers should just clear as throttle valve is opened and closed. To adjust, bend connecting rod between choke valve lever and fast idle cam using care not to bind the rod in the cam slot or to distort the fast idle cam return spring.

Cadillac—Open throttle and rotate fast idle cam so that stopscrew rests on high lobe of cam. Move choke valve toward closed position as far as possible, check choke valve opening by inserting drill rod between edge of valve and air horn wall. Choke valve opening should be .102" (#38 drill). To adjust, bend connecting rod between choke valve lever and fast idle cam loose lever at point near upper end. Use care not to cause bind in fast idle mechanism.

Packard—Check and adjust in same manner as Cadillac (above) except that choke valve opening should be 3/32".

Choke Release (All Models):—With throttle valve wide open, ear on throttle lever contacts lug on fast idle cam (Buick), fast idle cam loose lever (Cadillac, Packard) and opens choke valve to correct flooding. To check, open throttle wide, check choke valve opening by inserting 11/64" (.156-.187") drill rod between upper edge of choke valve and air horn wall. To adjust, bend ear on throttle lever slightly (use bending tool T-25056 on Cadillac and Packard models). Use care not to bind fast idle rod or distort fast idle cam spring.

FLOAT LEVEL:—**Fuel Level**—Should be 19/32" (Buick), 5/8" (Cadillac, Packard) below top edge (gasket seat) of float bowl with engine idling (4-5 lbs. pressure Buick, Cadillac; 3 lbs. pressure Packard). To check fuel level, remove plug in sight hole on side of bowl. Fuel level should be even with bottom of hole.

Float Height—Use special service tool T-24971 to check floats. Remove air horn and bowl cover assembly, invert cover and place tool on gasket. Top of floats should be 3/64" above tops of vertical guides (Buick), even with tops of guides (Cadillac, Packard) and sides of floats should be tangent to tool guides without any drag (to provide clearance between floats and bowl). Use extreme care to adjust both floats alike.

Float Valve & Seat—Part No. P-22499. Furnished only as matched sets. When installing, make certain that needle valve is clipped to float lever.

Float Bowl Vent—Bowl vented through opening on side of air horn directly below air cleaner collar.

THROTTLE VALVE SETTING:—To check throttle valve setting, back throttle stopscrew off so that valves are tightly closed, insert drill rods in idle port and vacuum port as follows: Idle Port—#60 (Buick), #56 (Cadillac, Packard), Vacuum Spark Port—#58 (All models). Then measure distance from edge of throttle valve to nearest side of drill rod. These settings given in table below (all figures are plus or minus .004").

Car Model	Throttle Valve	Idle Port	Vacuum Spark Port
Buick (AAV-16)	P-24684—5°	.022"	.041"
Buick (AAV-26)	P-24740—5°	.022"	.055"
Cadillac	P-24172—5°	.040"	.012"
Packard	P-24740—5°	.040"	.012"

CHOKE:—Stromberg automatic integral type. See article in Carburetion Equipment Section for complete servicing directions.

Choke Setting—Inverted 'V' mark on thermostat cover scale should coincide with reference mark on top of choke housing. To adjust, loosen three cover screws, rotate thermostat cover assembly.

CAUTION—When connecting heat tube to thermostat cover connection, do not use excessive pressure which may rotate cover and change choke setting.

SERVICE PARTS:—**Gasket Set**—No. J-5656-G (Buick AAV-16), J-5655-G (Buick AAV-26), J-5421-G (Cadillac, Packard).

Number **MODEL AAV-2**

A-18792—CHRYSLER 8, C26 TRAVELER, SARATOGA, NEW YORKER (1940)
CHRYSLER 8, C27 CROWN IMPERIAL (1940)

This carburetor same design as used on corresponding 1939 car models.

THROTTLE GUARD NOTE:—This unit used on cars with Fluid Drive to prevent engine stalling. See article in Carburetion Equipment Section for adjustment and servicing instructions.

TYPE:—Same design as previous AAV-2 models. See 1939 Supplement for description and fuel system operation.

IDLING ADJUSTMENT:—Idle adjusting screw for each barrel controls fuel discharge from lower idling port. Screws should be turned in for leaner mixture and out for richer mixture and must be set alike. Idle speed controlled by throttle lever stopscrew and should be set for 6 MPH idling speed with engine warmed up (choke valve wide open and fast idle inoperative). See tune up instructions on car model page for complete adjustment instructions on car.

METERING JETS:—Main metering jets are non-adjustable fixed type. Jets should be changed only for special operating conditions such as high altitude. See Jet Specification Table for standard jet calibrations for all models.
NOTE—Whenever main discharge jet located directly above main metering jet is removed, new lead gasket must be used in carburetor body to insure a good seal when jet is replaced. Use tool T-19099 to remove plug, tool T-24924 to remove and install main metering jet, tool T-24967 to remove and install main discharge jet.

ECONOMIZER:—Consists of a by-pass valve and jet in the carburetor main body controlled by a vacuum piston in a cylinder in the air horn casting. Economizer by-passes fuel around main metering jets to main nozzles when vacuum in manifold decreases sufficiently so that piston is forced down by spring. No adjustment required.
NOTE—Use special tool T-24733 to remove vacuum power piston No. P-22803.
Setting—Vacuum piston opens valve with manifold vacuum of 5-7" of HG. corresponding to car speed of 70-75 MPH.

ACCELERATING PUMP:—**Capacity**—With pump set for maximum stroke, capacity per 10 strokes is 21-25 cc. (Slow), 27-31 cc. (Fast).
Adjustment—Two holes provided in throttle lever for pump link engagement. Inner hole (short radius) provides minimum stroke, outer hole (long radius) maximum stroke. See car model 'T&E' page for recommended settings.

FAST IDLE:—Consists of a stepped rotary cam linked to the choke valve lever and serving as a stop for the throttle lever stopscrew. Cam is rotated to fast idle position when choke valve closed for cold starting so that throttle valve held open slightly.
Adjustment—To check setting, hold stopscrew against first step of fast idle cam and check choke valve opening with ⅛" drill rod inserted between edge of choke valve and air horn wall. If opening not correct, adjust rod length (turn ball joint end on rod). Open throttle wide and again check choke valve opening with 7/32" rod. If opening not correct, bend extended arm of fast idle cam slightly.

FLOAT LEVEL:—**Fuel Level**—Should be ⅝" below top surface of float bowl with 3 lbs. pressure (engine idling) or approximately even with the bottom of the inspection hole on side of float bowl (take out plug to check level).
Float Height—Use special service tool, T-24971 when setting floats. Remove air horn and float cover assembly, invert, mount tool on cover gasket. Tool guides will also check float travel (floats must be free and not rub on bowl). Adjust floats by bending float lever. If tool not used, top of floats should be 1 11/32" above gasket on cover.
Float Valve & Seat—Part No. P-22499. Furnished only as matched sets.
Float Bowl Vent—Bowl vented to outside through opening in side of air horn directly below air cleaner collar.

THROTTLE VALVE SETTING:—When installing throttle valves, they must be set so that distance from upper lip of valve to lower edge of upper idle port is .040" (plus or minus .004") and distance from upper lip of valve to lower edge of vacuum spark port (use #56 drill inserted in port) is .015" (plus or minus .004") with throttle valve tightly closed.
Throttle Valves—Part No. P-22752, 5° type.

CHOKE VALVE:—Offset type. Sisson Automatic Choke is standard equipment. See Sisson Automatic Choke article in Carburetion Equipment Section.

SERVICE PARTS:—**Gasket Set**—No. J-5316-G.

MODEL AAO-161

STUDEBAKER PRESIDENT, MODEL 6C (1940)

This Carburetor same design as used on 1939 cars except as noted below.

NOTE:—This 1940 carburetor may be identified by number 6-85 stamped on float bowl cover.
Jet Changes for Increased Fuel Economy:—If greater fuel economy is desired, standard main metering jets may be changed to first smaller size (.045") with slight loss in performance. Second smaller size jets (.043") should only be used for operation at high altitudes. Both main metering jets should be changed at the same time and must be same size. See Stromberg Jet Specification Table for complete jet data.

TYPE:—Same design as used on 1939 cars except for improvements in Automatic Choke system as follows: New thermostatic coil used (may be indentified by figure '8' on outer face of coil housing). Hot air pipe is ⅛" in diameter and has a .075" reducer. Vacuum piston hole in throttle body changed to #56 drill size. ***See article in Carburetion Equipment Section for complete Automatic Choke and Fast Idle servicing data.***

IDLING ADJUSTMENT:—Must be made only with engine warmed up so that Fast Idle and Automatic Choke inoperative. Idle adjusting screws (one for each barrel) control fuel discharge and should be turned in for leaner mixture, out for richer mixture. Idle speed controlled by throttle stopscrew and should be set for 8 MPH. hot or slow idle. See tune up instructions on car model page for complete data.

FAST IDLE MECHANISM:—Same design as used on previous models (by-pass channel around throttle valve controlled by vacuum piston linked to choke valve. See article in Carburetion Equipment Section for adjustments to be made when servicing carburetor.
IMPORTANT NOTE—Whenever air horn and float bowl cover assembly is removed, remove throttle valve body first and unhook vacuum piston. If this is not done, vacuum piston link assembly may be damaged. When vacuum piston removed, see that it is installed with slot on side toward idle fuel cross-passage port.

METERING JETS:—Main metering jets are non-adjustable type. See Note above for recommended changes for increased fuel economy and Stromberg Jet Specification Table for complete instructions.

ECONOMIZER:—By-pass valve and jet located at bottom of accelerating pump cylinder and operated by pump piston. Should not require adjustment but setting can be checked by noting throttle valve opening when pump piston rests on seat of by-pass valve (less over-travel) with pump set for minimum stroke. Should be 5/16" (plus or minus 1/64"). No adjustment provided but pump 'walking beam' lever can be bent slightly to correct opening. NOTE—When re-installing lever make certain that ball end is toward carburetor.

ACCELERATING PUMP:—Same type as used on previous AAO-161 carburetors.
Capacity—16-20 cc. per 10 strokes when operated slowly with pump set for minimum stroke.
Adjustment—Two holes provided in throttle lever for pump link engagement. Inner hole (short radius) provides minimum stroke, outer hole (long radius) maximum stroke. See tune up instructions on car model page for recommended settings.

FLOAT LEVEL:—**Fuel Level.** Should be ⅝" below top surface of float bowl with 3 lbs. pressure (engine idling) or even with the lower edge of the inspection hole on the side of the bowl (take out plug to check level).
Float Height—Use special service tool, T-24971, to set floats. Remove air horn and float cover assembly (see Note in Fast Idle section for instructions to avoid damage to fast idle mechanism), invert cover, install tool on gasket. Tool guides will also check float travel (floats must be free and not rub on bowl). Adjust floats by bending float lever. If tools not used, top of floats should be 1 11/32" above gasket on cover.
Float Valve & Seat—Part No. 22499. Furnished only in matched set.
Float Bowl Vents—Bowl vented to outside through screened opening on side of air horn. Also vented through balance tube in air horn directly below air cleaner.

THROTTLE VALVE SETTING:—When installing valves see that distance from top edge of valve to lower edge of upper idle port is .020" plus or minus .004".

CHOKE:—Valve is offset type, operated by thermostatic spring coil coupled directly to choke valve shaft. See article in Carburetion Equipment Section for complete data.

SERVICE PARTS:—**Gasket Set**—Part No. J-5318-G.

Number **MODEL BXOV-26**
A-19162—PACKARD SIX, '110' MODEL 1800 (1940)

NOTE:—This model fitted with integral Fast Idle and Automatic Choke (thermostatic coil mounted on air horn and linked directly to choke valve shaft). See article in Carburetion Equipment Section for complete Fast Idle and Automatic Choke Servicing data.

THROTTLE GUARD NOTE:—Vacuum diaphragm type throttle guard used on all cars with Overdrive to prevent engine stalling at speeds below 20 MPH. See Packard Throttle Guard article in Carburetion Equipment Section for adjustment instructions.

TYPE:—Plain tube, downdraft type with throttle operated accelerating pump and vacuum controlled economizer.

Fuel System (Idling & Low Speed):—Fuel for idling taken from main jet well up through Idling Tube which meters the fuel to a cross-channel in which it is mixed with air admitted through Idle Air Bleed (air bleed passage opens into carburetor barrel below choke valve). Fuel mixture then taken down through channel to discharge ports at the throttle edge. For closed throttle idling, fuel discharged through lower port below throttle valve and controlled by idle adjusting screw (upper port above throttle valve serves as additional air bleed). As soon as throttle is cracked open for low speed running, additional fuel is discharged from this upper port also.

Driving Range (Below 65-70 MPH.)—As throttle is opened, suction increases on main discharge jet and this jet supplies fuel, the idling system dropping out. Fuel for main discharge jet is metered by main metering jet located at lower end of discharge jet. Discharge jet is air bled by High Speed Bleeder located directly above jet on auxiliary venturi support.

High Speed and Wide Open Throttle Operation—At speeds above 65-70 MPH. or whenever throttle held wide open so that manifold vacuum falls off, spring on vacuum piston forces piston down and opens by-pass valve. Fuel metered by the by-pass jet then flows directly to the main discharge jet.

IDLING ADJUSTMENT:—Adjust only when engine warm so that Automatic Choke and Fast Idle inoperative (choke valve wide open, throttle stopscrew on lowest step of fast idle cam) and engine idling at hot or slow idle speed. Idle adjusting screw controls fuel mixture discharge from lower idle port and should be turned in for leaner mixture, out for richer mixture (standard setting approximately 1¼ turns open from inner seated position). Idle speed controlled by throttle lever stopscrew and should be set for 6 MPH. idle speed. See car model 'T&E' page for complete adjustment instructions on car. Check Fast Idle Setting.

METERING JETS:—Main metering jet is non-adjustable type located under plug at lower end of discharge jet. Jets should be changed only for special operating conditions such as high altitudes. See Stromberg Jet Specification table for complete jet data.

ECONOMIZER:—Consists of a by-pass valve and jet in the carburetor main body controlled by a vacuum piston in a cylinder in the air horn casting. Economizer by-passes fuel around main metering jets to main nozzles when vacuum in manifold decreases sufficiently so that piston is forced down by spring. No adjustment required.
NOTE—Use special tool T-24733 to remove vacuum power piston No. P-24043.

Setting—Vacuum piston opens valve with manifold vacuum of 4-6" of HG. corresponding to car speed of 65-70 MPH.

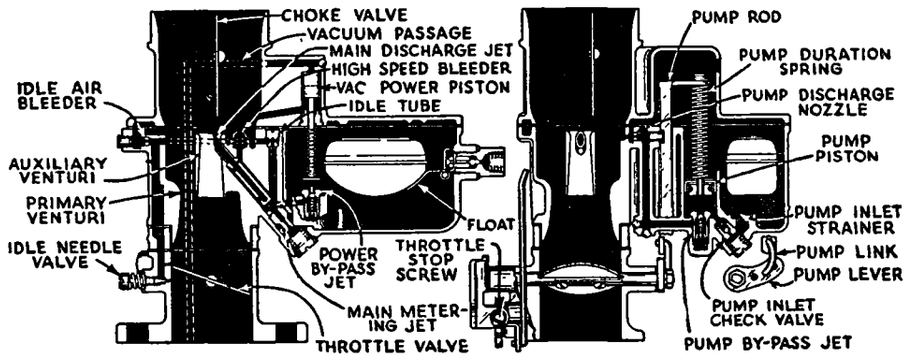
ACCELERATING PUMP:—Operated by throttle lever through vertical pump rod under float bowl cover. Fuel is drawn into pump chamber through strainer screen and inlet ball check valve and is discharged through outlet valve and pump discharge nozzle located in side of mixing chamber above main venturi when throttle opened for acceleration. Pump piston has duration spring on piston rod (spring compressed on sudden throttle openings, subsequent spring expansion prolongs pump discharge).

Capacity—Pump capacity in cc. per 10 strokes with pump set for medium stroke (link in center hole of throttle lever) should be 11-14 ccs. (pump operated slowly).

Adjustment—Three holes provided in throttle lever for pump link connection. Link engaged in center hole provides normal setting, outer hole (long radius) provides maximum pump discharge, inner hole (short radius) minimum discharge. See car model tune up page for recommended seasonal changes.
Pump Servicing Note—Strainer screen located in pump inlet in bottom of float bowl should be cleaned at frequent intervals to insure satisfactory pump performance.

FAST IDLE & CHOKE RELEASE:—Fast idle mechanism consists of a fast idle lever and cam mounted below the throttle valve shaft so that the cam serves as a stop for the throttle stopscrew. Fast idle lever is linked to choke valve lever by connecting rod so that cam is rotated to the fast idle position when the choke valve closes for cold starting. Choke release mechanism consists of an ear on the throttle lever which engages a lug on the fast idle cam so that the cam is rotated and choke valve opened when the throttle valve is opened wide. Fast idle and choke release setting are both adjusted by bending connector rod as follows:

Adjustment—Hold throttle stopscrew on lowest step of fast idle cam and against edge of second step, move choke valve toward closed position as far as possible (do not force valve beyond point where fast idle cam and lever are stopped against throttle stopscrew). Check choke valve opening by inserting



11/32" drill rod between upper edge of valve and air horn wall. If choke opening not correct, adjust by bending connector rod at bend near choke valve lever.

FLOAT LEVEL:—**Fuel Level**—Set at ⅝" below top edge (gasket seat) of bowl with 3 lbs. pressure (engine idling). Adjust by bending float arm at point where it is attached to float (use tool T-24733).
NOTE—Float fulcrum pin is retained by spring clip seated in float seat recess. When installing fulcrum pin, see that spring clip is seated and that it engages notches at ends of pin.

Float Valve & Seat—No. P-24063 (.086" intake hole). Furnished only in matched sets.

Float Bowl Vent—Bowl is vented to outside atmosphere through slot in upper end of pump rod housing on bowl cover.

THROTTLE VALVE SETTING:—Valve is No. P-24059—20° type. To check valve setting, insert #56 drill in idle port, two #60 drills in vacuum spark control ports. With throttle stopscrew backed off and throttle valve closed tight, edge of valve should be flush with drills in ports (.006" maximum clearance between valve and idle port drill allowable).
NOTE—Additional #60 vacuum spark port is drilled at random below valve.

CHOKE:—Valve is offset plain type. Operated by automatic choke thermostatic spring coil which is linked directly to shaft. See article in Carburetion Equipment Section for Automatic Choke data.
SERVICE PARTS:—**Gasket Set**—Part No. J-5409-G.

MODEL BXO-26

STUDEBAKER COMMANDER, MODEL 10A (1940)

This carburetor same design as used on 1939 cars except as noted below.

NOTE:—This 1940 carburetor may be identified by number 6-84 stamped on float bowl.

Jet Changes for Increased Fuel Economy—Where greater fuel economy is desired, standard main metering jet may be changed to first smaller size (.058") with slight loss in performance. Second smaller size (.056") should only be used for high altitudes. See Stromberg Jet Specification Table for complete jet data.

TYPE:—Same design as used on 1939 cars except for improvements in Fast Idle and Automatic Choke system as follows:

Fast Idle—Fast idle cam now operated by gravity (pull-back spring not used) and choke release (wide open throttle kicker) made more positive in action.

Automatic Choke—Thermostatic coil housing thickness has been doubled and vacuum piston linkage has been simplified (not adjustable). ***See article in Carburetion Equipment Section for complete Automatic Choke and Fast Idle servicing data.***

IDLING ADJUSTMENT:—Must be made only when engine warmed up so that Fast Idle and Automatic Choke inoperative. Idle adjusting screw controls fuel mixture and should be turned in for leaner mixture, out for richer mixture. Idle speed controlled by throttle stopscrew and should be set for 8 MPH. idling speed. See tune up data on car model page for complete instructions.

METERING JETS:—Main metering jet is non-adjustable type. See Note above for recommended changes for increased fuel economy and Stromberg Jet Specification Table for complete jet calibrations.

ECONOMIZER:—By-pass valve and jet located at bottom of accelerating pump cylinder and operated by pump piston. Should not require attention but setting can be checked by noting throttle opening when pump piston rests on seat of by-pass valve (less over-travel) with pump set for medium stroke (link engaged in middle hole on lever). Should be 13/32" (plus or minus 1/64").

Adjustment—To adjust, remove cotter pin and turn adjusting nut at upper end of pump piston stem. Make certain that cotterpin replaced to lock setting. NOTE—When dismantling carburetor, do not disturb this nut to avoid necessity of resetting economizer when carburetor is assembled.

ACCELERATING PUMP:—Same type as used on previous BXO-26 carburetors.

Capacity—17-22 cc. per 10 strokes when operated slowly with pump set for medium stroke (pump link in center hole).

Adjustment—Three holes provided in throttle lever for pump link engagement. Inner hole (short radius) provides minimum stroke, center hole medium stroke, outer hole (long radius) maximum stroke. See tune up data on car model page for recommended settings.

FLOAT LEVEL:—Fuel Level. Set at 5/8" below top edge of float bowl with 3 lbs. pressure (engine idling). Can be adjusted by bending float arm at point where it is attached to float (use tool T-24733). NOTE—Float fulcrum pin is retained by clip seated in float seat recess. When installing pin, see that clip is seated and engages notches at each end of fulcrum pin.

Float Valve & Seat—No. P-21918. Furnished only in matched sets.

Float Bowl Vent—Bowl is vented to outside atmosphere through slot at upper end of pump rod housing on bowl cover.

THROTTLE VALVE SETTING:—Valve is No. P-23282. Should be set so that distance from upper edge of valve to lower edge of upper idle port is .010" plus or minus .004".

FAST IDLE SETTING:—Close throttle so that stopscrew is on lowest step of fast idle cam, move choke valve toward closed position until it is stopped by the stopscrew striking against the side of the next step on the fast idle cam (do not force valve beyond this position). Check choke valve opening by inserting 11/32" drill rod between upper edge of valve and air horn wall. If valve opening not correct, adjust by bending connector rod linking choke valve and fast idle cam. Make certain that linkage does not bind and that fast idle cam falls freely to slow idle position with throttle valve open.

CHOKE:—Choke valve is plain type offset valve. Operated by automatic choke mechanism (thermostatic coil linked directly to choke valve shaft. See Automatic Choke article in Carburetion Equipment Section for servicing data.

SERVICE PARTS:—Gasket Set—Part No. J-5319-G.

MODEL BXV-3

Number

A-18123—DODGE, D14 DELUXE, D17 SPECIAL (1940)

A-18133—*DODGE, EXPORT MODELS* (1940)

This carburetor same design as used on corresponding 1939 model.

TYPE:—Same design as previous BXV-3 model. See 1939 Supplement for description and fuel system operation.

IDLING ADJUSTMENT:—Idle adjusting screw controls fuel discharge from lower idle port and should be turned in for leaner mixture, out for richer mixture. Adjust only with engine warmed up so that choke valve wide open and fast idle inoperative. Idle speed controlled by throttle lever stopscrew and should be set for 7-8 MPH. hot idle speed. See car model tune up pages for adjusting instructions.

METERING JET:—Main metering jet is non-adjustable type and should be changed only for special operating conditions such as high altitude. See Stromberg Jet Specification table for complete jet data.
NOTE—Use tool T-19099 to remove main jet plug, tool T-24924 to remove and install main metering jet, tool T-24967 to remove and install main discharge jet.

ECONOMIZER:—Vacuum piston type. Consists of a vacuum piston in a cylinder in the air horn casting which controls the by-pass valve and jet assembly in the main body casting. No adjustment required. Economizer is set to open valve with vacuum of 4-6" of HG. corresponding to car speed of 65-70 MPH.
NOTE—Use tool T-24733 when removing vacuum piston No. P-24043.

ACCELERATING PUMP:—Capacity—With pump set for medium stroke (center hole in throttle lever), capacity in cc. per 10 strokes when pump operated slowly is 11-14 cc.

Adjustment—Three holes provided in throttle lever for pump link connection. Link engaged in center hole provides normal setting, outer hole (long radius) provides maximum pump discharge, inner hole (short radius) minimum discharge. See car model tune up page for recommended seasonal changes.

Pump Servicing Note—Strainer screen located in pump inlet in bottom of float bowl should be cleaned at frequent intervals to insure satisfactory pump performance.

FAST IDLE:—Consists of a cam pivoted directly below the throttle lever shaft and linked to the choke valve. Cam serves as stop for throttle lever stopscrew and opens throttle to fast idle position when choke valve is closed for starting. No adjustment required but stopscrew should be at high point of cam with choke valve fully closed.

FLOAT LEVEL:—Fuel Level—Should be 5/8" below top edge of float bowl with engine idling (3 lbs. pressure). Adjust by bending float lever arm at point where it is attached to float.

Needle Valve & Seat Assembly—Part No. P-24063. Furnished only as matched set. When installing float or needle valve make certain that spring clip is properly engaged in notches on float fulcrum pin.

CHOKE:—Valve is offset type with poppet type relief valve.

Automatic Choke—Sisson. See article in Carburetion Equipment Section for adjustment and servicing instructions.

THROTTLE VALVE SETTING:—Part No. P-24059 (20° type). To check throttle valve, insert #58 drill in idle port, two #60 drills in vacuum spark ports. With stopscrew backed off and throttle valve tightly closed, throttle valve edge should be flush with edge of drills (.006" maximum clearance between valve and idle port drill allowable). NOTE—An additional #60 vacuum spark port is drilled at random below throttle valve.

SERVICE PARTS:—Gasket Set—No. J-5968-G.

MODEL EE-22

LINCOLN, V12 MODELS (1940)

This Carburetor same type as used on 1939 Lincoln cars.

ADJUSTMENT & SPECIFICATIONS:—All adjustment and service operations same as for 1939 model. ***See Stromberg Model EE-22 carburetor article in Carburetor Section of manual for complete data and adjust to following specifications:***

Economizer Setting—Throttle valve opening at point where pump piston contacts economizer by-pass valve should be 21/64".

Pump Capacity—20-24 cc. (Slow), 17-21 cc. (Fast) per 10 strokes with pump set for maximum stroke.

Float Level—9/16" below top edge of bowl with engine idling (3 lbs. pressure).

Throttle Valve Setting—.030" from upper edge of throttle valves to lower edge of upper idle port with throttle valves tightly closed.

Number **MODEL EE-16**

A-18341—PACKARD EIGHT, '120' MODELS 1801, 1A (1940)

This Carburetor same design as used on 1939 Packard '120' models.

THROTTLE GUARD NOTE:—Vacuum diaphragm type throttle guard used on all cars with Overdrive to prevent engine stalling at speeds below 20 MPH. See Packard Throttle Guard article in Carburetion Equipment Section for adjustment instructions.

TYPE:—Same design as used on previous cars. Carburetor has integral Fast Idle and Automatic choke. See article in Carburetion Equipment Section for Automatic Choke and Fast Idle servicing data.

IDLING ADJUSTMENT:—Adjust only with engine warm so that Automatic Choke and Fast Idle inoperative (choke valve wide open, fast idle screw on lowest step of fast idle cam) and engine idling at hot or slow idling speed. Make certain that some clearance exists between fast idle adjusting screw and fast idle cam (on opposite end of throttle shaft from idling speed adjusting screw). Set throttle lever stopscrew for correct 6 MPH. idling speed. Turn idling adjusting screw for each carburetor barrel (both screws must be adjusted alike) in for leaner mixture or out for richer mixture. These screws control fuel discharge from lower (closed throttle) idling ports. Standard setting approximately 2-2½ turns open. Recheck idling speed adjustment. See car model tune up page for complete adjustment instructions. Check Fast Idle setting (below).

METERING JETS:—Main metering jets are non-adjustable type located under plug at lower end of each discharge jet. Jets should be changed only for special operating conditions such as high altitudes. See Stromberg Jet Specification table for complete jet data.

ECONOMIZER:—By-pass valve and jet located at bottom of pump cylinder which is operated by pump piston so as to permit continuous discharge from pump nozzle when throttle valve is wide open. Should not require attention but setting can be checked by noting throttle opening when pump piston rests on by-pass valve seat (less over-travel). Throttle opening should be 5/16" (plus or minus 1/64"). Check by inserting drill rod of correct size between throttle valve edge and carburetor wall.

Adjustment—Bend ball end of pump fulcrum lever (walking beam) slightly.

ACCELERATING PUMP:—Same design as used on previous EE-16 carburetors.

Capacity—17-21 cc. (slow), 11-15 cc. (Fast) per 10 strokes of the pump.

Adjustment—No adjustment provided.

Pump Servicing Note—Strainer screen located in plug below pump intake check valve should be removed and cleaned frequently to insure satisfactory pump operation.

FAST IDLE & CHOKE RELEASE:—Check and adjust as directed below. See article in Carburetion Equipment Section for complete servicing directions.

Fast Idle Speed—With throttle lever stopscrew set for correct hot or slow idle speed of 6 MPH., turn fast idle adjusting screw (on fast idle lever—do not confuse this screw with throttle lever stopscrew on opposite end of throttle valve shaft) in until it just contacts lowest step of fast idle cam, being careful not to exert pressure on screw or fast idle lever, then back screw out exactly ½ turn. This clearance will allow fast idle cam to rotate without any drag. Check entire fast idle mechanism for free movement but do not lubricate.

Fast Idle Setting—After setting both slow idle speed (throttle lever stopscrew adjustment) and fast idle speed (fast idle adjusting screw adjustment above), see that choke valve is wide open and close throttle valve completely so that throttle stopscrew is against stop on body. Hold throttle valve in this position and close valve by hand until fast idle screw strikes step on fast idle cam (do not force choke valve beyond this position which will bind fast idle rod or distort fast idle cam spring). Measure choke valve opening at this point by inserting drill rod between upper edge of valve and air horn wall. Opening should be 35/64". Adjust by bending fast idle rod at elbow near upper end.

Choke Release—Open throttle to wide open position so that choke valve is opened by ear on fast idle lever which contacts lug on fast idle cam. Measure choke valve opening by inserting drill rod between valve edge and air horn wall. Distance should be .156-.187" (11/64" drill). Adjust by bending ear on fast idle lever using extreme care not to damage fast idle rod and fast idle cam spring. CAUTION—Throttle valves must be opened by pressing lever on throttle lever end of shaft **not fast idle lever end.**

FLOAT LEVEL:—Fuel Level—Should be 15/32" below top edge of float bowl with engine idling. Adjust by bending float lever arm at point where it is attached to the float (use tool T-24733).

Float Needle Valve & Seat—Part No. P-23509. Furnished only in matched sets. When installing assembly make certain that needle valve has one corner down and is clipped to float lever.

Float Bowl Vent—Bowl vented to atmosphere through opening on side of air horn wall directly below air cleaner collar.

THROTTLE VALVE SETTING:—Throttle valves are No. P-23347 (Left), P-23357 (Right) 5° type. To check throttle valve setting, back off throttle stopscrew so that valves are tightly closed, measure distance from upper edge of throttle valve to lower edge of upper idle port. Should be .030" plus or minus .004".

CHOKE:—Stromberg automatic integral type. See article in Carburetion Equipment Section for complete servicing directions.

Choke Setting—Inverted 'V' mark on thermostat cover scale should coincide with reference mark on top of choke housing. To adjust, loosen three cover screws and rotate thermostat cover assembly.

CAUTION—When connecting heat tube to thermostat cover, do not use excessive pressure which may rotate cover and change setting.

1940 STROMBERG DOWNDRAFT CARBURETOR JET SPECIFICATIONS

Car Model	Year	Carb. No.	Venturi Size	Main Metering Jet Size	Main Metering Jet Part No.	By-Pass Jet Size	By-Pass Jet Part No.	Main Discharge Jet Size	Main Discharge Jet Part No.	H.S. Bldr.	Idle Tube Size	Idle Tube Part No.	Idle Air Bld. Jet Size	Idle Air Bld. Jet Part No.	Pump Discharge Nozzle Size	Pump Discharge Nozzle Part No.
BUICK 40, 50	1940	AAV-16	1 1/32"	.045"	P-24773	1#60	P-24674	#32-28	P-24670	#70⑭	#70	P-19424	#42㉓	P-24683	#68	P-24594
BUICK 60, 70, 80, 90①	1940	AAV-26	1⅛"	.052"	P-24673	1#54	P-21197	#32-28	P-24670	#70⑭	#70	P-19424	#42㉓	P-24683	#68	P-24594
BUICK 60, 70, 80, 90②	1940	AAV-26	1⅛"	.051"	P-24673	1#54	P-21197	#32-28	P-24670	#70⑭	#70	P-19424	#42㉓	P-24683	#68	P-24594
CADILLAC 60S, 62, 72, 75	1940	AAV-26	1⅛"	.049"	P-19442	1#53	P-24064	#32	P-23567	#70㉑	#64	P-24009	#36㉔	P-23536	⑳#65	P-23245, 6
CHRYSLER C26, C27	1940	AAV-2	1⅛"	.049"	P-22660	1#54	P-21197	#36	P-22795	#70	#70	P-19424	#42	——	㉒#65	P-23245, 6
DODGE D14, D17	1940	BXV-3	1 5/32"	.058"	P-19442	1#54	P-21197	#28-36	P-24036	#68⑯	#70	P-21778	#54	P-20470	⑱#70	P-24067
LINCOLN V12	1940	EE-22	1 3/16"	.057"	P-17004	4#56	P-18149	#28-32	P-21799	#70	#70	P-17007	#42	P-15447K	#60	P-20232
PACKARD 1800	1940	BXOV-26	1 7/32"	.060"	P-19442	1#54	P-21197	#28-34	P-24610	#70⑭	#65	P-24776	#65	P-20750	⑱#68	——
PACKARD 1801, 1A	1940	EE-16	1 1/32"	.047"	P-19442	1#60	P-20752	#32	P-23346	#65⑰	#55	P-23633	#60⑲	P-23649	#65	P-23808, 9
PACKARD 1803 to 8	1940	AAV-26	1⅛"	.050"	P-19442	1#54	P-21197	#32	P-23567	#70⑭	#64	P-23527	#36⑮	P-23536	㉒#65	P-23245, 6
STUDEBAKER 10A	1940	BXO-26	1 3/16"	.059"⑪	P-19442	2#56	P-21776	#28-36	P-23264	#70	#70	P-21778	#54	P-20470	#64	P-23262
STUDEBAKER Pres. 6C	1940	AAO-161	1 1/32"	.047"⑫	P-22660	1#65	P-20467	#36	P-23485	#60	#68	P-21962	#66⑬	——	#65	P-21561

①—Standard Air Cleaner.
②—Heavy Duty (oil bath) Air Cleaner.
⑪—.059" Std., .058" First smaller (Econ.), .056" Second smaller (Alt.).
⑫—.047" Std., .045" First smaller (Econ.), .043" Second smaller (Alt.).
⑬—Main Body Bleeder. #38-50 Throttle Body Bleeders.
⑭—Part No. P-23985.
⑮—#52 in Main Body also.
⑯—Part No. P-24315.
⑰—Part No. P-22764.
⑱—Pump By-pass Jet 2#56, Part No. P-24062.
⑲—Secondary Bleeder #38. Part No. P-23658 in Throttle Body.
⑳—Pump discharge nozzles in Main Body. Pump By-pass Jet #58, Part No. P-24744.
㉑—Part No. P-22369.
㉒—Pump discharge nozzles in Main Body. Pump By-pass Jet #63, Part No. P-23742.
㉓—#70 in Main Body also.
㉔—#52 in Main Body also.

DY-1A—CROSLEY, MODEL A (1939-40)

TYPE:—Single barrel, plain tube, downdraft type with high speed (Main) and low speed (Idle) adjustments.

Fuel System (Idling & Low Speed):—Fuel is metered by restriction at lower end of Idle Tube and flows up through tube (located in main nozzle—see illustration) where it is mixed with air admitted through Idle Air Bleed hole in side of idle tube. Fuel mixture is controlled by Idle Adjusting Screw (at upper end of tube) and flows through Idle Fuel Supply Channel in carburetor casting to Idle Discharge Ports at the throttle edge. For closed throttle idling, all fuel is discharged through lower port. As soon as the throttle is opened for low speed running, additional fuel is discharged through upper port also. Idle system supplies all fuel for car speeds up to approximately 18 M.P.H.

Speeds above 18 M.P.H.—At approximately 18 M.P.H., throttle valve opening causes reduced suction on idle ports and increased suction on main nozzle so that fuel is discharged at main nozzle and idle system drops out. Fuel for main nozzle is metered by Main Adjustment Screw and is mixed with air admitted through holes in nozzle from main nozzle air bleed channel opening into air horn above choke valve. This air is metered by Main Nozzle Air Bleed Restriction located in air bleed channel at top of carburetor main casting.

ADJUSTMENT:—Make adjustments in order as listed below. Preliminary adjustment will allow engine to be started and warmed up (other adjustments should not be made until engine thoroughly warm).

Preliminary Adjustment:—Close Main Adjustment Screw by turning to right (clockwise) until it is lightly seated, then back screw out exactly two complete turns. Close Idle Adjustment Screw by turning to right (clockwise) until it is lightly seated, then back screw out exactly one complete turn. Start engine and run until thoroughly warmed up.

Main (High Speed) Adjustment:—With engine warm and running, open throttle so that engine speed is 30-35 M.P.H. Turn Main Adjustment Screw in or clockwise slowly (¼ turn at a time) until engine slows down due to lack of fuel, then back screw out very slowly (⅛ turn at a time) until maximum speed is secured. Correct setting will be approximately 1½ turns open (first 1000 cars), 1¾-2 turns open (later cars) of screw from inner seated position.

Idle (Low Speed) Adjustment:—Set throttle lever stopscrew so that engine runs at faster than normal idling speed. Close throttle. Turn Idle Adjustment Screw in or clockwise to lean mixture until engine begins to miss, then back screw out slowly until engine fires smoothly. Clear manifold by opening throttle momentarily, then recheck idle setting. Correct setting will be approximately ¾-1¼ turns of the screw from the inner seated position. Set throttle lever stopscrew for idling speed of 7 M.P.H. when pulling car in high gear.

PERFORMANCE:—Should be satisfactory for operation at altitudes less than 5000 feet if adjustments correctly made as directed above. If performance not satisfactory, check adjustments and tune up engine (see car model T&E page for tune up data). See Trouble Shooting Section below.

FLOAT LEVEL:—Fuel Level—Should be 23/32" below top edge of float bowl or just below lower edge of inspection hole on side of float bowl (remove inspection hole plug to check level).

Float Level—To check, invert upper body assembly (air horn and float bowl cover with complete float mechanism), measure from face of body gasket to top of raised seam on each float. Distance should be 1 27/64". To adjust, bend each float lever arm **using extreme care to secure equal setting for both floats.** DISASSEMBLY CAUTION—Before taking off Upper Body Assembly (to check or adjust float level), remove Idle Adjustment Screw, Spring and Idle Tube to avoid damage to tube and main nozzle when upper body assembly lifted off.

Inlet Needle Valve & Seat—Part No. 06287 (matched set).

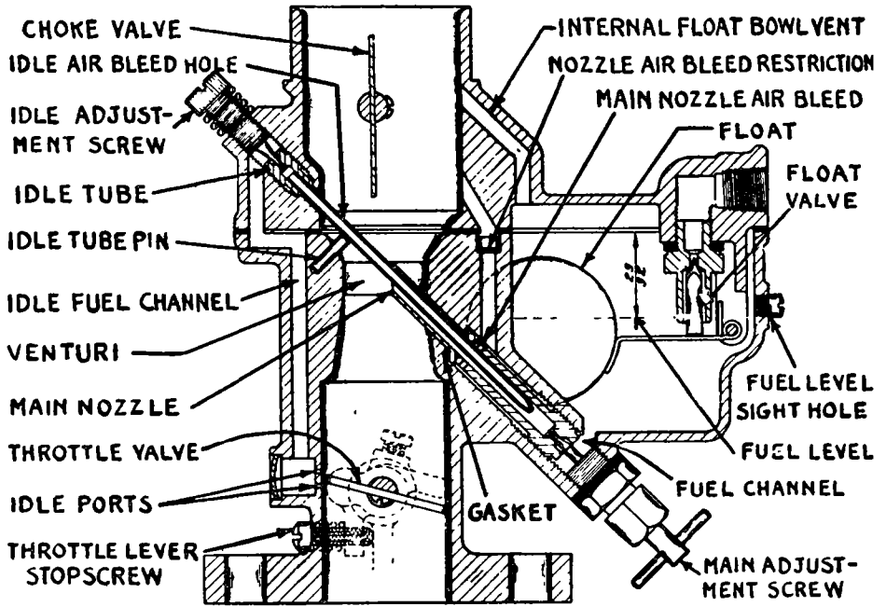
CHOKE:—Plain butterfly type. Adjust choke linkage so that choke valve is wide open when dash control button is pushed all the way in.

TROUBLE SHOOTING:—Engine Stalls—Check idle speed setting, tighten throttle stop retaining screw, check idling or low speed adjustment, see that idle adjustment screw not ringed, clean idle tube and idle fuel channels with air, check float level (see Fuel Level Note below).

Flatness on Acceleration—Check Idle (Low Speed) and Main (High Speed) Adjustments, check float level (if engine loads up, see Fuel Level Note below), clean idle tube and idle fuel channels with air.

Performance Unsatisfactory—Tune up engine (see car model T&E page for tune up data), check all carburetor adjustments.

Fuel Level Note—If fuel level in float bowl rises above setting, dismantle needle valve, clean needle valve and seat with a soft clean cloth, reseat needle valve by tapping with finger several times while turning needle around. Reset float level. If level not maintained, install new needle valve and seat.



SERVICING:—Before removing Upper Body Assembly (air horn and float bowl cover), remove Idle Adjustment Screw and spring, unscrew and remove Idle Tube through adjusting screw hole—this is important to avoid damage to tube and nozzle when upper assembly lifted off. Idle tube positioning pin in main body casting is not removable. Main nozzle outlet and gasket are staked in main body casting and cannot be removed (nozzle base can be removed through main adjustment screw plug hole after adjustment screw assembly removed). Blow out all jets and channels with compressed air—do not use wires or drills to clean passages. See that float bowl vent to air horn is open and clean.

Reassembly—Replace all worn or damaged parts with genuine Tillotson service parts. Use all new gaskets and replace parts in same order as removed. See that nozzles and plugs are tight. Set float level and adjust carburetor.

MODEL U-1B

WILLYS, PICK UP MODEL 440, PANEL DELIVERY MODEL 440P (1940)

TYPE:—High velocity, triple flexible expanding or automatic venturi type with venturi and reed design similar to that used on Model U-1A (Willys). Main nozzle and metering jet design (fixed type—no high speed adjustment) is new and operates as follows:

Fuel System (Closed Throttle Idling & Low Speed):—Fuel for idling is taken through side holes in main metering jet and channel to mixing chamber at idle adjusting screw (fuel metered by restriction at top of channel) where is mixed with air admitted through two bleeder openings (upper hole has restriction and leads to air horn above venturi assembly, lower hole leads to mixing chamber below venturi—see illustration) and controlled by the idle adjusting screw. Fuel mixture is then taken down through vertical channel (with restriction at upper end) to idle discharge ports at the throttle edge. For closed throttle idling, fuel mixture is discharged through lower port only. As soon as throttle is cracked open, additional fuel is discharged through top port. Idle system supplies fuel for car speeds up to 18 M.P.H.

Driving Range (18-60 M.P.H.):—At speeds above approximately 18 M.P.H., air velocity at nozzle tip in small venturi is sufficient to bring this nozzle into action, the fuel discharged through this nozzle being metered by the fixed metering jet at the nozzle base. The flexible reed valves are calibrated to maintain maximum velocity at nozzle tip (closed at low speed, open automatically at higher speeds) and correct air-fuel ratio throughout the entire driving range. Whenever throttle is opened for acceleration, additional fuel is discharged through accelerating pump nozzle above venturi (see Accelerating Pump below).

High Speed or Wide Open Throttle Operation:—At speeds above 60 M.P.H. or when throttle more than ¾ open, power jet valve plunger depressed by pump arm and opens power jet valve so that additional fuel is discharged through power jet in carburetor wall at top of venturi assembly. There is an air bleed at the top of the power jet fuel channel.

Main Nozzle Note—All fuel discharged by main nozzle through lower opening in nozzle tip. Upper opening in nozzle tip is not used. Use great care not to damage either opening in nozzle tip when servicing main nozzle as change in shape will alter air flow past nozzle and change discharge characteristics.

IDLE ADJUSTMENT:—With engine warmed up and choke valve wide open, set throttle lever stopscrew for slightly faster than normal idle speed, turn idle adjusting screw counter-clockwise (out) until engine begins to miss, then turn screw clockwise slowly until engine fires smoothly. Final setting should be approximately 1 turn open from inner seated position. Adjust throttle lever stopscrew for idle speed of 7 M.P.H. in high gear. See car model 'T&E' page for complete carburetor tune up instructions.

NOTE—If carburetor out of adjustment, turn idle screw in until it is seated, then back screw out exactly ¾ turn. Warm up engine and adjust as directed above.

PERFORMANCE:—Should be satisfactory if idle adjustment correctly made. Main metering jet is fixed type and no high speed adjustment provided. Standard metering jet should be satisfactory for operation at altitudes up to 3000 feet. For permanent operation at altitudes greater than 3000 ft., install high altitude metering jet (nozzle base) marked 'ALT'.

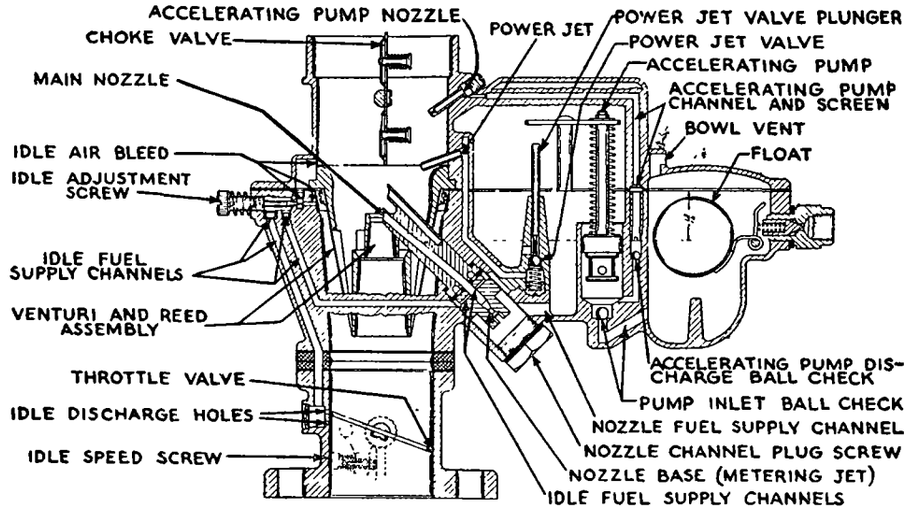
ACCELERATING PUMP:—Fuel is drawn into pump cylinder through intake ball check valve (in bottom of cylinder) when throttle is closed, and is discharged through outlet ball check valve, strainer (in plug at bowl cover flange) and pump jet in air horn when throttle is opened for acceleration. Upper section of pump piston is spring-loaded on stem to provide a prolonged pump discharge. **Adjustment**—On models where two holes provided in pump lever, engage link in hole nearest throttle shaft if flatness encountered on acceleration.

POWER JET:—Consists of a ball check valve controlling fuel discharge through power jet in carburetor wall above venturi and operated by accelerating pump arm (see Fuel System 'High Speed' above). No adjustment required.

FLOAT LEVEL:—Should be 13/16" below top edge (gasket seat) of bowl with engine running. To check float level, remove air horn and bowl cover assembly, remove gasket, use height gauge to measure actual fuel level below top edge of bowl. Do not press on float lever when checking (valve needle is spring-loaded which will permit some float movement with valve closed). To adjust, bend float lever slightly.
NOTE—When installing needle valve or float make certain that small spring is in place in hollow stem of valve needle. This spring is intended to minimize float movement and float level changes on rough roads.

CHOKE:—Manual control type, fitted with two poppet type relief valves. See that choke linkage properly adjusted to open and close choke valve fully.

SERVICING:—When servicing carburetor, blow out all channels and jets with compressed air (do not use wires or drills in jets or restrictions). Use extreme care not to bend valve reeds (if necessary to remove reeds, install short thick reed first and longer thin reed on outside). See that power jet valve ball seats tightly to prevent fuel discharge through power jet at intermediate speeds (check by



noting jet with engine running) and that plunger installed with small end down against valve ball. Make certain that pump plunger leather is good condition and contacts pump cylinder wall at all points (replace complete plunger assembly if leather worn or damaged). To remove nozzle, take out plug below metering jet, clean threads in casting thoroughly with compressed air, use socket wrench to remove metering jet, then remove nozzle from below taking great care not to damage threads in casting (if necessary, tap nozzle lightly on solid portion between upper and lower nozzle openings on upper end).

Reassembly—Replace all worn or damaged parts with genuine Tillotson service parts, use all new gaskets and re-install parts in same order as removed. Check gasoline level and idle adjustment as directed above.

TROUBLE SHOOTING:—**Motor stalls when idling**—Tighten throttle lever retaining screw and locknut, check idle adjustment. Remove idle adjusting screw, blow out all idling system channels and restrictions, clean metering jet with compressed air. Check fuel level. Tighten air horn and bowl cover retaining screws and carburetor mounting bolts, see that gaskets at these points are in good condition.

Flat Spots—Remove pump jet plug, clean pump jet and channels with compressed air. Remove air horn and bowl cover assembly, clean pump strainer (in pump outlet channel at air horn flange).

MODEL 61A5—Outline 9321
BANTAM, NEW SUPER FOUR SERIES 65 (1940)

TYPE:—Plain tube, updraft, 'balanced' type with float bowl vented through drilled hole in carburetor casting which opens into air horn. Fuel jets consist of a Low Speed or Idling System and a High Speed or Main Jet System in conjunction with a Compensating System which operate as follows:

Idling System—Fuel for closed throttle idling and low speed operation is taken from the main discharge jet well through a cross-drilled passage in the lower end of the main discharge jet and up through the idle fuel channel to the Idle Jet which meters this fuel. As the fuel leaves the idle jet it is mixed with air admitted through the Idle Air Channel and controlled by the Idle Adjusting Screw. The fuel mixture is then discharged through the Priming Plug port into the air stream at the throttle edge.

Main Jet System—At higher engine speeds, fuel is discharged directly from the main discharge jet into the throat of the venturi and the idling system drops out. This fuel is metered by the Main Jet located in the fuel channel below the main discharge jet and the discharge jet is air bled by admitting air from the idle air channel through the Well Vent and drilled cross-channels in the lower end of the main discharge jet. This well vent and air bleed channel form the Compensating System. The main jet and compensating system are not adjustable but the main discharge jet delivery can be made richer or leaner by changing the main discharge jet or the well jet (see Performance data below).

IDLE ADJUSTMENT:—Idle adjusting screw controls air for the idle fuel mixture. Adjust only when engine thoroughly warmed up and choke valve wide open. Set throttle stopscrew so that engine idles at 6 MPH., turn idle adjusting screw in or clockwise for richer mixture, out or counter-clockwise for leaner mixture until engine fires smoothly. Final position of adjusting screw should be 1-1½ turns out from inner seated position. Check idle speed and readjust throttle stopscrew.

CAUTION—If idle adjusting screw must be turned in less than ¾ turn from inner seated position for good idling performance, check carburetor for clogged idle channels and jet or for air leaks at gasket between main body and throttle body gaskets (see Servicing below).

PERFORMANCE:—Performance should be satisfactory if Idle Adjustment correctly made as directed above. If necessary to change main discharge jet fuel delivery calibration for special operating conditions, this fuel mixture can be made richer by either increasing the size of the Main Discharge Jet or decreasing the size of the Well Vent. The fuel mixture can be made leaner by either decreasing the size of the Main Discharge Jet or increasing the size of the Well Vent. See Jet Calibration Table below.

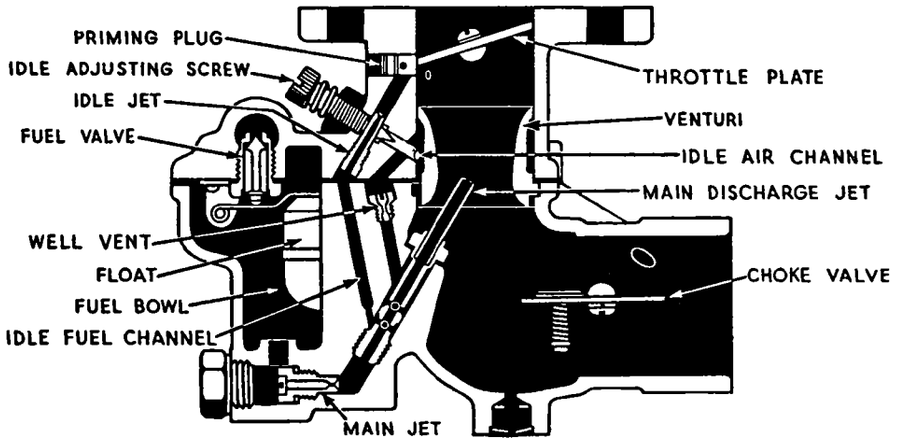
FLOAT LEVEL:—Fuel Level—Fuel level in bowl should be 13/32-15/32" below top edge (gasket seat) of float bowl.

Float Level—Bottom of float at free end should be 1 5/32" (plus or minus 5/64") from the gasket seat of the throttle body (bowl cover) with the needle valve closed. Check by inverting throttle body.

Adjustment—Manufacturer recommends that no attempt be made to correct float level by bending float arm. Install new parts to correct level.

CHOKE:—Butterfly type with poppet type relief valve. When checking choke linkage, see that choke valve is wide open when choke control button on instrument panel is pushed in, and that valve is fully closed when button is pulled out.

SERVICING NOTES:—Always use new Body Gasket #C142-16 between main body casting and throttle body casting whenever carburetor is dismantled for cleaning. Carburetor is 'balanced' type and air leaks at this point will upset carburetor performance.



ZENITH JET SPECIFICATIONS
Bantam—Model 61A5—Outline 9321

Part	Size	Part Number
Venturi	#16	C38-35
Main Jet	#18	C52-6-1
Idling Jet	#15	C55-6
Main Discharge Jet	#60-1	C66-26-1
Well Vent	#20	C77-18
Fuel Valve & Seat	#25	C81-17

NOTE—Fuel valve and Fuel Valve Seat (Float Valve) are furnished in matched sets. Always replace both parts as a unit.

CARBURETION EQUIPMENT SECTION

'CE' PAGES

The CARBURETION EQUIPMENT SECTION contains the *Complete Separate Treatment* of the SPECIAL EQUIPMENT connected with the Fuel System, such as Anti-Percolators, Automatic Chokes, Carburetor Controls, Fast Idle and Throttle Cracking Devices, Fuel Pumps and Gas Gauges. The Illustrations, Adjustment, Performance, Testing and Trouble Shooting of Each Unit is fully treated.

CARBURETION EQUIPMENT INDEX

NOTE: For CARBURETORS and CARBURETOR JET SPECIFICATIONS see The CARBURETOR INDEX in CARBURETOR SECTION.

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- A.C. Types AH, AS, AT CE-39
- A.C. Type AJ (Combination Fuel and Vacuum Pump) CE-40
- A.C. Type AN (Vacuum Pump only) CE-41
- A.C. Types B, O, P CE-29
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- A.C. Types F, I, J (Combination Fuel and Vacuum Pump) CE-34
- A.C. Types G, L, N (Ford) CE-32, 33
- A.C. Type R, W (with Oil Seal) CE-35
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- A.C. Type X (Combination Fuel and Vacuum Pump) CE-38
- Autopulse Electric Type CE-42
- King-Seeley Electric Type CE-43
- Stewart-Warner Types 383, 397, 403, 407, 414, 506, 514, 527. ..... CE-45
- Stewart-Warner Types 706, 708, 807, 814 ..... CE-46
- Stewart-Warner Electric Type CE-44

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- Hudson & Terraplane 1934-38 Models CE-28
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FUEL PUMP TESTING:
- A.C. Types CE-27

FUEL PUMP TROUBLE SHOOTING CE-27
GASOLINE GAUGES:
- A.C. Electric Type CE-48
- Auto-Lite Electric Type CE-49
- King-Seeley (K-S) Telegauge, Hydrostatic Type CE-50, 51
- King-Seeley (K-S) Electric Type CE-51
- Motometer (Auto-Lite) Types CE-52
- Stewart (Stewart-Warner) Electric Type CE-47

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- King-Seeley Types CE-50, 51
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STEWART GASOLINE GAUGE ..... See Gasoline Gauges
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FUEL PUMP TESTING:
- All AC Types CE-77

FUEL PUMP TROUBLE SHOOTING:
- All AC Types CE-77

GASOLINE GAUGES:
- AC Electric Type CE-48*
- Auto-Lite Electric Type CE-49*
- King-Seeley Electric Type CE-78
- Stewart (Stewart-Warner) Electric Type CE-47*

GASOLINE GAUGE TESTING:
- AC Electric Type CE-47*
- Auto-Lite Electric Type CE-49*
- King-Seeley Electric Type CE-78
- Stewart (Stewart-Warner) Electric Type CE-47*

GRAHAM SUPERCHARGER ..... See Mechanical Equipment Section

KING-SEELEY FUEL PUMP ..... See Fuel Pumps

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- Chrysler Type CE-78
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*Manual page number in latest edition of manual. For other editions, see previous Equipment Index listings.

CAPACITY AND PRESSURE TESTS FOR ALL TYPES

NOTE:—Manufacturer recommends that Fuel Pump Analyzer No. 1521551 be used in making these tests. All tests should be made with the fuel pump in place on the engine and the engine running to drive the pump. Engine speed should be 30-35 M.P.H. (for capacity test) or lowest possible idling speed (for pressure test).

TESTING:—Test equipment should be connected at pump outlet. Disconnect fuel line from pump to carburetor at pump, use special fitting and connect "T" connection, use rubber tubing to join gasoline line to end of "T", connect test equipment (bleeder line, pressure gauge and shut-off valve to open and close bleeder line) to side opening of "T" connection. Operate engine and make tests in following order.

CAPACITY TEST

Bleeder tube end must be at carburetor level or slightly higher. Shut-off valve should be open permitting fuel delivery through bleeder tube. Operate engine at 30-35 M.P.H. note quantity of fuel pumped in 45 seconds or 1 minute(see table below). Pressure gauge not used in making this test. If pump capacity in excess of 1 pint, check pump pressure (see test below), and if pressure not excessive pump need not be checked further. Delivery capacity of 1 pint is ample for all engine operation.

Fuel Pump Type	Minimum Capacity
A, B, E, G, J, L, N, O, P, R, S, T, V, W, X, Y	1 Pt. in 1 Minute.
C, D, F, I, AA, AB, AG, AH, AJ, AK, AU, AW	1 Pt. in 45 Seconds
AC, AD, AE, AF, AL, AM, AR, AS, AT	1 Pt. in 1 Minute.

PRESSURE TEST

Idle engine at lowest possible speed to secure static pressure reading. Close shut-off valve. Note pressure gauge reading. Pressure should not exceed figure in table below. If pressure does not exceed this figure and capacity is satisfactory, fuel pump operation is OK. Excessive pressure may cause rich fuel mixture and in extreme cases flooding of carburetor (if carburetor floods and pressure is not excessive, check carburetor float level setting and see that float needle valve shuts off tightly).

Fuel Pump Type	Maximum Pressure
A, B, E, G, J, L, N, O, P, R, S, T, V, W, X, Y	3½ pounds.
C, D	4¼ pounds.
F, I, AA, AB, AK, AU	4½ pounds.
AC, AF, AR	3 pounds.
AD, AE, AG, AL, AM	3½ pounds.
AH, AW	3¾ pounds.
AJ	4 pounds.
AS, AT	4¼ pounds.

TROUBLE SHOOTING

FUEL PUMP UNIT

TROUBLE SHOOTING:—If the pump action is not satisfactory, check in accordance with the following table:

No Fuel or Insufficient Fuel at Carburetor:

(1) Gasoline tank empty.
(2) Bent, kinked, leaky tubing or connections. Tighten all connections. Check condition of tubing. Replace if necessary.
(3) Dirty filter screen or loose sediment bowl. Take off glass sediment bowl, clean filter screen. Examine cork gasket and replace if necessary. Tighten bowl thumbnut securely.
(4) Loose valve plugs or caps. Examine gasket under head of plug, replace if necessary. Tighten plugs securely.
(5) Dirty or warped valves. Loose valve seat. Remove valve plugs and take out valves. Wash valves in gasoline. If warped or gummed, replace. Examine valve seat for smooth surface and see that seat is tight in pump body. Replace valves and assemble valve springs and plugs.
(6) Worn linkage, weak driving spring. Check for excessive play in linkage or worn rocker arm pin which will shorten pump stroke. Check driving spring (under diaphragm).
(7) Insufficient pump capacity. Check capacity (above).

Fuel Leakage through Vent in Pump Body:

(1) Worn or punctured diaphragm. Replace diaphragm.
(2) Loose diaphragm nut or defective gasket. See that nut on upper end of pull rod is tight and that gasket under nut is in good condition.

Fuel Leakage at edge of Diaphragm:

(1) Loose cover screws. Tighten cover screws securely (alternately around pump body).

Carburetor Flooding:

(1) Carburetor needle valve not seating. Check for worn valve or seat, sediment or other obstruction preventing seating of valve. Check float level.
(2) Excessive pump pressure. Check pressure (above).

VACUUM PUMP UNIT

TROUBLE SHOOTING:—If vacuum pump performance is not satisfactory as evidenced by faulty windshield wiper action, check as directed in following table:

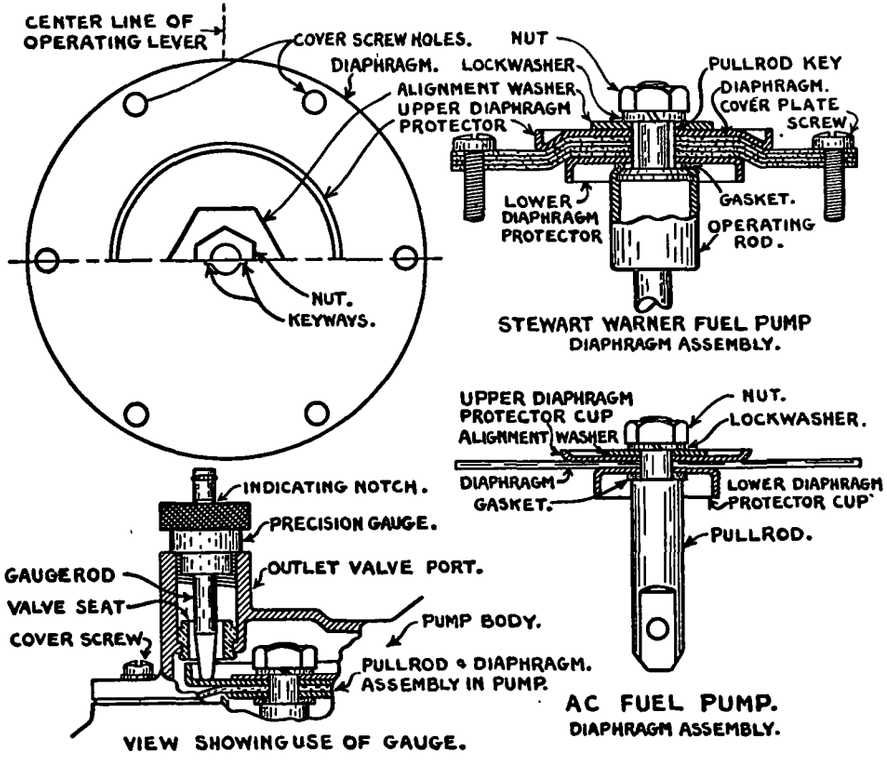
Windshield Wiper operations slow at high speeds or when accelerating. Indicates that vacuum pump is not operating. Check windshield wiper lines and fittings. If no leaks are found, disassemble vacuum pump and check valves and diaphragm.

Oil Smoke in Engine Exhaust. Indicates punctured diaphragm. To check before disassembling pump, disconnect line between pump and manifold, operate pump, hold a piece of paper over pump outlet. Oil spray in exhaust from pump indicates a punctured diaphragm (if no oil spray noted at this point, oil smoke may indicate defective piston rings, etc.

TESTING:—When fuel pump fails to operate satisfactorily, check pump for minor defects as directed on individual system pages before any attempt is made to disassemble pump. Manufacturers recommend that pump be given an operating test after being removed from engine to conclusively determine that pump is defective. See directions below.

TO REPLACE DIAPHRAGM:—Special fixtures and gauges are necessary in replacing diaphragms on A.C. pumps. To replace diaphragm, mount pump body rigidly in vise or on a test stand, take off pump cover (first mark pump cover and pump body to insure correct reassembly), take off nut on end of pull-rod, remove lock washer, alignment washer, upper diaphragm protector cup and old diaphragm. To install new diaphragm, assemble pull-rod gasket and lower diaphragm protector cup (with cup portion pointing down) on pull-rod, taking care that gasket is seated against shoulder on pull-rod. Then place four layers of diaphragm material on pull-rod and carefully line up holes, using a special locating ring or several cover plate screws. Place upper diaphragm protector cup on pull-rod (with cup portion pointing up), place hexagonal alignment washer on diaphragm protector, and assemble lock washer and pull-rod nut. Use special wrench to hold the alignment washer from turning while the nut is being tightened and keep diaphragm holes lined up with the locating ring or several of the cover screws until the nut is tight. This is very important. Place pump cover in position and insert cover screws. Before cover screws are tightened, insert end of alignment wrench in hole in pump body and force pull-rod and diaphragm assembly to extreme upper position and hold in this position while cover screws are evenly tightened (tighten screws alternately to secure correct alignment of pump cover). Test diaphragm assembly by installing precision gauge in outlet valve port so that gauge rod rests on upper diaphragm protector cup. With the diaphragm correctly installed and in the extreme upper position the notch in the gauge rod should be visible at the top of the gauge.

Combination Fuel and Vacuum Pumps. Diaphragms should be installed in this type pump with the pull-rod assembly out of the pump. Clamp the flatted end of the pull-rod in a vise, assemble pull-rod gasket and lower diaphragm protector (cupped side down) on pull-rod, place five layers of diaphragm material on pull-rod, lining up the tabs on the layers and turning the diaphragm so that the tabs are 7/16 inch clockwise from the center line of the pull-rod flatted end. Assemble upper diaphragm protector (cupped side up), alignment washer, lock washer and nut. Hold alignment washer with special wrench and securely tighten nut. Test diaphragm position to make certain that diaphragm layers have not been twisted or moved from position. This is very important. Assemble leather oil seal and cap on pull-rod boss, install driving spring, place pull-rod assembly in pump with diaphragm tab pointing toward center of mounting flange on pump body. Invert pump and engage flatted end of pull-rod in notch in operating link, turn pull-rod assembly one quarter turn until tab points toward projection on diaphragm flange. This will lock pull-rod and operating link Then assemble pump cover as directed above.



HUDSON AND TERRAPLANE MODELS

1934-35-36 PUMP REPLACEMENT

NOTE:—Manufacturer recommends that 1937 Fuel Pump, Type AK #1523289, be used for replacement purposes on these earlier models. New pump has greater capacity and will supply fuel under conditions which may cause Vapor Lock in the smaller original pumps.

INSTALLATION:—Same gasket and spacer assembly must be used with this Type AK pump, when installing pump on earlier models, as is used on 1937 car models to secure correct pump stroke (original pump used single gasket only). See 1937 pump installation data (following).

1937-1938 PUMP INSTALLATION

TYPE AK FUEL PUMPS:—Special spacer (composed of five layers with total thickness of .275" which compresses to .250") must be installed between pump baffle and pump mounting flange. This spacer must not be confused with type used on combination fuel-and-vacuum pumps (see following section) which is same size. To install pump, place spacer assembly next to fuel pump mounting flange, then the baffle with the flat side toward the fuel pump, install gasket between baffle and crankcase. Make certain that insulating sleeves installed on mounting capscrews and insulating washers under capscrew heads.

NOTE—To correct pump noise on early 1937 models (similar to noisy tappet) caused by pump operating lever striking right side of crankcase, file back of lever near end slightly (bright spot on lever will show where it has been striking).

TYPE AB COMBINATION FUEL-AND-VACUUM PUMPS:—This pump cannot be installed on earlier models (cam too narrow and stroke insufficient). Special spacer (composed of six layers with total thickness of .312" compressing to .281" when installed) must be used between pump mounting flange and crankcase. Baffle is installed in recess in pump mounting flange (see Note on baffle gasket below). Install baffle with flat side toward pump and small tongue over oil return hole at bottom (if baffle reversed, flange at top will strike pump arm, and drain hole flapper will prevent oil returning to crankcase and cause oil leakage through breather hole in pump body). Spacer acts as gasket between pump and crankcase. Make certain that pump operating lever is placed between camshaft and right side of crankcase before installing mounting screws.

NOTE—On all 1937 and first 1938 combination fuel-and-vacuum pumps, vellumoid gasket, Part No. 156324, should be installed between oil baffle and pump body whenever pump removed for servicing. This gasket acts as oil seal. On later models, baffle recess is shallower and no gasket is needed.

TYPE B

Std. Equipment On:

AUBURN 6, MODELS 653 (1935), 654 (1936-37)
AUBURN 8 & SCHGD. 8, 851 (1935), 852 (1936-37)
BUICK, MODEL 50 (1932)
CHEVROLET, ALL MODELS (1932-33)
CHRYSLER 6, CI ('32), C7 ('36), C16 ('37), C18 ('38), C22 RHD ('39)
CONTINENTAL, ACE MODEL 81 (1933)
DE SOTO, SC ('32), S1, S2 ('36), S3 ('37), S5 ('38), S6 RHD ('39)
DODGE 6, DL ('32), DP ('33), DR, DS ('34), DU ('35), D2 ('36), D5 ('37), D8 ('38), D11 RHD ('39)
ESSEX-TERRAPLANE, ALL MODELS (1932)
FRANKLIN, MODELS 18-B, 18-C, 19-A, 19-B (1934)
NASH SIX, 960, 1060 (1932), 1120 (1933)
NASH EIGHT, 970, 1070 (1932), 1130, 1170 (1933)
NASH EIGHT, 980, 990, 1080, 1090 (1932)
PLYMOUTH, PC, PD ('33), PE, PF ('34), PJ ('35), P1, P2 ('36), P3, P4 ('37), P5, P6 ('38), P7, P8 RHD ('39)
PONTIAC, SIX & EIGHT (1932)
WILLYS-OVERLAND, MODELS 690, 888 (1932-33)
WILLYS-KNIGHT, MODEL 66-D, 66-E (1932-33)

DESCRIPTION:—**The AC Fuel Pump is a mechanically operated gasoline pump. The pump is mounted on the side of the engine block and is driven through a rocker arm by an eccentric cam on the camshaft. It supplies gasoline at a positive pressure directly to the float chamber of the carburetor. The gasoline flow is controlled entirely by the needle valve in the carburetor float chamber and by the speed of the car so that the operation of the pump is entirely automatic.**

OPERATION:—**The shaft (G) which supplies power to operate the pump is ordinarily the camshaft of the engine. When the camshaft is rotated, the eccentric cam (H) causes the rocker arm (D) to move backward and forward. The movement of the rocker arm which is pivoted at (E) pulls down the pull rod (F) together with the pump diaphragm (A) which is bolted on the upper end of the pull rod between the cup shaped metal discs (B). This creates a vacuum in the pump chamber (M) which causes gasoline from the fuel tank at the rear of the car to enter the pump through the inlet (J) into the sediment bowl (K) through the filter screens (L) and the inlet valve (N) and fill the pump chamber. As the eccentric completes a revolution the rocker arm ceases to pull on the pull rod and the driving spring (C) forces the pull rod and diaphragm upward. This closes the inlet valve and opens the pressure valve (O) causing the gasoline to flow through the outlet (P) to the carburetor float chamber. When the carburetor bowl is filled and the float needle valve closes, the pressure of the gasoline backed up in the pump chamber is sufficient to hold the driving spring (C) compressed, holding the pull rod and diaphragm in its lowest position. The movement of the rocker arm which continues as long as the engine is absorbed by linkage (T). Pump remains inoperative until sufficient gasoline has been used from the carburetor float chamber to allow the driving spring to force the pull rod upward again when the pump resumes operation. This spring (S) is used merely to keep the rocker arm in contact with the eccentric to eliminate noise and to take up the free motion of the linkage and rocker arm break.**

PERFORMANCE:—See article on Fuel Pump Testing.
Capacity—1 pint in 1 minute. **Pressure**—3½ lbs. maximum.

TROUBLE SHOOTING:—See article on Fuel Pump Trouble Shooting. Use Fuel Pump Analyser to check performance before removing pump from car.

SERVICING:—See previous page on 'Servicing Fuel Pumps' for complete directions on servicing these pumps. Manufacturer recommends that pump not be disassembled further than is necessary to make tests and repairs outlined above. Special fixtures are necessary in reassembling the pump.

TYPES O & P

TYPE O

Std. Equipment On:

BUICK, MODEL 50 (1932-33)

TYPE P

Std. Equipment On:

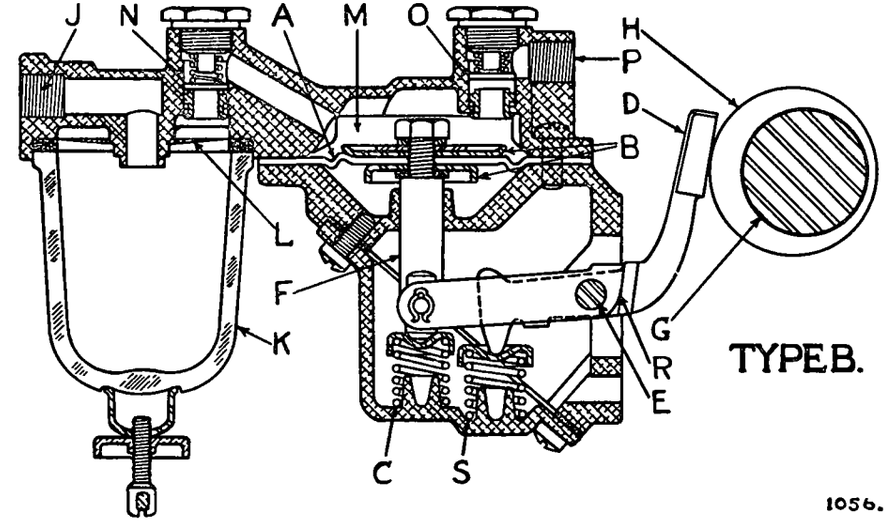
CHRYSLER SIX, CI ('32), CP ('33), CA, CB ('34), C6 ('35)
CHRYSLER IMPERIAL, MODEL CU (1934)
CONTINENTAL, BEACON (1933-34), FLYER (1933)
DE SOTO, SC ('32), SD ('33), SE ('34), SF, SG ('35)
DODGE SIX, MODEL DL (1932)
GRAHAM SIX, 58 ('32), 65 ('33), 74 ('35)
GRAHAM EIGHT, 57 ('32), 64 ('33)
GRAHAM MODELS 80, 90 ('36), 85, 95 ('37)
PLYMOUTH, MODEL PB (1932)
PONTIAC EIGHT, MODEL 603 (1932)
REO, S4 (1934), 6A, 7S (1935)
STUDEBAKER PRESIDENT, 2C (1936), 3C (1937)
WILLYS, MODEL 77 (1933-34-35-36)

These types are assembled from parts used on other pump types. For servicing information see data on previous types, as follows:
Series O:—Pump body—Series B. Pump cover—Series E.
Series P:—Pump body—Series E. Pump cover—Series B.

PERFORMANCE:—See article on Fuel Pump Testing.
Capacity—1 pt. in 1 min. **Pressure**—3½ lbs. maximum.

SERVICING:—See articles on Types "B" and "E" for complete data.

TROUBLE SHOOTING:—See article on Fuel Pump Trouble Shooting. Use Fuel Pump Analyser to check performance before removing pump from car.



TYPE B.

Std. Equipment On:

CADILLAC V8, ALL SERIES (1932-33-34-35)
CADILLAC V12 & V16, ALL SERIES (1932 to 1937)
CHRYSLER EIGHT, CT ('33), CZ ('35), C8 ('36)
CHRYSLER AIRFLOW, C1, C2, C3 ('35), C9 ('36)
CHRYSLER IMPERIAL, C14 ('37), C19 ('38), C23 RHD ('39)
CHRYSLER CUSTOM IMP., C15 ('37), C20 ('38), C24 RHD ('39)
CORD, MODEL 810 ('36), 812 ('37)
DODGE EIGHT, DK ('32), DO ('33)
FRANKLIN TWELVE, 17, 17-B (1932-33-34)
HUPMOBILE EIGHT, 621-N ('36), 825-H ('38), 925-H ('39)
LA SALLE V8, ALL SERIES (1932-33)
LINCOLN, V8 & V12 MODELS (1932)
PIERCE ARROW, 8 & 12 CYLINDER MODELS (1936-37-38)

DESCRIPTION:—The Type D is a mechanically operated, diaphragm type pump and is similar in design and operation to the other A.C. types except that the driving spring (C) is located within the lower cover of the pump body and bears directly on the lower end of the pull rod instead of being located within the upper pump body and bearing on the lower diaphragm protector.

OPERATION:—As in previous pump designs, the down stroke of the diaphragm and pull rod is positively operated, the pull rod being pulled down through the movement of the rocker arm toward the pump body as the eccentric (H) is rotated by the rotation of the camshaft. The rocker arm (D) and pull rod (F) are connected by a linkage. The downward movement of the diaphragm (A) creates a vacuum in the pump chamber (M) and gasoline is drawn in through the inlet (J) into the glass sediment bowl (K) and then through the filter screen (L) and suction valve (N) into the pump chamber. When the down stroke is completed, the rocker arm is forced to follow the face of the eccentric by the rocker arm spring (S), releasing the pull rod linkage and allowing the driving spring (C) to force the diaphragm upward. This forces the gasoline in the pump chamber out through the pressure valve (O) and the outlet (P) to the carburetor.

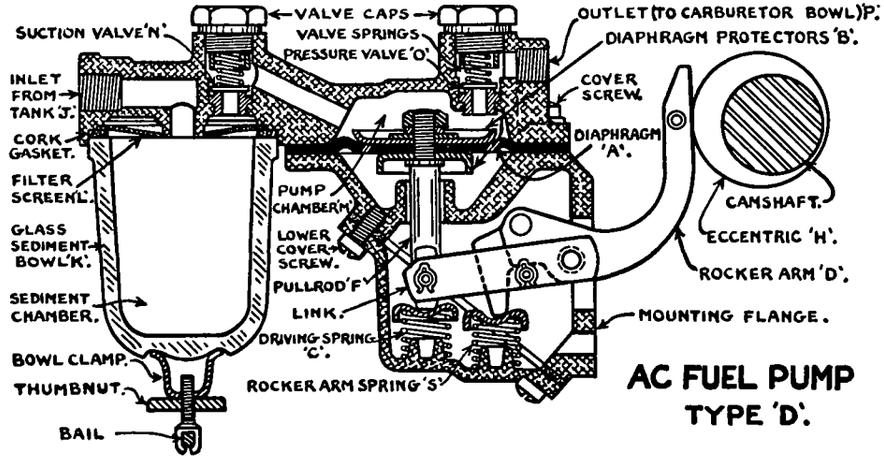
Fuel delivery is controlled by the back pressure of gasoline in the delivery line, so that whenever the carburetor float valve closes the back pressure holds the diaphragm at the bottom of its stroke with the driving spring compressed. The rocker arm continues to move as long as the eccentric cam rotates but this movement is absorbed by the linkage. Whenever the carburetor float valve reopens the pumping action is resumed.

PERFORMANCE:—See article on Fuel Pump Testing.

Capacity—1 pint in 45 seconds. **Pressure**—4¼ lbs. maximum.

SERVICING:—For complete directions on dismantling pump for diaphragm replacement, assembly of new diaphragms and bench testing of pumps, see separate page on 'Servicing Fuel Pumps'. Manufacturer recommends that pump not be disassembled further than is necessary to complete the operations noted in table above as special fixtures are necessary to reassemble pump.

TROUBLE SHOOTING:—See article on Fuel Pump Trouble Shooting. Use Fuel Pump Analyser to check performance before removing pump from car.



Std. Equipment On:

CHRYSLER SIX, MODEL CI (1932)
DE SOTO, MODEL SC (1932)
DODGE SIX, MODEL DL (1932)
ESSEX-TERRAPLANE, SIX & EIGHT MODELS (1933)
GRAHAM, SIX 58 ('32), EIGHT 57 ('32), 57A ('33)
HUDSON, SUPER SIX (1933)
OLDSMOBILE, SIX F-32 ('32), F-33 ('33), EIGHT L-33 ('33)
PLYMOUTH, MODEL PB (1932)
REO SIX, S ('32), S2 ('33), 6A ('36)
REO EIGHT, 8-31, 35, 52 ('32), N1, N2 ('33-34)
ROCKNE, 65, 75 ('32), 10, 31 ('33)

DESCRIPTION:—This fuel pump is of the mechanical, diaphragm type. It differs from previous designs in that the linkage has been simplified and the rocker arm spring relocated (see illustration). An air dome over the outlet valve is used. In servicing (replacing diaphragm), a preliminary assembly must be made with the pullrod out of the pump and the complete assembly then installed (see complete directions below).

OPERATION:—The down stroke of the diaphragm is positively actuated by the rocker arm 'D', which is connected to the pullrod 'F' through the link 'R'. The down stroke of the diaphragm causes a vacuum in the pump chamber and gasoline is drawn through inlet into the sediment chamber, through the filter screen 'L', and the inlet valve 'N' into the pump chamber 'M'. The rocker arm is forced to follow the eccentric driving cam by the rocker arm spring 'S', releasing the pullrod linkage, and the diaphragm is then forced up by the driving spring 'C', forcing the gasoline in the pump chamber through the outlet valve 'O' and the pump outlet to the carburetor. Fuel delivery is controlled by the back pressure of the gasoline in the carburetor float bowl so that when the carburetor float valve closes the back pressure will hold the diaphragm at the bottom of its stroke with the driving spring compressed. The rocker arm continues to move with the rotation of the eccentric cam but this action is absorbed by the pump linkage. Whenever the carburetor float valve reopens, the pumping action is resumed.

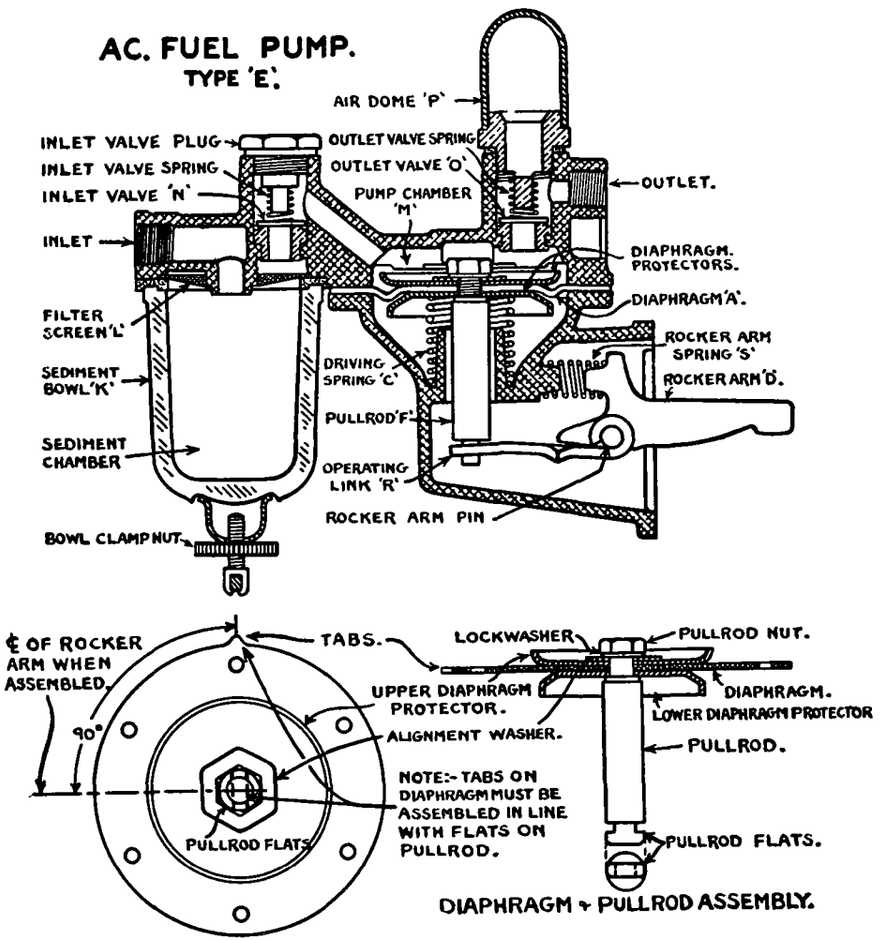
PERFORMANCE:—See article on Fuel Pump Testing.
Capacity—1 pt. in 1 min. Pressure—3½ lbs. maximum.

TROUBLE SHOOTING:—See article on Fuel Pump Trouble Shooting. Use Fuel Pump Analyser to check pump performance before removing pump from car.

SERVICING:—Servicing and testing of this type pump is similar to previous types (see page on 'Servicing Fuel Pumps') except for replacement of diaphragm. Complete directions for replacement of diaphragm are given below. Manufacturer recommends that pump not be disassembled further than is necessary to make tests and repairs indicated in Trouble Shooting table as special fixtures are necessary for reassembly.

Diaphragm Replacement:—With pump disassembled (pullrod out of pump body) and old diaphragm removed, clamp pullrod in vise, engaging flatted end of pullrod between vise jaws. Assembled pullrod gasket, lower diaphragm protector (cupped side down), four layers of diaphragm cloth, upper diaphragm protector (cupped side up), alignment washer, lock washer, pullrod nut, on pullrod in order given. Line up tabs on diaphragm and turn diaphragm layers so that tabs are in line with flatted end of pullrod (see illustration). Use special alignment washer wrench (#846291) and keep diaphragm from twisting or turning while pullrod nut is being tightened. Remove complete assembly from vise, clamp pump body in vise, place driving spring in position, insert diaphragm assembly, push down on diaphragm assembly (compressing driving spring), engage flatted end of pullrod in rocker arm link, turn diaphragm assembly 90° to right or left until holes in diaphragm line up with holes in pump body. Place pump cover in position, engage cover screws, flex diaphragm to extreme high position while tightening cover screws. Diaphragm gauge (#846295) used in testing assembly on previous pump designs should not be used on Type E pumps.

Rocker Arm Linkage. Whenever rocker arm or rocker link is removed from pump, make certain that link is replaced with loop upward (see illustration). Rocker arm pin must be secured with retaining rings.



TYPE G
MODELS B, BB FOUR CYLINDER CARS & TRUCKS (1932-33)

TYPE L
MODEL 18 V8 CARS & TRUCKS (1932)—EARLY PRODUCTION.

TYPE N
MODEL 18 (1932), 40 (1933) V8 CARS & TRUCKS.

NOTE:—1934 and later Ford models equipped with AC Type R fuel pump. See article on Type R pump for data on these later models.

DESCRIPTION:—The Ford Fuel Pumps are mechanically operated diaphragm pumps mounted on the crankcase and driven by an eccentric on the camshaft. Two types of pump have been used on the V-8 models. The principal difference in these types is in the linkage (see illustration). On the first type pump, diaphragm and pullrod were pulled down by the pushrod spring when the pushrod was moving downward as the eccentric moved away from the pump (downward). On this type the pushrod merely compressed the pushrod spring on the upstroke. On the later type V-8 pump and the four cylinder model, the diaphragm and pullrod were pulled down positively by the pushrod linkage. Both pumps are similar in operation in that the downstroke of the diaphragm and pullrod are completed on the high point of the camshaft eccentric with the pushrod or operating lever moving toward the pump body.

OPERATION:—As the camshaft eccentric rotates and forces the pushrod (V-8) or operating lever (4 cyl.) toward the pump body, the operating linkage pulls the diaphragm and pullrod down creating a vacuum in the pump chamber. This causes gasoline to flow from the main tank through the inlet into the sediment chamber and then through the filter screen and down through the inlet valve into the pump chamber, filling it with gasoline. As the pushrod or lever moves away from the pump (being forced to follow the eccentric by the linkage or pushrod spring), the driving spring under the diaphragm forces the diaphragm upward, forcing the gasoline out through the outlet valve to the carburetor, the inlet valve being closed meanwhile by the inlet valve spring. When the pushrod reaches the bottom of the stroke, the cycle is repeated.

PERFORMANCE:—See article on Fuel Pump Testing.
Capacity—1 pt. in 1 minute. **Pressure**—3½ lbs. maximum.

TROUBLE SHOOTING:—The following repairs may be performed on the pump without removing the pump from the engine. If the trouble cannot be located and repaired by these tests the pump should be removed and dis--assembled on the bench:

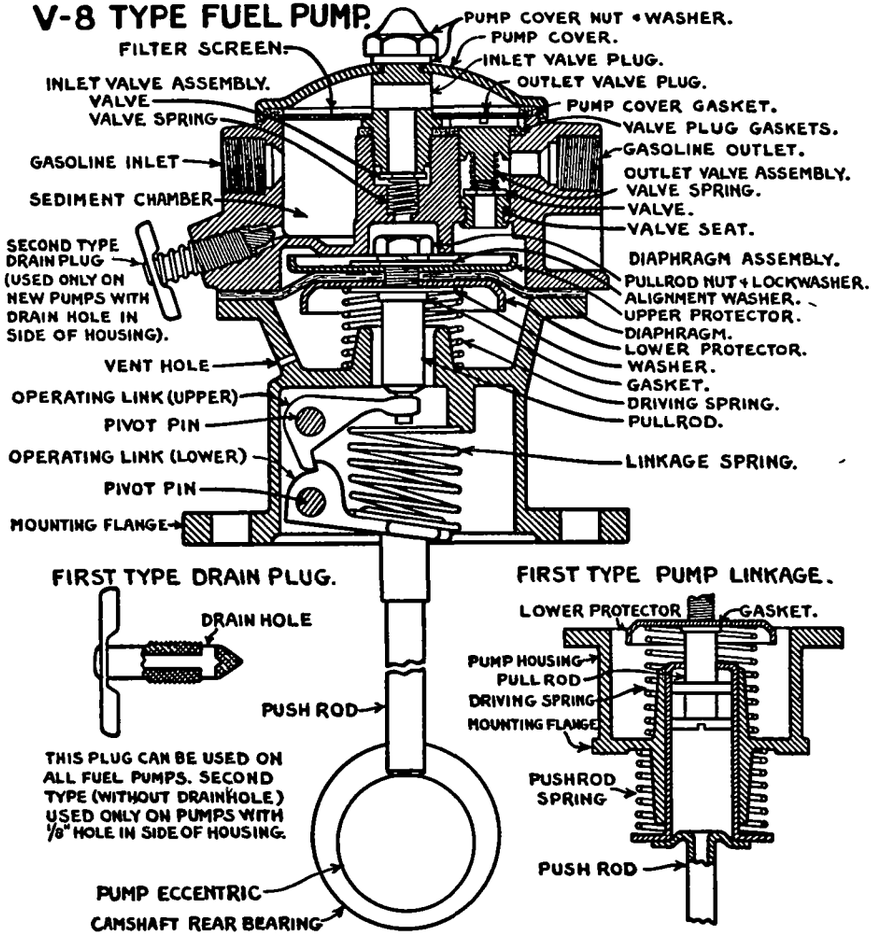
1. **Loss of Vacuum.** Pumping action is erratic or pump fails completely. Tighten all connections in gasoline line between tank and pump, tighten drain plug, examine gaskets under pump cover and pump cover nut, tighten pump cover nut.

2. **Filter Screen Clogged.** Filter screen is located under pump cover. Take off pump cover nut, remove pump cover and clean screen. If necessary, replace screen with new design incorporating reinforcing ribs to prevent distortion of the screen. See that cover gasket and cover nut gasket are in good condition before reassembling.

3. **Dirty or Warped Valves, Loose Valve Plugs or Seat.** Remove pump cover and valve plugs and inspect valves. Wash valves in gasoline. Replace if warped or damaged. Examine valve seats and see that outlet seat is tight in pump body. In replacing valves, see that springs are installed properly. Make certain that valve plug gaskets are in good condition and that plugs are tightened securely. Inlet valve plug should be examined whenever pump cover is removed as plug may be loosened by taking off pump cover nut.

4. **Leaks at Diaphragm.** Tighten upper pump body screws evenly and securely. Make certain that leakage is actually occurring at this point and not at the drain plug or pump cover.

5. **Sediment and Water in Pump.** Fuel pumps are provided with a sediment chamber in the pump body and a drain plug on the side of the upper pump body. On the first type pumps the drain plug was hollow and sediment and water could be drained off by unscrewing the drain plug slightly. On later pumps a ⅛ inch hole was drilled through the side of the drain plug boss and a new Type B-9185-B solid drain plug used. Water is drained from this type pump by unscrewing the drain plug until this hole is connected to the sediment chamber. The first Type B-9185-AR drain



plug (which may be identified by the hole just back of the taper seat) can be used on either type pump but the new type drain plug without this hole should only be used on pumps with the ⅛ inch drain hole drilled in the pump housing. Water and sediment should be drained from the pump at approximately 1000 mile intervals.

6. **Leakage at Vent Hole.** This may indicate a punctured diaphragm or leakage around the pullrod. This will require disassembling of the pump, replacement of the diaphragm or replacement of the pullrod gasket and tightening of the pullrod nut (see instructions below).

7. **Sticking Pushrod (Type L Pump only).** Remove pump from engine and examine action of pushrod. Clean pushrod and spring or replace if necessary.

SERVICING:—If the above operations do not correct pump trrouble or if it is necessary to disassemble pump to replace diaphragm or correct leakage at pullrod, spot upper and lower pump bodies to assure correct reassembly, remove pump cover by taking off pump cover nut, remove upper pump body by taking out upper body screws. This will expose diaphragm assembly. In replacing diaphragms, diaphragm assembly must be completed off the pump on both the new V-8 and 4 cylinder pumps. This will require disengaging the pullrod from the operating link and mounting the pullrod in a vise.

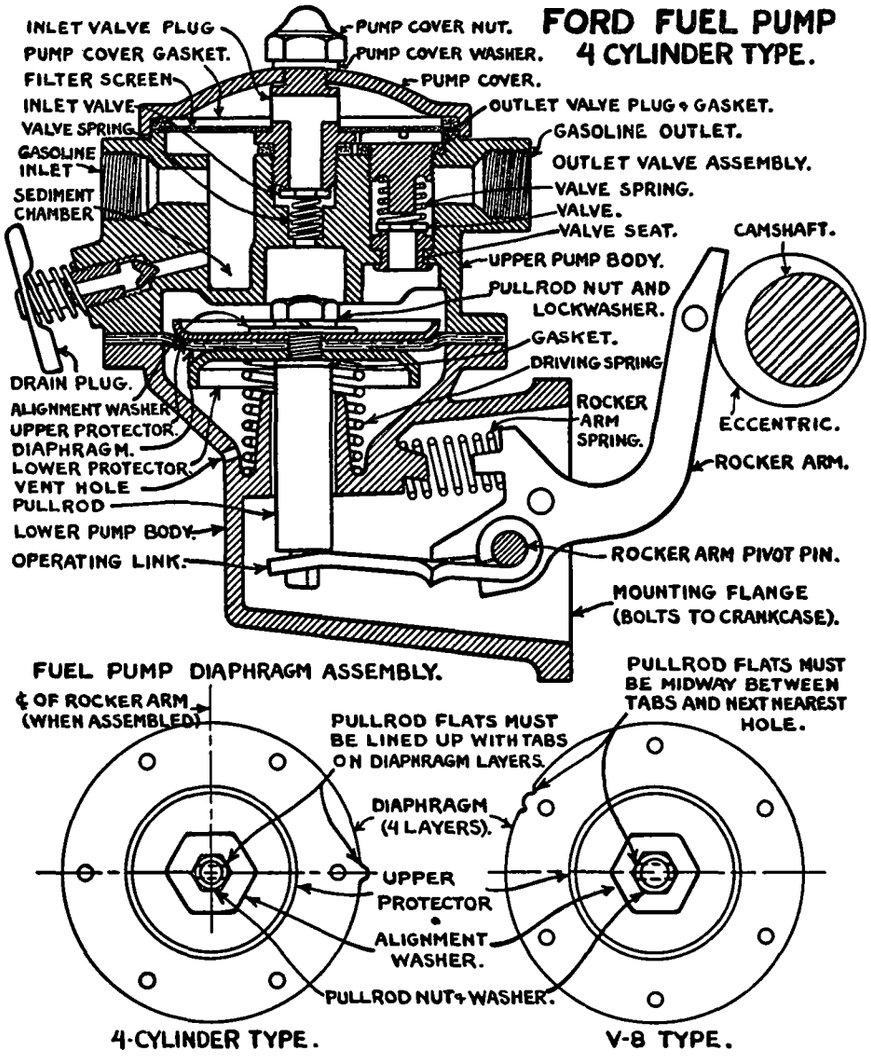
Diaphragm Assembly. Clamp flatted end of pullrod in jaws of bench vise (Type B-9393 rod, 2⅛" long over all on 4 cyl. pump. Type 18-9405-B rod, 1 13/16" long over all on new type V-8 pump). Place pullrod gasket over threaded end of pullrod. Place lower diaphragm protector washer with dished side down on pullrod above gasket. Place four layers of diaphragm material on pullrod (these must all be new—never use some old layers), lining up tabs on circumference of diaphragm with center line of flats on pullrod (4 cyl. pump), or so that center line of flats is midway between tabs and next nearest hole (V-8 pump)—see illustration. Place upper diaphragm protector on pullrod above diaphragm with dished side up. Assemble alignment washer, pullrod lock washer, and pullrod nut in order and tighten nut loosely with the fingers. Then hold diaphragm alignment washer from turning with special wrench No. V-83 and tighten pullrod nut securely. It is very important that the diaphragm should not turn or become wrinkled while tightening the nut and the position of the tabs must be checked after the nut is tight.

Remove diaphragm assembly from vise, clamp pump body in vise, place diaphragm spring in position in pump body with lower end over boss, dip diaphragm assembly and pullrod in kerosene and install in pump. The tabs on the diaphragm should be in line with the pullrod on the 4 cylinder pump and 30° to one side of the center line of the rocker arm on the new type V-8 pump. Push downward on the diaphragm compressing the spring until the flatted end of the pullrod is engaged in link and turn diaphragm 90° to correct position. If holes in diaphragm do not line up with holes in mounting flange when diaphragm assembly is turned 90°, turn slightly so that holes line up and tabs are at point nearest 90° from original position (see illustration).

Important. In assembling upper pump body, place upper pump body over diaphragm, insert cover screws and turn down cover screws loosely or until they touch the lock washers. Then press in on pump lever (4 cyl. pump), or use a small rod to press up on lower pump link (V-8 pump) so that diaphragm is at the lowest possible position. Hold diaphragm in this position and tighten the cover screws evenly and securely. This is necessary in order to secure the correct pump stroke.

Rocker Arm and Link Assembly. Whenever rocker arm and link have been disassembled, the link should be installed in the pump body with the flange upward (see 4 cylinder Type G illustration) and the rocker arm inserted so that it engages one side of the link. Rocker arm pin should then be inserted through hole in pump body so that it engages one side of the rocker arm. Then place rocker arm spring in position, making certain that spring engages projection on rocker arm. Then hold rocker arm in operating position and force pin through rocker arm and link so that it enters the second hole in the pump body, assemble retaining rings on pin. See that rocker arm operates freely.

OPERATING TEST:—The pump may be tested by connecting a piece of rubber tubing approximately 30 inches long to inlet opening, immersing the end of the tubing in a pail of gasoline and operating the pump by hand. The pump should raise gasoline 30 inches and should deliver fuel at the outlet after not more than forty strokes. If fuel does not flow from the outlet after forty strokes, the pump will not perform satisfactorily on the car. The pump suction and pressure may be tested by holding the finger alternately over the inlet and outlet openings while the pump is operated. When



installed on the car, the pump should prime itself and deliver fuel to the outlet in twenty seconds or less with the engine being turned over by the starter.

Std. Equipment On:

TYPE F

BUICK, 60, 80, 90 (1932-33), 60, 90 (1934)
PACKARD EIGHT, ALL MODELS (1933 to 37)
PACKARD SUPER EIGHT, ALL MODELS (1932 to 38)

TYPE I

BUICK, 50 (1934-35), 60, 90 (1935)
CHRYSLER, CP, CH, CL ('32), CL*, CQ ('33), CV, CW ('34), CW* ('35), C8, C10, C11 ('36), C14 ('37), C19 ('38)
LA SALLE, ALL MODELS (1934-35-36)
LINCOLN, ALL V12 MODELS (1933 to 39)
PACKARD, EIGHT & SUPER EIGHT (1935)
PACKARD TWELVE, ALL MODELS (1933 to 39)

TYPE J

HUPMOBILE, MODELS 421-J, 427-T (1934)
NASH, 1180, 1190 (1933)
OLDSMOBILE EIGHT, MODEL L-32 (1932)
STUDEBAKER, 73, 82, 92 ('33), C ('34), 1C ('35), 2C ('36), 3C ('37), 4C ('38), 5C ('39).

DESCRIPTION:—These types fuel pumps consist of two distinctly separate units, a fuel pump (upper section of the unit) and a vacuum pump (lower section of the unit) which are entirely separate except that the same operating linkage is used for both units. The Fuel Pump is similar in design and operation to the Type E (see separate article for complete data on servicing of fuel pump section).

The Vacuum Pump unit is designed for windshield wiper operation and acts as a booster pump to ensure continuous windshield wiper operation even when the car is operated with wide open throtttle and consequently low manifold vacuum.

PERFORMANCE:—See article on Fuel Pump Testing.
Capacity—1 pt. in 45 sec. (F, I), 1 min. (J).
Pressure—4½ lbs. (F, I), 3½ lbs. (J), maximum.

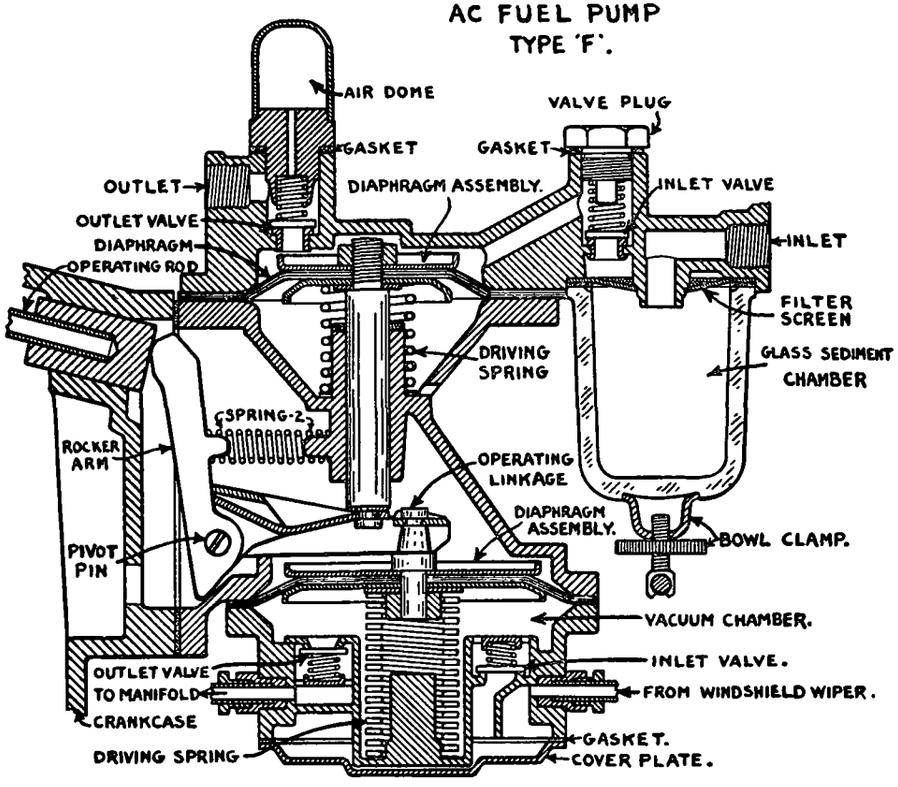
OPERATION OF VACUUM PUMP:—The vacuum pump consists of a vacuum chamber containing the inlet and outlet valves and closed at the upper end by the pump diaphragm. A spring is assembled in the center of the pump under the diaphragm. The operating shaft on the upper surface of the diaphragm assembly is connected to the pump rocker arm through the linkage. In operation when the rocker arm is actuated by the eccentric on the camshaft the vacuum pump diaphragm is forced down, expelling any air in the pump chamber through the outlet valve into the manifold. When the rocker arm moves back (freeing the pump linkage), the driving spring under the diaphragm forces the diaphragm upward creating a vacuum in the chamber, opening the inlet valve and causing the windshield wiper to operate.

Whenever the engine is operated with the windshield wiper turned off the vacuum in the vacuum chamber will hold the diaphragm at its lowest position (with the driving spring compressed) and the vacuum pump will not operate. Whenever the manifold vacuum is higher than the pump vacuum the pump will likewise be inoperative and the windshield wiper will be operated by the manifold vacuum straight through the pump with both valves open. At all other times the pump operates as a booster in operating the windshield wiper.

SERVICING (VACUUM PUMP SECTION):—To replace vacuum pump diaphragm, assemble in order, pull rod gasket, protector washer, five layers of diaphragm cloth, protector washer, alignment washer, lock washer, pull rod nut. Line up holes in diaphragm layers and see that center line of flats on pull rod is exactly midway between adjacent holes on diaphragm. Hold diaphragm alignment washer from turning while pull rod nut is being tightened. Follow directions below for assembly of pump.

Assembly of Vacuum Pump Section. Place fibre inlet valve in position on brass valve seat in body. Place inlet valve spring in position on valve. Place valve stop plate (spider-shaped die-cast piece) on top of valve spring with top coil of spring seated in stop plate. Check assembly of inlet valve by pressing down on inlet valve stop, see that valve spring is properly centered in stop and that legs of stop plate fit in recess in body. Place outlet valve spring in position, see that spring is centered in recess. Place outlet valve on spring. Hold down on inlet valve spring stop plate, slide valve retainer gasket in place, place valve retainer on top of gasket (without releasing inlet valve spring). Mount valve retainer in place, using flat-head screws (tighten center screws first), make certain that valve retainer is correctly installed with countersunk holes facing upward. Invert vacuum pump body, place screen in position, see that screen is flat and fits around shoulders of body screw holes. Assemble bottom cover.

Installing Vacuum Pump Section. Invert fuel pump and mount in a vise on the bench. Install vacuum pump diaphragm assembly, making certain that flatted end of pull rod is engaged in operating link and turned 90° to position for correct engagement. Place diaphragm spring in position on diaphragm. Place assembled vacuum pump unit in position on fuel pump, make certain that diaphragm spring is centered on boss in vacuum pump body. Push in on the pump rocker arm until the diaphragm is flat, wedge a small piece of metal between body and shoulder on rocker arm to hold rocker arm in this position while assembly is being completed. Line up marks on body flanges (these marks should be made before pump is disassembled), press down on pump, install screws and lock washers loosely, threading screws through holes in diaphragm layers. Then remove metal wedge, allowing diaphragm to assume highest position, tighten screws alternately and securely.



TESTING:—The strength of the vacuum pump spring will make it impractical to bench-test the pump before it is installed on the car. In installing the pump, see that the rocker arm is in the innermost position to avoid possibility of distorting the pump mountng flange while mounting nuts are being tightened.

To check vacuum pump operation, note windshield wiper performance while engine is alternately idling and accelerating. Windshield wiper action should be constant. Do not operate the pump with the outlet closed or blocked as the downward stroke is positively driven by the linkage.

TROUBLE SHOOTING:—See separate article for complete trouble shooting directions for both Fuel Pump and Vacuum Pump sections.

TYPE R

Std. Equipment On:

BUICK, MODEL 40 (1934-35)
CHEVROLET, ALL MODELS (1934)
FORD V8, ALL '60' MODELS (1937-38-39), ALL '85' MODELS (1934 to 39)
GRAHAM, SIX 68 ('34), 73 ('35), 96 ('38-39); EIGHT 67 ('34), 72 ('35)
GRAHAM, SCHGD. 75 ('35), 110 ('36), 116, 120 ('37), 97 ('38-39)
HUDSON, ALL SIX & EIGHT MODELS (1934-35-36)
LAFAYETTE, 110 ('34), 3510 ('35)
LINCOLN-ZEPHYR, ALL MODELS (1936 to 39)
MERCURY, MODEL 99A (1939)
NASH, ALL SIX & EIGHT MODELS (1934-35)
PACKARD, MODEL 120 (1935)
PONTIAC, EIGHT 603 ('34), ALL SIX & EIGHTS (1935-36)
STUDEBAKER DICTATOR, A ('34), 1A, 2A ('35)
TERRAPLANE, ALL MODELS (1934-35-36)

NOTE:—Type R is similar in design to Type T. See following article on Type T for complete description and servicing data for Type R pumps without oil seal. Data on pumps with oil seals are given below.

OIL SEAL NOTE:—Pump differs from other Type R pumps only in that an Oil Seal is assembled on the lower end of the pull rod below the diaphragm. The Oil Seal assembly consists of an upper retainer (with a flange at its lower end serving as lower seat for the driving spring), two leather oil seal washers, and a lower retainer. The entire assembly is locked in place on the pull rod stem by the shoulder on the lower end of the pull rod and rests on the pump boss in the pump body (see illustration). The operation of the pump is entirely similar to other Type R pumps.

PERFORMANCE:—See article on Fuel Pump Testing.
Capacity—1 pint in 1 minute. **Pressure**—3½ lbs. maximum.

SERVICING:—Trouble Shooting and servicing for this pump are the same as for other Type R pumps except for the special directions given below for the removal of the diaphragm assembly, assembling of oil seal on the pull rod, and replacing of diaphragm assembly in the pump.

To Remove Diaphragm Assembly from Pump:—Use special tool #1521556, which is designed to free lower retainer from boss on pump body (if this tool is not used, it will be necessary to remove rocker arm pin in order to free pull rod from rocker arm linkage). To remove diaphragm assembly (with pump cover or upper body removed), invert pump body, force edge of special tool under edge or flange of upper oil seal retainer, pry on tool to move flange on retainer up onto top edge of pump boss. Hold pump link against upper stop by wedging a screwdriver between the link and the bottom of the pump body, push down on diaphragm and away from end of link. This will unhook the pull rod from the link and diaphragm assembly can then be removed. Diaphragm assembly should be replaced as a unit (see directions below for assembly of oil seal on pull rod).

To Assemble Oil Seal on Diaphragm Assembly:—Place driving spring (E) in position on pull rod against lower diaphragm protector, place upper oil seal retainer in position on lower end of driving spring with cupped portion within spring, compress spring by pressing on oil seal retainer until retainer is below shoulder on pull rod, then rotate retainer ¼ turn so that it is locked in place. Force two leather oil seal washers down on pull rod stem until they rest against upper retainer, assemble lower retainer below washers and lock in place by rotating ¼ turn. The complete assembly is then ready to be installed in the pump.

To Install Diaphragm Assembly in Pump:—Invert the pump body, hold link against upper stop by wedging screwdriver between link and bottom of pump body, insert diaphragm assembly in pump body, tilting assembly so that flange on upper oil seal retainer rests on top edge of pump boss and pull rod clears end of link (see illustration). Press down on diaphragm assembly and hook pull rod over end of link, then push diaphragm back into vertical position and center in pump body so that oil seal retainer snaps into place around pump boss. The upper pump body can then be put in place and the screws installed.

TROUBLE SHOOTING:—See article on Fuel Pump Trouble Shooting. Use Fuel Pump Analyser to check pump performance before removing pump from car.

TYPE W

Std. Equipment On:

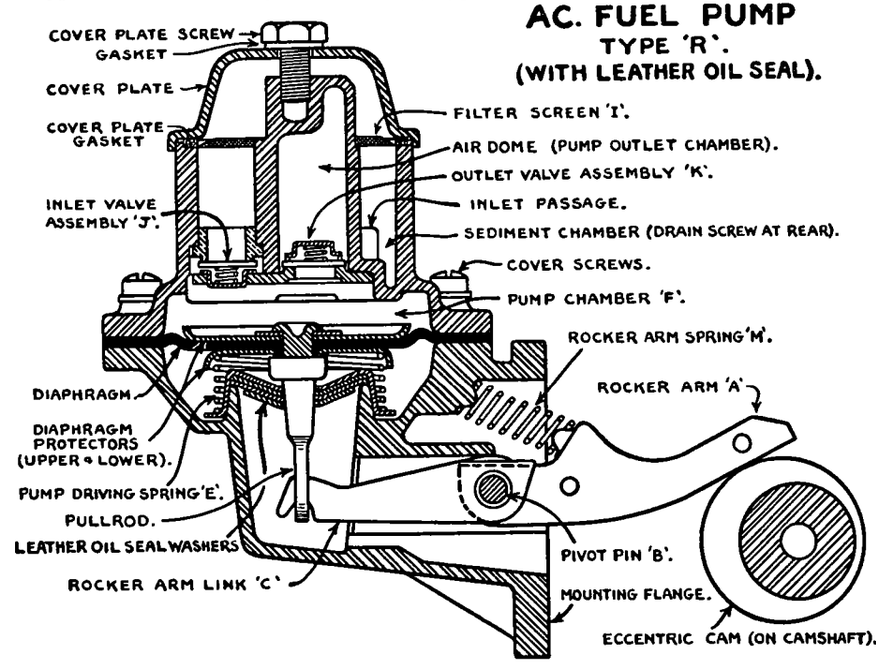
BUICK, MODEL 40 (1936-37) & FIRST CARS ONLY (1938)
CHEVROLET, ALL MODELS (1935-36)
NASH 6, 3620, 3640 ('36), 3720 ('37), 3820 ('38), 3920 ('39)
NASH 8, MODEL 3680 (1936)
NASH-LAFAYETTE, 3710 ('37), 3810 ('38), 3910 ('39)
STUDEBAKER DICT., 3A, 4A ('36), 5A, 6A ('37), 7A, 8A ('38), 9A ('39)

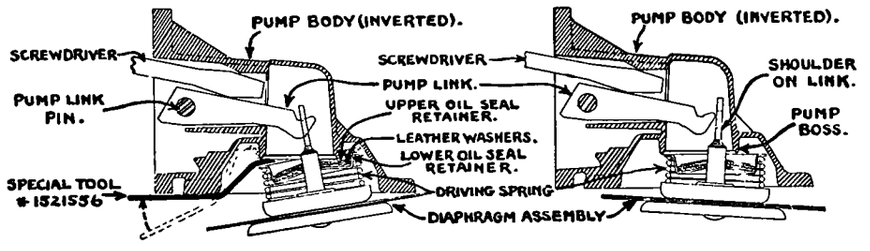
NOTE:—The Type W pumps are assembled from parts as listed below:
Body (including linkage) ..... **Type R.** Top Cover Assembly.....**Type B.**

PERFORMANCE:—See article on Fuel Pump Testing.
Capacity—1 pt. in 1 minute. **Pressure**—3½ lbs. maximum.

OIL SEALS:—Both leather and rubber oil seal washers have been used on these pumps. On pumps with leather oil seal washers, the upper oil seal washer retainer is held in place by a separate spring assembled above the retainer and below the lower diaphragm protector. Assemble the oil seal as follows: With the diaphragm assembly inverted, place the retainer spring over the pullrod so that it rests on the lower diaphragm protector, then assemble following parts in order: (1) upper oil seal washer retainer with concave side toward spring (cupped portion away from spring), (2) two leather oil seal washers, (3) lower retainer with concave side toward leather seals. Install diaphragm and oil seal assembly in pump as directed for Type R

SERVICING:—For all other servicing data than oil seals (above), see article on Type R (for lower body and linkage), Type B (top cover).





TYPE T

Std. Equipment On:

HUPMOBILE, 518-D, 521-J, 527-T ('35), 618-G ('36), 822-E ('38), 922-E, SKYLARK R ('39)
OLDSMOBILE SIX, F-34 ('34), F-35 ('35), F-36 ('36)
OLDSMOBILE EIGHT, L-34 ('34), L-35 ('35), L-36 ('36)
STUDEBAKER, COMM. B ('34), 1B ('35); PRES. C RHD ('34)

DESCRIPTION:—These pumps are mechanically operated, diaphragm type pumps and are similar in operation to previous pump types. The pump design is not similar to previous designs (see illustration). The sediment chamber (H) is located in the pump body and the external glass sediment bowl is not used. The sediment chamber can be drained by removing the screw (N). The pull rod is assembled as a unit with the diaphragm and diaphragm protectors (upper end of pull rod is riveted) and it is necessary to replace this entire assembly as a unit whenever the diaphragm is found defective.

OPERATION:—As in previous pump designs, the down stroke of the diaphragm is positive, the diaphragm being pulled down by the action of the rocker arm (A), which is connected to the pull rod by the linkage (C). This creates a vacuum in the pump chamber and gasoline is drawn in through inlet (G), sediment chamber (H), filter screen (I), and inlet valve (J) into pump chamber (F). The rocker arm is forced to follow the face of the eccentric cam by the rocker arm spring (M), releasing the pull rod linkage and the diaphragm is then pushed upward by the driving spring (E). This forces the gasoline out through the outlet valve (K) and the pump outlet (L) to the carburetor. Fuel delivery is controlled by the back pressure of the gasoline in the carburetor float bowl so that when the carburetor float valve closes, this back pressure holds the diaphragm at the bottom of its stroke with the driving spring compressed. The rocker arm continues to move with the rotation of the eccentric cam but this motion is absorbed by the linkage. Whenever the carburetor float valve opens, the pumping action is resumed.

PERFORMANCE:—See article on Fuel Pump Testing.
Capacity—1 pt. in 1 minute. **Pressure**—3½ lbs. maximum.

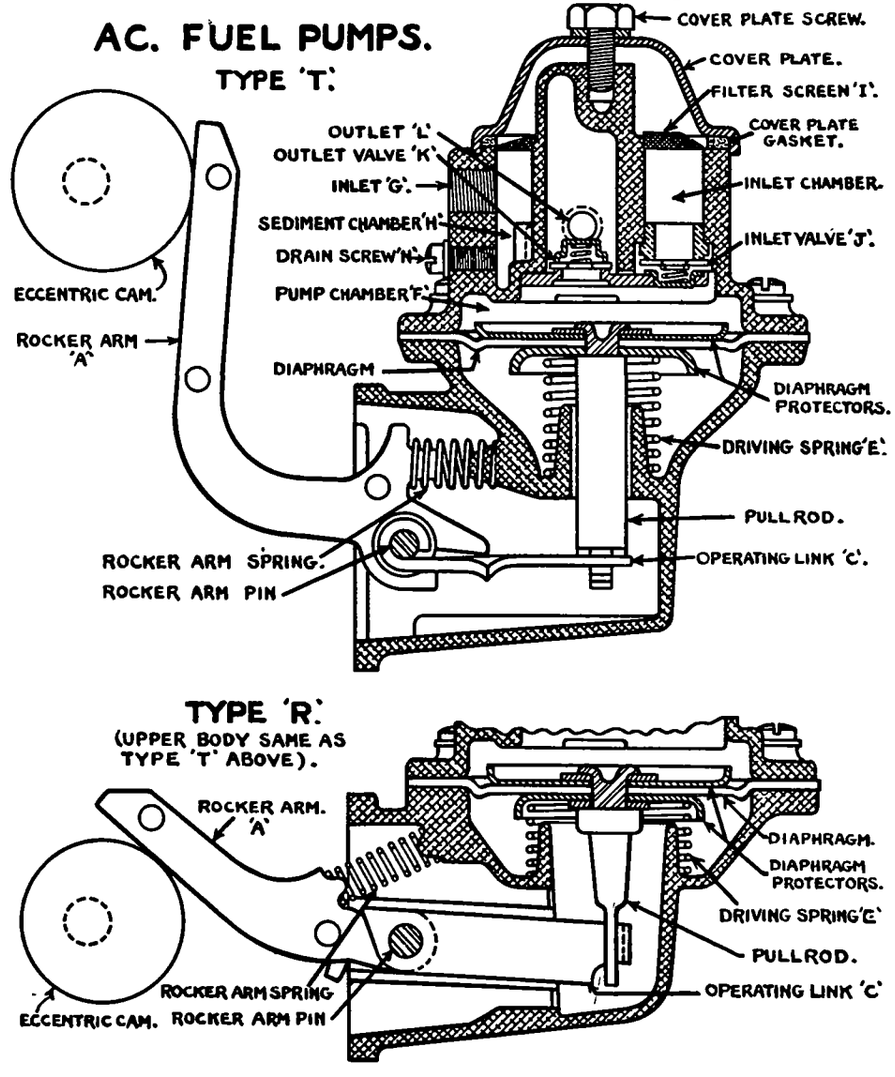
TROUBLE SHOOTING:—See article on Fuel Pump Trouble Shooting. Use Fuel Pump Analyser to check pump performance before removing pump from car.

SERVICING:—Diaphragm and pullrod are riveted together and must be replaced as a unit. To assemble pump, follow directions as given below.

Diaphragm and Pullrod Assembly. Place diaphragm (driving) spring in place in pump body, position diaphragm assembly on driving spring so that spring is centered in lower diaphragm protector, press downward on diaphragm and turn to left at same time so that pullrod engages end of rocker link, turn diaphragm assembly one-quarter turn to left so that holes in diaphragm and pump body line up. Push in on rocker arm until diaphragm is flush with pump body flange, place top assembly in position (as designated by marks on pump and cover made before disassembly), install cover screws and lock washers, turn screws down loosely. Release rocker arm, which will flex diaphragm in extreme upper position, tighten cover screws alternately and securely.

Valve and Cover Assembly. To assemble valves and cover before installing on pump, place outlet valve spring retainer in cover, being careful not to distort legs of retainer, place valve plate gasket in position, install outlet valve spring in retainer, place outlet valve on spring. Place inlet valve on its seat, position valve spring on center of inlet valve, install inlet valve retainer in valve plate and see that shoulder of retainer fits flush in depression in plate. Install valve plate in position in cover and insert three mounting screws. See that inlet valve is centered in spring seat and outlet valve centered on valve seat in valve plate. Install strainer screen on top of cover, see that screen fits properly around inlet and at edges of cover. Place cork gasket in cover, install cover plate. Install fibre gasket on cover plate capscrew, tighten capscrew so that cover plate is secure and tight. See that gasket seats properly and that filter screen is not distorted. Cover assembly is then ready to install on pump body.

Rocker Arm and Linkage. If rocker arm has been removed, assemble link, rocker arm, and rocker arm spring in pump body in proper position (see illustration), insert rocker arm pin through hole in body so that it engages rocker arm and link. Stake pin in place by using punch to turn body metal over pin at each end. See that rocker arm operates freely after assembly (if arm binds, drive pin back slightly). Rocker arm linkage will ordinarily not require disassembly when servicing pump.



TYPE V

Std. Equipment On:

1521544—OLDSMOBILE SIX, MODEL F-34 (1934)
1521681—OLDSMOBILE SIX, MODEL F-34 RHD CARS (1934)
1521545—OLDSMOBILE EIGHT, MODEL L-34 (1934)

DESCRIPTION:—This combination fuel-and-vacuum pump is same design as Type J except that fuel pump top cover assembly is same as Type R.

PERFORMANCE:—See article on Fuel Pump Testing for complete testing data. **Capacity**—1 pint in 1 minute. **Pressure**—3½ lbs. maximum.

SERVICING:—**Fuel Pump Section**—See article on Type R Fuel Pump for data. **Vacuum Pump Section**—See article on Type J fuel-and-vacuum pump.

Optl. Equipment On:

OLDSMOBILE SIX, MODEL F-36 (1936)

OLDSMOBILE EIGHT, MODEL L-36 (1936)

DESCRIPTION:—This type fuel pump is similar in design and operation to previous combination fuel and vacuum pumps except that the sediment chamber is located at the top of the fuel pump section within an inverted glass sediment bowl and the location of fuel pump inlet valve assembly (J) and outlet valve assembly (K) is somewhat changed. As in previous designs, the fuel pump and vacuum pump are two distinct units although the same linkage is used for the operation of both units.

OPERATION:—Fuel Pump. Fuel pump operation is similar to previous types and down stroke or suction stroke of diaphragm is positively actuated. The diaphragm is forced upward on the delivery stroke by the driving spring below the diaphragm. Fuel flow through the pump after entry through the inlet is through the inlet passage or riser into the glass sediment bowl. From near the top of the sediment bowl, fuel passes through filter screen (I) and inlet passage to inlet valve (J) and into the pump chamber. From the pump chamber the fuel is forced through outlet valve (K) to the pump outlet. An air chamber is formed in the upper body casting above the outlet valve. The lower portion of the glass bowl below the top of the inlet passage to the pump chamber forms the sediment chamber (H).

Vacuum Pump. The down stroke of the vacuum pump diaphragm by which air is displaced from the pump chamber is positively actuated by the pump linkage. The diaphragm is forced upward by the heavy driving spring below the diaphragm, creating a vacuum within the pump chamber. This opens the inlet valve and operates the windshield wiper. The pump acts as a booster to insure continuous wiper operation and will be inoperative whenever pump vacuum is exceeded by manifold vacuum (both valves will be open), or whenever the wiper is not being used (diaphragm held at lower end of stroke by vacuum in pump chamber).

PERFORMANCE:—See article on fuel pump testing.
Capacity—1 pt. in 45 seconds. Pressure—4½ lbs. maximum.

TROUBLE SHOOTING:—If fuel pump or vacuum pump operation is not satisfactory, check in accordance with the following tables:

Fuel Pump Unit

No fuel or insufficient fuel at carburetor—Check fuel line for bent, kinked, leaky tubing or connections. Tighten all connections. Clean filter screen, examine sediment bowl gasket, tighten bowl thumbnut securely (loose bowl on this type will cause leaks around lower edge of bowl if any gasoline is in sediment chamber). Check valves and valve seats for dirty or warped valves, loose valve assemblies. Check diaphragm driving spring.

Fuel Leakage through vent in pump body—Diaphragm is worn or punctured and should be replaced.

Fuel Leakage at edge of diaphragm—Loose cover screws. Tighten cover screws evenly around pump body.

Carburetor flooding—Check carburetor float level. See that float valve seats properly. Replace float valve assembly if seat or valve is worn.

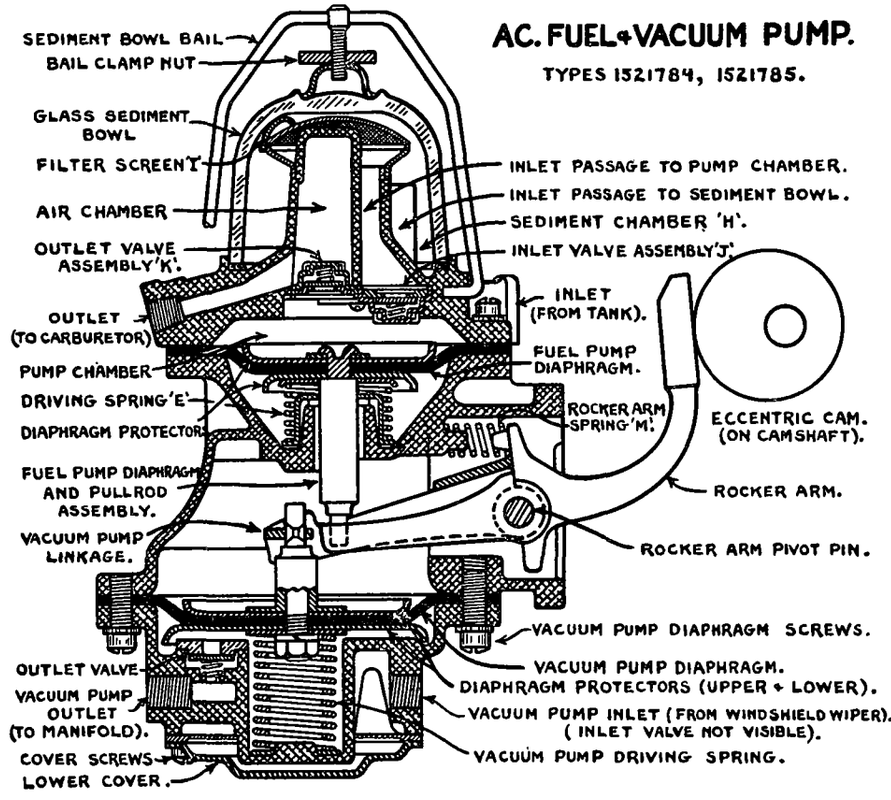
Vacuum Pump Unit

Not operating (no vacuum except as supplied by manifold). This will be evidenced by slow windshield wiper action at high speeds or with wide open throttle. Check vacuum lines and tighten connections. Examine vacuum pump valves and diaphragm.

Oil smoke in engine exhaust—Punctured vacuum pump diaphragm. Check before disassembling pump by disconnecting pump outlet line to manifold, operate vacuum pump and note oil spray in pump exhaust. Oil spray at this point indicates punctured diaphragm which should be replaced. If no oil spray is noted, oil smoke may be caused by worn rings, etc.

SERVICING:—Fuel Pump. Diaphragm assembly should be replaced as a unit (pullrod upper end is riveted). To install new diaphragm assembly, place oil seal gasket and oil seal gasket retainer over pullrod boss in pump body, place driving spring (E) on oil seal gasket retainer, place spring retainer on spring with cupped side downward, insert diaphragm and pullrod assembly in body, invert pump body so that fuel pump link falls toward pullrod, push diaphragm down in body to compress driving spring, engage flatted end of pullrod in slot in end of link, turn diaphragm assembly 90° to lock pullrod in link. If cover assembly has not been disassembled (see directions below for installation of valves in cover assembly), push upward on pump rocker arm until diaphragm is even with top edge of body, place cover assembly in position on body, lining up marks made before disassembly, install cover screws and lockwashers, turn screws down loosely. Release rocker arm, which will flex diaphragm in extreme upper position, and tighten cover screws alternately around pump body evenly and securely.

To assemble valves in cover assembly, place valve cage gaskets in position in cover, place inlet and outlet valve cage assemblies on cage seats in cover, making certain that the large diameter is placed downward against the gasket on the inlet side and that the small diameter is assembled in outlet



hole in the cover so that the shoulder of the cage fits properly against the gasket. This is very important. Place valve cage retainer in position, making certain that the curved end of two legs fits snugly against each valve cage, insert two mounting screws, tighten screws securely. Place cork bowl gasket in position on cover, assemble glass sediment bowl, bowl seat, thumbnut and bail above bowl, tighten thumbnut securely. This completes the top cover assembly.

Vacuum Pump. Vacuum pump servicing and assembly is exactly the same as for other types except that tabs are provided on the diaphragm and these tabs should be lined up with the center line of the flatted end of the pullrod when new diaphragms are being installed. See complete article on Types F, I, J pumps.

Std. of Optl. Equipment On:
TYPE AB
BUICK, MODELS 60, 80, 90 (1936 to 39)
CADILLAC V8, ALL SERIES (1936 to 39)
HUDSON & TERRAPLANE, ALL MODELS (1937-38)
LA SALLE V8, SERIES 50 (1937-38-39)

TYPE X
PACKARD, MODEL 120-B (1936)

NOTE:—The Type X pump is equipped with a Type R top cover assembly (fuel pump section). See article on Type R pumps with oil seal for illustration and fuel pump servicing instructions on this model.

DESCRIPTION:—These types similar in design to previous types (combination fuel and vacuum pumps) in that fuel pump and vacuum pump units are entirely separate although both units mounted on the same body casting and operated by the same linkage. New features include fuel pump oil seal, mounting flange baffle, silencer unit in body vent, and assembled diaphragm units (pull rod riveted on top protector washer forming assembly of pull rod, diaphragm, and protector washers).

OPERATION:—Fuel Pump—Same as for previous types. Downstroke or suction stroke of diaphragm positively actuated by linkage. Upstroke or delivery stroke actuated by driving spring under diaphragm. Rocker arm motion absorbed by linkage when delivery line closed by seating of carburetor float needle valve (pressure in line balances driving spring tension so that diaphragm held in lower position with spring compressed).

Vacuum Pump:—Same as for Type F. Downstroke of diaphragm in which air displaced from pump chamber positively actuated by linkage. Upstroke in which vacuum created in pump chamber actuated by heavy driving spring under diaphragm. Rocker arm motion absorbed by linkage when pump not in use (windshield wiper turned off) with diaphragm at lower end of stroke and driving spring compressed.

PERFORMANCE:—See article on Fuel Pump Testing.
Capacity—1 pt. in 45 seconds (AB), 1 minute (X).
Pressure—4½ lbs (AB), 3½ lbs. (X), maximum.

SERVICING:—Both fuel pump diaphragm and vacuum pump diaphragm replacements furnished as assemblies with pull rod and diaphragm protectors (pull rod riveted on upper protector washer). Instruction below for installation of these units.

Rocker Arm & Link Assembly in Body:—Assemble rocker arm, fuel pump link, link spacer and vacuum pump links on rocker arm pin bushing in same position as when removed from pump. Place hooked end of one vacuum link on top of other vacuum link while assembling. Insert assembly in pump body making certain that rocker arm spring is seated on ear of link spacer. Insert rocker arm pin, place washer on end of pin, peen counter-bored end of pin securely over washer.

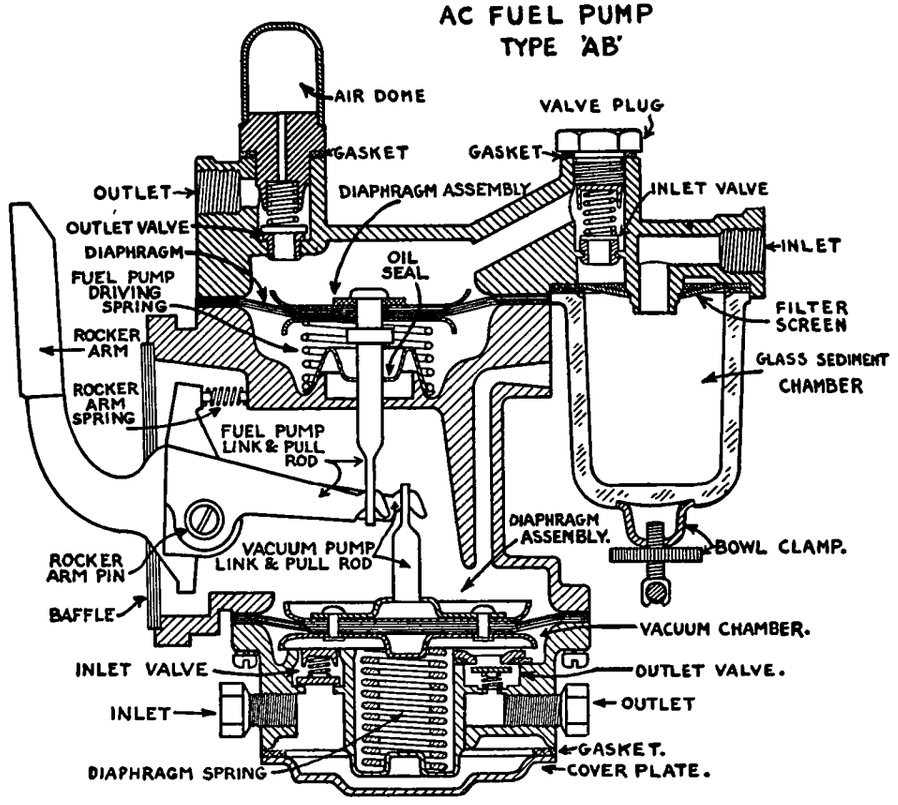
Fuel Pump Diaphragm Assembly (Type AB):—Invert pump body allowing link to fall against stop, insert small tool or screwdriver to hold link in this position. Place diaphragm driving spring in position on lower diaphragm protector, place oil seal (when used) on spring so that spring seats on lower flange with cupped portion of seal within spring, insert diaphragm assembly in pump body, compress diaphragm spring and hook pull rod over end of link. See that spring is seated in lower protector and on oil seal.

Fuel Pump Valve and Cover Assembly (Type AB):—See that valve chamber thoroughly cleaned, valve seat inserts tight in cover, and that seats are smooth and flat. Place a drop if Finol on each fibre valve (do not substitute other types of valves), place valves flat on valve seat, insert valve spring on top of valves, see that fibre gaskets on valve plugs in place and in good condition, install plugs making certain that valve spring enters spring cup in plug, tighten plugs securely. Examine sediment bowl gasket and filter screen, replace if necessary, install sediment bowl and tighten bail nut securely.

Fuel Pump Cover Assembly:—To install cover assembly on pump, clamp pump body in vise, place cover in position on body lining up marks made before disassembly, insert cover screws through holes in cover and diaphragm, turn screws down until heads within ⅛" of cover flange. Flex diaphragm in extreme upward position by pushing up on pull rod, hold in this position, tighten cover screws evenly and securely.

VACUUM PUMP SECTION

Vacuum Pump Unit Assembly:—Inlet Valve seat is part of vacuum pump body assembly. To assemble pump, place fibre inlet valve on valve seat, position valve spring on valve, place spider-shaped inlet valve stop plate on top of spring with top coil of spring seated in recess in bottom of spider. Insert outlet valve spring, centering spring coils in recess, place outlet valve in position on top of spring. Press inlet valve stop plate down until legs fit into recess in body making certain that valve spring is properly centered on stop, hold in this position and slide valve retainer gasket in position, place valve retainer in position on top of gasket making certain that retainer installed with countersunk holes upward. Insert valve retainer screws tightening center screws first and end screw last. Turn pump body over, install screen, see that screen lies flat and fits closely around screw holes in body. Install cover gasket on screen lining up screw holes, place cover on gasket, insert cover screws and tighten securely.



Vacuum Pump Installation:—Clamp completed fuel pump and body assembly in vise in inverted position. Install vacuum pump diaphragm assembly, see that pull rod hooked on both links properly and that diaphragm holes line up with holes in body. Place diaphragm spring in position on diaphragm, centering spring in lower protector washer, place assembled vacuum pump unit in position on diaphragm lining up marks made before disassembly and seeing that spring is centered on boss in vacuum pump body. Press in on rocker arm until diaphragm is flat and even with body flange, insert screws through holes in vacuum pump body and diaphragm, turn screws in until ⅛" from flange. Release rocker arm so that diaphragm spring flexes diaphragm to extreme upper position, tighten screws evenly and securely.

TESTING:—Vacuum pump spring strength makes it impractical to test combination units on the bench. Pump should be installed on engine and tested with No. 1521551 analyzer (fuel pump section). To test vacuum pump operation, open windshield wiper valve and note performance when engine is alternately idled and accelerated. Wiper action should be practically constant and independent of engine speed variations.
NOTE—Pump should never be operated with outlet passage of vacuum pump blocked. The exhaust stroke of the pump is positive and damage will result to the vacuum pump linkage.

TROUBLE SHOOTING:—See article on Fuel Pump Trouble Shooting.

TYPE AH

USED ON:

1523228—OLDSMOBILE SIX, F-37 (1937), F-38 (1938)
OLDSMOBILE EIGHT, L-37 (1937), L-38 (1938)
1523844—OLDSMOBILE SIX, '60' F-39, '70' G-39 ('39)
OLDSMOBILE EIGHT, '80' MODEL L-39 (1939)
1523109—PONTIAC SIX, 37-26CA (1937), 38-26DA (1938)
PONTIAC EIGHT, 37-28CA (1937), 37-28DA (1938)
1523844—PONTIAC SIX, MODELS 39-25, 39-26 (1939)
PONTIAC EIGHT, MODEL 39-28 (1939)

TYPE:—New design, inverted, mechanically operated, diaphragm type pump with improve oil seal on pull rod which necessitates removal of rocker arm pin to engage or disengage pull rod when servicing diaphragm assembly. Operation similar to previous types.

OPERATION:—As in previous designs, suction stroke of diaphragm positively actuated by pump linkage, delivery stroke actuated by driving spring 'E'. On suction stroke when diaphragm 'D' is pulled up by rocker arm 'A' and link which engages pull rod at 'C', fuel is drawn through inlet into sediment bowl 'H' and then through filter screen 'I' and inlet valve 'N' into pump chamber 'F'. Rocker arm is forced to follow face of eccentric driving cam by spring 'L', allowing driving spring 'E' to force diaphragm down on delivery stroke, and forcing the fuel out through the outlet valve 'J' to the carburetor. Fuel delivery is controlled by back pressure in line so that whenever carburetor float valve is closed, diaphragm remains at top of stroke with spring 'E' compressed, and rocker arm motion is absorbed by the linkage. When pressure is relieved by opening of carburetor float valve, pumping is resumed.

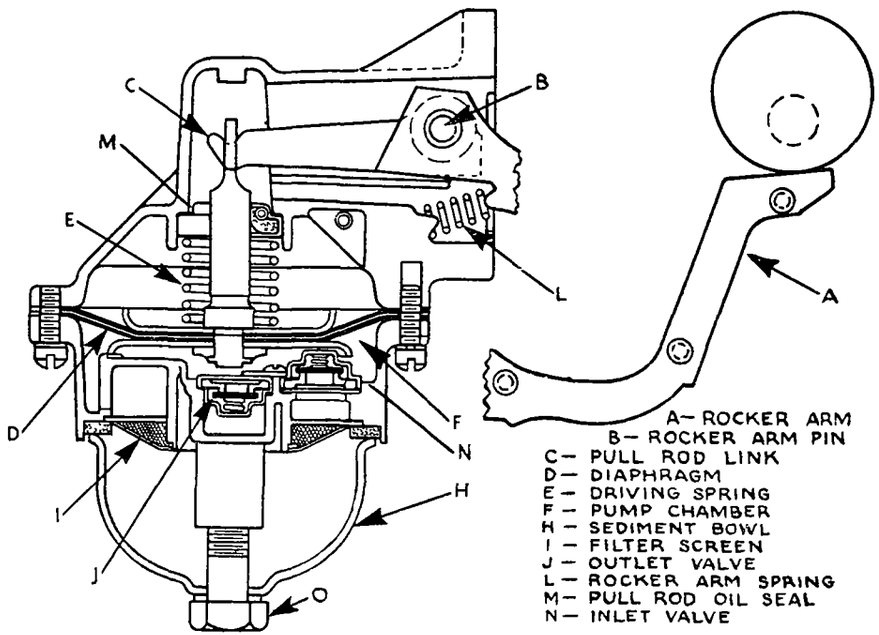
PERFORMANCE:—See article on Fuel Pump Testing and use of Analyzer.
Capacity—1 pt. minimum in 45 seconds. **Pressure**—3¾ lbs. maximum.

TROUBLE SHOOTING:—See article on Fuel Pump Trouble Shooting. Use Fuel Pump Analyzer No. 1521551 and check performance before removing fuel pump from car.

SERVICING:—Disassembly. Drill out counterbored (small end) of rocker arm pin with ⅜" drill. Use special tool No. 1521581 and drive pin out of arm and pump body. Invert pump and clamp in vise. Mark cover and body flange to insure replacing in same position. Take out ten capscrews in flange and lift off cover assembly. Lift out diaphragm and link assembly.

Valve & Cover Sub-assembly. Place gasket in position in cover casting, install valve and cage assemblies making certain that large diameter of inlet valve cage is against gasket and that small diameter of outlet valve cage is installed in hole in cover so that shoulder of cage fits against gasket. Pump will not operate satisfactorily if valves installed in any other manner. Place valve cage retainer in position on valves making certain that curved ends of two lugs fit snugly against each valve cage, insert two retainer screws and tighten securely. See that retainer has not shifted after screws are tightened. Install cork bowl gasket in cover, place metal sediment bowl cover on gasket, assemble cover screw gasket on cover, insert cover screw and tighten securely. Cover gasket and cover screw gasket must be in good condition and must contact seat at all points to insure tightness and prevent gasoline leaks at these points.

Pump Assembly. Assemble link, rocker arm bushing, link spacer washers and rocker arm spring in position in pump body, insert small end of special assembling tool No. 1521581 through rocker pin hole in body to hold these parts in position loosely. Install oil seal and diaphragm driving spring in position, install diaphragm assembly inserting pull rod through spring and oil seal and engaging pull rod end with hook on link. Then press assembling tool on through pump body until linkage is held in position by larger section of tool. Use regular rocker arm pin to drive assembling tool out. This will leave linkage correctly assembled on pin. Install steel washer on counterbored small end of pin and swedge end of pin out against washer. Push upward on rocker arm until diaphragm is level with top surface of body flange, install cover assembly, lining up marks on flanges made before disassembling pump, insert cover screws (see that lockwasher in place on each screw) and turn down screws until flanges are ⅛" apart. Release rocker arm which will allow diaphragm to move to highest position, tighten cover screws alternately and securely. Cover must be tightened only with diaphragm flexed in extreme upward position to insure pump having full stroke in service.



TYPE AS

Number **Used On:**
1523648—CHRYSLER ROYAL, MODEL C18 (1938)—OPTIONAL
DE SOTO, MODEL S5 (1938)—OPTIONAL
DODGE, MODEL D8 (1938)—OPTIONAL
PLYMOUTH, MODELS P5,6 ('38), P7,8 ('39)—OPTL.

DESCRIPTION:—This combination Fuel-and-Vacuum pump is an 'inverted' type (vacuum pump section on top) with same design body and mounting flange as Type AT pumps. Vacuum pump section is same design as other AC Vacuum pumps. Fuel pump section is same design as Type AH except that glass bowl type sediment chamber retained by bail and thumbscrew is used.

PERFORMANCE:—See article on 'Fuel Pump Testing' for complete testing data.
Capacity—1 Pint in 1 Minute. **Pressure**—4¼ pounds maximum.

SERVICING:—Fuel Pump Section—See article on Type AH Fuel Pump for data.
Vacuum Pump Section—See article on Type AJ combination fuel-and-vacuum pump for data.

TYPE AT

Number **Used On:**
1523647—CHRYSLER ROYAL, MODEL C18 (1938)
DE SOTO, MODEL S5 (1938)
DODGE, MODEL D8 (1938)
1523912—CHRYSLER ROYAL & WINDSOR, MODEL C22 (1939)
DE SOTO, MODEL S6 (1939)
DODGE, MODEL D11 (1939)
1523647—PLYMOUTH, MODELS P7, P8 (1939)

DESCRIPTION:—This pump same design as Type 'AH' except that mounting flange is same as that used on Type 'B' pumps and a glass bowl type sediment chamber retained by a bail and thumbscrew is used.

PERFORMANCE:—See article on 'Fuel Pump Testing' for complete testing data.
Capacity—1 Pint in 1 Minute or less. **Pressure**—4½ pounds maximum.

SERVICING:—See article on Type AH Fuel pump for complete directions (all servicing operations except sediment bowl removal same as for Type AH).

TYPE AJ COMBINATION FUEL-AND-VACUUM PUMP

USED ON:

1523687—BUICK, MODEL 40 (1938-39)—OPTL.
1523937—HUDSON SIX, 90, 91, 92, 93, 98 (1939)—OPTL.
1523936—HUDSON EIGHT, MODELS 95, 97 (1939)—OPTL.
1523227—OLDSMOBILE SIX, F-37 ('37), F-38 ('38)—OPTIONAL
OLDSMOBILE EIGHT, L-37 ('37), L-38 ('38)—OPTIONAL
1523825—OLDSMOBILE SIX, '60' F-39, '70' G-39 ('39)—OPTL.
1523895—OLDSMOBILE EIGHT, MODEL '80' L-39 (1939)—OPTL.
1523202—PACKARD SIX, MODEL 115C (1937).
PACKARD EIGHT, MODEL 120C (1937).
1523629—PACKARD SIX, MODEL 1600 (1938)
PACKARD EIGHT, MODELS 1601, 1A, 2 (1938)
1523867—PACKARD, SIX 1700, EIGHT 1701,1A,2 (1939)
1523896—PACKARD SUPER EIGHT, 1703,3A,5 (1939)
1523110—PONTIAC SIX, 37-26CA ('37), 38-26DA ('38)—OPTIONAL
PONTIAC EIGHT, 37-28CA ('37), 38-28DA ('38)—OPTIONAL
1523825—PONTIAC SIX & EIGHT, ALL MODELS (1939)—OPTL.

TYPE:—Combination fuel-and-vacuum pump. New design, inverted, mechanically operated, diaphragm type pump. Vacuum section mounted on top of pump body with fuel pump section below which is reversed from previous designs. Improved type oil seal used on fuel pump pull rod which necessitates removal of rocker arm pin to engage or disengage pull rod when servicing diaphragm assembly. Operation is similar to previous types.

FUEL PUMP SECTION

NOTE:—Design of fuel pump section identical with Type AH fuel pumps. See preceding article on Type AH for description of operation and complete servicing directions. Fuel pump section should be removed first and installed first when servicing these pumps.

PERFORMANCE:—See article on Fuel Pump Testing and use of Analyzer. **Capacity**—1 pt. minimum in 45 seconds. **Pressure**—4 lbs. maximum.

TROUBLE SHOOTING:—See article on Fuel Pump Trouble Shooting. Use Fuel Pump Analyzer No. 1521551 and check performance before removing pump from car.

VACUUM PUMP SECTION

OPERATION:—Exhaust stroke positively actuated by pump linkage and suction stroke actuated by large driving spring 'R'. When the diaphragm 'N' is forced up by the long rocker arm link 'M', air in the pump chamber 'O' is forced out through outlet valve 'P' and outlet 'Q' to the intake manifold. Driving spring 'R' then forces diaphragm down, creating a vacuum in the pump chamber and placing a suction on the windshield wiper line which is connected at inlet 'S' (inlet valve not shown).

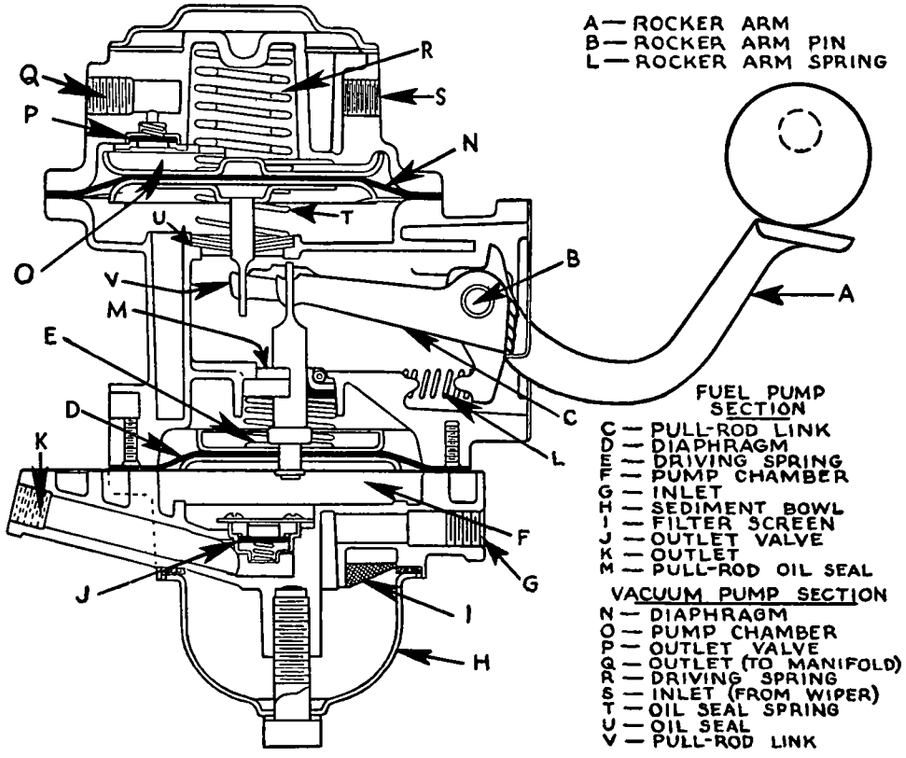
Whenever the windshield wiper is not in use (inlet line shut off), manifold vacuum holds the diaphragm at the upper end of its stroke with the driving spring compressed and the rocker arm motion is absorbed by the linkage. Likewise whenever the manifold vacuum is higher than that of the pump with the windshield wiper in operation, both the inlet and outlet valves will remain open and air flow from the wiper will be straight through the pump.

TROUBLE SHOOTING:—See article on Vacuum Pump Trouble Shooting.

SERVICING:—**Disassembly.** With pump clamped in vise, take out two opposite flange screws and install special guide pins as pilots when cover removed (guides may be made up of 3/16" cold-rolled stock, 2" long, with ¼" of 10-32 thread on one end). Mark cover and body flanges to insure correct reassembly, take out remaining flange screws, lift off cover assembly. Press down on rocker arm, unhook diaphragm assembly from inner pump link, lift diaphragm assembly out.

Vacuum Pump Body Assembly. Place fibre inlet valve on brass valve seat (body furnished with valve seat installed), and position inlet valve spring on valve. Install spider-shaped valve stop plate on valve spring making certain that top coil of spring is seated in recess in stop plate. Install outlet valve spring and see that spring is centered in recess in body. Press down on inlet valve stop plate, install fibre outlet valve on valve spring, see that legs on stop plate fit into recess in body. Without releasing stop plate, slide retainer gasket into position, place retainer on top of gasket (countersunk holes must face up), insert flat-headed retainer screws and tighten securely (tighten center screws first, end screw last). Turn pump body over and install screen making certain that screen is flat and fits snugly around screw holes in body, install gasket on screen, place bottom cover on gasket and install four cover screws. See that gasket fits properly and cover screws tightened evenly to prevent leaks at this point.

Diaphragm & Pull Rod Assembly. Diaphragm and pull rod furnished as an assembly (riveted together). Place small lower oil seal retainer, leather oil seal washer, large upper oil seal retainer, and oil seal retainer spring in position in pump body in that order. See that the asssembly fits snugly in the recess around the pull rod hole. Install diaphragm on top of retainer spring, threading pull rod through oil seal and engaging hooked end of longer pump link in pull rod slot.



Vacuum Pump Assembly. Clamp pump body (with fuel pump installed) in vise with vacuum diaphragm up. Press down on rocker arm until diaphragm is flat on flange, install small metal wedge between body and shoulder on arm to hold it in this position while completing assembly. Place heavy driving spring on diaphragm, place vacuum pump body assembly in position on spring making certain flange marks line up and that spring is centered on diaphragm and around boss in pump body. Press down on vacuum pump body, insert flange screws (lockwasher on each screw), turn screws down loosely. Remove rocker arm wedge, tighten screws evenly. Check vacuum pump operation after pump re-installed on engine.

TYPES AC, AF, AG, AK

TYPE AF

1523703—BUICK, MODEL 40 (1938 LATER CARS, ALL 1939)
1523089—CHEVROLET, ALL MODELS (1937-38-39)
1523753—HUDSON '112', 89 (1938), 90, 98 (1939)
1523306—WILLYS, MODEL 37 (1937), 38 (1938), 48 (1939)
WILLYS-OVERLAND, SPEEDWAY MODEL 39 (1939)

TYPE AK

1523195—BUICK, 60, 80, 90 (1937)—AFTER 10000 CARS
1523289—HUDSON SIX, 73 (1937), 83 (1938), 91, 92, 93 (1939)
HUDSON EIGHT, 74,5,6,7 ('37), 84,5,7 ('38), 95,7 ('39)
TERRAPLANE, 70,1,2 (1937), 80,1,2,8 (1938)
1523313—HUDSON, ALL RHD MODELS (1938-39)

TYPE:—These pumps are assembled of Body and Top Cover assemblies used on other fuel pump types as follows:

Pump Type	Body Assembly	Top Cover Assembly
AC	Type B	Type R
AF	Type R	Type AA
AG	Type D (Riveted Diaphragm)	Type AA
AK	Type R (Larger)	Type D

PERFORMANCE:—See article on Fuel Pump Testing for testing procedure.

Pump Type	Capacity (1 Pt. Min.)	Pressure (Maximum)
AC	1 minute Max.	3 lbs.
AF	1 minute Max.	3½ lbs.
AG	45 seconds Max.	3½ lbs.
AK	45 seconds Max.	4½ lbs.

SERVICING:—See previous articles on the Fuel Pump Types from which these pumps are assembled for complete servicing instructions.

TYPE AD

USED ON:

1523234—NASH-LAFAYETTE, MODEL 3710 (1937)—OPTIONAL EQUIP.
1523641—NASH-LAFAYETTE, 3810 (1938), 3910 (1939)—OPTL.
1523238—NASH AMBASSADOR SIX, MODEL 3720 (1937)—OPTIONAL.
1523643—NASH AMBASSADOR SIX, 3820 ('38), 3920 ('39)—OPTL.
1523236—NASH AMBASSADOR EIGHT, MODEL 3780 (1937)—OPTIONAL.
1523644—NASH AMBASSADOR EIGHT, 3880 ('38), 3980 ('39)
1522228—STUDEBAKER, MODELS 7A, 8A (1938)—OPTIONAL

TYPE:—This pump similar to Type X fuel and vacuum pump except that Top Cover for fuel pump section is Type B.

PERFORMANCE:—See article on Fuel Pump Testing for test procedure. **Capacity**—1 Pt. in 1 minute. (Min.). **Pressure**—3½ lbs. maximum.

SERVICING:—Follow instructions given for Type X except for top cover assembly (see Type B for valve and cover section of fuel pump).

TYPE AL

Number	Used On:
1523137	CHRYSLER ROYAL, C16 ('37), C18 ('38)—OPTL.
	DE SOTO, MODELS S3 ('37), S5 ('38)—OPTL.
	DODGE, MODELS D5 (1937), D8 (1938)—OPTL.
	PLYMOUTH, MODELS P3,4 ('37), P5,6 ('38)—OPTL.
1523915	CHRYSLER ROYAL, C22 (1939)—SWINGING WINDSHIELD.
	DE SOTO, MODEL S6 (1939)—SWINGING WINDSHIELD.
	DODGE, MODEL D11 (1939)—SWINGING WINDSHIELD.
1523885	PLYMOUTH, MODELS P7,8 (1939)—RHD CARS.

DESCRIPTION:—This combination Fuel-and-Vacuum Pump is same design as Type I except that fuel pump top cover assembly is same as Type B.

PERFORMANCE:—See article on 'Fuel Pump Testing' for complete testing data. **Capacity**—1 Pint in 1 Minute or less. **Pressure**—3½ pounds maximum.

SERVICING:—See article on Type I combination Fuel-and-Vacuum Pump for all servicing data (except fuel pump top cover and valve assembly for which refer to article on Type B pump).

TYPE AM

Number	Used On:
1523271	CHEVROLET, ALL MODELS (1938-39)—OPTL.

DESCRIPTION:—This combination fuel-and-vacuum pump is same design as Type 'X' except that mounting flange and fuel pump section Top Cover is same as used on Type 'AF' fuel pumps.

PERFORMANCE:—See article on 'Fuel Pump Testing' for complete testing data. **Capacity**—1 Pint in 1 Minute or less. **Pressure**—3½ pounds maximum.

SERVICING:—Fuel Pump Section. See article on Type AF Fuel Pump for data. **Vacuum Pump Section**—See article on Type X fuel-and-vacuum pump for data.

TYPE AN VACUUM PUMP

USED ON:

1523188—CHRYSLER CUSTOM IMPERIAL, C15 (1937), C20 (1938)
CHRYSLER IMPERIAL C23, CUST. IMP. C24 (1939)

NOTE:—This pump consists of the vacuum pump section of a Type 'I' pump. The fuel pump section is omitted and a special cover plate installed on the fuel pump mounting flange. See article on Type I for servicing instructions.

TYPE AR

DESCRIPTION:—This pump is assembled from parts which are also used on other pump models as follows:
Top Cover Assembly—Type 'AF'. Body and Linkage Assembly—Type 'B'. Pump has inverted glass bowl type sediment chamber. Diaphragm is riveted to pull rod and should be serviced as an assembly.

PERFORMANCE:—See article on 'Fuel Pump Testing' for complete testing data. **Capacity**—1 Pint in 1 Minute or less. **Pressure**—3 pounds maximum.

SERVICING:—See articles on Type B Fuel Pump (for body and linkage servicing including Diaphragm replacement) and Type AF Fuel Pump (for top cover and Valve Assembly servicing).

TYPE AU

Number	Used On:
1523695	CADILLAC V16, SERIES 90 (1938-39)—RIGHT HAND
1523696	CADILLAC V16, SERIES 90 (1938-39)—LEFT HAND

NOTE:—On this model, one pump mounted at forward end of each cylinder bank and supplies fuel to carburetor for that bank. Fuel lines to carburetors are inter-connected so that either pump can supply fuel for both carburetors, and one pump only will normally operate when engine is idling. When engine operated under load, both pumps operate.

DESCRIPTION:—These pumps assembled from parts which are also used on other pump models as follows:
Top Cover Assembly—Type 'AA'. Body and Linkage Assembly—Type 'AK'. NOTE—Type AK Body and Linkage Assembly is similar to Type R except that is larger size.

PERFORMANCE:—See article on 'Fuel Pump Testing' for complete testing data. **Capacity**—1 Pint in 45 Seconds or less. **Pressure**—4½ pounds maximum.

SERVICING:—See articles on Type R Fuel Pump (for body and linkage servicing including Diaphragm replacement) and on Type AA Fuel-and-Vacuum Pump (for top cover and Valve Assembly servicing).

TYPE AW

Std. Equipment On:

1523969—CHRYSLER IMPERIAL, SARATOGA, NEW YORKER, C23 (1939)
CHRYSLER CUSTOM IMPERIAL, MODEL C24 (1939)

DESCRIPTION:—This fuel pump same design as Type AH except for different mounting studs, air dome, and curled hair air cleaner.

PERFORMANCE:—See article on Fuel Pump Testing for complete testing data. **Capacity**—1 pint in 45 seconds. **Pressure**—3¾ lbs. maximum.

SERVICING:—See article on Type AH fuel pump for data.

DESCRIPTION:—The new type Autopulse has been considerably modified in construction and can be completely disassembled for inspection and service although the principle of operation remains the same as in the earlier types. The two valves are assembled in the pump base casting and are accessible after removing the filter and filter base casting and taking out the two brass screws under the filter screen. The driving motor is accessible by taking out the two screws on the side of the base cover.

OPERATION:—The operation of the pump is entirely automatic and is controlled by the back-pressure of the gasoline in the float chamber of the carburetor. The Autopulse feed wire should be connected to the coil side of the ignition switch or to the switch side of the ignition coil. In special cases where neither of these terminals is available the Autopulse can be connected to the ammeter through a special switch. This switch must be turned on when the engine is started.

INSTALLATION:—The Autopulse should be mounted near the carburetor and preferably at a slightly lower level than the carburetor bowl. If possible it should be mounted on the chassis frame under the front floor boards so that the filter may be easily reached for cleaning. The suction line should be shielded from the engine exhaust pipe if it is necessary to run them together, to prevent vaporizing of the gasoline in the line. Likewise the pump should not be mounted above the carburetor as this will allow air to be trapped in the delivery line which will cause the pump to flutter. The Autopulse should not be mounted on the dash.

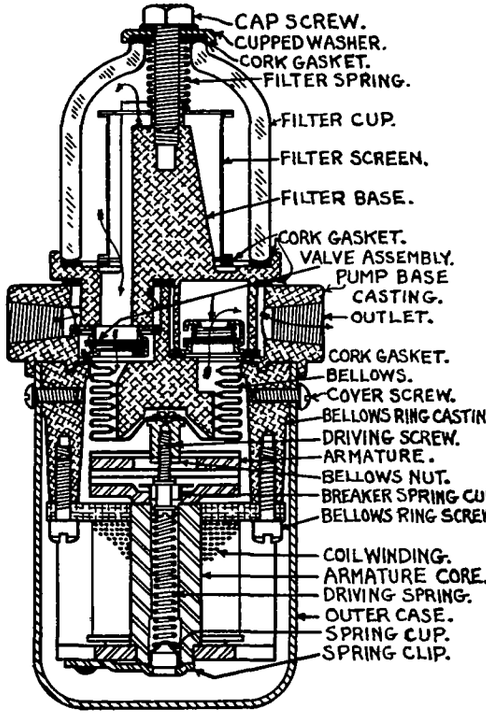
CAPACITY:—The Autopulse will pump approximately 12 gallons per hour. The standard unit is fitted with ⅛ inch openings which will take either ¼ or 5/16 inch tubing. The ¼ inch tubing will be sufficient for engines requiring up to ten gallons per hour. The pump is also furnished with ¼ inch pipe thread couplings which will accommodate ⅜ inch tubing. On multiple units inlet and suction manifolds are used. One end of the manifold can be closed with a pipe plug or if greater capacity is desired, two suction and delivery lines can be used connected to each end of the manifold. Additional pressure can be secured by reversing the small brass stamping on the lower end of the driving spring in the coil core which provides two pounds pressure instead of the standard one pound pressure. To make this change, first remove the motor cover. Then insert a small screwdriver in the slot in the spring support on the base of the motor, compress the spring and slip the support to one side. This will allow the spring and stamping to be removed. Reverse the stamping so that the small knob is against the spring and replace. Make certain that the support is snapped in place (see illustration).

SERVICING:—**Check for Correct Installation:**—After installing pump, turn on ignition but do not start engine. The pump should start at once and pump rapidly until the carburetor bowl is fulll. The pump should then stop. If the pump strokes rapidly and air bubbles are noticeable in the filter chamber, there is a leak in the suction line. If the pump does not stop and continues to pump slowly, there is a leak in the delivery line or the carburetor float valve is not properly seated.

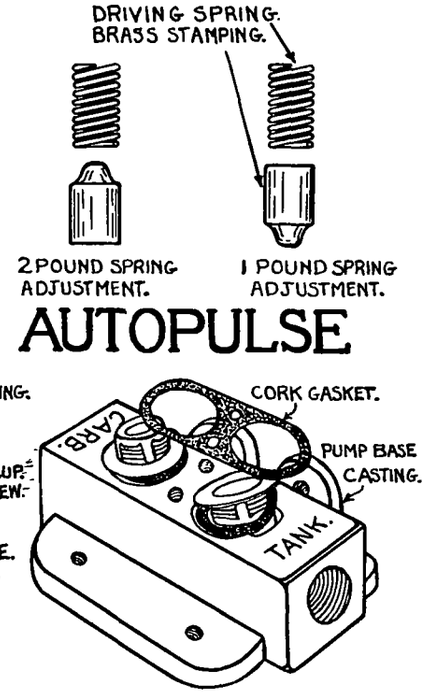
Cleaning Filter:—The filter is designed to trap all foreign matter and water in the filter chamber. To clean filter, take out the cap screw at the top, lift off the filter bowl and remove screen. In replacing the filter, carefully check the gaskets and replace if they are worn or damaged.

Valves:—To check valves, remove the filter and screen and take out the two screws in the filter base casting. Remove the filter base. The valves can then be taken out. Carefully examine the gaskets and replace if necessary. The valve on the 'Tank' side of the base should be inserted with the flange at the top and the valve on the 'Carb' side should be inserted with the flange at the bottom.

Pump Bellows:—To replace bellows, remove motor cover, take out driving spring by slipping spring clip at lower end to one side. Then loosen the nut on the driving screw directly below the bellows stud and loosen the driving screw by inserting a thin screwdriver in the spring hole. Then take out two screws in bellows ring casting and remove coil and armature. Take out the four screws in the bellows ring. The bellows ring and bellows can then be removed. After replacing the bellows, be careful to leave a clearance of .040 inch between the armature and the top of the magnet. The lock nut on the driving screw should be tightened to hold this adjustmet.



SECTIONAL VIEW.



VALVE ASSEMBLY.

Armature and Magnet:—When the lower contacts become worn it will be necessary to replace the armature. This operation requires the use of a special tool, a plain sleeve .341 inch outside diameter and .316 inch inside diameter, to align the breaker spring cup on which the lower contacts are mounted to insure proper clearance. To replace armature, disassemble as directed in above paragraph. Then remove armature by taking out two bolts. In reassembling, insert the special tool in the hole in the magnet to hold cup in alignment while the bolts are being tightened. Be careful to leave .040 inch clearance between the armature and the magnet. The magnet is installed in the same manner. If the upper contacts are worn they may be replaced by riveting a new upper contact bridge in place.

KING-SEELEY ELECTRIC FUEL PUMP

DESCRIPTION:—This pump is an electric, double-acting, piston type and is assembled as follows:

Piston & Valves—Valves are located in piston and are inertia type (valve mounted directly on each end of valve stem and operated by fuel flow without springs—light spring located on outlet valve stem used to facilitate priming when pump is dry). Piston is diamond-turned, die-cast aluminum and is screwed on upper end of piston rod directly above movable core. Fuel flows through channels in piston and ports in cylinder wall (see illustration).

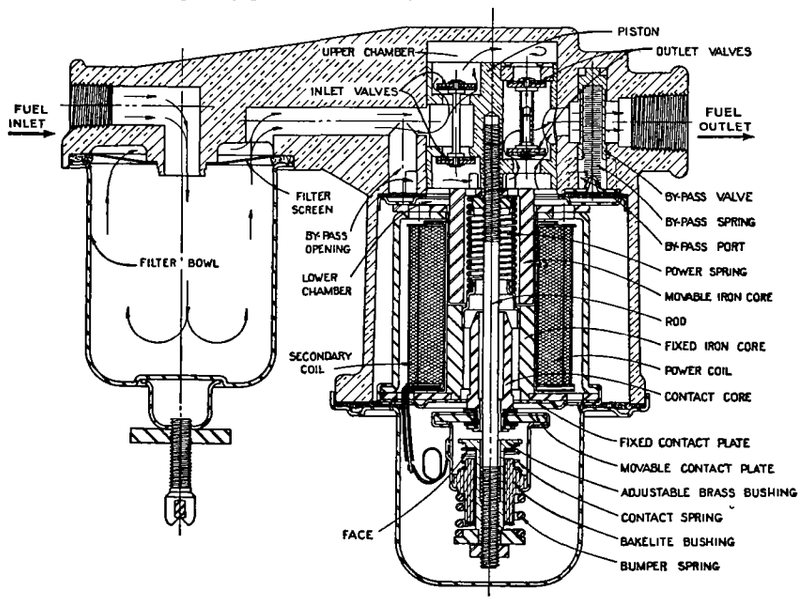
Coil & Power Spring—Coil is wound on form around stationary core and consists of a primary (connected in series between terminal on side of case and contacts) and a short-circuited secondary (which minimizes arcing at the contacts). Downstroke of piston, with coil energized, is caused by attraction between stationary core and movable core (mounted on piston rod below piston) and compresses the power spring located within the movable core. Upstroke of piston, with contacts open and coil not energized, is caused by power spring expansion.

Contact Mechanism—Contacts are stainless steel and are submerged in fuel which prevents arcing. Upper (stationary) contact is mounted on lower face of coil stationary core. Lower (movable) contact is mounted on the lower end of the contact core on the piston rod and is insulated from the rod by a bakelite bushing. Bakelite bushing is free on an adjustable brass bushing on the piston rod and is positioned by a bumper spring below and a contact spring above. This design results in a firm contact (contacts held together by attraction of coil core for contact core when coil energized so that contact spring compressed by piston movement) and a quick break (when contact spring reaches limit of compression).

OPERATION:—When coil is energized, movable core and piston are drawn down opening inlet valve and closing outlet valve of upper pump chamber so that fuel is drawn from tank through filter bowl and screen and channel in piston into this pump chamber. At the same time, inlet valve closes and outlet valve opens for lower pump chamber and fuel is forced out of this chamber through pump outlet to carburetor. During this stroke of the piston the contacts are held firmly closed (by attraction between stationary core and contact core) and the movement of the piston rod and brass bushing (which is rigidly mounted on rod) compresses the contact spring. When the spring is compressed sufficiently so that the brass bushing strikes the face of the bakelite bushing (which is part of the movable contact assembly), the subsequent movement of the bakelite bushing opens the contacts (contact spring snaps contacts wide open and prevents arcing as soon as coil is de-energized). Power spring (which is compressed during downstroke of piston) then forces piston up and valve action is reversed so that fuel is drawn into lower pump chamber and forced out of upper chamber. At the top of the stroke, the contacts close and the pumping cycle is then repeated.

Delivery Pressure Regulation—A spring-loaded, piston type, by-pass valve located in the outlet channel of the pump opens when the pressure exceeds the valve spring calibration and by-passes fuel through a channel in the pump housing back to the inlet side of the pump. Fuel is re-circulated through the pump in this manner until the carburetor float needle valve opens and the pressure decreases. When this occurs by-pass valve closes and fuel delivery resumes. By-pass valve springs are calibrated and standard spring limits delivery pressure to 2¼-2½ lbs. Special springs are available for pressures up to 4½ lbs.

SERVICING:—Units which do not operate satisfactorily should be replaced. Manufacturers service policy provides for replacement exchange.



STEWART-WARNER ELECTRIC FUEL PUMP

MODEL 110-A

DESCRIPTION:—Electrically driven, diaphragm type pump with new design magnetic motor consisting of an oscillating armature mounted in front of the power coil and linked to the pump diaphragm assembly. Contacts with control power coil circuit are sealed in a hydrogen filled tube and operated remotely by two relay coils (small contacts for relay coil operation are mounted on armature). Entire motor mechanism (power coil, armature, contact points, and contact operating relay coils) are located in upper pump housing and entirely removed from pumping chamber and fuel. Pumping mechanism (sediment bowl, filter screen, inlet and outlet valves, diaphragm assembly and delivery spring) are located in lower die-cast pump housing so that all fuel is below the diaphragm which is clamped between the two pump housing parts. Pump is pusher type and is designed to be mounted near the fuel tank (not more than 3' of suction line) and it is claimed that with this type of mounting vapor lock cannot occur.

Capacity & Performance—Pump will maintain delivery rate of 15 gallons of fuel per hour to the carburetor bowl (two pumps can be mounted in parallel for greater capacity) and operates at rate of 250 strokes per minute for maximum delivery. Current consumption is 1 ampere (maximum) or ½ ampere (average). NOTE—While pump is intended for liquid fuel pumping, all liquids including water may be handled. Pump is not affected by freezing.

OPERATION:—Pump switch contacts (in hydrogen filled tube) are normally held closed by spring tension so that power coil is energized immediately when the ignition switch is turned on. This causes armature to be drawn up toward coil core, compressing delivery spring, and raising pump diaphragm so that fuel is drawn into pump chamber from tank. When the armature reaches the upper position at the end of its stroke, the upper relay contacts close and upper relay coil is energized which attracts the movable contact of the main switch contact assembly, opening the contacts and breaking the power coil circuit. Delivery spring then pushes armature and pump diaphragm down and forces the fuel in the pump chamber out through the outlet valve and line to the carburetor bowl. When the armature reaches the lower end of its stroke, the lower relay contacts close and the lower relay coil is energized. This coil opposes the upper coil and counteracts the magnetic attraction holding the switch contacts open so that these contacts close. The pump cycle is then repeated.

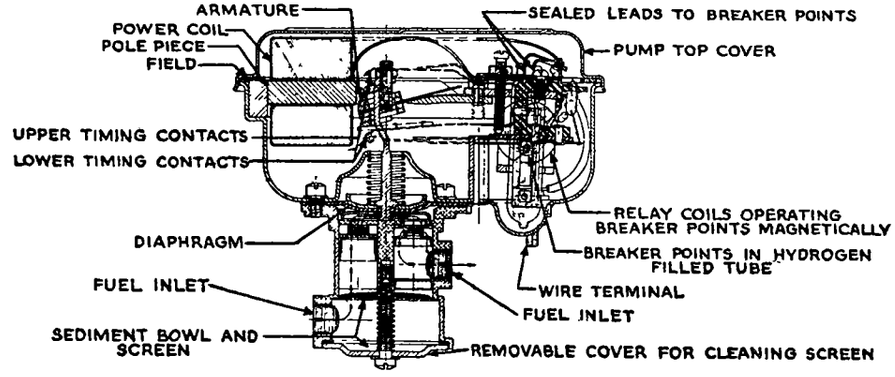
INSTALLATION:—Install pump upright (mark 'TOP' up) on frame side rail, cross-member, or bracket at tank level near tank so that suction line is not more than 3 feet in length. Tubing used to connect pump and tank should not be smaller than 5/16" outside diameter, tubing between pump and carburetor should be ¼" (small engines), 5/16" or ⅜" (large engines). Pump inlet and outlet are ⅛" P.T. Wire connecting terminal on fuel pump to ignition switch should be #16 or heavier. Connect pump to 'Gauge' terminal on switch so that pump controlled by switch. Make certain that pump well grounded through mounting bolts (use separate ground wire if necessary).

Dual Pump Installations—Use 'Tee' fitting in suction line and delivery line and connect each pump to this Tee. Wire pumps in parallel or install separate switches so that each pump can be cut in or out independently.

SERVICING:—**Sediment Bowl & Filter Screen**—To drain sediment bowl and clean filter screen, remove attaching screw on cover at bottom of pump casting, remove cover. Screen located within bowl and can be removed after cover has been taken off.

Switch Contacts—No servicing required. Contacts are sealed in hydrogen filled tube and are designed to outlast the life of the engine. Serviced by replacement only.

Diaphragm & Motor Servicing—Motor and diaphragm attaching screws are accessible by removing two screws in top cover. Diaphragm and diaphragm protectors are a unit with the pullrod (riveted assembly).



SERVICING STEWART-WARNER FUEL PUMPS

ALL MECHANICAL TYPES

Stewart Warner Pumps. Special tools and gauges are not necessary to replace diaphragms on these pumps. To install diaphragms, mount pump in bench vise, take off pump cover, nut, lock washer, alignment washer, diaphragm washer, and remove old diaphragm. See that spring retainer or lower diaphragm washer is properly installed with the cupped portion pointing down. Place four layers of diaphragm material (P-60637) in position on pull-rod, assemble upper diaphragm washer and alignment washer in place. Each of these parts has a keyway on the mounting hole. Line up keyways and compress driving spring so that the key on the pull-rod is engaged in these keyways. Hold the assembly in position and turn down nut and lock washer loosely. Hold the alignment washer from turning with a second wrench and tighten pull-rod nut securely. Be careful not to change relative position of diaphragm while this is being done. This is important. Then place pump cover in position, insert cover screws and turn screws down until about three threads on the end of each screw is engaged. Then flex diaphragm by pushing pump operating lever in toward pump as far as possible and hold it in this position while the cover screws are tightened evenly and alternately. This is important to secure the correct pump stroke. Test pump as directed above before installing in the car.

STEWART-WARNER FUEL PUMP

NOTE:—All models are similar to Model 403 (see illustration) except for minor details of mounting and construction of air dome and filter screen. The letter following the model number designates a particular installation. Model 407 is equipped with a large type diaphragm.

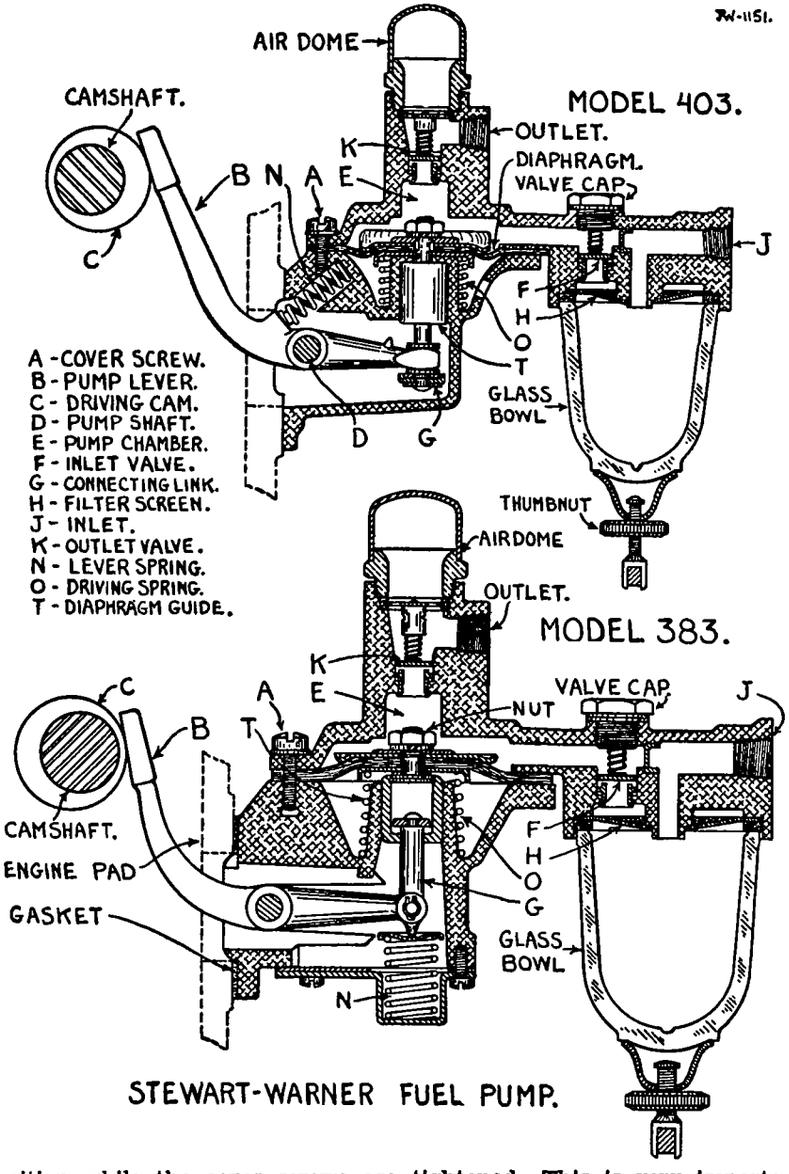
DESCRIPTION:—The Stewart Warner Fuel Pump is a mechanical diaphragm pump driven from the cam shaft of the engine and designed to deliver gasoline from the fuel tank at he rear of the car to the float chamber of the carburetor. A filter and glass sediment bowl are incorporated in the supply line of the pump so that all fuel passes through the glass bowl and then through a fine mesh strainer before it enters the pump chamber. From the pump chamber it is forced to the carburetor bowl, maintaining a constant supply which is designed to be in excess of the actual requirements of the engine. There is an air dome on the pump directly over the outlet valve which relieves the carburetor float valve of excessive pressure on the delivery stroke of the pump by allowing the air in the dome to be compressed.

OPERATION:—On the suction stroke of the pump the special cam on the camshaft forces the lever 'B' down, drawing the pump shaft and diaphragm downward. This creates a vacuum in the pump chamber 'E' which opens the inlet valve 'F' and causes gasoline from the fuel tank at the rear of the car to flow through the inlet 'J' into the glass reserve bowl or sediment chamber and then through the filter screen 'H' and the inlet valve to the pump chamber. As the camshaft rotates the pump lever moves upward through the action of the spring 'N'. This allows the driving spring 'O' to force the diaphragm upward closing the inlet valve, opening the outlet valve 'K' and forcing the gasoline out through the outlet to the carburetor. Air and gasoline vapor are compressed in the air dome during this delivery stroke and expand during the subsequent suction stroke so that the flow of gasoline in the line is kept more uniform and the rate is increased about twenty five per cent. When the back-pressure of gasoline in the line reaches 2.5 lbs. (carburetor float valve closed), the diaphragm is held in the lower position while the pump lever motion is absorbed by the linkage so that the pump remains inoperative until the float valve opens, when the pumping is resumed.

TROUBLE SHOOTING:—If the pump fails to deliver gasoline to the carburetor, disconnect delivery line and watch pump action while turning the engine over with the starter. If gasoline spurts from the delivery tube, the line to the carburetor is clogged or the carburetor needle valve is clogged. Observe breather hole in pump housing. If gasoline flows from this hole, the pump diaphragm is cracked and must be replaced. Disconnect supply line to gasoline tank and check for stoppage by blowing through the line. Then examine inlet and outlet valves, clean valves and valve seats and check valve springs. If the valves are warped or gummed, replace valves using new gaskets under the valve retaining nuts. Draw nuts down tight and tighten diaphragm screws. Clean out vent hole in pump housing to prevent back pressure in pump. If this does not correct trouble, remove pump from engine and test by connecting short pieces of rubber tubing to the inlet and outlet. Immerse the inlet tube in a glass of gasoline and operate pump by hand. Gasoline should spurt out of the outlet tube. If the pump does not operate it will be necessary to disassemble and examine the diaphragm and diaphragm spring. Replace weak springs, cracked or leaky diaphragm.

SERVICING:—See article on 'Servicing Fuel Pumps' on previous page for complete instructions on servicing and testing pumps. Diaphragms are installed as directed below.

To Replace Diaphragm:—Remove the pump cover by taking out cap screws. Unscrew the nut holding diaphragm on pump plunger using a second wrench to hold the large hexagonal nut from turning (this is very important to prevent tearing diaphragm and injuring pump). Remove old diaphragm and lay four pieces of diaphragm material in position on the spring retainer. Insert two cover screws to line up holes. Then place the two washers on the diaphragm, lining up the keyways in the washers and diaphragm with the key on the pump plunger stud. Compress driving spring by forcing these parts down on the stud until they seat properly with the key engaged in the keyway and screw the retaining nut down (holding the large hexagonal nut with a second wrench to prevent turning). Then place the pump cover on the diaphragm and engage the cover screws. Turn these screws down about three threads and then flex diaphragm by pushing the pump lever toward the pump as far as possible. Hold it in this



STEWART-WARNER FUEL PUMP.

position while the cover screws are tightened. This is very important to allow the proper pump action. In replacing the pump on the engine make certain that he gasket is in place between the pump and the engine pad. The pump will prime itself in approximately 20 strokes or 40 R.P.M. of the engine.

NOTE:—These fuel pumps are similar except that valve construction on Models 807, 814 is similar to Model 403 (see previous page). All models have the integral pullrod and diaphragm assembly. Letter following model number designates a particular installation. The Model 807 is equipped with a large diaphragm assembly.

DESCRIPTION:—The Model 706 Fuel Pump embodies many of the features found on previous models and is particularly small and compact. The maximum fuel delivery of the pump is 22 gallons per hour when operating at 2000 R.P.M. but pump delivers 18 gallons per hour operating at 100 R.P.M.

OPERATION:—Suction Stroke. The relative position of the moving parts and the flow of gasoline on the suction stroke is shown in the illustration. As the motor cam pushes lever 'B' toward the pump, the lever fulcrums at 'C', thereby pulling the pump diaphragm 'D' down. This creates a vacuum in chamber 'E'. Inlet valve 'F' opens, pressed down by a spring, and gasoline is drawn from glass reserve bowl 'G' through screen 'H'. The glass bowl is connected to the rear tank by inlet line 'J'. In operation the glass bowl will always be full of gasoline. The outlet valve 'K' is also pressed downward by a spring and will be closed during the suction stroke.

Delivery Stroke. When the low point on cam 'A' is on the side nearest the pump, pressure is exerted on lever 'B' by the lever spring 'N' causing the lever to follow the cam. The other end of the lever is engaged with the diaphragm but is free to slide in the diaphragm piston rod 'T'. On the end of the delivery stroke the lever is up as high as it will go, permitting the diaphragm spring 'O' to push the diaphragm up, forcing gasoline from chamber 'E' out through the outlet valve 'K' to the carburetor. The inlet valve 'F' is held closed by the spring during the delivery stroke. The air dome 'Q' relieves the excess pressure when the valve is closed and utilizes this pressure to increase the delivery rate by about 25 per cent. Maximum delivery pressure is 2½ pounds per square inch.

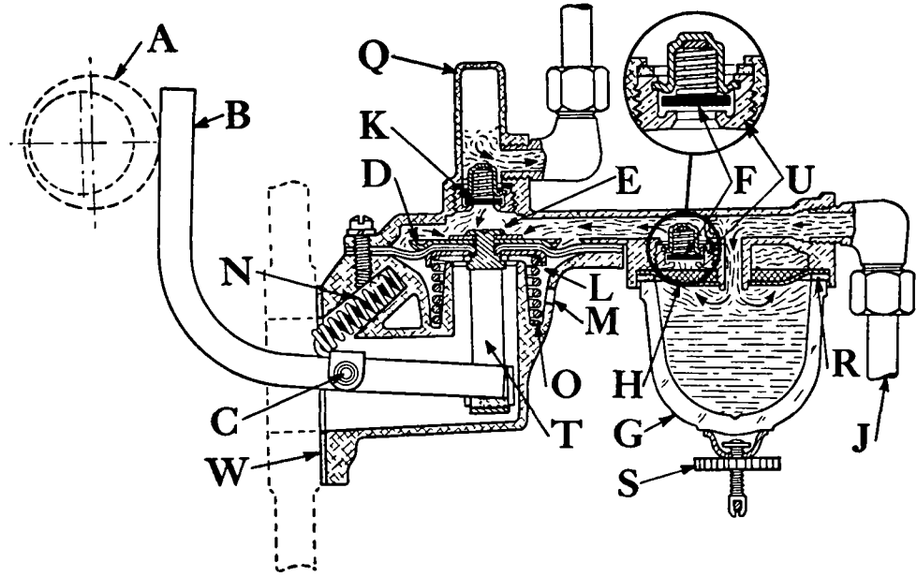
Control of Delivery. Maximum delivery rate of the pump is in excess of the motor requirements and the actual delivery of gasoline is controlled by the carburetor float valve which shuts off the flow of gasoline when the float bowl is full. When this occurs and the air dome pressure builds up to 2½ pounds, the pump diaphragm stops pumping and remains in the down position since the pressure of the gasoline in the pump chamber and carburetor line balances the pressure of the diaphragm spring. The pump lever continues to move with the rotation of the motor cam and slides on the piston rod 'T'.

TROUBLE SHOOTING:—On the Car. Do not remove pump from engine until the following points have been checked:

1. See that gasoline tank on car is not empty.
2. Note if gasoline has been coming out of breather hole 'M'. This will indicate a leak due to punctured diaphragm or at the piston rod.
3. Examine sediment bowl 'G' and screen 'H'. Empty water in bowl, clean screen. In replacing bowl be sure that gasket is intact, that bowl is flat on its seat when nut 'S' is drawn up. A leak at this point will cause erratic pump action and retard delivery. Soak new gasket in lubricating oil.
4. Check for loose connection or broken lines. Disconnect gasoline supply line at both ends and blow through it to be sure that it is not clogged.
5. Disconnect delivery line at pump, observe whether gasoline spurts out of pump outlet when engine is cranked with the starter. If gasoline delivery is satisfactory at pump and carburetor bowl is empty, see that delivery line is not clogged, and check carburetor float valve.

Testing Pump off the Engine. If tests on car indicate that pump is not operating satisfactorily, remove pump for bench testing. Attach a short piece of rubber tubing to inlet and delivery connections of pump, immerse inlet tube in pail of gasoline, operate pump by hand. Gasoline should spurt out of delivery tubing in approximately fifteen strokes of the lever. If pump does not operate, check as follows:

1. Examine check valves 'F' and 'K'. Some gasolines form gummy deposits on the valves and springs, preventing spring action and proper seating of valves. Clean valve seats and springs, replace valves with glossy side down. Be careful not to stratch valve seats. In replacing valve nut or cage 'U' always use a new gasket and be sure to draw nuts up tight.
2. Examine vent hole 'M' and clean out if necessary. It must be kept open.
3. Repeat test as given above for hand operation of the pump.



SERVICING PUMP:—Diaphragm. If pump cannot be made to operate, disassemble and examine diaphragm 'D' and diaphragm spring 'O'. A punctured diaphragm or weak diaphragm spring should be replaced. To remove diaphragm, drive out fulcrum shaft pin 'C'. Replace diaphragm and stem assembly as a unit. In reassembling pump be sure to stake ends of fulcrum pin hole after pin has been replaced in order to prevent pin working out in service. If it is not possible to stake pin in place, use Part No. 65043 snap ring and No. 65044 fulcrum shaft. The diaphragm is held in place on the piston rod by a spinning operation. Assembly must be replaced as a unit.

Assembling Pump. In replacing the diaphragm, clamp pump body in a vise, line up holes in diaphragm and pump body, set the pump cover on top of the diaphragm, push in far enough so that cover screws can be turned down not more than three threads. Then pull diaphragm down by pushing lever in toward pump as far as it will go, hold lever in this position and tighten cover screws. This is important for correct operation of pump.

Air Dome. The air dome is cast integrally with the pump cover and can not be removed. This eliminates possibility of leakage at air dome threads.

Valve Assemblies. Inlet and outlet valves are the same and are constructed as assemblies in a retaining nut or valve cage which is screwed in place in the pump castings. In servicing valves the entire valve assembly should be replaced although if the seat is satisfactory it is possible to replace only the valve or spring. In assembling the valve cage always use a new gasket and see that the cage is screwed tightly into the casting.

DESCRIPTION:—This is an electric gauge of the 'balanced' coil type and consists of a dash unit or recording device and a tank unit or measuring device. The two units are connected by an insulated wire and each unit is grounded. The feed wire on the dash unit is connected to the accessory terminal of the ignition switch (or coil side of switch) so that the gauge is operative only with the ignition turned 'on'.

OPERATION:—The two coils in the dash unit are connected in parallel to the switch terminal (1) on the gauge case. Coil (A) is grounded to the gauge case so that the current flow through this coil is constant. The other end of coil (B) is connected to the tank terminal on the gauge case so that the coil is in series with the resistance unit in the tank unit. The resistance unit is grounded through the contactor on the upper end of the gasoline tank float rod so that the resistance is cut in or out of the coil (B) circuit as the float rises and falls.

When the gasoline tank is empty (float in lowest position) all of the resistance coil in the tank unit will be in coil (B) circuit so that the current flow through coil (B) will be less than that through coil (A). This causes the dash unit armature to swing toward coil (A) so that the pointer (mounted on the armature) will be opposite the 'E' or empty end of the dial. As the float rises, the contactor cuts the resistance out of the coil (B) circuit so that when the tank is full, the resistance is entirely cut out and coil (B) is grounded directly. This attracts the armature so that the pointer swings over to the 'F' or full end of the dial. Variations in battery voltage have no effect on the operation of the gauge and the current consumption is negligible.

MOUNTING:—Both the dash unit and tank unit are grounded through the case and a good ground must be provided when they are mounted on the car. Remove all paint and grease from under the mounting flange and see that the two metal surfaces are in contact. When dash units are mounted on a wooden dash or other insulated support, a separate ground lead should be run from the mounting screw to the car frame or engine block.

TANK UNIT NOTE:—Tank units are furnished in both Gear Type (for tanks greater than 12" in depth or where baffles prevent installation of lever type) and Lever Type (for tanks of 12" depth or less). Tank units furnished with floats not attached to arm and should be installed as follows:

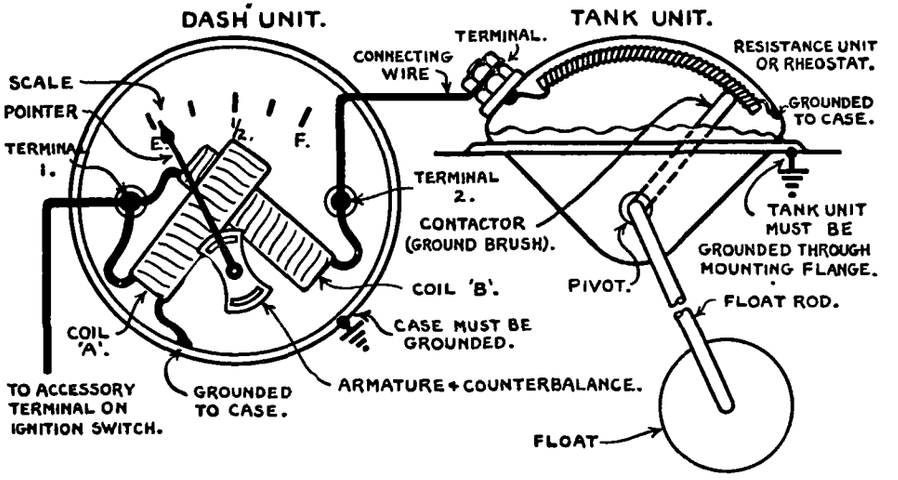
Gear Type—Travel limited to 52½° above and below horizontal position of arm. When installing, cut off float arm to correct length required for depth of tank and solder float on arm in horizontal position.

Lever Type—Furnished with float arm 12" long. Cut off float arm to correct length and solder float on arm at right angles to arm and with long diameter of float horizontal.

TROUBLE SHOOTING:—If gauge operation is not satisfactory, check in accordance with the following table:

Gauge Reads 'Full' at all times

1. Lead between dash unit and tank unit is grounded. Check by disconnecting lead at each end and substituting a test jumper wire. If gauge operates correctly, replace lead.
2. Connections on dash unit reversed. Reverse wires on dash unit and note performance.
3. Coil (A) in dash unit open-circuited. To check, disconnect tank unit lead on dash unit momentarily. Pointer should move to 'Empty' end of scale. This coil should draw .13 ampere at 6.0 volts (between switch terminal on dash unit and ground on case with tank unit lead disconnected).
4. Resistance unit in tank unit short-circuited. Check with voltmeter and battery between tank unit terminal and ground on case with dash unit lead disconnected. Resistance of unit should be 110 ohms.



Gauge Reads 'Empty' at all times

1. Dash unit not grounded. Examine ground contact or run extra ground lead from case to car frame.
2. Open-circuit between dash unit and tank unit. Check by connecting jumper wire between terminals on units and noting gauge performance.

Gauge Reading Inaccurate

Mechanical defect in dash unit or tank such as tight pivot bearings, armature counterbalance binding or incorrectly positioned, bent dial pointer, or bent float rod.

SERVICING:—Dash units or tank units which are found to be defective should be replaced.

AC GASOLINE GAUGE TESTING

NOTE:—Manufacturer recommends that AC Gas Gauge Tester, Part No. 1516000, be used in making these tests. Tester is similar to a gas gauge Tank Unit equipped with test leads and an operating handle by which the resistance can be cut in and out of the gauge circuit in a similar manner to the operation of the tank unit on the car.

TESTING:—Make the following tests in the order given which will completely check all gas gauge units and wiring.

DASH UNIT

With ignition switch 'off', disconnect tank wire at terminal on back of dash unit, connect RED tester lead to this terminal, ground BLACK tester lead to frame. Turn ignition switch 'on', move Tester arm up and down. Gas gauge dash unit should register 'Full' and 'Empty'. If operation is O.K., disconnect tester and reconnect tank wire. If dash unit pointer does not register correctly, check feed wire by connecting 6 volt test lamp between dash unit Ignition Terminal (second terminal on back of dash unit) and ground. If test lamp does not light, circuit from ignition switch is defective and ignition switch and connecting wire should be checked or replaced. If lamp lights (gauge circuit O.K.) and dash unit does not operate, replace dash unit and reconnect wires.

GAUGE WIRING

Disconnect tank unit wire at nearest point to tank unit (bayonet type snap connector or junction block). Attach Red tester lead to wire running back to dash unit, ground BLACK tester lead to car frame. Turn ignition 'on'. Move tseter arm up and down and watch dash unit pointer which should move from 'Empty' to 'Full'. If dash unit reads 'Empty' at all times, or if reading is lower than when dash unit tested alone (dash unit test above), check wire for shorts or leaks (broken insulation, short junction block terminals, un-insulated connectors touching body or frame, etc.). If dash unit reads above 'Full' at all times, or if reading is higher than when dash unit tested alone, check wire for open-circuits (break in wire, loose connections, corroded terminals, etc.). If dash unit and wire tests O.K., check tank unit.

TANK UNIT

Remove tank unit, clean tank unit terminal and mounting flange thoroughly, connect tank unit to wire running to dash unit, ground tank unit by connecting jumper wire from tank unit mounting flange to car frame. Turn ignition 'on'. Move tank unit float arm up and down. Dash unit pointer should move from 'Empty' to 'Full'. If dash unit reading indicates tank unit defective, replace tank unit. Always check tank units before installing in tank and make certain that float arm is free (check for freedom of movement by noting that float arm falls back to empty position when released in various positions). See that gasoline tank and tank unit mounting flange are clean (tank unit grounded to frame through tank) and that a good ground contact exists between tank and frame.

DESCRIPTION:—The A.C. Electric Gasoline Gauge is of the balanced coil type and consists of two units, a dash unit or recording gauge and a tank unit or measuring device mounted on top of the gasoline tank. The dash unit mounted on the instrument panel consists of two coils mounted at an angle of 90 degrees. The gauge pointer is attached to an armature which is pivoted at the intersection of the coil axes. The dash unit is connected to the coil side of the ignition switch and to the tank unit through insulated wires. The dash unit is grounded through the mounting screws to the instrument board and car frame.

The tank unit consists of a fixed resistance connected to the dash unit. A movable contact arm geared to a float in the gasoline tank cuts this resistance in or out of the dash unit coil circuit. The float rests on top of the gasoline in the tank and rises and falls with the gasoline level. A friction brake is built in the tank unit to prevent wave motion caused by road shocks affecting the gauge reading. The dash unit is also provided with an inertia dampener to prevent road shocks being transmitted to the gauge pointer. Both dash units and tank units are standardized so units are interchangeable.

OPERATION:—The upper terminal of the dash unit marked 'Ignition' is connected to the coil side of the ignition switch (or to the 'auxiliary' terminal of lock switch coils) so that the gauge is operative whenever the ignition switch is turned on. Current flows through coil 'A' of the dash unit to the center terminal marked 'Tank'. The second coil 'B' is connected to this terminal. The other end of this coil winding is grounded to the gauge case. The 'Tank' terminal of the gauge is connected to the terminal on the tank unit and circuit is completed to ground through the tank unit resistance winding. This resistance winding in the tank unit is grounded through the movable contactor so that the resistance is cut in or out of the dash unit coil circuits as the float rises and falls with the gasoline level in the tank.

When the gasoline tank is empty with the float at its lowest position, the contactor will be at the terminal end of the resistance unit so that the resistance is entirely cut out of the coil 'A' circuit and coil 'B' is practically short-circuited. Current in coil 'A' will be at maximum and in coil 'B' at minimum. The resulting magnetic field will cause the pointer armature to swing over so that the pointer will be opposite the 'Empty' end of the gauge scale. As gasoline is added in the tank and the float rises, the contactor moves along the resistance unit adding resistance in the coil 'A' circuit and causing more current to flow through coil 'B'. The pointer armature is attracted toward coil 'B' and the pointer passes over the gauge scale toward the 'Full' position. With the tank full the resistance will be entirely in the coil 'A' circuit and entirely out of the coil 'B' circuit.

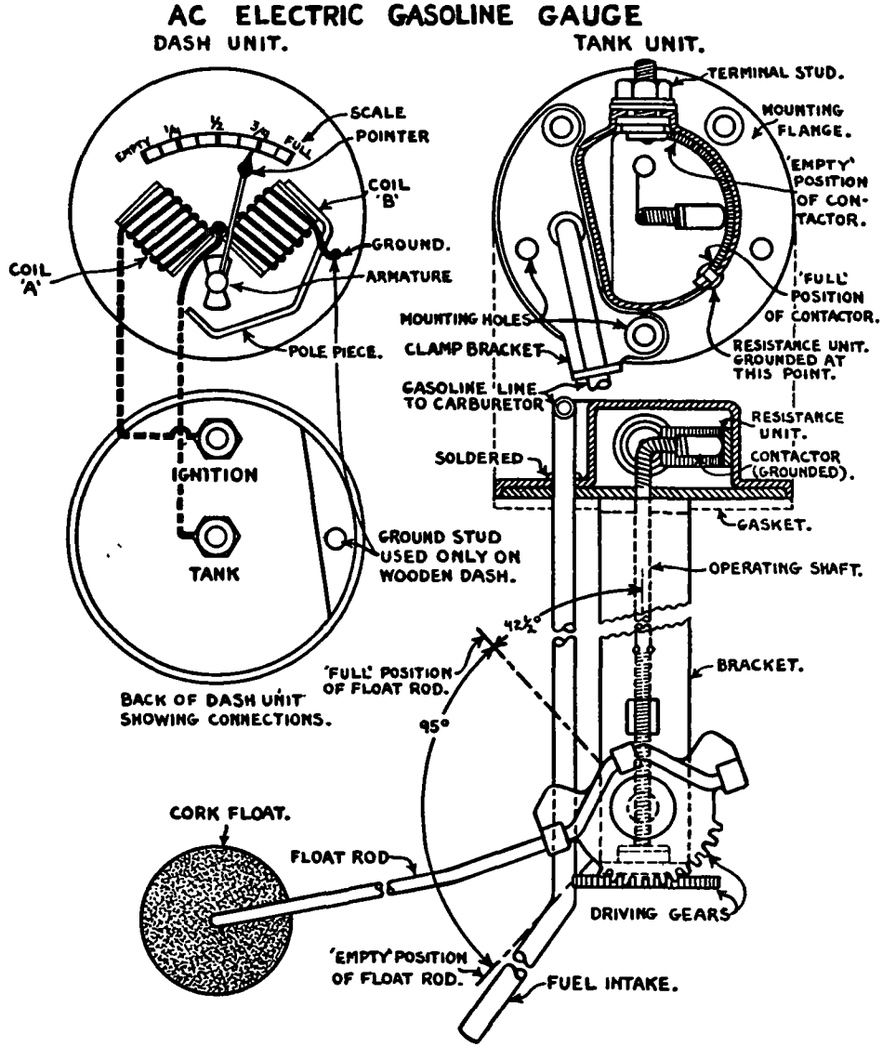
Since the gauge is of the balanced coil type, differences in the voltage of the car battery will have no effect on the accuracy of the gauge reading. Current consumption of the gauge is between 1/6 and 1/10 ampere and can be disregarded.

INSTALLATION:—Both the tank unit and dash unit are grounded and care must be taken whenever the units are installed or replaced that a ground is provided. On the tank unit it will be sufficient to remove paint and carefully clean the tank under the tank unit flange. Dash units designed to be mounted on a wooden dash or instrument board are provided with a ground stud which should be connected to the car frame.

TANK UNIT (NEW TYPE):—Gearless type with integral float arm and contactor arm (rheostat ground brush). Float arm is pivoted in lower end of tank unit case so that movement of the arm (with the rise and fall of the float in the tank) causes the upper end of the arm to sweep across the tank unit resistance coil. Except for this new type float arm construction and separately mounted fuel outlet pipe (some models), gasoline gauge is similar to type used on previous car models.

TROUBLE SHOOTING:—Defective units should be replaced and servicing operations will be confined to locating trouble in dash unit or tank unit. Check gauge operation from following table:

1. Pointer does not move when ignition is turned 'on'.
   The line from the ignition switch to the dash unit is open. Check connections and supply new lead from switch to 'IGN' terminal on gauge.
2. Gauge indicates 'Full' at all times.
   The line between dash unit and tank unit is open. Check connections and replace line with insulated wire.
   Tank unit burned out. Replace tank unit.
   Tank unit not grounded. Check by supplying new ground from tank unit to car frame.



3. Gauge indicates 'Empty' at all times.
   Wires reversed on dash unit. See that connections are made as indicated above on diagram.
   Dash unit is not grounded. See that dash unit is properly grounded. Check by supplying special test ground to car frame. If dash unit does not register correctly, it must be replaced.

AUTO-LITE ELECTRIC GASOLINE GAUGE

This type gauge standard equipment on the following car models:

Car Model	Model (Dash Unit).
Chrysler, Royal C22 (1939)	NG-9064D
Chrysler, Imperial C23 (1939)	NG-9064D
Chrysler, Cust. Imp. C24 (1939)	NG-9064D
DeSoto, Model S6 (1939)	NG-9040D
Dodge, Model D11 (1939)	NG-9023D
Plymouth, Models P7, P8 (1939)	NG-9009D
Studebaker Champion, Model G (1939)	NG-9211D

IMPORTANT SERVICE NOTE:—Three types of dash units have been used as described below and special precautions must be observed when tightening connections at dash unit terminals on each model. Excessive tightening will loosen terminal stud and destroy the accuracy of the gauge requiring replacement of the dash unit (see also Calibration Adjustment below).

First Type Dash Unit—No identification marks. No terminals staked to prevent turning. Use great care when tightening connections, particularly at 'IGN.SW.' terminal.

Second Type—May be identified by radio resistor terminal at top of gauge between '1' and '2' terminals and use of round insulating washers on each of these terminals. The 'IGN.SW.' terminal is staked to prevent turning. Other terminals are not staked.

Latest Type—May be identified by radio resistor terminal and insulating strip extending across between '1' and '2' terminals (replaces individual insulating washers used on other types). All three terminals staked to prevent turning.

DESCRIPTION:—Gauge consists of a bimetal or thermostatic arm type dash unit and a rheostat type tank unit connected together by two wires.

Dash Unit—Pointer actuated by the two bimetal arms on which heating coils are wound (these arms hinged at upper end with lugs to engage pointer at lower end). The two outer bimetal arms (without heating coils) compensate the dash unit for temperature changes (left hand arm controls dash unit contacts, right hand arm has insulated stop at each side to limit motion in each direction) and the contacts compensate for battery voltage variations (remain closed at 5 volts or less, open and close at voltages above 5 volts to maintain constant gauge input). The circuit through the dash unit is from the 'IGN.SW' terminal through the contacts and then through each heating coil to terminals '1' and '2'.

Tank Unit—Consists of a resistance coil wound on a flat form and connected between the two tank unit terminals. Contact arm is grounded and circuit from each terminal is through the resistance to ground at the contact arm. Contact arm is mounted on the float lever and moves across the resistance as the float rises and falls so that resistance is cut out of one dash unit heating coil circuit and in on the other heating coil circuit with this movement.

OPERATION:—When the ignition switch is turned on, current flow through heating coil on each bimetal arm in the dash unit depends on contact arm position in tank unit (contact arm controls amount of resistance in each heater coil circuit) and the unequal current flow through each coil causes an unequal deflection of the bimetal arms so that the pointer is moved on the scale. Any change in the position of the tank unit contact arm (caused by float movement) causes a like change in the bimetal arm deflection and pointer reading of the dash unit. When voltage at gauge exceeds 5 volts, or if bimetal arms become overheated, contacts open and close to maintain constant input so that readings are accurate regardless of voltage fluctuations (pointer position entirely dependent on division of current between heating coils on bimetal arms as controlled by tank unit. Contact opening and closing is sufficiently rapid so that pointer does not change). External temperature changes (affecting outer unwound bimetal arms) cause a slight rotation of the hinge so that position of inner bimetal arms and pointer remains unchanged. Gauge design results in a lag or damping action so that pointer fluctuations due to fuel tank surges are minimized. When ignition switch is turned off, bimetal arms flex away from pointer which is then returned to the empty position by the counterweight at the lower end.

TESTING:—Use spare tank unit, which is known to be in good order, to test gauge units. Disconnect wires on terminals '1' and '2' of dash unit, connect these terminals to same numbered terminals of test tank unit, ground test unit to car. Turn ignition switch on and operate test unit by hand, moving float from empty to full position, and noting dash unit pointer reading. NOTE—Allow one minute for dash unit to indicate true reading. If dash unit reads correctly when operated with test tank unit, trouble is in wiring or tank unit (see Trouble Shooting Table and test directions below). If dash unit does not read correctly, replace unit (see Calibration Adjustment below).

Checking Wiring—Connect 6 volt test lamp in series with wire to tank unit at connector accessible through hole in trunk floor. With ignition turned on, lamp should go on and off at regular intervals. If lamp does not light, wire is grounded or open-circuited (see Trouble Shooting table). Test both Brown and Blue wires in this manner. NOTE—Open-circuits are usually found at wire connectors in rear compartment. Clean contact surfaces thoroughly to remove all grease, dirt, insulating varnish. Grounds may occur at left windshield post where wires enter post or at left rear quarter window (make certain that moulding screws do not pinch or pierce wiring insulation).

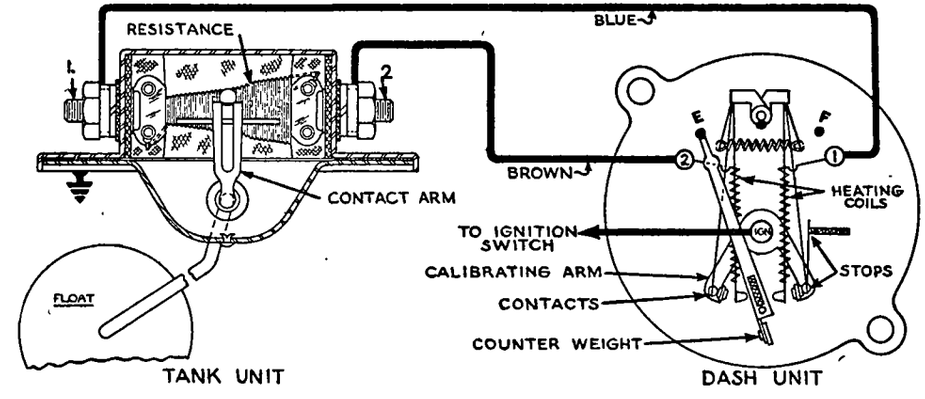
TROUBLE SHOOTING:—If wires open-circuited, grounded or reversed, gauge will read inaccurately as follows:

	Gauge Reading With		
	Tank Empty	Tank ½ Full	Tank Full
Blue Wire Grounded	Empty	¼ Full	½ Full
Blue Wire Open	½ Full	Full plus	Full plus
Brown Wire Grounded	½ Full	¾ Full	Full
Brown Wire Open	Empty	Empty	Empty
Wires Reversed	Full	½ Full	Empty

Gauge Reading Inaccurate—See table above. May also be caused by excessive tightening which has loosened terminal studs requiring replacement of dash unit (see Service Note and Calibration Adjustment).

Pointer Sticks or Binds—See that pointer does not bind on panel at lower end (if necessary, shim gauge out from panel by installing gasket cut to size of dash unit mounting face. Check pointer bearing alignment and endplay (adjust by bending bearing supports).

Fluctuating Pointer—Examine contact points and clean by drawing piece of bond paper between them.



CALIBRATION ADJUSTMENT:—If pointer position not correct at Empty or Full, or if gauge reads inaccurately, dash unit should be calibrated as follows: Remove dash unit from car, connect to tank unit known to be in good condition and to a battery (see illustration for connections). Loosen both nuts on 'IGN.SW' terminal (inner nut is staked on later type units) to release calibrating arms. Set tank unit float in Empty position, move left hand calibrating arm (on which stationary contact is mounted) to right to raise pointer reading, or to left to lower pointer reading. Move tank unit float arm to Full position, move right hand calibrating arm to right to raise pointer reading, or to left to lower pointer reading. Recheck gauge at Empty position (setting may be changed by the Full adjustment). Tighten nuts on 'IGN.SW' terminal to lock calibrating arms in position using extreme care not to shift arms while tightening inner nut. NOTE—When making this adjustment, or when testing dash unit on the bench, unit must be shielded from air currents which might cause unequal cooling of the bimetal arms and affect the gauge reading. Allow 1 minute for bimetal arm heating coils to heat up, after moving tank unit float, before checking dash unit pointer position.

K-S 'TELEGAUGE' FUEL GAUGE

DESCRIPTION:—The K-S Telegauge is a hydrostatic gasoline gauge. The gauge actually measures the pressure due to the weight of the gasoline in the tank on a column of trapped air in the tank unit of the gauge. This is recorded by the height of the liquid column in the dash unit of the gauge. Since the height of the column depends upon the height of the gasoline in the tank the dash unit is calibrated to read directly in gallons. It should be remembered that there are three distinct units to the gauge; the dash unit or recording unit, the tank unit or pressure unit, and the air line which connects them. These will be taken up individually.

Tank Unit:—The tank unit consists essentially of an inverted cup mounted in the bottom of the gasoline tank and connected through an air-tight tube to the gauge connection on the top of the tank. The cup is closed by a plate at the bottom to prevent fuel surges affecting the operation but gasoline is free to enter the cup through a hole in the plate. A vent pipe to protect the gauge against high pressure extends down through the cup with the lower end (which is open) at the lowest portion of the cupped lower plate. The upper end is open to the air. It is purely a safety measure and since the lower end is normally covered by gasoline it has no part in the operation of the gauge. There is, however, an air supply tube which terminates in a cup at the upper end in the tank while the lower end is curved up under the bottom of the cup. This acts to renew the air supply in the cup by trapping gasoline in the upper air cup from which it runs down through the tube, drawing with it small bubbles of air. These bubbles find their way into the cup of the tank unit and maintain the air supply. When the cup is completely filled they escape around the edge and through the gasoline in the tank.

Air Line:—This consists of an air-tight copper tube connecting the terminals of the tank unit and the dash unit. It transmits the air pressure in the tank unit to the dash or recording unit where it displaces the red liquid in the gauge.

Dash Unit:—The dash unit consists of a glass tube open at the top and mounted directly behind the face of the gauge so that the height of the liquid can be seen. The lower end of the tube is connected to a brass supply tube which is connected at its upper end to the air line from the tank unit. The whole assembly is thus a 'U' tube filled with a red liquid and open to the air at one end and connected to the tank unit or pressure source at the other end. When the pressure at both ends of the 'U' are equal, as they will be when the gasoline tank is empty, the liquid will be of the same height in the two sections of the 'U'. This corresponds to the 'Empty' position of the gauge and the top of the column in the gauge glass should be opposite the 'Empty' figure on the gauge face. Most of the gauges do not show a '0' or empty position and the gauge will read 'R' indicating the reserve supply at the lowest position of the liquid. A calibrating wire is installed in the brass tube at the factory. This wire must not be removed or the accuracy of the gauge will be affected.

OPERATION:—As the tank is filled with gasoline, the pressure of the gasoline tends to displace the air in the tank unit cup, driving it through the air line to the dash unit. Here it unbalances the two liquid columns, driving the liquid down in the supply tube and up in the gauge glass. The gauge is calibrated to read directly in gallons.

TROUBLE SHOOTING:—If performance of the gauge is not satisfactory, check trouble from following table:

Gauge Does Not Register. If gauge reading goes up slowly when motor is operated with car standing still, this may mean that air line is plugged and air in line is expanding from motor heat.

(1) Air line leaks. Dry out air line and test for tightness (vacuum).
(2) Broken Dash Unit. Inspect and replace if necessary.
(3) Plugged Air Line. Blow out air line with hand pump. See that air actually passes through line.
(4) Plugged or Broken Tank Unit. Inspect tank unit and replace if necessary.

Gauge Reading Erratic. Noticed as increase in reading when car is decelerated, and drop in reading when car is accelerated. Small variations when turning corners, etc., are normal.

(1) Moisture in air line. This takes the form of small plugs or drops of gasoline in the line. Dry out air line with hand tire pump.

Gauge Reading Drops When Car is Parked. A small drop over long periods, as when car is parked overnight, is normal at certain times.

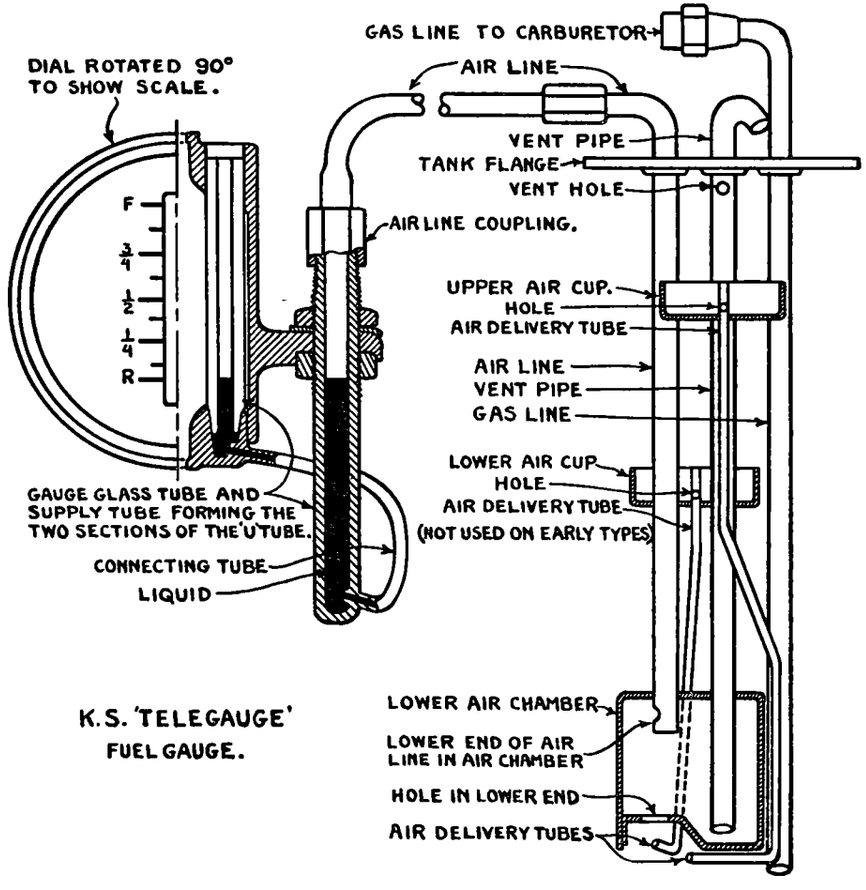
(1) Small leak in air line. Check air line for tightness (vacuum).

Gauge Reads High. Gauge will read full before tank is completely filled and will indicate gasoline in tank when tank is empty.

(1) Too much liquid in dash unit. Disconnect air line. Absorb excess liquid with match or toothpick until liquid level is at '0'. Dry out air line before reassembling.

Gauge Reads Low. Gauge does not read full with gasoline tank completely filled.

(1) Not enough liquid in dash unit. Disconnect air line. Add liquid until level is at '0' mark. Dry out air line before reassembling.
(2) See that calibrating wire is in place in brass tube of dash unit.



K.S. 'TELEGAUGE' FUEL GAUGE.

SERVICING:—Dash Unit. The level of the red liquid should be opposite the lowest mark on the gauge with the air line disconnected at top of the supply tube. To check, disconnect the air line and note the reading. The level of the liquid can be adjusted by using a toothpick to absorb excess or by adding additional liquid. This can be secured from the manufacturer and only genuine King-Seeley Telegauge liquid should be used. Make certain that the calibrating wire is in place in the brass tube. Inspect dash unit for evidence of breakage or mutilation.

To Test Dash Unit. Pump air into brass tube by moving thumb up and down rapidly at top of tube until reading is secured, then hold thumb tightly over brass tube and note whether reading is held. If liquid level in glass tube is maintained, dash unit is OK.

Air Line:—Air line should be dried out whenever it is disconnected. To do this, connect a hand tire pump to the dash unit end of the air line (special pump connection K-S No. 1502 may be used), remove gasoline tank filler cap, pump at least 50 full strokes through the line. Make certain that line is not plugged and that air passes through. Examine air line connections, see that cones are smooth, true and clean so that connections will be tight.

To Test Air Line. Plug tank end of air line. Suck on dash unit end. Vacuum should be sufficient to hold tongue against end of tube for one minute. If line leaks (no vacuum) or is plugged (air cannot be driven through), it should be replaced. Do not use air compressor line to blow out air line as pressure will be excessive.

Tank Unit:—Tank unit will ordinarily not require attention. Examine connector at top of air line tube. If tank unit is removed from gasoline tank, examine hole in air delivery tube in air cup, and see that hole in plate at lower end of chamber is open. Air chamber and line must be tight.

Final Check:—After reassembling air line, disconnect fuel line at pump and blow back through fuel line (when fuel tube is part of tank unit), or drive the car in such a manner as will cause fuel to splash in tank (where fuel tube is separate). This will build up the air supply in the air chamber so that the gauge will register. If the gauge reading is held for one-half hour, gauge is operating satisfactorily.

KING-SEELEY ELECTRIC TYPE GAUGES

DESCRIPTION:—This is an electric type gauge of a new type using bi-metal arms on which heating coils are wound in both the tank or engine unit 'Sender' and the dash unit 'Receiver'. The two heating coils are connected in series and the gauge circuit is completed to ground through a set of contacts in the Sender unit (one of which is mounted on the bi-metal arm). The feed wire on the Receiver unit is connected to the accessory terminal of the ignition switch so that the gauge registers only with the ignition on.

Gasoline, Oil, Water Level—For this purpose the ground contact in the Sender is mounted on a movable arm (arm mounted through diaphragm forming lower cover of Sender unit and flexes diaphragm as it is moved). The lower end of the ground contact arm is actuated by a cam on the upper end of the float rod pivot. When the float moves up to follow the gasoline, oil, or water level, the cam moves the arm so that contact pressure and length of time contacts remain closed is increased.

OPERATION:—When the Sender contacts are closed a current flows through the heating coils of both the Sender and Receiver units. This causes the bi-metal arm in the Receiver to bend, moving the pointer, and indicating a reading on the gauge dial. At the same time the heating coil in the Sender unit causes its bi-metal arm to bend, opening the contacts and interrupting the current flow. When this occurs the heating action stops and the cooling of the bi-metal arm causes it to flex in the opposite direction and again close the contacts. In operation, this cycle takes place very rapidly (approximately once each second for the gasoline gauge with tank empty), and a steady reading is obtained on the Receiver dial.

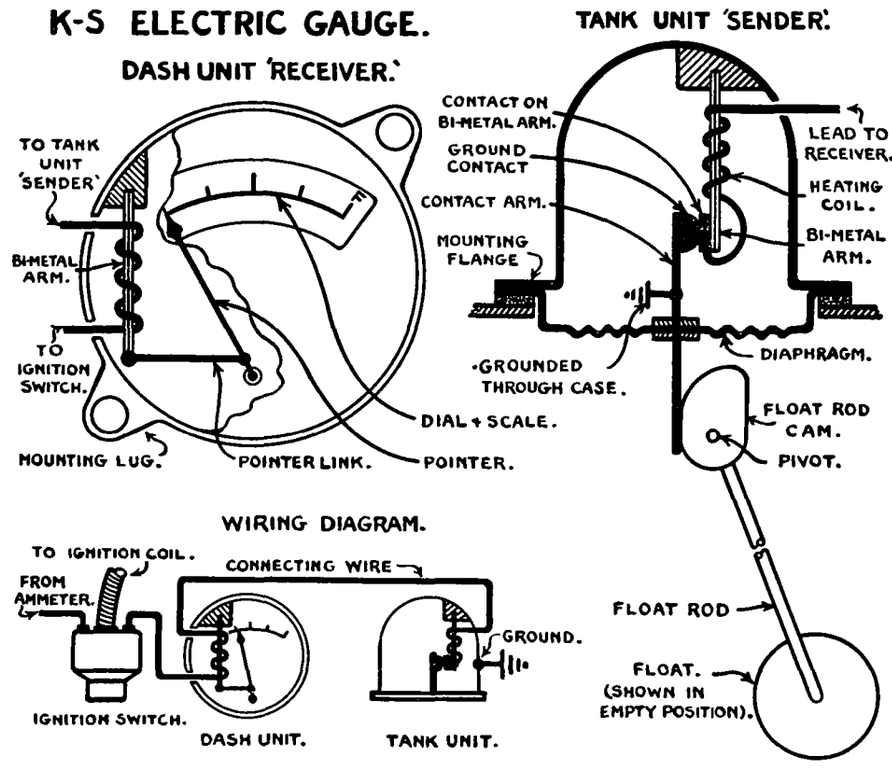
TROUBLE SHOOTING:—Gasoline, Oil, Water Level Gauges—Manufacturer recommends use of extra or test Sender and Receiver to check operation of units which do not perform satisfactorily. Make tests as directed below:

Testing Sender:—Disconnect lead of Sender unit on car, connect this lead to test Sender and ground this Sender to the car frame. Turn on ignition, move Sender float up to 'full' position and note reading on Receiver. Receiver should read full or 'F' after 10-15 seconds time. If Receiver reading is correct, check following points before replacing Sender unit.

1. Ground. Sender is grounded through case. See that all paint and grease are removed under flange and both surfaces make good contact.

2. Radio By-pass Condenser Shorted. If by-pass condenser is connected at Sender on cars with radio, test for short-circuit by disconnecting condenser and noting gauge operation. If gauge is satisfactory, replace condenser. Use only condenser of .05 microfarad capacity (manufacturer recommends Cornell Dubilier Corp. Condenser No. 22-259).

If reading is secured with test Sender is same as that with Sender on car, check wire connecting Sender and Receiver and replace if found to be open-circuited or grounded.



Testing Receiver—Disconnect wires on Receiver on car and connect to same terminals on test Receiver. Turn on ignition switch and note reading on gauge. If test Receiver reading is correct, replace Receiver on car. If test Receiver reading is same as car Receiver, repeat tests on Sender and wiring.

SERVICING:—No service operations are required other than to see that wires are properly connected and terminals are tight. No repair operations are possible and defective Senders and Receivers should be replaced.

ELECTRIC TYPE

FUEL-AND-OIL LEVEL GAUGE NOTE:—These installations consist of a regular gasoline gauge dash unit and tank unit and an additional tank unit placed in the crankcase oil pan to indicate the oil level. A two-way selector switch is used so that the dash unit may be connected to the fuel tank unit (for gasoline reading), or to the oil pan unit (for oil level reading). Dash unit and tank units used for this type installation are the same as used for regular gasoline gauges and these units are tested in the same manner as fuel gauges listed below.

DESCRIPTION:—The electric gasoline gauge is of the balanced coil type and consists of a dash recording unit and a tank resistance or variable resistance connected to a float in the gasoline tank. The gauge operates only when the ignition switch is on and indicates 'Empty' with the switch off. With engine stopped it will be necessary to turn the switch on to secure a correct reading. The gauge is not affected by changes in battery voltage and will give a correct reading with a discharged battery.

MOUNTING:—Both the dash unit and the tank unit should be grounded. If the gauge is mounted on a wooden dash it will be necessary to run a wire from the gauge case to the engine block or car frame. The tank unit is grounded through the mounting screws. One wire from the 'Ga' terminal on the dash unit runs to the terminal on the tank unit. A second wire from the dash unit terminal 'IGN SW' should be connected to the coil terminal of the ignition switch. Make certain that all connections are tight.

TROUBLE SHOOTING:—If gauge does not register correctly in service, first check for loose connections at switch, dash unit, or tank unit and check lines for broken wires. Make certain that both dash unit and tank unit are properly grounded. Then make the following tests:

Defective Dash Unit. Turn on ignition switch. Remove wire at tank unit. Gauge should register 'Empty'. Ground wire to car frame. Gauge should register 'Full'. If it does not, the dash unit is defective.

Defective Tank Unit. If the above tests indicate that the dash unit is operating correctly and the gauge will not operate in service, the tank unit is probably defective.

Do not attempt to make repairs to either the dash unit or tank unit. The manufacturer will replace all defective instruments.

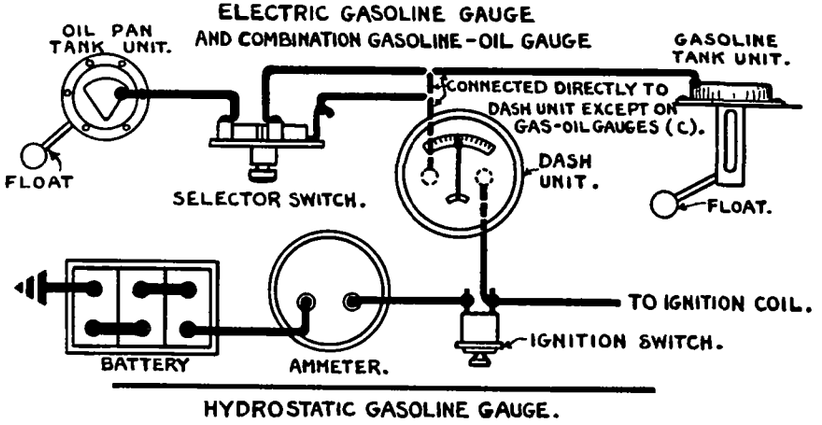
HYDROSTATIC TYPE

DESCRIPTION:—The hydrostatic type gasoline gauge consists of a pressure gauge on the dash calibrated to read in gallons of gasoline, an operating cup or air chamber in the gasoline tank, and a tube connecting the two units. This tube has a coupling at the dash unit and at the top of the gasoline tank and these couplings must be tight to prevent any leakage of air pressure from the system. The gauge line is also connected to the vacuum tank so that the air is removed whenever the tank operates. This has the effect of removing any gasoline vapor from the air line, which would interfere with the correct reading of the gauge. For this reason the gauge reading will drop back to zero or 'Empty' whenever the vacuum tank operates but the gauge will shortly afterward indicate a correct reading.

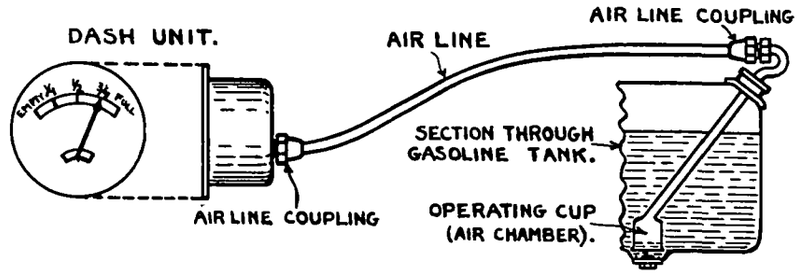
OPERATION:—The gauge, air line and operating cup are normally filled with air. The operating cup is open only at the bottom and the air will be trapped in the cup by the gasoline in the tank. The weight of the gasoline will exert a pressure on the air, compressing it slightly. This pressure is transmitted to the dash unit, which is a pressure gauge, and will be indicated on the scale in terms of gallons of gasoline. The pressure depends entirely on the height of the gasoline in the tank, increasing from no pressure when the gasoline level is below the bottom of the operating cup to a greater pressure when the tank is full. Naturally any leak in the air line will permit the escape of air and the pressure will be lost, causing the dash unit to register a lower reading than it should.

TROUBLE SHOOTING:—If the gauge fails to register, the trouble may be in the gauge or dash unit, the air line may be clogged, or the coupling may be loose. Check as follows:

Testing Dash Unit. Disconnect the air line at the back of the dash unit and slip a short piece of rubber tubing over the gauge socket and then blow through the tubing until the gauge reading is approximately ¾ 'Full'. Any excessive pressure will destroy the gauge. Seal the rubber tube and watch to see if the gauge holds the reading. Tap the gauge glass slightly. If the pointer remains at the ¾ mark, the dash unit is operating satisfactorily. If the pointer drops back to '0', indicating that the pressure is being lost, the dash unit is defective and must be replaced. No repairs are possible.



HYDROSTATIC GASOLINE GAUGE.



To Free Air Line. Disconnect the air line at the dash unit. Remove the gasoline tank filler cap. Then blow out the lines with a hand tire pump or tire air line. Any pressure may be used but the hand air pump is preferable. When the air bubbles through the gasoline in the tank, showing the air line is open, connect the air line to the dash unit. Use two wrenches to prevent damage to the dash unit. It will be necessary to run the engine to free the operating cup from gasoline which fills it whenever the air line is disconnected.

If the gauge registers less than the actual contents of the tank, it is an indication that the air line is not tight. Blow out the line and tighten the couplings, using two wrenches to avoid twisting the dash unit and tank unit.

If the gauge registers more than the actual contents of the gasoline tank, it is an indication that the dash unit has been subjected to excessive pressure. The dash unit must be replaced.

FAST IDLE & THROTTLE CRACKING ADJUSTMENTS

IMPORTANT NOTE:—The Fast Idle and Throttle Cracking Adjustments listed below are important for easy starting and good engine performance when cold. If engine is hard to start when cold, Automatic Choke should be examined to make certain that choke valve is closed, and Throttle Cracking linkage examined to see that throttle valve is being opened the correct amount. If engine does not idle smoothly or dies when cold, Fast Idle mechanism should be examined to make certain that throttle valve is held open in 'fast idle' position. If engine speed is excessive when started (this may cause damage to starter or pinion by too violent disengagement), examine Throttle Cracking setting for too large throttle opening. See settings below and special articles on all types of Automatic Chokes and Fast Idles. It should be kept in mind that engines fitted with Fast Idles run at a faster speed (Cold Idle Speed) when engine is cold and that this decreases to the normal speed (Hot or Slow Idle Speed) when the engine reaches normal running temperature.

DESCRIPTION:—Fast idle and throttle cracking devices are used on a number of the car models. Fast Idles consist of attachments on the carburetor which hold the throttle valve open slightly so that the engine operates at a higher or 'cold idle' speed during the warming up period, and decreases to the slow or 'hot idle' speed when the engine warms up, or when the choke valve is opened. Throttle Cracking devices consist of a linkage between the carburetor throttle valve and choke valve so that the throttle is opened when the carburetor is choked for starting, or a linkage between the throttle valve and the starting pedal so that the throttle is opened while the starter is being operated to crank the engine.

SERVICING:—For cars after 1935 see Car Model Page in Tune Up and Electrical Section. See car listing below for adjustments on previous car models.

Auburn Model 8-100 '32, 8-101 '33. Throttle Cracking—Choke valve and throttle interconnected by 'Throttle-Cracking' device so that throttle is opened .046" with choke valve fully closed. See article on Stromberg URO-2 carburetors for adjustment.

Auburn Model 8-50Y '34, 851 '35. Fast Idle—Stromberg lever type. See separate article. No adjustment required.

Auburn Model 653 '34-35, Carter Carburetor. Throttle Cracking—Throttle and choke valves interconnected so that throttle is opened .031-.035" when carburetor is choked for starting. No adjustment required.

Auburn Model 653 '35, Stromberg Carburetor. Throttle Cracking—Throttle stopscrew stop cam linked to choke valve so that throttle is opened slightly when carburetor is choked for starting. Throttle stopscrew should rest on high point of cam with choke valve fully closed.

Buick Models 40, 50, 60, 90, '34-35. Fast Idle—Buick Cold Idle Control (thermostatically controlled cam which serves as throttle stopscrew stop). See separate article for description and setting.

Throttle Cracking—Accelerator pedal control of starting switch. Vacuum switch or accelerator linkage adjustment as follows:

Buick Model 40. Warm up engine (water temperature should be 140°F.). Close hand throttle (push button in), check idling speed, adjust to correct 'hot' or slow idling speed of 8 M.P.H. Check accelerator pedal position (distance from top of pedal to floor should be 2 29/32"—adjust by changing length of pedal rod). Rotate 'fast' or cold idle control cam on carburetor counterclockwise until it is against the stop, see that cam remains in this position while vacuum switch adjustment is being made. Disconnect vacuum switch operating rod at vacuum switch, rotate switch lever until pointer lines up with line on case marked 'Fast Idle', adjust rod length so that it can be connected to switch lever without disturbing position of lever. Check operation of starter and see that gap between idle adjustment screw and throttle opening cam on carburetor is at least 7/32" at the instant when vacuum switch makes contact and operates starting motor.

Buick Models 50, 60, 90. Warm up engine (water temperature should be 140°F.). Check idling speed, adjust to correct 'hot' or slow idling speed of 8 M.P.H. See that throttle rod shoulder is screwed up as close as possible to the trunnion on the throttle valve lever, check accelerator pedal position. Distance from top of accelerator pedal to floor should be 4⅛" (50), 4⅜" (60), 4⅝" (90). Adjust by disconnecting accelerator pedal rod and changing position of trunnion on lower end. Rotate cold idle control cam clockwise by hand until it is against the stop, see that cam remains in this position while vacuum switch adjustment is being made. Take out cotter pin in lower end of vacuum switch lever operating rod, turn switch lever so that pointer lines up with line marked 'Fast Idle' on switch case, adjust rod length by turning rod in or out of switch lever trunnion until lower end of rod can be inserted in hole in lower bell crank without disturbing position of switch lever. Check operation of starter and see that gap between idler adjustment screw and throttle opening cam is at least 3/32" at the instant when vacuum switch makes contact and operates starting motor.

Cadillac V-8 355-D '34-35, V-12 370-B, C, D '32-35, V-16 452-B, C, D '32-35. Throttle Cracking—Kicker screw on carburetor opens throttle correct amount for starting. See article on Detroit Carburetors for adjustment of kicker screw.

Chrysler Model CO '33. Fast Idle—Thermostatic spring end serves as stop for throttle stopscrew when engine is cold, holding throttle open in fast idle position. If thermostatic spring is disturbed, adjust so that end of spring is even with mark on stop lug with engine at 70°F.

Throttle Cracking—Accelerator pedal control of starting switch. Throttle is opened when accelerator pedal is depressed to operate starter. See article on Delco-Remy Starter Controls for adjustment of vacuum switch which determines throttle opening when starter is cranking engine.

Chrysler Royal CT, Imperial CQ '33. Throttle Cracking—Accelerator pedal control of starting switch. Adjustment same as for Chrysler CO above.

Chrysler CA, CB '34. Fast Idle—Throttle stopscrew dog (stop cam pivoted below throttle shaft) linked to choke valve so that throttle is opened to fast idle position with choke valve more than half closed. No adjustment required.

Throttle Cracking—To adjust, loosen nut on movable plate on starting pedal, shift plate until gap between edge of plate and throttle cross shaft is 3/16" with throttle valve at idling or closed position and starting pedal released. With this setting throttle is opened ½-⅓ while engine is being cranked. A gap smaller han 3/16" will cause excessive engine speed when engine begins to fire.

Chrysler CU '34 (Stromberg EX-32 Carburetor). Fast Idle—Throttle stopscrew stop cam linked to choke valve so that throttle is opened to fast idle position when carburetor is choked for starting. Throttle stopscrew should rest on high point of cam with choke valve fully closed.

Throttle Cracking—Accelerator pedal control of starting switch. Throttle is opened when accelerator pedal is depressed to operate starter. To adjust linkage, see that accelerator pedal is in idle posiion, disconnect vacuum switch operating rod at switch, turn switch lever so that pointer lines up with line marked 'Idle' on switch case, vary length of rod by turning adjustable link on switch end of rod until rod can be coupled to switch without disturbing position of switch lever. Hold fast idle on carburetor in 'Off' position, adjust screw on throttle bell crank directly to rear of vacuum switch so that there is 3/16" play or lost motion in throttle linkage. This setting will provide ¼-⅓ throttle opening at point where vacuum switch makes contact and starter cranks engine.

FAST IDLE & THROTTLE CRACKING ADJUSTMENTS FOR 1933-34-35 CAR MODELS CONT.

Chrysler CU, CV '34, C2, C3 '35 (Stromberg EE-22 Carburetor). Fast Idle—Throttle stopscrew stop cam linked to choke valve so that throttle is opened to fast idle position when carburetor is choked for starting. Throttle stop screw should rest on high point of cam with choke valve fully closed, providing throttle opening of .016-.020".

Throttle Cracking (CU, CV '34 only). Same type as on Model CU with EX-32 carburetor. See adjustment instructions above.

Chrysler CH, CL '32, CL* '33, CW '34, CW* '35. Fast Idle—Stromberg type (see separate article). Setting should be 1½ turns of the fast idle screw beyond the point of contact with the throttle valve closed and the slow idle screw backed off so as to be inoperative. Slow or hot idling speed must be reset at 6 M.P.H. after adjustment is completed.

Chrysler Airstream Model C6. Fast Idle—Throttle stopscrew dog (stop cam which is pivoted below throttle valve) linked to choke valve so that throttle is opened to fast idle position with choke valve more than half closed. No adjustment required.

Throttle Cracking—Adjusted by shortening or lengthening rod connecting starting pedal and throttle cross shaft so that throttle valve is opened 1/4-1/3 with starter cranking engine.

Chrysler CZ, C1 '35. Fast Idle—Throttle stopscrew dog (stop cam pivoted below throttle shaft) linked to choke lever so that throttle is opened to fast idle position with choke valve closed. See that throttle stopscrew rests on high point of fast idle cam when choke valve is fully closed.

Throttle Cracking (CZ)—Design and adjustment same as Chrysler C6.

Continental Beacon '33, 41 '34. Throttle Cracking—Throttle stopscrew stop plate located on connector link between choke valve and throttle valve so that throttle is opened slightly when carburetor is choked for starting. Should not require adjustment.

Continental Flyer, Ace '33. Throttle Cracking—Throttle and choke valves interconnected so that throttle is opened slightly when carburetor is choked for starting. Should not require adjustment.

De Soto SD (1933). Throttle Cracking—Accelerator pedal control of starting switch. Throttle is opened when accelerator pedal is depressed to operate starter. See article on Delco-Remy Starter Controls for description and adjustment of control linkage.

De Soto SE '34, SF, SG '35. Fast Idle—Throttle stopscrew dog (stop cam pivoted below throttle shaft) linked to choke valve so that throttle is opened to fast idle position with choke valve more than one-half closed. No adjustment required.

Throttle Cracking (Model SD '34).—Throttle valve interconnected with starting switch pedal. For adjustment see Chrysler Model CA, CB '34 above.

Throttle Cracking (Model SF '35).—Throttle valve interconnected with starting switch pedal. For adjustment see Chrysler Model C6 '35 above.

Dodge DR, DS '34, DU '35. Fast Idle—Throttle stopscrew dog (stop cam pivoted below throttle shaft) linked to choke lever so that throttle is opened to fast idle position with choke valve closed. See that throttle stopscrew rests on high point of fast idle cam when choke valve is fully closed.

Throttle Cracking (Model DR, DS '34). Throttle valve interconnected with starting switch pedal. For adjustment see Chrysler CA, CB '34 above.

Throttle Cracking (Model DU '35). Throttle valve interconnected with starting switch pedal. For adjustment see Chrysler C6 '35 above.

Essex-Terraplane K '32, K, KT '33, KS '34, G '35. Throttle Cracking—Throttle and choke valves interconnected so that throttle valve is opened .022-.026" (K '32), .036-.040" (K '33, KS '34, G '35), .038-.042" (KT '33) when choke valve is closed for starting. Should not require adjustment.

Essex-Terraplane K, KU '34, GU '35. Fast Idle—Carter drop-bar type operated by Carter Climatic Control (Automatic Choke). See special article on Carter Fast Idles.

Ford V-8 1932-33. Throttle Cracking—Kicker screw on carburetor opens throttle correct amount for starting. See article on Detroit Carburetors (Ford) for adjustment of kicker screw.

Ford V-8 '34-35. Fast Idle—Stromberg. Special design with throttle stopscrew mounted on pivoted lever connected to choke valve lever. No adjustment required other than regular idling speed adjustment.

Franklin V-12 17, 17B '32-34. Throttle Cracking—Delco-Remy No. 1370 solenoid connected to starter terminal and linked to throttle valve so that throttle is opened ⅓ while starter is operating.

Graham all Models '31-33. Throttle Cracking—Kicker screw on carburetor opens throttle correct amount for starting. See article on Detroit Carburetors for adjustment of kicker screw.

Graham 67 '34. Throttle Cracking—Choke valve and throttle valve interconnected by 'Throttle Cracking' device so that throttle is opened .040" when carburetor is choked for starting. For adjustment see article on Stromberg URO-2 Carburetors.

Graham 68 '34, 74 '35. Throttle Cracking—Consists of lever and adjusting screw (kicker screw) pivoted on throttle valve shaft and linked to choke valve lever. Adjusting screw contacts ear on throttle valve lever and holds throttle open with choke valve closed. To adjust, hold choke valve closed, turn adjusting screw in or out until throttle opening is .060" (68), .073" (74) (check by passing #53 (68), #49 (74) drill between edge of throttle valve and carburetor wall).

Graham Special Six Model 73. Fast Idle—Integral with automatic choke. See article on Automatic Choke and Fast Idle on Model EX-23 Carburetor.

Graham Eight Model 72. Fast Idle—Integral with automatic choke. See article on Automatic Choke and Fast Idle on Model EE-14 Carburetor. Starting motor (solenoid pinion shift type) is controlled by accelerator pedal so that throttle is opened while starter is cranking engine.

Graham Supercharged 69 '34, 75 '35. Throttle Cracking—design and adjustment same as for Model 74 except that throttle opening should be checked with #52 drill (go) and #48 drill (no go). Throttle opening while cranking is same as for Model 72 (accelerator pedal operation of starting control).

Hudson Challenger Model LTS '34. Throttle Cracking—Throttle and choke valves interconnected so that throttle is opened .036-.040" when carburetor is choked for starting. Should not require adjustment.

Hudson LL, LT '34, GH, HT, HU, HHU '35. Fast Idle—Carter drop-bar operated by Carter Climatic Control (Automatic Choke). See special article on Carter Fast Idles.

Hupmobile 521-O (1935. Carter Fast Idle operated by Carter Climatic Control (Automatic Choke). See article on Carter Model 317-S Dual Carburetor.

La Salle 350 Series 50 '34-35. Fast Idle—Integral with Automatic Choke. See article on Automatic Choke and Fast Idle on Model EE-23 Carburetor.

La Salle Model 35-50 (Late 1935). Fast Idle—Integral with Automatic Choke. See article on Automatic Choke and Fast Idle on Model EE-15 Carburetor.

Oldsmobile F-33, L-33 '33. Fast Idle—Stromberg type (see separate article). Setting should be made by inserting #55 drill (F-33), .090" feeler (L-33) below throttle stopscrew and lug on carburetor, after setting hot or slow idling speed correctly, and turning up fast idle screw until it just makes contact.

Oldsmobile F-34 '34. Fast Idle—Integral with automatic choke. See article on Stromberg Model EX-23 Automatic Choke and Fast Idle (1934 Type).

Oldsmobile L-34 '34. Fast Idle—Stromberg Lever Type. See separate article. No adjustment required.

Throttle Cracking—Accelerator pedal control of starting switch. Throttle is opened when accelerator pedal is depressed to operate starter. See article on Delco-Remy Stater Controls.

Oldsmobile Six F-35, Eight L-35. Fast Idle—Stromberg type. See special article. Linkage should be adjusted so that clearance between top edge of throttle stopscrew and notch on intermediate step of fast idle cam should be 1/16" with choke valve wide open.

Throttle Cracking—Starting pedal lever and throttle cross shaft interconnected so that throttle is opened to provide 1/16" clearance between throttle stopscrew and high lobe of fast idle cam. This clearance is nectssary to allow automatic choke mechanism to close choke valve and revolve fast idle cam to fast idle position. To adjust, loosen capscrew on throttle cross shaft lever, shift lever until clearance between lever and pin on starting pedal lever is ¼", tighten capscrew. Check to see that this setting provides 1/16" clearance between throttle stopscrew and high lobe of fast idle cam.

Packard Eights 1931-32. Throttle Cracking—Kicker screw on carburetor opens throttle correct amount for starting. See article on Detroit Carburetors for kicker screw adjustment.

Packard 1001, 2, 3, 4 '33, 1100, 1, 2, 3, 4, 5 '34. Stromberg Type (see separate article). Setting should be 1¾ turns of the fast idle screw past the point where it contacts the fast idle lug with the throttle completely closed and throttle stopscrew backed off so as to be inoperative. Slow idle screw should be reset at 1¾ turns from closed position of throttle valve.

Packard Twelves '33-34-35. Stromberg Type (see separate article). Setting made as for Packard Eights above except that fast idle screw should be turned 6¾ turns.

Packard Model 120. Fast Idle—Integral with Automatic Choke. See article on Automatic Choke and Fast Idle on Model EE-14 Carburetor.

Packard Eight 1200, 1201, 1202; Super Eight 1203, 1204, 1205. Fast Idle—Integral with Automatic Choke. See article on Automatic Choke and Fast Idle used on Model EE-23 Carburetor.

Pierce Arrow Eight '34-35, Twelve '33-34-35. Fast Idle—Stromberg type (see separate article). Setting should be 1⅛ turns (8's), ¾ turn (12's) of the fast idling screw from throttle closed position with throttle stopscrew (hot or slow idling speed adjusting screw) backed off so as to be inoperative. Throttle stopscrew must be set for hot idling speed of 38 (37-39) explosions per 15 seconds after adjustment is completed.

Plymouth PF, PE '34, PJ '35. Fast Idle—Throttle stopscrew dog (stop cam pivoted below throttle shaft) linked to choke valve so that throttle is opened to fast idle position with choke valve more than one-half closed. No adjustment required.

Throttle Cracking '34. Throttle linkage connected to starting pedal. To adjust, loosen nut on movable plate on starting pedal, shift plate until gap between edge of plate and throttle cross shaft is 3/16" with throttle valve at idling or closed position, and starting pedal released. With this setting, throttle will be opened ½-⅓ while starter is cranking engine. A gap smaller than 3/16" will cause excessive engine speed when engine begins to fire.

Throttle Cracking '35. Adjusted by shortening or lengthening rod connecting starter pedal and throttle cross shaft. With correct setting, throttle should be opened ¼-⅓ while starter is cranking engine.

Pontiac 601 '33, 603 '34. Fast Idle—Throttle and choke valves interconnected so that throttle is opened .031-.035" when carburetor is choked for starting. Should not require adjustment.

Throttle Cracking '34. Accelerator pedal control of starting switch. Throttle is opened when accelerator pedal is depressed to operate starter. Adjustment same as for Model 605 '35 below. See also article in Equipment Section on Delco-Remy Starter Controls.

Pontiac Six 701A, 701B. Throttle and choke valve interconnected so that throttle is opened .031-.035" when carburetor is choked for starting. No adjustment required.

Pontiac Eight 605. Fast Idle—Carter drop-bar type. No adjustment.

Throttle Cracking—Accelerator pedal control of starting switch (solenoid pinion shift type starter). Vacuum switch or accelerator linkage adjustment as follows:

Pontiac Eight. Adjust rod connecting bell cranks on side of engine block so that accelerator pedal just touches floor board with carburetor throttle valve wide open. Release accelerator pedal and with throttle valve in closed position, set adjusting screw in lever at forward end of this connecting rod so that clearance between this lever and lever which operates carburetor throttle valve rod is .235-.265" (use gauge #J-635-1). Disconnect vacuum switch operating rod at switch lever, turn switch lever so that pointer lines up with line on switch body, adjust length of rod by turning trunnion on rod until rod can be connected to switch lever without disturbing position of lever. See that hand throttle is fully closed, loosen set screw in throttle cable trunnion (at lower end of cable), adjust cable length so that clearance between lever at forward end of hand throttle operating rod and carburetor throttle valve rod lever is 1/32" minimum (use gauge #J-635-2). Check setting after opening and closing hand throttle. These clearances are important.

Reo 'S' '33-34-35. Fast Idle—Stromberg type (see separate article). Setting should be .040" throttle opening (check by passing #60 drill between edge of throttle valve and carburetor wall) with choke valve fully closed and fast idle adjusting screw turned down so that it just contacts the cam.

Reo Flying Cloud 6-A '35. Fast Idle—Throttle stopscrew dog (stop cam pivoted below throttle shaft) linked to choke valve so that throttle is opened to fast idle position with choke valve more than one-half closed. No adjustment required.

Reo Royale N-2 '34. Fast Idle—Integral with Automatic Choke. See article on Stromberg Auomatic Choke and Fast Idle on Model EE-23 Carburetors (1934 Type).

Studebaker 56, 73, 82, 92 '33. Fast Idle—Stromberg Type (see separate article). Setting should be 1¼ turns (56), 1¾ turns (73, 82, 92) of the fast idle screw beyond the point where it contacts the fast idle lug with the throttle closed and the slow idle screw backed off so as to be inoperative.

Studebaker Dict. A, Comm. B '34. Fast Idle—Integral with Automatic Choke. See article on Stromberg Automatic Choke and Fast Idle on Models UR-23 (Dict. A), E-33 (Comm. B) Carburetors (1934 Type).

Studebaker Pres. C '34. Fast Idle—Stromberg Type (see separate article). Setting is same as for 1933 Models above (1¾ turns of the fast idle screw).

Studebaker Dictator 1-A, 2-A. Fast Idle—Integral with Automatic Choke. See article on Automatic Choke and Fast Idle on Model EX-23 Carburetor.

Studebaker Commander 1-B, President 1-C. Stromberg lever type (throttle stopscrew stop plate linked to choke valve). No adjustment required.

Terraplane Standard G. Throttle and choke valve interconnected so that throttle is opened .036-040" when carburetor is choked for starting No adjustment required.

Terraplane, all Models—See Essex-Terraplane above.

This type control used as standard equipment on the following Cadillac models:

Car Model	Carburetor.
V8, Model 355-D, Series 10, 20, 30 (1934-35)	Detroit X-8244
V12, 370-D, Series 40 ('34-35), 80, 85 ('36), 85 ('37)	Detroit 51
V16, 452-D, Series 60 ('34-35), 90 ('36-37)	Detroit 51

NOTE—It is necessary to block automatic choke in 'off' position when adjusting carburetor as raising the engine hood will lower temperature under hood sufficiently to cause slight choke action. This will lead to incorrect carburetor setting to offset this condition.

DESCRIPTION:—The Detroit carburetor used on Cadillac models is provided with two distinct choke operations (1), the starting sleeve which is rotated by the choke button on the instrument panel to open the priming port in the auxiliary unit for starting, and (2), the vane control lever operated by the automatic thermostatic spring coil to provide a richer mixture during the warming up period. See complete article on Detroit Carburetors.

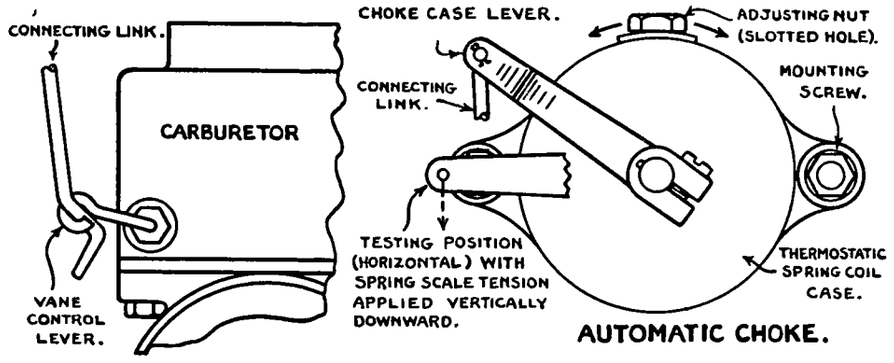
OPERATION:—**Choke Button**—The choke button is operated in the usual manner when the car is started. However, as soon as the engine begins to fire, the choke button should be returned to the 'off' position as the carburetor is controlled entirely by the automatic control during the warming up period. See Carburetor article for adjustment.

Automatic Choke Coil—The thermostatic spring coil is mounted on the carburetor riser and is linked to the vane control lever on the carburetor. The coil tends to wind and unwind in accordance with change in engine temperature, rotating the shaft and lever and increasing or decreasing the control lever pressure on the carburetor air vanes. This pressure is at a maximum when the engine is cold and is decreased as the engine warms up so that at regular operating temperatures the vanes are free and are controlled entirely by the air velocity within the carburetor.

ADJUSTMENT:—The operation of the choke control is entirely automatic. The choke setting is adjustable and should be checked if performance is not satisfactory during the warming up period. To check setting, disconnect connecting link at choke case lever, attach sensitive spring balance at this point and pull straight down until lever is horizontal. Note scale reading with lever horizontal and spring scale vertical.

Car Model	Scale Reading
Cadillac V8 (all models)	12.9 ounces
Cadillac V12, V16 (all models)	5.2 ounces

To adjust, loosen adjusting nut on top of choke case, slide nut to right or left along slot until pull required to hold arm horizontal is correct, tighten adjusting nut.



AUTOMATIC CHOKE.

CARTER FAST IDLE

DROP BAR TYPE

This type Fast Idle used with Carter Climatic Control on Carter Carburetors as standard equipment on the following car models:

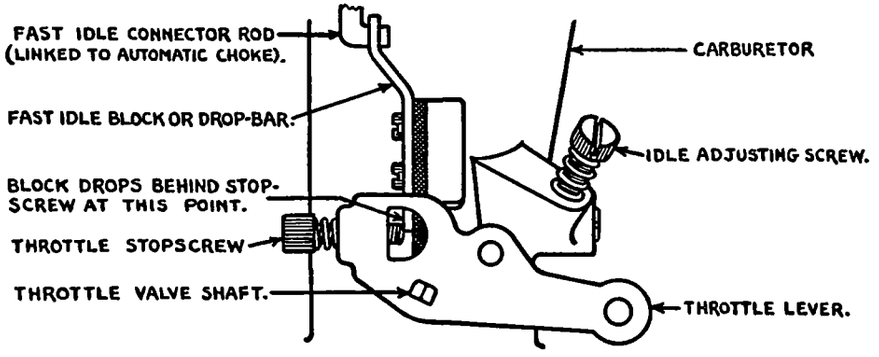
Car Model	Carburetor
Hudson Six, Models GH ('35), 63 ('36)	309-S, 329-S
Hudson Eight, Models LL, LT, LTS (1934)	282-S, 299-S
Hudson Eight, HH, HU, HHU ('35), 64, 65, 66, 67 ('36)	310-S, 330-S
Oldsmobile Six, Model F-36 (1936)	327-S, 39-S, 42-S
Pontiac Six, Model 36-26A, B (1936)	324-S, 340-S
Pontiac Eight, Model 605 (1935)	298-S, 315-S
Pontiac Eight, Model 36-28 (1936)	322-S
Reo, Model 6D (1936)	336-S
Studebaker Dictator, Models 5A, 6A (1937)	371-S
Terraplane, Models K, KU (1934)	281-S
Terraplane, Models GU ('35), 62 ('36)	309-S, 329-S

NOTE—All 1936 and later models are fitted with an 'Unloader' and Choke valve lock. See Climatic Control for settings and adjustment directions for these devices.

FAST IDLE MECHANISM:—The fast idle consists of a bar or arm linked to the choke valve shaft which drops down behind the throttle valve stop screw when the choke valve is closed. This prevents the throttle valve closing to its normal or 'hot idle' position. The fast idle bar will drop in place only when the throttle is opened and the accelerator pedal must be depressed to place the fast idle in operation. Carburetor adjustments should be made only with the fast idle inoperative (engine warmed up with the bar raised sufficiently so that it does not engage the stop screw).

SERVICING:—Fast idle linkage should not require attention. See that fast idle bar drops down behind throttle stopscrew when throttle valve is opened with engine cold (70°F). Automatic choke does not close choke valve when engine is hot. All adjustments on automatic choke and fast idle should be made with engine cold.

1936 and Later Models. On these models (With Unloader), fast idle connector rod or link cannot be disconnected from the fast idle block, and the two screws mounting the fast idle block on the carburetor body casting must be removed to allow the fast idle block to be removed with the Climatic Control whenever it is taken off the carburetor. When replacing fast idle block see that it slides freely with the mounting screws tight (replace screws if block binds).



This type automatic choke used as standard equipment on Carter carburetors on the following car models:

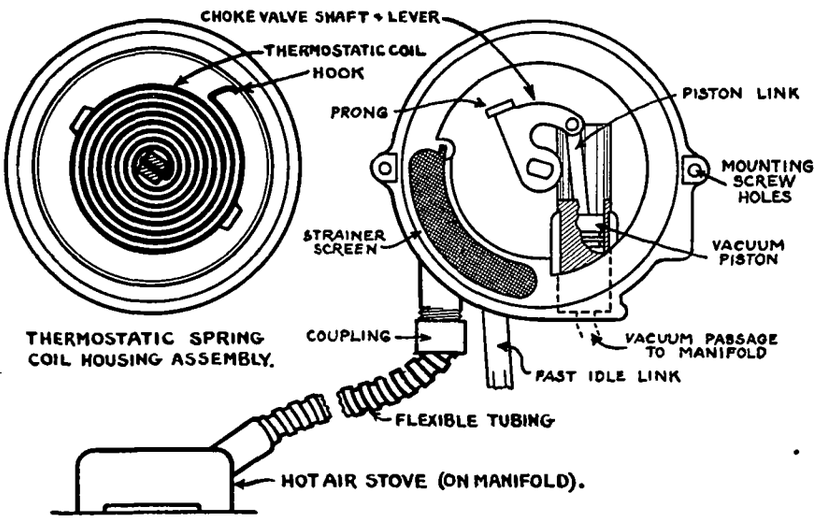
Car Model	Carburetor
Hudson Eight, Models LL, LT, LTS (1934)	282-S, 299-S
Hudson Six, Model GH (1935)	309-S
Hudson Eight, Models HT, HU, HHU (1935)	310-S
Hudson Six, Model 63 (1936)	329-S
Hudson Eight, Models 64, 65, 66, 67 (1936)	330-S
Hupmobile Six, 822-E ('38), 922-E, Skylark R ('39)	398-S
Nash Ambass. Six, 3920 (1939)	435-S
Oldsmobile Six, Model F-36 (1936)	327-S, 39-S, 42-S
Oldsmobile Six, Model F-37 (1937)	351-S
Oldsmobile Six, Model F-37 (Late '37), F-38 (1938)	385-S, 388-S
Oldsmobile Six, F & G-39 ('39) First Cars	385-S
Oldsmobile Six, F & G-39 ('39) Later Cars	425-S, 426-S
Pontiac Eight, Model 605 (1935)	298-S, 315-S
Pontiac Six, Models 36-26A, B (1936)	324-S, 340-S
Pontiac Eight, Model 36-28 (1936)	322-S
Pontiac Six, Model 37-26CA (1937)	352-S, 364-S
Pontiac Eight, Model 37-28 (1937)	350-S
Pontiac Six, Model 38-26DA (1938)	401-S
Pontiac Eight, Model 38-28DA (1938)	400-S
Pontiac Six, 39-25, 39-26 (1939)	433-S
Pontiac Eight, 39-28 (1939)	432-S
Reo, Model 6D (1936)	338-S
Studebaker Dict., Model 5A, 6A (1937)	371-S
Terraplane, Models K, KU (1934)	281-S
Terraplane, Model GU (1935)	309-S
Terraplane, Model 62 (1936)	329-S

DESCRIPTION:—The Carter Climatic Control is an automatic choke designed to choke the carburetor for cold starting and to control the choking action during the warming up period. It employs a combination of engine temperature (hot air from hot air stove on manifold is delivered to control unit case by a flexible connecting tube) and manifold vacuum (vacuum passage in carburetor casting connects port below throttle valve and port in control case) to actuate a thermostatic spring linked to the choke valve shaft lever and a vacuum piston assembly built around the shaft lever (bakalite piston is mounted directly on end of lever). The control is adjusted to close the choke valve completely at 70°F. and the choke valve is opened progressively by the thermostatic spring as the engine warms up. The piston assembly, actuated by manifold vacuum, tends to open the choke when the engine begins to fire and prevents over-choking. A 'fast-idle' control is linked on the choke valve shaft (see below).

1936-39 Type—Design changed slightly so that piston housing plate mounted on air horn by single rivet or screw. Lower edge of plate is flat and rests on ledge on main body casting (vacuum passage in carburetor body terminates at this point and connects with vacuum passage to vacuum cylinder in plate). Vacuum cylinder now located vertically with conventional piston linked to choke valve shaft.

SERVICING (1934-35):—Disassembly. To disassemble, loosen the lock screw holding the flexible tubing in place in the control case, take out two screws and lock screws in edge of case (cover holding screws), lift off housing assembly containing thermostatic spring (assembly consists of cover, cork insulator, thermostatic coil, and bracket). Do not attempt to remove thermostatic spring or alter its position. Clean out this assembly with air. To disassemble remainder of control unit, remove dust cover on carburetor, remove screw in choke trip lever assembly, taking care that small hand trip lever is not lost, remove two screws holding choke valve in place on choke valve shaft, revolve choke piston lever and shaft assembly until bakalite choke piston on end of lever can be removed, remove piston, pull choke shaft out. Remove two attaching screws holding case on carburetor casting, take out piston plate, port plate, and strainer. Clean these three parts with gasoline, dry with air. Clean remainder of control unit with air, blow out vacuum passage in carburetor (apply air pressure to port in piston plate housing). If the piston plate housing is removed from the air horn of the carburetor, use a new gasket to insure a tight connection at this point. Any air leak will interfere with correct choke action.

Reassembly. In reassembling control unit, see that cork gasket is placed on piston plate housing so that the small hole fits over the raised boss of the vacuum port. Place port plate in grooved recess in piston plate, place strainer in position covering slot in piston plate, assemble on cork gasket and piston plate housing, making certain that slot in piston plate and cork gasket coincide, install two attaching screws. Any misalignment in assembly will interfere with correct choke action. Slide choke valve shaft in until it engages first half of trip lever assembly, place bakelite piston in position in piston plate, line up piston with piston arm, slide choke valve shaft in until it fully engages trip lever. Mount choke valve on shaft, making certain it is perfectly lined up with the air horn bore (see that choke valve does not drag or stick in closed position). When mounting carburetor on engine, see that flexible tubing is entered to full depth of hole and tighten lock screw securely. Any air leak at this point will interfere with correct choke action. Place thermostatic spring housing assembly in position with calibration marking down, install retaining screws and lock washers (do not tighten screws), revolve housing assembly counter-clockwise until spring tension is felt on choke valve, tighten screws with center line of calibration in line with pointer. This is the standard setting.



SERVICING (1936-39):—Disassembly. Take out attaching screws, remove retainers on rim of piston housing plate which holds thermostatic coil housing in place. Turn thermostatic coil to right or clockwise to disengage coil hook from prong, lift coil and housing assembly off. Remove strainer screen. Take out choke valve screws, lift choke valve out. Loosen clamp screw on fast idle link and lever assembly, bend lip under screw with screwdriver (see Unloader adjustment when reassembling) so that it will clear portion of choke valve shaft which is not flat, revolve the choke shaft so that piston clears cylinder edge, remove choke shaft, piston, piston lever and link as an assembly. Remove suction passage gasket from air horn. Do not remove piston housing plate from air horn.

Servicing—Wash all parts in gasoline except thermostatic coil and housing assembly and cork gaskets. Clean thermostatic coil assembly with air. Blow out all passages with air. Replace all worn or damaged parts. Use all new gaskets when reassembling.

Reassembly. Install the choke piston lever, piston and link, and shaft assembly in air horn and see that choke lever pin and screw assembly correctly located on shaft. Tighten screw on choke lever and see that these parts work freely. Install choke valve using new valve screws. Turn screws down loosely, then close choke valve and tap lightly to centralize valve in air horn, tighten screws securely, see that choke valve operates freely without binding in air horn. Install strainer in piston plate housing. Install new suction passage gasket in air horn (do not use old gasket). Install air horn assembly on carburetor, tightening screws securely. Install attaching screw and lockwasher under piston housing plate. See that the cork insulating strip on thermostatic coil housing is in good condition and has not shrunk, turn housing so that word 'Climatic' is at bottom, install in this position, turn counter-clockwise until center mark on piston plate housing is in line with reference mark on housing, install retainers and tighten attaching screws which hold housing in place.

Installing Carburetor on Engine—See that flexible tubing connection at housing is tight. This is important as any air leak at this point will interfere with correct performance. See that choke valve operates freely throughout range without any binding at any point in the mechanism.

Choke Valve Installation—When installing choke valve, make certain that it is correctly aligned in air horn so that it does not drag or stick in closed position which will interfere with correct Climatic Control operation. Centralize valve by tapping lightly in closed position (attaching screws loose), tighten screws.

SETTING & ADJUSTMENT:—Setting indicated above (thermostatic coil case revolved so that reference mark lined up with center line of calibrations on piston housing plate) is standard for all models except those noted in the table below. For these special car models, rotate coil housing counter-clockwise (for Richer setting), clockwise (for Leaner setting) the correct number of graduations or 'points' before tightening the housing mounting screws. Check car performance as directed below and make any necessary readjustments for special fuel and operating conditions.

Car Model	Carburetor	Thermostat Setting
Nash 3920 (1939)	435-S	2 points Rich
Oldsmobile F-36 ('36)	327-S, 39-S, 42-S	1 point Rich
Oldsmobile F & G-39 ('39)	425-S, 426-S	2 points Rich
Pontiac Six (1937-38)	352-S, 401-S	1 point Rich
Pontiac Taxi (1937)	364-S	1 point Rich
Pontiac Eight (1937)	350-S	2 points Rich
Pontiac Eight (1938)	400-S	1 point Rich
Pontiac Six & Eight (1939)	432-S, 433-S①	2 points Rich
Pontiac Six & Eight (1939)	432-S, 433-S②	1 point Rich
Reo 6D (1936)	338-S	1 point Rich
Studebaker Dict. 5A, 6A ('37)	371-S	1 point Lean
All Others		Centered

①—First carburetors with #42 choke heat suction hole.

②—Later carburetors with #36 choke heat suction hole.

To Check Setting—Note engine performance during warming up period after engine has been started cold. Engine must be cold so that choke is operating (if engine is warm when started choke valve will not close). If engine has a tendency to run lean, thermostatic coil housing should be turned counter-clockwise one graduation. If engine runs rich or has a tendency to load up, coil housing should be turned one graduation clockwise.

To Adjust—Loosen retainer screws on rim of thermostatic coil case, rotate one graduation, tighten screws. Adjustments should always be made with engine cold (allow four hours for engine to cool off after it has been running) and setting should again be checked as directed above.

CARTER UNLOADER

NOTE:—No unloader used on 1934-35 type carburetors.

1936 TYPE

DESCRIPTION:—Consists of an ear on the fast idle block which strikes the throttle lever when throttle is opened (fast idle block down in fast idle position). When this contact is made, further movement of the throttle lever pushes the fast idle block up opening the choke valve so that a flooded condition can be corrected.

Adjustment—With throttle valve held wide open, adjust curved lip on fast idle block so that lower edge of choke valve is held away from inner wall of air horn by amount shown in table below. Then hold choke valve and throttle valve wide open, adjust lip on choke lever so that choke valve locked open. See that choke valve released when throttle valve closed.

NOTE—Clearance between lip on choke lever and top end of fast idle link should be 1/16" with choke valve and throttle valve held wide open. Adjust by removing fast idle block and link assembly from carburetor and filing not more than 1/32" from top of link. Do not change original shape of link. See that all burrs removed. See that entire choke mechanism operates freely without binding.

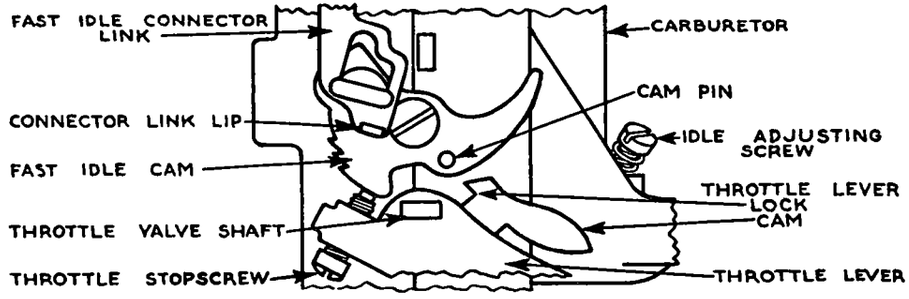
Car Model	Carburetor Model	Unloader Setting
Hudson (all models)	329-S, 330-S	7/16"
Oldsmobile	327-S, 339-S, 342-S	½"
Pontiac Six	324-S, 340-S	½"
Pontiac Eight	322-S	¼"
Reo	338-S	½"
Terraplane	329-S	7/16"

1937-39 TYPE

DESCRIPTION:—Consists of a cam on the throttle lever which opens choke valve (through fast idle linkage) when throttle is held wide open to correct flooding. To check, hold throttle wide open, check clearance between lower edge of choke valve and air horn wall (see table below for checking gauge and clearance for each model). To adjust, bend cam on throttle lever using tool T109-41.
NOTE—Unloader on Studebaker 371-S (drop bar type fast idle) adjusted in same manner as '1936 Type' above. Setting should be ¼".

Car Model	Carburetor	Gauge No.	Unloader Setting
Hupmobile 6	398-S	T-109-85	⅜"
Nash 3920	435-S	T-109-82	31/64"
Oldsmobile 6	351-S, 85-S, 88-S		⅜"
Oldsmobile 6	425-S, 426-S	T-109-81	7/16"
Pontiac 6 & 8	350-S, 352-S		¼"
Pontiac Taxi	364-S		½"
Pontiac 6 & 8	400-S, 401-S		5/16"
Pontiac 6	433-S	T-109-106	7/32"
Pontiac 8	432-S	T-109-31	¼"
Studebaker '37	371-S		¼"

CHOKE VALVE LOCK:—Prevents choke valve closing when throttle valve held wide open. To adjust, hold throttle and choke valves wide open, bend lip at lower end of fast idle link so that clearance between lip and lock on throttle lever is 1/32" (use Tool T-109-105) except Studebaker 371-S (1/16").



CARTER FAST IDLE

NOTE:—This type fast idle used with Carter Climatic Control on all of the 1937-39 car models listed above (see separate article for 'Drop Bar' type Fast Idle used on 1936 car models and 1937 Studebaker 371-S carburetor).

DESCRIPTION & OPERATION:—Consists of a fast idle cam serving as a stop for the throttle lever stopscrew which is linked to the choke valve lever. Cam is rotated to the fast idle position when the choke valve is closed for cold starting and opens the throttle valve. As choke valve opens, cam is rotated back to the hot or slow idle position.

ADJUSTMENT:—To check setting, turn fast idle cam to normal or slow idle speed position, tighten throttle lever stopscrew until it just seats against cam, rotate cam until stopscrew is against (not on) first step on cam, check clearance between lower edge of choke valve and air horn wall using tool T109-85 (clearance should be ⅝"—all models). To adjust, use tool T109-41 and bend offset portion of fast idle link.

This type automatic choke used with Carter Carburetors as standard equipment on the following car models:

Car Model	Year	Carburetor Type
Buick 39-40	1939	419-S, 440-S
Cadillac V16 38-90	1938	407-S, 408-S
Cadillac 39-90 V16	1939	407-S, 408-S
Chrysler Imperial C14	1937	373-S
Hudson Six 73	1937	344-S, 377-S
Hudson Eight 74, 5, 6, 7	1937	344-S, 377-S
Hudson Six 83, Eight 84, 5, 7	1938	402-S
Hudson Six & Eight 92, 93, 95, 97	1939	430-S
Hupmobile 521-O, 621-O, N	1935-36	317-S
Hupmobile Eight H-825	1938	399-S
Hupmobile Eight 925-H	1939	399-S
La Salle 37-50	1937	374-S
La Salle 38-50	1938	392-S
LaSalle 39-50 V8	1939	423-S
Nash Ambassador Eight 3980	1939	436-S
Oldsmobile Eight L-36	1936	341-S, 328-S
Oldsmobile Eight L-37	1937	345-S, 367-S
Oldsmobile Eight L-37, L-38	1937-38	386-S, 389-S
Oldsmobile Eight L-39	1939	389-S
Packard Eight 120C	1937	366-S
Terraplane Super 72	1937	344-S, 377-S
Terraplane Super 82	1938	402-S

DESCRIPTION:—Design same as single barrel type with flat piston except piston plate housing now attached to air horn by three screws and Fast Idle and Choke Unloader mechanism now mounted directly on opposite end of choke valve shaft from Climatic Control and must be removed when choke control is being disassembled.
NOTE—On Hudson and Terraplane models, a dashpot assembly is mounted on the carburetor and linked to the fast idle lever arm.

OPERATION:—Same as for other models. Thermostatic spring coil closes choke valve when engine is cold and controls choke during warming up period. Choke valve is offset and tends to open as thermostatic coil tension decreases when engine warms up. Vacuum piston opens choke valve slightly when engine begins to fire to prevent over-choking.

SERVICING:—Disassembly. Remove screw holding choke trip lever (fast idle end of choke lever shaft), take off choke shaft washer, trip lever, fast idle cam and collar assembly. Remove two thermostat housing attaching screws and lockwashers, take off thermostatic coil and housing assembly. Remove two screws holding choke valve on shaft, take out choke valve assembly. Move choke piston lever counter-clockwise until piston is out of cylinder, remove piston, pull lever and shaft assembly out. Take out the three screws holding the piston plate housing on the air horn, remove piston plate, port plate, piston plate strainer, cork insulator disk, piston plate housing, piston plate housing gasket, and hot air passage gasket.

Servicing. Wash all parts in gasoline except cork pieces and thermostatic coil and housing assembly (do not remove coil from housing). Blow out all passages with compressed air, replace all worn or damaged parts. Use all new gaskets when reassembling.

Choke Valve Installation—When installing choke valve, make certain that it is correctly aligned in air horn so that it does not drag or stick in closed position which will interfere with correct Climatic Control operation. Centralize valve by tapping lightly in closed position with attaching screws loose, then tighten screws.

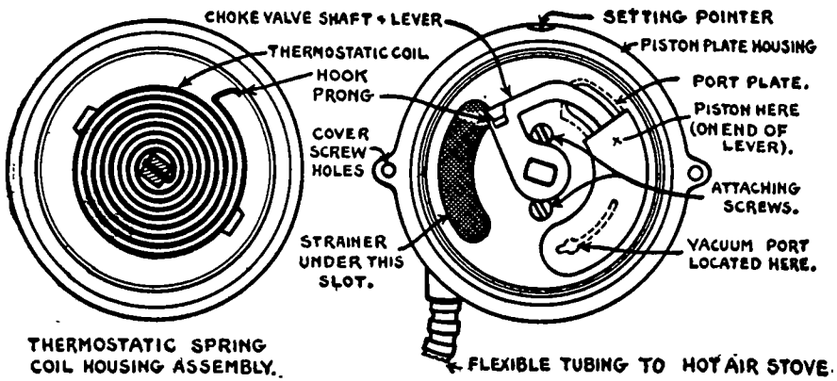
Assembly. Reverse disassembly directions above. Install new cork insulator disk in piston plate housing so that small hole in disk fits over boss on housing. Use new piston plate strainer if old strainer clogged or damaged. After installing piston lever assembly, place bakelite piston on lever and rotate lever so that piston enters housing. Use new choke valve screws and see that choke valve operates freely without binding or rubbing on carburetor after screws have been tightened securely. Replace cork insulator strip inside control housing, if old insulator not in good condition, to insure tight seal. Install thermostatic coil and housing assembly with label down, insert attaching screws and lockwashers loosely, then rotate housing counter-clockwise one-half turn until pointer on piston plate housing and notch in coil housing line up and tension can be felt on choke valve, tighten attaching screws.

Installing Carburetor on Engine. Make certain that hot air flexible tubing is properly connected at both ends (air leaks will interfere with choke operation). Thermostatic coil setting as given above is standard. If operation is unsatisfactory, see Adjustment directions below.

SETTING:—Thermostatic coil setting given in Assembly Directions above (center index mark or notch on thermostatic coil housing lined up with mark on piston plate housing) is correct for all car models except those listed in following table. For these special car models, rotate coil housing counter-clockwise (for Richer setting), clockwise (for Leaner setting) the correct number of graduations or 'points' before tightening the housing mounting screws. See Adjustment directions below if car performance is not satisfactory with these standard settings.

Car Model	Carburetor	Thermostat Setting
Buick 39-40	419-S	1 point Rich
Buick 39-40	440-S	1 point Lean
Hudson 6 & 8 '37	377-S	2 points Rich
LaSalle V8 '38	392-S	1 point Rich
Nash 3980	436-S	1 point Rich
Terraplane '37	377-S	2 points Rich
All Others		Centered

Adjustment:—Check engine performance when cold (70°) to determine whether standard setting satisfactory. If engine runs lean during warming up period attaching screws should be loosened and housing turned counter-clockwise one graduation at a time until performance is satisfactory. If engine loads up or runs ruch, housing should be turned clockwise. Adjustments should be made only when engine is cold (allow four hours for engine to cool off after running), and settings should be checked by noting performance after housing position has been changed.



UNLOADER & CHOKE VALVE LOCK

UNLOADER:—Consists of a lip on the throttle connector which engages the choke trip lever on the choke valve shaft so that the choke valve is opened to correct flooding when the throttle valve is held wide open. To adjust, hold throttle valve wide open, bend lip on fast idle connector link so that clearance between upper edge of choke valve and air horn wall is correct as shown in table below

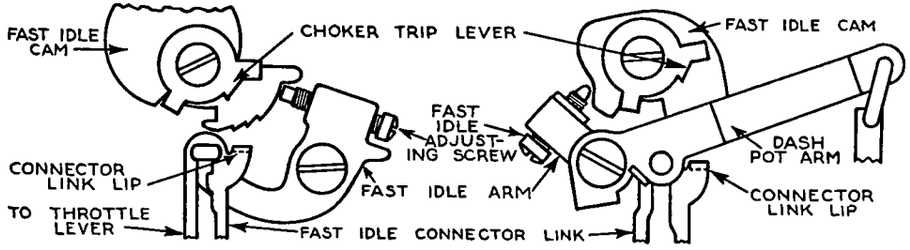
Car Model	Carburetor	Gauge No.	Unloader Setting
Buick 39-40	419-S	T-109-125	3/32"
Buick 39-40	440-S	T-109-28	3/16"
Cadillac 90	407-S, 408-S	T-109-28	3/16"
Chrysler C14	373-S	T-109-31	¼"
Hudson 6 & 8	344-S, 77-S; 402-S, 30-S	T-109-31	¼"
Hupmobile	317-S	T-109-31	¼"
Hupmobile	399-S	T-109-34	9/64"
LaSalle	374-S	T-109-28	3/16"
LaSalle	392-S, 423-S	T-109-36	⅛"
Nash 3980	436-S	T-109-34	9/64"
Oldsmobile	328S, 41S, 45S, 67S, 86S, 89S	T-109-31	¼"
Packard	366S	T-109-31	¼"
Terraplane	344-S, 77-S, 402-S	T-109-31	¼"

CHOKE VALVE LOCK:—With Unloader properly adjusted, choke valve will be locked open with throttle valve wide open, and released when valve closed.

CARTER FAST IDLE

NOTE:—This type Fast Idle used with Carter Climatic Control on all of the car models listed above.

DESCRIPTION & OPERATION:—Consists of a fast idle cam mounted on the choke valve shaft which rotates the fast idle arm to which the throttle connector link is attached so that the throttle is opened to the fast idle position while the choke valve is in use during the warming up period. An adjusting screw is provided on the fast idle arm.



ADJUSTMENT:—To adjust, hold choke valve tightly closed, turn adjusting screw on fast idle arm until throttle valve opening or clearance between edge of valve and carburetor wall on side opposite idle port is correct as shown in table below using special checking gauge for each model as listed in table.

Car Model	Carburetor	Gauge No.	Throttle Opening
Buick 39-40	419-S, 440-S	T-109-44	.018"
Cadillac 90	407-S, 408S		.026"
Chrysler	373-S	T-109-44	.018"
Hudson 6 & 8	344-S, 77-S; 402-S, 30S	T-109-44	.018"
Hupmobile	317-S	T-109-44	.018"
Hupmobile	399-S	T-109-29	.030"
LaSalle	374-S	T-109-44	.015"
LaSalle	392-S, 423-S	T-109-29	.030"
Nash	436-S	T-109-44	.015"
Oldsmobile	328S, 41S, 45S, 67S, 86S, 89S	T-109-44	.018"
Packard	366-S	T-109-44	.018"
Terraplane	344-S, 77-S, 402-S	T-109-44	.018"

CHANDLER-GROVES AUTOMATIC CHOKE

INTEGRAL TYPE

This type Automatic Choke and Fast Idle used on the following car models:

Car Model	Carburetor
Packard Six, 115C ('37)	AOC-2
Packard Six, 1600 ('38), 1700 ('39)	AOC-25

DESCRIPTION:—Designed to control choke valve and throttle for cold starting and warming up. Entire mechanism is built in carburetor body and consists of a thermostatic spring coil in a case on the lower end of the throttle valve body and a vacuum piston in a cylinder directly under thermostat case. Thermostat coil and piston are linked to a floating lever from which a rod extends up to the choke valve lever. The floating lever is mounted on the fast idle cam shaft and actuates the fast idle cam through a spring link.

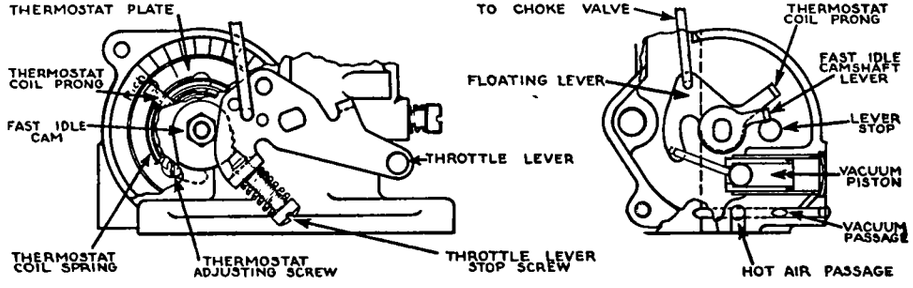
OPERATION:—As the engine cools off, the thermostatic spring coil winds up which tends to raise the connecting rod and close the choke valve. This action is prevented by the interference of the throttle lever stopscrew and the fast idle cam. However, when the throttle is opened before starting a cold engine, the stopscrew is raised from the cam and the thermostat snaps the choke valve closed. As soon as the engine begins to fire, the vacuum built up in the manifold causes the vacuum piston to move out in the cylinder (vacuum chamber in cylinder connected with carburetor barrel below throttle valve) rotating the floating lever and opening the choke valve slightly to prevent overchoking. As the engine warms up, the thermostatic spring coil tension lessens, allowing the offset choke valve to open, so that at operating temperature the choke valve is wide open and the fast idle cam has been rotated to the hot or slow idle position.

TROUBLE SHOOTING:—Engine Fails to Start. See that throttle opened to place automatic choke in operation. Check choke valve and linkage for binding, see that choke valve falls open from any position with thermostat case removed (thermostat coil unhooked) and closes without binding when floating lever is rotated clockwise (stopscrew must clear fast idle cam). Check thermostat setting (see adjustment section below), see that thermostat coil hooked on prong on floating lever, examine case for rust caused by condensation which will result in linkage binding or sticking (see note below to correct this condition).

Carburetor floods or Fast Idle continues after Engine warm. Check thermostat setting, see that vacuum piston moves freely in cylinder and that vacuum passages from chamber to carburetor barrel is clean and not obstructed, check spring linking floating lever and fast idle cam shaft, see that shaft operates freely and that levers do not strike carburetor casting. See that heat channel (hole in carburetor flange leading to thermostat case) is open and that correct gasket used between thermostat case and carburetor body.

NOTE—To correct condensation in thermostat case which will cause rust resulting in binding of the linkage, manufacturer recommends drilling #60 hole in throttle valve body, ⅜" to left of heat hole and 7/32" up from bottom of carburetor flange, through into the vacuum channel. This will ventilate thermostat case.

ADJUSTMENT:—To remove thermostatic coil and case assembly, take out two mounting screws on edge of case and lift off assembly taking care that thermostat coil is unhooked from prong on floating lever without distorting coil. Do not remove the thermostatic coil from the holder plate.



Thermostatic Coil Calibration. With thermostatic coil at 100°F., the free end of the thermostat should be directly over the mark on the holder plate. No adjustment is provided.

Thermostat Setting—Standard setting is with mark on thermostat holder plate lined up with mark on thermostat case. This setting may be varied not more than 3 graduations, if necessary, to secure satisfactory warming up performance. When making this adjustment, change setting ½ graduation at a time and note performance. If satisfactory performance cannot be secured with this variation, install new thermostatic coil.

Choke Valve Position—On cars with Overdrive, long side of choke valve must clear carburetor air horn by .005" with valve fully closed (do not centralize valve in air horn).

This type automatic choke used on the following car model:

Car Model	Carburetor
Oldsmobile Six, Model F-35 (optional)	EX-22

DESCRIPTION:—This device is an automatic choke designed to choke the carburetor for cold starting and to control the choking action during the warming up period. It is similar to previous designs except that the accelerating feature is omitted (accelerating piston on two cylinder types, or accelerating piston and floating piston on three cylinder types) and the single cylinder contains the spring-loaded bellows mechanism. The accelerating feature is taken care of in the carburetor design. The choking action is controlled by a thermostatic spring coil linked to the operating lever with the opposite end of the spring coil linked to the bellows, as in previous designs.

OPERATION:—As the engine cools off the thermostatic spring coil tends to wind up, rotating the shaft and operating lever, so that the choke valve is fully closed at a temperature of 55°F. The choke valve is thus in the correct position for cold starting. When the engine begins to fire the manifold vacuum tends to collapse the bellows, rotating the end of the thermostatic spring coil, so as to release the tension of the spring and allow the choke valve to open partially. As the engine warms up, the thermostatic spring coil unwinds until the choke valve is fully open with the engine at normal running temperature. The choke does not operate again until the engine is stopped and allowed to cool off.

TROUBLE SHOOTING:—If the action of the Carburetor Control is not satisfactory, check the following points:

Binding—Disconnect control rod (link connecting operating lever and choke valve lever) at operating lever and move rod up and down to see that choke valve operates freely without binding at any point. On carburetors with auxiliary fly or split choke valves see that the spring controlled fly moves freely. Operate automatic choke by hand and see that lever moves freely and returns to initial position when released. All moving parts should be free and clean. Do not oil any part of the Automatic Choke.

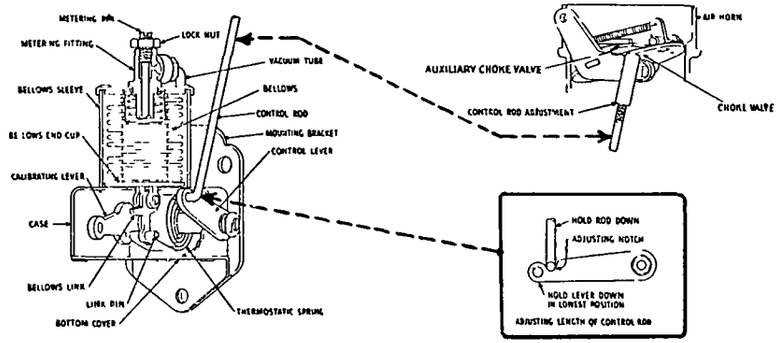
Control Rod Adjustment—Hold automatic choke operating lever and choke valve lever down at end of stroke (choke valve will be closed) and check length of control rod. Lower end of rod should fit in adjusting notch on upper face of operating lever. Adjust by turning rod in or out of socket at upper end. Starting mixture will be too rich if rod is too long, or too lean if rod is too short.

Manifold Leaks—See that mounting screws are tight. Examine gasket between mounting flange and manifold. Use new gasket whenever automatic choke is removed from engine. Shellac or any other gasket compound must not be used on this gasket.

Improper Choking or Flooding—If carburetor floods while checking automatic choke action, open choke valve by hand and crank engine to correct this condition. Then start engine and note operating lever action when engine begins to fire. Lever should travel 5/16" up in 12-15 seconds time to partially open choke valve and prevent overchoking. Incorrect bellows or lever travel may be caused by incorrect bellows travel setting, vacuum leak at mounting flange, leaky bellows, or obstruction in vacuum passage. See Servicing directions below.

ADJUSTMENT:—Bellows travel and timing can be checked on the bench by connecting to the windshield wiper connection on the engine and operating engine at idling speed. In any event the vacuum source should be equivalet to a vacuum of 15-20" of mercury. Check movement of operating lever and time required for this travel when vacuum is applied. Lever should move 5/16" upward in 12-15 seconds (this is not total lever movement). To adjust, loosen locknut on metering pin and turn pin in (clockwise) to increase time or out (counter-clockwise) to decrease time. Tighten locknut after completing adjustment. If no lever travel is observed, remove and examine metering pin. With metering pin out and vacuum source connected to automatic choke, close metering pin hole momentarily and note bellows action. Bellows should collapse and move lever up rapidly. If bellows action is correct, metering pin orifice was probably clogged and metering pin should be reseated as directed below. If no bellows action is observed, bellows are leaky and should be replaced as directed below. A leak too small to be detected by this test may be checked by noting length of time required for lever to drop after vacuum is cut off. This test should be made with metering pin in place and properly timed (12-15 seconds for 5/16" travel of lever). When vacuum is cut off, lever should require not less than 30 seconds to return to original position at bottom of stroke.

SERVICING:—**Metering Pin and Orifice**—If metering pin is found to be gummed or dirty when removed, clean in alcohol. The tapered hole or metering pin orifice can be cleaned with a #000 taper pin reamer (use reamer carefully and remove only dirt or gum—do not enlarge hole or remove any metal), or a tool can be made by grinding the threads off the end of a regular metering pin so that a rotating or wiping action can be secured. The pin should be dipped in alcohol and then turned in the orifice. This should be repeated until all dirt has been removed. Bellows travel must be retimed when automatic choke is reassembled and installed on the engine.



Replacing Bellows—Bend back small ears at lower end of choke case and remove bottom cover. Take out small 'hairpin' retainer on upper link pin coupling bellows end bracket and link, withdraw pin. Unscrew tube compression nut on metering pin fitting. Bend back three ears on cover at top of choke case, lift off bellows and cover assembly. When new bellows are installed see that bellows end cup rests against support plate below bellows when fully extended. Bellows travel is not adjustable. Do not disassemble choke unnecessarily to avoid damaging ears holding top and bottom covers. Do not stretch or compress bellows.

Thermostatic Spring and Shaft Assembly—It should not be necessary to disturb thermostatic spring coil assembly. To remove, unscrew nut on end of shaft at operating lever, remove bearing bushing through case by pulling off retainer spring within case. Assembly can then be removed. Extreme care should be taken if link pin in end of thermostatic coil is removed not to distort spring or change relative position of spring and calibrating lever.

These Carburetor Controls are used on the following car models:

Car Model	Carburetor Control	Control Type
Buick Model 40 ('34)	498-D	Two Cylinder
Buick Model 40 ('34-35)	498-D, E, F	Two Cylinder
Buick 40 ('36), 40, 60, 80, 90 ('37)	498-H	Two Cylinder
Buick Models 50, 60, 90 ('34-35)	498-C	Three Cylinder
Buick Models 60, 80, 90 ('36)	498-J	Three Cylinder
Oldsmobile Eight, Model L-35 ('35)	498-G	Two Cylinder

NOTE—Type 498-H used on 1937 Buick models when Marvel Carburetors are installed. Cars with Stromberg carburetors fitted with Type 490-A Carburetor Control (see following article).

DESCRIPTION:—The Automatic Carburetor Control is an automatic choke designed to choke the carburetor for cold starting and to control the choking action under all operating conditions during the warming up period. It employs a combination of engine temperature (thermostatic spring), manifold vacuum (bellows mechanism), and carburetor inlet air velocity (accelerating piston) to control the choke action, The choke valve operating lever is linked to one end of a spiral thermostatic spring so that the lever is rotated and the choke valve opened when the spring unwinds as the engine warms up. The collapsible bellows is linked to the other end of the thermostatic spring and the collapse of the bellows, when the engine begins to fire and manifold vacuum is built up, releases the thermostatic spring tension slightly and opens the choke valve to prevent over-choking. The floating piston of the three-cylinder type accelerating piston assembly is likewise held down by manifold vacuum and is forced up by the spring when the vacuum collapses as the engine is accelerated. This transfers air to the top of the accelerator piston, forcing the piston down, and increasing the choke action momentarily since the piston is linked to the operating lever shaft. The accelerating piston action after the engine warms up, with choke valve open, is negligible.

TROUBLE SHOOTING:—If Automatic Choke action is unsatisfactory, check the following points in order:

Binding of Parts. Disconnect link connecting carburetor choke valve and operating lever of automatic choke, see that choke valve lever moves freely. Operate automatic choke by hand. Lever should move freely and should return to initial position when released. All moving parts should be clean and free from oil. Do not oil any part of the choke mechanism.

Initial Choke Position. With operating linkage disconnected, hold both choke valve lever and choke operating lever down as far as they will go, check length of control rod or connecting link. The end of the link should rest in the notch in the upper face of the choke operating lever. Adjust by loosening lock nut and turning turnbuckle to increase or decrease length of link. Reassemble linkage. Starting mixture will be too rich if connecting link is too long, or too lean if connecting link is too short.

Initial Running Position (Take-off). See that control lever moves upward 7/8" (3-cylinder), 5/16" (2-cylinder) in 12-15 seconds time immediately after engine begins to fire. Measurements should be made at rod hole in lever. This movement is not total bellows travel except on 3-cylinder models. The timing is controlled by the metering pin at the top of the unit. To adjust, loosen locknut on metering pin, turn pin in or clockwise to increase 'take-off' time, and out or counter-clockwise to decrease 'take-off' time. Lever movement is controlled by bellows travel (see section below).

Manifold Leaks. Examine gasket between unit and manifold, see that mounting screws are tight. Use new gasket whenever units are removed from the engine. Do not use shellac or any other compound on these gaskets.

Improper Choking or Flooding. If engine cannot be started and carburetor floods, open choke valve by hand and crank engine to correct this condition. Check initial take-off and if correct setting cannot be secured, check unit as directed below.

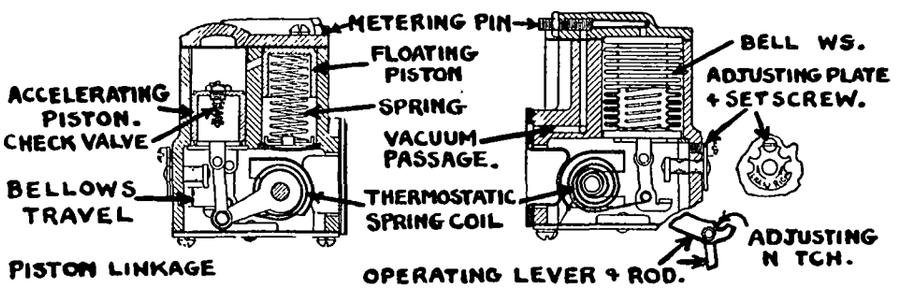
SERVICING AND ADJUSTMENT:—To disassemble control unit, disconnect control rod, take off bottom cover, take out link pin in thermostatic spring, being careful not to distort spring or change spring tension, take out piston link pin, disconnect vacuum line, remove top screws. The head and bellows can then be removed (3-cyl.). On 2-cyl. models cylinders and bellows are removed by rotating the top cover until the bracket at the bottom end of the bellows can be withdrawn through the hole in the support plate. Examine cylinders and pistons. Cylinders should be dry and free from oil or dirt. Do not stretch or compress bellows (see instructions below). Use a new head gasket when reassembling and retime vacuum 'take-off' (bellows stroke timing) as directed above.

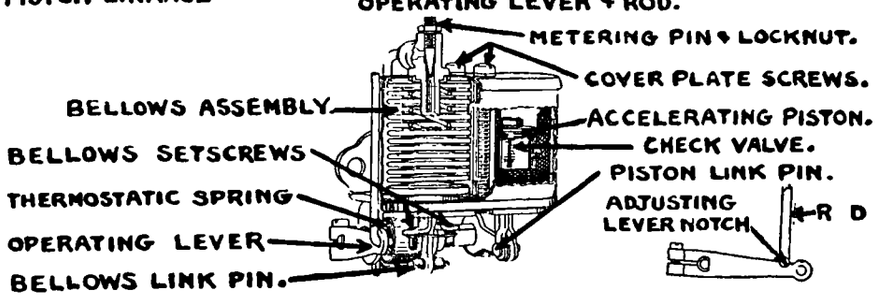
Obstructions in Vacuum Passage. Take out metering pin, clean out any dirt in metering pin passage, dry out unit if moisture is found in the bellows. Metering pin can be cleaned in alcohol. Clean metering pin orifice with a #000 taper pin reamer (use reamer lightly, remove only dirt or gum, do not enlarge hole or remove any metal). Spare metering pin can be used instead of the reamer by grinding off threads on end of pin so that wiping action can be secured. Pin should be dipped in alcohol and then turned in orifice. Bellows travel must be retimed (see Initial Take-off in Trouble Shooting section above) whenever metering pin is removed or setting disturbed.

Bellows or Vacuum Passage Leaking. With metering pin removed, collapse bellows by hand (do not compress bellows solid—bellows stroke is 3/8" or 1/4"), hold a finger tightly over metering pin hole and vacuum passage hole in head, note whether bellows remains collapsed. If bellows extends to original length, bellows or vacuum passage leaks.

Bellows Travel. See that bellows end cup rests against support plate with bellows fully extended. If it does not, bellows should be replaced. Bellows travel should be 3/8" (3-cylinder models with adjusting plate set at midpoint between 'rich' and 'lean'), or 1/4" (2-cylinder models—this is adjusting setscrew clearance with bellows extended). Bellows travel on 3-cylinder models is controlled by the adjusting plate. On the 2-cylinder models travel is controlled by the two setscrews in the bellows connecting linkage below the bellows.

Three Cylinder Type





Two Cylinder Type

Accelerating Piston Check Valve. Inspect check valve in top of accelerating piston. See that valve opens freely and that face of valve and valve seat are free from dirt or oil. Check valve spring tension by inverting piston. Spring tension should be sufficient to hold valve closed in this position. If valve is removed, be careful not to distort valve seat when replacing in piston (do not tighten excessively). A leaking check valve will cause a lean mixture on acceleration or the 'hop-off' or momentary opening of the choke valve when engine begins to fire will not occur. If check valve sticks or remains closed, the choke valve will not close again after this momentary opening.

Type No. **Used On:**

490-A—BUICK, MODELS 40, 60, 80, 90 (1937)—STROMBERG CARBURETORS
1990001—ABOVE MODELS WITH NEW TYPE (CD) MARVEL CARBURETORS
1990101—BUICK, MODELS 40, 60, 80, 90 (1938)—ALL CARBURETORS
1990102—REPLACEMENT UNIT FOR 1990101 (LESS VACUUM SWITCH)

TYPE:—This control is an automatic choke of entirely new design utilizing engine temperature, manifold vacuum, air intake velocity, and throttle valve opening to control the choke valve for cold starting and all possible warming up conditions. It is mounted on the engine side of the carburetor with a tongue-and-slot coupling for throttle valve shaft engagement and vacuum connection to vacuum passage in carburetor body on the face of the mounting pad. The upper end of the vertical control shaft is linked to the choke valve shaft by a flexible cable with a tubular rubber cover, and the lower end is clamped to one end of the thermostatic spring coil by the thermostat calibrating screw. The thermostat is wound spirally up the shaft with the upper end clamped to a gear which engages the rack of the vacuum 'take-off' piston so that thermostat tension can be varied by the vacuum piston and throttle shaft cam in accordance with operating conditions. The lower end of the thermostat extends down into the manifold heat tube on the top surface of the exhaust manifold so that it is affected by engine temperature changes. All types are similar in design (except for minor differences described below) and are serviced in same manner (exceptions due to differences in design noted in servicing sections).

Second Type (1990001)—Port hole and bleeder passage for dashpot piston not used and relief groove cut in side of cylinder wall instead. Connecting rod made integral with dashpot piston and small spring in take-off piston at end of rod discontinued, a second reload spring being wound on the pull-out lever shaft and hooked to the lever to secure the same performance. This type serviced in same manner as first type (490-A).

New Type With Starter Vacuum Switch (1990101, 1990102):—Vacuum switch (for starter solenoid control) mounted on take-off piston end of choke housing and operated by pushrod in choke which contacts ear on throttle cam. When switch not installed, special cover plate and gasket installed to close end of choke housing (takes place of screw plug used on first type). Design similar to second type (above) in all other particulars.

OPERATION:—The thermostat winds up as the engine cools off rotating the control shaft and closing the choke valve so that it is in position for starting (fully closed for temperatures below 85°). In this position, the vacuum 'take-off' piston and rack will be pushed in by the piston spring and the dashpot piston will be seated with no pressure being exerted on the piston connecting rod by the pull-out lever which is controlled by the throttle shaft cam. When the accelerator pedal is depressed to start the engine, the resultant throttle opening winds up the pull-out lever spring so that the lever presses on the dashpot piston connecting rod. If the engine does not begin to fire within a few seconds, the movement of the dashpot piston due to the pull-out lever pressure moves the rack forward, rotating the thermostat and control shaft assembly, and opening the choke valve slightly to prevent overchoking. This stroke of the dashpot piston requires 7-10 seconds (moves slowly to point where port hole is uncovered which admits air to cylinder and then rapidly to complete the stroke). The return stroke of the dashpot piston requires approximately 1 minute so that for repeated short cranking attempts the choke will not completely close. When the engine begins to fire, manifold vacuum pulls the vacuum take-off piston forward against the spring tension, opening the choke valve to provide the initial 'take-off' necessary for continued running (dashpot piston will retard this motion also). With the engine running, air velocity past the offset choke valve tends to open the valve and, as the thermostat unwinds as the engine warms up, the choke valve will be wide open at regular operating temperature.

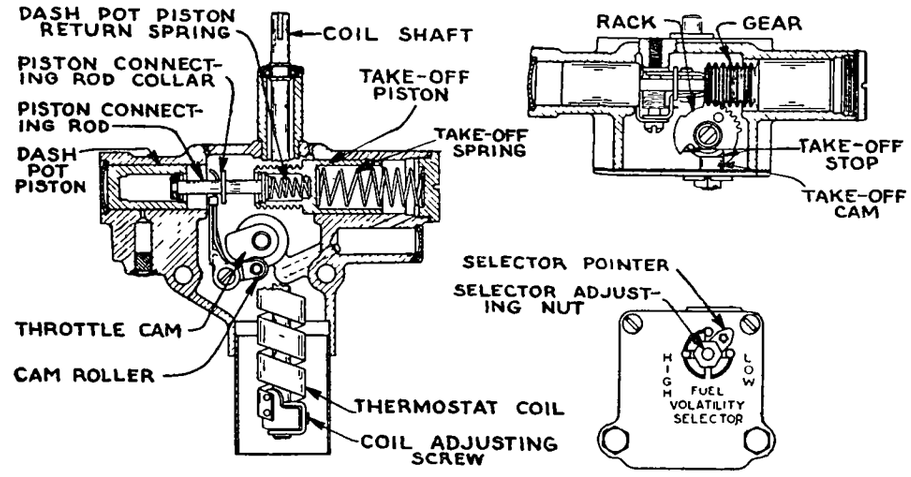
ADJUSTMENT:—No adjustment required except when regular fuel used by car owner is more or less volatile than standard and necessitates special setting of Volatility Selector for correct choke action.

Volatility Selector. Consists of adjusting nut and pointer on control unit cover. Standard setting as shown with pointer in second notch on 'Low' side of scale. Three additional notches provided toward 'high' end. If mixture too rich, move pointer toward 'High' end of scale (this will correct for more volatile fuels). If mixture too lean, move pointer toward 'Low' end.

CHECKING (ON CAR):—If choking action not satisfactory, check control unit before removing from car. Remove air cleaner so that choke valve can be seen. See that choke valve is free and that it returns to original position when opened or closed manually. With engine cold and not running, open throttle wide. Choke valve should open slowly after 7-10 second delay. Close throttle. Choke valve should close immediately. If this action faulty, check for sticking control unit pistons or linkage binding. Start the engine cold. Choke valve should move toward open position when engine begins to fire. If it does not, check for clogged vacuum passage in carburetor and control unit, leaks at gasket (mounting screws loose) or at vacuum take-off cylinder plug (plug loose or gasket defective), or for binding vacuum piston. Accelerate engine before it has warmed up. Choke valve should move toward closed position momentarily and then return. If it does not, check for sluggish dashpot piston, weak or broken dashpot piston lever spring, binding in linkage generally. If choke valve action is not correct in above tests, remove control unit for disassembly and inspection on the bench.

SERVICING:—Removal—Take off carburetor and control unit as an assembly (lift straight up so that thermostat unit clears manifold heat tube). Pull back control shaft rubber cover at either end slipping shaft out of engagement with cover. Take out two mounting screws on face of control unit.

NOTE—On types with vacuum switch, disconnect and tape two leads on vacuum switch terminals before removing unit.



Disassembly—Take out two screws in cover plate, remove cover. Take out dashpot pull-out lever pivot screw and remove lever. Remove take-off cylinder plug and gasket, take out piston spring. Pull piston assembly out until rack and gear disengage, then turn thermostat shaft and gear assembly approximately 180° so that dashpot piston will clear gear when piston assembly is pulled out (sight through bottom of casting and use extreme care that dashpot piston is not scratched in removal). Do not loosen thermostat calibrating screw which clamps lower end of thermostat to control shaft so that thermostat setting will not be disturbed (special calibrating tool required to reset thermostat).

NOTE—On types with vacuum switch (or end plate installed instead of switch), snap ring and spring retainer must be removed before take-off piston spring can be taken out.

Servicing—Wipe off pistons with clean cloth, wipe out cylinders with alcohol, dry all parts. See that all passages are open and clean (if air line used to blow out passages, air must be free of all water, oil and rust). Check flexible linkage between pistons, see that thermostat and gear assembly rotates freely in bearings. Do not oil any part of the choke mechanism.

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Reassembly—Reverse directions given above. With pistons in place mesh gear and rack so that first gear tooth overlaps the first tooth on the rack (this is important, wrong engagement will throw off thermostat calibration). See that take-off spring is installed in take-off piston and that plug gasket is in good condition, tighten plug securely. Install dashpot piston pull-out lever and make certain that curved end of pull-out spring is behind cross head on flexible linkage. Check to see that thermostat clip is meshed with the take-off gear through the pin and that the throttle shaft cam is engaged with the pull-out lever roller in the closed throttle position before replacing cover.

NOTE—On types with vacuum switch, after take-off piston spring, spring retainer and snap ring are installed, use screwdriver or coin inserted in throttle shaft slot to turn shaft to wide open position, then push switch operating rod into choke as far as possible and assemble switch. This will prevent rod distorting contact point spring in switch case which may cause a ground. On type with end plate, make certain that gasket is assembled so that small square in center of gasket hollow square covers the ⅛" hole adjacent to take-off cylinder.

Mounting & Checking—Assemble control unit on carburetor, see that mounting screws tightened securely and gasket pulled down to prevent leaks at this point. Open and close throttle several times to see that linkage does not bind. Engage tip of flexible shaft in control unit shaft, slip rubber cover down over shaft and over pilot on control unit (shoulder in cover must bottom on pilot). Engage upper end of flexible shaft and slip rubber cover over choke valve shaft pilot as single operation (at temperatures below 85° open throttle valve wide to align tongue and slot to avoid necessity of twisting shaft). See that rubber cover does not touch flexible shaft at any point. Check choke valve clearance in air horn (flexible shaft exerts thrust and valve must clear at opposite side of air horn when all end thrust in shaft is taken up). To adjust valve, loosen two mounting screws, tap valve lightly, tighten screws securely. Open and close choke valve several times to see that flexible shaft firmly engaged, choke valve operates freely and returns to original position. Recheck vacuum switch types (or end plate when installed) to make certain that no leakage can occur at cover gasket.

NOTE—Cut-away cover available which can be installed in place of regular cover so that operation of choke mechanism can be watched. To check dashpot piston timing with this cover in place, see that piston fully back in cylinder, rotate throttle shaft cam to wide open position. Piston linkage cross head (where pull-out lever contacts piston rod) should move up to the end of the take-off piston in 4-8 seconds. Rotate throttle shaft cam to closed throttle position. Dashpot piston should move to the bottom of the cylinder in one minute maximum. All movement should be smooth.

THERMOSTAT CALIBRATION:—With Test Fixture. Consists of pointer clamped on control unit shaft and graduated dial mounted on control unit. With Volatility Selector pointer set in second notch on 'Low' end of scale, test fixture pointer should line up with 'O' mark on scale when control unit is at room temperature of 72° F. (control unit should be allowed to stand until it reaches room temperature and temperature should be read on thermometer placed near unit when test is made). Pointer will register minus 1° on dial for each 2° in temperature below 72° or plus 1° for each 2° temperature rise above 72°. To adjust thermostat, use special Allen wrench to loosen thermostat calibrating screw (clampscrew at lower end of thermostat), rotate pointer to correct position, tighten screw. Be careful not to bend or distort thermostat in making this adjustment.

Without Test Fixture. Thermostat cannot be set without fixture but may be compared with a new unit by allowing both units to reach same temperature and then noting control shaft angularity (place units side by side, insert thin blade or match stick in shaft slot, note whether these blades are parallel).

BUICK COLD IDLE (FAST IDLE) CONTROL

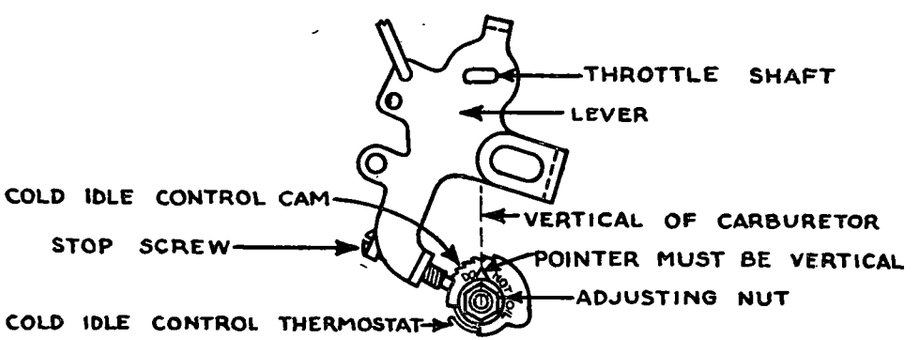
This type control standard equipment on the following Buick car models:

Car Model	Carburetor
40 (1934)	Marvel BB-1 10-1633
40 (1934-35-36)	Stromberg EE-1
50 (1934-35)	Marvel ED-1S 10-1577
60 (1934-35)	Marvel ED-2S 10-1579
90 (1934-35)	Marvel ED-3 10-1581
60, 80, 90 (1936)	Stromberg EE-22
40 (1937)	Stromberg AA-1 or Marvel BD-1 10-1749
60, 80, 90 (1937)	Stromberg AA-2 or Marvel BD-1S 10-1751
40 (1938)	Stromberg AAV-1 or Marvel CD-1B 10-1796,7
60, 80, 90 (1938)	Stromberg AAV-2 or Marvel CD-2B 10-1798,9

DESCRIPTION:—The Cold Idle Control consists of a thermostatically operated cam mounted on manifold heat jacket which serves as a stop for throttle-stop screw. Thermostat is located within cam and rotates cam in a clockwise direction when the engine is cold. The cam then moves the idle adjusting screw outward and automatically increases the idling speed, providing a 'fast idle' for warming up. As the engine temperature rises the cam is rotated counter-clockwise, allowing the idle adjusting screw to move toward the cam until the engine speed drops to the normal 'hot' or slow idle speed of 8 M.P.H.

ADJUSTMENT:—The Cold Idle Control should not require adjustment or attention in service. The setting can be checked as follows: Loosen nut in center of cam, rotate cam hub until pointer is vertical, tighten nut, open throttle momentarily to allow cam to assume correct position (thermostatic spring will not rotate cam while idle screw is resting on cam surface). Warm up engine, note position of idle screw on cam. Idle screw should contact cam on its thinnest portion within ¼" limit adjoining the first cam step. If idle screw contact point is not within these limits, loosen cam nut and rotate cam hub slightly (opening throttle to allow cam to assume correct position). If hub must be rotated more than 5° to secure correct idle screw position on cam, replace entire cold idle cam assembly. Do not oil any part of the mechanism.

NOTE—On Models 50, 60, 90 (1934-35) with Marvel updraft carburetors, the cam hub was punchmarked to indicate the correct setting. The punchmark should be vertical (same position as pointer on other models).



DESCRIPTION:—Two types of Sisson automatic chokes, AC-600 series, and AC-700 series, are used on the following car models:

Std. or Optl. Equipment On:

1934-37 CAR MODELS

Car Model	Choke Type Number
Chrysler Models CA, CU, CV (1934)	AC-600
Chrysler Models C-6, CZ, C1 (1935)	AC-700
Chrysler Models C7, C8, C9 (1936)	AC-751
Chrysler Models C2, C3 (1935), C10, C11 (1936)	AC-600
Chrysler Royal C-16	AC-751B
Chrysler Imperial C14, Cust. Imp. C-15	AC-600
Chrysler Airflow C17	AC-600
De Soto Model SE (1934)	AC-600
De Soto Models SF, SG (1935)	AC-700
De Soto Models S-1, S-2 (1936)	AC-751
De Soto S3	AC-751B
Dodge Models DR, DS (1934)	AC-600
Dodge Model DU (1935)	AC-700B
Dodge Models D2, D3, D4 (1936)	AC-751B
Dodge D5	AC-751B
Plymouth Models PF, PG (1934)	AC-600
Plymouth Model PJ (1935)	AC-700B
Plymouth Models P1, P2 (1936)	AC-751B
Plymouth P3, P4 (Optl.)	AC-751B

1938 CAR MODELS

Chrysler, C18 Royal (1938)	AC-758B
Chrysler, C19 Imp., C20 Cust. Imp. (1938)	AC-600
DeSoto, Model S5 (1938)	AC-758B
Dodge, Model D8 (1938)	AC-758B
Plymouth, Models P5, P6 (1938)—Optional	AC-758B

1939 CAR MODELS

Car Model	Carburetor	Sisson Choke No.
Chrysler Model C22 (1939)	Carter (B&B) E6N1, N2	AC-758B
Chrysler C23, C24 (1939)	Stromberg AAV-2	AC-600
DeSoto S6 (1939)	Carter (B&B) E6N1, N2	AC-758B
Dodge D11 (1939)	Stromberg BXV-3	AC-758B
Plymouth P7, P8 (1939)	Carter (B&B) D6A1, A2	AC-758B
Plymouth P7, P8 Econ. ('39)	Carter (B&B) B6K1, M1	AC-758B

Models AC-758, AC-758B. These models have minor refinements in design and are interchangeable with previous Models AC-700, AC-700B, AC-751, AC-751B.

These models are entirely similar in design and operation but are adjusted differently (see instructions below). The design is similar to that of previous Sisson models and employs a solenoid coil (to close choke valve when starter is operated with engine cold) and a thermostatic spring (to control choking action during warming up period). The terminal on the top or side of the choke case is connected to starter side of the starting switch.

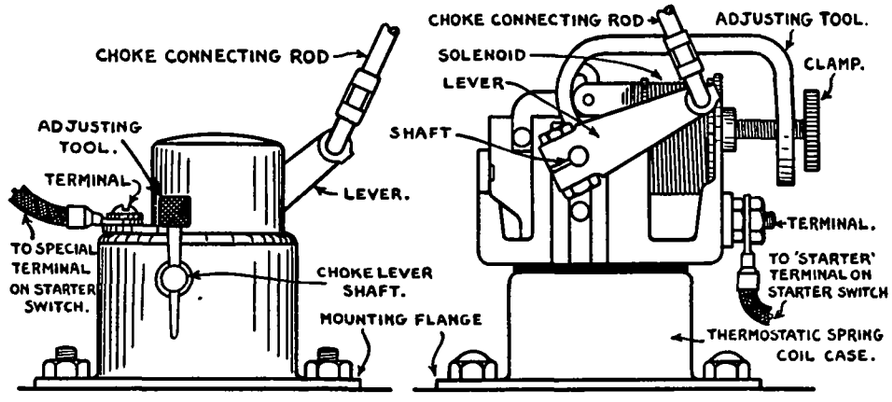
OPERATION:—When the starter is operated to crank the engine, the automatic choke solenoid is energized, attracting the armature, and rotating the choke lever, which is attached to the choke valve lever through a control rod so that the choke valve is closed if the engine is cold. When the engine is warm this armature movement does not take place and no choking action results. When the engine begins to fire and the starting switch is opened, the solenoid circuit is broken. The choke lever is then controlled entirely by the thermostatic spring within the choke case and this tends to rotate the lever and open the choke valve as the engine warms up. With the engine at normal operating temperatures, the choke valve will be entirely open.

ADJUSTMENT:—**AC-700 Series**—Remove air cleaner so that the choke valve can be noted. Insert special adjusting tool (obtainable from Pierce Governor Co., Anderson, Ind.), or #42 wire drill in hole in choke valve shaft opposite end from lever), operate choke lever by hand to close choke until adjusting tool engages slot in choke housing. This will lock choke mechanism in closed position. Then loosen clamp screw on shaft end of choke lever, lift up on lever until carburetor choke valve is entirely closed. Hold lever in this position and tighten clampscrew. Remove adjusting tool and test to see that there is no backlash or play between choke lever and choke valve. These chokes are shipped from the factory with a cotter pin in the adjusting hole. The cotter pin must be removed when the choke is installed on the engine and the adjustment tested as above. When replacing this type choke, always install the special Steelbestos gasket on the exhaust manifold under the choke base. This gasket will prevent excessive heat from damaging the choke mechanism.

NOTE—If choke operation is not satisfactory, see that choke valve is free (air cleaner clamp must not be so tight as to cause valve to bind), and that all linkage operates freely. If internal mechanism of choke sticks, thoroughly clean unit (installation of steelbestos gasket noted above will prevent rust forming within unit). Do not lubricate any part of choke mechanism and be careful not to bend the thermostat.

AC-600 Series—Take off automatic choke cover, remove air cleaner so that position of choke valve can be checked. Clamp special adjusting tool (obtainable from Pierce Governor Co., Anderson, Ind.) in place on choke so that end of tool enters and lines up the holes in the armature and magnet core. This will lock choke in closed position. Then loosen clamp screw on shaft end of the operating lever, move the lever until carburetor choke valve is fully closed, tighten clampscrew. Remove adjusting tool and see that there is no backlash or play between automatic choke lever and carburetor choke valve. Replace air cleaner and choke cover and check to see that choke mechanism operates freely without binding or striking these parts.

SISSON AUTOMATIC CHOKE.



AC-700 SERIES **AC-600 SERIES**

TROUBLE SHOOTING:—If car does not start promptly or if warming up performance is unsatisfactory, check entire ignition system and then check carburetor and choke operation as follows:

Hard Starting with Cold Engine:

1. Check fast idle mechanism to see that it is free and not binding at any point (fast idle connecting rods usually connected to choke valve lever and binding will interfere with choke action).
2. See that choke rod connecting Automatic Choke lever and choke valve lever does not bind in levers.
3. Examine carburetor choke lever, Automatic Choke lever, and fast idle mechanism and remove all paint, grease, or dirt which might cause binding.

CONTINUED ON NEXT PAGE

4. Check carburetor choke valve, see that edges are smooth and that valve does not rub against air horn walls or bind in any position. See that air cleaner does not interfere with choke valve and that mounting screw is not tightened excessively which will distort air horn and bind choke valve (check choke valve operation with air cleaner in place).

5. Check electrical connections at Automatic Choke and starter switch. Examine wire for short-circuits and breaks.

6. Check Automatic Choke ground (unit grounded through case). See that mounting screws are tight and that manifold under mounting flange is clean.

7. Check throttle cracking linkage (see Tune up instructions on car model page). This is important to insure correct throttle opening for starting and to place automatic choke in operation (on some cars with fast idles, fast idle will prevent choke valve closing until throttle valve has been opened to free fast idle cam).

8. Check Automatic Choke adjustment (see instructions above). If Automatic Choke does not function correctly after checking these points, the unit should be replaced.

Hard Starting with Hot Engine:

1. Check for rich mixture or flooding caused by percolating discharge of carburetor when engine stopped. To check, remove air cleaner immediately after stopping engine, note whether gasoline dripping into manifold from carburetor nozzle (this overflow should show up within 3-5 minutes after engine is stopped), Correct by installing special size Float Valve Needle and Seat Assembly and checking float level. See carburetor article in Carburetor Section for float level specifications.

INSTALLATION (PLYMOUTH):—A mounting pad is provided on the exhaust manifold for the automatic choke. Position choke on mounting pad with operating lever pointing toward carburetor, drill two 3/16" holes in line with mounting holes in base flange, tap with ¼x20 USS. tap, use studs furnished to mount choke on manifold. Take off all hand choke linkage, replace with control rod linking choke valve lever and choke operating lever. Connect terminal on choke case to special terminal on side of switch case on starter (do not connect to battery side of starting switch). On cars where this terminal is not provided, remove starter switch, mount pad on end of cable under switch with copper strip against starter terminal post and solder in place.

1939 PACKARD THROTTLE GUARD

Standard equipment on following car models with Overdrive Transmissions:

PACKARD SIX, MODEL 1700 (1939)

PACKARD '120' EIGHT, MODELS 1701, 1702 (1939)

PACKARD SUPER EIGHT, MODELS 1703, 1705 (1939)

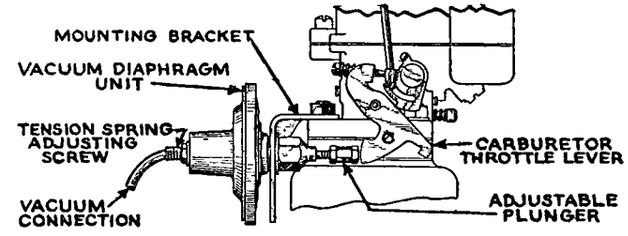
DESCRIPTION:—Throttle Guard designed to prevent engine stalling when freewheeling in the 0-20 MPH. range. Consists of a vacuum diaphragm unit, similar to those used on distributors for vacuum spark control, mounted on the carburetor so that the diaphragm plunger actuates the throttle valve fast idle lever. Unit has adjusting screw and locknut on vacuum diaphragm spring boss (opposite end from actuating plunger).

OPERATION:—Throttle Guard cuts in at 4 MPH. when manifold vacuum decreases sufficiently so that spring within unit forces plunger out against throttle lever opening throttle and accelerating engine to prevent stalling. Throttle Guard kicks out at 9 MPH. when manifold vacuum increases sufficiently to retract plunger and allow throttle valve to close to regular 5 MPH. hot or slow idle speed position.

ADJUSTMENT & TESTING:—**Note**—Make certain that carburetor correctly adjusted and set for 6 MPH. hot or slow idling speed before adjusting Throttle Guard.

Adjustment—Check clearance between outer end of throttle guard plunger and lug on throttle lever. This should be .060" (Six), .020" (Eight, Super Eight). Loosen locknut and turn tension spring and adjusting screw on outer face of throttle guard until distance from top of locknut to end of screw is 3/16" (Six, Eight), 3/32" (Super Eight), tighten locknut. Check adjustment by road-testing car.

Road Testing—See that Overdrive Control knob pushed in (Overdrive operative), allow car to coast in high gear (accelerator pedal released) and decrease car speed slowly by applying brakes. Throttle guard should cut in at 4 MPH. (slight movement of accelerator pedal will be noted) and bring car speed up to 9 MPH. (with brakes released) at which speed it should kick out. If cut in speed is above 4 MPH., decrease spring tension by turning adjusting screw out slightly; if cut in speed below 4 MPH., increase spring tension by turning screw in. If kick out speed is higher than 9 MPH., increase gap between diaphragm plunger and throttle lever (loosen locknut and turn plunger on rod); if kick out speed below 9 MPH., decrease gap.



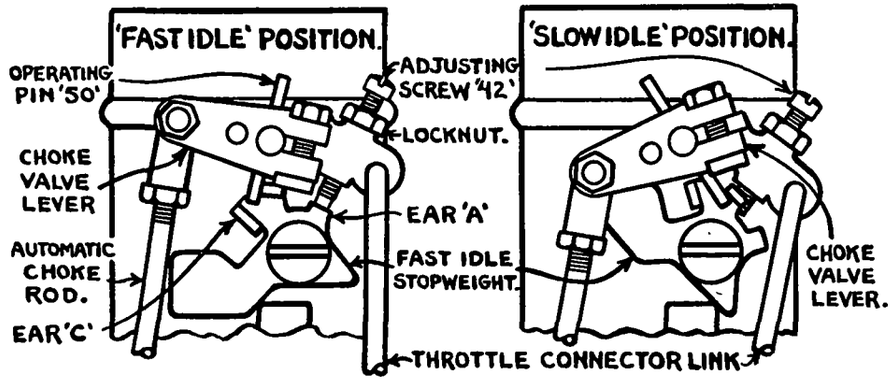
NOTE:—See table below for list of car models using this type Fast Idle.

FAST IDLING DEVICE:—The 'Fast Idling' Device used in conjunction with the Automatic Choke consists of a series of levers connected to the throttle valve, choke valve, and the Automatic Choke Control so that the carburetor choke valve does not close with either a hot or cold motor until the throttle is opened to a position equivalent to 20 M.P.H. As a result, when a hot motor is stopped and the throttle is closed, the contraction of the thermostat spring will close the choke valve from a wide open position to a partially closed position when the movement of the pin '50' against the ear 'C' causes the ear 'A' to contact with the adjustment screw '42'.

Operation. When the car is started the throttle must be opened to a position corresponding to a car speed of 20 M.P.H. The movement of the throttle valve raises the adjusting screw '42', releasing the ear 'A' and allowing the choke valve to snap closed. As soon as the engine begins to fire, the Automatic Choke Control partially opens the choke valve, causing the fast idle stop weight to rotate slightly counter-clockwise. As a result, when the throttle is closed after car has started, the adjustment screw rides on the ear 'A' of the fast idle stop weight, holding the throttle open in a position corresponding to a car speed of 20 M.P.H. When the carburetor is installed this adjustment is set for a car speed of 15-20 M.P.H. with a hot motor, or approximately 12 M.P.H. with a cold motor. As the motor warms up, the fast idle stop weight is rotated slightly clockwise so that the adjustment screw slides off of ear 'A', allowing throttle to close.

Adjustment. Whenever adjustment is being made with a hot motor it will be necessary to hold the fast idle stop weight in position so that the adjustment screw '42' rides on ear 'A' of fast idle stopweight with choke valve held closed. To adjust fast idle, back off throttle stopscrew (hot or slow idle speed adjusting screw) until throttle valve is completely closed. Close choke valve by hand, see that ear 'A' is directly under adjusting screw '42', loosen locknut on adjusting screw, turn screw down or clockwise until it just contacts ear 'A', then turn screw the correct number of additional turns as given in table below for each car model, tighten lockscrew. In some cases this adjustment is made in a slightly different manner by opening the throttle valve the correct amount (using a feeler gauge or wire drill of correct size inserted between edge of throttle valve and carburetor wall to hold throttle valve open) and then turning the adjusting screw '42' in until it just contacts ear 'A'.

Car Model and Year	Carburetor	Fast Idle Setting
Chrysler CL* (33), CW (34), CW* (35)	EE-3	1½ complete turns
Chrysler CU, CV (34), C2, C3 (35)	EE-22	.016-.020" throttle opening
Oldsmobile F-33 (1933)	EC-22	#55 drill (see Note)
Oldsmobile L-33 (1933)	EE-22	.090" feeler (see Note)
Packard Twelve (1933-34)	EE-3	6¾ complete turns
Packard Eight, Super Eight (33-34)	EE-22	1¾ complete turns
Pierce Arrow Eights (1933-38)	EE-3	1⅛ complete turns
Pierce Arrow Twelves (1933-38)	EX-32	¾ of one turn
Reo S3 (33), S4 (34), 7S (35)	EX-32	#60 drill throttle opening
Studebaker 56 (1933)	EX-22	1½ complete turns
Studebaker 73, 82, 92 (1933)	EE-22	1¾ complete turns
Studebaker Pres. C (1934)	EE-22	1¾ complete turns



Loading. If the engine becomes loaded when cranking, this condition can be corrected by holding the throttle in wide open position, which will open the choke valve approximately 40%.

Linkage. See article on Type C Automatic Choke for adjustment of choke connecting rod. Backlash in linkage should be .006". Endplay in choke valve shaft should be held to .003" with valve closed (measure with feeler gauge between air horn and shaft washers.

LEVER TYPE

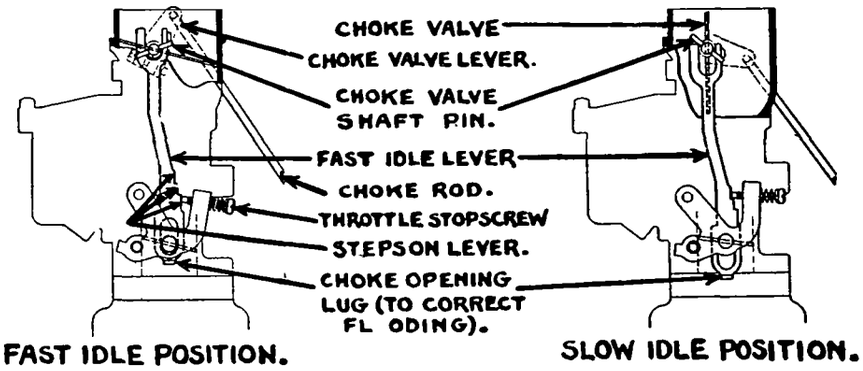
NOTE:—This type Fast Idle used on the following car models:

Car Model and Year	Carburetor
Auburn 850-X (1934), 851 (1935)	EE-1
Oldsmobile L-34 (1934)	EE-1
Studebaker Comm. 1-B, Pres. 1-C (1935)	EE-1

DESCRIPTION:—This type fast idle mechanism consists of a lever or bar linked to the choke valve shaft and having several steps or notches on its lower end which serve as stops for the throttle stop screw which controls idling speed. The pin on the choke valve shaft bears against a lug on the upper end of the lever so that the lever is raised as the choke valve closes. When the choke valve is opened, the lever falls of its own weight, allowing the stop screw to slide off each step in turn until the upper step or 'slow idle' position is reached.

OPERATION:—When this type fast idle is used on carburetors equipped with an automatic choke, the choke valve is closed by the thermostatic spring as the engine cools off until the stop screw engages the first step on the fast idle lever. When the engine is started, the momentary opening of the throttle (throttle must be opened by hand if no hook-up is provided with the starter mechanism), allows the choke valve to snap closed, raising the lever to the fast idle position. As the choke valve is opened, the lever is freed and drops so that the idling speed is increased (by the stop screw sliding from one step to another) until the final or slow idle position is reached.

TO CORRECT FLOODING:—With the throttle wide open, the throttle valve lever engages an ear on the lower end of the fast idle lever, pulling the lever down and opening the choke valve. If the carburetor loads up and engine will not start, the throttle should be opened wide and the engine turned over several times.



NOTE:—This type Automatic Choke used on the following car models:

Car Model and Year	Carburetor	Choke Type No.
Oldsmobile Model F-32 (1932)	EC-2	A-16130
Oldsmobile Model F-32 (1932)	EC-2	A-16400 (X)
Oldsmobile Model L-32 (1932)	EE-2	A-16210
Oldsmobile Model L-32 (1932)	EE-2	A-16410 (X)
Packard Twelve Models 905, 6 (32)	EE-3	A-16510

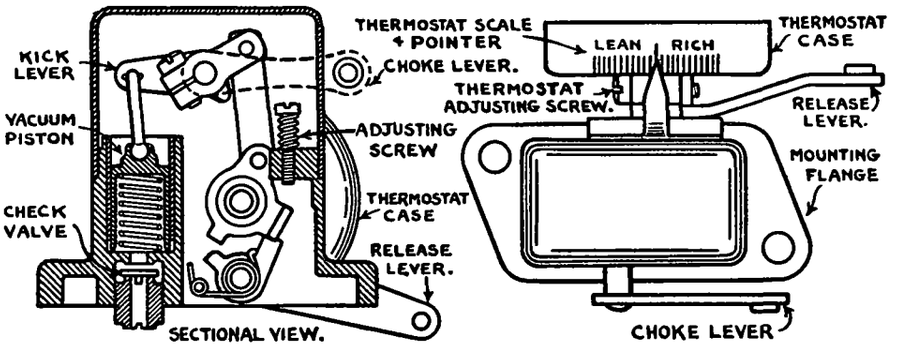
(X) These models same as preceding model except they are less choke rod and gasket.

DESCRIPTION:—This device is intended to choke the carburetor for cold starting and to control the choking action during the warming-up period. It employs a thermostatic spring coil controlled by exhaust manifold heat and a vacuum piston controlled by intake manifold vacuum to operate the lever which is linked to the carburetor choke valve. A second lever (release lever) is linked to the throttle valve lever and is designed to open the choke valve when the throttle valve is opened wide. This is designed to correct flooding.

OPERATION:—When the engine is cold the tension of the thermostatic spring closes the choke valve so that it is in position for starting. The choke valve is held closed during cranking by the locking of the linkage within the choke case. When the engine begins to fire, the downward motion of the vacuum piston unlocks the linkage and opens the choke valve slightly to prevent over-choking. As the engine warms up the tension of the thermostatic spring decreases, allowing the choke valve to open. The automatic choke is designed to completely close the choke valve at 70°F. and the choke valve should be wide open when the engine temperature reaches 120°F.

ADJUSTMENT:—(1932). Choke can be removed from engine by disconnecting control levers and taking out two mounting screws. Choke thermostat must be at normal room temperature of 70°F. before any adjustments are made. If engine has been running, remove choke and allow to cool off. If choke case temperature is under 70°, take choke into warm room and allow to come up to room temperature. The release lever must be held in a horizontal position (parallel to base) while the choke is being tested or adjusted. To check choke, unhook thermostat spring from prong in case, set the case at correct figure for car (5 notches lean for Oldsmobile F-32, 8 notches lean for Oldsmobile L-32, 16 notches lean for Packard 905, 6), raise choke lever to highest position and check distance from thermostat spring hook to prong on case. Correct figure should be .002-.020". Distance can be set by loosening set screw and turning the shaft. Tighten the set screw and see that thermostat does not bind on case. Invert choke, lift choke lever and allow it to drop. It should drop freely and the linkage should come back to the 'lock' position. Assemble thermostat spring hook on prong, set thermostat case at '0'. With this setting, choke lever should catch in the closed position but should yield to a light pressure. Revolve thermostat case one quarter turn so that prong is under pointer. With this setting, choke lever should resist slight pressure but should yield to a tap by hand. There should be a noticeable difference between the two settings. The amount of resistance offered by the choke lever is controlled by the adjusting screw in the choke case. Turn this screw down or clockwise to decrease resistance and up or counter-clockwise to increase resistance. Set the thermostat case for the correct figure, securely tighten the thermostat case clamp screw, assemble choke on engine, see that backlash between choke control and carburetor choke levers is not more than .006". This can be adjusted by changing position of carburetor choke lever on choke valve shaft. Release lever should be connected to accelerator rod. This release lever opens the choke valve when the accelerator is opened wide.

MODEL 'B'.



SETTING:—Thermostatic spring coil is set for each car model by loosening spring case clampscrew and rotating spring case the correct number of notches rich or lean from the center mark (count from center mark to mark under pointer). Tighten clampscrew. Settings are as follows:

Car Model	Setting
Oldsmobile F-32 (1932)	5 notches lean
Oldsmobile L-32 (1932)	8 notches lean
Packard Twelve (1932)	16 notches lean

STROMBERG FAST IDLE

NOTE:—This type Fast Idle used on the following car models:

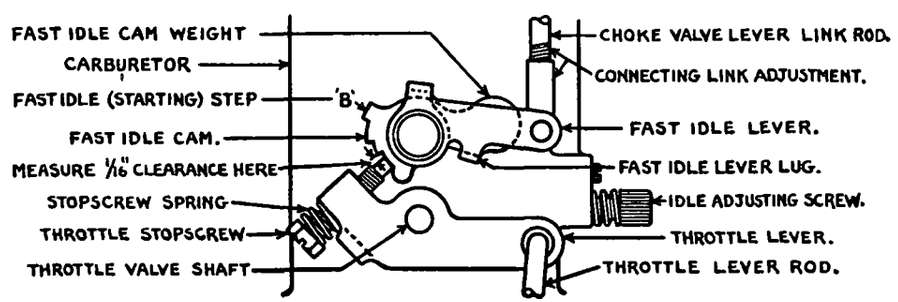
Car Model and Year	Carburetor
Oldsmobile F-35 (1935)	EX-22
Oldsmobile L-35 (1935)	EE-1

DESCRIPTION:—This type Fast Idle consists of a stepped cam (located directly above the throttle lever) which serves as a stop for the throttle lever stopscrew (idling speed adjustment). The lever which operates this cam is linked to the choke valve lever so that the cam is controlled by the automatic choke mechanism.

OPERATION:—When the engine cools off after being driven, the thermostatic spring in the automatic choke tends to close the choke valve but is prevented from doing so by the engagement of the throttle stopscrew with the first step on the fast idle cam. When the cold engine is started, the opening of the throttle valve lifts the throttle stopscrew and releases the fast idle cam, the automatic choke then closes the choke valve and rotates the fast idle cam so that the stopscrew rests on the highest step 'B' of the cam. This prevents the throttle from closing and provides the fast idling speed. As the engine warms up and the thermostatic spring tension decreases, allowing the choke valve to open, the fast idle cam lever is moved downward away from the lug on the fast idle cam. This allows the fast idle cam to rotate (by reason of the weight on the lever end of the cam) so that the throttle stopscrew slides over the various steps of cam and finally comes to rest on the lowest step, which provides the 'hot' or slow idling speed when the choke valve is fully open.

ADJUSTMENT:—No adjustment will ordinarily be required. The clearance between the throttle lever stopscrew and the notch or step at the end of the low speed step on the fast idle cam should be 1/16" with the choke valve wide open (see illustration). To adjust, disconnect rod linking choke valve lever and fast idle cam lever and adjust length of rod by turning rod in or out of adjusting link on lower end of rod.

All carburetor adjustments should be made with the engine warmed up so that the choke valve is wide open and the throttle stopscrew rests on the smallest step of the fast idle cam.



NOTE:—This type Automatic Choke used on the following car models:

Car Model and Year	Carburetor	Choke Type No.
Oldsmobile F-33 (1933)	EC-22	A-17220
Oldsmobile L-33 (1933)	EE-22	A-17220
Packard Eights (1933-34)	EE-22	A-17280
Packard 12 (1933-39)—See Note	EE-3	A-17290
Pierce Arrow Eight (1933)	EE-3	A-15150
Pierce Arrow Eights (1934-38)	EE-3	A-17630
Pierce Arrow Twelve (1933-38)	EX-32	A-16090
Reo S-2, 3, 4, 7 (1933-34-35)	EX-32	A-17360
Studebaker 56 (1933)	EX-22	A-17010
Studebaker 63, 73, 82, 92 (1933)	EE-22	A-17000
Studebaker Pres. C (1934)	EE-22	A-17590
Studebaker Comm. 1B, Pres. 1C (1935)	EE-1	A-17590
Studebaker Pres. 2-C (1936)	EE-1	A-17590
Studebaker 2C (Eng. No. B11876 Up)	EE-1	A-17940
Studebaker 3C (1937)	EE-1	A-17950
Stutz DV-32 (1933-34)	EE-3	A-17380

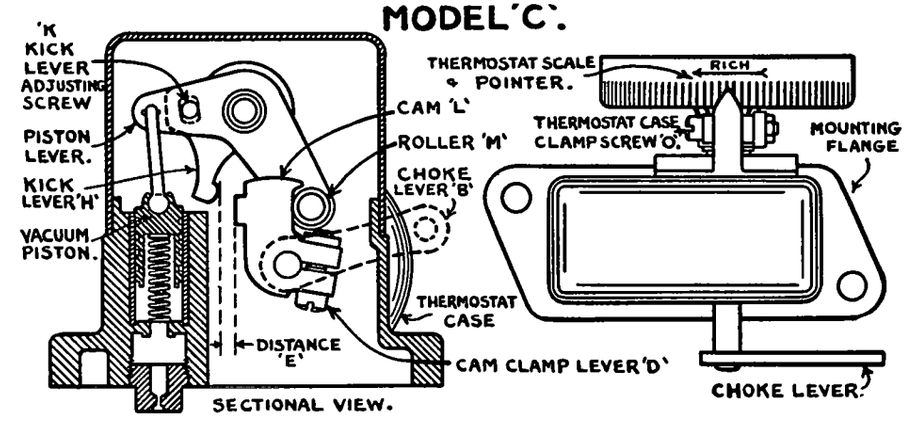
NOTE:—Packard Twelve. New 10-9A choke used on late '37 and all '38-39 cars. This model may be installed on early '37 cars to improve choke action by removing asbestos between choke hot plate and manifold and installing 3/32" plain washer No. 239304 on each screw as spacer. Choke valve lever to fast idle cam lever rod must be replaced by new 5 9/32" rod (old rod 5 9/16" long).
NOTE—New 10-9A choke setting 16 Notches Rich, old 10-9 setting 28 notches.

DESCRIPTION:—The Stromberg Automatic Choke Control is a device designed to automatically choke the carburetor when the engine is started cold and to automatically control the choke valve during the warming up period of the engine. It is designed to be mounted on the manifold and is operated by the engine heat and manifold vacuum.

OPERATION:—The coiled thermostat spring in the thermostat case on the side of the unit will close the carburetor choke valve at an engine temperature of 70°. The choke will thus be in position for starting and is held closed during the cranking operation by the locking of the roller 'M' against the cam 'L'. When the engine begins to fire, the vacuum in the manifold will act to pull down the piston 'G' (since the lower end of the piston cylinder is connected to the manifold), unlocking the roller 'M' and cam 'L'. As soon as the engine begins to fire regularly the piston will be drawn down to the end of the stroke so that cam 'L' bears against lever 'H', opening the choke valve slightly against the tension of the thermostatic spring.

ADJUSTMENT:—When the Type C Automatic Choke requires adjustment, it should be removed from the engine by disconnecting the carburetor connecting rod and taking out the two mounting screws. The Choke should then be allowed to cool off to 70° before any attempt is made at adjusting (this is particularly important if engine has been running and Choke is heated). However if temperature is under 70° choke should be taken into a room heated to 70° (this is normal room temperature) and allowed to come up to room temperature before adjustment is made. To adjust, first take off Choke case cover and see that all working parts operate freely. With roller 'M' in locked position against first notch of cam 'L' the distance between the center of the hole in the choke lever 'B' and the lower surface of the choke base plate should be measured (see Table #1). If not correct, loosen cam clamp lever 'D' and shift position of control lever until correct setting is secured. Measure the distance 'E' between the face of the cam 'L' and the surface of the kick lever 'H' (use a wire drill) with cam in locked position (see Table #2). Adjust by loosening kick lever adjusting screw 'K'. Then unhook thermostat spring end 'A' from prong 'N' in thermostat case, loosen clamp screw 'O' and rotate thermostat case 'Q' until the zero mark of the scale on the rim of the case is directly under the pointer. In this position the hook of the thermostat should be flush with the prong in the case. Place the hook on the prong, revolve the thermostat case the correct number of divisions toward the 'rich' or 'lean' side of the scale (see Table #3 below for each car model), securely tighten clamp screw 'O'. See that piston operates freely and does not stick in any position, assemble Choke case cover, mount choke on manifold, making certain that gasket is in good condition and that mounting screws are pulled down evenly and securely. Then connect control rod to carburetor choke lever and see that there is only .006 inch backlash between levers. If it is necessary to adjust control rod to secure correct backlash, loosen the clamp screw on the carburetor choke lever and shift the carburetor choke lever on its shaft. See that the carburetor air cleaner does not interfere with the free movement of the control rod.

CALIBRATING THERMOSTATIC COIL:—If the hook on the thermostatic coil is not flush with the prong on the case at 70°F with the pointer at '0' (see adjustment paragraph above), a new '0' location should be located as follows: loosen thermostat case clampscrew, revolve case until hook on thermostatic coil is flush with prong, tighten clampscrew and make a new '0' mark opposite the pointer. Obliterate the old '0' mark and use the new mark in setting the thermostatic coil (Table #3 above). This procedure may be necessary when installing a new thermostatic coil or when the old coil has taken on a permanent 'set'. Replace coils which have been deformed by rough handling.



Car Model and Year	Table #1 Lever Height	Table #2 Distance 'E'	Table #3 Setting Notches
Oldsmobile F-33 L-33 (1933)	1 5/8"	#20 drill	28 Rich.
Packard Eight (1933-34)	1 7/16"	#25 drill	8 Rich.
Packard Super Eight (1933-34)	1 7/16"	#25 drill	8 Rich.
Packard Twelve (1933-37)	1 15/16"	#12 drill	28 Rich.
Packard Twelve 1937-38-39	1 15/16"	#12 drill	*16 Rich
Pierce Arrow Eights (1933)	1 1/32"	#17 drill	12 Rich.
Pierce Arrow Eights (1934-38)	1 1/32"	#17 drill	10 Rich.
Pierce Arrow Twelve (1933-38)	41/64"	#17 drill	12 Rich.
Reo S-2, 3, 4 (1933-34)	1 11/16"	#10 drill	7/16" (x)
Reo 7-S (1935)	1 11/16"	#10 drill	3/8" (x)
Studebaker Six 56 (1933)	61/64"	#20 drill	16 Rich.
Studebaker 63, 73, 82 (1933)	1 3/32"	#20 drill	16 Rich.
Studebaker Spdwy Pres. 92 (1933)	1 3/32"	#20 drill	8 Rich.
Studebaker Pres. C (1934)	1 3/32"	#20 drill	16 Rich.
Studebaker Com. 1B, Pres. 1C ('35)	1 1/16"	#17 drill	16 Rich.
Studebaker 2C ('36) all models	1 3/32"	#20 drill	16 Rich.
Studebaker 3C ('37)	See Note.	#20 drill	8 Rich.
Stutz DV-32 (1933-34)	1 15/16"	#22 drill	3/8" (x)

*—This setting may be varied not more than 5 notches in either direction if engine runs rich or lean during warming up period.

(x) On these models the thermostat case should be revolved until the hook on the spring coil is this distance from the prong on the case with the choke at 70°F. These settings must be made before the thermostat spring coil hook is engaged with the prong.

NOTE—On Studebaker models, adjust kick lever cam setscrew so that roller is in contact with first notch of cam with .005-.009" clearance between setscrew and stop. Thermostat case housing is stamped 'R', 'M' and 'H'. Setting for standard grades of gasoline is at 'R' (8 notches rich). If engine loads up when cold with this setting, 'M' (4 notches rich) should be used. Setting 'H' (at zero) should only be used with highly volatile gasoline.

Std. Equipment On:
OLDSMOBILE EIGHT, MODEL L-34 (1934)

DESCRIPTION:—The Stromberg Automatic Choke is designed to completely close the choke valve at a temperature of 70°F. (engine not running) and to open the choke valve progressively as the engine heats up until the valve is wide open at an engine temperature of 120°. It employs both engine temperature (thermostatic spring coil) and manifold vacuum (vacuum piston) to control the choke under all operating conditions. Choke is locked in position (with lever against adjusting screw) with choke valve closed while engine is being cranked, and is unlocked by the vacuum piston movement when the engine begins to fire. See paragraph below for adjustment of locking action.

OPERATION:—With the engine cold and not running, the choke valve will be closed (thermostatic spring wound up and vacuum piston up at upper end of stroke). When the engine begins to fire, the manifold vacuum will cause the vacuum piston to move down, opening the choke partly. The choke valve is then controlled by the thermostatic spring and is opened as the engine heats up and the spring unwinds until the engine temperature reaches 120°, when the choke valve will be wide open.

ADJUSTMENT:—Linkage. See that operating linkage moves freely and does not bind. Check connecting rod clearance or backlash with choke valve in closed and wide open positions. With automatic choke lever in uppermost position and choke valve closed, backlash in connecting rod should be not more than .006". Adjust by shifting position of choke valve lever on choke valve shaft.

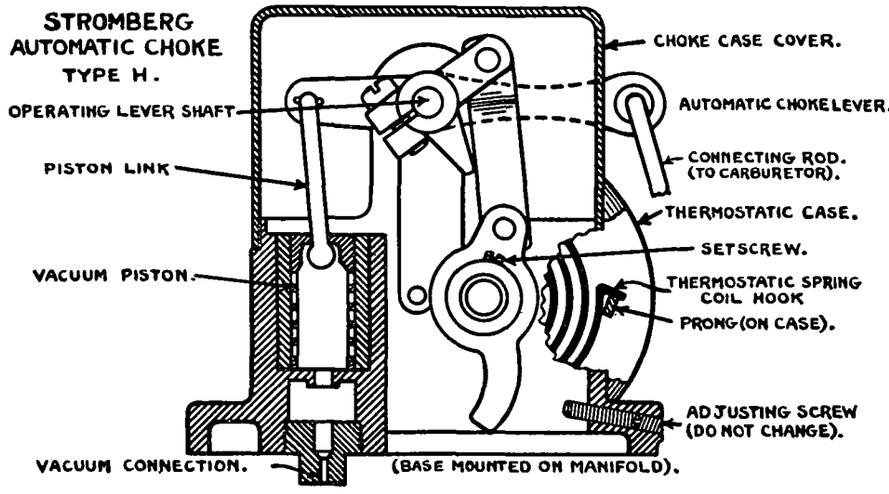
Lever Height. The height of the choke lever should be checked with the choke in the closed position. Center of hole in end of lever should be 2 25/64" plus or minus 1/64" above the lower face of the mounting flange. To adjust, loosen clamp screw which holds choke link and lever on shaft within choke case and shift position of lever. Tighten clamp screw after making adjustment.

Thermostatic Spring. Thermostatic spring must be at exactly 70°F. when this check is made. If engine has been running, allow car to stand until it has cooled off to 70°, or if engine temperature is under 70°, allow choke to come up to room temperature before testing. Remove thermostatic spring hook from prong on thermostat case. Revolve thermostat case until '0' mark of calibration is opposite pointer. In this position thermostatic spring hook should be flush with the prong on the case (with thermostat at 70°F.). To adjust, loosen setscrew which clamps choke link and lever on thermostatic spring shaft (within choke case), rotate thermostat shaft until hook is flush with prong, tighten setscrew. Check to see that thermostatic coil does not rub against case. Then reset choke as directed below.

Vacuum Piston. If automatic choke is removed from engine manifold, see that gasket between base and manifold is in good condition and tighten attaching screws evenly and firmly. An air leak at this point will interfere with the choke action.

Locking Action. To check locking action (cranking position with choke valve closed), revolve spring case so that setting is 27 notches rich. Locking action should break loose (lever move from its position against adjusting screw) when a force of ¾-1¼ lbs. is applied at outer end of choke operating lever. Adjust by turning adjusting screw (marked 'Do not change' in illustration) in or out. Choke must then be reset as directed below.

SETTING:—To set automatic choke, revolve the spring case the correct number of divisions on the scale rich or lean as directed for each car model. Correct setting for Oldsmobile L-34 is 3 notches rich.

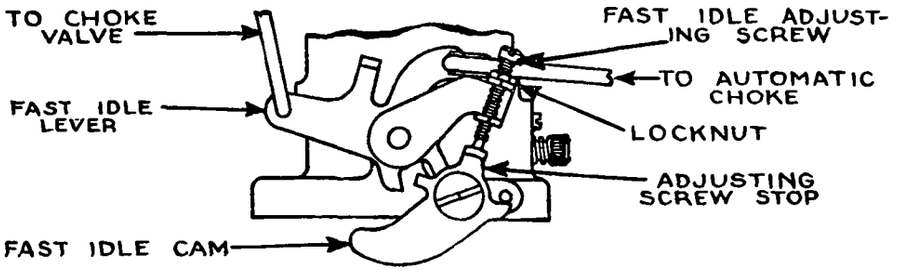


STROMBERG FAST IDLE

Std. Equipment On:
PACKARD TWELVE, 1207,8('35), 1407,8('36), 1506,7('37), 1606,7('38), 1707,8('39)

DESCRIPTION & OPERATION:—*Consists of a fast idle cam on the carburetor* casting below the throttle shaft which serves as a stop for the special fast idle adjusting screw on the throttle lever. Fast idle cam is controlled by fast idle lever linked to choke valve and is rotated to fast idle position when the choke is closed for cold starting (throttle must be opened momentarily to allow choke to close and fast idle to operate). In the fast idle position (see illustration), the fast idle screw rests on the ear of the fast idle cam. When the choke valve opens with the engine warm, the fast idle cam is released by the fast idle lever and falls of its own weight so that the ear is rotated past the fast idle screw. The throttle valve then closes to the hot or slow idle position (controlled by the throttle stopscrew on the opposite end of the throttle shaft).

ADJUSTMENT:—If adjustment is made with engine hot, throttle should be opened momentarily and fast idle cam rotated so that fast idle screw is directly over ear on cam. Hold fast idle cam in this position while adjusting. Back off throttle stopscrew (slow idle speed adjusting screw) until throttle valve is completely closed, loosen locknut on fast idle adjusting screw, turn this screw in until it just contacts ear on fast idle cam, then turn screw in an additional 6¾ turns, tighten locknut. Readjust throttle stopscrew for correct hot or slow idle speed.



STROMBERG AUTOMATIC CHOKE

Car Model and Year	Carburetor
La Salle Model 350, Series 50 (1934-35)	EE-23
Oldsmobile Model F-34 (1934)	EX-23
Studebaker Dict. A (1934)	UR-23
Studebaker Comm. B (1934)	E-33

DESCRIPTION:—Similar to previous designs except that units located differently and a fast idle cam is built in choke on carburetor. Fast idle stop screw on the throttle valve lever rests on this cam, and the cam is rotated to this high idle position when the choke valve is closed by the automatic choke. The operation of the vacuum piston when the engine begins to fire opens the choke valve slightly and also rotates the high idle cam so that the stop screw rests on the second step or intermediate idle position. Finally when the choke valve is entirely open, the cam is revolved so that the stop screw drops off to the slow idle or flat portion of the cam and the idling speed is then controlled by the throttle stop screw.

OPERATION:—The thermostatic spring coil on the exhaust manifold or exhaust pipe is linked directly with the choke valve lever through a connecting rod and is designed to close the choke valve completely at a temperature of 70° (engine not running). When the throttle is opened for starting, the high idle cam will be revolved to the high idle position, holding the throttle partly open, providing a high idling speed. When the engine begins to fire, the vacuum piston in the carburetor body will be drawn up (updraft carburetors) or down (downdraft carburetors) so that the choke valve is opened partly and the high idle cam is revolved to the intermediate idle position. As the engine temperature increases, the tension of the thermostatic spring coil decreases, allowing the off-center mounted choke valve to open. At an engine temperature of 120°, the choke valve should be wide open.

ADJUSTMENT:—High Idle Speed. The throttle stop screw should first be adjusted for correct hot or slow idle speed. To make this adjustment, engine must be thoroughly warm so that the choke valve is wide open and high idle cam is revolved to slow idle position so that throttle stop screw is operative. Adjust throttle stop screw so that idling speed is 6 M.P.H. on La Salle, 8 M.P.H. on Studebaker Dictator and Commander, and 6 M.P.H. on Oldsmobile (on Oldsmobile, throttle stop screw and high idle adjusting screw are the same so this is the only adjustment necessary). Then adjust high idle speed as follows:

La Salle 350. Turn high idle adjusting screw until it makes contact with the low or small diameter step on the high idle cam, then back off screw about ½ turn until clearance between screw and cam is .010". Use a feeler gauge to check this setting. Choke valve must be open when adjustment is made.

Studebaker Dictator and Commander. Insert a feeler gauge .034" (Dictator) or .060" (Commander) between the low idle screw (throttle stop screw) and the carburetor body. Open throttle, rotate high idle cam so that high idle adjusting screw rests on largest step or high idle portion of cam, close throttle, turn high idle adjusting screw in or out until it has a slight drag on the cam. This adjustment can also be made without using a feeler gauge by first turning the low idle screw (throttle stop screw in one turn (Dictator) or 1⅝ turn (Commander) from the correct or 8 M.P.H. position and then adjusting the high idle screw as directed above. In this case it will be necessary to reset the low idling speed by turning the stop screw out one turn (Dictator), or 1⅝ turns (Commander), after adjustment is completed.

TO CHECK OR ADJUST THERMOSTATIC COIL:—Disconnect operating rod and remove thermostatic coil assembly from position on manifold. Check position of operating lever as follows:

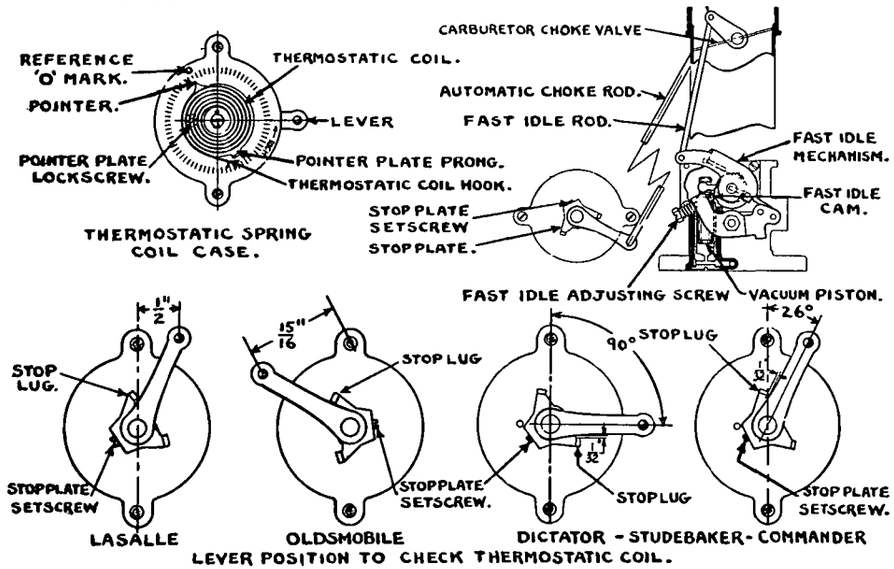
La Salle Model 350. With lever held in closed choke position (lever pointing up and to right of vertical line through mounting screw holes) and against upper lug or stop on thermostat case hub, the distance between the center of the upper mounting screw hole and center of lever connecting hole (outer end of lever) should be ½". To adjust, with lever held in correct position, loosen set screw in hub, rotate hub until lug is against lever, tighten set screw. This is a preliminary adjustment for thermostatic coil testing. After testing, the stop lug should be adjusted so that clearance is not more than 1/32" with choke valve closed.

Studebaker Dictator. Hold lever in closed choke position at right angles (90°) to right of vertical line through mounting screw holes, check clearance between lever and lower lug or stop on thermostat case hub. This clearance must be exactly 1/32". Adjust by loosening set screw in hub and rotating hub

Studebaker Commander. Hold lever in closed choke position. Lever should be 26° to right of vertical line through mounting screw holes and pointing upward. Check clearance between lever and upper stop or lug on thermostat case hub. Adjust by loosening set screw in hub and rotating hub.

Oldsmobile F-34. Hold lever in closed choke position. Center of hole in outward end of lever should be 15/16" from center of upper mounting screw hole. Loosen set screw in thermostat case hub, rotate hub until the upper lug or stop on the hub is against the lever, tighten set screw. This is a preliminary setting for testing of thermostatic coil. After testing is completed, adjust hub so that clearance between lever and lug is 1/32" with choke valve closed.

Thermostatic Coil Test:—See that thermostat temperature is exactly 70° (allow thermostat to stand until it comes up to room temperature (70°), check temperature with a thermometer placed adjacent to thermostat coil. When temperature is correct, unhook end of thermostat coil from prong on thermostat case, loosen pointer plate lock screw, rotate pointer plate until pointer is directly opposite '0' on scale, check position of thermostat coil hook. Hook



LEVER POSITION TO CHECK THERMOSTATIC COIL.

should be flush with the prong on the thermostat case. If hook is flush with the prong, thermostat coil tension is correct and thermostat can be reset and replaced on engine (see below).

If the above check indicates that thermostatic coil has taken on a permanent set and that original '0' position is incorrect, this can be corrected by locating a new '0' mark as follows (if coil has been deformed by rough handling, it should be replaced). Loosen pointer plate lock screw, revolve pointer plate until the thermostatic coil hook is flush with the hook on the case. Tighten lock screw, mark case with a new '0' opposite the pointer, obliterate the old '0' mark. This establishes a new reference point and thermostatic coil can then be reset and reinstalled on engine.

Setting Thermostatic Coil:—Correct settings for these car models are as follows:

Car Model	Thermostatic Coil Setting
La Salle 350	12 notches rich
Studebaker Dictator, Model A	3 notches rich
Studebaker Commander, Model B	11 notches rich
Oldsmobile, Model F-34	15 notches rich

To set the thermostatic coil, loosen pointer plate lock screw, revolve pointer plate the correct number of notches rich or lean, tighten lock screw. Install thermostat on manifold, connect choke lever operating rod, with choke lever closed, see that clearance between thermostat lever and stop lug on hub is 1/32" (it will be necessary to set this clearance on La Salle and Oldsmobile—see above).

DESCRIPTION:—This type Automatic Choke and Fast Idle is similar in design to the type used previously on these carburetor models. Used as standard equipment on the following car models.

Car Model	Year	Carburetor Type
Graham Model 73	1935	EX-23
La Salle 350 Series 50	1935	EE-23
Packard 1200, 1, 2, 3, 4, 5	1935	EE-23
Packard 1400, 1, 2, 3, 4, 5	1936	EE-23
Packard Super 8, All Models	1937-38-39	EE-23
Studebaker Dictator 1A, 2A	1935	EX-23
Studebaker Dictator 3A, 4A	1936	EX-23
Studebaker Dictator 5A, 6A	1937	EX-23

OPERATION:—The thermostatic spring coil lever is linked directly to the choke valve lever by a rod. A second rod links the choke valve lever with the fast idle cam so that the cam is rotated as the choke valve opens and closes. The thermostatic spring is designed to completely close the choke valve at 70°F. This action does not take place until the throttle valve is opened to the 20 M.P.H. position, lifting the fast idle screw off the low or hot idle portion of the cam and allowing the cam to be rotated to the fast idle position as the choke valve closes. Choke valve is offset and is not locked in position while the engine is being cranked. As soon as the engine begins to fire and vacuum is built up in the manifold, the vacuum piston is drawn down, opening the choke valve slightly and rotating the fast idle cam to the second or intermediate idle position. As the engine warms up, the tension of the thermostatic spring decreases, allowing the offset choke valve to open fully and rotate the fast idle cam to the low or hot idling position.

Choke Opening to Correct Flooding—The choke valve can be opened manually to correct a flooded carburetor by opening the throttle valve wide open. In this position the cam on the end of the throttle lever contacts the ear on the fast idle lever, rotating the lever and opening the choke valve.

ADJUSTMENT:—**Slow Idle Screw.** The hot or slow idling speed is controlled by the throttle stopscrew (see Carburetor Adjustment). This adjustment should be made only when the engine is warm with the fast idle screw resting on the low or slow idle portion of the fast idle cam. Standard settings for these models are given below. Setting indicates number of turns of the screw past the closed throttle position.

Car Model	Carburetor	Slow Idle Screw Setting
Graham	EX-23	1 turn
La Salle	EE-23	½ turn
Packard (all models)	EE-23	½ turn
Studebaker (all models)	EX-23	¾ turn

Fast Idle Screw. On some models a separate screw is used to control the fast idle speed. This screw should be set at ½ turn or .010" clearance between screw and low idle (small diameter) step of fast idle cam with throttle valve closed on La Salle.

Fast Idle Screw (Packard Models). Back off throttle stopscrew (hot or slow idle speed adjustment) so that throttle closes tightly, hold choke valve closed so that fast idle cam is rotated to fast idle position (open throttle momentarily to permit this rotation), turn fast idle screw in until it just contacts the fast idle cam, then turn screw in additional 2½-3 turns. This will provide throttle opening of .016-.020".

Choke Rod Linkage. The rod connecting the thermostatic spring coil lever and the choke valve lever should be adjusted so the choke valve is fully closed with approximately 1/32" clearance between thermostat lever and stop lug (T).

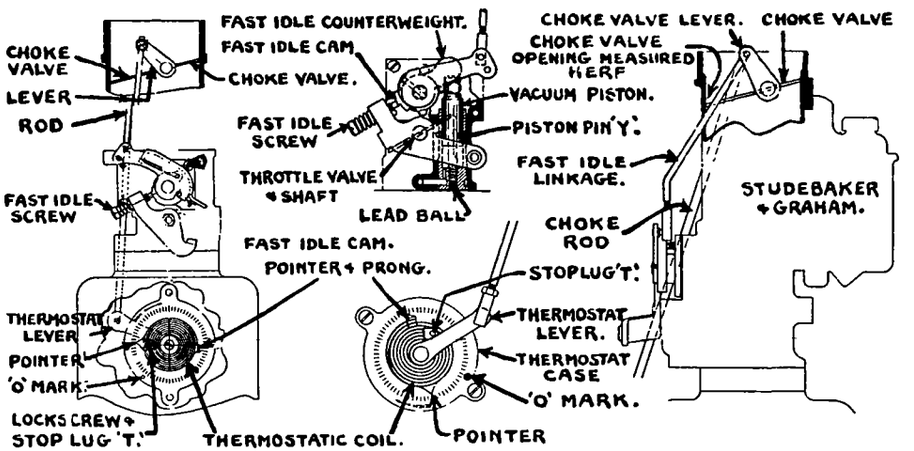
Fast Idle Linkage. The rod connecting the choke valve lever and the fast idle lever should be adjusted so that the choke valve is open 29/64" (EX-23), 5/16" (EE-23) with the vacuum piston down at the end of its stroke so that the fast idle screw rests on the middle step or intermediate idle position of the fast idle cam (see Vacuum Piston Servicing below). Choke valve opening should be checked on the long side of the valve (offset mounting) and can be measured by passing a drill rod of the correct size between the edge of the valve and the carburetor wall.

THERMOSTATIC SPRING:—To check the thermostatic spring, remove unit from manifold, allow unit to stand until it has cooled off or warmed up to room temperature (70°F). Temperature can be checked with an accurate thermometer held near the thermostat. Tests should be made at 70° as thermostat spring changes one notch for each 5° above or below 70°. Unhook end of thermostat coil from prong on pointer plate, loosen pointer plate lockscrew (T), revolve pointer until it is opposite '0' on scale, see that lever is against stop lug (T), note position of thermostat spring hook. If hook is flush with prong, thermostatic spring tension is correct and can be reset as directed below. If hook is not flush with prong, indicating that thermostat has a permanent 'set', thermostatic coil should be recalibrated (see Servicing paragraph below). Thermostatic coils which have been deformed by rough handling should be replaced.

Car Model	Carburetor Model	Thermostat Setting
Graham Model 73	EX-23	17 notches rich
La Salle Model 50	EE-23	6 notches rich
Packard (all models)	EE-23	10 Notches Rich
Studebaker Dictator	EX-23	10 notches rich
Studebaker Dict. '37	EX-23	See Note

NOTE—**Packard Models.** Setting may be varied 3 notches in either direction from the '0' mark which indicates the standard setting if the engine runs rich or lean during the warming up period. Replace thermostatic coil if this variation does not give satisfactory performance.

Studebaker Models. The thermostat case is stamped 'R', 'M' and 'H'. Setting for standard gasolines is at 'R' (7 notches rich). If engine loads up when cold with this setting, 'M' (4 notches rich) should be used. Setting 'H' (at zero) should be used only for highly volatile gasoline.



SERVICING:—**Recalibrating Thermostatic Coil.** If thermostatic coil hook is not flush with prong at 70°F with pointer set at '0' on scale and lever against stop, loosen pointer plate lockscrew (T), revolve pointer plate and prong until prong and hook are flush, tighten lockscrew, stamp a new '0' mark on the case opposite the pointer. Obliterate the old '0' mark and proceed with the setting, using the new '0' mark as the reference point.

Vacuum Piston. Vacuum piston stroke is regulated by pin (Y) mounted on vacuum piston sleeve within the piston. If pin or sleeve are replaced, piston stroke should be regulated by turning pin up or down until choke valve opening (measured on the long side of the valve is 29/64" (EX-23), 5/16" (EE-23) with the piston down against the pin. The pin setting should be sealed by a lead ball inserted in the pin hole below the pin. See Fast Idle Linkage adjustment above.

STROMBERG AUTOMATIC CHOKE

This type automatic choke and fast idle used on the following cars:

Car Model	Carburetor
Graham Eight, Model 72 (1935)	EE-14
Packard '120', 120 ('35), 120B ('36), 120C ('37)	EE-14
Packard Eight, Model 1601, 1A, 2 (1938)	EE-14

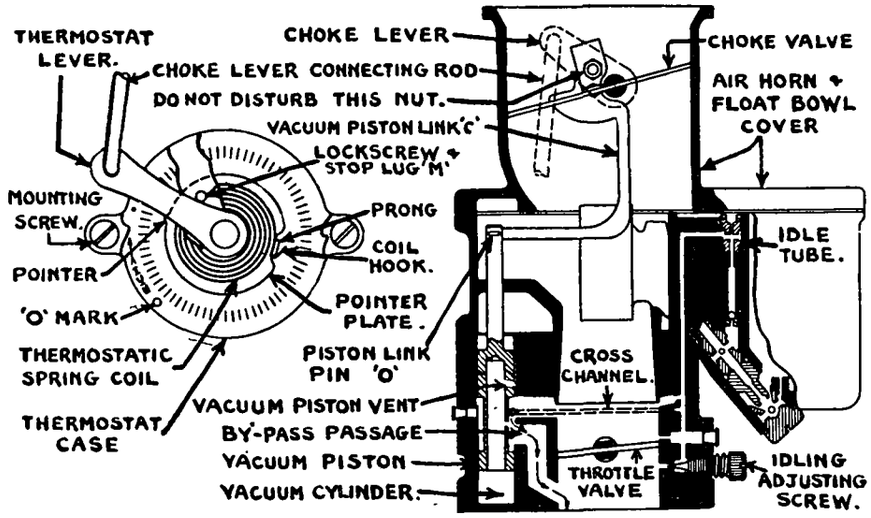
DESCRIPTION:—This type Automatic Choke and Fast Idle employs a thermostatic spring coil mounted on the manifold and a vacuum piston built in the throttle valve body. The Fast Idle consists of a fuel channel and by-pass passage around the throttle valve controlled by the vacuum piston. The entire fast idle mechanism is located within the carburetor body and no adjustment is required.

NOTE—Whenever the carburetor is disassembled or the air horn and float bowl cover is removed, first take out the cover screws, then lift top assembly straight up until pin (O) in upper end of vacuum piston stem is flush with the top of the casting, take out pin and lift off the top assembly. The nut on the screw connecting the vacuum piston link and the choke valve should not be disturbed. This is properly set at the factory.

OPERATION:—Thermostatic spring coil lever is linked directly to choke valve lever and is designed to completely close the choke valve at 70°F. Choke valve is offset and is not locked while the engine is being cranked. The vacuum piston is linked to the choke valve through the arm (C) so that the piston will be lifted to the top of its stroke when the choke valve is closed, uncovering the fuel cross-channel and opening the by-pass passage. The increased fuel discharge through this by-pass passage provides the fast idle with closed throttle. When the engine begins to fire, the vacuum built up in the manifold pulls the vacuum piston down (part stroke only) until the air vent in the piston is uncovered, relieving the vacuum and stopping the piston. In this position the choke valve is opened slightly but the by-pass and fuel channel remain open so that the fast idle remains operative during the warming up period. As the engine warms up, the thermostatic spring tension decreases, allowing the choke valve to open and the vacuum piston to complete its stroke, closing off the fuel channel and by-pass passage. The engine then idles at the hot or slow idling speed controlled by the throttle valve stopscrew and fuel is supplied by the regular idling system.

ADJUSTMENT:—Thermostatic Coil. To check thermostatic coil, remove unit from manifold, allow unit to stand until it has cooled off or come up to room temperature (70°F). All tests should be made at 70° as thermostat changes 1 notch for each 5° above or below 70°. Unhook end of thermostat coil from prong, loosen pointer plate lockscrew (M—this is also the lever stop lug), rotate pointer until it is opposite '0' mark on scale, see that lever is against stop lug (M), note position of thermostat coil hook. If hook is flush with prong, thermostatic coil tension is correct and unit can be reset as directed below. If hook is not flush with prong (indicating that coil has a permanent 'set'), thermostatic coil should be recalibrated as directed below. Coils which have been deformed by rough handling should be replaced.

Recalibrating Thermostatic Coil—If the thermostatic coil hook is not flush with the prong in the above test, loosen pointer plate lockscrew (M) and revolve pointer plate until prong is flush with hook, tighten lockscrew, stamp a new mark '0' mark on the case opposite the pointer, obliterate the old '0' mark, proceed with the setting, using the new '0' mark as the reference point.



Setting:—After completing test above, engage coil hook on prong, revolve pointer to rich or lean side of scale the correct number of notches for each car model as indicated in table below, tighten lockscrew (M), replace unit on manifold, connect choke valve rod, adjust rod so that choke valve is fully closed with thermostatic spring coil lever against stop (M).

Car Model	Carburetor Model	Thermostat Setting
Graham Model 72	EE-14	15 notches rich
Packard (all models)	EE-14	11 notches rich

NOTE—On Packard models, setting may be varied 5 notches in either direction from the 'O' mark which indicates the standard setting if the engine runs rich or lean during the warming up period. Replace thermostatic coil if this variation does not give satisfactory performance.

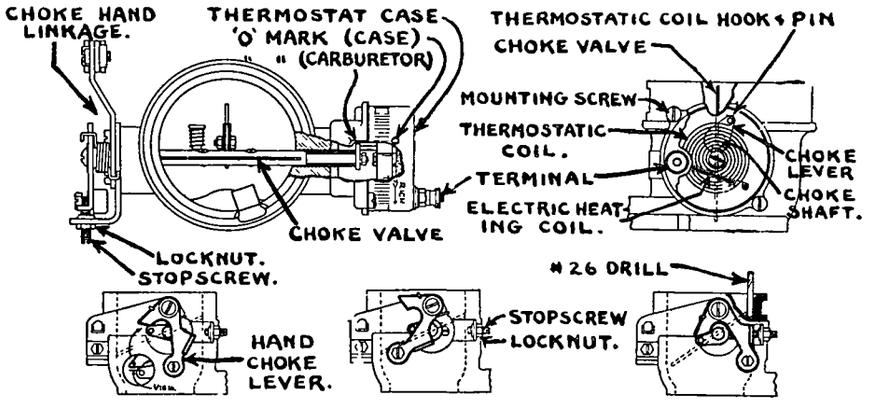
Car Model	Year	Carburetor
Cadillac V8, 36-60, 70, 75	**1936**	**EE-25**
Cadillac V8, 37-60, 65, 70, 75	**1937**	**AA-25**
Cadillac V8, 38-60, 60S, 65, 75	**1938**	**AAV-25**
Cord 810, 812	**1936-37**	**EE-15**
Cord Supercharged 812	**1937**	**AA-25**
La Salle 35-50, 36-50	**1935-36**	**EE-15**
La Salle 37-50 (first cars)	**1937**	**AA-25**

DESCRIPTION:—This type Automatic Choke consists of a thermostatic spring coil mounted on the carburetor and engaged directly with the choke valve shaft. An electric heating coil within the choke case and controlled by the ignition switch (turned on when ignition turned on to start engine) is used to warm up the thermostatic coil at a pre-determined rate irrespective of the exhaust manifold temperature.

Vacuum piston and fast idle mechanism (fuel channel and by-pass passage controlled by vacuum piston) design and operation is entirely similar to that used on Model EE-14 carburetors (see previous article).

THERMOSTATIC COIL ADJUSTMENT:—Thermostatic coil is designed to completely close choke valve at 70°F. and all tests should be made at this temperature (thermostat changes 1 notch for each 5° above or below 70°). To check thermostatic coil, remove thermostat case from carburetor, allow it to stand until it cools off or comes up to 70°, check position of thermostatic coil hook. The inside of the hook should be in line with the '0' mark on the case. If the hook is not in line with the '0' mark (this may be caused by coil taking on permanent set, installation of new coil or other new parts, etc.), stamp a new '0' mark on the case opposite the hook, obliterate the old '0' mark. In replacing thermostat case on carburetor, engage thermostatic coil hook with pin on choke valve lever, line up '0' marks on thermostat case and carburetor, then revolve thermostat toward rich side of scale the correct number of notches as shown below.

Car Model	Carburetor	Thermostat Setting
Cadillac (all models)	EE-25	16 Notches Rich.
Cadillac (all models)	AA-25	17 Notches Rich.
Cadillac (all models)	AAV-25	15 Notches Rich.
Cord	EE-15	17 Notches Rich.
Cord (Supercharged)	AA-25	17 Notches Rich.
La Salle (all models)	EE-15, AA-25	17 Notches Rich.



Cadillac Triple Range Choke Control on EE-15, EE-25 Carburetors.

CADILLAC 'TRIPLE RANGE' CHOKE CONTROL

NOTE:—This manual choke control used only on Model EE-25 Carburetor on Cadillac Models 60, 70, 75 (1936) and EE-15 Carburetor on LaSalle Models 35-50, 36-50 (1935-36). Not used on other Cadillac models (AA-25, AAV-25 Carburetors) or on Cord EE-15 carburetor.

MANUAL CONTROL:—The choke control button on the instrument panel has three operating positions, as follows:

1. Normal or Automatic Choke Position. Choke control button in middle position or flush with throttle button. Automatic choke is free to operate.

2. Manual Choke Position. Choke control button pulled out. Carburetor is choked by hand independently of any Automatic Choke action.

3. Partial Choke Position. Choke control button pushed in beyond the normal or flush position. Choke valve is held partially open.

Manual choke control linkage and choke valve lever stopscrew should be adjusted to secure choke operation as outlined above. Make adjustments as follows:

Stopscrew Adjustment—Open choke valve .147" or close choke valve on #26 drill placed between edge of choke valve on short side and carburetor wall. With choke valve in this position, loosen locknut on choke control operating lever adjusting screw and turn screw in or out until lever rests against screw with the cam or short leg of the 'V' shaped lever against the pin on the choke valve lever. Tighten the locknut. This adjustment provides the correct choke valve opening for #3 choke control button position

Linkage Adjustment—Place choke control button in normal position flush with throttle valve. With choke valve fully closed, adjust linkage to provide clearance of approximately 1/16" between the cam or short leg of the 'V' shaped choke control operating lever and the pin on the choke valve lever.

Std. Equipment On: Car Model	Carburetor Model
Buick Models 39-60, 80, 90 (1939)	AAV-26
Cadillac V8 Models 39-60S, 61, 75 (1939)	AAV-26
Packard '120' Eight Models 1701, 1A, 2 (1939)	EE-16

DESCRIPTION & OPERATION:—Thermostatic coil and vacuum piston type. Thermostatic coil and vacuum piston are mounted on carburetor and linked directly to choke valve lever (no external linkage). Vacuum passage (for piston operation) is drilled in carburetor casting and opens into manifold below throttle valve. Hot air tube (for thermostatic coil operation) is connected between choke housing and hot air stove on exhaust manifold. When engine is cold, thermostatic coil winds up and tends to close choke valve (valve cannot close until throttle opened momentarily to release fast idle screw from cam, but is snapped closed as soon as throttle opened). When engine begins to fire, manifold vacuum causes vacuum piston to be drawn into cylinder which opens choke valve slightly against the thermostatic coil tension to provide proper air mixture for continued running. As engine warms up, thermostatic coil tends to unwind, releasing choke valve and allowing it to open (valves are offset).

Fast Idle:—Consists of a stepped cam linked to the choke valve. When choke valve closed for cold starting, cam is revolved so that fast idle screw (EE-16), throttle stopscrew (AAV-26) rests on highest step of cam and throttle valve is held open in fast idle position. As engine warms up and choke valve opens, cam is revolved and throttle allowed to close, until with the engine warm and choke valve wide open, throttle is closed to hot or slow idle position.

ADJUSTMENT:—Thermostatic Coil Setting—Inverted 'V' mark or '0' mark on thermostatic coil housing should line up with reference mark on choke housing. This standard setting may be varied not more than 2 graduations (AAV-26) for use of high test fuel or with exceptional operating conditions. If warming up performance is not satisfactory with this setting, check choke valve and linkage for binding or replace thermostatic coil assembly. When installing thermostatic coil, place coil housing in position with coil hook down, then rotate housing in 'Rich' direction until correct setting secured (this will insure coil hook engaging prong properly).

CAUTION—When connecting heat tube, use extreme care not to use excessive pressure in tightening connection which may rotate thermosatic coil housing and change setting.

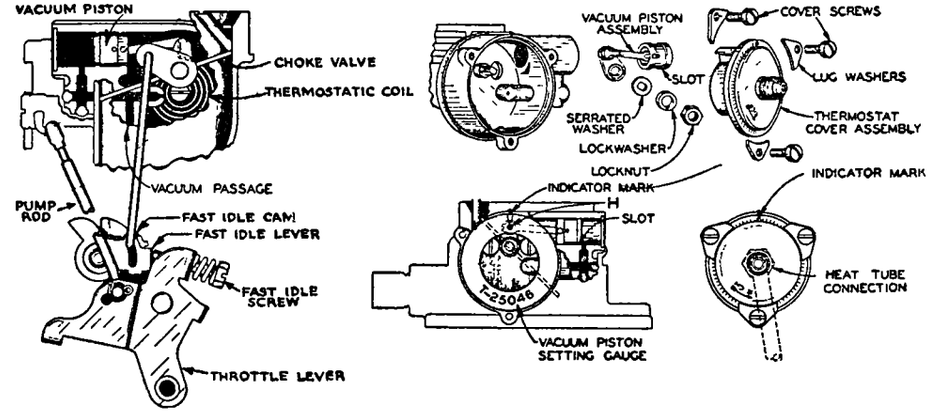
Fast Idle Speed—On Buick model, no separate fast idle screw used and fast idle speed will be correct if throttle stopscrew set for proper 7-8 M.P.H. hot or slow idle speed. On Cadillac (AAV-26) and Packard (EE-16) models, after throttle stopscrew set for correct hot or slow idle speed, turn fast idle screw in until it just contacts lowest step of fast idle cam (choke valve open), then turn screw out ½ turn which will provide correct clearance between screw and cam.

Fast Idle Setting—After setting both slow idle speed (throttle stopscrew adjustment), and fast idle speed (fast idle adjusting screw adjustment), see that choke valve is wide open and close throttle valve completely so that throttle stopscrew is against stop on body. Hold throttle valve in this position, close choke valve by hand as far as possible until fast idle screw strikes first step on fast idle cam (do not force choke valve beyond this position which may cause fast idle linkage to bind or distort fast idle cam spring), measure choke valve opening by inserting drill rod between choke valve edge and air horn wall. This distance should be 5/16" (Buick), .102" or #38 drill (Cadillac), 35/64" (Packard). Adjust by bending fast idle connector rod slightly.

Choke Release (Wide Open Throttle Adjustment)—Open throttle to wide open position so that choke valve is opened by ear on fast idle lever contacting lug on fast idle cam. Check choke valve opening with special gauge T-25057 (Buick), T-25056 (Cadillac) or by inserting drill rod between edge of choke valve and air horn wall. Opening should be .156-.187" (11/64" drill) on all models. Adjust by bending ear on fast idle lever slightly.

SERVICING:—Disassembly—Disconnect heat tube, remove carburetor from manifold, remove thermostatic coil housing attaching screws and lug washers, remove coil assembly. Remove locknut (use wrench T-25047) on end of choke valve shaft, remove nut, lockwasher, serrated washer (AAV-26 only) from shaft, take out vacuum piston assembly.

Servicing—Clean cylinder with cloth saturated with Acetone or alcohol, blow out all channels with air, clean screen on inside of cover by blowing through heat tube connection (use care not to distort screen. Do not attempt to remove thermostat coil (coil and cover serviced as an assembly).



Assembly & Adjustment—When installing vacuum piston, make certain that slot is down (toward vacuum port) on AAV-26 models. Do not lubricate cylinder. On AAV-26 models, assemble serrated washer, lockwasher, and locknut on shaft and tighten nut only loosely (do not tighten fully until vacuum piston adjusted). Install gauge ring, tool T-25046, with small hole in tool fitting over pin on choke lever and indicator line on rim of tool in line with reference mark on choke housing. Hold choke valve closed against #70 drill (.028") on Buick models, tool T-25057 or ¼" drill on Cadillac models, tighten locknut with wrench T-25047. Recheck choke valve opening to make certain that it was not changed while tightening nut. See that choke valve operates freely. NOTE—On Model EE-16 (Packard), vacuum piston lever is slotted and engages flatted portion of shaft so that above adjustment not required (lever can be installed in one position only). On AAV-26 models (with lever loose on shaft and positioned by serrated washer when nut is tightened), this adjustment important to properly position vacuum piston and thermostatic coil hook.

Used On:

Car Model	Carburetor
Studebaker Commander, 7A, 8A ('38), 9A ('39)	BXO-26
Studebaker President, 4C ('38), 5C ('39)	AAO-161

DESCRIPTION & OPERATION:—Thermostatic coil type. Thermostatic coil and vacuum piston mounted in housing on carburetor air horn and linked directly to choke valve shaft without external linkage. Vacuum passage (for vacuum piston operation) drilled in carburetor casting and opens into manifold below throttle valve. Hot air tube (for thermosatic coil operation) is connected between choke housing and hot air stove on exhaust manifold. When engine is cold, thermosatic coil winds up and tends to close choke valve (on Model BXO-26, throttle must be opened momentarily to free fast idle cam before this choke valve closing can occur). As soon as engine begins to fire, vacuum piston is pulled into cylinder and choke valve is opened slightly to prevent overchoking (with choke valve fully closed, both primary and secondary vacuum ports are open, as soon as piston moves slightly, primary port is cut off and vacuum is regulated by restriction in secondary port passage). As the engine warms up, thermostatic coil unwinds allowing the offset choke valve to open so that at normal running temperature the valve is wide open.

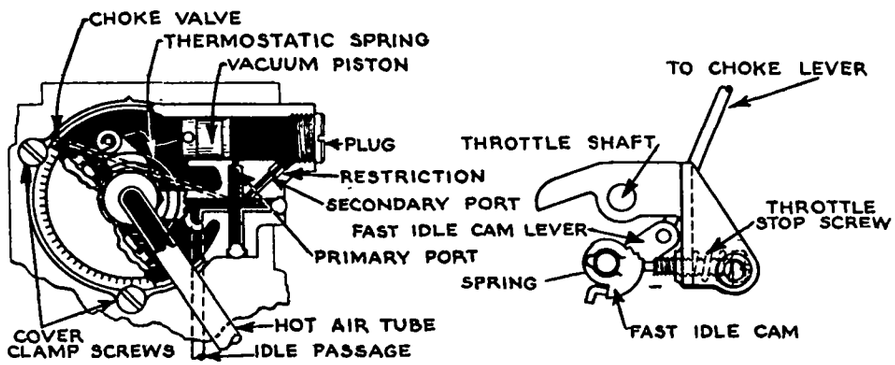
Fast Idle (Model BXO-26):—Consists of a spring-loaded fast idle cam and lever linked to the choke valve shaft and serving as the stop for the throttle stopscrew. With choke valve fully closed, fast idle cam is rotated so that the highest step of the cam is under the stopscrew and the throttle is held open in the fast idle position. As the choke valve opens, the cam is rotated so that successively smaller steps on the cam pass under the stopscrew, providing less throttle opening. At normal running temperatures (with choke valve wide open) throttle stopscrew rests on lowest step of fast idle cam providing the normal hot or slow idle speed. No adjustment is required, but stopscrew should rest on highest step of cam when choke valve is fully closed.

Model AAO-161. Fast idle on this model consists of a by-pass passage around the throttle valve controlled by the vacuum piston (see Carburetor article in Carburetor Section for illustration). Entire fast idle mechanism is within carburetor and requires no attention.

ADJUSTMENT:—Thermostat case marked with three settings 'H', 'M', 'R' on outer rim. To adjust, loosen mounting screws on edge of case, rotate case until mark 'R' lines up with highest projection on housing flange, tighten screws (standard setting). If engine tends to load up or over-choke while warming up with this setting, rotate case to 'M' position. Use 'H' setting only when highly volatile fuels used continuously.

Thermostat Checking (Model BXO-26):—With cover and thermostatic coil assembly removed, make certain that assembly is at exactly 70°F. (immerse assembly in pan of water at 70°F. for at least ten minutes), mark the cover flange in line with the center of the thermostatic coil hook. 'H' mark on cover should be two graduations, 'M' mark four graduations, 'R' mark six graduations from this reference mark.

Model AAO-161. This type must be checked on the carburetor. Immerse cover and thermostatic coil in water of 70°F. temperature for at least 10 minutes, see that air horn on carburetor is at 70°F., install thermostat on housing and see that hook engages choke valve lever, rotate cover until choke valve just closes. In this position, mark 'R' on cover should be approximately in line with projection on housing flange.



Std. Equipment On:	Fuel Pump		Fuel & Vacuum Pump	
Car Model	Type	Part No.	Type	Part No.
Buick 40-40, 50 (1940)			AJ	1537100
Buick 40-60, 70, 80, 90 (1940)			AJ	1523992
Cadillac 40-60S, 62, 72, 75 (1940)			AX	1537088
Cadillac V16 40-90 (1940)	AU	1523696 (L.H.) 1523695 (R.H.)		
Chevrolet All Models (1940)	AF	1523089		
Chrysler C25 (1940)	AT	1523912	AS ①	1523913
Chrysler C26, C27 (1940)	AW	1523869		
De Soto S7 (1940)	AT	1523912	AS ①	1523913
Dodge D14, D17 (1940)	AT	1523647	AS ①	1523648
Ford '60' Models (1940)	R	1523257		
Ford '85' Models (1940)	R	1523307		
Graham 108 (1940)	R	1523737		
Graham 107, 109 (1940)	R	1523731		
Hudson 40 (1940)	AF	1523753		
Hudson 41, 43, 44, 45, 47 (1940)	AK	1523289	AJ ②	1523936
Hupmobile R (1940)	T	1523811		
La Salle 40-50, 52 (1940)			AX	1537083
Lincoln-Zephyr 06H (1940)	R	1523307		
Mercury 09A (1940)	R	1523307		
Nash 4020 (1940)	W	1523642	AD ②	1523643
Nash 4080 (1940)			AD	1523644
Nash-Lafayette 4010 (1940)	W	1523640	AD ②	1523641
Oldsmobile 60 F-40, 70 G-40			AJ	1537094
Oldsmobile 90 L-40 (1940)			AJ	1523895
Packard '110' 1800 (1940)	AT	1537060		
Packard '120' 1801 (1940)	AH	1537067		
Packard '160' 1803, 4, 5 (1940)			AJ	1523867
Packard '180' 1806, 7, 8 (1940)			AJ	1523867
Plymouth P9, P10 (1940)	AT	1523647	AS ①	1523648
Pontiac 40-25, 26, 28 (1940)	AH	1523985	AJ ②	1523986
Pontiac Torpedo 40-29 (1940)			AJ	1537087
Studebaker Champ. 2G (1940)	W	1523957		
Studebaker Comm. 10A (1940)	W	1522227		
Studebaker Pres. 6C (1940)	E	1523926		
Willys 440, 440P (1940)	AF	1523306		

①—Cars with Swinging Windshield. ②—Optional Equipment.

These Pumps same design as used on previous car models (except AX).

PERFORMANCE:—Capacity & Pressure specifications for all models shown in tables below. See 'Fuel Pump Testing' in Carburetion Equipment Section of manual for complete testing instructions on all pump models.

Pump Capacity (Minimum)

Pump Model	Minimum Capacity
E, R, T, W, AD, AF, AS, AT	1 Pint in 1 Minute
AH, AJ, AK, AU, AW, AX	1 Pint in 45 Seconds

Pump Pressure (Maximum)

Pump Model	Maximum Pressure
E, R, T, W, AD	3½ lbs.
AF	3 lbs.
AH, AW	3¾ lbs.
AJ	4 lbs.
AS, AT	4¼ lbs.
AK, AU	4½ lbs.
AX	4¾ lbs.

Pontiac Note—Pressure on Type AH & AJ pumps on Pontiac cars should be 3-3¾ lbs. (1937-38 models), 4-5 lbs. (1939-40 models).

SERVICING & TROUBLE SHOOTING:—All data and service instructions same as for pumps of same type as used on previous car models (except AW & AX new types—see below). ***See articles on each Pump Type and on Fuel Pump Trouble Shooting in Carburetion Equipment Section of manual (or previous Supplements) and note new data as follows:***

TYPE AW

Number — Used On:

1523869—CHRYSLER 8, MODELS C23, C24 (1939); C26, C27 (1940)

DESCRIPTION:—This fuel pump same design as Type AH except for different mounting studs, air dome, and curled hair air cleaner.

PERFORMANCE:—See article on Fuel Pump Testing (in manual) for data.

SERVICING:—See article on Type AH Fuel Pump for complete instructions.

TYPE AX

Number — Used On:

1537088—CADILLAC V8, SERIES 40-60S, 62, 72, 75 (1940)
LA SALLE V8, SERIES 40-50, 52 (1940)

DESCRIPTION:—This combination fuel-and-vacuum is same design as Type AB except that it is fitted with a Type AA combination fuel cover.

PERFORMANCE:—See article on Fuel Pump Testing (in manual) for data.

SERVICING:—See article on Type AB combination fuel-and-vacuum pump for all data except for fuel cover for which see article on Type AA pump.

1940 CHRYSLER FAST IDLE

Car Model	Carburetor	Automatic Choke
Chrysler 8, C26, C27 (1940)	Stromberg AAV-2	Sisson AC-600

NOTE:—This carburetor and fast idle is used on conjunction with a separately mounted automatic choke, Sisson Model AC-600. See Sisson Automatic Choke article for data on this unit.

DESCRIPTION & OPERATION:—Fast Idle—Consists of a stepped fast idle cam and a fast idle lever pivoted directly above the throttle valve shaft and linked to the choke valve lever. Fast idle cam serves as the stop for the throttle stopscrew. When the choke valve is closed for cold starting, fast idle cam is rotated so that the stopscrew rests on the highest step of the cam and the throttle valve is opened to the fast idle position. As the engine warms up and the choke valve opens, fast idle cam is allowed to drop down and throttle valve to close progressively until, when the choke valve is wide open, the throttle is closed to the hot or slow idle position with the stopscrew resting on the lowest step of the cam.

Unloader or Choke Release—Consists of an ear on the throttle lever which strikes an extended arm on the fast idle lever when the throttle is opened wide so that the choke valve is opened somewhat to correct flooding caused by over-choking.

SETTING & ADJUSTMENT:—Fast Idle—To check setting, close throttle valve so that stopscrew is against first step of fast idle cam. Move choke valve toward closed position as far as possible (do not force valve beyond point where stopscrew strikes edge of next step on fast idle cam). Choke valve opening in this position should be ⅛" (check by inserting ⅛" drill rod between edge of valve and air horn wall). Adjust by loosening locknut and changing position of ball joint on lower end of connector rod.

Choke Release—To check setting, open throttle valve wide, note choke valve opening by inserting drill rod between edge of valve and air horn wall. Opening should be 7/32". Adjust by bending arm on fast idle cam lever slightly.

1940 SISSON AUTOMATIC CHOKE

Car Model	Carburetor	Sisson Choke Model
Chrysler C25 (1940)	Carter (B&B) E6S1, 2	AC-758B
Chrysler C26, C27 (1940)	Stromberg AAV-2	AC-600
De Soto S7 (1940)	Carter (B&B) E6N2, 3	AC-758B
Dodge D14, D17 (1940)	Stromberg BXV-3	AC-758B
Plymouth P9, P10 (1940) Optl.	Carter (B&B) D6C2	AC-758B

These Chokes same design as used on corresponding 1939 car models.

ADJUSTMENT:—Model AC758B—Remove air cleaner, open throttle approximately ¼. Move choke lever until hole in automatic choke shaft (opposite end from lever) lines up with slot in bearings, insert special tool, Sisson No. C-723, through hole in shaft and push tool down so that lower end engages slot in choke base mounting flange. Loosen clampscrew on choke lever, press up on lever until choke valve is closed tight (sight down air horn), hold lever in this position and tighten clampscrew. Remove tool.

Model AC-600—Remove air cleaner, open throttle approximately ¼, take off automatic choke cover. Clamp special adjusting tool, Sisson No. AC-620, in place on choke so that end of tool enters and lines up hole in armature and hole in magnet core, move flat bar on tool so that armature is locked tightly against magnet core. Loosen clampscrew on choke lever, move lever until choke valve is closed tight (sight down air horn), hold lever in this position and tighten clampscrew. Remove tool and replace automatic choke cover.

CAUTION—When replacing air cleaner, make certain that clamp not tightened excessively which may cause choke valve to bind. See that choke valve does not bind or stick and that entire choke mechanism and fast idle linkage operate freely. Always check choke adjustment with throttle partly open. See car model 'T&E' page for Throttle-Cracker adjustment.

SERVICING & TROUBLE SHOOTING:—Same as for previous models. ***See Sisson Automatic Choke in Carburetion Equipment Section of manual for complete data.***

PACKARD TYPE

Used on following Models with Econo-Drive

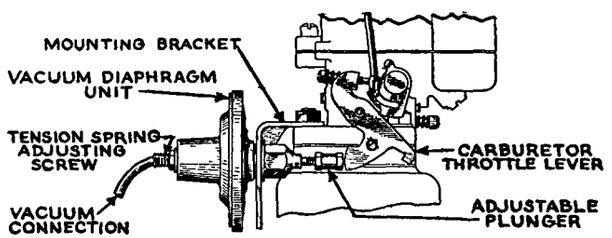
PACKARD 6, '110' MODEL 1800 (1940)
PACKARD 8, '120' MODEL 1801, 1A (1940)
PACKARD SUPER 8, '160' MODELS 1803, 4, 5 (1940)
PACKARD CUSTOM SUPER 8, '180' MODELS 1806, 7, 8 (1940)

DESCRIPTION:—Throttle Guard is designed to prevent engine stalling in the range from 0 to 20 M.P.H. It consists of a vacuum diaphragm unit, similar to those used on distributors for vacuum spark control, mounted on the carburetor so that the diaphragm plunger actuates the throttle valve fast idle lever. Unit has adjusting screw and locknut on vacuum diaphragm spring boss (opposite end from actuating plunger).

OPERATION:—Throttle Guard cuts in at 4 MPH. when manifold vacuum decreases sufficiently so that spring within unit forces plunger out against throttle lever opening throttle and accelerating engine to prevent stalling. Throttle Guard kicks out at 9 MPH. when manifold vacuum increases sufficiently to retract plunger and allow throttle to close to regular 6 MPH hot or slow idle speed position.

ADJUSTMENT & TESTING:—**Note**—Make certain that carburetor correctly adjusted and set for 6 MPH. hot or slow idling speed before adjusting Throttle Guard.

Adjustment—Check clearance between outer end of throttle guard plunger and lug on throttle lever. This should be .060" (Six), .020" (Eight, Super Eight). Loosen locknut and turn tension spring and adjusting screw on outer face of throttle guard until distance from top of locknut to end of screw is 3/16" (Six, Eight), 7/32" (Super 8), tighten locknut. Check adjustment by road-testing the car.



Road Testing—See that Overdrive Control knob pushed in (Overdrive operative), allow car to coast in high gear (accelerator pedal released) and decrease car speed slowly by applying brakes. Throttle guard should cut in at 4 MPH. (slight movement of accelerator pedal will be noted) and bring car speed up to 9 MPH. (with brakes released) at which speed it should kick out. If cut in speed is above 4 MPH., decrease spring tension by turning adjusting screw out slightly; if cut in speed below 4 MPH., increase spring tension by turning screw in. If kick out speed is higher than 9 MPH., increase gap between diaphragm plunger and throttle lever (loosen locknut and turn plunger on rod); if kick out speed below 9 MPH., decrease gap.

CHRYSLER TYPE

Used on following Models with Fluid Drive:

CHRYSLER 8, C26 SARATOGA & NEW YORKER (1940)
CHRYSLER 8, C27 CROWN IMPERIAL (1940)

DESCRIPTION & OPERATION:—Throttle Guard is designed to prevent engine stalling when the accelerator pedal is released quickly. It consists of a plunger operating on a swivel block which is part of the accelerator linkage. Plunger is actuated by a spring-loaded vacuum diaphragm unit (similar to those used for vacuum spark control) connected to the engine manifold and having a relief valve at the point where it is connected to the Throttle Guard body. In normal operation, the throttle guard plunger follows the swivel in the linkage as the accelerator pedal is depressed (due to the vacuum unit spring pressure). When the accelerator pedal is released quickly, the increase in manifold vacuum acting with the throttle return spring pull offsets the vacuum unit spring pressure and the accelerator pedal return is retarded, the speed of the pedal return being controlled by the metered relief valve in the vacuum line.

SETTING:—With engine running at idle speed of 5 MPH. (5-7 MPH) in high gear on level road, throttle control plunger should just touch swivel block on throttle rod. Setting can be adjusted by loosening capscrews holding vacuum unit on throttle cross-shaft and rotating unit to proper position. Tighten capscrews after completing adjustment.

SERVICING:—**Assembly & Adjustment**—When installing throttle guard, see that carburetor adjusted for correct idle mixture and speed (smooth firing and idle speed of 5 MPH). With push pin removed, attach throttle guard and bracket so that bracket is horizontal and 1⅛" from end of tube. Hold choke valve open, close throttle so that stopscrew is against low step on fast idle cam (hot or slow idle speed position), insert stub pin setting tool, adjust nut on rear end of bell crank-to-carburetor rod so that slight drag secured on .010" feeler placed between swivel block and stub pin setting tool. Tighten locknut using extreme care not to disturb position of adjusting nut. Remove stub pin setting tool and install throttle guard push pin.

KING-SEELEY ELECTRIC GASOLINE GAUGE

1940 CAR MODEL TYPE:—King-Seeley Electric Gasoline Gauges installed on 1940 car models are similar to design used on previous cars except for new style Tank Unit as follows (Dash Unit design unchanged):

Style 'N' Tank Unit—Supersedes earlier Style 'O' units (for original equipment and replacement use). Can be identified by shorter body and more direct actuation of thermostatic arm contacts (long contact lever and cam design of earlier 'O' units not used).

TROUBLE SHOOTING & SERVICING:—All operations same as for previous type. *See 'King-Seeley Electric Type Gauges' in Carburetion Equipment Section of manual for complete instructions.*

1939 & EARLIER CAR MODEL REPLACEMENT UNITS:—Original Style 'O' Tank Unit has been superseded by new Style 'N' (see 1940 data above) and Style 'N' Tank Units only are furnished for service. King-Seeley Part Nos. for this new Tank Unit are given in table below for all car models.

Ford Note—Ford Part No. given for Ford, Lincoln, Lincoln-Zephyr, and Mercury models.

King-Seeley Replacement Tank Units

Car Model	New Part No.	Original Part No.
Ford Pass. Cars ('36-37-38-39)	01A-9275A	78-9275
Ford (Police—22 Gal.) ('36-37-38-39)	70-9275B	70-9275
Ford Truck ('37—First 2500)	70-9275CR	79-9275A
Ford Truck ('37-38-39)	01T-9275	79-9275B
Ford Cab-over-Engine ('38-39)	01W-9275	81W-9275
Graham—all (1937)	7790	6120
Graham—all (1938-39)	7786	6928
Hudson & Terraplane (1934)	5190 ①	
Hudson & Terraplane (1935)	5582 ①	
Hudson & Terraplane ('36-37-38)	7550	5835
Hudson—all (1939)	7550	5835
Lincoln V12 (1936)	70-9275G ①	K-8380E
Lincoln V12 ('37-38-39)	70-9275B	70-9275
Lincoln-Zephyr ('36-37-38-39)	70-9275B	70-9275
Mercury (1939)	99A-9275B	99A-9275
Nash & Nash-Lafayette—all ('38-39)	7778	6732
Willys & Overland—all ('37-38-39)	7788	6280

①—Style 'O' Units.

Car Model	SINGLE BARREL CARBURETOR TYPE	Carburetor Model
Graham, 107, 108 (1940)		WA1 472-S, 473-S
Hudson 6, 40T, 40P, 48 (1940)		WA1 454-S
Hupmobile Skylark, Model R (1940)		W1 398-S
Nash 6, 4020 (1940)		WA1 435-S
Oldsmobile 6, 60 F-40, 70 G-40 (1940)		WA1 466-S, 467-S
Pontiac 6, 40-25, 40-26 (1940)		WA1 463-S
Pontiac 8, 40-28 (1940)		WA1 462-S
Studebaker Commander, 10A (1940)		WA1 410-S

DUAL CARBURETOR TYPE

Buick, 40-40, 50 (1940)	WDO 440-S, 474-S
Buick, 40-60, 70, 80, 90 (1940)	WDO 448-S
Cadillac V16, 40-90 (1940)	WDO 407-S, 408-S
Graham, Hollywood Schgr. 109 (1940)	WDO 488-S
Hudson 6, 41, 43 (1940)	WDO 430-SV, 461-S
Hudson 8, 44, 45, 47 (1940)	WDO 455-S
La Salle V8, 40-50, 52 (1940)	WDO 460-S
Nash 8, 4080 (1940)	WDO 465-S
Nash-Lafayette, 4010 (1940)	WDO 458-S
Oldsmobile 8, 90 L-40 (1940)	WDO 389-S, 471-S
Pontiac Torpedo 8, 40-29 (1940)	WDO 469-S
Studebaker President, 6C (1940)	WDO 409-S

PRODUCTION CHANGES:—**Nash-Lafayette 458-S**—New Climatic Control Assembly No. 6-334-S (supersedes 6-357-S) used on later cars for improved warming up performance. The new assembly has a new Thermostatic Coil & Housing Assembly No. 170K64S (supersedes 170B64S) which requires a different setting (see setting table below). This new assembly can be installed on early cars. When this change made by car dealers, new Hot Air Stove and Tube Assembly is also installed.

Pontiac Torpedo 8 469-S—New type Thermostatic Coil Assembly No. 170F16S (supersedes 170G16S) used on later cars for improved starting and warming up performance. These types may be identified by thermostatic coil number which is stamped on housing (Metering Rods also changed and carburetors with new rods marked '469-SM' for identification). NOTE—See setting table below for recommended change in setting on carburetors with first type thermostatic coil to correct complaints of hard starting and poor warming up performance.

THERMOSTATIC COIL SETTING:—On all models except those noted in table below, center index mark or notch on thermostatic coil housing should be lined up with mark on piston plate housing. On other models, thermostatic coil housing should be rotated clockwise (Rich), counter-clockwise (Lean), number of notches shown in the table below.

Adjustment—Loosen two mounting screws on rim of thermostatic coil housing, rotate coil and housing assembly, tighten mounting screws. NOTE—See Servicing data below for proper installation of thermostatic coil and housing assembly if taken off carburetor.

Car Model	Carburetor	Thermostatic Coil Setting
Buick 40, 50	440-S, 474-S	1 Notch Lean
Buick 60, 70, 80, 90	448-S	3 Notches Rich
Graham 107	473-S	1 Notch Rich
Graham 109	488-S	1 Notch Rich
Nash 4020	435-S	2 Notches Rich
Nash 4080	465-S	1 Notch Rich
Nash-Lafayette	458-S	See Note
Oldsmobile F & G-40	467-S Only	2 Notches Rich
Pontiac 6 & 8	462-S, 463-S	1 Notch Rich
Pontiac Torpedo 8	469-S	See Note
Studebaker Comm.	410-S	1 Notch Rich
Studebaker Pres.	409-S	1 Notch Rich
All Others		Centered

Nash-Lafayette 458-S Note—Carburetors with first Type 170B64S Thermostatic Coil assembly should be set 1 Notch Rich, later carburetors with new Type 170K64S Thermostatic Coil should be Centered.

Pontiac Torpedo 469-S Note—First carburetors with original Type 170G16S Thermostatic Coil assembly were set 1½ Notches Rich but this setting should be changed to 4 Notches Rich to correct hard starting and poor warming up performance complaints. Carburetors with later Type 170F16S Thermostatic Coil should be set 1½ Notches Rich.

NOTE—If performance not satisfactory with standard settings as given above, thermostatic coil can be rotated 1 notch clockwise to lean setting (if engine runs rich or has a tendency to load up), 1 Notch counter-clockwise to enrich setting (if engine runs lean during warming up period). Adjustments should always be made with engine Cold (allow 4 hours for engine to cool off after being run), setting should be changed only 1 notch at a time, and performance should be checked while engine is warming up.

FAST IDLE, UNLOADER & CHOKE VALVE LOCK:—See separate articles on each Carburetor type in Supplement 'C' Section for adjustment directions and specifications.

SERVICING (SINGLE BARREL CARBURETOR TYPE):—**Disassembly**—Take out attaching screws, remove retainers on rim of piston housing plate, turn thermostatic coil housing clockwise to disengage coil hook from prong, remove thermostatic coil and housing assembly. Remove strainer screen. Take out choke valve retaining screws, remove valve. Loosen clampscrew on fast idle link and lever assembly, bend lip under screw with screwdriver so that it clears portion of choke valve shaft which is not flat, revolve choke valve shaft so that piston clears cylinder, withdraw choke shaft, piston, piston lever and link as an assembly. Do not remove three screws mounting piston plate housing on air horn (these parts line-reamed at factory). If piston plate housing has been removed, line up the three holes so that the choke valve shaft and piston work freely.

Servicing—Wash all parts except thermostatic coil and housing assembly and cork gaskets in clean gasoline. Clean thermostatic coil assembly and blow out all passages with air. Replace all worn or damaged parts, use new gaskets when reassembling.

Reassembly—Install choke shaft, piston lever, link, and piston in air horn and at the same time install choke lever, link, and screw assembly on shaft behind piston plate housing. Install choke valve using new screws and turning screws down loosely, close choke valve and tap valve lightly to centralize valve in air horn, then tighten valve screws securely. See that choke valve operates freely without binding in air horn. Tighten choke lever screw. Install strainer in piston plate housing (replace if dirty or clogged). Install thermostatic coil housing with reference mark or label at bottom, turn counter-clockwise until mark is at top and in line with mark on piston plate housing, tighten retaining screws. Check Thermostatic Coil Setting (above) and Unloader adjustment (see Carburetor article).

SERVICING (DUAL CARBURETOR TYPE):—**Disassembly**—Take out attaching screws, remove retainers on rim of piston plate housing, turn thermostatic coil housing clockwise to disengage coil hook from prong, remove thermostatic coil assembly. Remove screw holding choke trip lever (fast idle end of choke valve shaft), remove washer, trip lever, fast idle cam and collar assembly from shaft. Take out choke valve attaching screws, remove valve. Turn shaft counter-clockwise until piston clears cylinder, remove piston (flat type) pull shaft and lever assembly out of air horn (round type piston removed as part of shaft assembly—use care not to lose piston pin).

Servicing—Same as Single Barrel type (above).

Reassembly—Install choke shaft, lever, and piston assembly in air horn. Install choke valve using new screws and tapping valve lightly before screws tightened to centralize it in air horn bore. Check to see that valve operates freely and does not bind (valve should fall open of own weight). Install fast idle cam and collar assembly, washer, and trip lever on shaft, tighten mounting screw. Install piston housing strainer. Install thermostatic coil and housing assembly with reference notch at bottom, turn assembly counter-clockwise until notch is at top in line with reference mark on piston plate housing, tighten retaining screws. Check Thermostatic Coil setting (above), adjust Fast Idle, Unloader, and Lock (see Carburetor articles in 'C' Section for instructions).

INSTALLATION CAUTION:—Make certain that hot air flexible tubing connections are tight. Air leak at housing will interfere with correct Climatic Control operation. See that choke valve operates freely without binding at any point.

Std. Equipment On:

Car Model	Carburetor Model
Buick, Series 40-40, 50 (1940)	AAV-16
Buick, Series 40-60, 70, 80, 90 (1940)	AAV-26
Cadillac V8, Series 40-60S, 62, 72, 75 (1940)	AAV-26
Packard Six, '110' Model 1800 (1940)	BXOV-26
Packard Eight, '120' Models 1801, 1A (1940)	EE-16
Packard Super 8, '160' 1803,4,5; '180' 1806,7,8 (1940)	AAV-26
Studebaker Commander, Model 10A (1940)	BXO-26
Studebaker President, Model 6C (1940)	AAO-161

NOTE:—Studebaker Commander Changes—Vacuum piston linkage has been simplified and is now non-adjustable. A single #70 drill hole is located in the piston head to reduce fluttering.

Studebaker President Fast Idle & Changes—Fast idle consists of a piston located within the carburetor body and linked to the choke valve: This type is not adjustable. Choke has been changed from type used on 1939 cars by adding .076" reducer in thermostat heat suction pipe, thermostat spring is thinner, and vacuum piston hole in throttle body has been changed from #52 to #56 drill size. New thermostat spring and cover assembly is stamped '8' for identification.

DESCRIPTION & OPERATION:—Thermostatic coil and vacuum piston type. Thermostatic coil and vacuum piston are mounted on carburetor and linked directly to choke valve lever (no external linkage). Vacuum passage (for piston operation) is drilled in carburetor casting and opens into manifold below throttle valve. Hot air tube (for thermostatic coil operation) is connected between choke housing and hot air stove on exhaust manifold. When engine is cold, thermostatic coil winds up and tends to close choke valve (valve cannot close until throttle opened momentarily to release fast idle screw from cam, but is snapped closed as soon as throttle opened). When engine begins to fire, manifold vacuum causes vacuum piston to be drawn into cylinder which opens choke valve slightly against the thermostatic coil tension to provide proper air mixture for continued running. As engine warms up, thermostatic coil tends to unwind, releasing choke valve and allowing it to open (valves are offset).

Fast Idle:—Consists of a stepped cam linked to the choke valve. When choke valve closed for cold starting, cam is revolved so that fast idle screw (EE-16), throttle stopscrew (others) rests on highest step of cam and throttle is held open in fast idle position. As engine warms up and choke valve opens, cam is revolved and throttle allowed to close, until with the engine warm and choke valve wide open, throttle is closed to hot or slow idle position.

ADJUSTMENT:—Thermostatic Coil Setting—Inverted 'V' mark or '0' mark on thermostatic coil housing should line up with reference mark on choke housing. This standard setting may be varied not more than 2 graduations (AAV-26) for use of high test fuel or with exceptional operating conditions. If warming up performance is not satisfactory with this setting, check choke valve and linkage for binding or replace thermostatic coil assembly. When installing thermostatic coil, place coil housing in position with coil hook down, then rotate housing in 'Rich' direction until correct setting secured (this will insure coil hook engaging prong properly).

Studebaker Models—Choke housing on these models marked by three letters 'H', 'M', 'R'. To adjust, loosen mounting screws, rotate housing until 'R' mark lines up with reference projection on housing flange. This is standard setting. If engine tends to load up or over-choke, change setting to 'M' position. Use 'H' setting only when highly volatile fuels used.
CAUTION—When connecting heat tube, use extreme care not to use excessive pressure in tightening connection which may rotate thermosatic coil housing and change setting.

Fast Idle Speed (Packard EE-16 only)—On this model, after the throttle stopscrew set for correct hot or slow idle speed, turn fast idle screw in until it just contacts lowest step of fast idle cam (choke valve open), then turn screw out ½ turn which will provide correct clearance between screw and cam.

Fast Idle Setting—After setting both slow idle speed (throttle stopscrew adjustment), and fast idle speed (fast idle adjusting screw adjustment), see that choke valve is open, close throttle valve so that stopscrew is on high lobe of cam (AAV-26 except Buick for which see note below), or on first or low step of cam (BXO-26, BXOV-26), or with low speed screw against stop on body and high speed screw on low stem of fast idle cam (EE-16). Move choke valve toward closed position as far as possible (do not force beyond point where stopscrew strikes against next step on fast idle cam), measure remaining choke valve opening by inserting drill rod between edge of valve and air horn wall. Opening should be .102" or #38 drill (Cadillac AAV-26), 3/32" drill (Packard AAV-26), 35/64" (Packard EE-16), 11/32" drill (Studebaker BXO-26). Adjust by bending fast idle connector rod slightly.

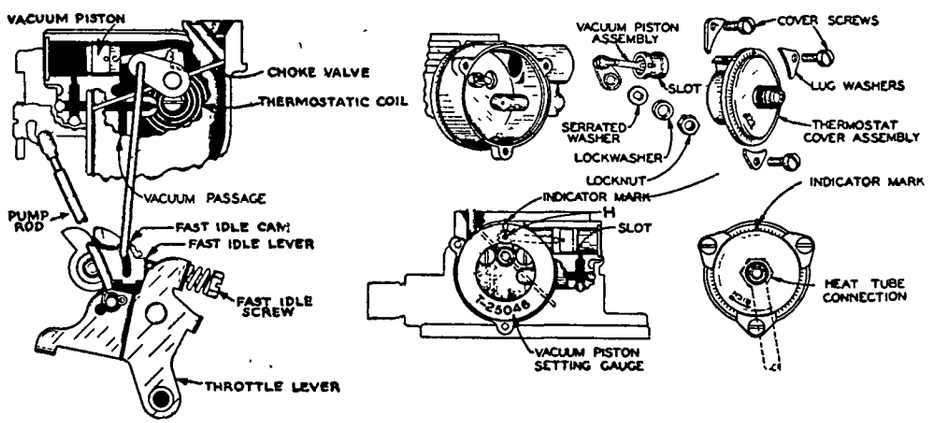
Buick Models—To check fast idle setting on these models, close choke valve against #53 drill (between valve and wall), open and close throttle and note clearance between locking lever on throttle valve lever and lug on loose lever mounted on fast idle cam shaft. Lever should just clear lug. Adjust by bending fast idle connector rod slightly.

Choke Release (Wide Open Throttle Adjustment)—Open throttle to wide open position so that choke valve is opened by ear on fast idle lever contacting lug on fast idle cam. Check choke valve opening with special gauge T-25057 (Buick), T-25056 (Cadillac) or by inserting drill rod between edge of choke valve and air horn wall. Opening should be .156-.187" or 11/64" drill (AAV-16, AAV-26, EE-16), 11/32" (BXOV-26), 13/64"-14/64" (AAO-161). Adjust by bending ear on throttle lever or fast idle lever slightly.

EE-16 Caution—Throttle must be opened by pressing on throttle lever only on EE-16. Do not press on fast idle lever.

SERVICING:—Disassembly—Disconnect heat tube, remove carburetor from manifold, remove thermostatic coil housing attaching screws and lug washers, remove coil assembly. Remove locknut (use wrench T-25047) on end of choke valve shaft, remove nut, lockwasher, serrated washer (AAV-26 only) from shaft, take out vacuum piston assembly.

Servicing—Clean cylinder with cloth saturated with Acetone or alcohol, blow out all channels with air, clean screen on inside of cover by blowing through heat tube connection (use care not to distort screen. Do not attempt to remove thermostat coil (coil and cover serviced as an assembly).



Assembly & Adjustment—When installing vacuum piston, make certain that slot is down (toward vacuum port) on AAV-26 models. Do not lubricate cylinder. On AAV-26 models, assemble serrated washer, lockwasher, and locknut on shaft and tighten nut only loosely (do not tighten fully until vacuum piston adjusted). Install gauge ring, tool T-25046, with small hole in tool fitting over pin on choke lever and indicator line on rim of tool in line with reference mark on choke housing. Hold choke valve closed against 15/64" drill (Buick AAV-16), #3 drill (Buick AAV-26), .028" or #70 drill (Cadillac & Packard AAV-26), tighten locknut with wrench T-25047. Recheck choke valve to make certain that setting not changed by tightening of locknut. See that choke valve operates freely. This adjustment is extremely important to properly position vacuum piston and thermostatic coil prong. When assembly fast idle connector rod, install bushing (washer—Buick) on lower end of rod only after rod has been assembled to lever. See that fast idle cam torsional spring is assembled with end of spring hook against ear of lever. See that cam operates freely and make certain that rod does not bind in slot in cam. This is very important.
NOTE—On all models except AAV-16 & AAV-26, vacuum piston lever is slotted and engages flattened portion of choke valve shaft so that no adjustment of the lever on the shaft is required.

MECHANICAL CAR MODEL SECTION

'M' PAGES

This section covers the GENERAL MECHANICAL Service Data on Each *Car Model,* such as Engine Data and Motor Overhaul, Valve Timing, Clutch, Brakes, Steering, Rear Axle, Transmission, Lubrication System, etc.

IMPORTANT: Be sure to refer to the *Special Shop Notes* for the different car makes. This information precedes the regular car pages.

For *Complete Separate Treatment* of Each TYPE OF MECHANICAL DEVICE OR EQUIPMENT *refer to the Mechanical Equipment Section.*

NOTE: The Tune Up & Electrical Data on Each Car Model is located in the Tune Up & Electrical Car Model Section.

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SERIAL NUMBER:—First number 8-100-1001 ('32), 8-101-1001, 8-105-1001 ('33). On right hand side of cowl under hood. Letter following number designates body type.

ENGINE NUMBER:—On left hand lower half of crankcase.

ENGINE:—Lycoming Model GU (8-100, 8-100A '32), GC (8-101, 8-105 '33). Eight cylinder, 'L' head type.

Dimensions—Bore 3". Stroke 4¾". Displacement 268.64 cubic inches.

Horsepower—Rated 28.8. Developed 100 HP. at 3400 R.P.M.

Compression—5.26-1 (GU), 5.3-1 (GC). Pressure approximately 90-95 lbs. at cranking speed.

Vacuum Reading—Gauge should show steady reading of 18-20" at idling speed.

Pistons:—Bohn, aluminum alloy, Invar Strut, split skirt type.

Weight—16 ozs. (stripped), 21.92 ozs. (with rings and pin).

Removal—Piston and rod assembly removed through bottom of engine.

Piston Length—3¾" (total), 2.3155" (top to center of pin).

Clearance—.0015" (skirt). See Fitting new pistons.

Fitting New Pistons—Use feeler stock ½" wide to check clearance. .0015" feeler should be withdrawn easily but .0025" feeler should lock. If spring scale is used, tension required to withdraw .002" feeler should be 7-12 pounds.

NOTE:—Install pistons with slot toward left (camshaft side).

Piston Rings:—Four rings per piston, all above pin. #1 and 2—compression rings, #3 and 4—oil control rings.

Ring	Width	End Gap	Side Clearance
Comp. (#1, 2)	⅛"	.006-.012"	.0015-.003"
Oil Cont. (#3)	⅛"	.007-.015"	.0015-.003"
Oil Con. (#4)	3/16"	.010-.018"	.0015-.003"

Piston Pin:—Diameter, .8750-.8748". Length, 2.520-2.500". Pin is locked in rod. Bushing not used in piston.

Pin Fit in Piston—Tight push fit at 70°F. (selective fit).

Connecting Rod:—Weight, 2.34 lbs. Length, 9½" (center-to-center).

Big End Bearing—Spun babbitt type. No shims.

Clearance—.0015-.003". Sideplay .004-.008".

Adjustment—Adjust when wear exceeds .004" by filing bearing caps (no shims used).

NOTE:—Connecting rods are numbered and must be installed in same numbered cylinders. Lower bearings are offset. Install rods with narrow half of bearing toward nearest main bearing. Oil jet holes in lower bearing upper half must be toward camshaft side of engine on all rods.

Crankshaft:—Five main bearing type.

Journal Sizes—2⅜" diameter (all bearings).

Bearing Type—Removable bronze-backed, babbitt-lined type.

Clearance—.002-.00325".

Adjustment—Take up bearings when wear exceeds .003". Check adjustment by assembling .002" feeler ½" wide between bearing and shaft. Crankshaft should turn by hand with feeler in place and bearing caps tight.

End Thrust—Taken by #3 (center) main bearing. Endplay, .003-.004". Use .003" feeler to check clearance.

Camshaft:—Six bearing type. Drive—Non-adjustable chain.

Clearance—.002-.003" (front bearing), .0017-.0047" (all others).

Timing Chain—Whitney. Width 1¼". Pitch ½". Length 24½" or 49 links.

Camshaft Setting—Sprockets are marked. Mesh chain with sprockets turned so there are 12 links on lower side of chain between marks. With sprockets in this position the top dead center mark '⅛' on flywheel will be in line with indicator on housing with pistons #1 and 8 on top dead center.

Valves:—	Head Diameter	Stem Diameter	Stem Lgth.	Seat Angle	Lift
Intake	1 7/16"	.3410-.3425"	5¼"	30°	11/32"
Exhaust	1 13/32"	.3410-.3425"	5¼"	45°	11/32"

Tappet Clearance—.006-.008" (all valves—engine hot). Clearance for timing only, .012".

Valve Springs—	Spring Pressure	Spring Length
Valve Closed	42-47 lbs.	2 3/16"
Valve Open	88-94 lbs.	1 27/32"

Valve Timing

Intake Valves Open—5° BTDC. Close—40° ALDC.
Exhaust Valves Open—50° BLDC. Close—10° ATDC.

To Check Valve Timing—Set tappet clearance #1 intake valve at .010" cold. This valve should open with piston 5° or .0113" before top dead center when point on flywheel approximately 1.347 teeth (8-100, 100A), 1.527 teeth (8-105) before dead center mark lines up with indicator on housing. Reset tappet clearance at .006-.008" with engine hot.

Motor Gauge—Weldenhoff Adapter #102. Rod #2.

Lubrication:—Pressure type. Gear type oil pump located in crankcase.

Normal Oil Pressure—15 lbs. (idling), 40 lbs. (maximum R.P.M.) warm.

Oil Pressure Relief Valve—Operates at 30 lbs. Located on left hand side of crankcase. Adjustable by adding or removing shims behind relief valve spring.

Capacity and Oil—8 qts. Use SAE. #30 (summer—first 3000 miles with new engine), #40 (summer—after 3000 miles), #20 (winter).

CLUTCH:—Long Model 9AB. Single plate, dry disc type. See article in Clutch Section for complete relining and assembling directions.

Facings—Moulded type, 2 required. Thickness .137". Inside Diameter 5½". Outside Diameter 9¾".

Adjustment—Clutch pedal free movement should be 1". To adjust, loosen clamp bolt at lower end of pedal, change pedal location.

STEERING:—**Steering Gear**—Ross Cam-and-Roller type. See article in Steering Section for complete adjustment instructions.

Front Suspension:—Conventional 'I' beam section front axle with Reverse Elliott ends and semi-elliptic springs.

Kingpin Inclination—7° crosswise.

Caster—1° minimum, 2° maximum. Adjust by inserting wedge shims between spring and spring pad on axle.

Camber—2°. No adjustment provided.

Toe In—⅛-3/16". Adjusted in usual manner by loosening clamp bolts and turning tie rod.

BRAKES (8-100, 8-101):—**Service**—Midland Steeldraulic, four wheel, internal expanding mechanically operated type. Hand lever applies all four service brakes.

Drum Diameter—13".

Lining—Width 1¾". Thickness .205". Length 33¾" per wheel.

NOTE—Brake shoes are semi-flexible and special moulded lining is used.

Clearance—.040".

Hand Brake:—See Service Brake adjustment.

BRAKES (8-105):—**Service**—Bendix Hydraulic, Single anchor due-servo type. Hand lever applies rear wheel service brakes through mechanical linkage. See article in Brake Section for complete adjustment instructions.

Drum Diameter—13".

Lining—Moulded type. Width 1¾". Thickness 3/16". Length 27¾" per wheel.

Clearance—.010" at heel and toe of each shoe.

Hand Brake:—See Service Brake adjustment.

SERIAL NUMBER:—First number 850X1001 or 850Y1001. On right hand side of cowl under engine hood. Letter following number designates body type.

ENGINE NUMBER:—On left hand lower side of crankcase.

ENGINE:—Lycoming Model GF (850X), GG (850Y). Eight cylinder, 'L' head type.

Dimensions—Bore 3 1/16". Stroke 4¾". Displacement 279.92 cu. ins.

Horsepower—Rated 30.0. Developed 100 at 3400 R.P.M. (GF), 115 at 3600 R.P.M. (GG).

Compression Ratio—(GF) 5.3-1. (GG) 6.2-1 Std.

Compression Pressure—Approximately 90-95 lbs. (GF), 105 lbs. (GG) at cranking speed.

Vacuum Reading—Gauge should show steady reading of 18-20" at idling speed.

Pistons:—Bohn, aluminum alloy, Invar Strut, Split skirt type.

Weight—16 ozs. (stripped), 21.92 ozs. (with rings and pin).

Removal—Piston and rod assembly removed through bottom of engine.

Piston Length—3¾" (total), 2.3155" (top to center of pin).

Clearance—.0015" (skirt). See Fitting New Pistons.

Fitting New Pistons—Use feeler stock ½" wide to check clearance. 0015" feeler should be withdrawn easily but .0025" feeler should lock. If spring scale is used, tension required to withdraw .002" feeler should be 7-12 pounds.

NOTE:—Install pistons with slot toward left (camshaft side).

Piston Rings:—Four rings per piston, all above pin. #1 and 2—compression rings, #3 and 4—oil control rings.

Ring	Width	End Gap	Side Clearance	Wall Thickness
Comp. (#1, 2)	⅛"	.010-.018"	.0015-.003"	.135-.125"
Oil Cont. (#3)	⅛"	.006-.012"	.001-.0025"	.135-.125"
Oil Cont. (#4)	3/16"	.006-.012"	.001-.0025"	

Piston Pin:—Diameter, .8750-.8748". Length, 2.520-2.500". Pin is locked in rod. **Pin Fit in Piston**—Tight push fit at 70°F. (selective fit).

Connecting Rod:—Weight, 2.34 lbs.. Length, 9½" (center-to-center).

Big End Bearing—Spun babbitt type. No shims.

Clearance—.001-.0025". Sideplay .004-.009".

Adjustment—Adjust when wear exceeds .004" by filing bearing caps (no shims).

NOTE:—Connecting rods are numbered and must be installed in same numbered cylinders. Lower bearings are offset. Install rods with narrow half of bearing toward nearest main bearing. Oil jet holes in lower bearing upper half must be toward camshaft side of engine on all rods.

Crankshaft:—Five main bearing type.

Journal Sizes—2⅜" diameter (all bearings).

Bearing Type—Removable bronze-backed, babbitt-lined type.

Clearance—.002-.00325".

Adjustment—Take up bearings when wear exceeds .003". Check adjustment by assembling .002" feeler ½" wide between bearing and shaft. Crankshaft should turn by hand with feeler in place and bearing caps tight.

End Thrust—Taken by #3 (center) main bearing. Endplay, .003-.004". Use .003" feeler to check clearance.

Camshaft:—Six bearing type. Drive, Non-adjustable chain.

Bearing Clearance—.0025-.0035" (radial).

Chain—Whitney. Width, 1". Length, 49 links. Pitch, ½".

Camshaft Setting—Sprockets are marked. Mesh chain with sprockets turned so there are 12 links on lower side of chain between marks. With sprocktts in this position the top dead center mark '⅛' on flywheel will be in line with indicator on housing with pistons #1 and 8 on top dead center.

Valves:—	Head Diameter	Stem Diameter	Stem Lgth.	Seat Angle	Lift
Intake	1 7/16"	.3410-.3425"	5¼"	30°	11/32"
Exhaust	1 13/32"	.3410-.3425"	5¼"	45°	11/32"

Tappet Clearance—.006-.008" (all valves—engine hot). Timing—.012".

Valve Springs—	Spring Pressure	Spring Length
Valve Closed	42-47 lbs.	2 3/16"
Valve Open	88-94 lbs.	1 27/32"

Valve Timing

Intake Valves Open—5° BTDC. Close—40° ALDC.
Exhaust Valves Open—50° BLDC. Close—10° ATDC.

To Check Valve Timing—Set tappet clearance #1 intake valve at .010". This valve should open with piston 5° or .0113" before top dead center when a point on the flywheel approximately 1.527 teeth before dead center mark lines up with indicator on housing. Reset tappet clearance at .006-.008" with engine hot.

Lubrication:—Pressure type. Gear type oil pump located in crankcase.

Normal Oil Pressure—15 lbs. (idling), 40 lbs. (maximum R.P.M.) warm.

Oil Pressure Relief Valve—Operates at 30 lbs. Located on left hand side of crankcase. Adjustable by adding or removing shims behind relief valve spring.

Capacity and Oil—8 qts. Use SAE. #30 (summer—first 3000 miles with new engine), #40 (summer—after 3000 miles), #20 (winter).

CLUTCH:—**Long Model 9AB-6CI.** Single plate dry disc type. See article in Clutch Section for complete relining and assembling directions.

Facings—Moulded type, 2 required. Thickness .137". Inside Diameter 5½". Outside Diameter 9¾".

Adjustment—Free movement of clutch pedal must be 1". To adjust, loosen clamp bolt at lower end of clutch pedal, change pedal location.

STEERING:—**Steering Gear**—Ross Cam-and-Roller type. See article in Steering Section for complete adjustment instructions.

Front Suspension:—Conventional 'I' beam section front axle with Reverse Elliott ends and semi-elliptic springs. Axle is Columbia Model 1700A-5.

Kingpin Inclination—7½° crosswise.

Caster—2° maximum (without load), 3° (loaded). Adjust by inserting wedge shims between spring and spring pad on axle.

Camber—1½°. No adjustment provided.

Toe In—⅛-3/16". Adjust in usual manner by loosening clamp bolts and turning tie rod.

BRAKES:—**Service**—Bendix Hydraulic, Single anchor, duo-servo type. Hand lever applies rear wheel service brakes through mechanical linkage. See article in Brake Section for complete adjustment instructions.

Drum Diameter—12" all models.

Lining—Hard moulded type (Raybestos #451). Width 2". Thickness 3/16". Length 24 9/32" per wheel.

Clearance—.010" at heel and toe of each shoe.

Hand Brake—See Service Brake adjustment.

Vacuum Power Cylinder:—Std. on Model 850Y only. Bendix type vacuum cylinder. See article in Brake Section for complete data.

SERIAL NUMBER:—First number 652X-1001, 652Y-1001, 653-1001. On right hand side of cowl under hood.

ENGINE NUMBER:—On front left hand upper half of crankcase.

ENGINE:—Lycoming, Model WF. Six cylinder, 'L' head type.

Bore—3 1/16". **Stroke**—4¾".

Piston Displacement—209.94 cubic inches.

Rated Horsepower—22.51.

Developed Horsepower—85 at 3500 R.P.M.

Compression Ratio—6.2-1 Std. aluminum head.

Pistons:—Bohn, aluminum alloy, split skirt, Invar strut type. Piston length, 3¾".

Weight—16 ozs. stripped, 21.92 ozs. with rings and pin.

Removal—Pistons and rods removed from below.

Clearance—Top .00975-.00825". Skirt .0015".

Fitting New Pistons—Use .0015" feeler stock ½" wide to check clearance. Pull required to withdraw feeler from between piston and cylinder wall on side opposite slot must be between 5-10 lbs.

Installing Pistons—Slot should be toward left or camshaft side of engine.

Piston Rings:—Two compression, two oil control rings per piston, all above pin. Lower ring groove drilled radially with oil drain holes.

Ring	Width	End Gap	Side Clearance
Comp. All	⅛"	.008-.013"	.0015-.003"
Oil Cont. (3)	⅛"	.008-.013"	.001-.0025"
Oil Cont. (4)	3/16"	.008-.013"	.001-.0025"

Piston Pin:—Diameter .8750-.8748". Length 2.520-2.500". Pin is locked in the rod. No bushing used in piston.

Pin Fit in Piston—Tight push fit at 70°F. (selective).

Connecting Rod:—Weight 2.34 lbs. Length 9½".

Crankpin Journal Diameter—2⅛".

Lower Bearing Type—Spun babbitt lined. No shims.

Clearance—.001-.0025" (total), .004-.009" (total sideplay).

Adjustment—Adjust by filing bearing caps when wear exceeds .004". No shims used.

Installing Rods—Rods are numbered and must be installed in same numbered cylinders. Lower bearings are offset. Install rods with narrow half of bearing toward nearest main bearing. Oil jet holes in upper half of lower bearing must be toward camshaft side of engine on all rods.

Crankshaft:—4 bearing. Integral counterweights with Lancaster type vibration dampener at front of engine.

Journal Diameters—2⅜" all bearings.

Bearing Type—Bronze-backed, babbitt-lined.

Clearance—.001-.00162".

Adjustment—Take up bearings when wear exceeds .003". Check adjustment by assembling .002" feeler ½" wide between bearing and shaft. Crankshaft should turn by hand with feeler in place and bearing caps tight.

End Thrust—Taken by second intermediate (#3) main bearing. Endplay .005" (minimum), .010" (maximum).

Camshaft:—Five bearing. Non-adjustable chain drive. Camshaft design changed on 653 ('35) model after 3034 engines (see Valve Timing below).

Bearing Type—Bronze and cast-iron.

Clearance—.0025-.0035".

Timing Chain—Whitney. Width 1¼". Pitch ½". Length 24½" or 49 links.

Camshaft Setting—Sprockets are marked. Mesh chain with sprockets turned so there are 12 links on lower side of chain between marks. This is equal to 13 teeth inclusive of teeth meshed opposite marks. With sprockets in this position, pistons 1 and 6 will be on top dead center with dead center mark on flywheel at indicator on housing. This setting correct for all engines. Change in valve timing (see below) is due to new camshaft design.

Valves:—	Head Dia.	Stem Dia.	Length
Intake	1 9/16"	.3424-.3425"	5¼"
Exhaust	1 13/32"	.3420-.3425"	5¼"

NOTE—On 652 X, Y models Intake valve head diameter 1 7/16".

	Seat Angle	Lift	Stem Clearance
Intake	30°	5/16"	.0045-.008"
Exhaust	45°	5/16"	.0045-.008"

Tappet Clearance—(652-X, Y) .006-.008" all valves with engine hot. (653). .008-.010" all valves with engine hot. Clearance for timing .010" (652-X, Y), .012" (653).

Valve Springs—	Spring Pressure	Length
Valve Closed	42-47 lbs.	2 3/16"
Valve Open	88-94 lbs.	1⅞"

Valve Timing—See Camshaft Setting (above).

1934-35 Cars ('35—before Serial #653-3034)

Intake Valves—Open 5° BTDC. Close 40° ALDC.
Exhaust Valves—Open 50° BLDC. Close 10° ATDC.

1935 Cars (after Serial #653-3034)

Intake Valves—Open 7½° BTDC. Close 37½° ALDC.
Exhaust Valves—Open 50° BLDC. Close 5° ATDC.

To Check Valve Timing—Set tappet clearance #1 intake valve at .010" (652-X, Y), .012" (653). This valve should open with piston #1 .0113" (652-X, Y—First 653), .0253" (653—after 3034 cars) before top dead center when flywheel mark '1/6' is approximately 1.53 teeth (652-X, Y—First 653), or 2.29 teeth (653—after 3034 cars) before the indicator on the housing. Reset tappet clearance .006-.008" (652-X, Y), .008-.010" .653) with engine hot.

Lubrication:—Pressure. Gear type oil pump located in crankcase.

Normal Oil Pressure—15 lbs. idling, 40 lbs. maximum engine R.P.M. with warm oil.

Oil Pressure Relief Valve—Located in bracket bolted on left hand side of crankcase. Operates at 30 lbs. Adjustable by changing spacer washers between plug and relief valve spring (plug at lower end of bracket).

Capacity and Oil—6 qts. Use SAE. #30 (summer, first 3000 miles with new engine), #40 (summer, after 3000 miles), #20 (winter).

CLUTCH:—**Long Model 9AB-CS.** Single plate, dry disc type. No adjustment required for wear.
See article in Mechanical Equipment Section for data.

Clutch Pedal Adjustment—Free movement of clutch pedal must be 1". To adjust, loosen transverse bolt at lower end of clutch pedal, change position of pedal (bolt hole is slotted).

Clutch Facings—Moulded type, 2 required, 5¾" I.D., 9" O.D., .137" thick. Clutch facings are Raybestos #250.

STEERING:—**Front Suspension.** Conventional 'I' beam section front axle with Reverse-Elliott ends and semi-elliptic springs. Axle is Columbia Type 10000A-1.

Kingpin Inclination—7½° crosswise.

Caster—3½-4°. Adjust by using wedge shims between spring and spring pad on axle.

Camber—1½°.

Toe In—⅛-3/16". Adjust in usual manner by changing length of tie rod.

Steering Gear:—Ross Model 140 Cam-and-Lever type.
See article in Mechanical Equipment Section for data.

BRAKES:—**Service**—Bendix hydraulic, Duo-Servo, single anchor type. Hand lever applies rear wheel brakes.
See article in Mechanical Equipment Section for data.
Drum Diameter—12".
Lining—Moulded type. Width 1½". Thickness 3/16". Length 24 9/32" per wheel.
Clearance—.010" at heel and toe of each shoe.

Hand Brake Adjustment:—See Service Brakes.

SERIAL NUMBER:—First number, 851-1001. On right hand side of cowl under hood. Letter following serial number designates body type.

ENGINE NUMBER:—On front left hand upper half of crankcase.

ENGINE:—**851**—Lycoming Model GG. Eight cylinder, In Line, 'L' head type.

Supercharged 851—Lycoming Model GH—Eight cylinder, In Line, 'L' head type. Engine is supercharged by centrifugal type supercharger mounted on left side of crankcase and driven by separate chain.

Bore—3 1/16". **Stroke**—4¾".

Piston Displacement—279.92 cubic inches.

Rated Horsepower—30.0.

Developed Horsepower—**(851)**—115 HP. at 3600 R.P.M. **(SC 851)** 150 HP. at 4000 R.P.M.

Compression Ratio—**(851)** 6.2-1 standard aluminum head. **(SC 851)** 6.5-1 standard aluminum head.

Pistons 851, SC 851 (before Eng. No. 4759):—Bohn, aluminum alloy, Invar strut, split skirt type.

Length—3¾".

Weight—16 ozs. stripped, 21.92 ozs. with rings and pin.

Removal—Rods and pistons removed from below.

Clearance—Top .00975-.00825". Skirt .0015".

Fitting New Pistons—Use .0015" feeler stock ½" wide to check clearance. Pull required to withdraw feeler from between piston and cylinder wall on side opposite slot must be between 5-10 pounds.

Installing Pistons—Slot should be toward left or camshaft side of engine.

Pistons SC 851 (after Engine No. 4759):—Ray Day, Ray Day metal type.

Length—3¾".

Weight—14.40 ozs. stripped, 19.84 ozs. with rings and pin.

Removal—Pistons and rods removed from below.

Clearance—Top .01125-.01325". Skirt .002-.0025".

Piston Rings:—**Bohn Pistons**—Two compression, two oil control rings per piston, all above pin. **Ray Day Pistons**—Two compression, one oil control ring per piston, all above pin. Rings used on Bohn pistons are all Sealed Power Corp. Rings used with Ray Day pistons are Perfect Circle #70 (compression), #85 (oil control).

Ring	Width	End Gap	Side Cl'rance
Comp. (#1, 2)	⅛"	.008-.013"	.0015-.003"
Oil Cont. (#3 Bohn)	⅛"	.008-.013"	.001-.0025"
Oil Cont. (#4 Bohn)	3/16"	.008-.013"	.001-.0025"
Oil Cont. (Ray Day)	3/16"	.007-.015"	.001-.0025"

Piston Pin:—Diameter .8750-.8748". Length 2.520-2.500". Pin is locked in the rod. No bushing used in piston.

Pin Fit in Piston—Tight push fit at 70°F (selective).

Connecting Rod:—Weight 2.34 lbs. Length 9½".

Crankpin Journal Diameter—2⅛".

Lower Bearing Type—Spun babbitt-lined. No shims.

Clearance—.001-.0025" (total). .004-.009" (total sideplay).

Adjustment—Adjust by filing bearing caps when wear exceeds .004". No shims used.

Installing Rods—Rods are numbered and must be installed in same numbered cylinders. Lower bearings are offset. Install rods with narrow half of bearing toward nearest main bearing. Oil jet holes in upper half of lower bearing must be toward camshaft side of engine on all rods.

Crankshaft:—Five bearings with Lanchester type vibration dampener. Shaft counterweighted on Supercharged (SC 851).

Journal Diameters—2⅜" all bearings.

Bearing Type—Bronze-backed, babbitt-lined.

Clearance—.0010-.00162".

Adjustment—Take up bearings by filing caps when wear exceeds .003". Check adjustment by assembling .002" feeler ½" wide between bearing and shaft. Crankshaft should turn by hand with feeler in place and bearing caps tight.

End Thrust—Taken by center main bearing. End-play .005" minimum, .010" maximum.

Camshaft:—Six bearing. Non-adjustable chain drive. Camshaft design changed on Model 851 (after 5169 engines). See Valve Timing (following).

Bearing Type—Bronze and cast-iron (851), Steel-backed babbitt lined type (SC 851).

Clearance—.0025-.0035" (851).

Timing Chain—Whitney. Width 1". Pitch ½". Length 24½" or 49 pitches.

Camshaft Setting—Sprockets are marked. Mesh chain with sprockets turned so there are exactly 12 links on lower side of chain between marks. This is equal to 13 teeth inclusive of teeth meshed opposite marks. With sprockets in this position, pistons #1 and 8 will be on top dead center with dead center mark on flywheel at indicator on housing. This setting correct for all engines. Change in valve timing on Model 851 (see below) is due to new camshaft design.

Valves:—	Head Diameter	Stem Diameter	Length
Intake	1 9/16"	.3420-.3425"	5¼"
Exhaust	1 13/32"	.3420-.3425"	5¼"

	Seat Angle	Lift	Stem Clearance
Intake	30°	5/16"	.0045-.008"
Exhaust	45°	5/16"	.0045-.008"

Tappet Clearance—.008-.010" all valves—running clearance with engine hot. Clearance for timing .012".

Valve Springs—	Spring Pressure	Length
Valve Closed	42-47 lbs.	2 3/16"
Valve Open	88-94 lbs.	1⅞"

Valve Timing—See Camshaft Setting above.

851 (Cars before Engine No. 5169)

Intake Valves—Open 5° BTDC. Close 40° ALDC.
Exhaust Valves—Open 50° BLDC. Close 10° ATDC.

851 (Cars after Engine No. 5169)—All SC 851

Intake Valves—Open 7½° BTDC. Close 37½° ALDC.
Exhaust Valves—Open 50° BLDC. Close 5° ATDC.

To Check Valve Timing—Set tappet clearance #1 intake valve at .012". This valve should open with piston #1 slightly before top dead center when flywheel mark '⅛' (dead center mark) is approximately 1.53 teeth (first Model 851 cars), or 2.29 teeth (later Model 851 cars—All Model SC 851 cars) before the indicator on the flywheel housing. Reset tappet clearance at .008-.010" with engine hot.

Lubrication:—Pressure. Gear type oil pump located in crankcase.

Normal Oil Pressure—15 lbs. idling, 40 lbs. at maximum engine R.P.M. with warm oil.

Oil Pressure Relief Valve—Located in bracket bolted on left hand side of crankcase. Operates at 30 lbs. Adjustable by changing spacing washer between plug and relief valve spring (plug at lower end of bracket).

Capacity and Oil—8 qts. Use SAE. #30 (summer—first 3000 miles with new engine), #40 (summer—after 3000 miles), #20 (winter).

CLUTCH:—**Long, Model 9AB-6C1.** Single plate, dry disc type. No adjustment for wear required. *See article in Mechanical Equipment Section for data.*

Clutch Pedal Adjustment—Free movement of clutch pedal must be 1". To adjust, loosen transverse bolt at lower end of clutch pedal, change position of pedal (bolt hole is slotted).

Clutch Facings—Moulded type, 2 required. 5½" I.D., 9¾" O.D., .137" thick. Clutch facings are Raybestos #250.

STEERING:—**Front Suspension**—Conventional 'I' beam section front axle with Reverse-Elliott ends and semi-elliptic springs. Axle is Columbia Type 1700A-5.

Kingpin Inclination—7½° crosswise.

Caster—2° maximum without load, 3° loaded. Use wedge shims inserted between spring and spring pad on axle to correct caster.

Camber—1½°.

Toe In—⅛-3/16". Adjust in usual manner by changing length of tie rod.

Steering Gear:—Ross Model 615 Cam-and-Lever type. *See article in Mechanical Equipment Section for data.*

BRAKES:—**Service**—Bendix hydraulic, Duo-Servo, single anchor type. Hand lever applies rear wheel brakes. *See article in Mechanical Equipment Section for data.*

Drum Diameter—12".

Lining—Moulded type. Width 2". Thickness 3/16". Length 24 9/32" per wheel.

Hand Brake Adjustment:—See Service Brakes.

ENGINE NUMBER:—First number—6601. Stamped on front left hand upper half of crankcase.

ENGINE SPECIFICATIONS:—Lycoming Model WF. Six cylinder 'L' head type.

Bore—3 1/16". Stroke—4¾".

Displacement—210 cubic inches.

Rated Horsepower—22.5 (SAE).

Developed Horsepower—85 at 3500 R.P.M.

Compression Ratio and Pressure—6.2-1 Std. aluminum head. No optional ratios. Pressure approximately 105 lbs. at cranking speed.

Vacuum Reading—Gauge should show steady reading of approx. 20" with engine idling at 7-8 M.P.H.

PISTONS:—Nelson Bohnalite, aluminum alloy, split skirt, Invar Strut type.

Length—3¾".

Weight—16 ozs. (stripped), 21.92 ozs. (with rings and pin).

Removal—Pistons and rods removed from below.

Clearance—Top .020". Skirt .0015". See Fitting Pistons.

Replacement Pistons:—Pistons furnished .003" and .005" oversize.

Fitting New Pistons:—Use .0015" feeler stock ½" wide. Pull required to withdraw feeler from between piston and cylinder wall on side opposite slot must be between 5-10 lbs.

Installing Pistons:—Slot should be toward left or camshaft side of engine.

PISTON RINGS:—Two compression, two oil control rings per piston, all above pin. Lower ring grooves drilled with eight 1/16" oil drain holes (#3), eight 1/8" holes and oil holes to piston pin bosses (#4).

Ring	Width	End Gap	Side Clearance
Comp. (all)	⅛"	.006-.012"	.0015-.003"
Oil Cont. (3)....	⅛"	.010-.013"	.001-.0025"
Oil Cont. (4)....	3/16"	.010-.013"	.001-.0025"

PISTON PIN:—Diameter—.8750-.8748". **Length**—2.52-2.50". Pin is locked in rod. No bushing used in pist'n.

Pin Fit in Piston—Tight push fit at 70° F. (selective).

CONNECTING ROD:—Length—9½" (center-to-center).

Weight—37.4 ozs. with bushings and caps.

Crankpin Journal Diameter—2⅛".

Lower Bearing—Spun babbitt-lined. No shims.

Clearance—.001-.0025" (total), .004-.009" (total side-play).

Bearing Adjustment:—Adjust by filing bearing caps when wear exceeds .004". No shims used.

Installing Rods:—Rods are numbered and must be installed in same numbered cylinders. Lower bearings are offset. Install rods with narrow half of bearing toward nearest main bearing. Oil jet holes in upper half of lower bearing must be toward camshaft side of engine.

CRANKSHAFT:—Four bearing. Integral counterwgts.

Journal Diameters—2⅜" all bearings.

Bearing Type—Bronze-backed, babbitt-lined.

Clearance—.001-.00162".

Bearing Adjustment:—Take up bearings when wear exceeds .003". Check adjustment by assembling .002" feeler ½" wide between bearing and shaft. Crankshaft should turn by hand with feeler in place and bearing caps tight.

End Thrust:—Taken by #3 intermediate bearing. Endplay .005" minimum, .010" maximum.

CAMSHAFT:—5 Bearing. Non-adjustable chain drive.

Bearing Type—Bronze and cast-iron.

Clearance—.0025-.0035".

End Thrust:—Taken by thrust button riveted to inside face of chain case cover. Endplay .015".

Timing Chain:—Whitney. Width 1¼". Pitch ½". Length 24½" or 49 links.

Camshaft Setting:—Sprockets are marked. Mesh chain with sprockets turned so there are 12 links on lower side of chain between marks. This is equal to 13 teeth inclusive of teeth meshed opposite marks. With sprockets in this position, pistons 1 and 6 will be on top dead center with dead center mark on flywheel at indicator on housing. This setting correct for all engines.

VALVES:—	Head Diameter	Stem Diameter	Length
Intake	1 9/16"	.3424-.3425"	5¼"
Exhaust	1 13/32"	.3420-.3425"	5¼"

	Seat Angle	Lift	Stem Clearance
Intake	30°	5/16"	.0045-.008"
Exhaust	45°	5/16"	.0045-.008"

Tappet Clearance—.008-.010" all valves—running clearance with engine hot.

Valve Guides:—Pressed in block and finish reamed to size providing correct stem clearance.

Valve Springs:—Springs have 'closed coils' at one end. Install springs with closed coil end up.

	Spring Pressure	Spring Length
Valve Closed	42-47 lbs.	2 3/16"
Valve Open	88-94 lbs.	1⅞"

Valve Timing:—See Camshaft Setting above.

Intake Valves—Open 7½° BTDC. Close 37½° ALDC.

Exhaust Valves—Open 50° BLDC. Close 5° ATDC.

NOTE—Figures correct with .012" tappet clearance.

To Check Valve Timing—Set tappet clearance #1 intake valve at .012". This valve should open with piston #1 .0253" before top dead center when flywheel mark '1/6' (dead center mark) is approximately 2.29 teeth before the indicator on the flywheel housing. Reset tappet clearance at .008-.010" with engine hot.

Motor Gauge—Weidenhoff Adapter #114, Rod #42.

LUBRICATION:—Pressure. Gear type oil pump located in crankcase.

Normal Oil Pressure:—15 lbs. idling, 40 lbs. maximum engine R.P.M. with warm oil.

Oil Pressure Relief Valve:—Located in bracket bolted on left hand side of crankcase. Operates at 30 lbs. Adjustable by changing spacer washers between plug and relief valve spring (plug at lower end of bracket).

Crankcase Capacity:—6 quarts (refill).

CLUTCH:—Long Model 9AB-CS. Single plate, dry disc type. See article in Clutch Section for relining and assembling directions.

Facings—Moulded type, 2 required. Inside Diam. 5¾". Outside Diam. 9". Thickness .137".

Adjustment—Free movement of clutch pedal must be 1". To adjust, loosen transverse bolt at lower end of clutch pedal, change position of pedal (bolt hole is slotted).

Removal:—Drop drive shaft by disconnecting front universal, remove transmission, take off pan on underside of clutch housing. Take out capscrews mounting clutch on flywheel, turning all screws out evenly to relieve spring tension, remove clutch from below through pan opening.

STEERING:—Steering Gear—Ross Model 140 Cam-and-Lever type. See article in Steering Section for adjustments.

Front Suspension:—Conventional 'I' beam section front axle with Reverse-Elliot ends and semi-elliptic springs.

Kingpin Inclination—7½° crosswise.

Camber—1½°. No adjustment.

Caster—3½-4°. Adjust by using wedge shims between spring and spring pad on axle.

Toe In—⅛-3/16". Adjust in usual manner by changing length of tie rod.

Tread—59" (front), 62" (rear).

BRAKES:—Service—Bendix Hydraulic, Duo-Servo, single anchor type. Hand lever applies rear wheel brakes. See article in Brake Section for complete adjustment procedure.

Drum Diameter—12".

Lining—Moulded type. Width 1½". Thickness 3/16". Length 24 9/32" per wheel.

Clearance—.010" at heel and toe of each shoe.

Hand Brake Adjustment:—See Service Brakes.

ENGINE NUMBER:—Stamped on left hand upper half of crankcase at front of engine. First serial number (on right hand side of cowl under hood) 4501 (852), 34501 (Schgd. 852).

ENGINE SPECIFICATIONS:—**Type**—Lycoming Model GG and GH (Supercharged). 8 cylinder In Line, 'L' head.

Bore—3 1/16". **Stroke**—4¾".

Displacement—279.92 cubic inches.

Rated Horsepower—30.01 (SAE).

Developed Horsepower—115 at 3600 R.P.M., 150 at 4000 R.P.M. (Supercharged).

Compression Ratio and Pressure—6.2-1 Std. aluminum head. Pressure approximately 105 lbs. at cranking speed.

Vacuum Reading—Gauge should show steady reading of 20" with engine idling at 5-6 M.P.H.

PISTONS—852:—Bohn, aluminum alloy, Invar strut, split skirt type. Length—3¾".

Weight—16 ozs. stripped, 21.92 ozs. with rings and pin.

Removal—Pistons and rods removed from below.

Clearance—Top .00975-.00825", Skirt .0015".

Replacement Pistons:—Pistons furnished in .003" and .005" oversizes.

Fitting New Pistons:—Use .0015" feeler stock ½" wide inserted between piston and wall on side opposite slot to check clearance. Pull required to withdraw feeler must be between 5-10 lbs.

Installing Pistons:—Slot should be toward left or camshaft side.

PISTONS—SCHGD. 852:—Ray Day, Ray Day metal alloy type. Length—3¾".

Weight—14.40 ozs. stripped, 19.84 ozs. with rings and pins.

Removal—Pistons and rods removed from below.

Clearance—Top .01125-.01325". Skirt .002-.0025".

Fitting New Pistons:—Use .002" feeler ½" wide inserted between piston and cylinder wall at right angles to pin bosses to check clearance. Pull required to withdraw feeler should be 6-11 lbs.

PISTON RINGS—852 (BOHN PISTONS):—Two compression, two oil control rings per piston, all above pin. Oil ring grooves drilled with eight 1/16" oil drain holes (#3), eight ⅛" oil holes and oil holes to piston pin bosses (#4).

Ring	Width	End Gap	Side Clearance
Comp. (all) ..	⅛"	.008-.013"	.0015-.003"
Oil (#3)	⅛"	.008-.013"	.001-.0025"
Oil (#4)	3/16"	.008-.013"	.001-.0025"

PISTON RINGS—SCHGD. 852 (RAY DAY PISTONS):—Two compression, one oil control ring per piston, all above pin. Rings are Perfect Circle #70 (comp.), #85 (oil control).

NOTE—Compression rings are stepped or grooved and must be installed with the groove downward.

Ring	Width	End Gap	Side Clearance
Comp. (all) ..	⅛"	.008-.013"	.0015-.003"
Oil Cont.	3/16"	.007-.015"	.001-.0025"

PISTON PIN:—**Diameter**—.8750-.8748". **Length**—2.520-2.500". Pin is locked in rod. No bushing used in piston. Pins furnished for service standard and .003" oversize.

Pin Fit in Piston—Tight push fit at 70° F. (selective).

CONNECTING ROD:—**Length**—9½".

Weight—2.34 lbs. (852 only).

Crankpin Journal Diameter—2⅛".

Lower Bearing—Spun babbitt-lined type. No shims.

Clearance—.001-.0025" (total), .004-.009" (total side-play).

Bearing Adjustment:—Adjust by filing bearing caps when wear exceeds .004".

Installing Rods:—Rods are numbered and must be installed in same numbered cylinders. Lower bearings are offset. Install rod with narrow half of bearing toward nearest main bearing. Oil jet holes in upper half of lower bearing must be toward camshaft side of engine on all rods.

CRANKSHAFT:—Five bearing. Counterweights used on Schgd. 852 only. Lanchester type vibration dampener used on both models.

Journal Diameters—2⅝" all bearings.

Bearing Type—Bronze-backed, babbitt-lined.

Clearance—.001-.00162".

Bearing Adjustment:—Take up bearings by filing bearing caps when wear exceeds .003". Check adjustment by assembling .002" feeler ½" wide between bearing and shaft. Crankshaft should turn by hand with feeler in place and bearing cap tight.

End Thrust:—Taken by center (#3) bearing. Endplay .005" minimum, .010" maximum.

CAMSHAFT:—Six bearing. Non-adjustable chain drive.

Bearing Type—Bronze and cast-iron (852), steel-backed, babbitt-lined bushings (Schgd. 852).

Clearance—.0025-.0035".

End Thrust:—Taken by thrust pin riveted on inside face of chain case cover. Endplay .015".

Timing Chain:—Whitney. Width 1" (852), 1¼" (Schgd. 852), Pitch ½". Length 24½" or 49 links.

Camshaft Setting:—Sprockets are marked. Mesh chain with sprockets turned so that there are 12 links or 13 teeth (inclusive of teeth meshed opposite marks) between marks. With sprockets in this position, pistons #1 and 8 will be on top dead center with dead center mark on flywheel lined up with indicator on housing.

SUPERCHARGER:—Centrifugal type mounted at left of engine and driven through accessory sprocket and shaft by separate chain in chain case. Chain is adjustable.

Chain Adjustment:—Accessory sprocket mounted on eccentric with slotted mounting holes. Adjusted by loosening screws and rotating eccentric to take up chain slack.

VALVES:—	Head Diameter	Stem Diameter	Length
Intake	1 9/16"	.3420-.3425"	5¼"
Exhaust	1 13/32"	.3420-.3425"	5¼"

	Seat Angle	Lift	Stem Clearance
Intake	30°	5/16"	.0045-.008"
Exhaust	45°	5/16"	.0045-.008"

Tappet Clearance.—.008-.010" all valves, engine hot.

Valve Guides:—Pressed in block and finish reamed to provide correct stem clearance (see table above).

Valve Springs:—Springs have 'closed coils' at one end. Install springs with closed coil end up.

	Spring Pressure	Spring Length
Valve Closed	42-47 lbs.	2 3/16"
Valve Open	88-94 lbs.	1⅞"

Valve Timing:—See Camshaft Setting above.

Intake Valves—Open 7½° BTDC. Close 37½° ALDC.

Exhaust Valves—Open 50° BLDC. Close 5° ATDC.

To Check Valve Timing—Set tappet clearance #1 intake valve at .012". This valve should open with piston #1 .0253" before top dead center when flywheel mark '1/8' (dead center mark) is approximately 2.29 teeth before the indicator on the flywheel housing. Reset tappet clearance at .008-.010" with engine hot.

Motor Gauge—Weidenhoff Adapter #105, Rod #5.

LUBRICATION:—Pressure. Gear type oil pump located in crankcase.

Normal Oil Pressure:—15 lbs. idling, 40 lbs. at maximum engine R.P.M. with warm oil.

Oil Pressure Relief Valve:—Located in bracket bolted on left hand side of crankcase. Operates at 30 lbs. Adjustable by changing spacing washer between plug and relief valve spring (plug at lower end f bracket).

Crankcase Capacity:—8 quarts (refill).

CLUTCH:—Long Model 9AB-6CI. Single plate, dry disc type. See article in Clutch Section for relining and assembling data.

Facings—Moulded type, 2 required. Inside Diam. 5½". Outside Diam. 9¾". Thickness .137".

Adjustment—Free movement of clutch pedal should be 1". To adjust, loosen transverse bolt at lower end of clutch pedal, change position of pedal (bolt is slotted).

Removal—Drop drive line (disconnect at front universal), remove transmission, take off pan under clutch housing, take out screws mounting clutch on flywheel, turning all screws out evenly, remove clutch from below through pan opening in housing.

STEERING:—**Steering Gear**—Ross Model 615 Cam-and-lever type. See article in Steering Section for adjustments.

Front Suspension:—Conventional 'I' beam section front axle with Reverse-Elliot ends and semi-elliptic springs.

Kingpin Inclination—7½° crosswise.
Caster—2° maximum without load, 3° maximum loaded. Adjusted by inserting wedge shims between spring and spring pad on axle.

Camber—1½°. No adjustment.
Toe In—⅛-3/16". Adjust in usual manner by changing length of tie rod.
Tread—59" (front), 62" (rear).

BRAKES:—**Service**—Bendix Hydraulic, Duo-Servo, single anchor type. Hand lever applies rear wheel brakes. See article in Brake Section for complete adjustment procedure.

Drum Diameter—12".

Lining—Moulded type. Width 2". Thickness 3/16". Length 24 9/32" per wheel.

Clearance—.010" at heel and toe of each shoe.

Hand Brake Adjustment:—See Service Brakes.

HOOD LATCH HANDLE NOTE:—On 1939 cars, latch handles located in driver's compartment on extreme right and left hand sides.

SERIAL NUMBER:—First number 60,001. Stamped on left frame side member below oil level gauge or on left side of cowl under engine hood.

ENGINE NUMBER:—First number 60,001. Stamped on left hand side of crankcase above Starter Bendix.

ENGINE SPECIFICATIONS:—Four cylinder, 'L' head type. Cylinders cast en-bloc and bolted to aluminum alloy crankcase (integral with flywheel housing). **Bore**—2.2". **Stroke**—3".
Displacement—45.6 cubic inches.
Rated Horsepower—7.8 S.A.E.
Developed Horsepower—20 at 4000 R.P.M.
Compression Ratio—7.0-1 Al. or CI. head.
Compression Pressure—90 lbs. at 150 R.P.M.

PISTONS:—Bohn Autothermic, steel strut, split skirt, Cam-ground, aluminum alloy type with tin-plated finish. **Length**—2 3/64".
Removal—Pistons and Rods removed from above except on engines with oil baffles (block assembly must be removed first).
Clearance—.0005" (skirt). See Fitting Pistons.
Replacement Pistons:—Pistons furnished in standard size and .003", .005", .010", .020", .030" oversize.
Fitting New Pistons:—Use .0025" feeler installed between piston and cylinder wall on side opposite slot at right angles to piston pin. Pull required to withdraw feeler must be within 7-12 lbs.
Installing Pistons:—Slot toward left hand side.

PISTON RINGS:—Two compression, one oil control ring per piston, all above pin. Oil ring groove drilled with oil drain holes.

Ring	Width	End Gap	Side Clearance
Compr.	3/32"	.004-.006"	.0015"
Oil Cont.	1/8"	.004-.006"	.0015"

Replacement Rings:—Rings furnished standard size and .003", .005", .010", .020", .030" oversize.

PISTON PIN:—**Diameter**—39/64". **Length**—1 15/16". Pin is locked in connecting rod.
Pin Fit in Piston—.002" clearance. When correctly fitted and installed, 3 lbs. pressure at end of rod should be required to rock rod from side to side.
Replacement Pins:—Furnished .003", .005" oversize.

CONNECTING ROD:—'H' section. **Length**—5¾".
Crankpin Journal Diameter—1 5/16".
Lower Bearing—Babbitt-lined type. No shims.
Clearance—.0008-.002". **Sideplay**—.0065".
Bearing Adjustment:—File bearing caps (use fine emery cloth on surface plate).
Installing Rods:—Install rods with oil dippers on bearing cap faces toward right side (all rods).

CRANKSHAFT:—Two bearing, counterweighted type.
Journal Diameters—2½" (all bearings).
Bearing Type—Babbitt-lined bushings. Front bushing has separate bearing retainer, rear bushing and retainer are integral. **Clearance**—.0008-.0025".
Bearing Adjustment:—None. Replace bearings. To remove bearing retainers proceed as follows:
Front Bearing Removal—Remove timing gear cover, pull both timing gears, take out four capscrews in retainer flange, use gear puller to remove bearing.
Rear Bearing Removal—Remove Transmission and Clutch (see Transmission and Clutch sections for directions), remove flywheel by removing 4 bolts and prying centering flange off crankshaft carefully. Remove nuts on bolts in bearing retainer flange, screw capscrew in each of two tapped holes in retainer, turn screws up evenly to force retainer and bearing out.
Replacement Bearings:—Finished bearing bushings furnished .003", .006", .009" undersize.
End Thrust:—Taken by rear bearing. Endplay .0045".

CAMSHAFT:—Three bearing. Helical gear drive.
NOTE—Front camshaft bushing retained by special-headed setscrew in upper part of crankcase which extends down into hole in bushing. Setscrew must be taken out before bushing can be removed.
Bearing Type—Bronze bushings. **Clearance**—.002".
Replacement Bearings:—Front bushing furnished finished to size. Other bushings must be reamed.
End Thrust:—Taken by rear face of camshaft gear hub and front end of camshaft front bushing. When installing timing gears, install camshaft gear first, tighten nut securely and make certain that all endplay removed and camshaft assembly rotates freely.
Camshaft Setting:—Two adjacent teeth on camshaft gear punchmarked. One crankshaft gear tooth also marked. Mesh this marked tooth between the marked camshaft gear teeth.

VALVES:—Intake valves marked 'INL', exhaust valves 'EXH' under head. Exhaust valves also have groove around stem under spring seat.

	Head Diameter	Stem Diameter	Length
All Valves	1 1/32"	.279"	3¼"

	Seat Angle	Lift	Stem Clearance
All Valves	30°	.257"	.0022"

Tappet Clearance—.006" Intake, .009" Exh. (hot).
Valve Guides:—Pressed in block. Top of guide should be 1" below valve port. Finish ream new guides to inside diameter of .2807-.2817".
Valve Springs:—Free length 1 11/16".

	Pressure	Length
Valve Closed	28 lbs.	1¼"

Valve Lifters:—Plunger type. Operate in individual guides in cylinder block. Guides removable from lower end after block removed from crankcase (retained by flange engaging recess in block). Serviced by installing new lifter and guide assembly.
Lifter Clearance in Guide—.001".

VALVE TIMING:—See Camshaft Setting above.
Intake Valves—Open 19° BTDC. Close 50° ALDC.
Exhaust Valves—Open 57° BLDC. Close 12° ATDC.
To Check Valve Timing—Check tappet clearance #1 intake valve. This valve should open with piston 19° or .1025" before top dead center when point on flywheel 1 5/32" before 'TDC' mark lines up with pointer on flywheel housing.

LUBRICATION:—Pressure system. Vane type oil pump in crankcase (at rear) feeds oil to all main and connecting rod bearings, front and rear camshaft bearings (center camshaft bearing lubricated by splash).
Oil Pump:—Vane type. In crankcase at rear of engine. To remove pump, remove cylinder block from crankcase, take off flat cover on crankcase over oil pump driving gear, pull this gear, remove woodruff key in shaft. Remove oil pan, take out two screws holding oil pump body to crankcase, withdraw oil pump from below. Install pump in same manner.
Normal Oil Pressure:—Over 10 lbs. at 30 M.P.H.
Oil Pressure Regulator:—Spring-loaded ball check valve type located on right hand side of crankcase above pump (in large plug). Not adjustable.
Crankcase Capacity:—6 pints or 3 quarts.

COOLING:—**Circulation**—Thermo-syphon (no pump).
NOTE—When installing lower water connection on left hand side of cylinder block, install shortest screw in rear hole. **Capacity** 6 qts. ('37-38), 4 ('39).

CLUTCH:—**Rockford.** Single plate, dry disc type.
See article in Mechanical Equipment Section for data.
Facings—Molded type, 2 required. 6½" I.D., 8 7/16" O.D., .125" thick. NOTE—Facings are riveted to flywheel and pressure plate (not driven disc).
Adjustment—Clutch pedal free travel should be 2". Adjust by loosening locknut and turning clevis on clutch throw-out link rod.
Removal:—Disconnect drive shaft at front universal flange, remove flywheel housing top cover, take out screws in flywheel housing rear cover, remove rear cover and transmission as a unit. Take out screws in clutch cover around flywheel rim (turn all screws out evenly to relieve pressure), lift clutch out.
NOTE—When installing clutch, turn clutch cover screws in loosely (so that driven disc can be moved by hand), place transmission in position on mounting studs and maneuver driven disc so that clutch shaft enters disc hub and pilot bearing in crankshaft, remove transmission and tighten clutch cover screws securely (do not disturb clutch disc).

TRANSMISSION:—**Warner.** Synchro-mesh, helical gears (second, high), sliding spur gear (low, reverse).
See article in Mechanical Equipment Section for data.
Removal:—Disconnect drive shaft at front universal flange, drop shaft, take off nuts on transmission mounting studs, pull transmission back.
NOTE—If transmission removed for work on clutch, take out rear flywheel cover screws and remove transmission and cover as an assembly.

UNIVERSAL JOINTS:—**Detroit Series 4100.** Roller bearing Ball and Trunnion type, 2 used.
See article in Mechanical Equipment Section for data.

REAR AXLE:—**Spicer Model 10.** Semi-floating, spiral bevel gear type with Hotchkiss drive.
See article in Mechanical Equipment Section for data.
Ratio—5.87-1. **Backlash**—.005".
Removal:—Disconnect drive shaft at rear universal. Disconnect brake cables and shock absorber links. Free spring clips at axle housing (or disconnect spring shackles to remove springs with axle), remove axle assembly from beneath car.
Axle Shaft Removal—Remove wheel, take out four capscrews in bearing retainer flange, remove grease retainer, bearing shims, brake flange. Use axle shaft puller to remove shaft and bearing.
Wheel Bearing Adjustment:—Controlled by shims under bearing retainer at outer end of axle shaft. Remove wheel, take out capscrews in retainer, remove retainer to adjust. Endplay—.008".

SHOCK ABSORBERS:—**Own Make.** Double faced, adjustable, friction disc type. One at front, two at rear.
Servicing:—Center bolt should be removed, lubricated with light oil and replaced at 15,000 mile intervals. To remove center bolts on rear units, disconnect rear spring front shackle bolt. This will allow shock absorber to drop down and provide clearance.
NOTE—To eliminate squeaks in shock absorbers, remove friction disc (after taking out center bolts), clean with a scraper and roughen with tool (do not use emery or sandpaper), oil center bolt when replacing (keep oil off of discs).

STEERING:—**Steering Gear**—Lavine Model A, Worm and Ball type (1937-38), Ross T-12, S-12 Cam-and Lever Type (1939). NOTE—T-12 is Twin-lever type.
See article in Mechanical Equipment Section for data.
Front Suspension:—Conventional, 'I' beam section front axle with transverse spring. Axle positioned by torque arm at each end.
Kingpin Inclination—1½° crosswise.
Toe In—3/32" plus or minus 1/32". Adjusted in usual manner by changing length of tie rod.
Caster—11°. No adjustment provided.
Camber—1½-1¾°. No adjustment provided.

BRAKES:—**Service**—Own make. Four wheel, mechanical type. Hand lever applies all four service brakes.
Drum Diameter—8".
Lining—Semi-molded type. Width 1⅛". Thickness 3/16". Length 17" per wheel.
Hand Brake:—See Service Brakes above.

1938 MODELS

HOOD SIDE PANEL REMOVAL:—Remove panel bolts at body and radiator shell, hood fastener rod screws at radiator shell, and lift panel off.

1939 MODELS

HOOD SIDE PANEL REMOVAL:—Remove bolt at rear upper end of side panel at shroud bracket, loosen front fender to shroud bolts. Remove headlamps by taking out three ⅜" capscrews and two bolts holding side panels to headlamp reinforcement plate. Remove bolts holding side panel to front fender hood side and radiator shell, lift panel out.

1939 MODELS

FRONT END ASSEMBLY:—Radiator shell, fenders, fender skirts and hood sides all bolted together and mounted as one unit as follows: One bolt in center of radiator mounting strap engages slotted hole in front frame cross-member (shims on bolt control height, slotted hole permits entire assembly to be moved fore-and-aft or sideways for alignment). Five bolts on each fender skirt at rear attach assembly to body shroud panel (bolt hole clearance permits assembly to be raised or lowered for alignment). All parts of assembly must be bolted together so that exposed joints are flush.

Alignment—See that radiator to frame bolt (at front), five fender to shroud bolts on each side, and shroud to hood side bracket on each side are loose to permit movement. Install upper hood and hinge assembly leaving front and rear saddle bolts loose. Shift entire front end assembly backward or forward for correct hood opening, adjust height at front end by adding or removing shims on front mounting bolt, adjust height at rear by raising or lowering entire assembly on rear mounting bolts to meet shroud bracket (bend bracket if necessary). Center radiator shell at front hood hinge saddle by loosening strut rods (between shell and fender skirt brace) and bending shell in proper direction (hold in position while tightening strut rods).

Front Fender Removal—May be removed separately as follows: Remove capscrews and nuts at shroud (rear end), remove bolts holding fender skirt and side panel to fender, remove headlamp, remove fender bolts at radiator shell and grille.

1932-35 MODELS

REPLACEMENT ANOLITE PISTONS:—Buick Anolite (aluminum alloy) pistons available for these past models (original equipment cast-iron). Pistons (with pins fitted) furnished in following sizes:

***Series 50 (1932-35)**

Size	Part Number
Standard	1399958
.001" High limit	1399959
.005" Oversize	1399960
.010" Oversize	1399961
.015" Oversize	1399962

*—On 1932-33 models bore must be increased 1/32" to take standard size piston.

Series 80 (1932-33), 90 (1932-35)

Size	Part Number
Standard	1399963
.001" High limit	1399964
.005" Oversize	1399965
.010" Oversize	1399966
.015" Oversize	1399967
.020" Oversize	1399968
.030" Oversize	1399969

***Series 60 (1932-33), 40, 60 (1934-35)**

These models take same size pistons as listed below for Series 40 (1936). See listing below.

*—On Series 60 (1932-33) bore must be increased 1/32" for standard (Original Production) pistons.

1936-39 MODELS

PISTONS (ORIGINAL & REPLACEMENT):—Pistons graded for size in .0003" steps and marked by one or two color marks below pin bosses within piston skirt. Paper sticker on replacement pistons indicates piston size and cylinder bore for which intended. Pistons fitted in .010" oversize blocks are all low limit .010" oversize (see Replacement Piston table). All replacement pistons furnished with pins fitted. See table below for piston size for all bore diameters.

PISTONS (1939):—'Dome head' type pistons have been modified by cutting dome back 1/32" from piston edge, increasing land clearance to .023-.030" (40), .026-.033" (60, 80, 90), and relieving top edge of skirt (at horizontal slot).

NOTE—These pistons used on 1938 engines after Eng. No. 3530562 (40), 3524480 (60, 80, 90).

CYLINDER BORE SIZES:—Original production (new engine) bore size indicated on '37-39 engines by number and color of paint marks on lower crankcase flange, under gasket, in line with each cylinder (not uniform for all cylinders of one block). See table below for sizes and markings. On engines where engine number followed by dash, all cylinders are .010" oversize.

Series 40—Original Production

Piston diam. 3 3/32", #1399803 ('36), 1394063 ('37), 1394421 ('38), 1394590 ('39).

Piston & Engine Mark	Piston Diameter	Cylinder Diameter
1—Yellow	3.0892-3.0895"	3.0910-3.0913"
2—Yellow	3.0895-3.0898"	3.0913-3.0916"
1—Green	3.0898-3.0901"	3.0916-3.0919"
2—Green	3.0901-3.0904"	3.0919-3.0922"
1—White	3.0904-3.0907"	3.0922-3.0925"
2—White	3.0907-3.0910"	3.0925-3.0928"
1—Red	3.0910-3.0913"	3.0928-3.0931"
2—Red	3.0913-3.0916"	3.0931-3.0934"

Series 40—Piston Oversizes

.001" Oversize

#1399852('36), 1394064('37), 1394456('38), 1394591('39).

Piston Marking	Piston Diameter	Cylinder Diameter
1—Red	3.0910-3.0913"	3.0928-3.0931"
2—Red	3.0913-3.0916"	3.0931-3.0934"

.005" Oversize

#1399853('36), 1394065('37), 1394457('38), 1394592('39).

1—Green	3.0948-3.0951"	3.0969-3.0972"
2—Green	3.0951-3.0954"	3.0972-3.0975"
1—White	3.0954-3.0957"	3.0975-3.0978"
2—White	3.0957-3.0960"	3.0978-3.0981"

.010" Oversize

#1399854('36), 1394066('37), 1394458('38), 1394593('39).

1—Green	3.0998-3.1001"	3.1019-3.1022"
2—Green	3.1001-3.1004"	3.1022-3.1025"
1—White	3.1004-3.1007"	3.1025-3.1028"
2—White	3.1007-3.1010"	3.1028-3.1031"

.015" Oversize

#1399855('36), 1394067('37), 1394459('38), 1394594('39).

1—Green	3.1048-3.1051"	3.1069-3.1072"
2—Green	3.1051-3.1054"	3.1072-3.1075"
1—White	3.1054-3.1057"	3.1075-3.1078"
2—White	3.1057-3.1060"	3.1078-3.1081"

.020" Oversize

#1399856('36), 1394068('37), 1394460('38), 1394595('39).

1—Green	3.1098-3.1101"	3.1119-3.1122"
2—Green	3.1101-3.1104"	3.1122-3.1125"
1—White	3.1104-3.1107"	3.1125-3.1128"
2—White	3.1107-3.1110"	3.1128-3.1131"

.030" Oversize

#1399857('36), 1394069('37), 1394461('38), 1394596('39)

1—Green	3.1198-3.1201"	3.1219-3.1222"
2—Green	3,1201-3.1204"	3.1222-3.1225"
1—White	3.1204-3.1207"	3.1225-3.1228"
2—White	3.1207-3.1210"	3.1228-3.1231"

Series 60, 80, 90—Original Production

Piston diam. 3 7/16", #1399804 ('36), 1394070 ('37), 1394422 ('38), 1394597 ('39).

Piston & Engine Mark	Piston Diameter	Cylinder Diameter
1—Yellow	3.4340-3.4343"	3.4360-3.4363"
2—Yellow	3.4343-3.4346"	3.4363-3.4366"
1—Green	3.4346-3.4349"	3.4366-3.4369"
2—Green	3.4349-3.4352"	3.4369-3.4372"
1—White	3.4352-3.4355"	3.4372-3.4375"
2—White	3.4355-3.4358"	3.4375-3.4378"
1—Red	3.4358-3.4361"	3.4378-3.4381"
2—Red	3.4361-3.4364"	3.4381-3.4384"

Series 60, 80, 90—Piston Oversizes

.001" Oversize

#1399858('36), 1394071('37), 1394462('38), 1394598('39).

Piston Marking	Piston Diameter	Cylinder Diameter
1—Red	3.4358-3.4361"	3.4378-3.4381"
2—Red	3.4361-3.4364"	3.4381-3.4384"

.005" Oversize

#1399859('36), 1394072('37), 1394463('38), 1394599('39).

1—Green	3.4396-3.4399"	3.4419-3.4422"
2—Green	3.4399-3.4402"	3.4422-3.4425"
1—White	3.4402-3.4405"	3.4425-3.4428"
2—White	3.4405-3.4408"	3.4428-3.4431"

.010" Oversize

#1399860('36), 1394073('37), 1394464('38), 1394600('39).

1—Green	3.4446-3.4449"	3.4469-3.4472"
2—Green	3.4449-3.4452"	3.4472-3.4475"
1—White	3.4452-3.4455"	3.4475-3.4478"
2—White	3.4455-3.4458"	3.4478-3.4481"

.015" Oversize

#1399861('36), 1394074('37), 1394465('38), 1394601('39).

1—Green	3.4496-3.4499"	3.4519-3.4522"
2—Green	3.4499-3.4502"	3.4522-3.4525"
1—White	3.4502-3.4505"	3.4525-3.4528"
2—White	3.4505-3.4508"	3.4528-3.4531"

.020" Oversize

#1399862('36), 1394075('37), 1394466('38), 1394602('39).

1—Green	3.4546-3.4549"	3.4569-3.4572"
2—Green	3.4549-3.4552"	3.4572-3.4575"
1—White	3.4552-3.4555"	3.4575-3.4578"
2—White	3.4555-3.4558"	3.4578-3.4581"

.030" Oversize

#1399863('36), 1394076('37), 1394467('38), 1394603('39).

1—Green	3.4646-3.4649"	3.4669-3.4672"
2—Green	3.4649-3.4652"	3.4672-3.4675"
1—White	3.4652-3.4655"	3.4675-3.4678"
2—White	3.4655-3.4658"	3.4678-3.4681"

CONTINUED FROM PRECEDING PAGE

1939 MODELS

ROCKER ARMS & COVERS:—Rocker arms are mounted on tubular shaft and held against side of shaft brackets by spring installed on shaft between adjacent rocker arms. Shaft retained in brackets by pilot setscrew installed in top of #2 bracket. When installing rocker arms, make certain that lug on side of arm at adjusting screw end is toward bracket (all rocker arms Series 40, intake rocker arms Series 60, 80, 90). Exhaust rocker arms for Series 60, 80, 90 are straight (no offset) and do not have reference lug.

Rocker Arm Clearance—.002-.004".

Rocker Arm Lubrication Connection:—Metering restriction for oil feed to hollow rocker arm shaft located in cylinder head (can be distinguished from previous threaded sleeve fitting by turning groove on center of hexagonal head) and oil pipe fitted directly into top of #1 bracket. #1 and #2 brackets are same part and shaft pilot screw is self-tapping type. NOTE—This type design used on late 1938 engines.

Rocker Arm Cover:—Covers interchangeable with 1938 except that center stud not used on 1939 engines (plug center stud hole if 1938 cover used on 1939 engine, remove center stud if new cover used on 1938 engine, studs for new cover are ⅜" shorter and must be used with cover).

1937-38-39 MODELS

REPLACEMENT MAIN BEARINGS:—Unfinished—Furnished with .014" (diameter) extra babbitt stock which must be line reamed to size (Tool HM-517).

Finished Sets—Furnished in sets of 5 only which are finish reamed as a set (must not be used singly).

Series 40 (1939) Bearings—The rear main bearing oil seal on 39-40 same as type used on 39-60, 80, 90. Series 40 replacement bearings not interchangeable with 1938 type for this reason (60, 80, 90 bearing sets interchangeable 1937-38-39).

1936-39 MODELS

OIL PUMP (1939):—New type drive. Slot in pump shaft engages tongue on end of distributor shaft (distributor shaft only pinned to drive gear).

Drive Clearances—Drive shaft bearing .001-.0025". Drive gear backlash .003-.005".

Pump Gear Clearances—Idler gear bearing .001-.0025". Backlash .003-.006". End Clearance .0005-.004".

1938 MODELS

CLUTCH PEDAL RETURN SPRING:—Used on 38-60, 80, 90. Over-center type connected to angular link (attached to lower end of clutch pedal) and by eye-bolt and nut to transmission support (60), front frame cross-member (80, 90). Over-center design allows spring pressure to be exerted to help hold pedal down with clutch disengaged and out with clutch engaged. Spring overall length 6 21/32" (60), 8¾" (80, 90).

Adjustment—Angular link self-positioned on pedal shaft. Only adjustment is nut on eye-bolt which must be turned up as far as possible to give proper spring tension of 200 lbs.

IMPORTANT—Spring tension must always be relieved (by backing off eye-bolt nut) before disconnecting clutch linkage.

1939 MODELS

ENGINE & REAR AXLE ALIGNMENT (40, 60):—New type drive (Inclined engine, front propeller shaft, frame mounted Universal Joint Ball) requires that engine and Universal Joint ball alignment must be accurately maintained for smooth and quiet operation. If alignment required by incorrect engine, rear axle, or universal removal, or if new frame installed, align engine as follows (NOTE—frame center-line marked on all frames at bottom rear flange of center cross-member plate).

Engine Installation:—Install engine mountings leaving all bolts finger-tight. Install engine, securely tighten bolts holding front support to front engine mountings, start (do not tighten) bolts holding engine to rear mountings. Attach rear axle to rear of transmission, tighten attaching screws (rear springs must not support car, support axle lightly at ball joint with jack, make certain that upward pressure not sufficient to affect alignment). Shift rear of engine sideways to align center mark on frame with mark on torque ball outer retainer (cold chisel marks), tighten front and rear engine mountings on frame. Check to see that flywheel housing contacts both rear engine mountings (use plain washers as shims, if required, to secure contact), tighten bolts holding engine on rear mountings.

Torque Ball Installation:—Install torque ball mounting assembly (mounting bracket and stud) on each rear leg of frame 'X' member with corrugated side of outer torque ball mounting washer (between frame and retainer) toward frame member. Loosen locknut on outer end of each torque ball mounting stud, adjust studs so that mounting washer is in solid contact with outer torque ball retainer but without exerting any pressure, tighten locknut on each stud partly (do not fully tighten locknut until after nut on opposite end of stud securely tightened). Install inner torque ball mounting washer (corrugated side toward frame member), lockwasher, and nut on each stud (do not tighten nut). Connect rear chassis springs and radius rod, install separate jack directly under each rear spring seat and allow jacks to support full weight of rear end of car. Tighten nuts on inner end of each torque ball mounting stud securely, then tighten torque ball mounting stud locknuts.

1939 MODELS

ENGINE ALIGNMENT (80, 90):—Install and align engine as directed for Series 40, 60 above. Special torque ball installation and alignment procedure not required. See Transmission Steady Rest adjustment directions below.

1938 MODELS

TRANSMISSION STEADY REST MOUNTING:—Transmission support at universal joint housing is part of engine mounting. Consists of cross-member bolted at each end to leg of frame X-member and secured to universal joint housing, together with positioning brace rod secured between support and lower center plate of frame X-member.

Adjustment—Bolt holes in frame and support slotted. Centering shims between frame and support provide adjustment at this point. Center screw (40) and two nuts (60, 80, 90) of support-to-universal joint housing must be tight up against spacer. Support must be adjusted so that no upward tension placed on transmission. Adjust positioning brace rod (nut on rod on each side of support) so that no tension placed on rod.

1939 MODELS

TRANSMISSION STEADY REST (80, 90):—Transmission support at universal joint housing which is part of engine mounting. Consists of cross-member bolted to leg of 'X' member at each end and to universal joint housing at center. A positioning brace rod is connected between the steady rest and the lower center plate of the 'X' member.

Adjustment—Bolt holes in frame and support are slotted and shims installed at each of support for centering. Make certain that shims in place when installing steady rest, tighten nuts on two center bolts up tight against spacer, adjust steady rest so that no upward tension placed on transmission, adjust brace rod so that it is tight with no tension placed on rod.

1937-38-39 MODELS

BRAKE ASSEMBLY REMOVAL FOR WORK ON FRONT SUSPENSION:—To facilitate work and avoid necessity for bleeding wheel cylinder, proceed as follows:

40, 60—Remove wheel, disconnect tie rod ball stud, remove hub and drum assembly, free backing plate and wire assembly to frame (without disturbing brake shoe assembly or brake line).

80, 90—Remove wheel, disconnect tie rod ball stud, loosen one caster adjuster cap screw ½ turn (do not disturb other cap screw), remove upper caster adjuster bolt nut and lower caster adjuster nut, remove complete brake assembly (with steering knuckle, hub, and drum assembly) as a unit, wire assembly to frame.

ENGINE NUMBER:—Stamped on right side of upper crankcase well above oil filler.

ENGINE SPECIFICATIONS:—Eight cylinder 'I' or overhead valve type.
Bore—2 15/16" (50), 3 1/16" (60).
Stroke—4¼" (50), 4⅝" (60).
Displacement—230.4 cu. ins. (50), 272.6 cu. ins. (60).
Rated Horsepower—27.61 (50), 30.2 (60).
Developed Horsepower—At 3200 R.P.M. (50), 3000 R.P.M. (60) for each year and each head as follows:

Model	Comp. Ratio	1932	1933
50	4.84-1	78.5	83
50	5.25-1	82.5	86
60	4.84-1	89	91
60	5.25-1	95	97

Compression Ratio—See table above. Low Comp. head (4.84-1) std. 1932, Optl 1933. High Comp. head (5.25-1) Std. 1933, Optl. 1932. See note below.
Compression Pressure—Approximately 86 lbs. (4.84-1 head), 92 lbs. (5.25-1 head) at cranking speed.
Vacuum Reading—Gauge should show steady reading of 18-20" at idling speed.

CYLINDER HEAD NOTE:—Same head used with thin gasket for high compression, and with special thick gasket (steel spacer insert) for low compression. H.C. engines marked by red label and mark 'HC' on valve rocker cover. Use only 9" wrench in tightening down heads to avoid distorting cylinder bores.

PISTONS:—Light weight cast-iron, relieved at pin bosses. 1933 type electroplated (tin plated) after finishing and cannot be ground. Recondition cylinder bores to take standard oversize pistons. Length 3½" (50), 3 13/32" (60).
Weight—25 ozs. (50), 26¾ ozs. (60).
Removal—Pistons and rods removed from below.
NOTE—Pistons #3 to 8 can be removed without removing counterweights by setting counterweights ahead of piston and rotating shaft as pistons are withdrawn on side opposite camshaft. To remove #1 and #2, take off balancer by taking out castellated nuts and washers on retaining bolts and taking out balancer halves. Do not remove spring banks and seats.
Clearance—.0015" (50), .00175" (60). See Fitting Pistons.
Replacement Pistons:—Finished pistons furnished .001", .005", .010", .015", .030" oversize.
See Buick Special Shop Notes for Replacement Anolite Pistons for use on these models.
Fitting New Pistons:—Use feeler stock ½" wide between piston and cylinder wall to check clearance. Piston should pass through bore of own weight on .00125" (50), .0015" (60) feeler and hold own weight on .002" (50), .00225" (60).
Installing Pistons:—Pin hole in piston offset 3/64". Install pistons with offset toward camshaft.

PISTON RINGS:—Two compression, one oil control ring per piston, all above pin (1932). Additional oil control ring below pin (1933). Oil ring grooves drilled with oil drain holes.

Ring	Width	End Gap	Side Clearance
Comp. (top)	⅛"	.010-.015"	.0015-.003"
Comp. (#2)	⅛"	.010-.015"	.001-.0025"
Oil Control ('32)	3/16"	.007-.015"	.001-.0025"
Oil Control ('33)	5/32"	.007-.015"	.001-.0025"

NOTE—New rings electro-plated in 1933.

PISTON PIN:—Diameter ¾" (50), 13/16" (60). Pin is hollow and is clamped in rod. Pin bosses in piston bronze bushed.
NOTE—Use only 5½" wrench in tightening pin clamp bolt in rod to avoid distorting pin or damaging piston bushings.
Pin Fit in Piston Bushing—.0002-.0004" clearance.

CONNECTING ROD:—Length—9" (50), 9¾" (60).
Weight—32 ozs. (50), 39.5 (60).
Crankpin Journal Diameter—2⅛" (50), 2 3/16" (60).
Lower Bearing—Spun babbitt type integral with rod and cap. Shims used.
Clearance—.001-.002". Sideplay .005-.009".
Adjustment:—Shims provided. Do not file rods or caps.
Installing Rods:—Lower bearings offset. Install rods with mark on cap pointing to nearest main bearing (narrow half of bearing toward main bearing).

CRANKSHAFT:—Five bearing. Bolted counterweights.
Journal Diameters—#1, 2 5/16"; #2, 2⅜"; #3, 2 7/16"; #4, 2½", #5, 2 9/16".
Bearing Type—Removable steel-backed, babbitt-lined.
Clearance—.001-.002".
Adjustment:—Shims provided. Do not file bearing caps. New bearings assembled with .000-.002" projection above face to insure contact and must be line-reamed.
End Thrust:—Taken by center main bearing. End-play .004-.007" total (1/32" clearance at each end for other bearings).

CAMSHAFT:—Five bearing (50), six bearing (60). Helical gear drive.
Bearing Diameters (50)—#1, 2 9/32"; #2, 2 7/32"; #3, 1 59/64"; #4, 1⅞"; #5, 1 21/32".
Bearing Diameters (60)—#1, 2 9/32"; #2, 2 7/32"; #3, 2 5/32"; #4, 2 3/32"; #5, 2 1/32"; #6, 1 21/32".
Bearing Type—Removable steel-backed, babbitt-lined bushings.
Clearance—.0005-.0025"(front), .0005-.0035"(others).
Timing Gears:—Crankshaft gear Steel. Camshaft gear Textolite. Backlash between gears .0005-.0015".
NOTE—Camshaft gears marked +1S furnished for service which are .001" thicker on pitch circle and will reduce backlash by this amount. If backlash is excessive after installation of this gear, replace both gears as a set.
Camshaft Setting:—Gears are marked. Mesh marked tooth opposite marked space on other gear.

VALVES:—	Head Dia.	Stem Dia. '32	Stem Dia. '33
Intake (50)	1 15/32"	.3407-.3417"	same
Exhaust(50)	1 11/32"	.3392-.3402"	.3403-.3411"
Intake (60)	1 9/16"	.3715-.3725"	same
Exhaust (60)	1 7/16"	.370 -.371 "	.3711-.3719"

	Seat Angle	Lift	Stem Clearance
Intake (50)	45°	.340"	.0015-.0035"
Exhaust (50)	45°	.340"	.003 -.005 "
Intake (60)	45°	.335"	.0015-.0035"
Exhaust (60)	45°	.335"	.003 -.005 "

Tappet Clearance—.008" all valves, engine hot.

Valve Springs:—Double springs used on all valves. Pressure for each spring as follows:

Model	Valve Closed	Valve Open
50 (inn.)	7½-12½ lbs.@1 13/16"	25-30 lbs.@1 15/32"
50 (out.)	25-30 lbs.@1 15/16"	74-80 lbs.@1 19/32"
60 (in.)	11½-16½ lbs.@1 21/32"	49-55 lbs.@1 5/16"
60 (out.)	28-33 lbs.@1 15/16"	82-89 lbs.@1 19/32"

Valve Timing:—See Camshaft Setting above.

Opening and Closing Points
Intake Valves—Open 13½° BTDC Close 65°46' ALDC
Exhaust Valves—Open 68½° BLDC Close 43½° ATDC

Timing Points
Intake Valves—Open 4½° BTDC Close 54° ALDC
Exhaust Valves—Open 58° BLDC Close 30° ATDC
NOTE—Timing point indicates valve .004" off seat with .008" tappet clearance.
To Check Valve Timing—Set up micrometer gauge over #2 or #7 exhaust valve so as to measure valve movement. Check tappet clearance. Valve should be .180" open with pistons #1 and 8 on top dead center.

LUBRICATION:—Pressure type. Gear type oil pump mounted in crankcase. Oil temperature regulator mounted on right hand side of crankcase.
Normal Oil Pressure—35 pounds.
Oil Pressure Relief Valve—On oil pump. Not adjustable. Operates at 35 lbs. Second non-adjustable by-pass valve located in temperature regulator.
Crankcase Capacity—(50) 9 qts. (dry), 7 qts. (refill). (60) 11½ qts. (dry), 8 qts. (refill).

CLUTCH:—Own Make. Single plate, dry disc type with 'Wizard' automatic clutch control. See article in Clutch Section for relining and assembling directions.
Facings—Moulded and woven type, 2 required. Thickness .135". Inside Diameter 6¼". Outside Diameter 9½" (50), 9⅞" (60).
Adjustment (50)—Free movement of clutch pedal should be 1". Adjust whenever this is less than ¾". To adjust, loosen locknut and turn adjusting screw on clutch link at rear of clutch pedal shaft.
Adjustment (60)—Clearance between pedal and underside of toeboard should be ¼". To adjust, loosen locknut and turn stopscrew at lower end of pedal behind shaft. Free movement of pedal should be 1". To adjust, turn nut on forward end of clutch release rod at release fork.

STEERING:—Steering Gear:—Jacox Worm-and-Sector type (50), Worm-and-Roller type (60). See article in Steering Section for complete adjustment instructions.
Front Suspension:—Conventional 'I' beam section front axle with Reverse Elliott ends and semi-elliptic springs.
Kingpin Inclination—9½° (50), 8° (60) crosswise.
Caster—1½-2°. Correct by inserting wedge shims between spring and spring pad on axle. Shims furnished ½° (220408), ¾° (188128), 1° (220409).
Camber—1-2°. No adjustment.
Toe In—5/32-7/32" measured at center of tire tread. Model 50 adjusted in usual manner by loosening clamp bolts and turning tie rod. Model 60 tie rod has right hand threads on both ends and is adjusted by turning rod in or out of one end socket.
Steering Shock Eliminator—Should be adjusted so that distance from front face of spring horn (under bolt head) to rear face of washer under nut is 3 17/32".

BRAKES:—Service—Own Make. 'Controlled Servo' four wheel mechanical type. Hand lever applies all four service brakes. See article in Brake Section for complete adjustment instructions.
Drum Diameter—12" (50), 14" (60).
Lining—Width 1¾". Thickness 3/16". Length per wheel one piece 6 15/32", one piece 12 9/16" (50); one piece 7 49/64", one piece 14 27/64" (60) per wheel.
Hand Brake Adjustment:—See Service Brakes above.

ENGINE NUMBER:—Stamped on right side of upper crankcase wall above oil filler.

ENGINE SPECIFICATIONS:—Eight cylinder, 'T' or overhead valve type.
Bore—3 5/16". **Stroke**—5".
Displacement—344.8 cubic inches.
Rated Horsepower—35.12.
Developed Horsepower—For each year and head as follows:

Comp. Ratio	R.P.M.	1932	1933
L.C.—4.40-1	2900	104 HP	105 HP.
H.C.—4.80-1	3200	113 HP	113 H.P.

Compression Ratio—See table above. Low compression head (4.40-1) standard 1932, Optl. 1933. High compression head (4.84-1) standard 1933, Optl. 1932. See note below.
Compression Pressure—Approximately 80 lbs. (4.40 head), 86 lbs. (4.84 head) at cranking speed.
Vacuum Reading—Gauge should show steady reading of 18-20" at idling speed.

CYLINDER HEAD NOTE:—Same head used with thin gasket for high compression, and with special thick gasket (steel spacer insert) for low compression. H.C. engines marked by red label and mark 'HC' on valve rocker cover. Use only 9" wrench in tightening down heads to avoid distorting cylinder bores.

PISTONS:—Light weight cast-iron, relieved at pin bosses. 1933 type electroplated (tin-plated) after finishing and cannot be ground. Recondition cylinder bores to take standard oversize pistons. Length 3 29/32".
NOTE—Buick Anolite (aluminum alloy) pistons available for use on these models.
Weight—30½ ozs.
Removal—Pistons and rods removed from below.
NOTE—Pistons #3 to 8 can be removed without removing counterweights by setting counterweights ahead of piston and rotating shaft as pistons are withdrawn on side opposite camshaft. To remove #1 and #2, take off balancer by taking out castellated nuts and washers on retaining bolts and taking out balancer halves. Do not remove spring banks and seats.
Clearance—.002". See Fitting pistons.

Replacement Pistons:—Finished pistons furnished .001", .005", .010", .015", .030" oversize.
See Buick Special Shop Notes for Replacement Anolite Pistons for use on these models.

Fitting New Pistons:—Use feeler stock ½" wide between piston and cylinder wall to check clearance. Piston should pass through bore of own weight on .0015" feeler and hold own weight on .00225".

Installing Pistons:—Pin hole in piston offset 3/32". Install pistons with offset toward camshaft.

PISTON RINGS:—Two compression, one oil control ring per piston, all above pin (1932). Additional oil control ring below pin (1933). Oil ring grooves drilled with oil drain holes.

Ring	Width	End Gap	Side Clearance
Comp (top)	⅛"	.010-.015"	.0015-.003"
Comp. (#2)	⅛"	.010-.015"	.001-.0025"
Oil Contr. ('32)	3/16"	.007-.015"	.001-.0025"
Oil Contr. ('33)	5/32"	.007-.015"	.001-.0025"

NOTE—New rings electro-plated in 1933.

PISTON PIN:—Diameter ¾" (50), 13/16" (60). Pin is hollow and is clamped in rod. Pin bosses in piston bronze bushed.
NOTE—Use only 5½" wrench in tightening pin clamp bolt in rod to avoid distorting pin or damaging piston bushings.
Pin Fit in Piston Bushings—.0002-.0004" clearance.

CONNECTING ROD:—Length 11".
Weight—49½ ozs.
Crankpin Journal Diameter—2⅜".
Lower Bearing—Spun babbitt type integral with rod and cap. Shims used.
Clearance—.001-.002". Sideplay .005-.009".

Adjustment:—Shims provided. Do not file rods or caps.

Installing Rods:—Lower bearings offset. Install rods with mark on cap pointing to nearest main bearing (narrow half of bearing toward main bearing).

CRANKSHAFT:—Five bearing. Bolted counterweights.
Journal Diameters—#1, 2 9/16"; #2, 2⅝"; #3, 2 11/16"; #4, 2¾"; #5, 2 13/16".
Bearing Type—Removable steel-backed, babbitt-lined.
Clearance—.001-.002".

Adjustment:—Shims provided. Do not file bearing caps. New bearings assembled with .000-.002" projection above face to insure contact and must be line-reamed.

End Thrust:—Taken by center main bearing. End-play .004-.007" total (1/32" clearance at each end for other bearings).

CAMSHAFT:—Six bearing, Helical gear drive.
Bearing Diameters—#1, 2 9/32"; #2, 2 7/32"; #3, 2 5/32"; #4, 2 3/32"; #5, 2 1/32"; #6, 1 21/32".
Bearing Type—Removable steel-backed, babbitt-lined bushings.
Clearance—.0005-.0025"(front), .0005-.0035"(others).

Timing Gears:—Crankshaft gear Steel. Camshaft gear Textolite. Backlash between gears .0005-.0015".
NOTE—Camshaft gears marked +1S furnished for service which are .001" thicker on pitch circle and will reduce backlash by this amount. If backlash is excessive after installation of this gear, replace both gears as a set.

Camshaft Setting:—Gears are marked. Mesh marked tooth opposite marked space on other gear.

VALVES:—

	Head Diam.	Stem Diam '32	Stem Diam. '33
Intake	1 25/32"	.3715-.3725"	same
Exhaust	1 19/32"	.370 -.371 "	.3711-.3719"

	Seat Angle	Lift	Stem Clearance
Intake	45°	.340"	.0015-.0035"
Exhaust	45°	.340"	.003 -.005"

Tappet Clearance—.008" all valves, engine hot.

Valve Springs:—Double springs used on all valves. Pressure for each spring as follows:

Model	Valve Closed	Valve Open
(Inner)	11½-16½ lbs.@1 21/32"	49-55 lbs.@1 5/16"
(Outer)	28-33 lbs.@1 15/16"	82-89 lbs.@1 19/32"

Valve Timing:—See Camshaft Setting above.

Opening & Closing Points		
Intake Valves	Open 13½° BTDC.	Close 65°46' ALDC
Exh. Valves	Open 68½° BLDC.	Close 43½° ATDC

'Timing' Points		
Intake Valves	Open 4½° BTDC.	Close 54° ALDC
Exh. Valves	Open 58° BLDC.	Close 30° ATDC

NOTE—Timing point indicates valve .004" off seat with .008" tappet clearance.

To Check Valve Timing—Set up micrometer gauge over #2 or #7 exhaust valve so as to measure valve movement. Check tappet clearance. Valve should be .180" open with pistons #1 and 8 on top dead center.

LUBRICATION:—Pressure type. Gear type oil pump mounted in crankcase. Oil temperature regulator mounted on right hand side of crankcase.
Normal Oil Pressure—35 lbs.
Oil Pressure Relief Valve—On oil pump. Not adjustable. Operates at 35 lbs. Second non-adjustable by-pass valve located in temperature regulator.
Crankcase Capacity—12½ qts. (dry), 9 qts. (refill).

CLUTCH:—Own make. Double plate, dry disc type with 'Wizard' automatic clutch control. See article in Clutch Sect. for relining and assembling directions.
Facings—Woven type, 4 required. Thickness .135". Inside Diameter 6½". Outside diameter 9".
Adjustment—Clearance between pedal and underside of toeboard should be ¼". To adjust, loosen locknut and turn stopscrew at lower end of pedal behind shaft. Free movement of pedal should be 1". To adjust, turn nut on forward end of clutch release rod at release fork.

STEERING:—**Steering Gear.** Saginaw Worm-and-Roller type.
See article in Mechanical Equipment Section for data.
Front Suspension:—Conventional 'T' beam section front axle with Reverse Elliott ends and semi-elliptic springs.
Kingpin Inclination—8° crosswise.
Caster—1½-2°. Correct by inserting wedge shims between spring and spring pad on axle. Shims furnished ½° (220408), ¾° (188128), 1° (220409).
Camber—1-2°. No adjustment.
Toe In—5/32-7/32" measured at center of tire tread. Tie rod has right hand threads on both ends and is adjusted by turning rod in or out of one end socket.
Steering Shock Eliminator—Should be adjusted so that distance from front face of spring horn (under bolt head) to rear face of washer under nut is 3 17/32".

BRAKES:—**Service**—Own Make. 'Controlled Servo' four wheel mechanical type. Hand lever applies all four service brakes. See article in Brake Section for complete adjustment instructions.
Drum Diamter—15".
Lining—Width 2". Thickness 3/16". Length per wheel one piece 15 27/64", one piece 8¼".
Hand Brake:—See Service Brake Adjustment.

SERIAL NUMBER:—First number, 2,777,650. On right front side of frame front cross member.

ENGINE NUMBER:—Stamped on right side of crankcase above oil filler.

ENGINE:—**Own Model 40.** Eight cylinder, In line, 'I' or overhead valve type.
Bore—3 3/32". **Stroke**—3⅞".
Piston Displacement—233 cubic inches.
Rated Horsepower—30.63.
Developed Horsepower—93 at 3200 R.P.M.
Compression Ratio—5.45-1. No optional ratios.
Compression Pressure—121 lbs. at 1000 R.P.M. or 100 lbs. at cranking speed (100 R.P.M.).

Pistons:—Electro-plated cast-iron. Pistons are tin-plated after finishing and cannot be ground. Refinish cylinders to take replacement pistons furnished .001", .005", .010", .015", .020", .030" oversize. *See Buick Special Shop Notes for Replacement Anolite Pistons for use on these models.*
Weight—26.0 ozs (stripped), 32.8 ozs. (with rings, pin, and pin bushings).
Removal—Pushrods must be removed before head can be taken off. Pistons and rods removed from above.
Clearance—.0075" top. .00175" bottom.
Fitting New Pistons—Use feeler stock ½" wide. Piston should pass through cylinder of own weight with .0015" feeler and should hold own weight with .00225" feeler.
Installing Pistons—Pin hole in piston offset 3/64". Install pistons with offset toward camshaft side

Piston Rings:—Four rings per piston, two compression rings, one oil control ring above piston pin, one oil control ring below pin. Both oil ring grooves drilled radially with ten ⅛" drain holes.

Ring	Width	End Gap	Wall Thickness	Side Clearance
Comp. (top)	⅛"	.010-.015"	.140"	.0015-.003"
Comp. (lower)	⅛"	.010-.015"	140"	.001-.0025"
Oil Cont. (all)	5/32"	.010-.018"	.135"	.001-.0025"

Piston Pin:—Diameter 13/16". Length 2 11/16". Pin is clamped in rod. Pin bosses in piston are bronze-bushed.
Clearance in Piston Bushings—.0003-.0005" radial.
NOTE—Use only 5½" wrench in tightening pin bolt to avoid damage to hollow pin.

Connecting Rod:—Weight 27.0 ozs. Length 7¼"
Lower Bearing Diameter—2".
Lower Bearing—Spun-babbittt lined type.
Clearance—.001-.002". Sideplay .005-.008".
Adjustment—Shims. Do not file bearing caps.

Installing Rods—Assemble rods with marks on rods and caps together and pointing toward rear of engine.
NOTE—Ground bolts used for cap and rod assembly and must not be replaced by any other type bolt. 45° rod caps used on '34 models only.

Crankshaft:—Five bearing type. Integral counterweights.
Journal Diameters—#1, 2 5/16"; #2, 2⅜"; #3, 2 7/16"; #4 2½"; #5 2 9/16".
Bearing Type—Steel-backed, babbitt-lined. Bearings are dowelled in crankcase and cap and are assembled with .000-.002" projection above cap and crankcase to insure contact. New bearings should be line-reamed after installing.
Clearance—.001-.002". 1/32" clearance at each end (except #3).
Adjustment—Shims provided. Do not file caps.
End Thrust—Taken by #3 (center) bearing. Endplay .004-.007".

Camshaft:—Five bearings. Non-adjustable chain drive.
Journal Diameters—#1 2 1/32"; #2 2"; #3 1 31/32"; #4 1 15/16"; #5 1 21/32".
Bearing Type—Steel-backed, babbitt-lined.
Clearance—(#1) .0005-.0025"; (all others) .0005-.0035"; Endplay .002-.006" (all bearings).
Timing Chain—Morse '34, Link Belt '35, Width 1". Pitch .500". Length 25" or 49 links.
Camshaft Setting—Both sprockets marked at space between teeth. Two teeth on chain also marked. Mesh chain so that marked tooth is opposite marked space on each sprocket.

Valves:	Head dia.	Stem Dia.	Seat Angle
Intake	1 17/32"	.3715-.3725"	45°
Exhaust	1 11 /32"	.3711-.3719"	45°

	Valve Lift	Stem Clearance
Intake	.334"	.0015-.0035"
Exhaust	.339"	.0021-.0039"

NOTE—Exhaust valve stems are copper-plated.

Tappet Clearance—.008" all valves—engine hot.

Valve Springs—Double springs used on all valves.

Pressure	Inner Springs	Length
Valve Closed—20-25 lbs.		**1 21/32"**
Valve Open—55-61 lbs.		1 5/16"

Pressure	Outer Springs	Length
Valve Closed—35-40 lbs.		**1 15/16"**
Valve Open—96-103 lbs.		**1 19/32"**

	Total Spring Pressure	Length
Valve Closed	55-65 lbs.	1 15/16"
Valve Open	151-164 lbs.	1 19/32"

Valve Timing—See camshaft setting above.
Intake Valves—Open 4½° BTDC. Close 54° ALDC.
Exhaust Valves—Open 57½° BLDC. Close 21° ATDC
NOTE—Above figures represent 'timing points'

To Check Valve Timing—Set up micrometer gauge over #2 or #7 exhaust valve so as to measure valve opening (gauge rod should rest on valve spring cap). Valve should be .163" open when dead center mark for pistons #1 and 8 is visible in flywheel inspection hole.

Lubrication:—Pressure type. Gear type oil pump located in crankcase.
Normal Oil Pressure—35 lbs.
Oil Pressure Relief Valve—Operates at 35 lbs. No adjustment.
Oil Pump Gear Clearances—.003-.006" (back lash), .0005-.004" (end clearance).
Capacity and Oil—7 qts. (dry), 6 qts. (refill). Use SAE. #30 (100 to 30°F.), #20-W (30 to 0°F.), #10-W (0° to —15°F.).

CLUTCH:—**Own Make.** Single plate, dry disc type. No adjustment required for wear.
See article in Mechanical Equipment Section for data.
Clutch Pedal Adjustment—Free movement or lash of clutch pedal should be 1". To adjust, turn nut on clutch release yoke.
Clutch Facings—Molded asbestos. 2 required, 6⅛" I.D., 9⅜" O.D., .130-.136" thick.
NOTE—Driven disc is segmented and care must be taken not to distort disc in removing and installing facings. Driven disc assembly should be balanced to with in ¼" ounce (static) with new facings by grinding outer edge of disc. Release lever heights must be equal within .005".

STEERING:—**Front Suspension**—Independent, linked parallelogram type with coil springs.
See article in Mechanical Equipment Section for data.
Caster—2¾-3¼° with car weight on wheels. See note below for preliminary checks. Toe-in must be adjusted first. To adjust caster, loosen nuts on upper adjuster bolt and adjuster shaft (on inner side of steering knuckle support, back off locknuts on adjustment screws at top of steering knuckle support (these screws bear against caster adjustment bolt). Turn rear adjusting screw out (counter-clockwise) and front screw in (clockwise) an equal amount to increase caster angle, or turn rear adjusting screw in (clockwise) and front screw out (counter-clockwise) to decerease caster angle. Adjustment range is 6°. Both screws must be tight against adjuster bolt. Tighten adjusting screw locknuts, adjuster bolt nut, and adjuster shaft nut. One turn of adjusting screws changes caster angle 1°.
Camber—¼° with car weight on wheels. See note below. No adjustment provided.
Toe In—⅛-3/16". Roll car ahead one complete revolution before checking toe-in. Adjust by changing length of each tie rod equally. With wheels in straight-ahead position, intermediate steering arm must be midway between rear lower support arm bolts. Correct by equalizing length or tie rods, check toe-in, and steering wheel position. Turning tie rods ⅛ turn changes toe-in 5/64".
NOTE:—All front wheel checks should be made with frame height corrected (by adding load or or raising frame) to following figures:
Distance from bumper seat on frame front cross member to top of lower support arm, 4 9/16"
Distance from frame to top of spring clip at rear—4 dr. Sedan and 2 dr. Sedan, 6⅞" with spare at rear or 7¼" with fender wells. Coupes, 6¼" with spare tire at rear or 6⅝" with fender wells.
Steering Gear:—Saginaw Worm-and-Roller type with center steering. See article in Steering Section for adjustments.

BRAKES:—**Service**—Bendix mechanical, Duo-Servo, single anchor type. Hand lever applies all four service brakes. See article in Brake Section for complete adjustment procedure.
Drum Diameter—12". Pressed steel type.
Lining—Moulded. Width 1¾". Thickness 3/16". Length 25⅞" per wheel.
Clearance—.010" at heel and toe of each shoe.

SERIAL NUMBER: — First number, 2,706,453 ('34), 2,777,650 ('35). On right frame side rail in front of shock absorber.

ENGINE NUMBER:—Stamped on right upper crankcase wall above oil filler.

ENGINE:—**Own Model 50.** Eight cylinder, In line, 'I' or overhead valve type.
Bore—2 31/32". **Stroke**—4¼"
Piston Displacement—235.3 cubic inches.
Rated Horsepower—28.2.
Developed Horsepower—88 at 3200 R.P.M.
Compression Ratio—5.25-1. No optional ratios.
Compression Pressuse—114 lbs. at 1000 R.P.M. or 97 lbs. at cranking speed (135 R.P.M.).

Pistons:—Electro-plated, cast-iron. Pistons are tin-plated after finishing and cannot be ground. Refinish cylinders to take replacement pistons furnished .001", .005", .010", .015", .020", .030" oversize. Length, 3½".
See Buick Special Shop Notes for Replacement Anolite Pistons for use on these models.
Weight—25.0 ozs. (stripped), 31.2 ozs. (with rings, pin, and bushings).
Removal—At bottom of engine. Remove pistons #3 to 8 on side opposite camshaft without removing counterweights by setting counterweights ahead of piston and rotating shaft as pistons are removed Take off balancer by removing castellated nuts and washers on retaining bolts and slipping off balancer halves as shaft is rotated before removing #1 and 2 pistons. Do not remove spring banks and seats from balancer halves.
Clearance—.0077" top, .0017" bottom.
Fitting New Pistons—Use feeler stock ½" wide. Piston should pass through cylinder of its own weight with .00125" feeler and hold its own weight with .002" feeler.
Installing Pistons—Pin hole in piston offset 3/64". Install pistons with offset toward camshaft side.

Piston Rings:—Four rings per piston, two compression rings, one oil control ring above pin, one oil control ring below pin. Both oil ring grooves drilled radially with ten ⅛" oil drain holes.

Ring	Width	End Gap	Wall Thickness	Side Clearance
Comp. Top	⅛"	.010-.015"	.130"	.0015-.003"
Comp.Lower	⅛"	.010-.015"	.130"	.001-.0025"
Oil Cont. All	5/32"	.010-.018"	.130"	.001-.0025"

Piston Pin:—Diameter ¾". Length 2 17/32". Pin is clamped in rod. Pin holes in piston bronze-bushed.
Clearance in Piston Bushings—.0003-.0005".
NOTE—Use only 5½" wrench in tightening pin bolt to avoid damage to hollow pin.

Connecting Rod:—Weight 32 ozs. Length, 9".
Lower Bearing Diameter—2⅛".
Lower Bearing—Spun-babbitt lined type.
Clearance—.001-.002": Sideplay, .005-.008".
Adjustment—Shims. Do not file bearing caps.
Installing Rods—Connecting rod lower bearings offset. Assemble rods with marks on caps pointing toward nearest main bearing.
NOTE—Ground bolts used for cap and rod assembly and must not be replaced by any other type bolt.

Crankshaft:—Five bearing type. Bolted-on counterweights.
Journal Diameters—#1, 2 5/16"; #2 2⅜"; #3 2 7/16"; #4 2½"; #5 2 9/16".
Bearing Type—Steel-backed, babbitt-lined type. Bearings are dowelled in crankcase and cap and are assembled with .000-.002" projection above cap and crankcase to insure contact. New bearings should be line-reamed after installing.
Clearance—.001-.002". 1/32" clearance at each end (except #3).
Adjustment—Shims provided. Do not file caps.
End Thrust—Taken by #3 (center bearing. Endplay, .004-.007".

Camshaft:—Five bearing. Helical gear drive.
Journal Diameters—#1 2 9/32"; #2 2 7/32"; #3 1 59/64"; #4 1⅞"; #5 1 21/32".
Bearing Type—Steel-backed, babbitt-lined type.
Clearance—(#1) .0005-.0025"; (all others) .0005-.0035"; endplay (all bearings) .002-.006".
Timing Gears—Crankshaft and generator gears Steel. Camshaft gear Textolite.
Gear Backlash—.0005-.0015" for new gears.
Adjustment—Install '+1S' replacement camshaft gear (with teeth .001" thicker on pitch circle) when backlash exceeds .0015". If lash is still excessive, install complete set new gears.
Camshaft Setting—Gears are marked. Mesh marked tooth opposite marked space between teeth.

Valves:—	Head Dia.	Stem Dia.	Seat Angle
Intake	1 15/32"	.3407-.3417"	45°
Exhaust	1 11/32"	.3403-.3411"	45°

	Valve Lift	Stem Clearance
Intake	.340"	.0007-.0015"
Exhaust	.340"	.0010-.0019"

NOTE—Exhaust valve stems are copper-plated.

Tappet Clearance (Lash)—.008" hot (all valves).
Valve Springs—Double springs on all valves.

	Total Spring Pressure	Length
Valve Closed	45-55 lbs.	1 15/16"
Valve Open	132-145 lbs.	1 19/32"

Valve Timing—See Camshaft Setting above.
Intake Valves open 4½° BTDC. Close 54° ALDC.
Exhaust Valves open 58° BLDC. Close 30° ATDC.
NOTE:—Above figures represent 'timing' points

To Check Valve Timing—Set up micrometer gauge over #2 or #7 exhaust valve so as to measure valve movement (gauge rod should rest on valve spring cap). Set tappet clearance at .008". Valve should be .180" open when dead center mark for pistons #1 and 8 is visible in inspection hole.

Lubrication:—Pressure type. Gear type pump located in crankcase.
Oil Pressure—35 lbs.
Oil Pressure Relief Valve—Not adjustable. Operates at 35 lbs.
Capacity and Oil—9 quarts (dry), 7 quarts (refill). Use SAE. #40 (100°F. and above), #30 (100°-30°F.), #20 (30°-0°F.), #10 (0° to —15°F.).

CLUTCH:—**Own Make.** Single plate, dry disc type. No adjustment required for wear.
See article in Mechanical Equipment Section for data.
Clutch Pedal Adjustment—Free movement or lash of clutch pedal should be 1". Adjust by turning nut on forward end of clutch release rod. Clearance between pedal and under side of toeboard should be ⅛". Adjust by turning stopscrew at rear of clutch pedal shaft.
Clutch Facings—Woven type, 2 required. 6¼" I.D., 9½" O.D., .130-.135" thick.
NOTE:—When replacing linings, driven plate assembly should be balanced within ¼ oz. (static) by grinding outer edge of disc. Release lever height must be equal within .005". Use J-285B gauge plate in setting up levers.

STEERING:—**Front Suspension**—Independent, linked parallelogram type with coil springs.
See article in Mechanical Equipment Section for data.
Kingpin Inclination—4°53' crosswise.
Caster—1¾-2¼° with car weight on wheels. See note below for preliminary checks. Toe In must be correct. To adjust caster, loosen nuts holding upper and lower knuckle support yokes to outer ends of control arms, loosen clampbolt on top of knuckle support, turn upper support bolt clockwise (facing forward—head of bolt to rear) to increase caster angle, or counter-clockwise to decrease caster angle. Tighten clamp bolt, tighten upper and lower yoke retaining nuts. Turning support bolt three complete turns will change caster angle 1°. Caster of both front wheels must be equal within ⅛°.
Camber—¼° with car weight on wheels. See note below. To adjust, insert special washers between upper knuckle support yoke and upper control arm to increase camber, or between lower knuckle support yoke and lower control arm to decrease camber. A 1/16" washer will change camber 1/3°.
Toe In—5/32-7/32". Roll car ahead one complete revolution of wheels before checking toe in. Adjust by changing length of each tie rod equally. With wheels in straight-ahead position, intermediate steering arm must be midway between rear lower support arm bolts. Correct by equalizing length of the tie rods, recheck toe-in, and steering wheel position. Turning tie rod ⅛ turn changes toe-in 1/16".
NOTE—All front wheel checks should be made with frame height correct (distance from top of jack pad to lower face of frame cross member must be equal within 1/64" on both sides of car.

Steering Gear:—Saginaw Worm-and-Roller type with center steering. See article in Steering Section for adjustments.

BRAKES:—**Service**—Own make. Internal-expanding, self-energizing, mechanically operated, vacuum power type. Hand lever applies all four service brakes. See article in Brake Section.
Drum Diameter—12". Cast-iron.
Lining—Woven and Moulded. Width 1¾". Thickness 3/16". Length 25⅛" per wheel.
Hand Brake Adjustment:—See Service Brakes.
Power Unit:—Own make. Consists of (1) vacuum control valve (mounted on inner side of left frame side member below brake pedal) linked to brake pedal pull rod and (2) power cylinder (mounted on right side of flywheel housing) linked directly to brake cross shaft rod operating front and rear wheel brakes. See article in Brake Section.

SERIAL NUMBER:—First number, 2,706,453 ('34), 2,777,650 ('35). On right frame siderail in front of front shock absorber.

ENGINE NUMBER:—Stamped on right side of upper crankcase wall above oil filler.

ENGINE:—**Own. Models 60 and 90.** Eight cylinder, In line, 'I' or overhead valve type.

Bore & Stroke—3 3/32 x 4⅝" (60), 3 5/16 x 5" (90).

Displacement—278.1 (60), 344.8 (90) cubic inches

Rated Horsepower—30.63 (60), 35.12 (90).

Developed Horsepower—100 (60), 116 (90) at 3200 R.P.M.

Compression Ratio—5.25-1 (60), 4.95-1 (90).

Compression Pressure—114 lbs. (60), 103 lbs. (90) at 1000 R.P.M. or 114 lbs. (60), 95 lbs. (90) at cranking speed (120 R.P.M.).

Pistons:—Electro-plated cast-iron. Pistons are tin-plated after finishing and cannot be ground. Refinish cylinders to take replacement pistons furnished .001", .005", .010", .015", .020", .030" oversize. Piston length, 3 13/16" (60), 3 29/32" (90).

See Buick Special Shop Notes for Replacement Anolite Pistons for use on these models.

Weight—26.7 ozs. (60), 30.4 ozs. (90) stripped or 33.6 ozs. (60), 38.4 ozs. (90) with rings, pin and bushings.

Removal—At bottom of engine. Remove pistons #3 to 8 on side opposite camshaft without removing counterweights by placing adjacent counterweights ahead of pistion and revolving shaft as piston is withdrawn. Take off balancer by removing castellated nuts and washers and slipping off balancer halves as shaft is rotated before taking out pistons #1 and 2. Do not remove spring banks and seats from balancer halves.

Clearance—Top .0075" (60), .0097" (90), Bottom .00175" (60), .002" (90).

Fitting New Pistons—Use feeler stock ½" wide. Piston should pass through cylinder of own weight with .0015" feeler and hold own weight with .00225" feeler.

Installing Pistons—Pin hole in piston offset 3/64" (60), 3/32" (90). Install pistons with offset toward camshaft side.

Piston Rings:—Four rings per piston, two compression rings, one oil control ring above pin, one oil ring below pin. Both oil ring grooves drilled radially with ten ⅛" oil drain holes.

Ring	Width	End Gap	Wall Thickness	Side Clearance
Comp. Top	⅛"	.010-.015"	.140"	.0015-.003"
Comp. Lower	⅛"	.010-.015"	.140"	.001-.0025"
Oil Cont. (60)	5/32"	.010-.018"	.135"	.001-.0025"
Oil Cont. (90)	5/32"	.010-.018"	.145"	.001-.0025"

Piston Pin:—Diameter 13/16" (60), ⅞" (90). Length 2 11/16" (60), 2 27/32" (90). Pin is clamped in rod. Pin holes in piston are bronze-bushed.

Clearance in Piston Bushing—.0003-.0005".

NOTE—Use only 5½" wrench in tightening pin bolt to avoid damage to hollow pin.

Connecting Rod:—Weight 39.65 ozs. (60), 49.5 ozs. (90). Length 9¾" (60), 11" (90).

Lower Bearing Diameter—2 3/16" (60), 2⅜" (90).

Lower Bearing Type—Spun-babbitt lined type.

Clearance—.001-.002". Sideplay, .005-.008".

Adjustment—Shims. Do not file bearing caps.

Installing Rods—Lower bearings are offset. Assemble rods with marks on rods and caps toward nearest main bearing.

NOTE—Ground bolts used for cap and rod assembly and must not be replaced by any other type bolt.

Crankshaft:—Five bearings. Bolted-on counterweights.

Journal Diameters—(60) #1 2 5/16", #2 2⅜", #3 2 7/16", #4 2½", #5 2 9/16". (90) #1 2 9/16", #2 2⅝", #3 2 11/16", #4 2¾", #5 2 13/16".

Bearing Type—Steel-backed, babbitt-lined type.

Clearance—.001-.002". 1/32" clearance at each end (except #3).

Adjustment—Shims. Do not file bearing caps.

End Thrust—Taken by #3 (center) bearing. End-play .004-.007".

Camshaft:—Six bearings. Helical gear drive.

Bearing Type—Steel-backed, babbitt-lined type.

Clearance—(#1) .0005-.0025"; (all others) .0005-.0035"; (endplay—all bearings) .002-.006".

Timing Gears—Crankshaft and generator gears Steel. Camshaft gear Textolite.

Gear Backlash—.0005-.0015" for new gears.

Adjustment—Install '+1S' replacement camshaft gear (with teeth .001" thicker on pitch circle when backlash exceed .0015". If lash is still excessive, install complete set of new gears.

Camshaft Setting—Gears are marked. Mesh marked tooth opposite marked space between teeth.

Valves:—

Engine	Head Diameter	Stem Diameter
60—Intake	1 9/16" (overall)	.3715-.3725"
60—Exhaust	1 7/16" "	.3711-.3719"
90—Intake	1 25/32" "	.3715-.3725"
90—Exhaust	1 19/32" "	.3711-.3719"

	Seat Angle	Lift	Stem Clearance
Intake-all	45°	.340"	.0007-.0015"
Exhaust-all	45°	.340"	.0010-.0019"

NOTE:—Exhaust valve stems are copper-plated.

Tappet Clearance (Lash)—.008" hot (all valves).

Valve Springs—Double springs used.

Inner Spring—	Pressure	Length
Valve Closed	20-25 lbs.	1 21/32"
Valve open	55-61 lbs.	1 5/16"
Outer Spring—	Pressure	Length
Valve Closed	35-40 lbs.	1 15/16"
Valve Open	96-103 lbs.	1 19/32"

Valve Timing—See Camshaft Setting above.

Intake Valves open 4½° BTDC. Close 54° ALDC.
Exhaust Valves open 58° BTDC. Close 30° ALDC.

NOTE:—Above figures represent 'timing' points when valve is .004" off seat with .008" lash.

To Check Valve Timing—Set up micrometer gauge over #2 or #7 exhaust valve so as to measure valve movement (gauge rod should rest on valve spring cap). Set tappet clearance at .008". Valve should be .180" open when dead center mark for pistons #1 and #8 is visible in inspection hole.

Lubrication:—Pressure type. Gear type oil pump located in crankcase.

Oil Pressure—35 pounds.

Oil Pressure Relief Valve—Not adjustable.

Capacity—Dry, 11½ quarts (60), 12½ quarts (90). Refill, 8 quarts (60), 9 quarts (90).

Recommended Oil—Use SAE. #40 (100°F. and above), #30 (100°-30°F.), #20 (30°-0°F.), #10 (0° to —15°F.).

CLUTCH:—**Own Make.** (60) Single plate, dry disc type. All specifications and data same as for Series 50 except facing outside diamter 9⅞". (90) Double plate, dry disc type. See data below. No adjustment required for wear.

See article in Mechanical Equipment Section for data.

Pedal Adjustment—Free movement or lash of clutch pedal should be 1". Adjust by turning nut on forward end of clutch release rod. Clearance between pedal and toeboard should be ⅛". Adjust by turning stopscrew at rear of pedal shaft.

Clutch Facings—Woven type, 4 required, 6½" I.D., 9" O.D., .135-.140" thick.

NOTE:—Center driving plate is bolted to flywheel and acts as a clutch pilot. Driven discs are clamped betwen center driving plate and front and rear driving plates when clutch is engaged.

Clutch Assembly—With clutch disassembled, check length of four center plate driving pins from face of center plate to end of pins on lever side. If lengths are not equal within .0005" replace plate. With one clutch driven plate tight against centerplate, check total clearance between center plate and other driven plate. Clearance must be equal within .005" from one side to the other. Correct by installing brass or steel shims between driven disc and clutch hub on low side, passing hub bolt through hole in shim and locking bolt by peening nut on flat side of bolt. Total clearance between discs and center plate should be .020-.045". Clearance between release levers and driving pins should be .001". With this clearance, release bearing run-out should be less than .005" with bearing resting solidly on all levers. Correct by grinding bottom of release lever clip slightly on levers which are low.

STEERING:—**Front Suspension**—Independent, linked parallelogram type with coil springs. See Series 50 for complete data and Caster, Camber, and Toe In adjustments.

See article in Mechanical Equipment Section for data.

Kingpin Inclination—4°53' crosswise.

Caster—1-1¼° with car weight on wheels.

Camber—¼° with car weight on wheels.

Toe In—5/32-7/32".

Steering Gear:—Saginaw Worm-and-Double Roller type with center steering. See article in Steering Section for adjustments.

BRAKES:—**Service**—Own make. Internal-expanding, self-energizing, mechanically operated, vacuum power type. Hand lever applies all four service brakes. See article in Brake Section.

Drum Diameter—14". Cast-iron.

Lining—Woven and Moulded. Width 1¾". (60), 2¼" (90). Thickness 3/16". Length 28 27/32" per wheel.

Hand Brake Adjustment:—See Service Brakes.

Power Unit:—See Buick Model 50 (1934-35).

ENGINE NUMBER:—First number—4-2,995,239. Stamped on right front of engine block above oil filler.

ENGINE SPECIFICATIONS:—**Type**—8 cylinder 'I' head.
Bore—3 3/32". **Stroke**—3 7/8".
Displacement—233 cubic inches.
Rated Horsepower—30.63 (AMA).
Developed Horsepower—93 at 3200 R.P.M.
Compression Ratio & Pressure—5.55-1 Std. cast-iron head. Pressure 118 lbs. at 1000 R.P.M. or approximately 98 lbs. at cranking speed of 135 R.P.M.
Vacuum Gauge—Steady reading of 18-20" of HG. with engine idling at 400-450 R.P.M. or 7-8 M.P.H.
NOTE—To drop oil pan for work on engine, first remove front stabilizer by disconnecting frame brackets and stabilizer links at lower control arms.

PISTONS:—Buick Anolite, Aluminum alloy, 'T' slot, cam ground type with anodized finish (special hard oxide bearing surface). Pistons cannot be ground. Recondition cylinders to take finished replacement pistons.
Weight—13.75 ozs. (stripped), 19.6 ozs. (with rings).
Length—3 4/5".
Removal—Pistons and rods removed from above.
Clearance—Top of skirt .0021", Limits .0018-0024".

Replacement Pistons:—*See Buick Shop Notes*

Fitting New Pistons:—Check piston with micrometer gauge at point just below 'T' slot junction on both sides of vertical slot and below lower end of slot. Finish cylinder bore to size giving correct clearance. Feeler gauge ½" wide can be used on side opposite slot. Piston should fall of own weight with .0015" feeler and hold on .00225" feeler with engine temperature of 65-75° F.

Installing Pistons:—Slot should be toward left or away from camshaft.

PISTON RINGS:—Two compression, two oil control rings per piston all above pin. Both oil ring grooves drille radially with ten ⅛" drain holes.
NOTE—Narrow heat deflector groove located above top ring groove. No ring fitted in this groove.

Ring	Width	End Gap	Side Clearance
Comp.	⅛"	.010-.015"	.002-.0035"
Oil Cont.	5/32"	.010-.018"	.0015-.003"

NOTE—Compression rings must be placed with undercut corner down. Service rings furnished .010", .020", .030" oversizes.

PISTON PIN:—Diameter 13/16". Length 2 11/16".
Pin is clamped in rod. Oversize pins not furnished. Pins are fitted and furnished with all replacement pistons.
Pin Fit in Piston—.0003-.0004" clearance at 70° F. or a hard push thumb fit.
NOTE—Use only 5½" wrench in tightening pin bolt to avoid damage to hollow pin.

CONNECTING ROD:—Weight 29.37 ozs. Length 7¼".
Crankpin Journal Diameter—2".
Lower Bearing—Spun-babbitt lined type.
Clearance—.0008-.0018". Sideplay .005-.010".

Bearing Adjustment:—Shims. Do not file rods or caps.

Installing Rods:—Cap and rod must line up. Install rod with mark toward rear of engine and oil spray hole in lower bearing upper half toward camshaft.
NOTE—Special diameter ground bolts used for cap and rod assembly. Common bolts must not be used.

CRANKSHAFT:—Five bearing. Integral counterweights.
Journal Diameters—#1, 2 5/16"; #2, 2⅜"; #3, 2 7/16"; #4, 2½"; #5, 2 9/16".
Bearing Type—Steel-backed, babbitt-lined. Bearings dowelled in crankcase and cap and assembled with .000-.002" projection. Line-ream new bearings.
Clearance—.0007-.0022". 1/32" clearance at each end.

Bearing Adjustment:—Shims provided. Do not file caps.

End Thrust:—Taken by #3 (center) bearing. Endplay .004-.007".

CAMSHAFT:—Five bearing. Non-adjustable chain drive.
Journal Diameters—#1, 2 5/32"; #2, 2⅛"; #3, 2 3/32"; #4, 2 1/16"; #5, 1 25/32".
Bearing Type—Steel-backed, babbitt-lined.
Clearance—.0005-.0035". Endplay .002-.006".

End Thrust:—Taken by thrust plate assembled between front bearing and camshaft sprocket.

Timing Chain:—Link-Belt. Width 1". Pitch .500". Length 24½" or 49 links.
Installing Chain—Install chain (new) with ¼"-⅜" slack midway between sprockets. Replace when sideplay exceeds 2" or chain becomes noisy.

Camshaft Setting:—Sprockets marked. Mesh chain on sprockets so that brass washers on link pins are opposite marked teeth on each sprocket. These chain markers are 10 links apart.

VALVES:—Head Diameter Stem Diameter Length
Intake .....1 17/32".....3715-.3725".....4.5"
Exhaust ....1 11/32".....3711-.3719".....4.037"

	Seat Angle	Lift	Stem Clearance
Intake	45°	.332-.338"	.0015-.0035"
Exhaust	45°	.332-.338"	.0021-.0039"

NOTE—Exhaust valve stems are copper-plated.
Tappet Clearance—.015" all valves. Engine hot.

Valve Guides:—Press fit in head. Install with undercut end up and finish ream to size for correct clearance.

Valve Springs:—Double springs on all valves.

Inner Spring	Pressure	Length
Valve Closed	21½-26½ lbs.	1 21/32"
Valve Open	53-59 lbs.	1 5/16"
Outer Spring	**Pressure**	**Length**
Valve Closed	31-36 lbs.	1 15/16"
Valve Open	81½-87½ lbs.	1 19/32"

Total Spring Pressure
Closed—52½-62½ lbs. Open—134½-146½ lbs.
NOTE—Tapers on valve keys and spring caps have been increased.

Valve Lifters—Single piece cast-iron. Lifter guide holes reamed in crankcase. Clearance .0005-.0025".

Rocker Arms:—Drop-forged fitted with steel-backed, babbitt-lined bushings.
Clearance—.0005"-.0025".
NOTE—When installing bushings see that oil hole to push rod ball lines up with hole in bushing.

Valve Timing:—See Camshaft Setting above. 'Timing Point' when valve .004" off seat with .015" tappet clearance or lash customarily listed instead of actual opening and closing points.

Timing Points
Intake Valves ....Open 8° BTDC.....Close 58° ALDC.
Exhaust Valves ..Open 58° BLDC.....Close 23° ATDC.

Opening and Closing Points
Intake Valves ..Open 21½° BTDC..Close 71° ALDC.
Exhaust Valves Open 71° BLDC..Close 36½° ATDC.

Valve Timing Check—#2 or #7 exhaust valve should be .150" open (actual opening as measured by dial indicator contacting valve spring cap), with #1 and 8 pistons on top dead center and flywheel mark 'TDC/1-8' at indicator in inspection hole in right front face of flywheel housing above starter.

LUBRICATION:—Pressure system from oil pump in crankcase through main oil channel in right side of crankcase.

Oil Pump:—Helical gear type in crankcase driven through tongue-and-slot coupling from camshaft gear. Ignition timing not disturbed by removal of oil pump.

Oil Pump Clearances—*See Buick Shop Notes.*

Normal Oil Pressure:—10 lbs. idling, 45 lbs. maximum at 35 M.P.H. and above.

Oil Pressure Regulator:—Operates at 45 lbs. Mounted on oil pump. Not adjustable.

Crankcase Capacity:—7 qts. (dry), 5 qts. (refill).

CLUTCH:—Own Make. Borg & Beck Driven Member. Single plate, dry disc type. See article in Clutch Section for relining and assembling directions.
Facings—Woven type, 2 required. Inside Diam. 6⅛". Outside Diam. 9½". Thickness .133".
Adjustment—Clearance between pedal and underside of toeboard must be ⅜-⅝". To adjust, loosen locknut and turn setscrew at rear of pedal above pedal stop. Free movement of clutch pedal must be ¾-1". To adjust, take out clevis pin connecting clutch rod and clutch fork, turn clevis on rod. One full turn of clevis changes pedal free movement 7/16".
Removal:—Remove rear end (take out flange bolts in front end of torque tube, pull rear end back to disconnect drive shaft at splined joint at universal), remove transmission and transmission support (support transmission at rear while it is being withdrawn), take off clutch pan, take out clutch mounting screws (turning all screws out evenly).
NOTE—When installing transmission support which is bolted to universal joint flange and frame, see that centering shims are in place at each end and that cross member is positioned so that rubber insulation is not compressed (bolt holes are slotted).

STEERING:—Steering Gear—Saginaw Worm-and-Double Roller type with center steering. See article in Steering Section for adjustments.

Front Suspension:—Independent, linked parallelogram type with coil springs. See article in Steering Section for description and adjustment procedure.
NOTE—To avoid damage to brake assembly when work is being done on front suspension, disassemble as follows: Remove wheel, disconnect tie rod ball stud, loosen one caster adjuster capscrew one-half turn (do not disturb second capscrew or caster adjustment will be lost), remove upper and lower caster adjuster bolt nuts, remove complete steering knuckle, hub and brake drum assembly and wire to frame to prevent damage to brake hose.
King Pin Inclination—3½-4½° crosswise.
Camber—Minus ¼ to plus ¾°. No adjustment.
Caster—3-3½°. Adjustable.
Toe In—1/16-⅛". Adjustable.
Steering Geometry (Toe Out)—Outer wheel turned 20°, inner wheel 23¼° plus or minus ¾°. Check tie rod ends, steering arms, kingpin, or wheel bearings for loosesness.

BRAKES:—Service—Buick (Bendix) Hydraulic Single-anchor four-wheel type. Hand lever applies rear wheel brakes. See article in Brake Section for complete adjustment procedure.
NOTE—Wheel cylinder diameters are 1 1/16" (front wheels), 1" (rear wheels) and no part of assembly is interchangeable between front and rear wheels.
Brake Drum Diameter—12".
Brake Lining—Ferodo BZ-10 Woven type. Width 1¾". Thickness 3/16". Length 9 15/16" (primary shoe), 12¾" (secondary shoe) or 22 11/16" per wheel.
Brake Clearance—.010" plus or minus .002" at heel and toe of each shoe.

Hand Brake Adjustment:—See Service Brake Adjustment.

ENGINE NUMBER:—First number (60) 6-3001000, (80) 8-3001000, (90) 9-3001000. Stamped on right front of engine block above oil filler.

ENGINE SPECIFICATIONS:—**Type** 8 cylinder 'T' head. **Bore**—3 7/16". **Stroke**—4 5/16". **Displacement**—320.2 cubic inches. **Rated Horsepower**—37.81 (AMA). **Developed Horsepower**—120 at 3200 R.P.M. **Compression Ratio & Pressure**—5.45-1 Std. cast-iron head. Pressure 108 lbs. at 1000 R.P.M. or approximately 95 lbs. at cranking speed of 135 R.P.M. **Vacuum Gauge**—Steady reading of 18-20" of HG. with engine idling at 400 R.P.M. or 7-8 M.P.H.
NOTE—To drop oil pan for work on engine, first remove front stabilizer by disconnecting frame brackets and stabilizer links at lower control arms.

PISTONS:—Buick Anolite, Aluminum alloy, 'T' slot, Cam ground type with anodized finish (special hard oxide bearing surface). Pistons cannot be ground. Recondition cylinders to take finished replacement pistons.
Weight—22.56 ozs. (stripped), 25.81 ozs. (with rings). **Length**—4.16".
Removal—Pistons and rods removed from above.
Clearance—Top of Skirt .0023". Limits .0020-.0026".
Replacement Pistons:—*See Buick Shop Notes.*
Fitting New Pistons:—Check piston with micrometer gauge at point just below 'T' slot junction on both sides of vertical slot and below lower end of slot. Finish cylinder bore to take replacement pistons. Feeler gauge ½" wide can be used on side opposite slot. Piston should fall of own weight with .0015" feeler and lock on .00225" feeler. Engine at 65-75° F.
Installing Pistons:—Slot should be toward left or away from camshaft.

PISTON RINGS:—Two compression, two oil control rings per piston all above pin. Both oil ring grooves drilled radially with ten ⅛" drain holes.
NOTE—Narrow heat deflector groove located above top ring groove. No ring fitted in this groove.

Ring	Width	End Gap	Side Clearance
Comp.	⅛"	.010-.015"	.002 -.0035"
Oil Cont.	5/32"	.010-.018"	.0015-.003"

NOTE—Install compression rings with undercut corner down. Rings furnished .010", .020", .030" oversize.

PISTON PIN:—**Diameter** ⅞". **Length** 2 31/32".
Pin is clamped in rod. Oversize pins not furnished. Pins fitted and furnished with all new pistons.
Pin Fit in Piston—.0003-.0004" clearance at 70°F. or a hard thumb push fit.
NOTE—Use only a 5½" wrench in tightening pin bolt to avoid damage to hollow pin.

CONNECTING ROD:—**Weight** 36.49 ozs. **Length** 8¼".
Crankpin Journal Diameter—2¼".
Lower Bearing—Spun-babbitt lined type.
Clearance—.0008-.0018". Sideplay .005-.010".
Bearing Adjustment:—Shims. Do not file rods or caps.
Installing Rods:—Cap and rod must line up. Install rod with mark toward rear and oil spray hole in lower bearing upper half toward camshaft.
NOTE—Special diameter ground bolts used for cap and rod assembly. Common bolts must not be used.

CRANKSHAFT:—Five bearing. Integral counterweights.
Journal Diameters—#1, 2 9/16"; #2, 2⅝"; #3, 2 11/16", #4, 2¾"; #5, 2 13/16".
Bearing Type—Steel-backed, babbitt-lined. Bearings dowelled in crankcase and cap and assembled with .000-.002" projection. Line ream new bearings.
Clearance—.0007-.0022".
Bearing Adjustment:—Shims. Do not file caps.
End Thrust:—Taken by #3 (center) bearing. Endplay .004-.007".
NOTE—Torsion balancer mounted ahead of fan pulley. Dynamically balanced before assembling and must be replaced as a complete assembly.

CAMSHAFT:—Five bearing. Non-adjustable chain drive.
Journal Diameters—#1, 2 5/32"; #2, 2⅛"; #3, 2 3/32"; #4, 2 1/16"; #5, 1 25/32".
Bearing Type—Steel-backed, babbitt-lined.
Clearance—.0005-.0035". Endplay—.002-.006".
End Thrust:—Taken by thrust plate assembled between front bearing and camshaft sprocket.
Timing Chain:—Link-Belt. Width 1¼". Pitch .500". Length 50 links or 25".
Installing Chain—Install new chain with ¼"-⅜" slack midway between sprockets. Replace when sideplay is over 2" or chain becomes noisy.
Camshaft Setting:—Sprockets marked. Mesh chain on sprockets so that brass washers on link pins are opposite marked teeth on each sprocket. These chain markers are 10 links apart.

VALVES:—

Head Diameter	Stem Diameter	Length
Intake 1 25/32"	.3715-.3725"	4 ⅝"
Exhaust 1 7/16"	.3711-.3719"	4 1/5"

Seat Angle	Lift	Stem Clearance
Intake 45°	.347-.348"	.0015-.0035"
Exhaust 45°	.347-.348"	.0021-.0039"

NOTE—Exhaust valve stems are copper-plated.
Tappet Clearance—.015" all valves engine hot.
Valve Guides:—Press fit in head. Installed with undercut end up and finish reamed to size for correct stem clearance.
Valve Springs:—Double springs on all valves.

Inner Spring	Pressure	Length
Valve Closed	21½-26½ lbs.	1 21/32"
Valve Open	53-59 lbs.	1 5/16"
Outer Spring	**Pressure**	**Length**
Valve Closed	31-36 lbs.	1 15/16"
Valve Open	81½-87½ lbs.	1 19/32"

Total Spring Pressure
Closed—52½-62½ lbs. **Open**—134½-146½ lbs.
NOTE—Tapers on valve keys and spring caps have been increased and parts are now copper-plated.
Valve Lifters:—Single piece cast-iron. Lifter guide holes reamed in crankcase. Clearance—.0005-.0025".
Rocker Arms:—Drop-forged fitted with steel-backed babbitt-lined bushings. **Clearance**—.0005-.0025".
NOTE—When installing bushings, see that oil hole to push rod ball lines up with hole in bushing. Water connections at each end of oil temperature regulator must be drawn down at same time rocker arm shaft brackets are bolted down. Run engine and check fittings for water leaks before replacing rocker arm valve cover.
Valve Timing:—See Camshaft Setting above. 'Timing Point' when valve .004" off seat with .015" tappet clearance or lash customarily listed instead of actual opening and closing points.

Timing Points

Intake Valves	Open 14° BTDC	Close 71° ALDC.
Exhaust Valves	Open 56° BLDC	Close 25° ATDC.

Opening and Closing Points

Intake Valves	Open 27° BTDC	Close 84½° ALDC.
Exhaust Valves	Open 69° BLDC	Close 38½° ATDC.

Valve Timing Check—#2 or #7 exhaust valve should be .155" open (actual opening is measured by dial indicator contacting valve spring cap), with #1 and 8 pistons on top dead center and flywheel mark 'TDC/1-8' at indicator in inspection hole in right front face of flywheel housing above starter.

LUBRICATION:—Pressure system with oil pump in crankcase and main oil channel on right side.
Oil Pump:—Helical gear type in crankcase. Driven through tongue-and-slot coupling from camshaft. Ignition timing not disturbed by oil pump removal.
Oil Pump Clearances—*See Buick Shop Notes.*
Normal Oil Pressure:—10 lbs. idling, 45 lbs. maximum at 35 M.P.H. and above.
Oil Pressure Regulator:—Operates at 45 lbs. Mounted on oil pump. Not adjustable.
Oil Temperature Regulator:—Consists of water tube running through rocker arm shaft. Disassemble and remove oil deposit in tube after considerable mileage. See Rocker Arms above for assembly directions.
Crankcase Capacity:—10 qts. (dry), 8 qts. (refill).

CLUTCH:—**Own Make. Long Driven Member.** Single plate, dry disc type. See article in Clutch Section for relining and assembling directions.
Facings—Woven type, 2 required. Inside Diam. 6½". Outside Diam. 11". Thickness .137".
Adjustment—Clearance between pedal and underside of toeboard must be ⅜-⅝". To adjust, loosen locknut and turn setscrew at rear of pedal above pedal stop. Free movement of clutch pedal must be ¾-1". To adjust, turn adjusting nut on rod connecting pedal and clutch throwout yoke. One full turn of adjusting nut changes pedal lash 5/16".
Removal:—Remove rear end (take out flange bolts in front end of torque tube, pull rear end back to disconnect drive shaft at splined joint at universal), remove transmission and transmission support (support transmission at rear while it is being withdrawn), take off clutch pan, take out clutch mounting screws (turning all screws out evenly).
NOTE—When installing transmission support which is bolted to universal joint flange and frame, see that centering shims are in place at each end and that cross member is positioned so that rubber insulation is not compressed (bolt holes are slotted).

STEERING:—**Steering Gear**—Saginaw Worm-and-Double Roller type with center steering. See article in Steering Section for adjustments.
Front Suspension:—Independent, linked parallelogram type with coil springs. See article in Steering Section for description and adjustment procedure.
NOTE—To avoid damage to brake assembly when work is being done on front suspension, disassemble as follows: Remove wheel, disconnect tie rod ball stud, loosen one caster adjuster capscrew one-half turn (do not disturb second capscrew or caster setting will be lost), remove upper and lower caster adjuster bolt nuts, remove complete steering knuckle, hub and brake drum assembly and wire to frame to prevent damage to brake hose.
Kingpin Inclination—4½-5½° crosswise.
Camber—Minus ¼° to plus ¾°. No adjustment.
Caster—1¾-2¼°. Adjustable. **Toe In**—1/16-⅛".
Steering Geometry—Outer wheel turned 20°, inner wheel (60, 80) 23¾°, (90) 24° plus or minus ¾°.

BRAKES:—Buick (Bendix) Hydraulic, Single Anchor, four-wheel type. Hand lever applies rear brakes. See article in Brake Section for complete data.
NOTE—Wheel cylinder diameters are 1¼" (front), 1 3/16" (rear) and no part of assembly is interchangeable between front and rear wheels.
Brake Drum Diameter—12".
Brake Lining—Ferodo BZ-10 Woven type. Width 2". Thickness 3/16". Length 9 15/16" (primary shoe), 12¾" (secondary shoe) or 22 11/16" per wheel.
Brake Clearance—.010" plus or minus .002" at heel and toe of each shoe.
Hand Brake Adjustment:—See Service Brakes.

ENGINE NUMBER:—1st number 4-3,166,225. On boss on lower right hand side of engine block behind starter. NOTE—Dash (-) following engine number indicates that engine factory-equipped with .010" oversize pistons.

ENGINE SPECIFICATIONS:—8 cylinder, 'I' head.
Bore—3 3/32". **Stroke**—4⅛".
Displacement—248 cubic inches.
Rated Horsepower—30.63 (S.A.E.).
Developed Horsepower—100 at 3200 R.P.M.
Compression Ratio & Pressure—Std. 5.7-1 cast-iron head. Pressure 97-103 lbs. at 150 R.P.M. Check pressure with engine warm, all plugs removed, throttle wide open and starter cranking engine.
Vacuum Reading—18-20" steady at 7-8 M.P.H.
NOTE—To drop oil pan, remove front stabilizer.

PISTONS:—Buick anolite, aluminum alloy, 'T' slot, cam ground type. Refinish cylinders to take finished replacement pistons. **Length**—3 4/5".
Weight—13.75 ozs. (stripped), 19.6 ozs. (with rings).
Removal—Pistons and rods removed from above.
Clearance—Top of skirt .0021". Limits .0018-.0024".
Original Bore Size & Replacement Pistons:—*See Buick Special Shop Notes.*
Fitting New Pistons:—Micrometer Gauge—Check at points just below 'T' slot junction on both sides of vertical slot and below lower end of slot, finishing cylinder bore to size giving correct clearance.
Feeler Gauge—Use ½" wide stock inserted on side opposite slot. Piston should pass on .0015" feeler and hold on .00225" with engine at 65-75° F.
Installing Pistons:—Slot to left or away from camshaft.

PISTON RINGS:—2 compression, 2 oil control rings per piston all above pin. Oil ring grooves drilled radially with 5/32" drain holes (10 top groove, 8 lower groove).

Ring	Width	End Gap	Side Clearance
Compression	3/32"	.010-.015"	.0015-.003"
Oil Control	3/16"	.010-.015"	.0015-.003"

NOTE—'Top' mark on compression rings to top of piston. Rings furnished .010", .020", .030" oversize.

PISTON PIN:—Diameter—13/16". **Length**—2 11/16".
Pin clamped in rod. Oversize pins not furnished. Replacement pistons have pins fitted.
Pin Fit in Piston—.0003-.0004" at 70° F. or light finger push.
NOTE—5½" wrench only, for use on pin bolt.

CONNECTING ROD:—Weight—29.92 ozs. **Length**—7⅝".
Crankpin Journal Diameter—2".
Lower Bearing—Spun-babbitt lined type.
Clearance—.0008-.0018". Sideplay .005-.010".
Bearing Adjustment:—Shims. Do not file rods or caps.
Installing Rods:—Align cap and rod. Marks to rear of engine, oil spray hole toward camshaft.
NOTE—⅜" diameter ground bolts used for rod and cap assembly. Common bolts must not be used.

CRANKSHAFT:—5 bearing. Integral counterweights.
Journal Diameters—#1, 2 5/16"; #2, 2⅜"; #3, 2 7/16"; #4, 2½"; #5, 2 9/16".
Bearing Type—Steel-backed, babbitt-lined. Bearings dowelled in crankcase and cap and assembled with .000-.002" projection. Line-ream new bearings.
Clearance—.0007-.0022". 1/32" clearance at each end.
Replacement Bearings—*See Buick Shop Notes.*
Bearing Adjustment:—Shims. Do not file caps.
End Thrust:—Center (#3) bearing. Endplay .004-.007".

CAMSHAFT:—5 bearing. Non-adjustable chain drive.
Journal Diameters—#1, 2 5/32"; #2, 2⅛"; #3, 2 3/32"; #4, 2 1/16"; #5, 1¾".
Bearing Type—Steel-backed, babbitt-lined.
Clearance—.0005-.0035". Endplay .002-.006".
End Thrust:—Taken by thrust plate assembled between front bearing and camshaft sprocket.
Timing Chain:—Link-Belt. Width 1". Pitch .500". Length 24½" or 49 links.
Installing Chain—¼ - ⅜" play midway between sprockets on new chain. 1" maximum play if worn.
Camshaft Setting:—Mesh chain with copper-plated washers opposite mark on each sprocket. Chain markers 10 links apart.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1 17/32"	.3715-.3725"	4 5/16"
Exhaust	1 11/32"	.3711-.3719"	4 3/64"

	Seat Angle	Lift	Stem Clearance
Intake	45°	.348"	.0015-.0035"
Exhaust	45°	.342"	.0021-.0039"

NOTE—Intake valves 'streamlined' tulip type.
Tappet Clearance—.015" all valves, engine hot.
Valve Guides:—Press fit in head. Install undercut end up. Finish ream to size for correct clearance.
Valve Springs:—Double springs on all valves.

Inner Spring	Pressure	Length
Valve Closed	15½-20½ lbs.	1 21/32"
Valve Open	45-51 lbs.	1 5/16"
Outer Spring	**Pressure**	**Length**
Valve Closed	26½-31½ lbs.	1 15/16"
Valve Open	63-73 lbs.	1 19/32"

Total Spring Pressure
Closed—42-52 lbs. Open—112-124 lbs.
NOTE—Valve springs not interchangeable with earlier models.
Valve Lifters:—Single piece,, cast-iron. Lifter guide holes reamed in crankcase. Clearance .0005-.0025".
Rocker Arms:—Drop-forged fitted with steel-backed, babbitt-lined bushings. Rocker arm shaft brackets are of aluminum alloy.
Clearance—.001-.003".
NOTE—Install bushings with oil holes aligned.

VALVE TIMING:—See Camshaft Setting above. 'Timing Point' when valve .004" off seat with .015" tappet clearance or lash customarily listed instead of actual opening and closing points.
Timing Points
Intake Valves—Open 13° BTDC. Close 68° ALDC.
Exhaust Valves—Open 55° BLDC. Close 22° ATDC.
Opening and Closing Points
Intake Valves—Open 26° BTDC. Close 81½° ALDC.
Exhaust Valves—Open 68° BLDC. Close 35° ATDC.
Valve Timing Check:—#2 or #7 exhaust valve should be .145" open (actual opening as measured by dial indicator contacting valve spring cap), with #1 and 8 pistons on top dead center and flywheel mark 'TDC/1-8' lined up with indicator in inspection hole in right front face of flywheel housing above starter.

LUBRICATION:—Pressure with oil pump in crankcase.
Oil Pump:—Helical gear type driven through tongue-and-slot coupling from camshaft gear. Ignition timing not disturbed by removal of oil pump.
Oil Pump Clearances—*See Buick Shop Notes.*
Normal Oil Pressure:—45 lbs. at normal speeds.
Oil Pressure Regulator:—Operates at 45 lbs. Mounted on oil pump. Not adjustable.
Crankcase Capacity:—7 qts. (dry), 6 qts. (refill).

CLUTCH:—Own (with Long 10CF-CI driven member). Single plate, dry disc type.
See article in Mechanical Equipment Section for data.
Facings—Woven type, 2 required. I.D. 6". O.D. 10". Thickness .125".
Adjustment—Clearance between pedal and underside of toeboard must be ⅜-⅝". To adjust, loosen locknut and turn setscrew at rear of pedal, above pedal stop. Free movement—¾-1". To adjust take out clevis pin connecting clutch rod and clutch fork, turn clevis on rod. One full turn equal to 3/16" free movement.
Removal:—Remove transmission (see Transmission Removal below), take off clutch pan, screw out cover mounting screws evenly, remove assembly from below.

TRANSMISSION:—Buick. Synchro-mesh on second and high gears. All gears helical type.
See article in Mechanical Equipment Section for data.
Removal:—Hoist rear of car by frame, disconnect rear brake cables at equalizer bar and brake tube connection on torque tube at rear of X-member, remove spring seat U-bolts, flange bolts on front of torque tube, pull axle assembly back withdrawing propeller shaft from ball and universal joint. Remove transmission rear support and mounting bolts. Support at rear while withdrawing unit to avoid clutch plate distortion.
NOTE—Centering shims at frame ends must be in place when installing rear transmission support.

UNIVERSAL JOINT:—Spicer (Buick Design). Plain bearing type. 1 used.
See article in Mechanical Equipment Section for data.

REAR AXLE:—Buick, semi-floating, hypoid gear type with torque tube drive.
See article in Mechanical Equipment Section for data.
Ratio—4.40-1.
Backlash—.008-.010". Shim adjustment.
Removal:—Axle shaft retained by horseshoe 'C' washer recessed in differential side gear. Remove housing cover, pinion shaft lockscrew, pinion shaft and spacer block, push axle shaft in, remove 'C' washer, withdraw shaft. For complete axle assembly removal see Transmission Removal (above) and disconnect rear spring shackles.
Wheel Bearing Adjustment—None.

SHOCK ABSORBERS:—Delco. Model 1945-A, B (front), 1713-A, B (rear). Double acting, piston type.
See article in Mechanical Equipment Section for data.

STEERING:—Steering Gear—Saginaw Worm-&-Double Roller type with center steering.
See article in Mechanical Equipment Section for data.
Front Suspension:—Independent, linked parallelogram type with coil springs.
See article in Mechanical Equipment Section for data.
NOTE—To avoid damage to brake hose for work on front suspension proceed as follows: remove wheel, disconnect tie rod ball stud, remove drum, knuckle and steering knuckle support (as a unit), wire to frame. Removing shock absorber bolts allows absorber unit to shift (caster will not be disturbed).
Kingpin Inclination—3½-4½° crosswise.
Camber—Minus ¼° to plus 1°. Not adjustable.
Caster—¼° plus or minus ⅜°. Adjustable.
Toe In—0-1/16". Adjustable.
Steering Geometry (Toe Out)—Inner wheel turned 23¼°, outer wheel 20°, plus or minus ¾°.

BRAKES:—Service—Bendix Hydraulic, single anchor type. Hand lever applies rear wheel service brakes.
See article in Mechanical Equipment Section for data.
Wheel Cylinders—Diameters: front 1 1/16", rear wheels 1". Front and rear assemblies not interchangeable.
Drum Diameter—12".
Lining—Ferodo BZ-10 woven. Length per wheel (front shoe 9 15/16", rear shoe 12¾"). Width 1¾". 3/16" thick.
Clearance—.010" plus or minus .002" heel and toe each shoe.
Braking Power—47% rear.
Hand Brake Adjustment:—See Service Brake (above).

ENGINE NUMBER:—First number (60) 6-3,176,225, (80) 8-3,176,225, (90) 9-3,176,225. Stamped on boss on lower right side of engine block behind starter.
NOTE—Dash (-) following engine number indicates engine factory-equipped with .010" oversize pistons.

ENGINE SPECIFICATIONS:—8 cylinder, 'I' head.
Bore—3 7/16". **Stroke**—4 5/16".
Displacement—320.2 cubic inches.
Rated Horsepower—37.81 (S.A.E.).
Developed Horsepower—130 at 3400 R.P.M.
Compression Ratio & Pressure—Std. 5.75-1 cast-iron head. Pressure 100-106 lbs. at 150 R.P.M. Check pressure with engine warm, all plugs removed, throttle wide open and starter cranking engine.
Vacuum Reading—18-20" steady at 7-8 M.P.H.
NOTE—To drop oil pan, remove front stabilizer.

PISTONS:—Buick Anolite, aluminum alloy, 'T' slot, cam ground type. Refinish cylinders to take finished replacement pistons. **Length**—4.161-4.163".
Weight—22.56 ozs. (stripped), 25.80 ozs. (with rings).
Removal—Pistons and rods removed from above.
Clearance—Top of skirt .0023". Limits .0020-.0026".
Original Bore Size & Replacement Pistons:—*See Buick Special Shop Notes.*
Fitting New Pistons:—Micrometer Gauge—Check at points just below 'T' slot junction on both sides of vertical slot and below lower end of slot, finishing cylinder bores to give correct clearance. **Feeler Gauge**—Use ½" wide stock inserted on side opposite slot. Piston should pass on .0015" feeler and hold on .00225" with engine at 65-75° F.
Installing Pistons:—Slot away from camshaft.

PISTON RINGS:—Two compression, two oil control rings per piston all above pin. Oil ring grooves drilled radially with 5/32" drain holes (10 top groove 8 lower groove).

Ring	Width	End Gap	Side Clearance
Compression	3/32"	.010-.015"	.0015-.003"
Oil Control	3/16"	.010-.015"	.0015-.003"

NOTE—Install compression rings with mark 'Top' toward the top of piston. Oversize rings furnished in sizes .010", .020", and .030" oversize.

PISTON PIN:—Diameter—⅞". **Length**—3 1/16"
Pin clamped in rod. Oversize pins not furnished. Replacement pistons have pins fitted.
Pin Fit in Piston—.0003-.0004" at 70° F. or light finger push.
NOTE—5½" wrench only, for use on pin bolt.

CONNECTING ROD:—Weight—38.43 ozs. **Length**—8¼".
Crankpin Journal Diameter—2¼".
Lower Bearing—Spun-babbitt lined type.
Clearance—.0008-.0018". **Sideplay**—.005-.010".
Bearing Adjustment:—Shims. Do not file rods or caps.
Installing Rods:—Align cap and rod. Mark on rod and cap to rear of engine, oil hole toward camshaft.
NOTE—7/16" diameter ground bolts used for rod and cap assembly. Common bolts must not be used.

CRANKSHAFT:—5 bearing. Integral counterweights.
Journal Diameters—#1, 2 9/16"; #2, 2⅝"; #3, 2 11/16"; #4, 2¾"; #5, 2 13/16".
Bearing Type—Steel-backed, babbitt-lined. Bearings dowelled in crankcase and cap.
Clearance—.0007-.0022".
Replacement Bearings—*See Buick Shop Notes.*
Bearing Adjustment:—Shims. Do not file caps.
End Thrust:—#3 (center) bearing. **Endplay** .004-.007"

CAMSHAFT:—5 bearing. Non-adjustable chain drive.
Journal Diameters—#1, 2 5/32"; #2, 2⅛"; #3, 2 3/32"; #4, 2 1/16"; #5, 1¾".
Bearing Type—Steel-backed, babbitt-lined.
Clearance—.0005-.0035". Endplay—.002-.006".
End Thrust:—Taken by thrust plate assembled between front bearing and camshaft sprocket.
Timing Chain:—Link-Belt. Width 1¼". Pitch .500". Length 50 links or 25".
Installing Chain—¼-⅜" play midway between sprockets on new chain. 1" maximum play if worn.
Camshaft Setting:—Mesh chain with copper-plated washers opposite mark on each sprocket. Chain markers 10 links apart.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1 25/32"	.3715-.3725"	4⅜"
Exhaust	1 7/16"	.3711-.3719"	4 7/32"

	Seat Angle	Lift	Stem Clearance
Intake	45°	.347"	.0015-.0035"
Exhaust	45°	.348"	.0021-.0039"

NOTE—Intake valves 'streamlined' tulip type.
Tappet Clearance—.015" all valves, engine hot.
Valve Guides:—Press fit in head. Install undercut end up. Finish ream to size for correct clearance.
Valve Springs:—Double springs on all valves.

Inner Spring	Pressure	Length
Valve Closed	15½-20½ lbs.	1 21/32"
Valve Open	45-51 lbs.	1 5/16"
Outer Spring	**Pressure**	**Length**
Valve Closed	26½-31½ lbs.	1 15/16"
Valve Open	63-73 lbs.	1 19/32"

Total Spring Pressure
Closed—42-52 lbs. Open—112-124 lbs.
Valve Lifters:—Single piece, cast-iron. Lifter guide holes reamed in crankcase. Clearance .0005-.0025".
Rocker Arms:—Drop-forged fitted with steel-backed, babbitt-lined bushings. Rocker arm shaft brackets are of aluminum alloy (no oil temp. regulator).
Clearance—.001-.003".
NOTE—Install bushings with oil holes aligned.

VALVE TIMING:—See Camshaft Setting above. 'Timing Point' when valve .004" off seat with .015" tappet clearance or lash customarily listed instead of actual opening and closing points.

Timing Points
Intake Valves—Open 14° BTDC. Close 71° ALDC.
Exhaust Valves—Open 56° BLDC. Close 25° ATDC.

Opening and Closing Points
Intake Valves—Open 27° BTDC. Close 84½° ALDC.
Exhaust Valves—Open 69° BLDC. Close 38½° ATDC.

Valve Timing Check:—#2 or #7 exhaust valve should be .155" open (actual opening as measured by dial indicator contacting valve spring cap), with #1 and 8 pistons on top dead center and flywheel mark 'TDC/1-8' at indicator in inspection hole in right front face of flywheel housing above starter.

LUBRICATION:—Pressure with oil pump in crankcase.
Oil Pump:—Helical gear type driven through tongue-and-slot coupling from camshaft gear. Ignition timing not disturbed by removal of oil pump.
Oil Pump Clearances—*See Buick Shop Notes.*
Normal Oil Pressure:—45 lbs. at normal speeds.
Oil Pressure Regulator:—Operates at 45 lbs. Mounted on oil pump. Not adjustable.
Crankcase Capacity:—9 qts. (dry), 8 qts. (refill).

CLUTCH:—Own Make. Long Driven Member (11CF-CI)
Single plate, dry disc type.
See article in Mechanical Equipment Section for data.
Facings—Woven type, 2 required, 6½" I.D., 11" O.D., 9/64" thick.
Adjustment—Clearance between pedal and underside of toeboard must be ⅜-⅝". To adjust, loosen locknut, turn setscrew at rear of pedal above stop. Free movement of clutch pedal must be ¾-1". To adjust, turn nut on rod connecting pedal and yoke.
Removal:—Remove transmission (see Transmission Removal below), take off clutch pan, take out clutch cover mounting screws evenly, lower assembly.

TRANSMISSION:—Buick. Synchro-mesh on second and high gears. All gears helical type.
See article in Mechanical Equipment Section for data.
Removal:—Hoist rear of car by frame, disconnect rear brake cables at equalizer bar and brake tube connection on torque tube at rear of X-member, remove spring seat U-bolts, flange bolts on front of torque tube, pull axle assembly back withdrawing propeller shaft from ball and universal joint. Remove brake master cylinder, pedal support, transmission rear support and mounting bolts. Support at rear while withdrawing transmission.
NOTE—Replace centering shims in same position when installing rear transmission support.

UNIVERSAL JOINT:—Spicer. (Buick Design). Plain bearing type. One used.
See article in Mechanical Equipment Section for data.

REAR AXLE:—Buick. Semi-floating, hypoid (60 only), spiral bevel gear type with torque tube drive.
See article in Mechanical Equipment Section for data.
NOTE—Bronze bushing used at front end of propeller shaft on Series 90 only.
Ratio—3.9-1 (60), 4.222-1 (80), 4.625-1 (90).
Backlash (Pinion & Ring Gear)—.008-.010". Shims.
Removal:—Axle shaft retained by horseshoe 'C' washer (60), nut and cotter pin (80, 90), recessed in differential side gear. Remove housing cover, pinion shaft lockscrew, pinion shaft and spacer block, push axle shaft in, remove 'C' washer (60), nut and cotter pin (80, 90), withdraw shaft. For complete axle assembly removal disassemble axle as outlined under Transmission Removal, disconnect rear spring shackles, and withdraw housing from under car.
Wheel Bearing Adjustment—None.

SHOCK ABSORBERS:—Delco. Model Nos. as follows:

	Model 60	Models 80, 90
Front	1945-A, B	1902-D, C
Rear	1713-A, B	1713-C, D

See article in Mechanical Equipment Section for data.

STEERING:—Steering Gear. Saginaw Worm-&-Double Roller type with center steering.
See article in Mechanical Equipment Section for data.
Front Suspension:—Independent, linked parallelogram type with coil springs.
See article in Mechanical Equipment Section for data. See Buick Special Shop Notes for brake assembly removal for work on Front Suspension.
Kingpin Inclination—3½-4½° (60), 4¼-5¼° (80), 4-5° (90).
Camber—Minus ¼° to plus 1°. No adjustment.
Caster—¼° plus or minus ⅜° (60), 0° plus or minus ⅜° (80, 90). Adjustable.
Toe In—0-1/16". Adjustable.
Steering Geometry—Outer wheel turned 20°, inner wheel 23¾° (60, 80), 24° (90) plus or minus ¾°.

BRAKES:—Service—Bendix Hydraulic, single anchor type. Hand lever applies rear service brakes.
See article in Mechanical Equipment Section for data.
NOTE—For Model 60 specifications see Model 40. All data same except for lining width 2", on 60.
Wheel Cylinders—Diameters: front 1¼", rear wheels 1 3/16". Not interchangeable front and rear.
Drum Diameter—12" (80), 14" (90).
Lining—Woven (Ferodo BZ-10) type. Width 2". Thickness 3/16" (80), ¼" (90). Length per wheel front shoe 9 15/16" (80), 12 1/16" (90), rear shoe 12¾" (80), 14¾" (90).
Clearance—.010" + or — .002" at heel and toe.
Braking Power—47.4% rear.
Hand Brake Adjustment:—See Service Brake (above).

HOOD SIDE PANEL REMOVAL:—See Buick Shop Notes.
SERIAL NUMBER:—First number, 13219848 (Flint). 23238767 (South Gate, Calif.), 33245765 (Linden, N. J.). Stamped on top right frame side rail at dash.
ENGINE NUMBER:—First number 4-3396937. Stamped on boss on right side of crankcase above starter. NOTE—Dash (—) following engine number indicates engine equipped with .010" oversize pistons.
ENGINE SPECIFICATIONS:—8 cylinder, 'I' head.
Bore—3 3/32". **Stroke**—4⅛".
Displacement—248 cubic inches.
Rated Horsepower—30.63 (S.A.E.).
Developed Horsepower—107 at 3400 R.P.M.
Compression Ratio—6.15-1 cast-iron head.
Compression Pressure—110-118 lbs. at cranking speed. Cylinders should be uniform within 6 lbs.
Vacuum Reading—18-20" steady at 7-8 M.P.H.
PISTONS:—Buick new 'Dome-shaped head', Lo-Ex alloy, Tri-slot, cam ground type with anodized finish. Refinish cylinders to take finished replacement pistons. **Length**—4 9/32". **Weight**—14.5 ozs.
Removal—Pistons and rods removed from above.
Clearance—Land .018-.025". Skirt .0021" desired, .0015-.0021" limits. See Fitting (following).
Original Bore Size & Replacement Pistons:—*See Buick Special Shop Notes.*
Fitting New Pistons:—**Micrometer Gauge**—Check at points just below T-slot junction on both sides of vertical slot and below lower end of slot. Use light contact only. Clearance given above for 70°F.
Feeler Gauge—Piston (with pin) and engine must be 65-70°F. Insert ½x12" feeler in cylinder, piston (with pin parallel to crankshaft and T-slot on opposite side from feeler) should pass on .0015" feeler and hold on .00225" feeler.
Installing Pistons:—T-slot away from camshaft.
PISTON RINGS:—2 compression, 2 oil control rings per piston all above pin. Top compression ring carries relief on upper inner diameter. #2 comp. assembled with mark TOP toward piston head.

Ring	Width	End Gap	Side Clearance
Comp. (#1)	⅛"	.010-.015"	.0015-.003"
Comp. (#2)	3/32"	.010-.015"	.0015-.003"
Oil Control	3/16"	.010-.015"	.0015-.003"

Replacement Rings:—.010", .020", .030" oversize.
PISTON PIN:—**Diameter**—13/16". **Length**—2 11/16". Pin clamped in rod. Pins not furnished separately.
Pin Fit in Piston—.0003-.0004" at 70°F. or easy finger push fit at room temperature.
NOTE—Use No. 25 wrench 5½" long on pin bolt.
CONNECTING ROD:—**Weight**—29.92 ozs. **Length**—7⅝".
Crankpin Journal Diameter—2".
Lower Bearing—Spun-babbitt lined type.
Clearance—.0008-.0018". **Sideplay**—.005-.010".
Bearing Adjustment:—Shims. Do not file rods or caps.
Installing Rods:—Align cap and rod. Mark on rod and cap to rear, oil hole to camshaft.
NOTE—Max. weight variation ⅛ oz. Special ground bolts used for cap assembly.
CRANKSHAFT:—5 bearing, integral counterweights with torsional balancer mounted on forward end.
Journal Diameters—#1, 2 5/16"; #2, 2⅜"; #3, 2 7/16"; #4, 2½"; #5, 2 9/16".
Bearing Type—Steel-backed, babbitt-lined. See Buick Shop Notes for replacement bearings.
Clearance—.0007-.0022".
Bearing Adjustment:—Shims. Do not file caps.
End Thrust:—Center (#3) bearing. **Endplay** .004-.008".
CAMSHAFT:—5 bearing. Non-adjustable chain drive.
Journal Diameters—#1, 2 5/32"; #2, 2⅛"; #3, 2 3/32"; #4, 2 1/16"; #5, 1¾".
Bearing Type—Steel-backed, babbitt bushings.
Clearance—.0005-.0035". **Endplay**—.002-.006".
End Thrust:—Taken by thrust plate assembled between front bearing and camshaft sprocket.
Timing Chain:—Link-Belt. Width 1". Pitch .500". Length 24½" or 49 links.
Camshaft Setting:—Mesh copper-plated washers (on chain) with marks on sprockets (on upper side).
VALVES:

	Head Diameter	Stem Diameter	Length
Intake	1 17/32"	.3715-.3725"	4 5/16"
Exhaust	1 11/32"	.3711-.3719"	4 3/64"

	Seat Angle	Lift	Stem Clearance
Intake	45°	.348"	.0015-.0035"
Exhaust	45°	.342"	.0021-.0039"

Tappet Clearance—.015" all valves (hot).
Valve Guides:—Press fit in block. Install with taper end to top. Finish ream to size.
Valve Springs:—Double springs on all valves.
Free length: Inner 1⅞". Outer 2 5/16".

Inner Spring	Pressure	Length
Valve Closed	15½-20½ lbs.	1 21/32"
Valve Open	45-51 lbs.	1 5/16"
Outer Spring	**Pressure**	**Length**
Valve Closed	26½-31½ lbs.	1 15/16"
Valve Open	67-73 lbs.	1 19/32"

Valve Lifters:—Single piece, cast-iron. Lifter guide holes reamed in crankcase. **Clearance** .0005-.0025".
Rocker Arms:—Drop-forged fitted with steel-backed babbitt bushings. Rocker arm shaft brackets are of aluminum alloy. **Clearance**—.001-.003".
VALVE TIMING:—See Camshaft Setting.
NOTE—'Timing Point' when valve .004" off seat with .015" tappet clearance or lash customarily listed instead of actual opening and closing points.
Timing Points
Intake Valves—Open 13° BTDC. Close 68° ALDC.
Exhaust Valves—Open 55° BLDC. Close 22° ATDC.
Opening and Closing Points
Intake Valves—Open 26° BTDC. Close 81½° ALDC.
Exhaust Valves—Open 68° BLDC. Close 35° ATDC.
Valve Timing Check:—#2 or #7 exhaust valve should be .145" open (actual opening as measured by dial indicator contacting spring cap), with #1 and 8 pistons on top dead center and flywheel mark 'TDC/1-8' lined up with indicator in inspection hole in right front face of flywheel housing above starter.
LUBRICATION:—Pressure with oil pump in crankcase.
Oil Pump:—Helical gear drive from camshaft. Ignition timing not disturbed by pump removal.
Oil Pump Clearances—*See Buick Shop Notes.*
Normal Oil Pressure:—45 lbs. at 35 MPH.
Oil Pressure Regulator:—On pump. Opens at 45 lbs.
Crankcase Capacity:—7 qts. (dry), 6 qts. (refill).
COOLING SYSTEM:—**Capacity** 13¼ qts. (14¼ with heater).
Water Pump:—Plain bushing, self-adjusting packing type (first cars), ball-bearing packless type (After Engine No. 4-3535259).
See articles in Mechanical Equipment Section for data.
Removal—Remove fan belt, pump mounting bolts. Lift off pump and fan assembly.
Thermostat:—Harrison. In cylinder head outlet.
Setting—Starts 148-153°F. Fully open 170-175°F.
CLUTCH:—**Own (with Long 10CF-CS driven member).** Single plate, dry disc type.
See article in Mechanical Equipment Section for data.
Facings—Woven-joined, 2 required. I.D. 6". O.D. 10". Thickness .125".
Adjustment—Clearance between pedal and underside of toeboard must be ⅜-⅝". To adjust, loosen locknut and turn setscrew at rear of pedal, above pedal stop. Free movement ¾-1". To adjust, turn self-locking nut on yoke end of equalizer lever.
Removal:—Remove Rear axle (see Rear Axle) and Transmission (see Transmission). Take off clutch underpan, disconnect clutch linkage at yoke, remove spring washer (retains release bearing support in flywheel housing), bearing support, pull yoke out (with release bearing). Mark cover and flywheel, remove mounting screws evenly and lower assembly. NOTE—Metal spacers used between release levers and cover will facilitate removal.
TRANSMISSION:—**Buick**—Constant mesh, synchromesh type with all helical gears.
See article in Mechanical Equipment Section for data.
Removal:—Remove Rear Axle (see Rear Axle). Take off steady rest rod, transmission support (with shims attached to each end), use Guide Pins (J-851) in upper bolt holes and withdraw transmission.
See Buick Special Shop Notes for Transmission Steady Rest Mounting data.
SELF-SHIFTING TRANSMISSION:—Optional.
See article in Mechanical Equipment Section for complete Removal and Adjustment instructions.
UNIVERSAL JOINT:—**Spicer** (Buick design). Plain bearing type. One used.
See article in Mechanical Equipment Section for data.
REAR AXLE:—**Buick**—Semi-floating, hypoid gear type with torque tube drive.
See article in Mechanical Equipment Section for data.
Ratio—4.40-1 (std.). 3.615-1 (with self-shift trans.).
Backlash—.006-.010".
Removal:—Hoist rear of car, remove front floor, disconnect parking brake at equalizer and remove brake conduit from torque tube, disconnect brake line at rubber hose connection (end of torque tube), rear shocks at bottom, rear radius rod at frame, coil springs at lower end (tie ends to bumper), disconnect torque tube at U-joint, pull assembly out.
Axle Shaft Removal—Remove housing cover, differential pinion shaft screw, shaft, and spacer block. Push axle assembly in, remove 'C' washer on inner end, withdraw shaft assembly. NOTE—Right axle shaft ¾" longer than left shaft.
Wheel Bearing Adjustment—None.
Rear Suspension:—Coil springs, conventional axle.
See article in Mechanical Equipment Section for data.
SHOCK ABSORBERS:—**Delco**—Model 1947-A,B (front), 1100-S (rear). Double acting, hydraulic type. Direct acting (rear only).
See article in Mechanical Equipment Section for data.
STEERING:—**Steering Gear**—Saginaw Worm-and-Double Roller type.
See article in Mechanical Equipment Section for data.
Front Suspension:—Independent, linked parallelogram type with coil springs.
See article in Mechanical Equipment Section for data.
NOTE—See Buick Shop Notes for brake assembly removal for work on Front Suspension.
Kingpin Inclination—3½-4½°.
Camber—Minus ¼° to plus 1°. Not adjustable.
Caster—Minus ⅞° plus or minus ⅜°. Adjustable.
Toe In—0-1/16". Adjustable.
Steering Geometry (Toe Out)—Inner wheel turned 23¼° plus or minus ¾°. Outer wheel 20°.
BRAKES:—**Service**—Bendix hydraulic, rigid cylinder type. Hand lever applies rear service brakes.
See article in Mechanical Equipment Section for data.
Wheel Cylinders—Diameters: Front 1 3/32". Rear 1".
Drum—Centrifuse. 12".
NOTE—Drum turn down limit .030" cut.
Lining—Ferodo BZ-10 (woven—primary), Manhattan 2320-K (moulded—secondary). Length per wheel (front shoe 9 15/16", rear 12¾"). Width 1¾" (40), 2" (60). Thickness 3/16".
Clearance—.010" plus or minus .002" at heel and toe.
Braking Power—47% rear.
Hand Brake Adjustment:—See Service Brakes (above).

HOOD SIDE PANEL REMOVAL:—See Buick Shop Notes.

SERIAL NUMBER:—First number (All Series) 13219848 (Flint), 23238767 (South Gate, Calif.), 33245765 (Linden, N. J.). On top right frame side rail at dash.

ENGINE NUMBER:—Stamped on boss on right side of crankcase above starter. First number 60 (6-3396937), 80 (8-3396937), 90 (9-3396937). NOTE—Dash (—) following engine number indicates engine factory-equipped with .010" oversize pistons.

ENGINE SPECIFICATIONS:—8 cylinder, 'I' head.
Bore—3 7/16". **Stroke**—4 5/16".
Displacement—320.2 cu. ins. **Rated H.P.**—37.81
Developed Horsepower—141 at 3600 R.P.M.
Compression Ratio—6.35-1 cast-iron head.
Compression Pressure—111-118 lbs. at cranking speed. Cylinders should be uniform within 6 lbs.
Vacuum Reading—18-20" steady at 7-8 M.P.H.

PISTONS:—Buick new 'Dome-shaped head', Lo-Ex alloy, Tri-slot, cam ground type with anodized finish. Refinish cylinders to take finished replacement pistons. **Length**—4 7/16". **Weight**—17.7 ozs.
Removal—Pistons and rods removed from above.
Clearance—Land .021-.028". Skirt .0023" desired, .0017-.0023" limits. See Fitting (following).
Original Bore Size & Replacement Pistons:—*See Buick Special Shop Notes.*
Fitting New Pistons:—**Micrometer Gauge**—Check at points just below T-slot junction on both sides of vertical slot and below lower end of slot. Use light contact only. Clearance given above for 70°F.
Feeler Gauge—Piston (with pin) and engine must be at 65-75°F. Insert ½x12" feeler in cylinder, piston (with pin parallel to crankshaft and T-slot on opposite from feeler) should pass on .0015" feeler and hold on .00225" feeler.
Installing Pistons:—T-slot away from camshaft.

PISTON RINGS:—2 compression, 2 oil control rings per piston all above pin. Top compression ring carries relief on upper inner diameter. #2 comp. assembled with face marked TOP toward piston head.

Ring	Width	End Gap	Side Clearance
Comp. (#1)	1/8"	.010-.015"	.0015-.003"
Comp. (#2)	3/32"	.010-.015"	.0015-.003"
Oil Control	3/16"	.010-.015"	.0015-.003"

Replacement Rings:—.010", .020", .030" oversize.

PISTON PIN:—**Diameter**—⅞". **Length**—3 1/16". Pin clamped in rod. Pins not furnished separately.
Pin Fit in Piston—.0003-.0004" at 70°F. or easy finger push fit at room temperature.
NOTE—Use No. 25 wrench 5½" long on pin bolt.

CONNECTING ROD:—**Weight**—38.43 ozs. **Length**—8¼".
Crankpin Journal Diameter—2¼".
Lower Bearing—Spun-babbitt lined type.
Clearance—.0008-.0018". **Sideplay**—.005-.010".
Bearing Adjustment:—Shims. Do not file rods or caps.
Installing Rods:—Align cap and rod. Mark on rod and cap to rear of engine, oil hole to camshaft.
NOTE—Max. weight variation ⅛ oz. Special ground 7/16" diam. bolts used for cap assembly.

CRANKSHAFT:—5 bearing, integral counterweights with torsional balancer mounted on forward end.
Journal Diameters—#1, 2 9/16"; #2, 2⅝"; #3 2 11/16"; #4, 2¾"; #5, 2 13/16".
Bearing Type—Steel-backed, babbitt-lined. See Buick Shop Notes for replacement bearings.
Clearance—.0007-.0022".
Bearing Adjustment:—Shims. Do not file caps.
End Thrust:—Center (#3) bearing. **Endplay** .004-.008".

CAMSHAFT:—5 bearing. Non-adjustable chain drive.
Journal Diameters—#1, 2 5/32"; #2, 2⅛"; #3, 2 3/32; #4, 2 1/16"; #5, 1¾".
Bearing Type—Steel-backed, babbitt bushings.
Clearance—.0005-.0035". **Endplay**—.002-.006".
End Thrust:—Taken by thrust plate assembled between front bearing and camshaft sprocket.
Timing Chain:—Link-Belt. Width 1". Pitch .500". Length 50 links or 25".
Camshaft Setting:—Mesh copper-plated washers (on chain) with marks on sprockets (on upper side).

VALVES:

	Head Diameter	Stem Diameter	Length
Intake	1 25/32"	.3715-.3725"	4 13/32"
Exhaust	1 7/16"	.3711-.3719"	4 7/32"

	Seat Angle	Lift	Stem Clearance
Intake	45°	.347"	.0015-.0035"
Exhaust	45°	.348"	.0021-.0039"

Tappet Clearance—.015" all valves (hot).
Valve Guides:—Press fit in block. Install with taper end to top. Finish ream to size.
Valve Springs:—Double springs on all valves.

Inner Spring	Pressure	Length
Valve Closed	15½-20½ lbs.	1 21/32"
Valve Open	45-51 lbs.	1 5/16"
Outer Spring	**Pressure**	**Length**
Valve Closed	26½-31½ lbs.	1 15/16"
Valve Open	63-73 lbs.	1 19/32"

Valve Lifters:—Single piece, cast-iron. Lifter guide holes reamed in crankcase. **Clearance** .0005-.0025".
Rocker Arms:—Drop-forged fitted with steel-backed babbitt-lined bushings. **Clearance**—.001-.003".

VALVE TIMING:—See Camshaft Setting above.
NOTE—'Timing Point' when valve .040" off seat with .015" tappet clearance or lash customarily listed instead of actual opening and closing points.
Timing Points
Intake Valves—Open 14° BTDC. Close 71° ALDC.
Exhaust Valves—Open 56° BLDC. Close 25° ATDC.
Opening and Closing Points
Intake Valves—Open 27° BTDC. Close 84½° ALDC.
Exhaust Valves—Open 69° BLDC. Close 38½° ATDC.
Valve Timing Check:—#2 or #7 exhaust valve should be .155" open (actual opening as measured by dial indicator contacting valve spring cap), with #1 and 8 pistons on top dead center and flywheel mark 'TDC/1-8' at indicator in inspection hole in right front face of flywheel housing above starter.

LUBRICATION:—Pressure with oil pump in crankcase.
Oil Pump:—Helical gear drive from camshaft. Ignition timing not disturbed by pump removal.
Oil Pump Clearances—*See Buick Shop Notes.*
Normal Oil Pressure:—45 lbs. at 35 MPH.
Oil Pressure Regulator:—On pump. Opens at 45 lbs.
Crankcase Capacity:—9 qts. (dry). 8 qts. (refill).

COOLING SYSTEM:—**Capacity** 17 qts. (18 with heater).
Water Pump:—Plain bushing, self-adjusting packing type (all 80, 90; first 60), ball-bearing, packless type (Model 60 after Engine No. 6-3524449).
See articles in Mechanical Equipment Section for data.
Removal—Remove fan belt, pump mounting bolts. Lift off pump and fan assembly.
Thermostat:—Harrison. In cylinder head outlet.
Setting—Starts 148-153°F. Fully open 170-175°.

CLUTCH:—**Own (with Borg & Beck driven member).** Single plate, dry disc type.
See article in Mechanical Equipment Section for data.
Facings—Molded-woven type, 2 required. I.D. 6½". O.D. 11". Thickness ⅛".
Pedal Return Spring—See Buick Shop Notes.
Adjustment—Clearance between pedal and underside of toeboard must be ⅜-⅝". To adjust, loosen locknut, turn setscrew at rear of pedal above top. Free movement of pedal must be ¾-1". To adjust, turn nut on yoke end of inner equalizer lever (60), on pedal rod (80, 90).
Removal:—Remove Rear Axle (see Rear Axle) and Transmission (see Transmission). Take off clutch underpan, release tension on pedal return spring by backing off nut on eye bolt, disconnect clutch linkage at yoke, remove spring washer (retains release bearing support), pull yoke out (with release bearing). Mark cover and flywheel, remove mounting screws evenly and lower assembly out. NOTE—Metal spacers used between release levers and cover will facilitate removal of mounting screws.

TRANSMISSION:—**Buick**—Constant mesh, synchro-mesh type with all helical gears.
See article in Mechanical Equipment Section for data.
Removal:—Remove Rear Axle (see Rear Axle). Release nut on eye bolt of clutch pedal return spring. Remove pedal bracket and brake master cylinder. Take off steady rest rod, transmission support (with shims attached to each end), use Guide Pins (J-851) in upper mounting holes, withdraw transmission.
See Buick Special Shop Notes for Transmission Steady Rest Mounting data.

UNIVERSAL JOINT:—**Spicer** (Buick design). Plain bearing type. One used.
See article in Mechanical Equipment Section for data.

REAR AXLE:—**Buick**—Semi-floating, hypoid gear type with torque tube drive.
See article in Mechanical Equipment Section for data.
Ratio—3.9-1 (60), 4.1818-1 (80), 4.555-1 (90).
Backlash—.006-.010".
Removal:—Hoist rear of car, remove front floor, brake conduit from torque tube, disconnect brake line at rubber hose connection (end of torque tube), rear shocks at bottom, rear radius rod at frame, coil springs at lower end (tie ends to bumper), disconnect torque tube at U-joint, pull assembly out.
Axle Shaft Removal—Remove housing cover, differential pinion shaft screw, shaft, and spacer block. Push axle assembly in, remove 'C' washer on inner end, withdraw shaft assembly. Right axle shaft ¾" (60), 15/16" (80, 90) longer than left shaft.
Wheel Bearing Adjustment—None.
Rear Suspension:—Coil springs, conventional axle.
See article in Mechanical Equipment Section for data.

SHOCK ABSORBERS:—**Delco**—Model 1947-A, B (60—front), 1902-C, D (80, 90—front). 1100-S (all—rear). Double acting, hydraulic type. Direct acting (rear).
See article in Mechanical Equipment Section for data.

STEERING:—**Steering Gear**—Saginaw Worm-and-Double Roller type.
See article in Mechanical Equipment Section for data.
Front Suspension:—Independent, linked parallelogram type with coil springs.
See article in Mechanical Equipment Section for data.
NOTE—See Buick Shop Notes for brake assembly removal for work on front suspension.
Kingpin Inclination—3½-4½° (60), 4¼-5¼° (80), 4-5° (90).
Camber—Minus ¼° to plus 1°. Not adjustable.
Caster—Minus ⅞° plus or minus ⅜°. Adjustable.
Toe In—0-1/16". Adjustable.
Steering Geometry (Toe Out)—Inner wheel turned 23¾° (60, 80), 24° (90). Outer 20°.

BRAKES:—**Service**—Bendix hydraulic, rigid cylinder type. Hand lever applies rear service brakes.
See previous page (38-40) for 60 specifications.
See article in Mechanical Equipment Section for data.
Wheel Cylinders—Diam. Front 1¼". Rear 1 3/16".
Drum—12" (80), 14" (90). Cast-iron, ribbed.
Lining—Ferodo BZ-10 (woven—primary), Manhatten 2320-K (moulded—secondary). Length per wheel (front shoe 9 15/16"—80, 12 1/16"—90; rear 12¾"—80, 14¾"—90). Width 2". Thickness 3/16" (80), ¼" (90).
Clearance—.010" plus or minus .002" at heel and toe.
Braking Power—47.4% rear.
Hand Brake Adjustment:—See Service Brakes (above).

SERIES 60 NOTE:—All data on chassis units (Universal Joint, Transmission, Rear Axle, Shock Absorbers, Steering and Brakes) given below applies also to Series 60 cars.

SERIAL NUMBER:—First number 13388547 (Flint), 23395088 (Calif.), 33405088 (Linden). Stamped on top of right frame side rail at dash.

ENGINE NUMBER:—First number 3572652. Stamped on boss on right side of crankcase above starter.
NOTE—Dash (—) following engine number indicates engine equipped with .010" oversize pistons.

ENGINE SPECIFICATIONS:—Own Model 40. 8 cylinder, 'I' head type. **Bore** 3 3/32". **Stroke** 4⅛".
Piston Displacement—248 cu. ins.
Rated Horsepower—30.63.
Developed Horsepower—107 at 3400 RPM.
Compression Ratio—6.1-1 Std. cast-iron head.
Compression Pressure—126 lbs. at 1000 RPM., 112 lbs. at cranking speed (uniform within 6 lbs.).
Vacuum Reading—18-20" idling at 7-8 MPH.

PISTONS:—Modified type 'Dome head,' aluminum alloy, tri-slot, cam-ground, anodized type.
See Buick Shop Notes for description and all Replacement Piston specifications and data.
Length—4 9/32". Weight—14¼ ozs. (stripped).
Removal—Pistons and rods removed from above.
Clearance—.0021" (.0018-.0024") top of skirt.
Fitting New Pistons:—If micrometer used, check at points on each side of vertical slot at top of skirt, and at lower end of slot (light contact only). Clearance above correct for pistons at 70°F. If feeler gauge used, install ½" wide feeler between piston and cylinder wall on side opposite slot (piston inverted, pin parallel to crankshaft). Piston should pass on .0015" feeler, hold on .00225" feeler.
Installing Pistons:—Slot away from camshaft.

PISTON RINGS:—Two compression, two oil control rings, all above pin (narrow heat-dam groove above top ring). Both oil ring grooves drilled for oil drains.
NOTE—Install top compression ring with relief on inner rim up, #2 ring with mark 'TOP' up.

Ring	Width	End Gap	Side Clearance
Compr. (#1)	1/8"	.010-.020"	.002-.004"
Compr. (#2)	3/32"	.010-.015"	.0015-.003"
Oil Contr.	3/16"	.010-.015"	.0015-.003"

Replacement Rings:—.010", .020", .030" oversize.

PISTON PIN:—Diameter .8127". **Length** 2 11/16".
Pin clamped in rod. Not furnished separately (all replacement pistons have pins installed).
Pin Fit in Piston—.0003-.0004" at 70°F. (easy finger push fit at room temperature).
NOTE—Use #25 wrench (5½") only on pin bolt.

CONNECTING ROD:—Length 7⅝". **Weight** 30¾ ozs. (maximum variation ⅛ ounce).
Crankpin Journal Diameter—2".
Lower Bearing—Spun babbitt-lined type.
Clearance—.0008-.0018". **Sideplay** .005-.010".
Bearing Adjustment:—Shims. Do not file rods or caps.
Installing Rods:—Marks on rod and cap toward rear of engine, oil hole toward camshaft. Align rod and cap.
NOTE—Special ground bolts must be used on rod caps.

CRANKSHAFT:—5 bearing, integral counterweights.
Journal Diameters—#1, 2 5/16".; #2, 2⅜"; #3, 2 7/16"; #4, 2½"; #5, 2 9/16".
Bearings—Steel-backed, babbitt-lined type. *See Buick Shop Notes for Replacement Bearing data.*
Clearance—.0007-.0022".
Bearing Adjustment:—Shims. Do not file caps.
End Thrust:—Center (#3) bearing. **Endplay** .004-.008".

CAMSHAFT:—5 bearing. Non-adjustable chain drive.
Journal Diameters—#1, 2 5/32"; #2, 2⅛"; #3, 2 3/32"; #4, 2 1/16"; #5, 1¾".
Bearing Type—Steel-backed, babbitt bushings.
Clearance—.0005-.0035". **Endplay**—.004-.008".
End Thrust:—Thrust plate between front bearing and camshaft sprocket.
Timing Chain:—Link Belt. Width 1". Pitch .500", Length 24½" or 49 links.
Camshaft Setting:—Mesh copper-plated washers on chain with marks on sprockets (marks upward).

VALVES:—

	Head Diam.	Stem Diam.	Overall Length
Intake	1 17/32"	.3720"	5.1"
Exhaust	1 11/32"	.3715"	5.1"

	Seat Angle	Lift	Stem Clearance
Intake	45°	.348"	.0015-.0035"
Exhaust	45°	.342"	.0021-.0039"

Tappet Clearance:—.015" all valves—engine hot.
Valve Guides:—Press fit in head, installed with taper end up. Finish ream for correct clearance.
Valve Springs:—Double springs on all valves. Spring free length 1⅞" (inner), 2 5/16" (outer).

	Inner Spring. Pressure	Inner Spring. Length	Outer Spring. Pressure	Outer Spring. Length
Closed	15½-20½ lbs.	1 21/32"	26½-31½ lbs.	1 15/16"
Open	45-51 lbs.	1 5/16"	67-73 lbs.	1 19/32"

Valve Lifters:—Barrel type, cast-iron. Lifter guide holes reamed in block. **Clearance** .0005-.0025".
Rocker Arms:—*See Buick Shop Notes for installation and fitting directions.*
Valve Timing:—See Camshaft Setting above.
Timing Points (Valve .004" Open).
Intake Valves — Open 13° BTDC. Close 68° ALDC.
Exhaust Valves—Open 55° BLDC. Close 22° ATDC.
Opening & Closing Points.
Intake Valves—Open 26° BTDC. Close 81½° ALDC.
Exhaust Valves—Open 68° BLDC. Close 35° ATDC.
Valve Timing Check—With .015" tappet clearance, #2 or 7 exhaust valve should be .145" open (actual valve opening—use dial indicator) with #1 & 8 pistons at TDC and flywheel mark 'TDC/1-8' at indicator (inspection hole, right front face of housing).

LUBRICATION:—Pressure type (gear type oil pump in crankcase.) *See Buick Shop Notes for Oil Pump data.*
Normal Oil Pressure:—45 lbs. at 35 MPH.
Oil Pressure Regulator:—On pump, opens at 45 lbs. Non-adjustable type.
Crankcase Capacity:—7 qts. (dry), 6 qts. (refill).

COOLING SYSTEM:—Capacity—13¼ qts.
Water Pump:—New ball-bearing, packless type.
See article in Mechanical Equipment Section for data.
Removal—Remove fan belt, pump mounting bolts, lift off pump and fan assembly.
Thermostat:—Harrison. In cylinder head outlet.
Setting—Opens at 148-155°F.
Temperature Gauge:—AC #1510755 Thermo type.
See article in Mechanical Equipment Section for data.

CLUTCH:—Own Make with Borg & Beck 'Borglite' driven member. Single plate, 'crown-spring' type.
See article in Mechanical Equipment Section for data.
Facings—Woven, grooved type, 2 required. Inside Diam. 7". Outside Diam. 10". Thickness .125".
Adjustment:—Pedal free movement ¾-1" (adjusting clevis and locknut on link at clutch fork). Pedal toeboard clearance (underside) ⅞" (setscrew and locknut at lower end of pedal).
Removal:—Remove Rear Axle & Transmission (see below), take off clutch underpan, release return spring (back off nut on spring eyebolt), disconnect linkage, remove yoke and release bearing retainer, mark clutch and flywheel, take out mounting screws in clutch cover flange.
See Buick Shop Notes for 'Over-center' Return Spring installation and adjustment.

TRANSMISSION (40, 60):—Own Make. All helical gear, constant-mesh, synchro-mesh (second and high), sliding gear (low and reverse) with new remote shift control.
Transmission Control:—Buick 'Handi-shift' type.
See article in Mechanical Equipment Section for data.
Removal:—Remove Rear Axle (see below), disconnect shift linkage at transmission case, remove upper mounting bolts, install guide pins (J-851), remove lower mounting bolts, pull transmission back and out.
NOTE—See Mechanical Equipment Section for shifter linkage adjustment when installing transmission.

UNIVERSAL JOINT (40,60):—Mechanics Type 2C. 1 used
See article in Mechanical Equipment Section for data.

REAR AXLE (40, 60):—Own Make. Semi-floating, hypoid gear type with torque tube drive (new straight-line drive).
See article in Mechanical Equipment Section for data.
Ratio—4.44-1 (Std. 40), 3.9-1 (Std. 60, Optl. 40), 3.615-1 (Optl. 60). **Backlash**—.008-.010".
Removal:—Hoist rear of car; disconnect parking brake at equalizer, hydraulic brake line at frame connection, shock absorber links at lower end, axle end of rear radius rod, lower end of chassis springs (wire springs to bumper for chassis). Disconnect front end of front torque tube at transmission end plate. Remove nut, lockwasher, torque ball mounting washer at inner end of each torque ball mounting stud, take out bolts holding torque ball mounting assembly to frame on each side, remove rear axle assembly. **Do not loosen locknut on torque ball mounting stud or interchange torque ball mounting assemblies from one side of car to the other which will destroy Rear Axle and Engine alignment.** *See Buick Shop Notes for Aligning Instructions.*
Axle Shaft Removal:—Same as 1938 (see 1938 data).
Wheel Bearing Adjustment—None.
Rear Suspension:—Coil springs, conventional axle.
See article in Mechanical Equipment Section for data.

SHOCK ABSORBERS:—Delco. Model 1948-A (right frt.), 1948-B (left frt.), 2103-A, E (right rear), 2103-B, F (left rear). Double acting, hydraulic type. NOTE—Rear Shocks are new parallel cylinder type. Valves for these rear shocks have been changed in production.
See article in Mechanical Equipment Section for data.

STEERING:—Steering Gear—Saginaw Worm-and-Double roller type. *See Mechanical Equipment Section.*
Front Suspension:—Independent, linked parallelogram type with coil springs.
See article in Mechanical Equipment Section for data.
Kingpin Inclination—3½-4½° crosswise.
Camber—Minus ¼° to plus 1°. Not adjustable.
Caster—Minus ⅞° plus or minus ⅜°. Adjustable.
Toe In—0-1/16". Adjustable.
Steering Geometry (Toe-out on Turns)—Inner wheel turned 22½ plus or minus ¾°, outer wheel 20°.

BRAKES (40, 60):—Service—Bendix hydraulic, duo-servo, single anchor type without eccentric adjustment. Hand lever apples rear wheel service brakes.
See article in Mechanical Equipment Section for data.
Drums—Centrifuse type. Diameter 12".
Lining—Woven (primary), moulded (secondary). Width 1¾" (40), 2" (60), Thickness 3/16". Length per wheel 22 11/16".
Clearance—.015" (both ends of secondary shoe).
Braking Power—47% rear, 53% front.
Hand Brake:—See Service Brakes above.
NoRol:—Optl. *See article in Mechanical Equipment Section.*

SERIES 60 NOTE:—For data on chassis units (Universal Joint, Transmission, Rear Axle, Shock Absorbers, Steering and Brakes) refer to preceding Series 40 data. Engine and Clutch data below apply to Series 60.

SERIAL NUMBER:—First number 13388547 (Flint), 23395088 (Calif.), 33405088 (Linden). Stamped on top of right frame side rail at dash.

ENGINE NUMBER:—First number (60) 6-, (80) 8-, (90) 9-3572652 (same number all series). Stamped on boss on right side of crankcase above starter. NOTE—Dash (—) following engine number indicates engine equipped with .010" oversize pistons.

ENGINE:—Own Series 60, 80, 90. 8 cylinder, 'I' or overhead valve type.
Bore—3 7/16". **Stroke**—4 5/16".
Piston Displacement—320.2 cu. ins.
Rated Horsepower—37.81.
Developed Horsepower—141 at 3600 RPM.
Compression Ratio—6.25-1 Std. cast-iron head.
Compression Pressure—130 lbs. at 1000 RPM, 113.8 lbs. at cranking speed (uniform within 6 lbs.).
Vacuum Reading—18-20" idling at 7-8 MPH.

PISTONS:—Modified 'Dome-head', aluminum alloy, tri-slot, cam ground, anodized finished type.
See Buick Shop Notes for description and all Replacement Piston specifications and data.
Length—4 7/16". **Weight**—17.3 ozs. (stripped).
Removal—Pistons and rods removed from above.
Clearance—.0023" (.0020-.0026") top of skirt.
Fitting New Pistons:—If micrometer used, check at points on each side of vertical slot at top of skirt, and at lower end of slot (light contact only). Clearance above correct for pistons at 70°F. If feeler gauge used, install ½" wide feeler between piston and cylinder wall on side opposite slot (piston inverted, pin parallel to crankshaft). Piston should pass on .0015" feeler and hold on .00225" feeler.
Installing Pistons:—Slot away from camshaft.

PISTON RINGS:—Two compression, two oil control rings, all above pin (narrow heat-dam groove above top ring). Both oil ring grooves drilled for oil drains. NOTE—Install top compression ring with relief on inner rim up, #2 ring with mark 'TOP' up.

Ring	Width	End Gap	Side Clearance
Compr. (#1)	1/8"	.010-.020"	.002-.004"
Compr. (#2)	3/32"	.010-.015"	.0015-.003"
Oil Contr.	3/16"	.010-.015"	.0015-.003"

Replacement Rings:—.010", .020", .030" oversize.

PISTON PIN:—Diameter ⅞". **Length** 3 1/16".
Pin clamped in rod. Not furnished separately (all replacement pistons have pin installed).
Pin Fit in Piston—.0003-.0004" at 70° F. (easy finger push fit at room temperature).
NOTE—Use #25 wrench (5½") only on pin bolt.

CONNECTING ROD:—Length 8¼". **Weight** 38½ ozs. (maximum variation ⅛ ounce).
Crankpin Journal Diameter—2¼".
Lower Bearing—Spun babbitt-lined type.
Clearance—.0008-.0018". **Sideplay** .005-.010".
Bearing Adjustment:—Shims. Do not file rods or caps.
Installing Rods:—Marks on rod and cap toward rear of engine, oil hole toward camshaft. Align rod and cap.
NOTE—Special ground bolts must be used on rod caps.

CRANKSHAFT:—5 bearing. Integral counterweights.
Journal Diameters—#1, 2 9/16"; #2, 2⅝"; #3, 2 11/16"; #4, 2¾"; #5, 2 13/16".
Bearings—Steel-backed, babbitt-lined type. *See Buick Shop Notes for replacement bearing data.*
Clearance—.0007-.0022".
Bearing Adjustment:—Shims. Do not file caps.
End Thrust:—Center (#3) bearing. **Endplay** .004-.008".

CAMSHAFT:—5 bearing. Non-adjustable chain drive.
Journal Diameters—#1, 2 5/32"; #2, 2⅛"; #3, 2 3/32"; #4, 2 1/16"; #5, 1¾".
Bearing Type—Steel-backed, babbitted bushings.
Clearance—.0005-.0035". **Endplay** .004-.008".
End Thrust:—Thrust plate between front bearing and camshaft sprocket.
Timing Chain:—Link Belt. Width 1". Pitch .500". Length 25" or 50 links.
Camshaft Setting:—Mesh copper-plated washers on chain with marks on sprockets (marks upward).

VALVES:—

	Head Diam.	Stem Diam.	Overall Length
Intake	1 25/32"	.3720"	5¼"
Exhaust	1 7/16"	.3715"	5¼"

	Seat Angle	Lift	Stem Clearance
Intake	45°	.347"	.0015-.0035"
Exhaust	45°	.348"	.0021-.0039"

Tappet Clearance:—.015" all valves—engine hot.
Valve Guides:—Press fit in head, installed with taper end up. Finish ream for correct clearance.
Valve Springs:—Double springs on all valves. Spring free length 1⅞" (inner), 2 5/16" (outer).

	Inner Spring.		Outer Spring.	
	Pressure	Length	Pressure	Length
Closed	15½-20½ lbs.	1 21/32"	26½-31½ lbs.	1 15/16"
Open	45-51 lbs.	1 5/16"	67-73 lbs.	1 19/32"

Valve Lifters:—Barrel type, cast-iron. Lifter guide holes reamed in block. **Clearance** .0005-.0025".
Rocker Arms:—*See Buick Shop Notes for installation and fitting directions.*
Valve Timing:—See Camshaft Setting above.

Timing Points (Valve .004" Open).
Intake Valves — Open 14° BTDC. Close 71° ALDC.
Exhaust Valves—Open 56° BLDC. Close 25° ATDC.

Opening & Closing Points.
Intake Valves—Open 27° BTDC. Close 84½° ALDC.
Exhaust Valves—Open 69° BLDC. Close 38½° ATDC.
Valve Timing Check—With .015" tappet clearance, #2 or 7 exhaust valve should be .155" open (actual valve opening—use dial indicator) with #1 & 8 pistons on TDC and flywheel mark 'TDC/1-8' at indicator in inspection hole in right front face of flywheel housing.

LUBRICATION:—Pressure type (gear type oil pump in crankcase). *See Buick Shop Notes for oil pump data.*
Normal Oil Pressure—45 lbs. at 35 MPH.
Oil Pressure Regulator—On pump. Opens at 45 lbs. Non-adjustable type.
Crankcase Capacity—9 qts. (dry), 8 qts. (refill).

COOLING SYSTEM:—Capacity—17 qts.
Water Pump:—New ball-bearing, packless type.
See article in Mechanical Equipment Section.
Removal—Remove fan belt, pump pulley mounting bolts, lift out pump and fan assembly.
Thermostat:—Harrison. In cylinder head outlet.
Setting—Open at 148-155°F.
Temperature Gauge:—AC #1510755 Thermo type.
See article in Mechanical Equipment Section for data.

CLUTCH:—Own make with Borg & Beck 'Borglite' driven member. Single plate, dry disc type.
See article in Mechanical Equipment Section for data.
Facings—Woven, grooved type, 2 required. Inside Diam. 6½". Outside Diam. 10½". Thickness .125".
Adjustment:—Pedal free movement ¾-1" (adjusting clevis and locknut on link at clutch fork). Pedal toeboard clearance (underside) ⅞" (setscrew and locknut at lower end of pedal).
Removal:—Remove Rear Axle & Transmission (see below), take off clutch underpan, release return spring (back off nut on spring eyebolt), disconnect linkage, remove yoke and release bearing retainer, mark clutch and flywheel, take out mounting screws in clutch cover flange.
See Buick Shop Notes for 'Over-center' return spring installation and adjustment.

TRANSMISSION (80, 90):—Own make. All helical gear, constant-mesh, synchro-mesh (second and high), sliding gear (low and reverse) with new remote shift control.
Transmission Control:—Buick 'Handi-shift' type.
See articles in Mechanical Equipment Section.
Removal:—Remove rear axle (see below), remove Steady-rest rod and support with shims attached to each end, remove upper mounting bolts, install guide pins (J-851), remove lower mounting bolts, pull transmission back and out.
NOTE—*See Mechanical Equipment Section for shifter linkage adjustment when installing transmission.*
Transmission Steady Rest—*See Buick Shop Notes for installation and adjustment directions.*

UNIVERSAL JOINT (80, 90):—Spicer No. 302-2. 1 used.
See article in Mechanical Equipment Section for data.

REAR AXLE (80, 90):—Own Make. Semi-floating, hypoid gear type with torque tube drive. NOTE—New straight-line drive used only on Series 40, 60. See Series 40 page for 40, 60 data.
See article in Mechanical Equipment Section for data.
Ratio—4.182-1 (80), 4.555-1 (90).
Backlash—.008-.010".
Removal:—Hoist rear of car; disconnect parking brake at equalizer, hydraulic brake line at frame connection, lower end of shock absorber links, equalizer bar at axle end, lower end of chassis springs (wire springs to bumper for clearance). Disconnect torque tube at universal joint ball, remove axle assembly.
Axle Shaft Removal:—Same as 1938 (see 1938 data).
Wheel Bearing Adjustment—None.
Rear Suspension:—Coil springs, conventional axle.
See article in Mechanical Equipment Section for data.

SHOCK ABSORBERS (80, 90):—Delco. Double acting, hydraulic type (Inertia control for front shocks only).

	Right Frt.	Right Rear.	Left Frt.	Left Rear.
Model 80	1902-D-60	1751-R	1902-C-60	1751-S
Model 90	1902-D-61	1751-R	1902-C-61	1751-S

See article in Mechanical Equipment Section for data.

STEERING (80, 90):—Steering Gear. Saginaw Worm-and-double-roller type.
See article in Mechanical Equipment Section for data.
Front Suspension:—Independent, linked parallelogram type with coil springs.
See article in Mechanical Equipment Section for data.
Kingpin Inclination—4¼-5¼° (80), 4-5° (90).
Camber—Minus ¼° to Plus 1°. Not adjustable.
Caster—Minus ⅞° plus or minus ⅜°. Adjustable.
Toe In—0-1/16". Adjustable.
Steering Geometry (Toe-out on Turns)—Inner wheel turned 23¾° (80), 24° (90) plus or minus ¾°, outer wheel turned 20°.

BRAKES (80, 90):—Service. Bendix hydraulic, duo-servo, single anchor type without eccentric adjustment. Hand lever applies rear wheel service brakes.
See article in Mechanical Equipment Section for data.
Drums—Cast-iron. Diameter 12" (80), 14" (90).
Lining—Woven (primary), moulded (secondary). Width 2". Thickness 3/16" (80), ¼" (90). Length per wheel 22 11/16" (80), 26 13/16" (90).
Clearance—.015" both ends of secondary shoe.
Braking Power—47.4% rear, 52.6% front.
Hand Brake:—See Service Brakes above.
NoRol:—Optl. *See article in Mechanical Equipment Section.*

1938-39 MODELS

HOOD & SIDE PANEL REMOVAL:—Hood hinged at cowl and lifts from forward end. Tilt radiator ornament back to free latch, lift hood slightly, free safety catch under forward edge of hood, lift up. NOTE—1939 V8 Models equipped with automatic safety catch (released by radiator ornament).

Side Panels—To remove, take out two bolts on upper edge of panel. Lower edge of panel secured by clips (50, 60, 60S, 61, 65), thumb screws (75, 90).

1938-39 MODELS

RADIATOR REMOVAL (ALL SERIES):—To remove radiator core (for work on front of engine), drain cooling system, remove hood side panels (not necessary to remove hood). Remove air cleaner assembly (V8 cars), ignition coils, distributor heads, fuel pumps, and fan assembly (V16 cars). Remove radiator-to-dash brace rods, loosen hoses at radiator fittings (on V16, remove lower elbows also), remove sheet metal shroud above core, take out radiator mounting screws, slide top of core back, lift up.

1936-39 MODELS

CYLINDER HEAD GASKETS (V8 MODELS):—Care must be exercised to install proper gasket. Use of wrong gasket may cause sluggish engine performance. Part numbers stamped between inner bores.

Model	Part Number
36-60	1412661
36-70, 75	1412662
37, 38, 39-50	1419114
37, 38, 39-60, 60S, 61, 65, 70, 75	1419759

Installation—Interchangeable between banks. Install large triangular hole on inner edge to rear.

1938-39 MODELS

CYLINDER HEAD IDENTIFICATION (V8 MODELS):—Same cylinder head used on both the La Salle 50 and the Cadillac 75 models (provides higher compression ratio on 75). All production cylinder heads marked with piston displacement and compression ratio as follows: Right Hand Head—322-625 and 346-670, Left Hand Head—322-625 (La Salle 50), 346-670 (Cadillac 75). Replacement heads marked with both ratios (both right and left hand heads). NOTE—Some of first heads incorrectly marked 346-680, these heads identical with those marked 346-670.

Models 60, 60S, 61, 65. These heads have 6.25-1 ratio. Interchangeable between these models only.

1936-39 MODELS

CYLINDER HEAD INSTALLATION:—V8 Models. Two capscrews used at water outlet connection on each head have oversize head and are ½" longer. Must not be used in any other position (will damage head if installed in any other holes). Tighten all head screws to 70-75 ft. lbs. tension.

1938-39 MODELS

V16 Models. Install short capscrews along lower edge of head, coat all screws with white lead before installing (necessary to prevent leaks as screws enter water jacket). Tighten screws from center of head outward, retighten with engine warmed up.

1937-39 MODELS

LOWERING COMPRESSION RATIO (V8 MODELS):—Standard compression ratio may be lowered by installing two shims between cylinder head and block. Shim part numbers as follows: 50 (#1421931), 60, 60S, 61, 65, 70, 75 (#1421930).

1937 MODELS

V-12, V-16—Standard compression ratio lowered by installing thick gaskets between cylinder heads and blocks. Part numbers as follows: 85 (894339), 90 (896450).

1938-39 MODELS

REPLACEMENT PISTONS (ALL MODELS):—Finished aluminum alloy, T-slot, cam ground pistons with anodized finish furnished for service in sizes (with piston skirt diameter limits) listed below.

1939 V8 Note—Pistons have wider top land and use a narrower top compression ring.

CADILLAC V8 AND LA SALLE V8

Size	La Salle V8	Cadillac V8
Standard	3.3726-3.3746"	3.4979-3.4999"
.003" oversize	3.3761-3.3776"	3.5014-3.5029"
.005" oversize	3.3781-3.3796"	3.5034-3.5049"
.010" oversize	3.3831-3.3846"	3.5084-3.5099"
.015" oversize	3.3881-3.3896"	3.5135-3.5149"
.030" oversize	3.4031-3.4046"	3.5284-3.5299"

CADILLAC V16

Size	Cadillac V16
Standard	3.2483-3.2503"
.005" oversize	3.2538-3.2553"
.010" oversize	3.2588-3.2603"
.015" oversize	3.2638-3.2653"
.030" oversize	3.2788-3.2803"

1936-39 MODELS

PISTON PIN SERVICING (V8 MODELS):—Removal. Heat piston in boiling water to expand pin hole, push pin out by hand from ribbed boss end (one boss marked by raised rib on underside within piston). Do not use arbor press to remove pins.

Pin Bushing in Connecting Rod:—Split type. Press out old bushing in arbor press (use sudden jerk to start bushing). Use special tool kit No. HM-250 to install new bushings. Insert bushing with split at right angles to rod center-line, and oil hole lined up with oil hole in rod, press bushing into rod with special bushing replacer and arbor press. Finish bushing by pressing burnishing bar through bushing (use kerosene as lubricant) using 2 or 3 ton arbor press, check pin fit, repeat burnishing operation until correct clearance secured.

Installing Pin:—Heat piston in boiling water, coat pin with engine oil, press pin in by hand from side opposite ribbed boss.

1938-39 V16 MODELS

PISTON PIN REMOVAL & INSTALLATION (V16):—Rod web split at pin hole with clampscrew below pin (pin hole not split open) and pin must be removed and installed as follows: With locking screw removed, use tool J-1167 to spread split end of connecting rod, then tap pin out of piston and rod with brass drift. Install in same manner, with notch in pin lined up with lockscrew hole, turn lockscrew part way in before removing spreader tool. Tighten lockscrew to 20-25 ft. lbs. tension.

1936-39 MODELS

CONNECTING RODS (V8 MODELS):—Rods are split at an angle at lower end to permit removal through top of block. Caps doweled in rod and held by special capscrews (unequal length) with lockwashers under head. Use new lockwashers (Part #1419129) and tighten bearing capscrews to 55-60 ft. lbs.

Connecting Rod Bearing Installation:—Bearing halves not interchangeable (upper half has oil holes for piston pin oil channel and spray hole for cylinder wall lubrication). When installing upper halves, oil holes must line up with drilled holes in rod.

1936-39 MODELS

MAIN BEARING SERVICING (ALL MODELS):—Removal. To remove bearing upper halves (without removing crankshaft), use cotterpin with head flattened to 'T' shape inserted in crankshaft oil hole, rotate crankshaft in reverse direction to turn bearing shell out. Rotate new bearing shell in place in same manner (making sure locating lug on bearing shell in correct position to seat in groove in block). Tighten cap bolts to 130-140 ft. lbs. (V8), and to 100-110 lbs. (V16).

1938-39 MODELS

Rear Main Bearing Oil Seal Installation:—With crankshaft out of engine (remove bearing shells to prevent damaging), install length of new packing making certain that it is inserted behind sheet metal retainer, drive packing up into place in crankcase with tool J-1177 (pound handle of tool with hammer to seat packing), cut off each end of packing flush with bearing edge before removing tool. Install packing in bearing cap in same manner (use arbor press to seat packing).

1936-39 MODELS

CAMSHAFT BEARING SERVICING (V8 MODELS):—Removal. To remove camshaft, remove radiator and engine front cover, transmission and flywheel housing, distributor and oil pump drive gear, valve lifter assemblies, timing chain and sprockets. Pull camshaft out, press old bushings out (use tool J-829).

Camshaft Bushing Installation:—Paint outside surface of bearings with white lead, install front bearing first, rear bearing second, center bearing last (in each case, pilot installing tool in other two bearings). Make certain that oil holes aligned.

1938-39 MODELS

CAMSHAFT SERVICING (V16 MODELS):—Camshaft must be removed for all service operations.

Removal & Installation:—Remove front end assembly (radiator & frt. fenders) as unit, disconnect the flexible pipes from gasoline lines to fuel pumps and jack up front of engine, remove crankshaft bal-

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ancer and pulley, chain case cover, timing chain and camshaft sprocket, valves, valve lifters, vacuum pump and operating plunger. Install special camshaft tool J-1210 (attach by turning tool into tapped hole for sprocket screw), withdraw camshaft. When installing camshaft, make certain that front camshaft bearing is properly installed (offset to insure correct alignment).

1936-39 MODELS

VALVE SERVICING (V8 MODELS):—Valves should be checked with gauge J-1055 for correct stem length when installed (grind off end of stem until gauge slides in place with valve in closed position).

NOTE—Valve lifter assemblies must be removed before valve springs can be compressed to remove spring keepers and free valves. Use tool J-827 to hold plungers down when re-installing lifters. Use tool J-257-X to compress valve springs for spring keeper removal and installation.

1936-39 MODELS

LUBRICATION SYSTEM SERVICING (V8 MODELS):—Clean all oil lines and channels in block before installing new main or connecting rod bearings. To clean channels in block, remove oil pump, filter, take out plug at front end of crankcase oil header (left side at angle of crankcase and cylinder block). Use compressed air and shots of kerosene at plug hole to clean lines (if engine dismantled, take out plugs at line to each bearing, clean lines with wire brush). Clean oil spray hole at lower end of each rod. NOTE—Oil filter used on 1936-37 V8 models cars only.

Oil Pump Specifications ('36-38):—Drive gear Backlash .018" Maximum, Endplay .003-.010" (new), .015" (worn limit). Drive shaft clearance in bushing .001-.0025" (new), .010" (worn limit). Pump gear clearance in pump body .0025-.0085" (new), Endplay .002-.004" (new), .015" (worn limit).

Oil Pump Specifications ('39):—Pump drive gear Backlash .008-.012", Endplay .001-.004" (new), .006" (worn). Drive shaft clearance in pump body .0010-.0025" (new), .005" (worn). Pump gear clearance in pump body .002-.004" (new), .006" (worn).

1938-39 MODELS

LUBRICATION SYSTEM SERVICING (V16 MODEL):—Clean oil passages in block in same manner as for V8 models. If auxiliary relief valve for hydraulic valve lifter lines removed (located at rear of left hand lifter passage) make certain that relief hole turned so that oil will flow against camshaft and not on oil pump gears when valve reinstalled. Do not disturb plugs in crankcase directly above each valve lifter oil passage.

Oil Pump Specifications:—Oil pump drive gear Backlash .008-.012", Endplay .001-.004" (new), .006" (worn). Drive shaft clearance in pump body .0010-.0025" (new), .005" (worn). Pump gear clearance in pump body .002-.004" (new), .006" (worn).

1938-39 MODELS

CLUTCH BALANCING (ALL MODELS):—Balance clutch after installation by running the engine (with rear wheels jacked up) at speeds of 24 to 30 MPH. (for V8), 32 to 38 MPH. (for V16) and checking vibration. Add ⅛" washers with 5/16" hole under mounting screw heads (start at point where clutch drilled for balance) until vibration gone.

Clutch Housing Removal (V16):—Clutch must be removed before housing can be taken off engine (housing will not clear clutch and flywheel).

1939 MODELS

REAR STABILIZER (60S, 75, & 90):—**Installation.** With car at curb weight (no passenger load), attach stabilizer to axle first, and then to frame bracket, finally draw up adjusting nuts securely without disturbing position of rod.

1939 MODELS

FAN PULLEY REPLACEMENT (V8 MODELS):—Two types of fan pulleys used in production. Second type (also used for service replacement) carries metal reinforcement cup 5/64" thick on inner side of hub.

Cadillac V8—No allowance necessary for reinforcement cup (pulley attached to rear face of hub).

La Salle—When replacing first type pulley with second type, driving hub must be forced back 5/64" on shaft for fan belt alignment.

NOTE—Install new fan hub whenever removed.

SERIAL NUMBER:—Same as engine number.

ENGINE NUMBER:—Stamped on right side of crankcase below water inlet.

ENGINE SPECIFICATIONS:—8 cylinder, 90 degree 'Vee' 'L' head type.

Bore—3⅜". **Stroke** 4 15/16".

Displacement—353 cubic inches.

Rated Horsepower—36.45 (AMA).

Developed Horsepower—115 at 3000 R.P.M.

Compression Ratio—5.4-1 std. head. 5.7-1 optional high compression head.

Compression Pressure—Approximately 94 lbs. (5.4-1 head), 98 lbs. (5.7-1 optional head) at cranking speed.

Vacuum Reading—Gauge should show steady reading of 18-20" with engine idling.

PISTONS:—Cast-iron, light weight. 355-C pistons are tin-plated.

Length—3 21/32".

Weight—23.824 ozs. (stripped), 30.400 ozs. (with rings, pin, and locking screw).

Clearance—Top .0135-.0185". Bottom .002-.003".

Removal—Pistons and rods removed from below.

PISTON RINGS:—Four rings (355-B), five rings (355-C) per piston. Two compression (355-B), three compression (355-C), two oil control rings (all models). Lower ring groove drilled radially with oil drain holes.

355-B Piston Rings

Ring	Width	End Gap	Wall Thickness
Comp. (upper)	⅛"	.008"	.148"
Comp. (lower)	3/16"	.008"	.148"
Oil Control (upper)	3/16"	.008"	.148"
Oil Control (lower)	5/32"	.008"	.148"

355-C Piston Rings

Comp. (upper)	⅛"	.005-.010"	.135"
Comp. (#2)	.0930"	.005-.010"	.135"
Comp. (#3)	.0930"	.005-.010"	.135"
Oil Control (upper)	3/16"	.003-.011"	.140"
Oil Control (lower)	5/32"	.003-.011"	.140"

PISTON PIN:—**Diameter**—⅞". **Length** 3 1/32". Pin is locked in piston by locking screw in one boss. Bushing is split type and must be installed loosely and then expanded with burnishing tool.
Pin Fit in Rod Bushing—.0003-.0007".

CONNECTING ROD:—**Weight**—32.875 ounces.
Length—10½" (center-to-center).
Crankpin Journal Diameter—2⅜".
Lower Bearing—Poured babbitt type. No shims.
Clearance—.003". Endplay .003-.006".

Bearing Adjustment:—None (no shims). Do not file caps. Replace rods.

CRANKSHAFT:—Three bearing type with four counterweights.
Journal Diameters—2⅜" all bearings.
Bearing Type—Bronze backed, babbitt lined.
Clearance—.0015".

Bearing Adjustment:—None (no shims). Replace bearings. Do not file caps.

End Thrust:—Taken by rear (#3) main bearing.
End Play—.001-.005".

CAMSHAFT—Non-adjustable chain drive.

Timing Chain:—Morse #766. Width 1¾". Pitch .500". Length 27" or 54 links.

Camshaft Setting:—Sprockets are marked. Mesh chain with sprockets turned so that 'O' marks are adjacent and in line with a straightedge across the shaft centers.

VALVES:—	**Head Diameter**	**Stem Diameter**	**Length**
Intake	1.660-1.666"	⅜"	6 17/32"
Exhaust	1.634-1.640"	⅜"	6½"

	Seat Angle	**Lift**	**Stem Clearance**
Intake	30°	23/64"	.0025"
Exhaust	45°	23/64"	.0025"

Tappet Clearance—.006" Int., .008" Exh., engine cold.

Valve Springs:—	**Spring Pressure**	**Length**
Valve Closed	79 lbs.	2.500"
Valve Open	160 lbs.	2.148"

Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 6° BTDC. Close 42° ALDC.
Exhaust Valves—Open 38° BLDC. Close 2° ATDC.
To Check Valve Timing—Set tappet clearance at .006" for intake valve #1 cylinder (second valve from radiator on right hand bank). This valve should open with #1 piston 6° (.0165") before top dead center.
Motor Gauge—Weidenhoff Adapter #104, Rod #29.

LUBRICATION:—Pressure type.
Oil Pump:—Gear type located in crankcase.
Normal Oil Pressure—30 lbs. at 30 M.P.H.
Oil Pressure Regulator:—Relief valve opens at 10 M.P.H. with pressure of 10 pounds.
Crankcase Capacity—8 quarts.

CLUTCH:—**Own Make.** Double plate, dry disc type. See article in Clutch Section for complete data.
Clutch Facings—Woven asbestos, 5½" Inside Diameter, 10" Outside Diameter. .135-.145" thick. Four facings required.
NOTE—Mark clutch cover and flywheel before disassembling and reassemble in same position.

STEERING:—**Steering Gear**—Saginaw Model Worm-and-Sector type. See article in Steering Section Section for adjustments.
Front Suspension:—Conventional 'I' beam section front axle with Reverse-Elliott ends and semi-elliptic springs.
Kingpin Inclination—7°45' crosswise.
Caster—2½-3½°.
Camber—1½°.
Toe In—⅛-¼". Adjust in usual manner by changing length of tie rod.

BRAKES:—**Service**—Own Make. Internal expanding, self-energizing, mechanically operated, vacuum power type. Hand lever applies rear wheel service brakes. See article in Brake Section for relining and complete adjustment procedure.
Drum Diameter—15".
Lining—Semi-moulded Latex type. Width 2". Thickness 3/16". Length per wheel 29¾".
Clearance—.007" between lining and drum for each shoe.
Hand Brake Adjustment:—See Service Brakes.
Power Unit:—Bendix Type. See article in Brake Section for complete data.

ENGINE NUMBER:—Stamped on timing chain case at right of engine directly in front of generator.

Model	Year	First Number
370-B	1932	1,300,001
452-B	1932	1,400,001
370-C	1933	4,000,001
452-C	1933	5,000,001

ENGINE SPECIFICATIONS (370-B, C):—Own make, 12 cylinder, 45° Vee, 'I' or overhead valve type.

Bore—3⅛". **Stroke**—4".

Displacement—368 cubic inches.

Rated Horsepower—46.9.

Developed Horsepower—135 at 3400 R.P.M.

Compression Ratio—5.30-1 (1932). 5.60-1 (1933). Optl. ratios of 5.4-1 and 4.9-1 offered in 1933.

Compression Pressure—Approximately 90-95 lbs. (1932), 95-100 lbs. (1933) at cranking speed.

Vacuum Reading—Gauge should show steady reading of 18-20" at idling speed.

ENGINE SPECIFICATIONS (452-B, C):—Own make. 16 cylinder, 45° Vee, 'I' or overhead valve type.
Bore—3". **Stroke**—4".
Displacement—452 cubic inches.
Rated Horsepower—57.5.
Developed Horsepower—165 at 3500 R.P.M. (1932), 3400 R.P.M. (1933).
Compression Ratio—5.35-1 (1932), 5.70-1 (1933). Optl. ratios of 5.4-1 and 4.9-1 offered in 1933.
Compression Pressure—Approximately 90-95 lbs. (1932), 96-100 lbs. (1933) at cranking speed.
Vacuum Reading—Steady reading of 18-20" at idling speed.
NOTE—Optl. lower compression heads installed at factory to compensate for operating conditions such as high altitude or lower grades of fuel.

Pistons:—Own make, molybdenum cast-iron, light weight, tapered skirt type. Pistons are tin-plated after being finished and cannot be ground (except V-16 1932). Recondition engine to size for finished replacement pistons. Length 3 7/16".
Weight (Stripped)—20.88 ozs. (V12), 19.68 ozs. (V16).
Weight (With rings, pin and locking screw)—27.152 ozs. (V12), 25.648 ozs. (V16).
Removal—Pistons and rods removed from below.
Clearance—Top .012" (V12), .0125" (V16). Skirt .002-.003" (V12), .003" (V16).
Installing Pistons—Lock screw boss of piston must be on same side as flanged side off rod (next to crankshaft cheek).

Piston Rings:—Two compression rings, two oil control rings per piston (V12), three compression, one oil control ring per piston (V16). Oil ring grooves have slotted oil drain.

V12 370-B, C Ring Specifications

Ring	Width	End Gap	Wall Thickness
Comp. (#1)	⅛"	.003-.011"	.125"
Comp. (#2)	3/16"	.003-.011"	.125"
Oil Cont. (#3	⅛"	.005-.010"	.125"
Oil Cont. (#4)	3/16"	.005-.010"	.125"

V16 452-B, C Ring Specifications

Comp. (#1, 2)	⅛"	.003-.011"	.120"
Comp. (#3)	3/16"	.003-.011"	.120"
Oil Cont. (#4)	3/16"	.005-.010"	.120"

Piston Pin:—Diameter ⅞". Length 2 15/16" (V12), 2 13/16" (V16). Pin is locked in piston by locking screw in one boss.
Pin Fit in Rod Bushing—.0003-.0007" clearance.

Connecting Rod:—Weight 31.808 ozs. Length 9¼".
Lower Bearing—Spun babbitt type. No shims.
Clearance—.0015". Sideplay .004-.007".
Adjustment—None. Do not file caps. Replace rods.
Installing Rods—Numbers on rods and caps must correspond and must be toward bottom of engine. Flanged side of rod must be next to crankshaft cheek.

Crankshaft:—Four bearing (V12), five bearing (V16). Integral counterweights.
Journal Diameters—2⅝" (all bearings).
Bearing Type—Steel-backed, babbitt-lined type.
Clearance—.002-.004".
Adjustment—None. Do not file caps. Replace bearings.
End Thrust—Taken by #3 main bearing. Endplay .001-.005".

Camshaft:—Duplex chain drive with automatic take-up.
Timing Chain—Morse #766 Duplex. Width 1½". Pitch .375". Length 41¼" or 110 links. See Equipment Section for complete data on Morse Automatic Idler Sprocket.
Camshaft Setting—Sprockets are marked. Mesh chain with sprockets turned so that '0' marks are adjacent and in line with a straightedge across the shaft centers.

Valves:—	Head Diam.	Stem Diam.	Length
Intake	1.446"	11/32"	6 9/64"
Exhaust	1.452"	11/32"	6 9/64"

	Seat Angle	Lift	Stem Clearance
All valves	45°	11/32"	.0015"

Tappet Clearance—None in service (automatic take-up).
See article in Mechanical Equipment Section for data.

Valve Springs—Double springs used on all valves.

V12 370-B, C Specifications

	Spring Pressure	Inner Spg. Length	Outer Spg. Length
Valve Closed	69½ lbs.	1.751"	1.922"
Valve Open	167 lbs.	1.407"	1.578"

V16 452-B, C Specifications

Valve Closed	64 lbs.	1.751"	1.875"
Valve Open	141 lbs.	1.407"	1.531"

Valve Timing—See Camshaft Setting above.
Intake Valves Open—At TDC. Close—44° ALDC.
Exhaust Valves Open—39° BLDC. Close 5° ATDC.
To Check Valve Timing—No. 1 intake valve should open with piston on top dead center when flywheel mark 'C/1-11' lines up with indicator.

NOTE:—Automatic valve tappet take-up should not require attention in service but must be reset to initial clearance of .030" when replacing or grinding valves. See Equipment Section for data.

Lubrication—Pressure type. Gear type oil pump mounted in crankcase on rear main bearing cap.
Normal Oil Pressure—30 lbs. at 60 M.P.H.
Oil Pressure Relief Valve—Operates at 14 lbs. Not adjustable. Located under plug on front face of chain case cover.
Capacity & Oil—9 qts. (V12), 10 qts. (V16). Use SAE #40 or 50 (summer), #20 (winter).

CLUTCH:—Own make. Double plate, dry disc type.
See article in Mechanical Equipment Section for data.
Facings—Woven asbestos compound, 4 required.

Facing Specifications

Model	Thickness	Inside Diam.	Outside Diam.
370-B, C	9/64"	5½"	10"
452-B, C	9/64"	6½"	11"

Clutch Pedal Adjustment—Lash or free movement of clutch pedal should be 1½". Clearance between clutch pedal and under side of toeboard should be ¼" with clutch pedal released (pedal stop screw adjustment).
NOTE—Driven discs and facings should be selected so that difference in thickness of the two disc assemblies is not more than .005". Total clearance between clutch facings and center driving plate should be approximately .030".

STEERING:—**Steering Gear**—Saginaw Worm-and-Sector type. See article in Steering Section for complete adjustment directions.

Front Suspension:—Conventionel 'I' beam section front axle (rectangular end sections) with Reverse Elliott type ends and semi-elliptic springs.
Kingpin Inclination—7° 45' crosswise.
Caster—2½-3½°. Adjust by inserting wedge shims between spring and spring pad on axle.
Camber—1½°. No adjustment provided.
Toe In—3/16". Adjust in usual manner by loosening clamp bolts and rotating tie rod.

BRAKES:—**Service**—Own make. Internal expanding, self-energizing, mechanically operated, vacuum power type. Hand lever applies rear wheel service brakes. See article in Brake Section for complete adjustment instructions.
Drum Diameter—15" (V12), 16" (V16).
Lining—Semi-moulded Latex. Width 2" (V12), 2¼" (V16), Thickness 3/16", Length 29¾" (V12), 31⅝" (V16) per wheel.
Clearance—.007" between lining and drum for each shoe.

Hand Brake Adjustment:—See Service Brakes above.

Power Unit:—Bendix type vacuum cylinder.
See article in Mechanical Equipment Section for data.

ENGINE NUMBER:—First number, 3,100,001 ('34), 3,105,001 ('35). Stamped on right hand side of crankcase below water inlet.

ENGINE:—Model 355-D. Eight cylinder, 90 degree 'Vee', 'L' head type.

Bore—3⅜". Stroke—4 15/16".

Piston Displacement—353 cubic inches.

Rated Horsepower—36.45.

Developed Horsepower—130 at 3400 R.P.M.

Compression Ratio—6.25-1 (Std.), 5.75-1 (Optional).

Compression Pressure—148 lbs. at 1000 R.P.M. or 160 lbs. at 2800 R.P.M. (standard head).

NOTE—Cylinder heads are stamped with compression ratio at point directly above the front spark plug.

Pistons:—Lynite Lo-Ex, aluminum alloy, 'T' slot, cam ground type with Anodized finish (special hard oxide deposited on bearing surface). Piston diameter across pin bosses is .0065" less than at right angles to bosses. Pistons cannot be ground. Refinish cylinders to take replacement pistons furnished .005", .015", .030" oversize. Piston length, 3 21/32".

Weight—15.008 ozs. (stripped), 20.880 ozs. (with rings, pin, and locking screw).

Removal—Piston and rods removed from below.

Clearance—Top .019". Bottom .0023".

Fitting New Pistons—Check piston with micrometer gauge at point just below and to left of 'T' slot junction midway between pin holes with piston at 70°. Check cylinder bore with micrometer, finish bore to size giving correct clearance. Feeler gauges ⅜-½" wide can be used in side opposite slot. Piston should fall of own weight with .002" feeler and lock on .0025" feeler.

Installing Pistons—Install pistons with slot to left as viewed from driver's seat.

Piston Rings:—Three compression rings, one oil control ring per piston. Oil ring groove drilled with oil drain holes. Install compression rings in #2 and 3 grooves with notch or step toward bottom.

Ring	Width	End Gap	Wall Thickness
Comp. (all)	.0930-.0935"	.007-.012"	.145"
Oil Cont.	.1860-.1865"	.007-.015"	.145"

Piston Pin:—Diameter .8742-.8744". Length 3 1/32". Pin is locked in piston by locking screw in one boss. Heat piston in boiling water to remove or install pins.

Pin Fit in Piston—Locking screw end .0004" press fit or hand push fit with piston at 200-210°F. Free end .0000" clearance or hand push fit with piston at 70°F.

Pin Clearance in Rod Bushing—.0002-.0008".

Connecting Rod:—Weight 34.496 ozs. Length 10½".

Lower Bearing—Spun babbitt type. No shims.

Clearance—.0015". Sideplay .003-.006".

Adjustment—None. Do not file bearing caps. Replace rods.

Installing Rods—Numbers on rods and caps must correspond and must be toward bottom of engine.

Crankshaft:—Three bearing type with four counterweights.

Journal Diameters—2⅜" (all bearings).

Bearing Type—Bronze-backed, babbitt-lined type.

Clearance—.0015".

Adjustment—None. Do not file caps. Replace bearings.

End Thrust—Taken by #3 (rear) main bearing. Endplay .001-.005".

Camshaft:—Non-adjustable chain drive.

Timing Chain—Morse #766. Width 1¾". Pitch .500". Length, 27" or 54 links.

Camshaft Setting—Mesh chain with sprockets turned so that '0' marks are adjacent and in line with a straightedge across the shaft centers.

Valves:—

	Head Diameter	Stem Diameter	Length
Intake	1.660-1.666"	⅜"	6 17/32"
Exhaust	1.634-1.640"	⅜"	6½"

	Seat Angle	Lift	Stem Clearance
Intake	30°	23/64"	.0015-.0035"
Exhaust	45°	23/64"	.0025-.0045"

Tappet Clearance—.006" Int., .010" Exh., engine cold.

Valve Springs—Double springs used on all valves.

	Spring Pressure	Inner Spg. Length	Outer Spg. Length
Valve Closed	70 lbs.	1.751"	1.922"
Valve Open	185 lbs.	1.407"	1.578"

Valve Timing—See Camshaft Setting above.

Intake Valves—Open 6° BTDC. Close 42° ALDC.
Exhaust Valves—Open 38° BLDC. Close 2° ATDC.

To Check Valve Timing—No flywheel marks. Intake opening point for #1 cylinder is approximately 1.883 teeth before flywheel mark 'C 1/4'.

Lubrication:—Pressure type. Gear type oil pump located in crankcase.

Oil Pressure—30 lbs. at idling speed.

Pressure Relief Valve—Operates at 11 lbs. or 10 M.P.H. Not adjustable.

Capacity and Oil—8 quarts. Summer, SAE. #30 (moderate driving) or SAE. #40-50 (high speed driving). Winter, SAE. #20-W (temperatures down to 0°F.), SAE. #10-W (temperatures down to —15°F.) for moderate driving.

CLUTCH:—Own make. Double plate, dry disc type.

See article in Mechanical Equipment Section for data.

Clutch Pedal Adjustment—Lash or free movement of clutch pedal should be 1½". Clearance between clutch pedal and under side of toeboard should be ¼" with clutch pedal released (pedal stop screw adjustment).

Clutch Facings—Woven type, 4 required, 6½" I.D., 9½" O.D., .120-.130" thick (see Note).

NOTE—Driven discs and facings should be selected so that difference in thickness of the two disc assemblies is not more than .005". Total clearance between clutch facings and center driving plate should be approximately .030".

STEERING:—**Front Suspension**—Independent, linked parallelogram type with helical springs.

See article in Mechanical Equipment Section for data.

Caster—1½° with car weight on wheels. Adjusted by turning threaded pin linking upper suspension arms (shock absorber arms) to steering knuckle support. To adjust, loosen pin locks, loosen lower suspension arm yoke, turn pin as follows:

Right wheel (head of pin to rear)—Turn pin clockwise to increase caster angle, or counter-clockwise to decrease caster angle.

Left wheel (head of pin to front)—Turn pin counter-clockwise to increase caster angle, or clockwise to decrease caster angle.

One full turn of the pin will change caster ½°. Lock pins in place after making adjustment. Caster must be exactly equal on both wheels.

Camber—¾-1½° with car weight on wheels and top surface of lower spring support 5 3/16" below lower face of frame. No adjustment recommended. Crosswise inclination of kingpin, 4°.

Toe In—⅛-3/16". To adjust, increase or decrease length of each tie rod equally. Turn tie rods in same direction that wheels revolve to increase toe-in, and in opposite direction to decrease toe-in.

Steering Gear:—Saginaw Worm-and-Double Roller Type. See article in Steering Section.

BRAKES:—**Service**—Own Make. Internal-expanding, self-energizing, mechanically operated, vacuum power type. Hand lever applies rear wheel service brakes. See article in Brake Section.

Drum Diameter—14.995-15.005". Out-of-round .007" maximum. Run-out (installed) .010" maximum.

Lining—Woven type. 2" (all shoes).

	Thickness	Length per Shoe
Top (aluminum) Shoe	.245-.260"	15 19/32"
Lower (steel) Shoe	.183-.198"	14¼"

Clearance—.007" (approximate).

Hand Brake Adjustment:—See Service Brakes.

Power Unit:—Bendix internal valve type vacuum cylinder mounted on frame 'X' member and linked to relay lever (Series 10 & 20) and to a lever on the pedal shaft (Series 30). See article in Brake Section.

ENGINE NUMBER:—On chain case at right of engine directly in front of engine.

Model	Year	First Number
370-D	1934	4,100,001
452-D	1934	5,100,001
370-D Series 40	1935	4,101,701
452-D Series 60	1935	5,110,001

ENGINE (V12 370-D:—Twelve cylinder, 45° Vee, 'T' or overhead valve type. Cylinder blocks for each bank cast enbloc and separate from crankcase.
Bore—3⅛". **Stroke**—4".
Piston Displacement—368 cubic inches.
Rated Horsepower—46.9.
Developed Horsepower—150 at 3600 R.P.M.
Compression Ratio—6.0-1 (std.), 5.65-1 (optional).
Compression Pressure—145 lbs. at 1000 R.P.M. or approximately 100-105 lbs. at cranking speed.

ENGINE (V16 452-D):—Sixteen cylinder, 45° Vee, 'T' or overhead valve type. Cylinder blocks for each bank cast Enbloc and seperate from crankcase.
Bore—3". **Stroke**—4".
Piston Displacement—452 cubic inches.
Rated Horsepower—57.5.
Developed Horsepower—185 at 3800 R.P.M.
Compression Ratio—6.0-1 (Std.), 5.65-1 (optional).
Compression Pressure—154 lbs. at 1000 R.P.M. or approximately 100-105 lbs. at cranking speed.
NOTE—Cylinder heads are stamped with compression ratio on end of head. Compression ratio may be altered by changing head gasket.

Pistons:—Lynite Lo-Ex, aluminum alloy, 'T' slot, Cam ground type with Anodized finish (special hard oxide deposited on bearing surface). Piston diameter across pin bosses is .0065" less than at right angles to bosses. Pistons cannot be ground. Refinish cylinders to take replacement pistons furnished .005", .015", .030", oversize. Piston length 3 5/16".
Removal—Pistons and rods removed from bottom.
Weight (Stripped)—11.172 ozs. (V12), 12.040 ozs. (V16).
Weight (With rings, pin and locking screw)—16.976 ozs. (V12), 17.232 ozs. (V16).
Clearance (V12)—Top .019". Bottom .0020".
Clearance (V16)—Top .018". Bottom .0018".
Fitting New Pistons—Check piston with micrometer gauge at point just below and to left of 'T' slot junction midway between pin holes with piston at 70°. Check cylinder bore with micrometer, finish to size giving correct clearance. Feeler gauges ⅜-½" wide can be used in side opposite slot. Piston should fall of own weight with .0015" feeler and lock on .002" feeler.
Installing Pistons—Install pistons with slot to left as viewed from driver's seat.

Piston Rings:—Three compression rings, one oil control ring per piston, all above pin. Oil ring groove drilled with oil drain holes. Install compression rings in #2 and 3 grooves with notch or step toward bottom.

Ring	Width	End Gap	Wall Thickness
Comp. (all)	.0930-.0935"	.007-.012"	.130"
Oil Cont.	1545-.1550"	.007-.015"	.135"

Piston Pin:—Diameter .8742-.8744". Length 2.810-2.815". Pin is locked in piston by locking screw in one boss. Heat piston in boiling water to remove or install pin.
Pin Fit in Piston—Locking screw end .0004" press fit or hand push fit with piston at 200-210°F. Free end .0001" clearance or hand push fit at 70°F.
Pin Clearance in Rod Bushing—.0002-.0008".

Connecting Rods:—Weight 31.856 ozs. Length 9¼".
Lower Bearing—Spun babbitt type. No shims.
Clearance—.0015". Sideplay .004-.007".
Adjustment—None. Do not file caps. Replace rods.
Installing Rods—Numbers on rods and caps must correspond and must be toward bottom of engine.

Crankshaft:—Four bearing (V12), five bearing (V16). Integral countreweights.
Journal Diameters—2⅝" (all bearings).
Bearing Type—Steel-backed, babbitt-lined type.
Clearance—.002-.004".
Adjustment—None. Do not file caps. Replace bearings.
End Thrust—Taken by #3 main bearing. End-play .001-.005".

Camshaft:—Duplex chain drive with automatic take-up.
Timing Chain—Morse #766 Duplex. Width 1½". Pitch .375". Length 41¼" or 110 links. See equipment section for complete data on Morse automatic idler sprocket.
Camshaft Setting—Sprockets are marked. Mesh chain with sprockets turned so that 'O' marks are adjacent and in line with a straightedge across the shaft centers.

Valves:—

	Head Diam.	Stem Diam.	Length
Intake	1.509-1.515"	11/32"	6 9/64"
Exhaust	1.384-1.390"	11/32"	6 9/64"

	Seat Angle	Lift	Stem Clearance
All Valves	45°	11/32"	.001-0025"

Tappet Clearance—None in service (automatic take-up).
See article in Mechanical Equipment Section for data.
Valve Springs—Double springs used on all valves.
NOTE—If valve spring pressure (installed) is less than 48 lbs. after valve grinding, correct by installing special .040" spacer, Part No. 889407, under valve spring retainer (spacer will increase pressure 10.9 lbs.).

V12 370-D Spring Specifications

	Spring Pressure	Inner Spring Length	Outer Spring Length
Valve Closed	69½ lbs.	1.751"	1.922"
Valve Open	167 lbs.	1.407"	1.578"

V16 452-D Spring Specifications

Valve Closed	64 lbs.	1.751"	1.875"
Valve Open	141 lbs.	1.407"	1.531"

Valve Timing—See Camshaft Setting above.
Intake Valves Open—At TDC. Close—44° ALDC.
Exhaust Valves Open—39° BLDC. Close— 5° ATDC.
NOTE:—Automatic valve tappet take-up should not require attention in service but must be reset to initial clearance of .030" when replacing or grinding valves. See Equipment Section for complete data.
To Check Valve Timing—No. 1 intake valve should open with piston on top dead center when flywheel mark 'C.1/11' (V12), 'C.1/15' (V16) lines up with indicator.

Lubrication—Pressure type. Gear type oil pump located in crankcase on rear main bearing cap.
Normal Oil Pressure—30 lbs. at 60 M.P.H.
Oil Pressure Relief Valve—Operates at 14 lbs. Not adjustable. Located under plug on front face of chain case cover.
Capacity & Oil—9 qts. (V12), 10 qts. (V16). Use SAE #40 or 50 (summer), #20 (winter).

CLUTCH:—Own make. Double plate, dry disc type. ***See article in Mechanical Equipment Section for data.***
Clutch Pedal Adjustment—Lash or free movement of clutch pedal should be 1½". Clearance between clutch pedal and underside of toeboard should be ¼" with clutch pedal released (pedal stopscrew adjustment).
Clutch Facings—Woven asbestos compound, 4 required.

Model	Thickness	Inside Diam.	Outside Diam.
V12 370-D-	.120-.130"	5⅞"	10"
V16 452-D-	.135-.145"	6½"	11"

NOTE—Driven discs and facings should be selected so that difference in thickness of the two disc assemblies is not more .005". Total clearance between clutch facings and center driving plate should be approximately .030".

STEERING:—**Steering Gear**—Saginaw Worm-and-double roller type. See article in Steering Section for complete adjustment instructions.
Front Suspension:—Independent, linked parallelogram type with coil springs. See article in Steering Section for complete description and adjusting directions.
Caster—1½° with car weight on wheels. Adjusted by turning threaded pin linking upper suspension arms (shock absorber arms) to steering knuckle support. To adjust, loosen pin locks, loosen lower suspension arm yoke, turn pin as follows:
Right wheel (head of pin to rear)—Turn pin clockwise to increase caster angle or counter-clockwise to decrease caster angle.
Left wheel (head of pin to front)—Turn pin counter-clockwise to increase caster angle or clockwise to decrease caster angle.
One full turn of the pin will change caster ½°. Lock pins in place after making adjustment. Caster must be exactly equal on both wheels.
Camber—¾-1½° with car weight on wheels and top surface of lower spring support 5 3/16" below lower face of frame. No adjustment recommended. Crosswise inclination of kingpin, 4°.
Camber—1° with car weight on wheels. No adjustment provided. Crosswise inclination of kingpin, 4°.
Toe In—⅛-3/16". To adjust, increase or decrease length of each tie rod equally. Turn tie rods in same direction that whels revolve to increase toe-in or in opposite direction to decrease toe-in.

BRAKES:—**Service**—Own make. Internal expanding, self-energizing, mechanically operated, vacuum power type. Hand lever appiles rear wheel service brakes. See article in Brake Section for complete adjustment instructions.
Drum Diameter—15" all models.
Lining—Woven type. Width 2". Thickness .245-.260" (forward shoe), .183-.198" (rear shoe). Length 15 19/32" (forward shoe), 14¼" (rear shoe) or 29 27/32" per wheel.
Clearance—.007" between lining and drum for each shoe.
Hand Brake:—See Service Brake Adjustment above.
Power Unit:—Bendix vacuum cylinder with internal valve. See article in Brake Section for complete data.

ENGINE NUMBER:—First number—36-60, 6010001; 36-70, 75, 3110001. Stamped on top of crankcase, behind fan support.

ENGINE SPECIFICATIONS:—8 cylinder, 90 degree 'Vee' 'L' head type.
Bore—3⅜" (60), 3½" (70, 75). **Stroke**—4½".
Displacement—322 cu. in. (60), 346 cu. in. (70, 75).
Rated Horsepower—36.45 (60), 39.20 (70, 75).
Developed Horsepower—125 (60), 135 (70, 75) at 3400 R.P.M. Std. 6.25-1 head.
Compression Ratio—6.25-1 Std. cast-iron head. Optl. 5.75-1 cast-iron head.
Compression Pressure—155 lbs. (60), 170 lbs. (70, 75) at 1000 R.P.M. or approx. 105-110 lbs. at cranking speed for std. 6.25-1 head.
Vacuum Reading—Gauge should show steady reading of 20-21" with engine idling at 6 M.P.H.
NOTE—Upper crankcase and two cylinder blocks cast in one piece. Two cylinder head capscrews for water outlet elbow ½" longer than others and must be used for this purpose only. Cylinder head gaskets Part No. 1412661 (60), 1412662 (70, 75) are interchangeable (left and right banks) and must be installed with triangular hole on inner edge to rear.

PISTONS:—Lynite, Lo-Ex aluminum alloy, 'T' slot, Cam ground type with anodized finish (special hard oxide formed on bearing surface).
Length—4⅛". Weight—16.88 ozs. (60), 18.304 ozs. (70, 75).
Removal—Pistons and rods removed from above.
Clearance—Top .023" (60), .025" (70, 75). Bottom of skirt .0019" (60), .0021" (70, 75). See Fitting Pistons.

Replacement Pistons:—Finished anodized pistons furnished as follows:

	Model 36-60	36-70 ,75
Standard	3.3726-3.3746"	3.4979-3.4999"
.003" Oversize	3.3761-3.3776"	3.5014-3.5029"
.005" Oversize	3.3781-3.3796"	3.5034-3.5049"
.010" Oversize	3.3831-3.3846"	3.5084-3.5099"
.015" Oversize	3.3881-3.3896"	3.5135-3.5149"

NOTE—Cylinder bores in same block held within .002" limits. Max. cylinder bore out-of-round .0005".

Fitting New Pistons:—Check piston diameter with micrometer gauge at right angles to pin hole just below lower ring groove and ½" above lower edge. Using ½" feelers inserted between piston and cylinder wall on side opposite slot, piston should drop of its own weight with .002" feeler and hold its own weight on .0025" feeler.

Installing Pistons:—Slot should be toward left as viewed from drivers seat on all pistons.

PISTON RINGS:—Two compression, two oil control rings per piston, all above pin. Lower ring grooves drilled radially with oil drain holes.
NOTE—A narrow heat deflector groove located above top compression groove. No ring fitted.

Ring	Width	End Gap	Side Clearance
Compression	⅛"	.007-.012"	.0015-.0028"
Oil Control	5/32"	.007-.015"	.0013-.0026"

NOTE—Worn limits on all rings .025" (End Gap) and .004" (Side Clearance).

PISTON PIN:—Diameter ⅞". Length 2 15/16" (60), 3 1/16" (70, 75). Pin floats in piston and rod. Held by retaining rings. Split-type bushing used in pin hole in rod. See Note below.
Pin Fit in Piston—.0004" press fit (rib end), .0001" clearance or free fit at 70° F. (other end).
Pin Fit in Rod Bushing—.0002 0008" (new), .0015" max. (worn).
Removal:—Remove snap rings, place piston in boiling water for one minute, then push pin out by hand from rib end (piston boss ribbed on under side for identification). Install pin by same procedure except that pin is pushed in from opposite end. Install snap ring with opening down.
NOTE—In removing and installing split-type bushing an arbor press and special tool kit (Tool No. HM-250) are necessary. Bushings must be pressed in, expanded, then burnished to give correct clearance.

CONNECTING ROD:—Weight 41.26 ozs. **Length** 8¾".
Crankpin Journal Diameter—2.4590-2.4595".
Lower Bearing—Removable steel-backed, babbitt-lined shell type. No shims.
Clearance—.001-.0025" (new), .006" max. (worn). Sideplay .003-.006".
Bearing Adjustment:—None (no shims). Replace bearings. Do not file rods or caps.
NOTE—New lock washers (Part No. 1415487) must be used under connecting rod bolts. Wrench for tightening bolts must not be longer than 12". Tool No. J-835 recommended by manufacturer.
Installing Rods:—Numbers on bearing cap and rod must correspond and must point toward oil pan.
NOTE—Crankpin out-of-round .002" maximum.

CRANKSHAFT:—3 bearing, 6 counterweights, #2 and 5 held by capscrews, all others integral.
Journal Diameters—2½" all bearings.
NOTE—Journal out-of-round .002" maximum.
Bearing Type—Removable steel-backed, babbitt-lined shells. New bearings require no line-reaming.
Clearance—.0015" (new), .004" (worn).
Bearing Adjustment:—None (no shims). Replace bearings. Do not file caps. Upper halves rotated in and out with 'T' shaped cotter pin in oil passage.
NOTE—When reinstalling rear main bearing cap use new wooden plugs in grooves.
End Thrust:—Taken by center (#2) bearing. Endplay .001-.005" (new), .010" (worn).

CAMSHAFT:—3 bearing. Non-adjustable chain drive.
Journal Diameters—#1 and 2, 2.4076-2.4083"; #3, 2.0014-2.0021".
Bearing Type—Removable steel-backed, babbitt-lined bushings.
Clearance—.002-.004" (new), .005" (worn limit).
NOTE—Use Tool J-829 to remove and install bearings. Bearing out-of-round must not exceed .002".
End Thrust:—Taken by thrust plate behind sprocket. No endplay permissible.
Timing Chain:—Morse #3377. Width 1¼". Pitch ⅜". Length 23¼" or 62 links.
Installing Chain—Install chain 'endless' as an assembly with both sprockets. Use Tool J-836 to pilot camshaft sprocket when installing on shaft.
Camshaft Setting:—Sprockets are marked. Install chain with sprockets turned so that 'O' marks are adjacent and in line with a straightedge across the shaft centers.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1.876-1.886"	.3415-.3425"	5 33/64"
Exhaust	1.626-1.636"	.3405-.3415"	5 33/64"

	Seat Angle	Lift	Stem Clearance
Intake	45°	11/32"	.006" (worn limit)
Exhaust	45°	11/32"	.005" (worn limit)

NOTE—Valve lifter assemblies must be removed before valve springs can be compressed to remove spring keepers and free valves. Use Tool J-827 to hold plungers down when re-installing lifters.
Tappet Clearance—None. (Automatic take-up.)
Valve Guides:—Removable. Pressed in block with long stepped end down and finish reamed to provide clearance of .001-.0023" Int., .002-.0033" Exh.
Valve Springs:—Free length 2.210".

	Spring Pressure	Length
Valve Closed	62-69 lbs	1 15/16"
Valve Open	140-151 lbs	1 9/16"

Valve Lifters:—Mushroom type with Automatic valve tappet takeup. See article in Equipment Section

Valve Timing:—See Camshaft Setting above.
Intake Valves—Open at TDC. Close 42° ALDC.
Exhaust Valves—Open 52° BLDC. Close 10° ATDC.
To Check Valve Timing—Intake valve for cylinder #1 (front cylinder—left bank) should open with piston on top dead center when mark 'C.1/' on crankshaft pulley lines up with pointer.
Motor Gauge—Weidenhoff #114 Adapter, #42 Rod.

LUBRICATION:—Pressure system with main oil channel located in left hand crankcase wall.
Oil Pump:—Gear type located in oil pan at rear of engine. Driven through idler gear from camshaft.
Oil Pump Drive Clearances—Drive shaft bushing .001-.0025" (new), .010" (worn). Endplay in accessory idler gear .002-.006" (new), .010" (worn). Endplay in spiral gear on drive shaft .003-.010" (new), .015" (worn). Backlash in spiral drive gears .018" max.
Oil Pump Gear Clearances—Pump body and gears .0025-.0085" (new), .010" (worn). Pump gear endplay .002-.004" (new), .015" (worn).
Normal Oil Pressure:—15 lbs. idling, 30 lbs. at 60 M.P.H.
Oil Pressure Regulator:—Operates at 30 lbs. Located on oil pump. Not adjustable.
Crankcase Capacity:—7 qts. refill.

CLUTCH:—Long Model 11CF-CI (60), 11CF-CL (70, 75). Semi-centrifugal single plate, dry disc type.
See article in Mechanical Equipment Section for data.
Facings—Woven type, 2 required. Inside Diam. 6½". Outside Diam. 11". Thickness .135-.139".
Adjustment—Free movement of clutch pedal should be ⅞-1⅛". Adjust by turning nut on forward end of pedal rod directly below pedal equalizer link.
Removal—Disconnect front universal joint, remove from propeller shaft, remove cross member carrying transmission rear support; remove front propeller shaft housing and propeller shaft (70, 75 only); disconnect clutch release mechanism (70, 75 only); remove transmission (pull straight back to avoid distortion to clutch disc), drop clutch housing pan and remove clutch release yoke retaining screw (60 only). Prick punch clutch cover, spring pressure plate and flywheel (install in same position to maintain balance), take out clutch mounting bolts, turning all bolts out evenly. Remove clutch.
NOTE—On Series 36-60 cars keep transmission in high gear or install brace across face of case to hold clutch connection in position, preventing high-speed synchronizing drum from pulling out of splines.

STEERING:—Steering Gear Saginaw worm-and-double roller type. See article in Steering Section.
Front Suspension:—Independent linked perallelogram type with coil springs. See article in Steering Section for description and adjustments.
Kingpin Inclination—4°51' (60), 5°38' (70, 75) crosswise. **Caster**—1½-2° (60). ¾-1¼° (70, 75).
Camber—¼-1° (60). 0-½° (70, 75). **Toe In**—O-1/16".
Steering Geometry—Inner wheel turned 21¾-23¼° (60), 22-23½° (70, 75), outer wheel turned 20°.

BRAKES:—Bendix Hydraulic, single anchor type. Hand lever applies rear wheel service brakes. See article in Brake Section for complete data.
Wheel Cylinders—Diameters: front 1 1/16" (60), 1¼" (70, 75), rear 15/16" (60), 1 1/16" (70, 75). No part of assembly is interchangeable.
Drum Diameter—11.995-12.005" (60), 13.995-14.005" (70, 75). Out-of-round .007" max. Run out (installed) .010" maximum.
Lining—Moulded (primary), woven (secondary). Width 2" (60), 2¼" (70, 75). Thickness 3/16" (60), ¼" (70, 75). Length 10⅛"-60, 12¼"-70, 75 (frt. wh. primary), 13"-60, 15"-70, 75 (all others).
Clearance—.010" between lining and drum.
Hand Brake Adjustment:—See Service Brake.

ENGINE NUMBER:—First number—4110001 (80, 85), 5110001 (90). On right hand side of chain case in front of generator.

ENGINE SPECIFICATIONS:—12 cylinder (80, 85), 16 cylinder (90), 45° Vee, 'I' or overhead valve type. Cylinder blocks for each bank cast enbloc and separate from crankcase.
Bore—3⅛" (80, 85), 3" (90). **Stroke**—4".
Displacement—368 cu. ins. (80, 85), 452 cu. ins. (90).
Rated Horsepower—46.9 (80, 85), 57.5 (90).
Developed Horsepower—150 at 3600 R.P.M. (80, 85), 185 at 3800 R.P.M. (90). Std. 6.00-1 head.
Compression Ratio—6.0-1 Std. cast-iron head. Optl, ratio of 5.65-1 (80, 85), 5.57-1 (90) for special operating conditions may be secured by installing special thick head gaskets.
Compression Pressure—145 lbs. (80, 85), 154 lbs. (90), at 1000 R.P.M. or approximately 100-105 lbs. at cranking speed.
Vacuum Reading—20-21" steady at 320 R.P.M.

PISTONS:—Lynite, Lo-Ex aluminum alloy. 'T' slot, Cam gound type with anodized finish (special hard oxide formed on bearing surface).
Length—3 5/16". **Weight**—11.712 ozs. (80, 85), 12.038 ozs. (90).
Removal—Pistons and rods removed from below.
Clearance—Top .019" (80, 85), .018" (90). Bottom .0020" (80, 85), .0018" (90). See Fitting New Pistons.
Replacement Pistons:—Finished anodized pistons furnished .005", .015" oversize or reground blocks with pistons fitted furnished .015", .030" oversize.
NOTE Cylinder bores in same block held within .002" limits. Max. cylinder bore out-of-round .0005".
Fitting New Pistons:—Check piston with micrometer gauge at point just below and to left of 'T' slot junction midway between pin holes with piston at 70° F. Check cylinder bore with micrometer, finish to size giving correct clearance. Feeler gauges ⅜-½" wide can be used on side opposite slot. Piston should fall of own weight with .0015" feeler and lock on .002"
Installing Pistons:—Install pistons with slot to left as viewed from the driver's seat.

PISTON RINGS:—Three compression, one oil control ring per piston, all above pin. Lower ring groove drilled radially with oil drain holes.
NOTE—A narrow heat deflector groove located above top compression groove. No ring fitted.

Ring	Width	End Gap	Side Clearance
Comp (80, 85)	⅛"	.007-.012"	.0015-.0028"
Comp (90)	3/32"	.007-.012"	.0015-.0028"
Oil Cont	5/32"	.007-.015"	.0013-.0026"

NOTE—Worn limits on all rings .025" (End Gap) and .004" (Side Clearance).

PISTON PIN:—Diameter ⅞". Length 2.810-2.815". Pin is locked in piston by locking screw in one boss. Heat piston in boiling water and push pin out from lock-screw end (in from opposite end to install).
Pin Fit in Piston—Locking screw end .0004" press fit or hand push fit with piston at 200-210° F. Free end .0001" clearance or hand push fit at 70° F.
Pin Fit in Rod Bushing—.0002-.0008" (new), .0015" (worn).
NOTE—To remove and install split-type bushing manufacturer recommends special tool kit (No. HM-250). Bushings must be pressed in with an arbor press, expanded, then burnished.

CONNECTING ROD:—Weight 31.856 ozs. **Length** 9¼".
Crankpin Journal Diameter—2½".
Lower Bearing—Spun babbitt. No shims.
Clearance—.001-.0025". Sideplay .004-.007".
Bearing Adjustment:—None (no shims). Do not file caps. Replace rods.
Installing Rods:—Numbers on rods and caps must correspond and must be toward bottom of engine.

CRANKSHAFT:—4 (80, 85), 5 (90) bearing type with integral counterweights.
Journal Diameters—2 ⅝" (all bearings).
Bearing Type—Removable steel-backed, babbitt-lined shells. New bearings require no line reaming.
Clearance—.001" (new), .004" (worn) (80, 85). .002-.004" (90).
Bearing Adjustment:—None (no shims). Replace bearings (upper halves rotated in or out with 'T' shaped cotter pin in oil passage). Do not file caps.
NOTE—Use new wooden plugs with rear bearing cap.
End Thrust:—Taken by #3 main bearing. Endplay .001-.005".

CAMSHAFT:—Four (80, 85), five (90) bearings. Duplex chain drive with automatic take-up.
Journal Diameters—#1, 2"; all others 2⅛".
Clearance—.0011-.0026" (new), .005" (worn limit).
End Thrust:—Taken by thrust plate at rear of camshaft sprocket. Endplay .005-.015". Replace plate if endplay exceeds .015".
Timing Chain:—*Morse #766 Duplex. Width 1½". Pitch ⅜". Length 41¼" or 110 links. See Equipment Section for complete data on Morse automatic idler sprocket.*
Camshaft Setting:—Sprockets are marked. Mesh chain with sprockets turned so that 'O' marks are adjacent and in line with a straightedge across the shaft centers.

VALVES:—

	Head Diam.	Stem. Diam.	Length
Intake	1.509-1.515"	.3392-.3397"	6 9/64"
Exhaust	1.384-1.390"	.3392-.3397"	6 9/64"

	Seat Angle	Lift	Stem Clearance
Intake (80, 85)	45°	11/32"	.001-.0015"
All others	45°	11/32"	.001-.0025"

Tappet Clearance—None (automatic take-up).
See article in Mechanical Equipment Section for data.
Valve Guides:—One piece, removable. Install with long stepped end up and finish ream to correct clearance.
Valve Springs:—Double springs used on all valves.
NOTE—If valve spring pressure (installed) is less than 48 lbs. after valve grinding, correct by installing special .040" spacer, Part No. 889407, under valve spring retainer (will increase pressure 10.9 lbs.).

Inner Spring	Spring Pressure	Length
Valve Closed	18-21 lbs.	1¾"
Valve Open	49-54 lbs.	1 7/16"

Outer Spring	Spring Presure	Length
Valve Closed	48-52 lbs.	1 15/16"
Valve Open	111-120 lbs.	1 9/16"

Valve Lifters:—Roller type lifters or cam slides operating in individual removable guides. Clearance in guide .001-.0025" (new), .005" (worn limit). Roller clearance on pin .0017-.003" (new), .004" (worn).
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open at TDC. Close at 44° ALDC.
Exhaust Valves—Open at 39° BLDC. Close at 5° ATDC.
To Check Valve Timing—No. 1 intake valve should open with piston on top dead center when flywheel mark '1C/11' lines up with indicator.
Motor Gauge—Weidenhoff #113 Adapter, #33 Rod.

LUBRICATION:—Pressure system from oil pump in crankcase through oil tube in oil pan.
Oil Pump:—Gear type in crankcase. Driven through tongue-and-slot coupling by gear on camshaft.
Oil Pump Drive Clearances—Drive shaft bushing .001-.0025" (new), .010" (worn limit). Drive gear endplay .009-.015" (new), .020" (worn limit). Drive gear backlash .018" maximum.
Oil Pump Gear Clearances—Pump body and gears .0025-.0085" (new), .010" (worn limit). Pump gear endplay .002-.004" (new), .015" (worn limit).
Normal Oil Pressure—30 lbs. at 60 M.P.H.
Oil Presure Regulator—Operates at 14 lbs. Not adjustable. Under plug on front of chain case cover.
Crankcase Capacity:—9 qts. (80, 85), 10 qts. (90).

CLUTCH—SERIES 80, 85:—Long Model 11CF-C. Semi-centrifugal, single plate, dry disc type. See article in Clutch Section.
See article in Mechanical Equipment Section for data.
Facings—Same as V8 model (see previous page).
Adjustment—Free movement of clutch pedal should be ⅞-1⅛". Adjust by turning nut on forward end of pedal rod directly below pedal equalizer link.
Removal—Clutch removed in same manner as on Series 70, 75 except that clutch housing is integral with transmission case so that clutch is exposed when transmission is removed and no pan is used. See previous page for complete directions.

CLUTCH—SERIES 90:—Own Make. Double plate, dry disc type. See article in Clutch Section.
Facings—Woven type, 4 required. Inside Diam. 6½". Outside Diam. 11". Thickness .135-.145".
Adjustment—Clearance between pedal and underside of toeboard should be ¼" with clutch engaged. Adjust by loosening locknut and turning stopscrew at lower end of pedal at rear of bracket on outside of frame. Free movement of clutch pedal must be 1½". To adjust, remove clevis pin in lower end of pedal, loosen locknut and turn clevis on link.
Removal—Disconnect rear universal joint, remove drive shaft, remove transmission rear support (as unit with cross member on which support is mounted), remove front propeller shaft and shaft housing, disconnect clutch release mechanism, take out transmission mounting screws and pull transmission straight back until clutch connection shaft is free, take off four nuts on studs mounting clutch center driving plate on flywheel (accessible through holes in rear driving plate), remove clutch assembly.

STEERING:—Steering Gear—Saginaw Worm-and-Double-Roller type. See article in Steering Section.
Front Suspension:—Independent, linked parallelogram type with coil springs. See article in Steering Section for description and adjustments.
Kingpin Inclination—5°38' (80, 85), 4° (90).
Caster—¾-1¼° (80, 85), 1½° (90).
Camber—0-½° (80, 85), ¾-1½° (90).
Toe In—0-1/16" (all models).
Steering Geometry—Inner wheel turned 22-23½°, outer wheel 20° (all models).
NOTE—When checking camber, springs must be compressed sufficiently so that distance from lower face of frame sidemember to top face of spring lower support is 5 3/16" on all models.

BRAKES—SERIES 80, 85:—Bendix Hydraulic, Single Anchor type. All specifications and adjustments same as for Series 70, 75. See previous page.

BRAKES—SERIES 90:—Service—Own Make. Internal-expanding, self-energizing, mechanically operated, vacuum power type. Hand lever applies rear service brakes. See article in Brake Section.
Drum Diameter—15.995-16.005". Out-of-round .007" maximum. Run-out (installed) .010" maximum.
Lining—Woven type. Width 2" (all shoes).

	Thickness	Length per Shoe
Top (aluminum) Shoe	.245-.260"	15 19/32"
Lower (steel) Shoe	.183-.198"	14¼"

Clearance—.007" (approximate).
Hand Brake Adjustment:—See Service Brakes.
Power Unit:—Bendix internal valve type vacuum cylinder mounted on frame 'X' member and linked to equalizer lever between front and rear wheel brake cross shafts. See article in Brake Section.

SERIAL NUMBER:—Same as engine number below.
ENGINE NUMBER:—First number (60) 6030001, (65) 7030001, (70, 75) 3130001. Stamped on left side of crankcase at rear of left cylinder block.
ENGINE SPECIFICATIONS:—Own. 8 cylinder, 90° Vee, 'L' head type. Upper crankcase and cylinder blocks cast Enbloc. **Bore**—3½". **Stroke**—4½".
Displacement—346 cu. ins. **Rated HP.**—39.20.
Developed Horsepower—135 HP. at 3400 R.P.M.
Compression Ratio—6.25-1 Std. 5.75-1 Optl.
Compression Pressure—155 lbs. at 1000 R.P.M. or approx. 105-110 lbs. at cranking speed (std. head). *See Cadillac Special Shop Notes for cylinder head installation instructions, head gasket identification, and changing compression ratios*
Vacuum Reading—Steady 20-21" at idle speed.
PISTONS:—Lynite or Bohn Lo-Ex aluminum alloy, 'T' slot, Cam Ground type with Anodized finish (special hard oxide bearing surface). **Length**—4⅛".
Weight—18.30 oz. stripped. 25.13 oz. complete.
Removal—Pistons and rods removed from above.
Clearance—Skirt .0021". See Fitting New Pistons.
Replacement Pistons:—Finished anodized pistons furnished Std. (3.4979-3.4999"), .003" (3.5014-3.5029"), .005" (3.5034-3.5049"), .010" (3.5084-3.5099"), .015" (3.5135-3.5149") oversize.
NOTE—Hold all cylinders in same block within .002" size limits. Max. out-of-round .0005".
Fitting New Pistons:—Check piston diameter with micrometer gauge at right angles to pin hole just below lower ring groove and also ½" above lower edge. If feeler gauges (⅜-½" wide) used, insert feeler next to T-slot. Piston should fall of own weight with .002" feeler, hold tight on .0025" feeler.
Installing Pistons:—Slot to left, for all pistons.
PISTON RINGS:—Two compression, two oil control rings per piston, all above pin.

Ring	Width	End Gap	Side Clearance
Compression	1/8"	.007-.012"	.0015-.0028"
Oil Control	5/32"	.007-.015"	.0013-.0026"

NOTE—Worn limits .025" (gap), .004" (side clear.).
Replacement Rings: .003",.005",.010",.015",.030" oversize.
PISTON PIN:—Diameter ⅞". Length 3 1/16". Pin floats in piston and rod. Held by locking rings. *See Cadillac Shop Notes for special pin removal and installation instructions.*
Pin Fit in Piston—.0004" press fit (ribbed end), .0001" clearance or free fit at 70° F. (plain end).
Pin Fit in Rod Bushing—.0002-.0008" clearance (new), .0015" (worn limit).
CONNECTING ROD:—Weight 37.472 oz. **Length** 8¾".
Crankpin Journal Diameter—2.460".
Lower Bearing—Steel-backed, babbitt-lined.
Clearance—.0015" (new), .006" Max. (worn).
Sideplay—.003-.006".
Bearing Adjustment:—None (no shims). Replace bearings. Do not file rods or caps. *See Cadillac Special Shop Notes for connecting rod data and bearing installation.*
Installing Rods:—Numbers on rods and bearing caps on same side and installed in same numbered cylinders with marks down toward oil pan.
CRANKSHAFT:—3 bearing. 6 counterweights.
Journal Diameters—2½" all bearings.
Bearing—Steel or bronze backed, babbitt-lined.
Clearance—.0015" (new), .004" (worn limit).
Bearing Adjustment:—None (no shims). Replace bearings. Do not file bearing caps. *See Cadillac Special Shop Notes for main bearing removal instructions.*
End Thrust:—Taken by center bearing. Endplay .001-.005" (new), .010" Max. (worn).
CAMSHAFT:—3 bearings. Non-adjustable chain drive.
Journal Diameters—#1 and 2, 2.4071-2.4078"; #3, 2.0009-2.0016".
Bearing Type—Steel-backed, babbitt-lined.
Clearance—.0027-.0037" (new), .005" (worn limit). *See Cadillac Special Shop Notes for Camshaft Bushing removal and installation instructions.*
End Thrust:—Taken by thrust plate behind camshaft sprocket. No endplay should be permitted.
Timing Chain:—Morse Type C #3682-RX Side guide type. Width 1¼". Pitch ⅜". Length 23¼" or 62 links. NOTE—Install chain 'endless' as an assembly with sprockets. Use tool J-836 to pilot camshaft sprockets.
Camshaft Setting:—Sprockets marked. Mesh chain with sprockets turned so that '0' marks are adjacent and in line with straightedge across centers.

VALVES:—	Head Diameter	Stem Diameter	Length
Intake	1.876-1.886"	.3415-.3425"	5 33/64"
Exhaust	1.626-1.636"	.3405-.3415"	5 33/64"

	Seat Angle	Lift	Stem Clearance
Intake	45°	.335"	.001-.0023"
Exhaust	45°	.345"	.002-.0033"

NOTE—Worn limit for valve stem-to-guide clearance .006" Intake, .005" Exhaust. *See Cadillac Special Shop Notes for valve removal and installation instructions.*
Tappet Clearance:—None (automatic take-up used).
Valve Guides:—Pressed in block with long stepped end down and reamed to correct size.
Valve Lifters:—Wilcox-Rich 'Zero-lash' type hydraulic lifters. Lifters are mushroom type operating in removable guide brackets. *See article in Mechanical Equipment Section.*
Clearance—.001-.0025" (new), .005" (worn).

Valve Springs:—	Pressure	Length
Valve Closed	66 lbs.	1.926"
Valve Open	145 lbs.	1.581"

Valve Timing:—See Camshaft Setting above.
Intake Valves—Open at TDC. Close at 42° ALDC.
Exhaust Valves—Open 52° BLDC. Close 10° ATDC.
To Check Timing—Intake valve for #1 cylinder opens with piston on top dead center when 'C.1/6' on vibration dampener lines up with pointer.
LUBRICATION:—Pressure system with gear type oil pump located in crankcase. *See Cadillac Special Shop Notes for oil pump data and lubrication system servicing.*
Normal Oil Pressure—30 lbs. at 60 MPH. 15 lbs. idle.
Oil Pressure Regulator—Located on oil pump. Operates at 30 lbs. Not adjustable.
Crankcase Capacity—7 qts. (refill).
COOLING SYSTEM:—Water Pump. Centrifugal type. Belt-driven in tandem with generator. *See article in Mechanical Equipment Section.*
Thermostat:—Mounted in radiator top tank, linked to radiator shutters by rod on forward side.
Setting—(Std. Type) Starts to open 148-153°F., fully open at 170°F. (High Reading Type—use with heaters). Starts to open 163-168°F. Fully open 185°F.
Shutter Adjustment—Adjust clevis on threaded end of rod to secure 1/16" tension on thermostat with shutters closed.
CLUTCH:—Long Model 11CF-CL. Semi-centrifugal, single plate dry disc type. *See article in Mechanical Equipment Section for data.*
Facings—Woven type. 2 required. Inside Diameter 6½". Outside Diameter 11". Thickness .137".
Adjustment:—Free movement of pedal should be ⅞-1⅛". To adjust, turn nut on forward end of connector link in front of clutch fork.
Removal:—Remove transmission (see Transmission Section below), drop clutch housing pan, punch mark clutch cover, pressure plate, and flywheel to insure correct installation, take out 6 mounting bolts in cover flange, remove clutch from below.
TRANSMISSION:—Own Make. Constant-mesh helical gear (second), synchro-mesh (second and high), sliding helical gear (low and reverse). *See article in Mechanical Equipment Section for data.*
Removal:—With car on blocks, remove floor boards, disconnect drive shaft at front universal joint, support engine with jack under oil pan (use wooden block to avoid damage to pan), free transmission extension at rear support cross-member, disconnect engine support stabilizer (all except 60) on right hand side (take out pin at forward end), disconnect exhaust pipe brace, free cross-member carrying engine rear support (4 bolts at each end on 60, 2 bolts on other models), disconnect speedometer cable. Take out transmission mounting capscrews, pull transmission straight back (plug clutch connection shaft bearing drain hole as soon as it is accessible to prevent lubricant loss). NOTE—When installing, shift transmission in reverse and remove plug.
UNIVERSAL JOINTS:—Mechanics Model 3-C. Needle bearing type. *See Mechanical Equipment Section.*
REAR AXLE:—Own make. Hypoid gear (60), Spiral-bevel gear (65, 70, 75). Semi-floating type with Hotchkiss drive. *See article in Mechanical Equipment Section for data.*
NOTE—Manufacturer recommend Differential Carrier Assembly be returned to factory for servicing.
Ratio—3.69-1 (60), 4.30-1 (65, 70, 75). No optl. ratios.
Backlash—.004-.008". Screw adjustment.
Removal:—Disconnect drive shaft at rear universal, remove axle shafts (see below), remove capscrews on differential carrier flange, pull carrier assembly out without disturbing axle housing.
Axle Shaft Removal—Jack up car, remove rear wheels, pull wheel hub and brake drum assembly, disconnect brake line and remove backing plates (bleed brake line when re-installed). Use tool J-838, pull shaft and bearing assembly out.
NOTE—Early axle shafts have no locating shoulder for wheel bearing. Install bearing with 5/32" clearance between inner edge of hub and bearing.
Wheel Bearing Adjustment:—None (sealed type).
SHOCK ABSORBERS:—Delco. 1946C, D (60 front), 1751A, B (60 rear), 1951D, C (65, 70, 75 front), 2052A, B (65, 70, 75 rear). Double acting, hydraulic type. *See article in Mechanical Equipment Section for data.*
STEERING:—Steering Gear—Saginaw Worm-and-roller type. *See Mechanical Equipment Section.*
Front Suspension:—Independent linked parallelogram type with coil springs. *See article in Mechanical Equipment Section for data.*
Kingpin Inclination—4° 51' (60), 5° 38' (65, 70, 75).
Caster—¼-1° (60), 0° plus or minus ¼° (65, 70, 75). Car weight on wheels, equal within ¼°.
Camber—¼-1° (60). 0-½° (65, 70, 75). Equal within ¼° at both wheels.
Toe In—1/16-3/32" (at rest), 0-1/16" (in motion).
Steering Geometry—Inner wheel turned 21¾-23¼° (60), 22-23½° (65, 70, 75). Outer wheel 20° (all).
BRAKES:—Service—Bendix hydr., Duo-servo. Single Anchor type. Hand lever applies rear serv. brakes. *See article in Mechanical Equipment Section for data.*
Drum Diameter—12" (60, 65, 70), 14" (75). Centrifuse type. Out-of-round .007" max. Run-out (installed) .010" max. Drum turndown limit .030" cut.
Lining—Molded type. Width 2¼" (except 60, 65, 70 rear wheels), 2" (60, 65, 70 rear wheels only); Thickness 3/16" (60, 65, 70), ¼" (75); Length (per shoe) 12 15/16" (60, 65, 70), 12¼" (75—front shoe front brakes), 15" (75—all others).
Clearance—.010" for all models.
Hand Brake:—See Service Brakes above.

ENGINE NUMBER:—First number 4130001 (85), 5130301 (90). Stamped on generator drive chain housing at right front corner of crankcase.

ENGINE SPECIFICATIONS:—12 cylinder (85), 16 cylinder (90), 45° Vee, Overhead valve type.
Bore—3¼" (85), 3" (90). **Stroke**—4".
Displacement—368 cu. ins. (85), 452 cu. ins. (90).
Rated Horsepower—46.9 (85), 57.5 (90).
Developed Horsepower—150 at 3600 R.P.M. (85), 185 at 3800 R.P.M. (90).
Compression Ratio—6.0-1 Std., 5.65-1 Optl.
Compression Pressure—145 lbs. (85), 154 lbs. (90) at 1000 R.P.M. or approx. 100-105 lbs. at cranking speed.
Vacuum Reading—20-21" steady reading with engine idling at 320 R.P.M.

PISTONS:—Lynite Lo-Ex aluminum alloy, 'T' slot, cam ground type with anodized finish. **Length** 3 5/16".
Weight—11.712 ozs. (85), 10.96 ozs. (90) stripped or 16.976 ozs. (85), 16.144 ozs. (90) with rings, pin and locking screw.
Removal—Pistons and rods removed from below.
Clearance—Top .019" (85), .018" (90), Skirt .002" (85), .0018" (90). See Fitting New Pistons.

Replacement Pistons:—Finished pistons furnished .005" and .015" oversize. Reground blocks (pistons fitted) furnished .015", .030" oversize (exchange basis). Hold all bores in same block within .002" limit and maximum out-of-round to .0005".

Fitting New Pistons:—If micrometer used, check cylinder bore and pistons (just below and to left of 'T' slot junction midway between pin holes with piston at 70°). If feeler gauges (⅜-½" wide) used, install on side opposite slot. Piston should fall of own weight with .0015" feeler and hold on .002" feeler.

Installing Pistons:—Slot to left (viewed from driver's seat) for all pistons in both banks.

PISTON RINGS:—Three compression, one oil control ring per piston, all above pin (no ring in heat deflector groove at top). Lower ring groove drilled with oil drain holes.

Ring	Width	End Gap	Side Clearance
Comp.	.0930-.0935"	.007-.012"	.0015-.0028"
Oil Cont.	.1540-.1550"	.007-.015"	.0013-.0026"

NOTE—Worn limits .025" (end gap), .004" (side clearance).

PISTON PIN:—Diameter .8742-.8745", **Length** 2.810-2.815". Pin locked in piston by locking screw in one boss. To remove pins, heat piston in boiling water, push out at lockscrew end (install from opposite end).
Pin Fit in Piston—.0004" press fit or hand push fit with piston at 200-210° F. (lockscrew boss), .0001" clearance or hand push fit at 70° F. (free end).
Pin Fit in Rod Bushing—.0002-.0008" clearance (new), .0015" (worn limit).

CONNECTING ROD:—Weight 31.856 ozs. **Length** 9¼".
Crankpin Journal Diameter—2¼".
Lower Bearing—Spun babbitt. No shims.
Clearance—.0015". Sideplay .004-.007".

Bearing Adjustment:—None. Replace rods. Do not file bearing caps.

Installing Rods:—Numbers on rods and caps must correspond and point down toward oil pan.

CRANKSHAFT:—Four (85), five (90) bearing type with integral counterweights.
Journal Diameters—2⅝" all bearings.
Bearing Type—Removable steel-backed, babbitt-lined. No shims.
Clearance—.001" (new), .004" (worn limit).

Bearing Adjustment:—None. Replace bearings. Do not file caps. Rotate upper halves in or out without removing crankshaft.

End Thrust:—Taken by #3 bearing (center on 85). Endplay .001-.005".

CAMSHAFT:—Four (85), five (90) bearing. Duplex chain drive with automatic take-up idler sprocket.
Journal Diameters—#1, 2"; all others 2⅛".
Clearance—.0011-.0026" (new), .005" (worn limit).

End Thrust:—Taken by thrust plate at rear of camshaft sprocket. Endplay .005-.015". Replace plate when endplay exceeds .015".

Timing Chain:—Morse #766 Duplex. Width 1½". Pitch .375". Length 41¼" or 110 links. See Mechanical Equipment Section for data on Morse automatic idler.

Camshaft Setting:—Sprockets marked. Mesh chain with sprockets turned so that '0' marks are adjacent and in line with straightedge across shaft centers.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1.509-1.515"	.3392-.3397"	6.220-6.228"
Exhaust	1.384-1.390"	.3392-.3397"	6.220-6.228"

	Seat Angle	Lift	Stem Clearance
Intake	45°	.3476"	.0015"
Exhaust	45°	.3476"	.0025"

Tappet Clearance:—None (automatic take-up).
See article in Mechanical Equipment Section for data.

Valve Guides:—Pressed in head with long stepped end up and finish reamed for correct clearance.

Valve Lifters:—Roller type in individual removable guides. Clearance in guide .001-.0025" (new), .005" (worn limit). Roller clearance on pin .0017-.003" (new), .004" (worn limit).

Valve Springs:—Double springs used on all valves.

	Inner Spring	Outer Spring
Valve Closed	19.5 lbs., 1.751"	50 lbs., 1.922"
Valve Open	51.5 lbs., 1.407"	115.5 lbs., 1.578"

NOTE—Whenever valves reconditioned, check spring pressure. Total for both springs should be 48-63 lbs. (measure with Tool No. J-444). Minor variations can be corrected by installing .040" spacers (Part No. 889407) under valve spring retainers. Each spacer increases pressure 11 lbs.

Valve Timing:—See Camshaft Setting above.
Intake Valves—Open at TDC. Close 44° ALDC.
Exhaust Valves—Open 39° BLDC. Close 5° ATDC.
To Check Valve Timing—#1 intake valve should open with piston on top dead center when flywheel mark '1C/11' or '1C/15' lines up with indicator.
Motor Gauge—Weidenhoff Adapter #113. Rod #33.

LUBRICATION:—Pressure system. Gear type oil pump mounted in crankcase. See 1936 data for all oil pump clearances.
Normal Oil Pressure—30 lbs. at 60 M.P.H.
Oil Pressure Regulator—Located under plug on front face of chain case cover. Opens at 14 lbs. Not adjustable.
Crankcase Capacity—9 qts. (85), 10 qts. (90).

CLUTCH (85):—Long Model 11CF-C. Semi-centrifugal, single plate, dry disc type. All specifications, Adjustment, and Removal instructions same as for Model 75 (see previous page for complete data).

CLUTCH (90):—Own make. Double plate, dry disc type.
See article in Mechanical Equipment Section for data.
Facings—Woven type, 4 required. Inside Diameter 6½". Outside Diameter 11". Thickness .135-.145".

Adjustment:—Free movement of pedal should be 1¼-1½". To adjust, turn adjusting nut on pedal rod.

Removal:—Remove transmission (see Transmission Section below). Take off four nuts on studs on which center driving plate mounted on flywheel (nuts accessible through holes in rear driving plate), remove clutch assembly.

TRANSMISSION:—Own Make. Constant mesh, synchro-mesh, helical gears (second and high), sliding helical gear (85), spur gear (90) for low and reverse.
See article in Mechanical Equipment Section for data.

Removal (85):—Same as for Model 75 (see previous page).

Removal (90):—Disconnect universal joints and remove drive shaft, remove transmission rear support (as unit with cross-member), remove front propeller shaft and housing, disconnect clutch release mechanism, take out transmission mounting screws, pull transmission straight back (clutch housing integral with transmission case).

UNIVERSAL JOINTS:—Mechanics Model 3C (85), 4C (90). Needle bearing type, two used.
See article in Mechanical Equipment Section.

REAR AXLE:—Own make. Semi-floating (85), 3/4 floating (90), spiral bevel gear type with Hotchkiss drive.
See article in Mechanical Equipment Section for data.
NOTE—Manufacturer recommends Differential Carrier Assembly be returned to factory for servicing.
Ratio—4.60-1 (Std. 85), 4.64-1 (Std. 90). 4.07-1, 4.31-1, 4.41-1 (Optl. 90 only).
Backlash—.004-.008". Screw adjustment.

Removal:—Disconnect drive shaft at rear universal, remove axle shafts (see below), remove capscrews on differential carrier flange, pull carrier assembly out without disturbing axle housing.
Axle Shaft Removal (85):—Jack up car, remove rear wheels, pull wheel hub and brake drum assembly, disconnect brake line and remove backing plates (bleed brake line when re-installed), use tool J-838 and pull shaft and bearing assembly out.
Axle Shaft Removal (90):—Jack up rear end, remove wheel, take out capscrews in driving hub flange, pull driving hub and axle shaft out as an assembly.

Wheel Bearing Adjustment:—None required.

SHOCK ABSORBERS:—Delco Hydraulic, double acting type.

	Front	Rear
85	1951D, C	2052A, B
90	1950D, C	2050C, D

See article in Mechanical Equipment Section for data.

STEERING:—Steering Gear—Saginaw Worm and Double Roller type.
See article in Mechanical Equipment Section for data.

Front Suspension:—Independent, linked parallelogram type with coil springs.
See article in Steering Section for data.
Kingpin Inclination—5° 38' (85), 4° 30' (90).
Caster—0° plus or minus ¼°. Adjustable.
Camber—0° to ½°. Adjustable.
Toe In—0 to 1/16". Adjustable.
Steering Geometry—Inner wheel turned 22-23½°, outer wheel 20°.

BRAKES:—Service—Bendix hydraulic, single anchor type with vacuum power operation (90 only). Hand lever applies rear wheel service brakes.
See article in Mechanical Equipment Section for data.
Drum Diameter—14".
Lining—Molded (all shoes 85, primary shoes 90), Woven (secondary shoes, 90 only).
Clearance—.010" for each shoe.

Hand Brake:—See Service Brakes above.

Power Unit (Series 90):—Bendix internal valve type Vacuum Power cylinder linked to brake pedal lever.
See article in Mechanical Equipment Section for data.

ENGINE HOOD & SIDE PANEL REMOVAL:—*See Cadillac Special Shop Notes for instructions.*

SERIAL NUMBER:—Same as engine number below.

ENGINE NUMBER:—First number (60) 8270001, (60S) 6270001, (65) 7270001, (75) 3270001. Stamped on left side of crankcase at rear of left cylinder block, and on left frame rail at rear of front engine support.

ENGINE SPECIFICATIONS:—Own. 8 cylinder, 90° Vee, 'L' head type. Upper crankcase and cylinder blocks cast Enbloc. **Bore**—3½". **Stroke**—4½".

Displacement—346 cu. ins. **Rated HP.**—39.20.

Developed Horsepower—135 (60, 60S, 65), 140 (75) at 3400 R.P.M.

Compression Ratio—6.25-1 (Std. 60, 60S, 65), 6.70-1 (Std. 75), 5.75-1 Optl. (all models).

See Cadillac Special Shop Notes for cylinder head identification and interchangeability data.

Compression Pressure—155 lbs. (60, 60S, 65), 170 lbs. (75) at 1000 R.P.M. or approximately 105-110 lbs. (60, 60S, 65), 110-115 lbs. (75) at cranking speed.

Vacuum Reading—Steady 20-21" at idle speed.

PISTONS:—Lynite or Bohn Lo-Ex aluminum alloy, 'T' slot, Cam Ground type with Anodized finish (special hard oxide bearing surface). **Length**—4⅛".

Weight—18.30 oz. stripped. 25.13 oz. complete.

Removal:—Pistons and rods removed from above

Clearance—Skirt .0021". See Fitting New Pistons.

Replacement Pistons:—Finished anodized pistons furnished Std. (3.4979-3.4999"), .003" (3.5014-3.5029"), .005" (3.5034-3.5049"), .010" (3.5084-3.5099"), .015" (3.5135-3.5149") oversize.

NOTE—Hold all cylinders in same block within .002" size limits. Max. out-of-round .0005".

Fitting New Pistons:—Check piston diameter with micrometer gauge at right angles to pin hole just below lower ring groove and also ½" above lower edge. If feeler gauges (⅜-½" wide) used, insert feeler next to T-slot. Piston should fall of own weight with .002" feeler, hold tight on .0025" feeler.

Installing Pistons:—Slot to left, for all pistons.

PISTON RINGS:—Two compression, two oil control rings per piston, all above pin.

Ring	Width	End Gap	Side Clearance
Compression	1/8"	.007-.012"	.0015-.0028"
Oil Control	5/32"	.007-.015"	.0013-.0026"

NOTE—Worn limits .025" (gap), .004" (side clear.).

Replacement Rings: .003", .005", .010", .015", .030" oversize.

PISTON PIN:—Diameter ⅞". **Length** 3 1/16". Pin floats in piston and rod. Held by locking rings.

See Cadillac Shop Notes for special pin removal and installation instructions.

Pin Fit in Piston—.0004" press fit (ribbed end), .0001" clearance or free fit at 70° F. (plain end).

Pin Fit in Rod Bushing—.0002-.0008" clearance (new), .0015" (worn limit).

CONNECTING ROD:—Weight 37.472 oz. **Length** 8¾".

Crankpin Journal Diameter—2.460".

Lower Bearing—Steel-backed, babbitt-lined.

Clearance—.0015" (new), .006" Max. (worn).

Sideplay—.003-.006".

Bearing Adjustment:—None (no shims). Replace bearings. Do not file rods or caps.

NOTE—Use new lockwashers under bearing cap bolts. Use only 12" wrench to tighten (Tool J-835).

Installing Rods:—Numbers on rods and bearing caps on same side and installed in same numbered cylinders with marks down toward oil pan.

CRANKSHAFT:—3 bearing. 6 counterweights.

Journal Diameters—2½" all bearings.

Bearing—Steel or bronze backed, babbitt-lined.

Clearance—.0015" (new), .004" (worn limit).

Bearing Adjustment:—None (no shims). Replace bearings. Do not file bearing caps. Upper halves can be rotated out without removing shaft.

See Cadillac Special Shop Notes for Rear Main Bearing oil seal renewal (new type).

End Thrust:—Taken by center bearing. Endplay .001-.005" (new), .010" Max. (worn).

CAMSHAFT:—3 bearings. Non-adjustable chain drive.

Journal Diameters—#1 and 2, 2.4071-2.4078"; #3, 2.0009-2.0016".

Bearing Type—Steel-backed, babbitt-lined.

Clearance—.0027-.0037" (new), .005" (worn limit).

See Cadillac Special Shop Notes for Camshaft Bushing removal and installtion instructions.

End Thrust:—Taken by thrust plate behind camshaft sprocket. No endplay should be permitted.

Timing Chain:—Morse Type C #3682-R Side guide type. Width 1¼". Pitch ⅜". Length 23¼" or 62 links. NOTE—Install chain 'endless' as an assembly with sprockets. Use tool J-836 to pilot camshaft sprocket

Camshaft Setting:—Sprockets marked. Mesh chain with sprockets turned so that '0' marks are adjacent and in line with straightedge across centers.

VALVES:—	Head Diameter	Stem Diameter	Length
Intake	1.876-1.886"	.3415-.3425"	5 33/64"
Exhaust	1.626-1.636"	.3405-.3415"	5 33/64"

	Seat Angle	Lift	Stem Clearance
Intake	45°	.335"	.001-.0023"
Exhaust	45°	.345"	.002-.0033"

NOTE—Worn limit for valve stem-to-guide clearance .006" Intake, .005" Exhaust.

See Cadillac Special Shop Notes for valve removal and installation instructions.

Tappet Clearance:—None (automatic take-up used). **See article in Mechanical Equipment Section.**

Valve Guides:—Pressed in block with long stepped end down and reamed to correct size.

Valve Lifters:—Wilcox-Rich 'Zero-lash' type hydraulic lifters. Lifters are mushroom type operating in removable guide brackets.

See article in Mechanical Equipment Section for data.

Clearance—.001-.0025" (new), .005" (worn).

Valve Springs:—	Pressure	Length
Valve Closed	66 lbs.	1.926"
Valve Open	145 lbs.	1.581"

Valve Timing:—See Camshaft Setting above.

Intake Valves—Open at TDC. Close at 42° ALDC.

Exhaust Valves—Open 52° BLDC. Close 10° ATDC.

To Check Timing—Intake valve for #1 cylinder opens with piston on top dead center when 'C.1/6' on crankshaft pulley lines up with pointer.

LUBRICATION:—Pressure system with gear type oil pump located in crankcase.

See Cadillac Special Shop Notes for oil pump data.

Normal Oil Pressure—25 lbs. at 30 M.P.H.

Oil Pressure Regulator—Located on oil pump. Operates at 30 lbs. Not adjustable.

Crankcase Capacity—7 qts. (refill).

COOLING SYSTEM:—Water Pump. Centrifugal type. Belt-driven in tandem with generator.

See article in Mechanical Equipment Section for data.

Thermostat:—Mounted in radiator top tank, linked to radiator shutters by rod on forward side.

Setting—(Std. Type) Starts to open 148-153°F., fully open at 170°F. (High Reading Type—use with heaters). Starts to open 163-168°F. Fully open 185°F.

Shutter Adjustment—Adjust clevis on threaded end of rod to secure 1/16" tension on thermostat with shutters closed.

CLUTCH:—Long Model 11CF-CI. Semi-centrifugal, single plate, dry disc type.

See article in Mechanical Equipment Section for data.

Facings—Woven joined type, 2 required. Inside Diam. 6½". Outside Diam. 11". Thickness .125".

Adjustment:—Free movement of pedal should be ⅞-1⅛". To adjust, turn nut on forward end of connector link in front of clutch fork.

Removal:—Remove transmission (see Transmission Section below), drop clutch housing pan, punch mark clutch cover, pressure plate, and flywheel to insure correct installation, take out mounting bolts in cover flange, remove clutch from below.

TRANSMISSION:—Own make. Constant-mesh helical gear (second), synchro-mesh (second and high), sliding helical gear (low and reverse).

Transmission Control—Own make. Remote control, type (shift lever mounted on steering column).

See article in Mechanical Equipment Section for data.

Removal:—Disconnect shifter rods at levers on left hand side of case, disconnect drive shaft at front universal joint, support engine with jack under oil pan (use wooden block to avoid damage to pan), free transmission extension at rear support crossmember, disconnect engine support stabilizer on right hand side (take out pin at forward end), disconnect exhaust pipe brace, disconnect speedometer cable. Take out transmission mounting capscrews, pull transmission straight back (plug clutch connection shaft bearing drain hole as soon as it is accessible to prevent lubricant loss).

UNIVERSAL JOINTS:—Mechanics Model 3-C. Needle bearing type, 2 used.

See article in Mechanical Equipment Section for data.

REAR AXLE:—Own Make. Hypoid gear, semi-floating type with Hotchkiss drive.

See article in Mechanical Equipment Section for data.

NOTE—Manufacturer recommend Differential Carrier Assembly be returned to factory for servicing.

Ratio—3.92-1 (60, 60S), 4.58-1 (65, 75).

Backlash—.004-.008". Screw adjustment.

Removal:—Disconnect drive shaft at rear universal, remove axle shafts (see below), remove capscrews on carrier flange, pull carrier assembly out.

Axle Shaft Removal—Jack up car, remove rear wheels, pull wheel hub and brake drum assembly, disconnect brake line and remove backing plates. Use tool J-838, pull shaft and bearing assembly out.

Wheel Bearing Adjustment:—None (sealed type).

SHOCK ABSORBERS:—Delco. Front—1946-E,F(60,60S), 1951-C, D (65, 75). Rear—1751-E, F (60), G, H (60S), 2052-A, D (65, 75). Double acting type.

See article in Mechanical Equipment Section for data.

STEERING:—Steering Gear—Saginaw Worm-and-roller type. *See data in Mechanical Equip. Section.*

Front Suspension:—Independent linked parallelogram type with coil springs.

See article in Mechanical Equipment Section for data.

Kingpin Inclination—4°51' (60, 60S), 5°38' (65, 75)

Caster—(60, 60S) Neg. ¼° to Neg. 1¼°, (65, 75) Neg. ¼° to Pos. ¼° at curb weight (gasoline tank full).

Camber—Neg. ¼° to Pos. ½° (all). Adjustable.

Toe In—1/32-3/32" (at rest), 0-1/16" (in motion).

Steering Geometry—Inner wheel turned 23½° (60, 75), 23¾° (60S, 65). Outer wheel 20° (all).

BRAKES:—Service—Bendix hydraulic, Duo-servo, Single Anchor type. Hand lever applies rear brakes.

See article in Mechanical Equipment Section for data.

Braking Power—54½% Front (60, 60S, 65), 58% Front (75), 45½% Rear (60, 60S, 65), 42% Rear (75).

Brake Drums—Diameter 11.995-12.005" (60, 60S, 65), 13.995-14.005" (75). Centrifuse type.

Lining—Moulded type. Width 2¼" (Front—all models, Rear—75 only), 2" (Rear—60, 60S), 2½" (Rear—65). Thickness 3/16" (60, 60S, 65), ¼" (75). Length per shoe 12 15/16" (60, 60S, 65), 12¼" (75—front primary shoe), 15" (75—all others).

Clearance—.010" for all models.

Hand Brake:—See Service Brakes above.

HOOD & SIDE PANEL REMOVAL:—*See Cadillac Special Shop Notes for complete instructions.*

SERIAL NUMBER:—Same as engine number below.

ENGINE NUMBER:—First number 5,270,001. Stamped on upper rear corner of left hand cylinder block and on left frame member ahead of steering gear.

ENGINE SPECIFICATIONS:—16 cylinder, 135° Vee, 'L' head. Cylinder banks and crankcase cast integral. NOTE—Install shorter cylinder head capscrews along lower edge of head. Coat all screws with white lead to prevent leaks.
Bore—3¼". Stroke—3¼". Displacement 431 cu. ins.
Rated Horsepower—67.6.
Developed Horsepower—185 at 3600 R.P.M.
Compression Ratio—6.75-1 Std. 6.08-1 Optl.
Compression Pressure—180 lbs. at 1000 R.P.M. or approximately 110-115 lbs. at cranking speed.
Vacuum Reading—Steady 20-21" idling at 8-9 MPH.

PISTONS:—Lynite & Bohn, Lo-Ex aluminum alloy, 'T' slot, Cam Ground type with Anodized finish (special hard oxide bearing surface). **Length—3¾".**
Weight—15.28 oz. (stripped). 21.136 oz. (complete).
Removal—Pistons and rods removed from above.
Clearance—.019" top, .0015-.002" (bottom of skirt).
Replacement Pistons:—Finished replacement pistons furnished .005", .010", .015" oversize.
Fitting New Pistons:—If micrometer used, check piston skirt at largest diameter (adjacent to T slot) at two points, ½" from lower edge of skirt, and 1¼" down from head. If feeler gauge used, install ⅜-½" wide feeler next to T slot. Piston should fall through bore of own weight on .0015" feeler and hold on .002" feeler.
Installing Pistons:—Slot toward left (as viewed from drivers seat) for all pistons in both banks.

PISTON RINGS:—Two compression, one oil control ring per piston, all above pin.

Ring	Width	End Gap	Side Clearance
Comp. (top)	⅛"	.007-.015"	.0015-.0025"
Comp. (#2)	3/32"	.007-.015"	.0015-.0025"
Oil Cont.	3/16"	.007-.015"	.001-.002"

NOTE—Worn limits—.025" gap, .004" side clearance.
Replacement Rings:—Furnished .003", .005", .010", .015", .030" oversize.

PISTON PIN:—Diameter—13/16". Length—2 25/32". Pin is locked in rod by locking screw. Oil grooves broached for full length of pin hole in piston.
Pin Fit in Piston:—.00035" clearance.
See Cadillac Shop Notes for special pin removal and installation instructions.
Replacement Pins:—Undersizes not furnished.

CONNECTING RODS:—Weight 24.528 ozs. Length 6⅜".
Crankpin Journal Diameter—2".
Lower Bearing—Steel-backed, babbitt-lined.
Clearance—.001-.0025" (new), .006" (worn limit).
Sideplay—.004-.008".
Bearing Adjustment:—None (no shims). Replace bearings. Do not file connecting rods or caps.
Installing Rods:—Numbers on rods and caps must correspond and point down toward pan, all rods.

CRANKSHAFT:—9 bearing. Integral counterweights.
See Cadillac Special Shop Notes for Rear Main Bearing Oil Seal renewal.
Journal Diameters—2½" all bearings.
Bearing Type—Steel-backed, babbitt-lined.
Clearance—.0015" (new), .004" Max. (worn).
Bearing Adjustment:—None (no shims). Replace bearings. Do not file bearing caps. Bearing upper halves can be rotated out without removing crankshaft. *See Cadillac Shop Notes for instructions.*
End Thrust:—Taken by #5 (center) bearing. Endplay .001-.005" (new), .010" (worn limit).

CAMSHAFT:—Five bearing. Non-adjustable chain drive.
See Cadillac Special Shop Notes for Camshaft removal and installation instructions.
Bearing Type—Steel-backed, babbitt bushings.
Bearing Clearance—.002-.003" (new), .005" (worn).
End Thrust:—Taken by thrust plate flange at front bearing. Endplay .005-.015" (new), .020" (worn limit).
Timing Chain:—Morse Type C #3682-R. Width 1¼". Pitch ⅜". Length 23¼" or 62 links.
Camshaft Setting:—Sprockets are marked. Mesh chain with sprockets turned so that marks are adjacent and in line with straightedge across shafts.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1.495-1.505"	.3415-.3425"	5 19/32"
Exhaust	1.370-1.380"	.3405-.3415"	5 39/64"

	Seat Angle	Lift	Stem Clearance
Intake	45°	.290"	.0023"
Exhaust	45°	.302"	.0033"

NOTE—Worn limit for stem clearance .0033" (intake), .004" (exhaust).
Tappet Clearance:—None in service (hydraulic type lifter used). See Valve Lifter data below.
Valve Guides:—Pressed in block (taper end up).
Valve Lifters:—Wilcox-Rich 'Zero-lash' type hydraulic lifters. Barrel type operating in reamed holes.
See article in Mechanical Equipment Section for data.
NOTE—Two sizes of lifter used, must be re-installed in same guide hole from which removed. Larger size lifter used in holes marked by yellow paint 'X' or stamped 'B' below valve spring. First lifters not marked for size, later larger lifter stamped 'B' in oil groove. Valves must be removed first.
Lifter Clearance—.0033" (new), .004" (worn limit).
Valve Springs:—Free length 2.130".

	Spring Pressure	Length
Valve Closed	49 lbs.	1.812"
Valve Open	95.5 lbs.	1.510"

Important—Valve Spring 'Howl' Correction—No dampener used on first cars and springs may develop howl similar to axle gear noise. Correct by installing new Spring and Dampener assemblies No. 1428284 and lower retainers No. 1428295 (32 of each required). These are latest type internal dampener. First type dampener (external type) is satisfactory but interferes with rapid valve removal.
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 6° BTDC. Close 28° ALDC.
Exhaust Valves—Open 44° BLDC. Close 12° ATDC.
To Check Timing—No. 1 intake valve should open with piston 8° or .0208" before top dead center with the ignition mark 'IG/A' for this cylinder in line with the pointer on the chain case cover.

LUBRICATION:—Pressure system. Main oil header in left crankcase wall (feed from pump) for main, connecting rod, and camshaft bearings. Pipe from this header through filter feeds oil header above each line of valve lifters.
Oil Pump:—Helical gear type. In rear of crankcase.
Normal Oil Pressure:—25 lbs. at 30 M.P.H.
Oil Pressure Regulator:—Piston type built in oil pump. Operates at 28 lbs. Not adjustable.
Crankcase Capacity:—11 quarts.

COOLING SYSTEM:—Water Pump. Centrifugal type. 2 used (one pump for each bank, driven in tandem with fan pulley by double Vee belt).
See article in Mechanical Equipment Section for data.
Pump Removal—Drain cooling system, back off belt adjustment, disconnect hose, take out mounting screws in pump flange.
Belt Adjustment:—Loosen two mounting bolts on fan bracket, lift fan pulley and bracket assembly up (right bolt hole slotted, pivots on left bolt), until all slack removed from belts, tighten bolts.
NOTE—Replace belts together as matched set.
Thermostat:—Mounted on rear of radiator top tank.
Setting—(Std. Type) Starts to open at 132-142°F., fully open at 154°F. (High reading type—for use with heaters). Starts 156-164°F. Fully open 176°.
Shutter Adjustment—Disconnect shutter rod at lever on front of radiator top tank, loosen locknut, turn clevis so that rod extends 1/16" past lever (provides slight tension with shutters closed).

CLUTCH:—Long Model 12CB-11½C. Single plate, dry disc type. No adjustment required.
See article in Mechanical Equipment Section for data.
Facings—Spiral wound type, 2 required. I.D. 7", .O.D. 11½". Thickness .125".
Adjustment—Clutch pedal free travel should be ⅞-1⅛". To adjust, turn nut at forward end of connecting rod at clutch fork.
Removal:—Remove transmission (see Transmission Removal below), take off clutch housing underpan, take out clutch mounting screws in cover flange, remove clutch through pan opening at bottom.
See Cadillac Shop Notes for special clutch housing note and clutch balancing.

TRANSMISSION:—Own make. All helical gear type. Constant-mesh, synchro-mesh (second and high), sliding gear (low and reverse).
Transmission Control—Own make. Remote control, with gear shift lever mounted on steering column.
See article in Mechanical Equipment Section for data.
Removal:—*See preceding V8 page for data.*

UNIVERSAL JOINTS:—Mechanics Model 3C. Two used.
See article in Mechanical Equipment Section for data.

REAR AXLE:—Own make. Hypoid gear, semi-floating type with Hotchkiss drive.
See article in Mechanical Equipment Section for data.
NOTE—Manufacturer recommends Differential Carrier assembly returned to factory for servicing
Ratio—4.31-1 Std. Backlash—.004-.008".
Removal:—*See preceding V8 page for data.*
Wheel Bearing Adjustment—None (sealed type).

SHOCK ABSORBERS:—Delco Model 1951-C, D (front), 2052-A, B (rear). Double-acting, hydraulic type. Front Shock Absorbers are part of front suspension assembly. Rear Shocks are Inertia Control type.
See article in Mechanical Equipment Section for data.

STEERING:—Steering Gear—Saginaw Worm and Double Roller type with offset steering column and universal joint connection (Mechanics type—see Mechanical Equipment Section).
See article in Mechanical Equipment Section for data.
Front Suspension:—Independent, linked parallelogram type with coil springs.
See article in Mechanical Equipment Section for data.
Kingpin Inclination—5° 38' crosswise.
Caster—Neg. ¼° to Pos. ½° at curb weight (full gasoline tank). Adjustable.
Camber—Neg. ¼° to Pos. ½°. Adjustable.
Toe In—1/32-3/32" (at rest), 0-1/16" (in motion).
Steering Geometry (Toe-out on turns)—Inner wheel turned 23½°, outer wheel 20°.

BRAKES:—Service. Bendix hydraulic, Duo-servo, single anchor type with rigid wheel cylinders. Hand lever applies rear wheel service brakes.
See article in Mechanical Equipment Section for data.
Braking Power—58% (front), 42% (rear).
Brake Drums—Diameter 14". Centrifuse type.
Lining—Moulded type. Width 2¼". Thickness ¼". Length 12¼" (front primary shoes), 15" (all others)
Clearance—.010" for heel and toe at each shoe.
Hand Brake:—See Service Brakes above.

ENGINE HOOD & SIDE PANEL REMOVAL:—*See Cadillac Shop Notes for instructions.*

SERIAL & ENGINE NUMBER:—First number (60S) 6290001, (61) 8290001, (75) 3290001. Stamped on left side of crankcase at rear of left cylinder block and on left frame side member opposite steering gear.

ENGINE SPECIFICATIONS:—**Own.** 8 cylinder, 90° Vee, 'L' head type. Upper crankcase and cylinder blocks cast Enbloc. **Bore**—3½". **Stroke**—4½"
Displacement—346 cu. ins. **Rated HP.**—39.20.
Developed Horsepower—135 (60S, 61), 140 (75) at 3400 R.P.M.
Compression Ratio—6.25-1 (Std. 60S, 61; Optl. 75), 6.70-1 (Std. 75; Optl. 60S, 61), 5.75-1 (Optl. all).
See Cadillac Shop Notes for Head installation, head gasket data, and changing compression ratios.
Compression Pressure—155 lbs. (60S, 61), 170 lbs. (75) at 1000 R.P.M. or approximately 105-110 lbs. (60S, 61), 110-115 lbs. (75) at cranking speed.
Vacuum Reading—Steady 20-21" idling at 7-8 MPH.

PISTONS:—Lynite or Bohn Lo-Ex aluminum alloy, 'T' slot, Cam Ground type with Anodized finish (special hard oxide bearing surface). **Length**—4⅛".
Weight—18.30 ozs. (stripped. 25.13 ozs. (complete).
Removal—Pistons and rods removed from above.
Clearance—Skirt .0020-.0025". See Fitting Pistons.
Replacement Pistons:—*See Cadillac Shop Notes.*
Fitting New Pistons:—Check piston diameter with micrometer gauge at right angles to pin hole just below lower ring groove and also ½" above lower edge. If feeler gauges (⅜-½" wide, 7-10" long) used, insert feeler next to T-slot. Piston should fall through bore of own weight on .002" feeler, and hold on .0025" feeler. NOTE Cylinder bore out-of-round .0005" max., taper .0003".
Installing Pistons:—Slot to left, for all pistons.

PISTON RINGS:—Two compression, two oil control rings per piston, all above pin.

Ring	Width	End Gap	Side Clearance
Comp. (Top)	3/32"	.007-.012"	.0023-.0041"
Comp. (#2)	⅛"	.007-.012"	.0013-.0026"
Oil Control	5/32"	.007-.015"	.0013-.0026"

Replacement Rings: .003",.005",.010",.015",.030" oversize.

PISTON PIN:—**Diameter**—⅞. **Length**—3 1/16". Pin floats in piston and rod. Held by locking rings. *See Cadillac Shop Notes for special pin removal and installation instructions.*
Pin Fit in Piston—.0004" press fit (ribbed end), .0000" clearance or free fit at 70° F. (plain end).
Pin Fit in Rod Bushing—.0002-.0008" clearance (new), .0018" (worn limit).

CONNECTING ROD:—**Weight** 37.472 ozs. **Length** 8¾".
Crankpin Journal Diameter—2.4590-2.4595".
Lower Bearing—Steel-backed, babbitt-lined type.
Clearance—.0015-.0025" (new), .0045" Max. (worn).
Sideplay—.008-.014".
Bearing Adjustment:—None (no shims). Replace bearings. Do not file rod or caps. *See Cadillac Shop Notes for connecting rod and bearing installation data.*
Installing Rods:—Numbers on rods and bearing caps on same side and installed in same numbered cylinders with marks down toward oil pan.

CRANKSHAFT:—3 bearing. 6 counterweights.
See Cadillac Shop Notes for main bearing servicing and rear main bearing oil seal renewal.
Journal Diameters—2½" all bearings.
Bearings—Steel or bronze backed, babbitt-lined.
Clearance—.0015-.0025" (new), .005" (worn).
Bearing Adjustment:—None (no shims). Replace bearings. Do not file bearing caps. Upper halves can be rotated out without removing crankshaft.
End Thrust:—Taken by center (#2) bearing.
Endplay—.001-.005" (new), .010" Max. (worn).

CAMSHAFT:—3 bearing, non-adjustable chain drive.
See Cadillac Shop Notes for camshaft bushing data.
Journal Diameters—#1 and #2, 2.4071-2.4078"; #3, 2.0009-2.0016".
Bearing Type—Steel-backed, babbitt-lined.
Clearance—.0015-.0033" (new), .0045" (worn).
End Thrust:—Taken by thrust plate behind camshaft sprocket. No endplay should be permitted.
Timing Chain:—Morse Type C #3682-R Side Guide type. Width 1¼". Pitch ⅜". Length 23¼" or 62 links. NOTE—Install chain 'endless' as an assembly with sprockets. Use Tool J-836 to pilot camshaft sprocket.
Camshaft Setting:—Sprockets marked. Mesh chain with sprockets turned so that '0' marks are adjacent and in line with a straightedge across shaft centers.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1.876-1.886"	.3415-.3425"	5 33/64"
Exhaust	1.626-1.636"	.3405-.3515"	5 33/64"

	Seat Angle	Lift	Stem Clearance
Intake	45°	.335"	.0012-.0032"
Exhaust	45°	.345"	.0022-.0042"

NOTE—Worn limit for stem clearance .005" (all valves). Valve heads not slotted.
See Cadillac Shop Notes for valve servicing.
Tappet Clearance:—None (automatic take-up used).
Valve Guides:—Press in block (long step end down).
Valve Lifters:—Wilcox-Rich 'Zero-lash' type hydraulic lifters (mushroom type) in removable brackets. *See article in Mechanical Equipment Section for data.*
Clearance—.0010-.0024" (new), .0035" (worn).
Valve Springs:—Free length 2.210".

	Spring Pressure	Length
Valve Closed	66 lbs.	1.926"
Valve Open	145 lbs.	1.581"

Valve Timing:—See Camshaft Setting above.
Intake Valves—Open at TDC. Close 42° ALDC.
Exhaust Valves—Open 52° BLDC. Close 10° ATDC.
To Check Timing—#1 cylinder (front—left bank) intake valve should open with piston at TDC and mark 'C.1/6' on crankshaft pulley aligned with chain case cover pointer.

LUBRICATION:—Pressure (gear type oil pump in crankcase). *See Cadillac Shop Notes for oil pump data.*
Normal Oil Pressure:—15 lbs. idling, 25 lbs. at 30 MPH.
Oil Pressure Indicator:—Opens at 30 lbs. On oil pump. Non-adjustable type.
Crankcase Capacity:—7 quarts.

COOLING SYSTEM:—**Capacity**—24½ quarts.
See Cadillac Shop Notes for radiator core removal and fan pulley replacement instructions.
Water Pump:—Self-adjusting packing type.
See article in Mechanical Equipment Section for data.
Removal—Drain water, remove pump belt, pump hose and pump mounting screws. Lift pump out.
Thermostat:—Mounted in radiator top tank, linked to radiator shutters by rod on forward side.
Setting—(Std. Type) Starts to open 148-153° F., fully open at 170° F. (High Reading Type—use with Heaters) Starts to open 163-168°F. Fully open 185°F.
Shutter Adjustment—Adjust clevis on threaded end of rod to secure 1/16" tension on thermostat with shutters closed.
Temperature Gauge:—AC. Electric. #1510773 (dash unit), #1510774 (engine unit).
See article in Mechanical Equipment Section for data.

CLUTCH:—**Long Model 11CF-CI.** Semi-centrifugal, single plate, dry disc type.
See article in Mechanical Equipment Section for data.
Facings—Woven joined type, 2 required. Inside Diam. 6½". Outside Diam. 11". Thickness .123-.127".
Adjustment:—Free movement of pedal should be ⅞-1⅛" (adjusting nut on connector link at fork).
Removal:—Remove transmission (see below), drop clutch housing pan, punch mark clutch cover, pressure plate, and flywheel (re-install to these marks), remove 6 cover screws (release tension evenly).
See Cadillac Shop Notes for clutch balancing data.

TRANSMISSION:—**Own Make.** Constant-mesh, synchro-mesh, all helical gear type (sliding gear, low & reverse).
Transmission Control:—Remote steering col. shift.
See articles in Mechanical Equipment Section for data.
Removal:—Support engine with jack under rear end of oil pan (use wooden block to avoid damage to pan), remove propeller shaft (disconnect front and rear universals), free transmission extension at engine rear support, remove crossmember with engine rear support, disconnect speedometer cable, remove shifter rods from levers at transmission, support transmission at rear, take out mounting screws, pull straight back (plug clutch connection shaft bearing drain hole as soon as accessible to prevent lubricant loss), lower front end of transmission and remove

UNIVERSAL JOINTS:—**Mechanics Model 3C.** Needle bearing type. *See Mechanical Equipment Section.*

REAR AXLE:—**Own Make.** Hypoid gear, semi-floating type with Hotchkiss drive.
See article in Mechanical Equipment Section for data.
NOTE—Manufacturer recommends Differential Carrier assembly be returned to factory for servicing.
Ratio—3.92-1 (60S, 61). 4.58-1 (75).
Backlash—.004-.010". Screw adjustment.
Removal:—Disconnect drive shaft at rear universal, remove axle shafts (see below), remove capscrews on carrier flange, pull carrier assembly out.
Axle Shaft Removal—Remove rear wheels, take off axle shaft nut, pull wheel hub and brake drum, disconnect brake line and remove backing plate. Pull shaft and bearing assembly out (use Tool J-838).
Wheel Bearing Adjustment—None.
See Cadillac Shop Notes for Rear Stabilizer Adjustment for Models 60S, 75.

SHOCK ABSORBERS:—**Delco.** Front—1946-E, F (60S), 1946-G, H (61), 1951-C, D (75). Rear—1751-G, H (60S), 1751-V, W (61), 2010-C, D (75). Double acting, hydraulic. *See Mechanical Equipment Section.*

STEERING:—**Steering Gear**—Saginaw Worm-and-Double Roller type. *See Mechanical Equipment Section.*
NOTE—New type steering linkage with idler arm attached to right frame sidemember on 61.
Front Suspension:—Independent linked parallelogram type with coil springs.
See article in Mechanical Equipment Section for data.
Kingpin Inclination—5°44' (60S), 5°6' (61), 5°1' (75).
Caster—Pos. ¼° to Neg. 1¼° (60S), Neg. ¼° to Neg. 2¼° (61), 0° plus or minus ¼° (75).
Camber—Neg. ¼° to Pos. ½° (60S), Neg. ¼° to Pos. ¾° (61), 0° to Pos ½° (75). Equal within ½°.
Toe In—1/32-3/32" (at rest), 0-1/16" (in motion). NOTE—On Model 61, adjusting sleeve at wheel end of each tie rod provided for toe in adjustment.
Steering Geometry—Inner wheel turned 22¼-23¾° (61), 22¾-24¼° (60S, 75). Outer wheel turned 20°.

BRAKES:—**Service.** Bendix hydraulic, duo-servo, single anchor type (no eccentric on 60S, 61). Hand lever applies rear serv. brakes. *See Mechanical Equip. Sect.*
Drums—Centrifuse. Diameter—11.995-12.005" (60S, 61), 13.995-14.005" (75).
Lining—Moulded. Length per shoe—Front 11 17/32" (60S, 61), 13 21/32" (75); Rear 12 31/32" (60S, 61), 15 1/32" (75). Width 2" (except 75 front wheel), 2¼" (75 front). Thickness 3/16" (60S, 61), ¼" (75).
Clearance—.015" both ends of secondary shoe (60S, 61), .010" (75).
Braking Power—45½% rear (60S, 61), 43-44% (75).
Hand Brake:—See Service Brakes.

ENGINE HOOD & SIDE PANEL REMOVAL:—*See Cadillac Shop Notes for instructions.*

SERIAL NUMBER & ENGINE NUMBER:—First number 5290001. Stamped on upper rear corner of left hand cylinder block and on left frame side member opposite steering gear.

ENGINE SPECIFICATIONS:—16 cylinder, 135° Vee, 'L' head. Cylinder banks and crankcase cast integral. *See Cadillac Shop Notes for head installation data.*
Bore—3¼". **Stroke** 3¼".
Displacement—431 cu. ins. **Rated HP.**—67.60.
Developed Horsepower—185 HP. at 3600 R.P.M.
Compression Ratio—6.75-1 Std. 6.08-1 Optl.
Compression Pressure—180 lbs. at 1000 R.P.M. or approximately 110-115 lbs. at cranking speed.
Vacuum Reading—Steady 20-21" idling at 7-8 MPH.

PISTONS:—Lynite & Bohn Lo-Ex aluminum alloy, 'T' slot, cam ground type with anodized finish (special hard oxide bearing surface). **Length**—3¾".
Weight—15.28 ozs. (stripped), 21.136 ozs. (complete).
Removal—Pistons and rods removed from above.
Clearance—.0020-.0025" skirt. See Fitting Pistons.
Replacement Pistons:—*See Cadillac Shop Notes.*
Fitting New Pistons:—Check piston diameter with micrometer gauge at right angles to pin hole just below lower ring groove and also ½" above lower edge. If feeler gauges (⅜-½" wide, 7-10" long) used, insert feeler next to T-slot. Piston should fall through bore of own weight on .0015" feeler and hold on .002" feeler. NOTE—Cylinder bore out-of-round .0005", taper .0003".
Installing Pistons:—Slot to left, for all pistons.

PISTON RINGS:—Two compression, one oil control ring per piston, all above pin.

Ring	Width	End Gap	Side Clearance
Comp. (Top)	3/32"	.007-.015"	.0030-.0043"
Comp. (#2)	⅛"	.007-.015"	.0013-.0026"
Oil Control	3/16"	.007-.015"	.0013-.0026"

Replacement Rings: .003",.005",.010",.015",.030" oversize.

PISTON PIN:—**Diameter**—13/16". **Length**—2 25/32".
Pin is locked in rod by locking screw. Oil grooves broached for full length of pin hole in piston.
See Cadillac Shop Notes for special pin removal and installation instructions.
Pin Fit in Piston—.0001-.0006" clearance (new), .0018" (worn).
Replacement Pins:—Undersizes not furnished.

CONNECTING ROD:—**Weight** 24.528 ozs. **Length** 6⅜".
Crankpin Journal Diameter—1.9988-1.9993".
Lower Bearing—Steel-backed, babbitt-lined.
Clearance—.0015-.0025" (new), .0045" (worn).
Sideplay—.008-.014".
Bearing Adjustment:—None (no shims). Replace bearings. Do not file connecting rods or caps.
Installing Rods:—Numbers on rods and bearing caps on same side and installed in same numbered cylinders with marks down toward oil pan.

CRANKSHAFT:—9 bearing, integral counterweights.
See Cadillac Shop Notes for main bearing servicing and rear main bearing oil seal renewal.
Journal Diameters—2½ all bearings.
Bearing Type—Steel-backed, babbitt-lined.
Clearance—.0015-.0025" (new), .005" Max. (worn).
Bearing Adjustment:—None (no shims). Replace bearings. Do not file bearing caps. Upper halves can be rotated out without removing crankshaft.
End Thrust:—Taken by #5 (center) bearing.
Endplay—.001-.005" (new), .010" (worn).

CAMSHAFT:—5 bearing, non-adjustable chain drive.
See Cadillac Shop Notes for camshaft removal and installation instructions.
Bearing Type—Steel-backed, babbitt bushings.
Clearance—.0013-.0025" (new), .004" (worn).
End Thrust:—Taken by thrust plate flange at front bearing. **Endplay** .005-.015" (new), .020" (worn).
Timing Chain:—Morse Type C #3682-R. Width 1¼". Pitch ⅜". Length 23¼" or 62 links.
Camshaft Setting:—Sprockets marked. Mesh chain with sprockets turned so that '0' marks are adjacent and in line with a straightedge across shaft centers.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1.495-1.505"	.3415-.3425"	5 19/32"
Exhaust	1.370-1.380"	.3405-.3415"	5 39/64"

	Seat Angle	Lift	Stem Clearance
Intake	45°	.290"	.0010-.0030"
Exhaust	45°	.302"	.0020-.0040"

NOTE—Worn limit for stem clearance .005" (all valves). Valve heads not slotted.
Tappet Clearance:—None (automatic take-up used).
Valve Guides:—Pressed in block (taper end down).
Valve Lifters:—Wilcox-Rich 'Zero-lash' type hydraulic lifters. Barrel type operating in reamed holes.
See article in Mechanical Equipment Section for data.
NOTE—Two sizes of lifter used, must be re-installed in same guide hole from which removed. Large lifter stamped 'B' in oil groove. Large guide hole stamped 'B' beside hole. Valves must be removed first.
Lifter Clearance—.0015-.0025" (new), .0035" (worn).

Valve Springs:—Damper used at bottom. Free length 2.074".

	Spring Pressure	Length
Valve Closed	50 lbs.	1 25/32"
Valve Open	100 lbs.	1 15/32"

Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 6° BTDC. Close 28° ALDC.
Exhaust Valves—Open 44° BLDC. Close 12° ATDC.
To Check Timing—#1 cylinder (front—left bank) intake valve should open with piston 6° or .0112" before top dead center with ignition mark 'IG/A' aligned with pointer on chain case cover. NOTE—Intake opening and ignition timing same point.

LUBRICATION:—Pressure system. Main oil header in left crankcase wall (feed from pump) for main, connecting rod, and camshaft bearings. Pipe from this header through filter feeds oil header above each line of valve lifters (non-adjustable auxiliary relief valve at rear of left line).
Oil Pump:—Helical gear type. In rear of crankcase.
Normal Oil Pressure:—15 lbs. idling, 25 lbs. at 30 MPH.
Oil Pressure Regulator:—Piston type built in oil pump. Opens at 30 lbs.
Crankcase Capacity:—11 quarts.

COOLING SYSTEM:—**Capacity**—30 quarts.
See Cadillac Shop Notes for radiator core removal.
Water Pump:—Packless type, sealed ball-bearing shaft (2 used—one pump for each bank, driven in tandem with fan pulley by double Vee belt).
See article in Mechanical Equipment Section for data.
Removal—Drain cooling system, back off belt adjustment, remove hose and pump mounting screws.
Belt Adjustment:—Loosen two mounting bolts on fan bracket, lift fan pulley and bracket assembly up (right bolt hole slotted, pivots on left bolt), until all slack removed from belt, tighten bolts.
NOTE—Replace belts together as matched sets.
Thermostat:—Harrison. In radiator top tank. Linked to radiator shutters by rod on forward side.
Setting—(Std. Type) Starts to open 148-153° F., fully open at 170° F. (High Reading Type—use with Heaters) Starts to open 163-168°F. Fully open 185°F.
Shutter Adjustment—Disconnect shutter rod at lever on front of radiator top tank, loosen locknut, turn clevis so that rod extends 1/16" past lever (provides slight tension with shutters closed).
Temperature Gauge:—AC. Electric. #1517703 (dash unit), #1517704 (engine unit).
See article in Mechanical Equipment Section for data.

CLUTCH:—**Long Model 12CB-11½C.** Single plate, dry disc type. No adjustment required.
See article in Mechanical Equipment Section for data.
Facings—Woven-joined, 2 required. Inside Diam. 7". Outside Diam. 11½". Thickness .123-.127".
Adjustment:—Free movement of pedal should be ⅞-1⅛" (adjusting nut on connector link at fork).
Removal:—Remove transmission (see below), drop clutch housing pan, punch mark clutch cover, pressure plate, and flywheel (re-install to these marks), remove 12 cover screws (release tension evenly).
See Cadillac Shop Notes for special clutch housing note and clutch balancing data.

TRANSMISSION:—**Own Make.** Constant-mesh, synchro-mesh, all helical gear type (sliding gear, low & reverse).
Transmission Control:—Remote steering col. shift.
See articles in Mechanical Equipment Section for data.
Removal:—Remove propeller shaft, free transmission extension at engine rear support, remove crossmember (with engine rear support), disconnect speedometer cable, remove shifter rods from levers at transmission, support transmission at rear, take out mounting screws, pull straight back (plug clutch connection shaft bearing drain hole as soon as accessible to prevent lubricant loss), lower front end of transmission and remove from car.

UNIVERSAL JOINTS:—**Mechanics Model 3C.** Needle bearing type. Two used.
See article in Mechanical Equipment Section for data.

REAR AXLE:—**Own Make.** Hypoid gear, semi-floating type with Hotchkiss drive.
See article in Mechanical Equipment Section for data.
NOTE—Manufacturer recommends Differential Carrier Assembly be returned to factory for servicing.
Ratio—4.31-1. **Backlash**—.004-.010". Screw adj.
Removal:—Disconnect drive shaft at rear universal, remove axle shafts (see below), remove capscrews on carrier flange, pull carrier assembly out.
Axle Shaft Removal—Remove rear wheels, take off axle shaft nut, pull wheel hub and brake drum, disconnect brake line and remove backing plate. Pull shaft and bearing assembly out (use Tool J-838).
Wheel Bearing Adjustment—None.
See Cadillac Shop Notes for rear stabilizer data.

SHOCK ABSORBERS:—**Delco Model 1951-C, D (front), 2010-C, D (rear).** Double acting, hydraulic type. Front shock absorbers are part of front suspension assembly. Rear Shocks are Inertia Control type.
See article in Mechanical Equipment Section for data.

STEERING:—**Steering Gear**—Saginaw Worm-and-Double Roller type with offset steering column and universal joint connection (Mechanics type).
See articles in Mechanical Equipment Section for data.
Front Suspension:—Independent linked parallelogram type with coil springs.
See article in Mechanical Equipment Section for data.
Kingpin Inclination—5°1' crosswise.
Caster—Neg. ¼° to Pos. ¼°. Adjustable.
Camber—0° to Pos. ½°. Shim adjustment.
Toe In—1/32-3/32" (at rest), 0-1/16" (in motion).
Steering Geometry (Toe-out on turns)—Inner wheel turned 22¾-24¼°, outer wheel 20°.

BRAKES:—**Service.** Bendix hydraulic, duo-servo, single anchor type with eccentric adjustment and rigid wheel cylinders. Hand lever applies rear service brakes. *See Mechanical Equipment Section for data.*
Drums—Centrifuse. Diameter 13.995-14.005".
Lining—Moulded. Length per shoe 13 21/32" (primary), 15 1/32" (secondary). Width 2¼". ¼" thick.
Clearance—.010" at each end of secondary shoe.
Braking Power—43% rear, 57% front wheels.
Hand Brake:—See Service Brakes.

1939 MODELS

FRONT END REMOVAL:—Fenders and radiator grille assembly may be removed as a unit for work on front of engine or on Master Deluxe for Front Suspension Unit removal as follows: Remove hood, drain cooling system (one drain cock on lower left side of crankcase, radiator drain cock on rear at lower right side), disconnect headlamp wires at terminal blocks in engine compartment and free wiring loom along top of radiator support, take out fender bolts at running boards and body, remove 2 radiator support nuts. Lift off fenders and radiator grille assembly as a unit.

1939 MODELS

RADIATOR CORE REMOVAL:—To take out radiator core proceed as follows: Drain radiator, disconnect upper hose and remove lower hose, remove hood assembly and moulding, disconnect radiator brace rod at front end and at one side on dash (loosen opposite side at dash allowing brace rod to be turned up for core clearance), free wiring harness along top of radiator support, take out water pump and fan assembly, remove 2 core-to-radiator support bolts on each side (nuts crimped in support), take off front hood hinges and take out core by tilting slightly to rear and lifting upward.

1939 MODELS

ENGINE MOUNTINGS:—Adjustment—Tighten front engine mounting bolts (replace mountings if oil-soaked), tighten rear mounting bolts at transmission (studs must be tight in case), clearance between cross-member and 'U' section plate should be .005-.015" **(limits fore and aft engine movement)**, if clearance excessive, remove mounting and bend plate to obtain correct clearance. Tighten side engine mounting bracket bolts. Take out engine side mounting bolts, check clearance between mounting and bracket at each side, clearance must be 1/16" (if clearance excessive, use 3/8" plain washer to shim for proper clearance, if clearance less than 1/16", loosen bracket bolts and push mounting up or if necessary remove brackets and file holes with round file to give 1/16" clearance). Tension on side mountings must be equal at each side.

1934 (Mstr. only), 1935-38 MODELS

HARMONIC BALANCER:—Serviced as a complete unit only. New balancers furnished with two cap screws holding halves together. If Chevrolet Balancer Puller and Driver used, remove these two screws and with driver placed in starter cranking jaws, assemble puller body to balancer by means of two screws assembled in these tapped holes. With key and keyway aligned drive balancer into position using puller screw as driver.

IMPORTANT—If Chevrolet Puller and Driver not used, two screws must be left on balancer (to hold halves together) until installed on engine, then screws must be removed to allow proper functioning of balancer.

1939 MODELS

HARMONIC BALANCER:—Serviced as complete assembly only (component parts not serviced separately).

Removal—Remove Front End Assembly as a unit first (see directions above). Use Chevrolet Harmonic Balancer Puller and Driver (consists of puller body, puller screw and pinned driver head), attach puller body to balancer by means of 2 cap-screws in two tapped holes in balancer, pull balancer by turning up puller screw.

Installation—Place driver in starting crank jaws of balancer, install puller body (as above), line up keyway in balancer and key in crankshaft, turn puller screw down to contact driver, then use puller screw as driver and drive balancer in place.

1937-38-39 MODELS

MAIN BEARINGS:—Installation—Front intermediate bearing shell marked 'I' in oil groove and must be used in #2 bearing cap. Front intermediate (#2) and Rear intermediate (#3) bearing caps must be installed with mark 'FRONT' (#2 cap) toward front, 'REAR' (#3 cap) toward rear.

Line-Boring—Bearings must be line-bored with .008" shims (four .002" shims) under each end of bearing caps. After line-boring, Rear intermediate (#3 bearing must be faced to provide proper end-play. Adjust as directed below.

Endplay Adjustment—Crankshaft endplay and oil slinger clearance controlled by rear intermediate (#3) bearing. When installing new bearings, this bearing should be machined on front flange just enough to clean up face (amount of stock removed from front flange controls oil slinger clearance). Then machine rear flange of bearing to obtain end-play of .004-.007" (measure with feeler gauge inserted between rear side of #3 bearing and crankshaft with shaft in extreme rear position). Finally check oil slinger clearance by inserting feeler between rear face of slinger and oil groove (clearance should be .002-.032").

1938-39 MODELS

CAMSHAFT BEARINGS:—Installation. Oil groove extends 70° around bearing from oil hole. To insure proper alignment with oil hole in block, mark front of bore opposite oil hole. Align oil hole in bearing with mark (with groove toward bottom of engine away from oil hole in block), press bearings in place and stake to prevent movement. Finally line ream bushings.

1934-39 MODELS

TIMING GEARS:—Installation—With gears off, check Gear alignment (controlled by shims behind Crankcase Front End Plate). Using new Camshaft Thrust Plate, hold in place on End Plate (before assembling on camshaft). Lay straightedge across crankshaft shoulder and thrust plate. Add or remove shims to align these two surfaces. Set End Plate screws with punch. Camshaft gear is press fit on hub. Remove and install gear in arbor press with camshaft out of engine. Press gear on shaft until no perceptible clearance remains between gear and thrust plate but gear is free to turn. CAUTION—Use hub of gear only when pressing gear on shaft to avoid damaging gear. New thrust plate must be used whenever gear removed.

1935-37 MODELS

1938 VALVES:—Servicing for 1935-36-37 engines—New design (more metal under head) and serviced for 1935-36-37 engines. When used on these models 1938 exhaust valve guide (Part No. 602978) should be used or drill top of old guide down to head metal in valve port using 5/8" drill ground to 20° point. Remove burr from inside of guide.

1938-39 MODELS

VALVE GUIDES:—To Install. Starting with 1938 exhaust guides shorter than previous type, not counter-bored and installed with inner end flush with inside of valve port. Use special stop-collar drivers (J-1089 Int., J-1090 Exh.) to install new guides. These drivers position guides so that distance from head to top of guide is 1 1/16" Intake, 61/64" Exhaust. Rough ream guides to .341", finish ream to .343" inside diameter after installing.

1937-38-39 MODELS

ROCKER ARMS:—Two types of intake arms used. Install arms with slight angle toward front of engine for cylinders #1, 3, 5; angle toward rear for #2, 4, 6. All exhaust rocker arms straight. Replace worn rocker arms and worn shafts. Replacement arms furnished with finished bushings installed. Assemble rocker arm shafts with open end toward center of engine. Special bolt and washer used for rocker arm and shaft assembly (washer prevents oil leak around bolt). Assemble spring to brass coupling, place elbow pipe on coupling (press elbow back on spring), install coupling on rear shaft (elbow can then be assembled to front shaft), finally turn up coupling nut on end of oil pipe.

1937-38-39 MODELS

OIL LEAD TO VALVE ROCKER ARMS:—Installation—New assembly must be used (nipple and pipe assembly Part #838487 '37-38, #838914'39 whenever removed from engine. To install proceed as follows: insert pipe in block, coat threads of nipple with white lead and screw in block (on right side), install nipple and sleeve nut on lower end of pipe (left side of block) and secure in place, then bend pipe in upward loop and connect to oil distributor, bend pipe on right side of engine to clear push rod cover and also an additional bend (toward front of engine) to allow for expansion in pipe, finally connect pipe to valve rocker shaft coupling. Fill cooling system and check for leaks with engine running.

1937-38-39 MODELS

CHECK OILING SYSTEM:—Check troughs and nozzles whenever oil pan removed. Use Gauge No. J-969-3 to check oil nozzle height for connecting rod clearance (remove pan gasket, hook end of gauge over pan rail, position gauge in trough with word 'front' toward front of engine). Open end of nozzle must be directly below gauge. Use Gauge No. 969-2 to check oil trough height. Gauge stem should just touch edge of all troughs. Use Gauge No. J-969-1 to check nozzle aim (use water pressure, see that nozzle stream hits hole in target gauge). Use wrench J-793-2 to adjust nozzles. Recheck nozzle height.

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1938-39 MODELS

REAR SPRING SEATS (PASSENGER CAR MODELS):—Bracket welded on front of housing at each spring. Spring seat attached to bracket by means of rubber bushed bolt (spacer sleeve through which bolt passes, used to prevent collapse of bracket through tightening bolts with too great pressure). Rubber washers used between bracket and each end of spring seat. Spring seat attached to springs through conventional U-bolts. IMPORTANT—When reassembling spring seat to bracket (when installing rear axle), eye bolt nut must not be tightened until all other connections made and car weight resting on all 4 wheels.

1938-39 MODELS

REAR SPRING SEATS (TRUCK MODELS):—Fitting. Whenever rear spring seats are adjusted, clearance between spring seat and rear axle housing must be checked as follows: Block up rear of car under frame side rails, drop rear of spring by disconnecting spring shackle, take out spring U-bolts, remove spring seats (lower spring cap secured by means of 2 screws). File face of each spring seat halve evenly (place in bench vise) until spring seat gives slight drag when placed on housing and rotated. CAUTION—File both halves evenly.

1938-39 MODELS

AXLE SHAFT (PASSENGER CARS):—To Install. Assemble new oil deflector, gasket (coat with shellac or paint on both sides), line up extra hole (center of three closest together) with notch in hub flange in axle shaft (also oil pocket in oil deflector with this notch), insert six new bolts and peen into place in counter-sink at bolt holes in flange.

Axle Spacers—Furnished in three sizes (1938), four sizes (1939) as follows: 1.0105", 1.0195", 1.0295", and 1.0345" (4th size 1939 only), across ground faces. Select spacer so that clearance between ends of axle shafts and spacer is Free fit to .014".

1938-39 MODELS

REAR WHEEL BEARING OIL SEAL (1½ Ton):—Rear wheel bearings are lubricated from differential. Soft stamped steel plate used under hub bolt heads and wheel bearing oil seal spring-backed to retain lubricant. Vellumoid gasket between axle flange and wheel hub should be replaced after every four removals. Oil slinger behind inner bearing must be installed with Oil Slinger Replacer J-973 to insure proper position to mate with slinger in wheel hub.

1939 CAB-OVER-ENGINE MODELS

ENGINE COVER REMOVAL:—To take off engine cover proceed as follows: Remove seat cushion and seat back, take out 4 bolts on cover at gear shift lever and raise assembly to rear, remove floor mats on each side, remove engine cover screws (at rear and at front on each side). Lift engine cover out by raising forward end and pulling out towards front.

NOTE—Right floor pan has hand hole for access to engine oil stick, crankcase oil filler pipe, and for lubrication of distributor and starter.

Left Floor Pan Note—Whenever floor pan removed, disconnect accelerator linkage by passing wire through accelerator spring and pull it upward exposing cotter pin retainer, then pull cotter pin out.

FRONT COWLING REMOVAL:—Take out 6 retaining screws on each side (2 top screws nuts accessible through side ventilators—not used on late models), remove 2 screws at top of cowling and take off radiator filler cap. Lift cowling up and forward. When replacing cowling, rubber insulators at upper screws must be installed between cowling and dash at each side. NOTE—With cowling removed, radiator may be taken out allowing access to water pump, fan belt, harmonic balancer, generator and front engine mountings.

SERIAL NUMBER:—First number ('33) CC-1001. ('34) DC-1001. On right front body sill in front of right seat.

ENGINE NUMBER:—Stamped on boss on right side of cylinder block.

ENGINE:—Six cylinder, overhead valve type.
Dimensions—Bore, 3 5/16". Stroke, 3½". Displacement, 181 cu. ins.
Horsepower—Rated, 26.3. Developed, 60 H.P. at 3000 R.P.M.
Compression—Ratio 5.2-1 (1933), 5.35-1 (1934). Pressure approximately 90-95 lbs. at cranking speed.
Vaccum Reading—Gauge should show steady reading of 18-20" at idling speed.

Pistons:—Cast-iron 'Cam' ground type with greatest clearance across pin bosses. Pistons furnished in standard oversizes of .003", .010", .020". Recondition cylinders to standard oversize (hone cylinders for .003" oversize or ream and hone for .010" or .020" oversize pistons). Reconditioned cylinders should not be out-of-round or tapered more than .001".
Clearance—.002-.003" (skirt)—see 'Installing New Pistons'.
Weight—Pistons of same size held to ⅛ ounce maximum weight variation.
Removal—Piston and rod assembly removed from top of engine.
Installing New Pistons—Use feeler gauge in cylinder bore at right angles to piston pin boss to gauge clearance. Piston should pass through bore with .002" feeler and should lock on .003" feeler. Finish hone cylinder bore to provide this clearance with standard oversize pistons.

Piston Rings:—Three rings per piston (all above pin), #1 and 2—compression rings, #3—oil control ring. Lower ring groove is drilled radially with oil return drain holes.

Ring	Width	End Gap	Side Clearance
Compression (#1, 2)	5/32"	.004-.014"	.0015-.003"
Oil Control (#3)	3/16"	.004-.014"	.0015-.0025"

Piston Pin:—Pin is clamped in connecting rod. Pin bosses in piston are bronze bushed. Service pistons furnished with bushings in and new pins fitted.
Pin Fit in Piston—Light thumb push fit.

NOTE:—In assembling piston and connecting rod, center pin in piston and rod between piston bosses before tightening pin clamp screw. End clearance between upper end of connecting rod and end of piston pin bosses must be not less than .025".

Connecting Rod:—Length, 6 17/32". Weight—Rods are held to satisfactory weight variation (⅛ ounce).
Big End Bearing—Spun babbitt type. Shims are used.
Clearance—Snap fit (see adjustment below). Sideplay .004-.010".
Adjusting Bearings—Remove shims, assemble bearing cap, check clearance by tapping rod from side to side with 8 oz. ball pein hammer. Bearing should move with light hammer tap but should not be movable by hand. If bearing can be moved by hand, clearance is too great. If bearing does not move under light hammer tap, clearance is too small.

NOTE:—Assemble rods with number on rod and cap together (this number indicates cylinder in which rod should be used). Install rods in engine with these numbers toward camshaft side (piston pin clamp bolt should also be toward camshaft side of engine). Assemble oil dipper on bearing cap (under bolts) with mouth of dipper toward camshaft side of engine. Check height of dipper with special gauge (Part Number K-438). End of dipper should just touch cross bar of gauge with gauge rods resting on crankcase flange. Center rod on gauge should be used to test depth of oil troughs in oil pan (rest cross bar on flange, center rod should touch bottom of oil trough).

Crankshaft:—Three main bearing type with integral counterweights.
Journal Sizes—#1, 2 1/16"; #2, 2⅛"; #3, 2 3/16".
Bearing Type—Steel-backed, babbitt-lined type. Shims used.
Clearance—.002".
Adjustment—Remove shims until there is a heavy drag on crankshaft, then replace one .002" shim. Use an equal number of shims on each side. If necessary to use unequal number to secure correct clearance, put extra shim on camshaft side of engine.
End Thrust—Taken by #2 (center bearing). Correct end play, .004-.007". Clearance between oil deflector on rear of crankshaft and oil groove in cylinder block back of rear main bearing also controlled by center main bearing. Clearance should be .002-.032" with crankshaft in extreme rear position.

NOTE:—Crankshaft alignment should be checked when shaft is taken out of engine. Maximum allowable run-out at center bearing, .002". If more than .002", shaft should be straightened. Check crankshaft journals for out-of-round or taper. If more than .001", replace shaft.

Camshaft:—Three bearing type. Camshaft drive—helical gear. Center main bearing on camshaft is removable steel-backed, babbitt-lined type and is staked in the block and reamed to clear distributor drive shaft (drive gear located in center).
Bearing Diameters—#1, 1 13/16"; #2, 1 25/32"; #3, 1⅝".
Clearance (Center Bearing)—.002-.0035".
Inspection Limits—Camshaft alignment should be checked when camshaft is removed from engine. Maximum allowable run-out at center bearing is .002". If more than .002", straighten shaft. Check camshaft journals for out-of-round. If more than .001", replace camshaft.
End Thrust—Taken by thrust plate in back of camshaft gear. End play should be Free to .003". Adjustable by changing position of gear on camshaft (gear is press fit on shaft).
Camshaft Gears—Gears should be checked for run-out or alignment when installed. Maximum allowable run-out is .003" (crankshaft gear), .004" (camshaft gear). Replace gears if run-out is excessive and cannot be corrected (when caused by burrs on shaft or gear, etc.). Backlash between gears should be .002-.004".
Camshaft Setting—Tooth on crankshaft gear and space between teeth on camshaft gear punch-marked. Mesh marked tooth opposite marked space.

Valves:—	Head Diameter	Stem Diameter	Length	Seat Angle	Lift
Intake	1 29/64"	5/16"	4 15/16"	45°	.314"
Exhaust	1 11/32"	5/16"	4 15/16"	45°	.314"

Stem Clearance in Guide—.001-.003" Intake, .002-.004" Exhaust.
Tappet Clearance—.006" Int., .008" Exh. (1933), .013" Exh. (1934), with engine hot.
Valve Timing—See Camshaft Setting above.
Intake Valves—Open 4° Before TDC. Close 34° After LDC.
Exhaust Valves—Open 47° Before LDC. Close 4° After TDC.
To Check Valve Timing—Check tappet clearance #1 intake valve. This valve should open with piston 4° or .0051" before top dead center when a point on the flywheel approximately 1.15 teeth before dead center mark lines up with indicator on housing.
Motor Gauge—Weldenhoff #113 Adapter with #151 Adapter, Rod #19.

LUBRICATION:—Pressure type (positive pressure to crankshaft and camshaft bearings and through oil distributor at left of engine to valve rocker arm bushings and connecting rod dipper troughs). Connecting rod bearings, piston pins, and cylinder walls lubricated by splash from troughs. Vane type oil pump located in crankcase.
Oil Pressure Relief Valve—Conventional pressure relief or by-pass valve not used. Oil distributor on left side of crankcase proportions oil between high-pressure points (crankshaft and camshaft bearings), and low-pressure points (oil troughs and rocker arm shafts). An overflow tube returns excess oil from rocker shafts to crankcase.
Oil Pump Clearances—Replace pump when clearance between shaft and oil pump body exceeds .009". Assemble taper end of oil pump blades in direction of rotation.
Capacity—4½ quarts (refill).

CLUTCH:—Own make. Single plate, dry disc type. See article in Clutch Section for relining and assembling directions.
Facings—Moulded type, two required. Thickness ⅛". Inside Diameter 6¼". Outside Diameter 9".
Adjustment—Clearance between pedal and toeboard should be ½". To adjust, loosen two nuts on bracket at right of pedal, adjust pedal stop, tighten nuts. Free movement of clutch pedal should be 1". To adjust, loosen locknut and turn adjusting nut on clutch fork connecting link.

STEERING:—Steering Gear—Saginaw Model, Worm-and-Sector type. See article in Steering Section for adjustments.
Front Suspension:—Conventional 'I' beam front axle with Reverse-Elliott ends and semi-elliptic springs.
Kingpin Inclination—7°10' crosswise.
Caster—1¾° plus or minus ½°. Adjust by inserting shims between spring and spring pad on axle.
Camber—1° plus or minus ½°. Axle may be bent cold for minor corrections.
Toe In—5/64-⅛". Adjust by changing length of tie rod.

BRAKES:—Service—Own make. Internal expanding, two shoe type, mechanically operated. Hand lever applies all four service brakes. See article in Brake Section for relining and complete adjustment procedure.
Drum Diameter—10".
Lining—Moulded type. Width 1½". Thickness 3/16". Length per wheel 15½" ('33), 20" ('34).
Clearance—Very slight drag should be evident with brakes in proper adjustment.
Hand Brake Adjustment:—See Service Brakes.

NOTE:—To remove oil pan for work on engine, drop right hand tie rod. On cars with conventional front axle it may be necessary to bend lip of front cross member or hoist engine so that oil pan will clear.

ENGINE NUMBER:—First number—1st serial number (CA) 3,367,317 (DA) 1001. Stamped on boss on right side of block back of fuel pump.

ENGINE:—Own Master Model. Six cylinder, 'I' or overhead valve type. Cylinders cast enbloc.
Bore—3 5/16". Stroke—4".
Piston Displacement—206.8 cubic inches.
Rated Horsepower—26.3 A.M.A.
Developed Horsepower—65 at 2800 R.P.M. (CA); 80 at 3300 R.P.M. (DA).
Compression Ratio—5.2-1 (CA), 5.4-1 (DA), Standard cast-iron head. No optional ratios.
Compression Pressure—Approximately 91 lbs. (5.2-1 hd.), 96 lbs. (5.4-1 hd.) at cranking speed.
Vacuum Reading—Gauge should show steady reading of 18-20" with engine idling.

Pistons:—Cast-iron, cam ground type with greatest clearance across pin bosses. See Replacement Pistons below.
Weight—25 ozs. (CA), 27¼ ozs. (DA), Held to ⅛ oz. maximum variation.
Length—3 11/16".
Clearance—.011" (CA, DA) top, .0015-.003" skirt.
Replacement Pistons—Refinish cylinders to take standard replacement pistons furnished .003", .010", .020", .030", .040" oversize (hone cylinders for .003" oversize or ream and hone for larger pistons).
Removal—Pistons and rods removed from above.
Fitting New Pistons—Use feeler gauge between piston and cylinder at right angles to pin bosses to check clearance. Piston should pass through bore on .002" feeler and lock on .003" feeler.

Piston Rings:—Two compression, one oil control ring per piston, all above pin. Lower ring groove drilled radially with oil drain holes. Rings furnished .005", .010", .015", .020", .030", .040" oversize.

Ring	Width	End Gap	Side Clearance
Comp. All	⅛"	.005-.015"	.0015-.003"
Oil Cont.	3/16"	.013-.021"	.0015-.0025"

Piston Pin: — Diameter .990-.9895". Length 2 29/32". Pin is locked in rod. Pin bosses in piston are bronze bushed. New pistons furnished with bushings installed and pins fitted. Pins furnished for service standard and .003", .005", .010" oversize.
Pin Fit in Piston Bushing—Tight thumb push fit (CA), Light thumb push fit (DA).

Connecting Rod:—Weight 31.68 ozs. Length 7½".
Crankpin Journal Diameter—2.1245-2.1250".
Lower Bearing Type—Spun babbitt. Solid shims.
Clearance—.0005-.002". Sideplay .004-.011".
Adjustment—Shims. Remove shims from each side equally to secure 'snap fit' (rod should snap from one side to the other with a light tap of 8 oz. ball pein hammer). Bearing is loose if rod can be moved by hand.
Installing Rods—Install rods in same numbered cylinders as indicated by numbers stamped on rod and cap with these numbers together and toward camshaft side of engine. Oil hole in cap should be away from camshaft. Assemble oil dippers on rod caps with mouth of dipper toward camshaft.

Crankshaft:—3 bearings. Integral counterweights.
Journal Diameters—#1, 2 1/16"; #2, 2⅛"; #3, 2 3/16".
Bearing Type—Removable steel-backed, babbitt-lined. **Clearance**—.001-.003".
Adjustment—Shims. Remove shims until there is a heavy drag on the crankshaft, then replace one .002" shim. If necessary to use unequal number, place extra shim on camshaft side.
End Thrust—Taken by center bearing. Endplay .004-.007". Flanges on center main bearing should be turned down for this clearance and clearance of .002-.032" between oil slinger on rear of crankshaft and groove in cylinder block.

Camshaft:—Three bearing. Gear driven.
Journal Diameters—#1, 1.808-1.809"; #2, 1.776-1.7777"; #3, 1.620-1.621".
Bearing Type—#2 and 3 are steel-backed, babbitt-lined. These bearings are pressed in crankcase and staked to prevent movement.
Clearance—.002-.004". Check at center bearing.
End Thrust—Taken by thrust plate in back of camshaft gear. Endplay should be Free to .003".
Camshaft Gears—Crankshaft gear steel. Camshaft gear Bakelite-Fabric composition. Backlash between gears .003-.004" (CA), .002-.005" (DA).
Camshaft Setting:—Mesh marked tooth on crankshaft gear opposite marked space between teeth on camshaft gear. Marked tooth on crankshaft gear is fifth (CA), third (DA) tooth counter-clockwise from space in line with keyway. Marked space on camshaft gear is 16th. (CA), 13th. (DA) space clockwise from space opposite keyway (15 CA, 12 (DA) teeth between these points).

Valves (CA):—	Head Diam.	Stem Diam.	Length
Intake	1 29/64"	5/16"	4 15/16"
Exhaust	1 11/32"	5/16"	4 15/16"

	Seat Angle	Lift	Stem Clearance
Intake	45°	.314"	.001-.003"
Exhaust	45°	.314"	.002-.004"

Valves (DA)	Head Diameter	Stem Diameter	Length
Intake	1 45/64"	11/32"	5.986"
Exhaust	1 15/32"	11/32"	4.810"

	Seat Angle	Lift	Stem Clearance
Intake	30°	.316"	.001-.003"
Exhaust	30°	.309"	.002-.004"

Installing New Guides—Use special tool to press out old guides and install new guides. On DA model assemble collars on guides with open face up (intake), down toward cylinder head (exhaust) before installing, finish ream new guides to .3125" (CA), .343" (DA).
Tappet Clearance—.006" minimum (.006-.008") Int., .008" Exh. (CA), .013" Exh. (DA).
Valve Springs (CA):—Painted yellow to distinguish from previous design.
Pressure—57 lbs. closed, 95 lbs. open.
Valve Springs (DA)—Have variable spaced coils Install springs with close-coil end toward cylinder head (down).

	Spring Pressure	Length
Valve Closed	45 lbs.	1⅞"
Valve Open	98 lbs.	1 9/16"

Valve Timing—See Camshaft Setting above.
Intake Valves—Open 4° BTDC. Close 34° ALDC.
Exhaust Valves—Open 47° BLDC. Close 4° ATDC.
To Check Valve Timing—No flywheel mark provided for valve timing check. With intake tappet clearance set at .006" (engine hot), #1 intake valve should open with piston 4° .0061") before top dead center when a point on the flywheel approximately 1⅛ (CA), 1½ (DA) teeth before the dead center point lines up with the indicator in the inspection hole.
Motor Gauge—Weidenhoff Adapter #113 (with #151 attachment for CA, #152 for DA), Rod #19 (CA), #33 (DA).

Lubrication:—Pressure and positive splash system (positive pressure to crankshaft and camshaft bearings, timing gears, and through oil distributor at left of engine to valve rocker arm bushings and connecting rod dipper troughs). Connecting rod bearings, piston pins and cylinder walls lubricated by splash from troughs at low speeds and by jet from oil nozzles striking rod dippers directly at high speeds. Vane type oil pump located in crankcase.
Normal Oil Pressure—14 lbs. at 30 M.P.H.
Oil Pressure Relief Valve—Conventional pressure relief or by-pass valve not used. Oil distributor on left side of crankcase proportions oil between high pressure points (crankshaft, camshaft bearings, timing gears) and low pressure points (oil troughs and rocker arm shafts). Excess oil is returned from rocker arm shafts to crankcase through overflow pipe. Distributor valve operates at 6½ lbs.
Checking Connecting Rod Oiling System—Use special gauge to check height of dippers assembled on connecting rod bearing cap and height of oil troughs (one gauge) when assembling rods. Use Target Gauge to check jet from oil nozzles in troughs (use water under pressure—jet should strike hole in target—use special tool to bend nozzle to correct position). Check nozzles after this adjustment with height gauge to make certain that rods will clear. These checks should be made whenever pan is taken off engine.
Crankcase Capacity—5 quarts.

CLUTCH:—Own make. Single plate, dry disc type. No adjustment required for wear.
See article in Mechanical Equipment Section for data.
Clutch Pedal Adjustment — Clearance between pedal and toeboard should be ½". To adjust, loosen two nuts on bracket at right of pedal adjust pedal stop, tighten nuts. Free movement of clutch pedal should be 1". To adjust, loosen locknut on pedal shaft stop below pedal (CA), loosen check nut, turn adjusting screw for 1" clearance. On DA model loosen locknut and turn adjusting nut on clutch fork connecting link.
NOTE—On CA, brakes must be adjusted whenever clutch pedal stop is moved.
Clutch Facings—Molded woven asbestos composition, 2 required, 6¼" I. D., 9" O. D., ⅛" thick.
NOTE—Propeller shaft must be disconnected at universal and transmission removed to remove clutch.

STEERING:—Steering Gear—Saginaw Worm-and-Sector (CA), Worm-and-Roller (DA).
See article in Mechanical Equipment Section for data.
Front Suspension CA, DA:—Conventional 'I' beam section front axle with Reverse-Elliott ends and semi-elliptic springs.
Kingpin Inclination—7°10' plus or minus 1°.
Caster—1¾° plus or minus ½°. Adjust by installing wedge shims between spring and spring pad on axle.
Camber—1° plus or minus ½°. Axle may be bent cold to correct camber.
Toe In—5/64-⅛". Adjust in usual manner by loosening clamps and turning tie rod.

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OIL PAN REMOVAL:—To remove pan for work on engine on cars with conventional front axle factory advises that tie rod be dropped on right hand side and motor hoisted so that pan clears front cross member when removed. Pan can be removed without hoisting engine by bending lip of cross member.

FLEET MODEL NOTE:—A special engine is available for fleet use where maximum economy is desired. Engines are standard except for cylinder head (identified by letter 'F' cast above #1 exhaust port), carburetor with economy throttle stop, and vacuum spark control. Rear axle ratio with this engine is 3.82-1 (42-11 ring gear and pinion). All specifications are the same except:
Spark Plug Gap—Set at .040".
Intake Tappet Clearance—.010" Hot.
Exhaust Tappet Clearance—.016" Hot.
Ignition Setting—At TDC.
These models may be identified by special name plate on instrument panel and plate on valve push-rod cover listing these specifications.

ENGINE NUMBER:—First number 4,708,995 with prefix as follows: M—Passenger cars (EA, EC, ED), K—Commercial (EB), T—Trucks (Q). Stamped on boss on right side of cylinder block in back of fuel pump.

ENGINE: — Own Master Model. Six cylinder, 'I' or overhead valve type. Cylinders cast enbloc.
Bore—3 5/16". **Stroke**—4".
Displacement—206.8 cu. ins. **Rated HP.**—26.3.
Developed Horsepower—74 HP. (Std.), 80 HP. (Mstr.), 68.5 (Trucks) at 3200 R.P.M.
Compression Ratio—5.45-1 (Std. & Trucks), 5.6-1 (Mstr.).
Compression Pressure—Approximately 95 lbs. (5.45-1), or 97 lbs. (5.6-1) at cranking speed.
Vacuum Reading—18-20" at idling speed.

Pistons:—Cast-iron, tin-plated, cam ground type with greater clearance across pin bosses. Pistons are tin-plated to thickness of .0005-.001" after finishing and cannot be ground. Refinish cylinders to take standard replacement pistons furnished .003", .010", .020", .030", .040" oversize (hone cylinders for .003" oversize or ream and hone for larger pistons). Piston length 3 11/16".
Weight—28.8 ozs. stripped, 38.24 ozs. with rings, pin and bushings. Held to ⅛ oz. max. variation.
Removal—Pistons and rods removed from above.
Clearance—.0145" top, .0015-.003" skirt.
Fitting New Pistons—Use feeler gauge between piston and cylinder at right angles to pin bosses to check clearance. Piston should pass through bore on .002" feeler and lock on .003" feeler.

Piston Rings:—Two compression, one oil control ring per piston, all above pin. Lower ring groove drilled radially with oil drain holes. Rings furnished .005", .010", .015", .020", .030", .040" oversize.

Ring	Width	End Gap	Side Clearance
Comp. All	⅛"	.005-.015"	.0015-.003"
Oil Cont.	3/16"	.013-.021"	.0015-.0025"

Piston Pin: — Diameter .990-.9895". Length 2 29/32". Pin is locked in rod. Pin bosses in piston are bronze bushed. New pistons furnished with bushings installed and pins fitted. Pins furnished for service standard and .003", .005", .010" oversize.
Pin Fit in Piston Bushing—Light thumb push fit.

Connecting Rod:—Weight 31.68 ozs. Length 7½".
Crankpin Journal Diameter—2.1245-2.1250".
Lower Bearing Type—Spun babbitt. Solid shims.
Clearance—.0005-.002". Sideplay .004-.011".
Adjustment—Shims. Remove shims from each side equally to secure 'snap fit' (rod should snap from side to side with light tap of 8 oz. hammer). Bearing is loose if rod can be moved by hand.
Installing Rods—Install rods in same numbered cylinders as indicated by numbers stamped on rod and cap with these numbers together and toward camshaft side of engine. Oil hole in cap should be away from camshaft. Assemble oil dippers on rod caps with mouth of dipper toward camshaft.

Crankshaft:—3 bearings. Integral counterweights.
Journal Diameters — #1, 2.058-2.059"; #2, 2.120-2.121"; #3, 2.183-2.184".
Bearing Type—Steel-backed, babbitt-lined.
Clearance—.001-.003".
Adjustment—Shims. Remove shims until there is a heavy drag on the crankshaft, then replace one .002" shim. If necessary to use unequal number, place extra shims on camshaft side.
End Thrust—Taken by center bearing. Endplay .004-.007". Flanges on center main bearing should be turned down for this clearance and clearance of .002-.032" between oil slinger on rear end of crankshaft and groove in cylinder block.

Camshaft:—Three bearing. Gear driven.
Bearing Type—#2 and 3 are steel-backed, babbitt-lined. These bearings are pressed in crankcase and staked to prevent movement.
Clearance—.002-.004". Check at center bearing.
End Thrust—Taken by thrust plate in back of camshaft gear. Endplay should be Free to .003".
Camshaft Gears—Crankshaft gear steel. Camshaft gear Bakelite-Fabric composition. Backlash between gears should be .002-.005".
Camshaft Setting—Mesh marked tooth on crankshaft gear opposite marked space between teeth on camshaft gear.

Valves:—

	Head Diameter	Stem Diameter	Length
Intake	1 45/64"	11/32"	5.986"
Exhaust	1 15/32"	11/32"	4.810"

	Seat Angle	Lift	Stem Clearance
Intake	30°	.316"	.001-.003"
Exhaust	30°	.309"	.002-.004"

NOTE—On a few of the first cars valve head diameter was 1 41/64" (Int.), 1 15/32" (Exh.), and seat angle was 45° (all).
Installing New Guides—Use special tool to press out old guides and install new guides. Assemble collars on guides with open face up (intake), down toward cylinder head (exhaust) before installing. Finish ream new guides to inside diameter .343" (all). Check stem size with 'No-Go' gauges (stem sizes above merely nominal).
Tappet Clearance—.006" min. (.006-.008") Intake, .013" minimum (.013-.015") Exh. with engine hot.
Valve Springs—Springs have variable spaced coils. Install springs with close-coil end toward cylinder head (down).

	Spring Pressure	Length
Valve Closed	45 lbs.	1⅞"
Valve Open	98 lbs.	1 9/16"

Valve Timing—See Camshaft Setting above.
Intake Valves—Open 4° BTDC. Close 34° ALDC.
Exhaust Valves—Open 47° BLDC. Close 4° ATDC.
To Check Valve Timing—No flywheel mark provided for valve timing check. With intake tappet clearance set at .006" (engine hot), #1 intake valve should open with piston .0061" (4°) before top dead center when a point on the flywheel approximately 1½ teeth before dead center point lines up with the indicator in the inspection hole.
Motor Gauge—Weidenhoff Adapter #113 (with #152 Adapter), Rod #33.
Lubrication—Pressure and positive splash system.
Oil Pump—Vane Type in crankcase driven through tongue-and-slot coupling from camshaft gear.
Oil Distributor—On left side of crankcase. Proportions oil between high pressure points (crankshaft, camshaft bearings, timing gears) and low pressure points (oil trough, rocker arm shaft). Overflow pipe returns excess oil from rocker arm shaft.
Checking Connecting Rod Oiling System—Should be checked whenever oil pan removed. See 1934 model (previous page) for complete directions.
Normal Oil Pressure—12 lbs. at 50 M.P.H.
Crankcase Capacity—5 quarts.

CLUTCH:—Own make. Single plate, dry disc type. No adjustment required for wear. See article in Clutch Section for complete data.
Clutch Pedal Adjustment — Clearance between pedal and toeboard should be ½". To adjust, loosen two nuts on bracket at right of pedal (EA, EB, EC, ED) or on pedal stop bracket below pedal (Q), adjust pedal stop, tighten nuts. Free movement of clutch pedal should be 1". To adjust, loosen locknut and turn adjusting nut on clutch fork connecting link (EA, EB, EC, ED), or loosen locknut on pedal shaft stop below pedal, loosen locknut on adjusting setscrew, turn setscrew.
Clutch Facings—(EA, EB, EC, ED) molded woven asbestos composition, 2 required, 6¼" I.D., 9" O.D., ⅛" thick. (Q) molded asbestos composition, 2 required, 6¼" I.D., 10" O.D., ⅛" thick.

STEERING:—**Steering Gear**—Saginaw Worm-and-Sector (Std. & Trucks), Worm-and-Roller (Mstr. EA, ED). See article in Steering Section for adjustmts.
Front Suspension Std. EC, Mstr. ED & Trucks:—Conventional 'I' beam front axle with Reverse-Elliott ends and semi-elliptic springs.
Kingpin Inclination—7°10' plus or minus 1°.
Caster—1¾° plus or minus ½° (EB, EC), 3° (Mstr. ED), 2¾° (Q). Adjust by installing wedge shims between spring and spring pad on axle.
Camber—1° plus or minus ½°. Axle may be bent cold to correct camber.
Toe In—5/64-⅛". To adjust, turn tie rod.
Front Suspension Master Model EA:—Independent 'Knee Action' Type. See article in Steering Section for adjustment. Specifications below correct with car weight supported by horses at wheel spindle inner bearing cone.
Suspension Unit Height—Distance from bottom of kingpin support to bottom of brake flange plate should be 5⅝" (5-wheel cars), 4⅝" (6-wheel cars).
Kingpin Inclination—7¾°. Correct by bending kingpin support.
Camber—¼°. No adjustment provided. If spindle is bent, replace suspension unit. If kingpin bearings are worn, they should be replaced (special oversize rollers can be installed by reaming out kingpin support yoke ends).
Kingpin Caster—0°. Correct by bending kingpin support. Caster effect is secured by trailing wheel center behind center of kingpin.
Toe In—1/16-3/32" measured at hub height. Correct as usual by changing length of tie rod.

BRAKES:—**Service**—Own make. Internal expanding, self-energizing, mechanically operated brakes. Hand lever applies all four service brakes. See article in Brake Section for complete data.
Drum Diameter—10" (Std.), 12" (Mstr.).
Lining—Semi-moulded (Std.), moulded (Mstr.). Width 1¾". Thickness 3/16". Length per wheel 20.2" (Std.), 24 19/32" (Mstr.).
Clearance—Very slight drag should be evident when brakes in proper adjustment.
Hand Brake Adjustment:—See Service Brakes.

NOTE:—To remove oil pan for work on engine, drop right hand tie rod. On Master Model FD with conventional axle it may be necessary to bend lip of front cross member or hoist engine so that oil pan will clear.

FLEET 'ECONOMY' MODEL NOTE:—All models available with special economy engine which may be identified by prefix 'V' on engine number and plate on Valve Push Rod Cover listing special tune up specifications. Engine is standard except for these tune up specifications (see Tune up page), special carburetor (painted gray) which has stop pin designed to limit throttle to half-throttle opening, manifold cover, and passenger car intake manifold riser sleeve used on FB and R models.

ENGINE NUMBER:—First number—5500179. Prefixed by letter indicating model as follows: M—FC passenger cars. K—FB commercial cars. T—R Trucks. No prefix used on Master FA, FD passenger cars. Economy engines indicated by 'V' (V, VM, VK, VT). Number is stamped on boss on right side of block back of fuel pump.

ENGINE SPECIFICATIONS:—6 cylinder, 'I' head.
Bore—3 5/16". **Stroke**—4".
Displacement—206.8 cubic inches.
Rated Horsepower—26.3 (AMA).
Developed Horsepower—79 at 3200 R.P.M.
Compression Ratio & Pressure—6.0-1 Std. cast-iron head. Pressure 102 lbs. at cranking speed or 90 lbs. min. and equal within 5-10 lbs. for all cylinders.
Vacuum Gauge Reading—Should show steady reading of 20-22" with engine idling at 400 R.P.M.

PISTONS:—Cast iron, tin-plated, cam ground type with greater clearance across pin bosses. Pistons are tin-plated to thickness of .0005-.001" after finishing and cannot be ground. Use finished replacement pistons. **Weight**—28¾ ozs. (stripped). **Length**—3 11/16".
Removal—Pistons and rods removed from above.
Clearance—.0145" Top. .0015-.003" Skirt.
Replacement Pistons:—Finished pistons furnished .003", .010", .020", .030", .040" oversize.
Fitting New Pistons:—Use feeler gauge at right angles to pin bosses to check clearance. Piston should pass through bore on .002" feeler and lock on .003" feeler.

PISTON RINGS:—Two compression, one oil control ring per piston all above pin. Lower ring groove drilled radially with oil drain holes.

Ring	Width	End Gap	Side Clearance
Comp.	⅛"	.005-.015"	.0015-.003"
Oil Cont.	3/16"	.013-.021"	.0015-.0025"

NOTE—Compression ring face tapered and marked 'Top' on upper side. Install rings with this mark toward top of piston. Rings furnished .005", .010", .015", .020", .030", .040", oversize.

PISTON PIN:—Diameter .990-.9895". **Length** 2 29/32". Pin is locked in rod. Pin bosses in piston bronze-bushed. New pistons furnished with bushings and pins fitted. Pins furnished standard and .003", .005", .010" oversize.
Pin Fit in Piston Bushing—Light thumb push fit.

CONNECTING ROD:—Weight 31⅝ ozs. **Length** 7½".
Crankpin Journal Diameter—2⅛".
Lower Bearing—Spun-babbitt lined type.
Clearance—.0005-.002". Sideplay .004-.011".
Bearing Adjustment:—Solid shims. Remove shims from each side equally to secure 'snap fit' (rod should snap from one side to the other with a light tap of 8 oz. ball pein hammer). Bearing loose if rod can be moved by hand.
Installing Rods:—Install rods in same numbered cylinders as indicated by numbers stamped on rod and cap with these numbers together and toward camshaft side of engine. Oil hole in cap should be away from camshaft. Assemble oil dippers on rod caps with mouth of dipper toward camshaft.
NOTE—Check dipper height with special gauge.

CRANKSHAFT:—3 bearing. Integral counterweights.
Journal Diameters—#1, 2 1/16"; #2, 2⅛"; #3, 2 3/16".
Bearing Type—Steel-backed, babbitt-lined removable type.
Clearance—.001-.003".
Bearing Adjustment:—Shims. Remove shims until there is a heavy drag on the crankshaft, then replace one .002" shim.
End Thrust:—Taken by center bearing. Endplay .004-.007". Flanges on center main bearing should be turned down for this clearance and clearance of .002-.032" between oil slinger on rear end of crankshaft and edge of groove in cylinder block.

CAMSHAFT—Three bearing. Gear driven.
Journal Diameters—#1, 1 13/16"; #2, 1 25/32"; #3, 1⅝".
Bearing Type—#1 machined in crankcase. #2, 3 steel-backed, babbitt-lined type pressed in crankcase and staked to prevent movement.
Clearance—.002-.0035". Check at center bearing.
NOTE—When replacing center bearing manufacturer recommends use of special driver and alignment pin to align oil holes and distributor drive. Ream distributor hole and line-ream bearings. #1 bearing serviceable only by using special reamer to ream hole in crankcase and then installing bearing and new standard camshaft.
End Thrust:—Taken by thrust plate in back of camshaft bear. Endplay—Free to .003". Adjusted by changing gear position on shaft. See Timing Gear Note.
Timing Gears:—Steel (crankshaft), Bakelite-Fabric (camshaft). Backlash between gears .002-.005".
NOTE—Camshaft gear press fit on shaft. Remove and install gear in arbor press with camshaft out of engine using special sleeve to support hub. Use new thrust plate and press gear on shaft until no endplay (between gear and thrust plate) is perceptible but gear is free to turn.
Camshaft Setting:—Mesh marked tooth on crankshaft gear with marked space between teeth on camshaft gear. Marked tooth on crankshaft gear is third counter-clockwise from space in line with key way. Marked space on camshaft gear is thirteenth space clockwise from space in line with keyway. (12 teeth between these points.)

VALVES:—	Head Diameter	Stem Diameter	Length
Intake	1 45/64"	11/32" (nom.)	5 7/32"
Exhaust	1 15/32"	11/32" (nom.)	4 1/32"

	Seat Angle	Lift	Stem Clearance
Intake	30°	.316"	.001-.003"
Exhaust	30°	.319"	.002-.004"

NOTE—Stem sizes nominal. Check with special 'No-go' gauge.
Tappet Clearance (Std. Engine)—.006" Min. (.006-.008") Int., .013" Min (.013-.015") Exh. with eng. hot.
Tappet Clearance (Economy Engine)—.010" Int., .016" Exh. with engine hot.
Valve Guides:—Use special tool to press out old guides and install new guides. Assemble collars on guides with open face up (intake), down toward cylinder head (exhaust). Exhaust guides counter-bored ¼" on lower end. Rough-ream these guides to .341", counter-bore with special reamer (KMO-33). Finish ream all guides to .343" after installing.
Valve Springs:—Variable spaced coil type. Install with close-coil end toward cylinder head (down).

	Spring Pressure	Length
Valve Closed	45 lbs.	1 ⅞"
Valve Open	98 lbs.	1 9/16"

Valve Lifters:—Single piece cast-iron with ground contact face. Oversize lifters not furnished.
Pushrod Springs:—Spring mounted on each pushrod above valve lifter. To remove pushrods, take out three bolts in spring retainer to release spring tension, remove 'C' washer under spring, withdraw pushrod. Install in same manner.
Rocker Arms:—Intake arms have left and right hand angles. Intake arm with left hand angle must be installed on #2, 4, 6 cylinders, right hand angle on #1, 3, 5 cylinders.
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 4° BTDC. Close 34° ALDC.
Exhaust Valves—Open 47° BLDC. Close 4° ATDC.
To Check Timing—No flywheel marks. With intake valve tappet clearance set at .006" (hot), #1 intake valve should begin to open with piston 4° or .0061" before top dead center when point on flywheel approximately 1½ teeth before dead center point lines up with pointer on inspection hole in right front face of flywheel housing.
Motor Gauge—Weidenhoff #113 Adapter with #152 Attachment. #33 Rod.

LUBRICATION:—Pressure and positive splash system used. Rifle-drilled passages in block to main bearings.
Oil Pump:—Vane type in crankcase driven through tongue-and-slot coupling from camshaft gear.
Normal Oil Pressure:—12 lbs. at 50 M.P.H.
Oil Distributor:—On left side of crankcase. Proportions oil between high pressure points (crankshaft, camshaft bearings, timing gears) and low pressure points (oil troughs, rocker arm shaft). Overflow pipe returns excess oil from rocker arm shaft.
NOTE—Oil pipe to rocker arm shaft passes through water jacket in center of block. When replacing check for water leaks at block connections.
Checking Connecting Rod Oiling System:—Check whenever oil pan taken off engine. Use special gauge to check dipper height (on connecting rod bearing cap) and oil trough height (same gauge). Use special target gauge to check oil nozzle jets (use water under pressure, bend nozzle with special tool until jet strikes hole in target gauge). Check nozzles with special height gauge after this adjustment to make certain that rods will clear.
Crankcase Capacity—5 qts. refill.
NOTE—SAE #10-W oil recommended for Economy engine. Oil heavier than #20 must not be used at any time in this engine.

CLUTCH:—Own make. Single plate, dry disc type. See article in Clutch Section for relining and assembly directions.
Facings—Molded-braided (FA, B, C, D), moulded (RA, B, C, D). Inside Diam. 6¼" (all), Outside Diam. 9" (FA, B, C, D), 10" (RA, B, C, D). Thickness ⅛".
Adjustment—Clearance between pedal and underside of floor board must be ½". To adjust, loosen two nuts at side of pedal, move pedal stop forward or backward. Free movement of pedal must be 1". To adjust, loosen checknut (upper), and turn adjusting nut (lower) on clutch fork connecting link.

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Removal:—Disconnect universal (see Note for Std. Model), remove transmission underpan and transmission rear cross member, lift propeller shaft and slide transmission out using pilot studs to hold transmission. Disconnect clutch linkage, take out capscrew holding throwout fork in flywheel housing, take out fork, force springs holding sleeve to throw-out levers over ends of levers and remove sleeve. Take out nine capscrews mounting clutch cover on flywheel, turning out screws evenly until spring pressure is released.

NOTE—On Standard model, universal joint ring is riveted (On Master model universal joint is split by taking bolts out of this ring) and rear end must be freed and pulled back to disengage drive shaft at splined joint back of universal.

STEERING:—**Steering Gear**—Saginaw Worm-and-Sector (Std. FC) Worm-and-Roller (Mstr, FA, FD). See article in Steering Section for adjustments.

Front Suspension Std. FC., Mstr. FD:—Conventional 'I' beam front axle with semi-elliptic springs.
Kingpin Inclination—7°10′ plus or minus 1°. Angle on both wheels must be same within ½°.

Caster—2¾° (St.FC), 1¾° (FB), 2¾° (R), 3° (Mstr. FD) plus or minus ½°. Must be same within ¼° on both wheels. Adjusted by inserting wedge shims between spring and spring pad.

Camber—1° plus or minus ½°. Must be same within ¼° on both wheels. No adjustment. Axle may be bent cold for minor corrections.

Toe In—5/64-⅛″. Adjusted in usual manner by turning tie rod to increase or decrease length.

Steering Geometry—Inner wheel turned 23°, outer wheel 20°. Check tie rod ends and kingpin for looseness, replace steering arms.

Front Suspension Master Model FA:—Independent 'Knee Action' Type. See article in Steering Section for adjustments. Specifications below correct with car weight supported by horses at wheel spindle inner bearing cone (necessary for use of Chevrolet testing equipment).

Wheel Setting (Suspension Unit Height)—Should be 5⅜″ (Spare at rear), 4⅜″ (With fender wells) from bottom of kingpin support to bottom of brake flange plate.

Kingpin Inclination—7¾° crosswise.

Camber—¼°. No adjustment provided.

Kingpin Caster—0°. Caster effect secured by trailing wheel behind suspension unit.

Toe In—1/16-3/32″ measured at hub height on center of tire tread.

Steering Geometry—Inner wheel 23°, outer 20°

BRAKES:—Own design. Four-wheel hydraulic type. Hand brake lever applies rear wheel brakes. See article in Brake Section for complete adjustment instructions.

Wheel Cylinders—Diameters, (Mstr. FA, FD & FB) Front wheel 1¼″, Rear wheel 1 3/16″. (Std.FC) Front wheel 1⅛″, Rear wheel 1 1/16″. (R) Front wheel 1¼″, Rear wheel 1½″. Not interchangeable.

Brake Drum Diameter—11″.

Lining—Semi-moulded (Std.FC), Moulded (Mstr. FA, FD), (FB). Width 1¾″. Thickness 3/16″. Length 22⅝″ per wheel.

Brake Clearance—Adjusting cover backed off 4 notches from slight drag position.

Hand Brake Adjustment:—See Service Brake.

CHEVROLET MODELS (1933-34)

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Front Suspension DA:—Independent 'Knee-Action' type. See article in Steering Section for adjustments. Specifications below correct with car weight supported by horses at wheel spindle inner bearing cone (necessary for use of Chevrolet testing equipment).

Wheel Setting (Suspension Unit Height)—Should be 5½″ (Spare at rear), 4½″ (With fender wells) from bottom of kingpin support to bottom of brake flange plate.

Kingpin Inclination—7° crosswise.

Camber—1°. No adjustment provided.

Kingpin Caster—0°. Caster effect secured by trailing wheel behind suspension unit.

Toe In—1/16-3/32″ measured at hub height on center of tire tread.

Steering Geometry—Inner wheel 23°, outer 20°.

BRAKES:—**Service**—Own make. Internal expanding, self-energizing, mechanically operated brakes. Hand lever applies all four service brakes. See article in Brake Section for relining and complete adjustment procedure.

Drum Diameter—12″.

Lining—Molded (CA), Semi-molded (DA), Thickness ¼″ (CA), 3/16″ (DA). Width 1¾″. Length per wheel 18 11/32″ (CA), 24 9/32″ (DA).

Clearance—Very slight drag should be evident when brakes in proper adjustment.

Hand Brake Adjustment:—See Service Brakes.

NOTE:—Oil Pan Removal—To remove oil pan for work on engine on Master Deluxe and Master models, the Engine-Side-Support Tie-Bar (cross-member under engine) should be dropped first. This cross-member is bolted to bottom of frame side rails.

FLEET MODEL NOTE:—Special Economy engine available for all models. This engine may be identified by prefix 'V' on engine number and special service plate on Push Rod Cover listing special tune up specifications for this model. Engine is standard except for these specifications and Carburetor which has stop-pin designed to limit throttle opening to half-throttle. See article in Carburetion Section for complete data on this Carburetor.

ENGINE NUMBER:—First number—1. Prefixed by a letter indicating model: 'K' Commercial Model GC, 'T' Model S trucks. Economy engines indicated by 'V' (VK, VT). Engine number stamped on boss on right side of cylinder block back of fuel pump.

ENGINE SPECIFICATIONS:—Own. 6 cyl., 'I' head type.
NOTE—Cylinder head gasket marked 'This Side Up'. Install as directed.
Bore—3½". Stroke—3¾".
Displacement—216.5 cubic inches.
Rated Horsepower—29.4.
Developed Horsepower—85 at 3200 R.P.M. (GA, GB Master), 78 at 3200 R.P.M. (GC, SA, SB, SC, SD trucks).
Compression Ratio—6.25-1 Std. cast-iron head.
Compression Pressure—112 lbs. at 65 R.P.M. cranking speed, 159 lbs. max. at 2000 R.P.M.
Vacuum Reading—20-22" steady reading with engine idling at 400 R.P.M.

PISTONS:—New type Cast-iron, domed head, cam ground, tin-plated, with slipper type skirt. Recondition engines to take finished replacement pistons (hone for .003" oversize, bore and hone for other sizes). See Replacement Pistons.
Weight—22.7 ozs. (without rings or pin). NOTE—Special pistons (1½ ozs. heavier than Pass. car type) used on Trucks after April 1, 1937.
Length—3 59/64". Pistons balanced by grinding off bottom of skirt so that all pistons not equal (height above pin same for all pistons).
Removal—Pistons and rods removed from above.
Clearance—Top .006-.013". Skirt .0015-.003". See Fitting New Pistons.

Replacement Pistons:—Finished pistons with bushings and pins fitted furnished standard and .003", .010", .020", .030", .040" oversize.

Fitting New Pistons:—Use feeler gauges between piston and cylinder wall at right angles to pin bosses. Piston should pass through bore on .002" feeler and lock on .003" feeler.

PISTON RINGS:—Two compression, one oil control ring per piston, all above pin. Oil ring slotted or drilled type. Oil ring groove drilled with oil drain holes. Compression and slotted type oil ring furnished .005", .010", .015", .020", .030", .040" oversize; Drilled type oil ring .005", .010", .015", .020" oversize. Unit pkg. is 12 compression or 6 oil rings.
NOTE—Compression rings have tapered face. Install with word 'Top' up.

Ring	Width	End Gap	Side Clearance
Comp.	⅛"	.004-.014"	.0015-.0035"
Oil Cont.	3/16"	.004-.014"	.0015-.0035"

NOTE—Use .002" feeler to check side clearance. Top ring should be very free, middle ring free, oil ring tight.

PISTON PIN:—Diameter—.8645-.8650". **Length—3 3/32".** Pin is locked in rod and pin bosses in piston are bronze bushed. New pistons furnished with bushings and pins fitted. Pins furnished standard and .003". .005", .010" oversize.
Pin Fit in Piston Bushings—Thumb push fit (not heated).

CONNECTING ROD:—Length 6 13/16". Weight 28 ozs.
Crankpin Journal Diameter—2.311-2.312".
Lower Bearing—Spun-babbitt lined type.
Clearance—.0005-.002". Sideplay .004-.011".
NOTE—Connecting rod bearings now diamond-bored and must not be fitted as tight as previously.

Bearing Adjustment:—Solid shims. Remove shims to secure 'snap fit' (bearing tight to hand but rod should snap from one side to other with light tap of 8 oz. hammer), **then replace .002" shim for clearance.** With correct adjustment, rod should move from side to side with two-finger pressure.

Installing Rods:—Install rods in same numbered cylinders indicated by numbers on rod and caps with these numbers together and toward camshaft side. Assemble oil dippers on rod caps with mouth of dipper toward camshaft.
NOTE—Check dipper heights with J-969-2 gauge.

CRANKSHAFT:—4 bearing. Integral counterweights. Harmonic Balancer mounted on forward end.
See Chevrolet Special Shop Notes for balancer data.
Journal Diameters—#1, 2.6835-2.6845"; #2, 2.7145-2.7155"; #3, 2.7455-2.7465"; #4, 2.7765-2.7775".
Bearing Type—Steel-backed, babbitt-lined.
Clearance—.002-.004".
See Chevrolet Special Shop Notes for main bearing line-boring and installation instructions.

Bearing Adjustment:—Solid shims. Remove shims until slight drag on crankshaft secured, then replace one .002" shim for clearance. If unequal number, install extra shim on camshaft side.

End Thrust:—Taken by #3 main bearing. Adjusted by replacing bearing. Endplay .004-.007".
See Chevrolet Shop Notes for Main Bearing End Play Adjustment instructions.
NOTE—Oil slinger clearance at rear end of crankshaft must be .002-.032".

CAMSHAFT:—Four bearing. Gear driven.
Journal Diameters—#1, 2.0282-2.0292"; #2, 1.9657-1.9667"; #3, 1.9032-1.9042"; #4, 1.8407-1.8417".
Bearing Type—Steel-backed, babbitt-lined bushings. Pressed in crankcase and staked to prevent movement.
NOTE—Line-ream new bushings
Clearance—.002-.004".

End Thrust:—Taken by thrust plate behind camshaft gear. Endplay Free to .003". Adjusted by changing gear position on shaft.

Timing Gears:—Crankshaft gear Steel. Camshaft gear Bakelite & Fabric composition. Gear run-out (maximum) .003" crankshaft gear, .004" camshaft gear.
Backlash—.002-.005".
See Chevrolet Special Shop Notes for timing gear installation instructions.

Camshaft Setting:—Gears marked. Mesh marked tooth of crankshaft gear with marked space between teeth on camshaft gear.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1 41/64"	.3407-.3417"	6 5/64"
Exhaust	1 15/32"	.3397-.3407"	4 13/16"

	Seat Angle	Lift	Stem Clearance
Intake	30°	5/16"	.001-.003"
Exhaust	30°	5/16"	.002-.004"

NOTE—Exhaust valves marked 'GM37EXHAUST' and cup in head more shallow than in 1936. 1936 exhaust valves must not be used in 1937 engines may cause after-fire).
See Chevrolet Special Shop Notes for installing 1938 valves on these engines.

Tappet Clearance:—.006 Int. Min. (.006-.008"), .013" Exh. Min. (.013-.015") with engine hot.

Valve Guides:—New type without shoulder. Use special stop-collar drivers (J-1089 Int., J-1090 Exh.) to install new guides. These drivers position guides in head so that distance from head to top of guide is 1 1/16" Int., 61/64" Exh. Rough ream guides to .341", finish ream to .343" inside diameter after installing.

Valve Springs:—Check by compressing springs to 1½". Pressure should be 104-112 lbs.

	Spring Pressure	Spring Length
Valve Closed	42-48 lbs	1⅞"
Valve Open	94-102 lbs	1 9/16"

NOTE—Install spring with close-coil end toward cylinder head. Use round springs caps on intake valves, hexagonal caps on exhaust valves.

Valve Lifters:—Cast-iron type with ground contact face. Oversize lifters not furnished.

Pushrod Springs:—Spring mounted on each pushrod above valve lifter. To remove pushrods, take out three bolts in spring retainer, remove 'C' washer under spring, withdraw pushrod. Install in same manner.

Rocker Arms:—Two types of intake rocker arms used. Install arms with slight angle toward front of engine for cylinders #1, 3, 5; angle toward rear for #2, 4, 6. All exhaust rocker arms are straight. Assemble rocker arm shafts with open ends toward center of engine.

Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 9° BTDC. Close 29° ALDC.
Exhaust Valves—Open 52° BLDC. Close 1° BTDC.
To Check Timing—No flywheel marks provided. With intake tappet clearance set at .006", #1 intake valve should open with piston 9° or .0294" BTDC. when point on flywheel aproximately 3.475 teeth before top dead center lines up with indicator in inspection hole in right front face of flywheel housing.
Motor Gauge—Weidenhoff Adapter #113, Rod #33.

LUBRICATION:—Pressure and positive splash system similar to previous models except for oil pump.

Oil Pump:—New gear type located in crankcase. Install pump gears with ground face toward cover.

Normal Oil Pressure:—13.5 lbs. at 50 M.P.H.

Oil Pressure Regulator:—Located in oil pump cover. Operates at 75 lbs. Not adjustable. Pressure normally controlled by Oil Distributor.

Oil Distributor:—Mounted on left side of crankcase. Proportions oil between high pressure points (crankshaft bearings, camshaft bearings, timing gears) and low pressure points (connecting rod oil troughs and rocker arms). Overflow pipe returns excess oil from rocker arm shafts.
See Chevrolet Special Shop Notes for installing oil lead (through block) to valve rocker arms.

Checking Oil System:—Check troughs and nozzles whenever oil pan removed. Use Gauge No. J-969-3 to check oil nozzle height for connecting rod clearance (remove pan gasket, hook end of gauge over pan rail, position gauge in trough with word 'front' toward front of engine). Open end of nozzle must be directly below gauge. Use Gauge No. 969-2 to check oil trough height. Gauge stem should just touch edges of all troughs. Use Gauge No. J-969-1 to check nozzle aim (use water pressure, see that nozzle stream hits hole in target gauge). Use wrench J-793-2 to adjust nozzles.

Crankcase Capacity:—5 quarts.

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CLUTCH:—Own make. Single plate, dry disc type.
See article in Mechanical Equipment Section for data.
Adjustment (GA, GB)—Pedal free travel must be 1". To adjust, loosen locknut and turn adjusting nut on connecting link stud at clutch throw-out fork.
(GC, SA, SB, SC, SD)—Loosen locknut on lever at lower end of clutch pedal, back off locknut on adjusting screw on lower end of lever, turn adjusting screw for 1" free travel.
Facings—Asbestos Comp., 2 required. Inside Diam. 6". Outside Diam. 9" (GA, GB, GC) 10" (SA, SB, SC, SD). Thickness ⅛".
Removal:—Remove transmission (see Transmission Section). With flywheel underpan off, take out alternate clutch mounting screws, then turn remaining screws out evenly, remove clutch from below.
NOTE—On Model GC, block levers with 1/32" washers so levers will clear.

TRANSMISSION (GA, GB, GC):—Own make. Constant mesh, helical gear (second only), Synchro-mesh (second and high). Low and reverse—sliding spur gear.
See article in Mechanical Equipment Section for data.
Removal:—Disconnect pull rods on brake cross-shaft, remove left hand cross-shaft bracket, remove shaft. Take out speedometer cable and gear assembly (screwed into universal joint retainer). Take out screws in ball collar flange, slide ball and collar back on propeller shaft, remove bolts in universal joint ring, split joint. Remove top mounting bolts in flywheel housing and install guide pins, remove flywheel underpan, take out lower mounting screws. Take out bolts holding transmission mounting and support to cross-member. Slide transmission straight back on guide pins and remove.
NOTE—On Model GC with 4 Spd. Transmission, remove transmission support cross-member and take out 2 screws on brake cylinder bracket on transmission case.

TRANSMISSION (SA, SB, SC, SD):—Own make. 4 speed, sliding spur gear type (all speeds). This transmission optional on Model GC.
See article in Mechanical Equipment Section for data.
Removal:—Same as for passenger cars (above) except that nuts holding front propellor shaft assembly to cross-member should be removed and front propellor shaft dropped down. Split universal joint by removing trunnion bearing lock springs and driving trunnion bearings out.

UNIVERSAL JOINTS:—Own make. Plain bushing type. One used (except SA, SB, SC, SD with additional intermediate universal on frame cross-member). Mounted in ball housing at rear of transmission.
See article in Mechanical Equipment Section.

REAR AXLE (GA, GB):—Own make. Semi-floating, Hypoid gear type with Torque Tube drive.
See article in Mechanical Equipment Section for data.
Ratio—4.22-1 (GA), 3.73-1 (GB). 3.73-1 axle marked by prefix 'C' on serial number on differential carrier. No prefix for 4.22-1 axle.
Backlash—.004-.008". Screw adjustment.
Removal:—Jack up rear end of car (or use chain hoist), remove rear wheels, disconnect hydraulic brake line and brake cables, disconnect shock absorber links at spring seats, disconnect nuts on 'U' bolts holding rear springs to spring seats. Disconnect spring shackles and drop springs, pull axle assembly back to free shaft at splined joint in rear of transmission.
Wheel Bearing Adjustment:—None (sealed type).
Axle Shaft Removal:—Wheel bolted directly to flange on outer end of shaft. Axle shaft retained by 'C' washer at inner end in differential case. To remove shaft, remove wheel, take out two machine screws in brake drum, remove drum, install clamp on wheel brake cylinder. Take off axle housing cover, remove differential pinion shaft screw, pull out pinion shaft, remove axle shaft spacer. Push axle shaft in, remove 'C' washer at inner end, pull shafts out. When installing new shaft, use new bolts in axle flange (pressed in flange), new oil deflector, and new gasket. Shellac or paint both sides of gasket for good oil seal and line up extra hole (center of three closest together) with notch in hub flange in axle shaft. Oil pocket in oil deflector should also be in line with this notch.
NOTE—Axle shaft spacers furnished in three sizes: 1.0105", 1.0195", 1.0295" across ground faces. Select spacer so that clearance between ends of axle shafts and spacer is Free to .014".

REAR AXLE (GC):—Own make. Semi-floating, spiral bevel gear type with torque tube drive.
See article in Mechanical Equipment Section for data.
Ratio—4.11-1 or 3.82-1 Std. 3.82-1 axle identified by prefix 'F" in front of serial number on differential carrier (no prefix for 4.11-1 axle).
Backlash—.004-.006". Screw adjustment.
Removal:—Same as for passenger car models above.

REAR AXLE (SA, SB, SC, SD):—Own make. Full floating, Spiral bevel gear type with torque tube drive.
See article in Mechanical Equipment Section for data.
Ratio—5.428-1 or 6.166-1 Std. 6.166-1 axle identified by prefix 'H' in front of serial number on differential carrier (no prefix for 5.428-1 axle).
Backlash—.008-.010". Screw adjustment.
Removal:—Remove two nuts holding front propellor shaft to cross-member, drop unit, remove capscrews holding ball collar to housing, slide ball back on rear axle shaft housing, remove trunnion bearing lock rings, drive trunnion bearings from place, split universal joint and drop rear axle propeller shaft. Remove rear yoke from end of rear axle propeller shaft and ball and collar from housing. Remove axle shafts (see below), remove nuts holding differential carrier in housing, pull third member assembly (differential carrier and shaft assembly) from housing.
Axle Shaft Removal—Remove capscrews which attach axle shaft flange to wheel hub. Install two screws in holes located between regular mounting screw holes, turn screws in to start axle shaft, remove shaft. Wheel bearing adjustment not disturbed by axle removal.
Wheel Bearing Adjustment:—With axle shaft removed, tighten adjusting nut (within wheel hub on outer end of axle housing) moderately tight while rotating hub, install star lock on adjusting nut, note alignment of lock tangs with notches in outer edge of adjusting nut, bend lock tang into notch on adjusting nut. Rotate wheel hub by hand to note that bearings seated and that wheel turns freely. Install locknut and draw up tight, bend lock tang into notch in locknut.
NOTE—Wheel bearings now lubricated from differential case (no oil seal used at differential side bearing). Soft stamped steel plate used under hub bolt heads, and wheel bearing oil seal is spring-backed to retain lubricant. When replacing axle shaft, see that new type .020" vellumoid gasket is in place between axle flange and wheel hub.

SHOCK ABSORBERS:—Delco Hydraulic single-acting type std. on all models except GA (GA has double acting shock absorber built in the Knee Action unit). Double-acting type optional.
See article in Mechanical Equipment Section for data.

Model	Front	Rear
GA	1068386, 7	1431V, W
GB	1200P, N	1200M, L

STEERING:—Steering Gear (GA)—Saginaw Worm-and-Roller type. **(GB, GC, SA, SB, SC, SD)**—Saginaw Worm-and-Sector type.
See article in Mechanical Equipment Section for data.
Front Suspension (GA):—Chevrolet Knee-Action type Independent suspension. Similar to type used on previous models except that kingpins now mounted on floating type plain bushings.
See article in Mechanical Equipment Section for data.
NOTE—Specifications below correct with car weight supported on horses at inner bearing cone (wheels removed for use of special test equipment).
Height (Suspension Unit Setting)—4⅞" from bottom of kingpin support to bottom of brake flange plate.
Kingpin Inclination—7° 45' crosswise.
Caster—0° (kingpin). Caster effect secured by trailing wheel center.
Camber—¼° (¼-¾°). No adjustment.
Toe In—1/16-3/32". Adjustable.
Steering Geometry—Inner wheel 23°. Outer 20°.
Front Suspension (GB, GC, SA, SB, SC, SD):—Conventional 'I' beam section front axle with Reverse Elliott ends and semi-elliptic springs.
NOTE—Kingpin bushings are new 'floating' type.
Kingpin Inclination—7° 10' crosswise.
Caster—2¼° (GB), 1¾° (GC), 2¾° (SA, B, C, D) plus or minus ½° and equal for both wheels within ¼°. Adjust by inserting wedge shims between spring and spring pad on axle.
Camber—1° plus or minus ½° and equal within ¼° for both wheels. Axle may be bent cold for minor corrections.
Toe In—5/64-⅛". Adjusted in usual manner by turning tie rod to increase or decrease length.
Steering Geometry—Inner wheel 23°. Outer 20°.

BRAKES:—Service—Own design, hydraulic type. Hand brake lever applies rear wheel service brakes.
See article in Mechanical Equipment Section for data.
Wheel Cylinders—Diameters—1¼" (front—all), 1 3/16" (rear—GA, GB, GC), 1½" (rear—SA, SB, SC, SD). Not interchangeable.
Drum Diameter—11" (GA, GB, GC), 12" (SA, B, C, D—front), 14" (SA, B, C, D,—rear).
Lining—Moulded type. Special lining on SA, B, C, D.

Model	Width	Thickness	Length
GA, GB, GC	1¾"	3/16"	22⅝"
SA, B, C, D Frt.	2"	.243-.250"	28⅞"
" Rear	3"	.250"	35 13/16"

NOTE—Lengths as given are per wheel.
Clearance—Adjusting cover backed off 4 notches (GA, GB, GC all wheels), 5 notches (SA, SB, SC, SD front wheels), adjusting pinion shaft backed off ¾ turn (SA, SB, SC, SD rear wheels) from slight drag position.
Hand Brake:—See Service Brakes above.

NOTE:—Oil Pan Removal—On passenger car models, the Engine-Side-Support Tie-Bar (cross-member under engine) should be dropped first. This cross-member bolted to bottom of frame side rails.

FLEET MODEL NOTE:—Special economy engine available for all models. Engine identified by code letter 'V' stamped ahead of engine number and special service plate on Push Rod Cover listing special tune-up specifications for this model. Engine standard except for these specifications and Carburetor which has stop-pin designed to limit throttle opening to half-throttle. See article in Carburetor Section for complete data on this carburetor.

SERIAL NUMBER:—Prefixes 1-HA-01, indicate assembly plant (1-21), model (HA Mstr. Del., HB Mtsr., HC ½ Ton, HD ¾ Ton, HE 1 Ton, TA TB TC TD 1½ Ton) and month (01-12). Located on right front side of body under hood (front of dash—Trucks).

ENGINE NUMBER:—First engine number Flint—1,187,-822. Buffalo—1. Prefixes as follows: Flint—passenger cars (none), ½ Ton Commercial (K), all others (T). Buffalo—passenger cars (B), ½ Ton Commercial (KB), all others (TB). Economy engines indicated by (V) thus (VK, VKB, etc.). Engine number stamped on boss on right side of block to rear of distributor.

ENGINE SPECIFICATIONS:—Own. 6 cyl., 'I' head type.
Bore—3½". **Stroke**—3¾".
Displacement—216.5 cubic inches.
Rated Horsepower—29.4 (S.A.E.).
Developed Horsepower—85 at 3200 (passenger cars), 78 at 3200 (all others).
Compression Ratio—6.25-1 Std. cast-iron head.
Compression Pressure—112 lbs. at 65 R.P.M. (cranking speed). 90 lbs. min. All cyls. within 5-10 lbs.
Vacuum Reading—20-22" steady reading with engine idling at 400 R.P.M.

PISTONS:—Cast-iron, domed head, cam ground, tin-plated, with slipper type skirt. Recondition engines to take finished replacement pistons (hone for .003" oversize, bore and hone for larger sizes). See Replacement Pistons. **Length**—4 11/64".
Weight—30.72 ozs. (including bushing—passenger cars). 32.96 ozs. (including bushing—trucks).
TRUCK PISTON NOTE—Marked by two ¼"x3/16" bosses on bottom of pin bosses at piston side wall. Must not be interchanged with Pass. car type (heavier).
Removal—Pistons and rods removed from above.
Clearance—Top .006-.013". Skirt .0015-.003". See Fitting New Pistons (below).

Replacement Pistons:—Finished pistons with bushings and pins fitted furnished standard and .003", .010", .020", .030", and .040" oversize.

Fitting New Pistons:—Use feeler gauges between piston and cylinder wall at right angles to pin bosses. Piston should pass through bore on .002" feeler (with light pressure) and lock on .003" feeler.

PISTON RINGS:—Two compression, one oil control ring per piston, all above pin. Oil ring slotted or drilled type. Oil ring groove drilled with oil drain holes. Rings furnished standard and .005", .010", .015", .020", .030" and .040" oversize.
NOTE—Compression rings have tapered face. Install with word "TOP" toward top of piston.

Ring	Width	End Gap	Side Clearance
Comp.	⅛"	.004-.014"	.0015-.003"
Oil Cont.	3/16"	.004-.014"	.002-.0035"

NOTE—Use .002" feeler to check side clearance. #1 ring very free, #2 just free, #3 light drag.

PISTON PIN:—Diameter—.865". **Length**—3 9/64". Pin locked in rod, pin bosses in piston bronze bushed. New pistons have bushings and pins fitted. Pins furnished std. and .003", .005", .010" oversize.
Pin Fit in Piston—Thumb push fit (room temp.).

CONNECTING ROD:—Length 6 13/16". **Weight** 28.3 oz.
Crankpin Journal Diameter—2.311-2.312".
Lower Bearing—Spun-babbit lined type.
Clearance—.0005-.002". **Sideplay**—.004-.011".

Bearing Adjustment:—Solid shims. Remove shims (equally from both sides) to secure 'snap fit' (bearing tight to hand but rod should snap from one side to other with light tap of 8 oz. hammer), **then replace .002" shim for clearance.** If unequal number, install extra shim on camshaft side. With correct adjustment, rod should move from side to side with two finger pressure.

Installing Rods:—Install rods in same numbered cylinders indicated by numbers on rod and caps with these numbers together and toward camshaft side. Assemble oil dippers on rod caps with mouth of dipper toward camshaft.
NOTE—Check dipper heights with J-969-2 gauge.

CRANKSHAFT:—4 bearing. Integral counter weights with harmonic balancer mounted on forward end.
See Chevrolet Shop Notes for balancer data.
Journal Diameters—#1, 2.6835-2.6845"; #2, 2.7145-2.7155"; #3, 2.7455-2.7465"; #4, 2.7765-2.7775".
Bearing Type—Steel-backed, babbitt lined.
Clearance—.002".
See Chevrolet Special Shop Notes for main bearing line-boring and installation instructions.

Bearing Adjustment:—Solid shims. Remove shims until slight drag on crankshaft secured, then **replace one .002" shim for clearance.** If unequal in number, install extra shim on same side for all bearings.

End Thrust:—Taken by #3 main bearing. Adjusted by replacing bearing. **Endplay**—.004-.007".
See Chevrolet Shop Notes for Main Bearing End Play Adjustment instructions.
NOTE—Oil slinger clearance at rear end of crankshaft must be .002-.032".

CAMSHAFT:—Four bearing. Gear driven.
Journal Diameters—#1, 2.0282-2.0292"; #2, 1.9657-1.9667"; #3, 1.9032-1.9042"; #4, 1.8407-1.8417".
Bearing Type—New type steel-backed, babbitt-lined with oil grooves.
See Chevrolet Special Shop Notes for camshaft bushing installation instructions.
Clearance—.002-.0035".

End Thrust:—Taken by thrust plate behind camshaft gear. Endplay—Free fit to .003" max. Adjusted by changing gear position on shaft.

Timing Gears:—Crankshaft gear Steel. Camshaft gear Bakelite & fabric composition. Gear run-out (maximum) .003" crankshaft, .004" camshaft.
Backlash—.002-.005".
See Chevrolet Special Shop Notes for timing gear installation instructions.

Camshaft Setting:—Gears marked. Mesh marked tooth of crankshaft gear with marked space between teeth on camshaft gear.

VALVES:—Marked 38 on head. 1938 exhaust valve new design (more metal under head).
See Chevrolet Special Shop Notes for installing 1938 valves on 1935-36-37 engines.

	Head Diameter	Stem Diameter	Length
Intake	1 23/32"	.3407-.3417"	6 1/16"
Exhaust	1 15/32"	.3397-.3407"	4 13/16"

	Seat Angle	Lift	Stem Clearance
Intake	30°	.305"	.001-.003"
Exhaust	30°	.3195"	.002-.004"

Tappet Clearance:—.006-.008" Intake, .013-.015" Exhaust (hot). Idle engine for 20 minutes at 600 RPM. Fast idle to insure proper operating temperature.

Valve Guides:—Straight type (no shoulder).
See Chevrolet Special Shop Notes for valve guide installation instructions.

Valve Springs:—New 9 coil springs used. Cannot be used on previous models. Free length 2 7/32". Check spring compressed to 1½". Pressure should be 125-133 lbs.

	Spring Pressure	Spring Length
Valve Closed	42- 48 lbs.	1.821"
Valve Open	111-119 lbs.	1.505"

NOTE—Install spring with close-coiled end toward cylinder head. Use round spring caps on intake valves, hexagonal caps on exhaust valves.

Valve Lifters:—Cast-iron type with ground contact face. Oversize lifters not furnished.

Pushrod Springs:—Not used on 1938 models due to increased valve spring tension.

Rocker Arms:—***See Chevrolet Shop Notes for data.***

Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 9° BTDC. Close 29° ALDC.
Exhaust Valves—Open 52° BLDC. Close 1° BTDC.
To Check Timing—No flywheel marks provided. With intake tappet clearance set at .006", #1 intake valve should open with piston 9° or .0294" BTDC. when a point on the flywheel approximately 3.475 teeth before top dead center lines up with indicator in inspection hole in right front face of flywheel housing.
Motor Gauge—Weidenhoff Adapter #113, Rod #33.

LUBRICATION:—Pressure and positive splash system. Gear type oil pump in crankcase.
Oil Pump Installation—Assemble ground side of driven gear toward cover. Oil Pump assembly mounted to crankcase by tapered set screw and lock nut. Screw must be firmly seated in tapered hole in pump body and set with lock nut.

Normal Oil Pressure:—13.5 lbs. at 50 M.P.H.

Oil Pressure Regulator:—Located in oil pump cover. Operates at 75 lbs. Not adjustable. Pressure normally controlled by Oil Distributor.

Oil Distributor:—Mounted on left side of crankcase. Proportions oil between high pressure points (crankshaft bearings, camshaft bearings, timing gears) and low pressure points (connecting rod oil troughs and rocker arms). Overflow pipe returns excess oil from rocker arm shafts.
See Chevrolet Shop Notes for installing oil lead (through block) to valve rocker arms.

Checking Oiling System:—***See Chevrolet Shop Notes.***

Crankcase Capacity:—5 quarts.

COOLING SYSTEM:—Water Pump. Centrifugal, belt-driven, with self-adjusting type packing.
See article in Mechanical Equipment Section for data.
Removal—Remove lower hose connection, mounting screws and lift assembly off.

Thermostat:—Mounted in cylinder head water outlet.
Setting—Start to open 142°F (#3108572—Standard), 150°F (#985127—non-permanent anti-freeze used with overflow return tank #985319), 162°F. (#985128 permanent anti-freeze), 170° F. (Econ. Engines).

Water Capacity:—14 quarts (Standard). 15½ quarts (Trucks with heavy duty radiators).

CLUTCH:—Own Make. Entirely new design, single plate, dry disc type with diaphragm spring serving as clutch spring and release levers, and ball throwout bearing. Two sizes, with larger pressure plate and cover used on HD, HE and T models. Diaphragm spring interchangeable on either clutch.
See article in Mechanical Equipment Section for data.
Adjustment (HA, HB)—Pedal free travel must be ¾-1". To adjust loosen locknut and turn adjusting nut on connecting link stud at clutch throwout fork.

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All others—Loosen locknut on lever at lower end of clutch pedal, back off locknut on adjusting screw on lower end of lever, turn adjusting screw for ¾-1" free travel.

Facings—9" disc (HA, HB, HC), 11" (HD, HE, T). Woven and formed asbestos. 2 required.

Removal:—Remove transmission (see Transmission Section). With flywheel underpan off, take out throwout bearing from fork, fork mounting (using ⅞" and ¾" wrench) and fork. Support clutch with Clutch Pilot Tool K-411, loosen cover mounting bolts (one turn at a time) until spring pressure released and remove assembly from below. NOTE—When reassembling turn flywheel to place 'X' mark at bottom, install cover assembly with 'X' mark on cover in line with 'X' mark on flywheel.

TRANSMISSION (HA, HB, HC, HD, HE):—Own Make. Constant mesh, helical gear (second only), Synchro-mesh (second and high). Low and reverse—sliding spur gear. NOTE—HC transmission same as HA, HB except that case longer permitting interchange-ability with 4 spd. transmission. HD, HE transmis-sion same as HC except that carburized gears used (identified by prefixes 'Y' or 'Z' before assembly number on boss at rear of transmission case cover).

See article in Mechanical Equipment Section for data.

Removal (HA, HB, HC):—Disconnect pull rods on brake cross-shaft, remove left hand cross-shaft bracket, remove shaft. On HC remove hand brake lever from transmission case. Take out speedometer cable and gear assembly (screwed in universal joint ball retainer). Use jack under front end of torque tube. Take out screws in ball collar flange, slide ball and collar back on propeller shaft, remove bolts in universal joint ring, split joint. Lower jack until propeller shaft clears transmission. Remove top mounting bolts in flywheel housing and install guide pins, remove flywheel underpan, take out lower mounting screws. Take out bolts holding transmission mounting and support to cross-mem-ber. Slide transmission straight back on guide pins and remove. NOTE—On Model HC with 4 Spd. Transmission, remove transmission support cross-member and take out two screws on brake cylinder bracket on transmission case.

Removal (HD, HE):—Remove hand brake lever from transmission case. Take out speedometer cable and gear assembly (screwed in front universal joint ball retainer). Remove capscrews on front universal joint, remove bolts on frame cross-member freeing propeller shaft, slide ball back, split front joint by removing trunnion bearing lock rings and driving trunnion bearings out. Disconnect cross-member at frame ends and lower assembly to floor. Remove transmission using guide pins as directed for HA, HB, HC.

TRANSMISSION (TA, TB, TC, TD):—Own Make. 4 speed, sliding spur gear type (all speeds). This transmission optional on Models HC, HD, HE.

See article in Mechanical Equipment Section for data.

Removal:—Same as for HD, HE (above) except that two nuts holding front propeller shaft assembly should be removed and front propeller shaft dropped down.

UNIVERSAL JOINTS:—Own Make. Plain bushing type. One used (except HD, HE, TA, TB, TC, TD with additional intermediate universal on frame-cross-member).

See article in Mechanical Equipment Section for data.

REAR AXLE (HA, HB):—Own Make. Semi-floating, Hypoid gear type with Torque tube drive.

See article in Mechanical Equipment Section for data.

Ratio—4.22-1 (HA), 3.73-1 (HB). 3.73-1 axle marked by prefix 'C' or 'CB' on serial number on differential carrier. Straight number or prefix 'B' on 4.22-1 axle.

Backlash—.004-.008". Screw adjustment.

See Chevrolet Shop Notes for data on new type spring seats on 1938 models.

Removal:—Jack up rear end of car (use chain hoist), remove rear wheels, disconnect hydraulic brake line and brake cables, disconnect shock absorber links at axle, remove 'I' bolt nut and withdraw bolt free-ing spring seat from housing bracket (not necessary to disturb 'U' bolts). Disconnect spring shackles and drop springs (with spring seats attached), pull axle assembly back to free shaft at splined joint in rear of transmission.

Wheel Bearing Adjustment—None.

Axle Shaft Removal:—Wheel bolted directly to flange on outer end of shaft. Axle shaft retained by 'C' washer at inner end of differential case (shafts unequal length—use long shaft on right side). To remove shaft, remove wheel, take out two machine screws in brake drum, remove drum, install clamp on wheel brake cylinder. Take off axle housing cover, remove differential pinion shaft screw, pull out pinion shaft, remove axle shaft spacer. Push axle shaft in, remove 'C' washer at inner end, pull shafts out.

See Chevrolet Shop Notes for axle shaft installation instructions and axle shaft spacer sizes.

REAR AXLE (HC, HD, HE):—Own Make. Semi-floating, spiral bevel gear type with Torque Tube drive.

See article in Mechanical Equipment Section for data.

Ratio—4.11-1 (standard). 3.82-1 (optional HC only). Axles identified by prefixes stamped on carrier as follows: 4.11-1—straight number or 'B' on HC, HD; 'T' or 'TB' on HE. 3.82-1—'F' or 'FB'.

Backlash—.004-.006". Screw adjustment.

Removal:—Same as for passenger cars except that new type spring seat not used and spring 'U' bolts must be disconnected instead.

NOTE—Axle shaft spacers furnished in three sizes: 1.1485", 1.1575", 1.1675". Fit as directed for passenger car models above.

REAR AXLE (TA, TB, TC, TD):—Own Make. Full float-ing, spiral bevel gear type with Torque Tube drive.

See article in Mechanical Equipment Section for data.

Ratio—5.43-1 or 6.16-1 standard. Identified by first letter in serial number on top right hand side of differential housing as follows: 5.43-1—'T'; 6.16-1 —'H.'

Backlash—.008-.010". Screw adjustment.

Removal:—Remove two nuts holding front propeller shaft to cross-member, drop unit, remove capscrews holding ball collar to housing, slide ball back on rear axle shaft housing, remove trunnion bearing lock rings, drive trunnion bearings from place, split universal joint and drop rear propeller shaft. Re-move rear yoke from end of rear propeller shaft and ball and collar from housing. Remove axle shafts (see below), remove nuts holding differential carrier in housing, pull third member assembly (differential carrier and shaft assembly) from housing.

Axle Shaft Removal—Remove 8 capscrews which attach axle shaft flange to wheel hub and capscrew lock. Install two screw in holes located between regular mounting screw holes, turn screws in to start axle shaft, remove shaft. Use new steel lock when replacing capscrews. Wheel bearing adjust-ment not disturbed by axle shaft removal.

Wheel Bearing Adjustment:—With axle shaft re-moved, tighten adjusting nut (within wheel hub on outer end of axle housing) moderately tight while rotating hub, install star lock on adjusting nut, note alignment of lock tangs with notches in outer edge of adjusting nut, bend back tang into notch on adjusting nut. Rotate wheel hub by hand to note that bearings seated and that wheel turns freely. Install locknut and draw up tight, bend lock tang into notch in locknut.

See Chevrolet Shop Notes for wheel bearing oil seal and gasket data.

SHOCK ABSORBERS:—Delco—Hydraulic single-acting type standard on all models except HA (HA has double acting shock absorber built in Knee Action unit). Double acting type optional.

See article in Mechanical Equipment Section for data.

Model	Front	Rear
HA	10688388, 9	1431-V, W
HB, HC, HD	1201-A, B	1201-C, D
HE	1201-A, B	None

STEERING:—Steering Gear (Passenger Cars)—Saginaw Worm-and-Roller type. **Trucks**—Saginaw Worm-and-Sector type.

See article in Mechanical Equipment Section for data.

Front Suspension (HA):—Chevrolet Knee-Action type independent suspension with kingpins mounted on floating type plain bushings.

See article in Mechanical Equipment Section for data.

NOTE—Specifications below correct with car weight supported on horses at inner bearing cone (wheels removed for use of special test equipment).

Height (Suspension Unit Setting)—4⅞" (plus or minus ⅛") from bottom of kingpin support to bot-tom of brake flange plate.

Kingpin Inclination—7¾° crosswise.

Caster—0° (kingpin). Caster effect secured by trail-ing wheel center.

Camber—¼°. No adjustment.

Toe In—1/16-3/32". Adjustable.

Steering Geometry—Inner wheel 23°, outer 20°.

Front Suspension (All models except HA):—Conven-tional 'I' beam section front axle with Reverse-Elliott ends and semi-elliptic springs.

NOTE—'Floating' type kingpin bushings on HB.

Kingpin Inclination—7°10' plus or minus 1° cross-wise.

Caster—2¼° (HB), 1¾° (HC, HD, HE), 2¾° (TA, B, C, D), plus or minus ½°. Controlled by a caster shim ('I' beam spacer) inserted between spring and spring pad on axle.

Camber—1° plus or minus ½°. Axle may be bent cold for minor corrections.

Toe In—5/64-⅛". Adjusted in usual manner by turning tie rod to increase or decrease length.

Steering Geometry—Inner wheel 23°. Outer 20°.

BRAKES:—Service—Own design, hydraulic type. Hand brake lever applies rear wheel service brakes.

See article in Mechanical Equipment Section for data.

Wheel Cylinders—Diameters—1¼" (front—all), 1 3/16" (rear—HA, HB, HC, HD), 1⅜" (rear—HE), 1½" (rear—TA, B, C, D). Not interchangeable.

Drum Diameter—11" (all—HA, HB, HC, HD; front —HE). 14" (front—TA, B, C, D; rear—HE). 16" (rear —TA, B, C, D).

Lining—Moulded type. Semi-moulded (TA, B, C, D).

Model	Width	Thickness
HA, B, C, D (HE—front)	1¾"	.187-.194"
HE (rear)	2"	.265-.272"
TA, B, C, D (front)	2"	.243-.250"
TA, B, C, D (rear)	3"	.243-.250"

Clearance—Adjusting cover backed off 4 notches (HA, B, C, D, E all wheels), 5 notches (TA, B, C, D front wheels), adjusting pinion shaft backed off ¾ turn (TA, B, C, D rear wheels) from slight drag position.

Hand Brake:—See Service Brakes above.

FRONT END ASSEMBLY REMOVAL:—Should be removed as a unit for work on front of engine. *See Chevrolet Shop Notes for directions.*

NOTE:—Oil Pan Removal—On passenger car models, the Engine-Side-Support Tie-Bar (frame cross-member for engine side mountings) must be unbolted from frame for oil pan removal. *See Chevrolet Shop Notes for Engine Mounting adjustment.*

FLEET MODEL NOTE:—Special Economy engine available for all models. Identified by code letter 'V' stamped ahead of engine number and special tune-up specification plate on Push Rod Cover listing special settings. Special carburetor has stop pin to limit throttle opening to half-throttle.

CAB-OVER-ENGINE TRUCK NOTE:—*See Chevrolet Shop Notes for Engine Cover Removal & Front Cowling Removal (for work on engine).*

SERIAL NUMBER:—First number 1001 with model prefix as follows: JA (Master Deluxe), JB (Master), JC (Half ton), JD (¾ ton), JE (¾ ton Special), VA, VB, VC, VD (1½ ton), VE, VF, VG, VH (Cab-Over-Eng). On plate on right side of cowl under hood.

ENGINE NUMBER:—First number 1915447 (Flint), B10503 (Buffalo) with prefix letter for each model as follows: Pass. Cars—B (Buffalo—no prefix for Flint), Comm'l. ½ Ton—K (Flint). KB (Buffalo). All other Trucks—T (Flint), TB (Buffalo). Stamped on boss on right side of block at rear of distributor.

ENGINE SPECIFICATIONS:—Own. 6 cyl., 'I' head type.
Bore—3½". **Stroke**—3¾".
Displacement—216.5 cu. ins. **Rated HP.**—29.4.
Developed Horsepower—85 HP. at 3200 R.P.M. (passenger cars). 78 HP. at 3200 R.P.M. (all others).
Compression Ratio—6.25-1 Std. cast-iron head.
Compression Pressure—112 lbs. at 65 R.P.M. (cranking speed). 90 lbs. min. Cylinders even within 5-10 lbs. NOTE—Engine must be at normal operating temperature (idle at 600 RPM. for 20 minutes).
Vacuum Reading—Steady 20-22" with engine idling.

ENGINE MOUNTING:—*See Chevrolet Shop Notes for Adjustment directions.*

PISTONS:—Passenger Cars. Cast-iron, domed head, cam ground, tin-plated, with slipper type skirt. If oversize pistons to be installed, hone for .003" oversize, rebore and hone for larger oversizes.
Trucks—Same as for Passenger Cars except 1½ ozs. heavier and two ¼"x3/16" bosses on bottom of pin bosses at piston side wall.
Length—4 11/16".
Weight—25½ oz. stripped (Pass.), 27 (Trucks).
Removal—Pistons and rods removed from above.
Clearance—Top .0145-.019". Skirt .0015-.003".
Replacement Pistons:—Finished pistons with bushings and pins fitted furnished standard and .003", .010", .020", .030" and .040" oversize.
Fitting New Pistons:—Use feeler gauges between piston and cylinder wall at right angles to pin bosses. Piston should pass through bore on .002" feeler (with light push only) and lock on .003" feeler. NOTE—Bore taper or out-of-round not to exceed .001".

PISTON RINGS:—Two compression, one oil control ring per piston, all above pin. Oil ring slotted or drilled type. Oil ring groove drilled with oil drain holes. NOTE—Compression ring face tapered for 'break-in'. Install side marked 'TOP' toward top

Ring	Width	End Gap	Side Clearance
Comp.	.1235-.1240"	.004-.014"	.0015-.0035"
Oil Contr.	.1860-.1865"	.004-.014"	.0015-.0035"

NOTE—Use .002" feeler to check side clearance. #1 ring very free, #2 ring just free, #3 light drag.
Replacement Rings: .005",.010",.015",.020",.030",.040" OS.

PISTON PIN:—Diameter .8645-.8650". **Length** 3.135-3.165". Pin locked in rod, pin bosses in piston bronze bushed. New pistons fitted with bushings and pins.
Pin Fit in Piston—Thumb push fit (room temp.).
Replacement Pins:—Std. & .003", .005", .010" oversize.

CONNECTING ROD:—Length 6 13/16". **Weight** 28.3 oz.
Crankpin Journal Diameters—2.311-2.312".
Lower Bearing—Spun-babbitt lined type.
Clearance—.001-.0025". **Sideplay**—.004-.011" (side clearance between rod and pin bosses .025").
Bearing Adjustment:—Solid shims used. Remove shims (equally from both sides) to secure 'snap fit' (bearing tight to hand but should snap from one side to other with light tap of 8 oz. hammer), **then replace .002" shim for clearance.** If unequal number of shims, install extra shim on camshaft side. With correct adjustment, rod should move from side to side with two finger pressure.
Installing Rods:—Install rods in same numbered cylinders indicated by numbers on rods and caps with these numbers together and toward camshaft side. Assemble oil dippers on rod caps with mouth to camshaft. NOTE—Check dipper heights, Gauge J969-2.

CRANKSHAFT:—4 bearing, integral counterweights with new rubber type balancer on front end.
See Chevrolet Shop Notes for Balancer data.
Journal Diameters—#1, 2.6835-2.6845"; #2, 2.7145-2.7155"; #3, 2.7455-2.7465; #4, 2.7765-2.7775" (same as for 1937, 1938).
Bearing Type—Steel-backed, babbitt-lined type.
Clearance—.002-.004". *See Chevrolet Shop Notes for Main Bearing line-boring and installation data.*
Bearing Adjustment:—Solid shims. Remove shims until slight drag on crankshaft secured when turned by hand, **then replace one .002" shim for clearance.** If unequal in number, install extra shim on same side for all bearings.
End Thrust:—Taken by #3 main bearing. Replace if clearance exceeds .011". **Endplay**—.004-.007" (new). *See Chevrolet Shop Notes for Main Bearing Endplay adjustment instructions.*

CAMSHAFT:—Four bearing. Gear driven.
Journal Diameters—#1, 2.082-2.0292"; #2, 1.9657-1.9667"; #3, 1.9032-1.9042"; #4, 1.8407-1.8417".
Bearing Type—New type steel-backed, babbitt-lined bearings with oil grooves (same as 1938).
See Chevrolet Shop Notes for Camshaft Bearing data.
Clearance—.002-.004".
End Thrust:—Taken by thrust plate behind camshaft gear. **Endplay**—Free fit to .003" max. Adjusted by changing gear position on shaft.
Timing Gears:—Crankshaft gear Steel. Camshaft gear Bakelite & fabric composition. Maximum gear run-out .003" crankshaft. .004" camshaft.
Backlash—.002-.005". *See Chevrolet Shop Notes for Timing Gear installation instructions.*
Camshaft Setting:—Gears marked. Mesh marked tooth of crankshaft gear with marked space between teeth on camshaft gear.

VALVES:—New type (no slot in head).

	Head Diameter	Stem Diameter	Length
Intake	1 41/64"	.3407-.3417"	6 5/64"
Exhaust	1 15/32"	.3397-.3407"	4 13/16"

	Seat Angle	Lift	Stem Clearance
Intake	30°	.305"	.001-.003"
Exhaust	30°	.3195"	.002-.004"

Tappet Clearance:—.006-.008" Int., .013-.015 Exh. hot.
Fleet Econ. Models—.010" Int., .016" Exh. hot.
NOTE—Run engine at 600 R.P.M. for 20 minutes before adjusting. Set at Max. figure for heavy duty.
Valve Guides:—Straight cut type on cylinder head.
See Chevrolet Shop Notes for valve guide data.
Valve Springs:—9 coil type spring used. Free length 2 7/32". Using Valve Spring Tester Tool U15 spring tension should be 125-133 lbs. compressed to 1½".

	Spring Pressure	Spring Length
Valve Closed	49-56 lbs.	1 13/16"
Valve Open	121-133 lbs.	1½"

NOTE—Install spring with closed-coil end toward cylinder head. Use round spring caps on intake valves, hexagonal caps on exhaust valves.
Valve Lifters:—Cast-iron type with ground contact face. Oversize lifters not furnished.
Clearance—.001". Free fit in guide holes.
Rocker Arms:—*See Chevrolet Shop Notes for data.*
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 9° BTDC. Close 29° ALDC.
Exhaust Valves—Open 52° BLDC. Close 1° BTDC.
To Check Timing—With #1 intake valve tappet clearance set at .006", valve should open with piston 9° or .0294" BTDC. with point on flywheel 3.475 teeth before 'U/C' mark in line with indicator in hole in right front face of flywheel housing.

LUBRICATION:—Pressure and positive splash system. Gear type oil pump in crankcase.
Oil Pump Installation—Assemble ground side of driven gear toward cover. Oil pump assembly mounted on crankcase by tapered set screw and lock nut (must seat firmly in tapered hole in pump).
Normal Oil Pressure:—13.5 lbs. at 50 M.P.H.
Oil Pressure Regulator:—Located on oil pump cover. Opens at 75 lbs. Non-adjustable type. Pressure normally controlled by Oil Distributor.
Oil Distributor:—Same design as used on previous models except that by-pass channel and metering restriction added on high pressure side of valve so that rocker arms and other low pressure points oiled immediately when engine started.
See Chevrolet Shop Notes for instructions on installing oil lead (through block) to Valve Rocker Arms.
Checking Oiling System:—*See Chevrolet Shop Notes.*
Crankcase Capacity:—5 quarts (refill).

COOLING SYSTEM:—Capacity. 14 qts. (all except Cab-Over-Engine). 16½ qts. (Cab-Over-Engine Trucks).
See Chevrolet Shop Notes for Radiator Core Removal
Water Pump:—Packless, ball-bearing shaft type.
See article in Mechanical Equipment Section for data.
Removal—Remove lower hose connection and pump mounting screws. Lift assembly out.
Thermostat:—Harrison. In cyl. head water outlet.
Setting—Starts to open 140°F (Std. #3108572), 148° (#985127 for non-permanent anti-freeze), 160° (#985128 Fleet Economy models and others with perm. anti-freeze or overflow tank #985319).
Temperature Gauge:—AC. #1510759 (Master Deluxe), #1510163 (Commercial and Truck models).
See article in Mechanical Equipment Section for data.

CLUTCH:—Own Make. Diaphragm spring type. Single plate, dry disc type. 9" disc used on pass. cars and ½ ton trucks, 11" disc on all others.
See article in Mechanical Equipment Section for data.
Facings—Moulded, 2 required. Inside Diam. 6¼" (pass. cars, ½ ton), 7" (others). Outside Diam. 9" (pass. cars, ½ ton), 10¾" (others). Thick. ⅛".
Adjustment:—Pedal free travel must be ¾-1". To adjust, loosen check nut and turn adjusting nut on connecting link stud at clutch throwout fork.
Removal:—Remove transmission (see below) and flywheel underpan. Take out throwout bearing from fork, pry fork loose from ball, remove fork mounting (use a ⅞" and ¾" wrench). Support clutch with Clutch Pilot Tool K-411, loosen 6 cover bolts (one turn at a time) until spring pressure released and remove assembly from below. NOTE—When assembling plate on cover, line up '0' marks on pressure plate lug and cover. Line up 'X' marks on cover and flywheel when installing clutch assembly.

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TRANSMISSION (JA, JB, JC, JD, JE):—Own Make. Constant mesh, synchro-mesh with helical gears (second), sliding spur gear (low & reverse).

JC Transmission—Same as JA, JB except that case longer (to interchange with 4 spd. transmission).

JE, JD Transmission—Same as JC transmission except that carburized gears used (identifed by prefixes 'Y' or 'Z' before assembly number.

See article in Mechanical Equipment Section for data.

Transmission Control (Pass. Cars):—Remote control steering column shift, vacuum assistor type. Optl.

See article in Mechanical Equipment Section for data.

Removal (JA, JB, JC):—Remove floor-and-toeboard plate, disconnect 3 pull rods at brake cross shaft bracket, remove shaft. On JC take off hand brake lever at transmission case. Take out speedometer cable and gear assembly (screwed in universal joint ball retainer). Use jack under front end of torque tube. Take out screws in ball collar flange, slide ball and collar back on propeller shaft, remove bolts in universal joint ring, split joint. Lower jack until propeller shaft clears transmission. Take out rear transmission mounting bolts. Remove 2 top mounting capscrews and install guide pins, take out lower flywheel mounting capscrews and flywheel underpan. Slide transmission to rear on guide pins until free of clutch disc and remove assembly.

NOTE—On passenger car models with remote control shift, disconnect air and vacuum lines, selector rod at bell crank, and control rod at protective boot (replace clevis pin). On Model JC with 4 sp. transmission, remove frame cross member (to lower propeller shaft housing) and take out 2 brake cylinder mounting bracket screws from case.

Removal (JD, JE):—Remove hand brake lever from transmission case. Take out speedometer cable and gear assembly (in front universal joint ball retainer). Remove front propeller shaft (remove mounting screws at rear universal, unbolt frame cross member at frame and lower shaft assembly, take out rear universal ball collar capscrews, slide ball and collar to rear, split rear joint by removing trunnion bearing lock rings and driving bearings out, pull front propeller shaft with ball-bearing and housing out to rear as an assembly, then remove front universal joint ball housing by removing ball collar capscrews and sliding housing out to rear exposing rear yoke of front joint). Remove transmission using guide pins as directed for JA, JB, JC

TRANSMISSION (VA, B, C, D, E, F, G, H):—Own Make. 4 speed sliding spur gear type (all speeds). Optional equipment on Models JC, JD, JE.

See article in Mechanical Equipment Section for data.

Transmission Control (Cab-Over-Engine):—Remote control type. *See Chevrolet Shop Notes for data.*

Removal:—Same as for JD, JE (above) except that rear universal joint support mounted on underside of frame cross member.

NOTE—Models VE and VF (Cab-Over-Engine) use only one propeller shaft (with Hotchkiss drive). To free propeller shaft, remove 4 flange mounting bolts at front universal flange and lower propeller shaft to floor. Then proceed as outlined for JA, JB, JC.

UNIVERSAL JOINTS:—Own Make. Plain bushing type. One used (Pass. cars and ½ ton truck), two used (all others). Models VE and VF used sealed type joints with Hotchkiss drive.

See article in Mechanical Equipment Section for data.

REAR AXLE (Pass. Cars):—Own Make. Semi-floating, hypoid gear type with Torque tube drive.

See article in Mechanical Equipment Section for data.

Ratio—4.222-1 (JA), 3.727-1 (JB). 3.727-1 axle marked by prefix 'C' or 'CB' on serial number on carrier. Straight number or prefix 'B' on 4.222-1.

Backlash—.004-.008". Screw adjustment.

Removal:—Raise rear end of car. Remove rear wheels and brake drums, clamp brake wheel cylinders, free hand brake cables at pull rods and clamps on frame, disconnect brake line at axle housing, and shock absorber 'I' bolts at spring seats. Remove spring 'U' bolts and disconnect spring shackles to drop springs, pull axle back to free front end of shaft.

See Chevrolet Shop Notes for rear spring seat data.

Wheel Bearing Adjustment—None.

Axle Shaft Removal:—Wheel bolted directly to flange on outer end of shaft. Axle shaft retained by 'C' washer at inner end in differential case (shafts unequal in length—use long shaft on right side). To remove shaft, remove wheel, two machine screws in drum, remove drum, clamp wheel cylinder. Take off axle housing cover, remove differential pinion shaft screw, pull out pinion shaft, remove axle shaft spacer. Push axle shaft in, remove 'C' washer (on inner end of shaft), pull axle shaft out. *See Chevrolet Shop Notes for axle shaft installation data and spacer sizes.*

REAR AXLE (½ & ¾ Ton):—Own Make. Semi-floating, spiral bevel gear type with Torque tube drive.

See article in Mechanical Equipment Section for data.

Ratio—4.11-1 (standard). 3.82-1 (optional JC only). Axles identified by prefixes stamped on carrier as follows: 4.11-1—straight number or 'B' on JC, JD; 'T' or 'TB' on JE. 3.82-1—prefix 'F' or 'FB'.

Backlash—.006-.010". Screw adjustment.

Removal:—Same as for passenger cars (above).

REAR AXLE (1½ Ton Trucks):—Own Make. Full floating, spiral bevel gear type with Torque tube drive (except VE, VF), Hotchkiss drive (VE, VF).

See article in Mechanical Equipment Section for data.

Ratio—5.43-1 or 6.17-1 standard. Identified by first letter in serial number on top right side of differential housing as follows: 5.43-1—'T', 6.17-1—'H'.

Backlash—.006-.010". Screw adjustment.

Removal:—On Models VE, VF with Hotchkiss drive, propeller shaft can be lowered by taking out bolts in driving flange at rear universal (bolted directly to rear axle pinion shaft). On all other models rear universal joint must be split as follows: remove 2 mounting nuts at frame cross member, lower propeller shafts, take out rear universal ball collar capscrews, slide ball back on housing, take out trunnion bearing lock rings and drive bearings out, split universal joint and lower rear propeller shaft, remove rear yoke from rear propeller shaft and ball and collar from housing. Then take out axle shafts (see below) and carrier mounting screws. Pull carrier assembly out (on all Models except VE, VF, propeller shaft assembly withdrawn with carrier).

See Chevrolet Shop Notes for rear spring seat data.

Axle Shaft Removal:—Take out 8 capscrews in axle shaft flange at outer end and capscrew lock, install 2 screws in tapped holes in flange (between regular screw holes) and turn these screws up evenly to loosen shaft, remove shaft. NOTE—Replace Vellumoid axle shaft flange gasket every fourth time, new steel capscrew lock under capscrew every time and turn up tangs on lock plate at screws. Wheel bearing adjustment not disturbed for shaft removal.

Wheel Bearing Adjustment:—With axle shaft removed, tighten adjusting nut (within wheel hub on outer end of axle housing) moderately tight while rotating hub, install star lock on adjusting nut, note alignment of lock tangs with notches in outer edge of adjusting nut, bend back tang into notch on adjusting nut. Rotate wheel hub by hand to note that bearings seated and that wheel turns freely. Install locknut and draw up tight, bend lock tang into notch in locknut. *See Chevrolet Shop Notes for wheel bearing oil seal and gasket data.*

REAR AXLE (TWO-SPEED TYPE):—Optl. on trucks.

See article in Mechanical Equipment Section for data.

SHOCK ABSORBERS:—Delco. Hydraulic single acting type standard except JA (new parallel cylinder double acting type), JB (direct acting type on front only). Double acting optl. on trucks.

See articles in Mechanical Equipment Section for data.

Model	Front	Rear
JA (Mstr. Deluxe)	2200-A, B	2100
JB (Master)	1116-M	1201-C, D
JC (½ Ton Truck)	1430-CA, DA	1430-LA, MA
JD (¾ Ton), JE (Spec.)	1430-CA, DA	1431-X, Y

STEERING:—Steering Gear. Saginaw Worm-and-Roller (Pass. cars), Worm-and-Sector (Trucks).

See article in Mechanical Equipment Section for data.

Front Suspension (JA):—New design 'S.L.A.' (short & long arm) or parallelogram type with coil springs.

NOTE—Entire suspension unit assembly may be removed from the car as a unit.

See article in Mechanical Equipment Section for data.

NOTE—Make all checks with car weight on wheels (curb weight—car ready for road but no load).

Frame Height—Install special gauges at front and rear ends of car to level frame when checking. Clearance between top of rear axle housing and lower face of frame side rail is 7 7/32". This adjustment must be made first to check specifications.

Kingpin Inclination—4¾° plus or minus ½°.

Caster—0° plus or minus ½°. Adjustable.

Camber—Neg. ¼° (wheel tilts in at top), + or —½°

Toe In—0-1/16". Adjust left tie rod (right non-adj.).

Steering Geometry (Toe out on turns)—Outer wheel turned 20°. Inner wheel 24° + or — 2°. Non-adj.

Front Suspension (All models except JA):—Conventional 'I' beam section front axle with Reverse Elliott ends and semi-elliptic springs.

NOTE—Floating type kingpin bushings used on JB.

Kingpin Inclination—7°10' + or — 1° crosswise.

Caster—2¼° (JB), 1¾° (JC, JD, JE), 2¾° (VA, B, C, D), 3° (VE, F, G, H), plus or minus ½°. Adjust by use of caster shims between spring and spring pad on axle for 2° variation. Over 2° use tools.

Camber—1° plus or minus ½°. Axle may be bent cold for minor corrections.

Toe In—5/64-⅛". Adjust by turning tie rod.

Steering Geometry (Toe out on turns)—Outer wheel turned 20°. Inner wheel turned 23° + or — 2°.

BRAKES:—Service. Own design, hydraulic type. Hand brake lever applies rear service brakes.

See article in Mechanical Equipment Section for data.

Wheel Cylinders—Diameters 1¼" (front wheel), 1 3/16" (rear—JA, B, C, D), 1⅜" (rear—JE), 1½" (rear—1½ Ton).

Drums—Cast-iron, steel web. Pressed steel (1½ Ton). Diameters—11" (all—JA, B, C, D; front—JE), 14" (rear—JE, front—1½ Ton), 16" (rear—1½ Ton).

Lining—Moulded type used.

Model	Width	Thickness	Length
JA, B, C, D; JE (front)	1¾"	3/16"	22⅝"
JE (rear only)	2"	3/16"	38½"
1½ Ton (front)	2"	¼"	28⅞"
1½ Ton (rear only)	3"	¼"	35 13/16"

Clearance—Adjusting cover backed off 4 notches (JA, B, C, D, E all wheels), 5 notches (1½ Ton, front wheels), adjusting pinion shaft backed off ¾ turn (1½ Ton, rear wheels) from slight drag position.

Braking Power—47½% rear (JA, B, C, D) 54¾% (JE), 59% (V).

Hand Brake:—See Service Brakes above.

1933-39 MODELS

ENGINE NUMBER LETTERING:—Letters immediately following engine number (not in circular pads) denote following 'special standard' sizes: 'A'—.020" larger standard cylinder bore. 'B'—.010" smaller standard main and connecting rod bearings. 'AB'—cylinder bore, main and connecting rod bearings 'special standard'.

1939 MODELS

FRONT END ASSEMBLY (UNIT) REMOVAL:—For work on front of engine, remove radiator and fender assembly as a unit as follows: remove hood and side panel assembly, front bumper assembly, and radiator lower splash pan. Disconnect headlamp wiring at junction block on left fender lower shield. Remove front wheels and drain cooling system. Disconnect radiator support studs and radiator hoses. Disconnect fenders at running board and body. Lift radiator shell, core and fenders off in an assembly.

1939 MODELS

ORIGINAL PISTON & CYLINDER BORE SIZES:—Original production (new engine) piston and bore sizes indicated by letter located as follows:

Piston Size—Letter stamped on piston head (number following letter on Dodge pistons is weight).

Bore Size—Letter stamped on pad at top of block on distributor side.

.020" Oversize Pistons and Bores—Graded in same steps as for standard sizes except .020" larger and marked P, Q, R, S, and T.

CHRYSLER C22, DE SOTO S6

Piston & Engine Mark	Piston Diameter	Cylinder Diameter
A	3.37425-3.37475"	3.37475-3.37525"
B	3.37475-3.37525"	3.37525-3.37575"
C	3.37525-3.37575"	3.37575-3.37625"
D	3.37575-3.37625"	3.37625-3.37675"
E	3.37625-3.37675"	3.37675-3.37725"

CHRYSLER C23, C24

A	3.24925-3.24975"	3.24975-3.25025"
B	3.24975-3.25025"	3.25025-3.25075"
C	3.25025-3.25075"	3.25075-3.25125"
D	3.25075-3.25125"	3.25125-3.25175"
E	3.25125-3.25175"	3.25175-3.25225"

DODGE D11

A	3.2495"	3.24975-3.25025"
B	3.2500"	3.25025-3.25075"
C	3.2505"	3.25075-3.25125"
D	3.2510"	3.25125-3.25175"
E	3.2515"	3.25175-3.25225"

PLYMOUTH P7, P8

A	3.12415-3.12465"	3.12475-3.12525"
B	3.12465-3.12515"	3.12525-3.12575"
C	3.12515-3.12565"	3.12575-3.12625"
D	3.12565-3.12615"	3.12625-3.12675"
E	3.12615-3.12665"	3.12675-3.12725"

Additional Piston Sizes—AA pistons .0005" smaller than A pistons, EE pistons .005" larger than E

Dodge Steel Strut Piston Weight—All 6 pistons in one block must be alike (same number on head).

DODGE D11—PISTON WEIGHTS

Piston Mark	Weight (in lbs.)
8	.91-.92
9	.92-.93
10	.93-.94
11	.94-.95
12	.95-.96
13	.96-.97
14	.97-.98

1937-38-39 MODELS

REPLACEMENT PISTONS:—Finished Pistons—Furnished standard and .003", .005", .010", .015", .023", .025", .030", .040", .050" and .060" oversize.

Semi-finished Pistons—Furnished in two sizes: (1) for bores standard to .023" oversize, (2) .025-.050" oversize. Pistons slotted and finished except for skirt. Skirts must be cam ground.

1937-38 MODELS

ENGINE ASSEMBLY REMOVAL:—Drain radiator, remove hood and side panels (if used), disconnect tie rods at radiator (if used). Remove fan blades and radiator core (disconnect radiator hoses, remove water pump—C14, 15 only, fan pulley—except C14, 15, 17, remove core-to-shell bolts and lift core out, on Chrysler Airflow C17, radiator shell and grille assembly and fan shield must also be removed). Remove bolts at each side of front engine support. Disconnect starter cable, generator and distributor wires, fuel pump lines, throttle controls, oil gauge line at engine, heat indicator tube and bulb at cylinder head. Remove front floor boards and disconnect hand brake cable, overdrive control cable (if used), propeller shaft (see removal instructions below for cars equipped with two shafts and center bearing), clutch release fork, intermediate clutch linkage shaft at engine (on 1938 cars). Remove transmission (see car model 'M' page for directions). Disconnect exhaust pipe and remove rear engine mounting bolts. Lift engine assembly out of car.

Installation:—Reverse procedure listed above. IMPORTANT—In order to secure proper engine alignment when installing engine assembly, loosen exhaust pipe support brackets and run engine a few seconds with engine mounting bolts loose. Then tighten mounting bolts and exhaust pipe brackets.

1939 MODELS

ENGINE ASSEMBLY REMOVAL:—Remove Front End Assembly (see above). Remove front floor boards and propeller shaft (see removal instructions below for cars equipped with two shafts and center bearing). Disconnect: hand brake cable, starter cable, battery ground cable, speedometer cable and gear-shifter rod and cable at transmission (on cars with overdrive remove solenoid coil and control cable), feed line at fuel pump, oil gauge line at engine, coil wires, heat indicator tube and bulb at head, exhaust pipe at manifold, throttle controls and clutch linkage. Attach hoist to engine (remove air cleaner and horns if necessary). Remove front and rear engine support bolts. Loosen engine side splash aprons and lift engine assembly out of car. NOTE—On Plymouth P7, remove transmission cover.

Installation:—Reverse procedure listed above. IMPORTANT—In order to secure proper engine alignment when installing engine assembly, loosen exhaust pipe support brackets and run engine a few seconds with engine mounting bolts loose. Then tighten mounting bolts and exhaust pipe brackets.

1932-39 MODELS

REPLACEMENT MAIN BEARING CAPS:—Available for service. Identical with original cap except for stud holes which are 1/64" larger and bearing cap length which is 1/16" shorter. This allows for filing or shimming to obtain proper bearing fit.

1937-38-39 MODELS

MAIN BEARINGS:—Removal—Car manufacturer recommends that Engine Assembly be removed on Chrysler and De Soto 1937-38-39 models for removing and installing main bearings. See separate Engine Assembly Removal paragraphs (above) for directions.

1932-38 MODELS

Front Main Bearing Cap Removal for Six Cylinder Engines (Chrysler & De Soto 1937-38, Dodge 1932 to 1938, Plymouth 1933 to 1938):—Remove oil pan, oil suction pipe and fan drive pulley (using Puller Tool No. CM-57). Take off timing chain cover. Remove flat head screw from timing case cover plate to oil pan front gasket oil seal plate (located on front face of cover plate just below and to the left of chain). Remove oil pan front gasket oil seal plate which will permit access to front main bearing cap.

1939 MODELS

Front Main Bearing Cap Removal for Six Cylinder Engines (All 1939 Models):—With oil pan removed, oil pan front gasket oil seal plate can be removed by taking out 2 screws on lower edge of timing chain cover (not necessary to remove cover) permitting access to front main bearing cap.

1933-39 MODELS

Adjustment:—Replace bearings. Do not shim or file bearing caps (see Replacement Main Bearing Caps above). With caps removed, the bearing upper halves may be rotated out without removing crankshaft by using pin installed in oil hole in shaft.

1933-39 MODELS

Replacement Bearings:—Finished bearings furnished in following sizes for years as indicated: 1933-36—Standard and .010" undersize. 1937—Standard and .0015" and .010" undersize. 1938-39—Standard and .002", .010", .012" undersize.

1933-39 MODELS

Fitting Bearings:—Check crankshaft for scoring. To check bearing fit, use .002" feeler, ½" wide, 1" long. With cap removed, place feeler along center of bearing, tighten cap. Bearing fit correct when slight drag perceptible when turning crankshaft by hand. Remove feeler, tighten cap. Renew oil seals.

1938-39 MODELS

CRANKSHAFT OIL SEALS:—Servicing—Car manufacturer recommends that new oil seals be installed if chain cover or rear bearing cap removed.

Front Oil Seal:—Leather oil seal mounted in timing chain cover. When installing seal, leather should be soft and pliable, soaked in thin oil for approximately thirty minutes, then rolled with smooth bar.

Rear Oil Seal:—Located at rear bearing. Consists of three separate seals as follows: 1—Bearing oil seal formed in two halves. Lower half mounted on rear of bearing cap and held by retainer screwed (3 screws with lockwashers) to rear face of cap. Upper half retained in same manner with retainer screwed in place on rear face of crankcase. 2—Bearing cap seal. Groove on each side of cap (immediately to rear of stud holes) fitted with seal. Seal assembled in groove with doubled-over end in toward bearing. 3—Bearing cap gaskets. L-shaped cap gaskets assembled around oil slinger groove (at rear of cap). Install gaskets (one on each side).

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1933-39 MODELS

EXHAUST VALVE SEAT INSERTS:—Refacing—Exhaust valve seat inserts must be reground (cannot be recut due to hardness) with high speed grinding stones (Tool C-372) used dry. Roughing stone—to obtain full contact; Finishing stone—to obtain proper finish. Stones must first be dressed for concentricity. Grinding tool centers on expanding pilot inserted in clean valve guide (upper end must be cleaned and chamfered with reamer to provide 60° seat 1/16" wide for this pilot). Lubricate pilot with few drops of oil. All carbon or grease must be removed from valve seat before grinding. Finished seat allowable runout .0005". Check with indicator.

Replacement Inserts—Furnished .010" oversize. Use special tool set C-386 (includes grinding and replacement tools). Inserts removed with special puller to avoid damage to engine block. Special cutters (allowing press fit for new insert) and peening tools (securing insert in place) used with pilot in valve guide (as above) for proper alignment. After installing, finish guide (see Refacing).

1938 MODELS

TIMING CHAIN REMOVAL:—With hood and side panels removed, take off radiator shell and radiator as a unit, support engine under front end and remove front engine support. Remove fan drive pulley and balancer (if used) with Puller Tool No. CM-57. Take off chain cover and chain.

1938 MODELS

OIL PUMP REMOVAL AND INSTALLATION:—Chrysler & DeSoto only). Disconnect oil gauge and fuel pump lines, exhaust pipe, starter pedal (DeSoto only), drain radiator and disconnect hoses. Remove floor boards, loosen engine mountings and tilt engine by placing jack under oil pan. Remove pump body capscrews, remove pump. To install, reverse procedure.

1939 MODELS

RADIATOR CORE REMOVAL:—Chrysler C22, De Soto S6, Dodge D11, Plymouth P7, P8. Remove hood and side panels. Drain cooling system. Remove water pump (Chrysler and Dodge only). Disconnect radiator hoses and take fan blades off pulley (De Soto and Plymouth only). Disconnect headlamp wires at junction block on left fender lower shield and push forward through radiator core side flange. Remove three radiator core-to-support capscrews at each side. Lift core out. NOTE—Loosen lower front screws of fender shield if necessary.

Installation—Reverse procedure listed above. Headlamp wires should be tied together at terminals with a long piece of string, pass string through core flange hole (toward the rear), assemble core and pull wires through hole.

Chrysler C23, C24:—Remove complete hood assembly and side panels. Drain cooling system. Remove screws and bolts securing lower splash pan (at front of car) to shell cross member (below grille) and to side shields, front wheels and front bumper from frame. Free front end of fenders by removing 5 capscrews (fender-to-grille shell) and 2 capscrews in fender bracket-to-radiator support. Remove radiator hoses. Take out fan shroud bolts and lift shroud out. Free radiator shell from support by removing two capscrews at each side (just above top end of outside grille bars). Pull radiator shell forward off car with fenders moved apart. Remove radiator core support capscrews and lift core out. NOTE—When reassembling, secure bolts and screws which hold shell and fenders in a half tight position, tighten only after hood alignment obtained.

1937 MODELS

CLUTCH CHANGE TO CORRECT HARD SHIFTING:—Shifting trouble caused by driven member not releasing properly can be corrected by installing new type driven disc or by cutting twenty-seven spiral grooves 3/32" wide and 1/32" deep spaced equally around facing. Grooves must not exceed these dimensions or facing will be weakened and wear will be excessive.

1935-39 MODELS

PROPELLER SHAFT CENTER BEARING REMOVAL AND INSTALLATION:—Used on all passenger car models with two propeller shafts. To remove, take out rear propeller shaft, disconnect front universal (at rear of transmission), remove center bearing-to-frame mounting screws, slide front propeller shaft (with bearing) out through frame opening in X-member. To install, reverse procedure taking care to replace bearing-to-frame spacer (if used).

1938-39 MODELS

HAND BRAKE ADJUSTMENT:—Fully release hand lever (cable length adjusted by means of clevis at lower end). Remove lock wire on anchor screw (on right lower side), adjust for .015-.020" band to drum clearance for lower portion of band, lock in place. Back off large adjusting bolt nut at top until free. Loosen guide bolt lock nut (on mounting bracket), turn adjusting nut (under locknut) for .015-.020" band to drum clearance, tighten locknut. Tighten large nut at top until tension on either side of guide bolt is just relieved (groove in nut must align with ridge in lockwasher).

NOTE—Clearance between side of anchor & bracket must not exceed .005". To correct, clamp anchor bracket in vise and tap lightly with hammer.

SERIAL NUMBER:—First number 6,756,001. Stamped on right front door hinge piller post.

ENGINE NUMBER:—Stamped on boss on left side of cylinder block between #1 and #2 cylinders.
NOTE—Letter 'A' following engine number indicates that bore .020" larger than standard. Letter 'B' indicates main and connecting rod bearings .010" smaller than standard. Letters 'AB' indicate bore and bearing sizes as above.

ENGINE SPECIFICATIONS:—6 cylinder, 'L' head type. Floating power engine mounting.
Bore—3¼". **Stroke**—4½".
Displacement—223.98 cu. ins.
Horsepower—Rated—25.35, **Developed**—83 at 3400 R.P.M., 100 at 3400 R.P.M. (Optl. H.C. 6.2-1 head).
Compression Ratio—6.35-1 (Std.), 6.2-1 (Optl. Al. head).
Compression Pressure—Approximately 90-95 lbs. (std. head), 100-105 lbs. (Optl. head) at cranking speed.
Vacuum Reading—Gauge should show steady reading of 16-18" at idling speed.
NOTE—Special cylinder head gaskets, head studs and spark plugs (long thread) used with optional aluminum heads. Aluminum heads must be tightened cold.

PISTONS:—Aluminum alloy, 'T' slot, Cam ground type. Pistons cannot be ground and cylinders should be reconditioned to take standard oversize pistons.
Weight—¼ oz. maximum variation.
Removal—Pistons and rods removed from above.

Clearance:—.025" (top), .0015" skirt. See Fitting Pistons.

Replacement Pistons:—Finished pistons furnished .003", .005", .010", .015", .020", .023", .025", .030", .040", .050", .060" oversize. Install same oversize in all cylinders to maintain balance.

Fitting New Pistons:—Use micrometer gauge to check piston diameter and cylinder bore. Finish bore to size for correct clearance. Feeler gauge .0015" thick can be used to check clearance on side opposite slot.

Installing Pistons:—Slot should be toward left (away from valves).

PISTON RINGS:—Four special tongue-and-groove type compression rings, one oil control ring per piston, all above slot. Clearance between rings in tongue-and-groove pair should be .003-.005".

Ring	Width	End Gap	Side Clearance
Comp. (all)	9/64"	.005-.010"	.003" Max.
Oil Control	5/32"	.007-.015"	.003" Max.

PISTON PIN:—Diameter 55/64". Length 2¾". Pin floats in piston and rod. Pin hole in rod is bronze-bushed.
Pin Fit in Piston—Tight thumb push fit with piston at room temperature.
Pin Fit in Rod Bushing—Tight thumb push fit at room temperature (70°F.).
NOTE—Pins furnished .003", .005", .008" oversize.

CONNECTING ROD:—Length—8¾". **Weight**—Held to ¼ oz. maximum variation.
Crankpin Journal Diameter—1 15/16".
Lower Bearing—Babbitt lined integral with rod and cap. No shims used.
Clearance—.001-.00275". Sideplay .003-.009".
Adjustment:—None. (no shims). Replace rods. Do not file rods or caps.
Installing Rods:—Lower bearings offset. Install rods with widest half of bearing toward rear of engine (cylinders #1, 3, 5) or toward front of engine (cylinders #2, 4, 6). Oil hole in upper half of lower bearing must be toward camshaft on all rods.

CRANKSHAFT:—4 bearing. Integral counterweights.
Journal Diameters—2¼".
Bearing Type—Removable babbitt-lined, bronze-backed.
Clearance—.001-.002".
Adjustment:—None (no shims). Replace bearings. Do not file caps.
End Thrust:—Taken by #4 (rear) main bearing. Endplay .004-.005".

CAMSHAFT:—4 bearing. Non-adjustable chain drive.
Bearing Type—Removable steel-backed, babbitt-lined type except #4 which is machined in crankcase.
Clearance—.0015-.0025". Endplay .003-.005".
End Thrust—Taken by thrust plate at front bearing.
Timing Chain:—Morse. Width 1¼". Pitch ½". Length 24" or 48 links.
Camshaft Setting:—Sprockets are marked. Mesh chain with sprockets turned so that marks are adjacent and in line with a straightedge across the shaft centers.

VALVES:—	Head Diameter	Stem Diameter	Length
Intake	1 17/32"	11/32"	5¼"
Exhaust	1 15/32"	11/32"	5¼"

	Seat Angle	Lift	Stem Clearance
Intake	45°	5/16"	.001-.003"
Exhaust	45°	5/16"	.003-.005"

See Chrysler Special Shop Notes for Exhaust valve seat insert removal and installation instructions.
Tappet Clearance—.005" Int., .007" Exh. engine hot.

Valve Springs:—Do not compress springs to over-all length of less than 1¾".

	Spring Pressure	Spring Length
Valve Closed	40-44 lbs.	2 1/16"

Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 6° BTDC. Close 46° ALDC.
Exhaust Valves—Open 42° BLDC. Close 8° ATDC.
To Check Valve Timing—Use regular timing gauge installed in timing hole over #6 piston. Set tappet clearance #6 intake valve at .011". This valve should open with piston .013" past top dead center. Reset tappet clearance at .005" with engine hot.
Motor Gauge—Weidenhoff Adapted #103. Rod #12.

LUBRICATION:—Pressure type. Gear type oil pump located at right of crankcase.
Normal Oil Pressure—15 lbs. idling, 30-40 lbs. at 20 M.P.H.
Oil Pressure Relief Valve—Under cap on left hand side of crankcase. To adjust, remove cap, take out locking wire, turn slotted plug clockwise to increase, or counter-clockwise to decrease oil pressure, replace locking wire.
Crankcase Capacity—6 qts.

CLUTCH:—Borg and Beck Model 10A1. Marked 611 on cover. Single plate, dry disc type. See article in Clutch Section for relining and assembling directions.
Facings—Moulded type, 2 required. Thickness ⅛". Inside diameter 6¾". Outside diameter 9⅞".
Adjustment—Adjust pedal stopscrew (at rear of pedal below pedal shaft) for highest position of pedal without interference with floor. Pedal free movement must be 1⅛". To adjust, loosen locknut and turn clutch fork adjusting screw in front of pedal shaft.

STEERING:—Steering Gear—Gemmer Worm - and - Sector type. See article in Steering Section for complete adjustment directions.

Front Suspension:—Conventional 'I' beam section front axle with Elliott type ends and semi-elliptic springs.
Kingpin Inclination—7° crosswise.
Caster—1-3°. Adjust by inserting wedge shims between spring and spring pad on axle.
Camber—0-1¼°. No adjustment. Must be equal for both wheels.
Toe In—1/16" measured 9" up on wheels. Adjusted in usual manner by loosening tie rod ends and turning tie rod.

BRAKES:—Service—Lockheed Hydraulic, double anchor type. Hand lever applies separate brake at rear of transmission. See article in Brake Section for complete adjustment directions.
Drum Diameter—11".
Lining—Moulded type. Width 1½". Thickness 3/16". Length 20 7/32" per wheel.
Clearance—.012" toe, .006" heel for each shoe.

Hand Brake:—External type on drum at rear of transmission.
Adjustment—Place lever in released position, remove locking wire and turn anchor adjusting screw to give 1/16" clearance between lining and drum at this point. Turn adjusting nut at top of adjusting bolt to give 1/16" clearance around band. If necessary, loosen locknut and turn guide bolt nut so that clearance is uniform around band.
Drum Diameter—7".
Lining—Width 2". Thickness 5/32". Length 21 13/32".

SERIAL NUMBER:—First number (CT) 7,000,001, (CQ) 7,529,001. Stamped on right hand front door hinge pillar post.

ENGINE NUMBER:—Stamped on boss on left side of engine block between #1 and #2 cylinders.
NOTE—Letter 'A' following engine number indicates that cylinder bore .020" larger than standard. Letter 'B' indicates that main and connecting bearings .010" smaller than standard. Letters 'AB' indicate that bore and bearing sizes are as above.

ENGINE:—Model CT Royal Eight. Eight cylinder, 'L' head type. Floating power engine mounting.
Bore—3¼". Stroke—4⅛".
Displacement—273.8 cubic inches.
Horsepower—Rated—33.80. **Developed**—90 at 3400 R.P.M.
Compression Ratio—5.20-1 Std. head, 6.20-1 Optl. aluminum head.
Compression Pressure—Approximately 90 lbs. (5.2-1 head), 105 lbs. (6.2-1 head) at cranking speed.
Vacuum Reading—Gauge should show steady reading of 16-18" with engine idling.

ENGINE:—Model CQ Imperial Eight. Eight cylinder, 'L' head type. Floating power engine mounting.
Bore—3¼". Stroke 4½".
Displacement—298.6 cubic inches.
Horsepower—Rated—33.80. **Developed**—108 at 3400 R.P.M.
Compression Ratio—6.20-1 Std. head, 5.20-1 Optl. low compression head.
Compression Pressure and Vacuum Reading—Same as for Royal Eight above.

PISTONS:—Aluminum alloy, 'T' slot, Cam ground type. Pistons can not be ground and cylinders should be reconditioned to take standard oversizes. Piston length 3⅞".
Weight—Held to ¼ oz. maximum variation.
Removal—Pistons and rods removed from above.
Clearance—.025" (top), .0015" skirt. See Fitting Pistons.

Replacement Pistons:—Finished pistons furnished .003", .005", .010", .015", .020", .023",. .025", .030", .040", .050", .060" oversize. Install same oversize in all cylinders to maintain balance.

Fitting New Pistons:—Use micrometer gauge to check piston diameter and cylinder bore. Finish bore to size for correct clearance. Feeler gauge .0015" thick can be used to check clearance on side opposite slot.

Installing Pistons:—Slot should be toward left (away from valves).

PISTON RINGS:—Four special tongue-and-grove type compression rings, one oil control ring per piston, all above pin. Clearance between rings in tongue-and-groove pair should be .003-.005".

Ring	Width	End Gap	Side Clearance
Comp. (all)	9/64"	.005-.010"	.003" Max.
Oil Control	5/32"	.007-.015"	.003" Max.

PISTON PIN:—Diameter—55/64". Length—2¾". Pin floats in piston and rod. Pin hole in upper end of connecting rod is bronze bushed.
Pin Fit in Piston—Tight thumb push fit with piston at room temperature (70°F.).
Pin Fit in Rod Bushing—Tight thumb push fit at room temperature (70°F.).

CONNECTING ROD:—Length 9". Weight—Held to ¼ oz. maximum variation.
Crankpin Journal Diameter—2 3/16".
Lower Bearing—Removable steel-backed, babbitt-lined type. No shims.
Clearance—.001-.00275". Sideplay .003-.009".
Adjustment:—None (no shims). Replace bearings. Do not file rods or caps.
Installing Rods:—Lower bearings offset. Install rods with widest half of bearing toward rear of engine (cylinders #1, 3, 5, 7) or toward front (cylinders #2, 4, 6, 8). Oil hole in lower bearing upper half should be toward camshaft side on all rods.

CRANKSHAFT:—Five bearing. Integral counterweights.
Journal Diameters—2½" all bearings.
Bearing Type—Removable bronze-backed, babbitt-lined.
Clearance—.001-.002".
Adjustment:—None (no shims). Replace bearings. Do not file bearing caps.
End Thrust:—Taken by #5 rear main bearing. Endplay .002-.005".

CAMSHAFT:—Six bearing. Non-adjustable chain drive.
Bearing Diameters—#1, 2 1/16"; #2, 2 1/32"; #3, 2"; #4, 1 31/32"; #5, 1 15/16"; #6, 1⅜".
Bearing Type—Removable steel-backed, babbitt-lined except #6 which is machined in crankcase.
Clearance—.0015-.0025". Endplay .003-.005".
End Thrust—Taken by thrust plate at front bearing.
Timing Chain:—Morse. Width 1¼". Pitch ½". Length 24" or 48 links.
Camshaft Setting:—Sprockets are marked. Mesh chain with sprockets turned so that marks are adjacent and in line with a straightedge across the shaft centers. Install chain endless with camshaft sprocket off hub.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1 15/32"	11/32"	5½"
Exhaust	1 13/32"	11/32"	5½"

	Seat Angle	Lift	Stem Clearance
Intake	45°	5/16"	.001-.003"
Exhaust	45°	5/16"	.003-.005"

See Chrysler Special Shop Notes for Exhaust valve seat insert removal and installation instructions.
Tappet Clearance—.005" Int., .007" Exh. engine hot.
Valve Springs:—Do not compress springs to over-all length of less than 1¾".

	Spring Pressure	Spring Length
Valve Closed	40-44 lbs.	2 1/16"

Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 6° ATDC. Close 46° ALDC.
Exhaust Valves—Open 42° BLDC. Close 8° ATDC.
To Check Valve Timing—Use regular timing gauge installed in timing hole over #8 piston. Set tappet clearance #8 intake valve at .011". This valve should open with piston .013" past top dead center. Reset tappet clearance at .005" with engine hot.
Motor Gauge—Weidenhoff Adapter #103. Rod #12.

LUBRICATION:—Pressure type. Gear type oil pump located at right of crankcase.
Normal Oil Pressure—30-40 lbs. at 30 M.P.H.
Oil Pressure Relief Valve—Under cap on left hand side of crankcase. To adjust, remove cap, take out locking wire, turn slotted plug clockwise to increase, or counter-clockwise to decrease oil pressure, replace locking wire.
Crankcase Capacity—6 quarts.

CLUTCH:—Borg and Beck Model 10A1. Marked 615-630 on cover. Single plate, dry disc type. See article in Clutch Section for relining and assembling directions.
Facings—Moulded type, 2 required. Thickness ⅛". Inside diameter 6¾" (CT), 6⅛" (CQ). Outside diameter 9⅞" (both models).
Adjustment—Adjust pedal stopscrew at rear of pedal shaft for highest possible position of pedal without interference with floor board. Pedal free movement must be 1¼" (CT), 1⅛" (CQ). To adjust, loosen locknut and turn clutch release fork lever adjusting screw at lower end of pedal in front of pedal shaft.

STEERING:—Steering Gear—(CT) Gemmer Worm-and Sector type. (CQ) Gemmer Worm-and-Double Roller type. See article in Steering Section for complete adjustment instructions.

Front Suspension:—Conventional 'I' beam section front axle with Elliott type ends and semi-elliptic springs.
Kingpin Inclination—7° crosswise.
Caster—1-3°. Adjust by inserting wedge shims between spring and spring pad on axle.
Camber—0-1¼° (CT), ¼-¾° (CQ). No adjustment. Must be equal for both wheels.
Toe In—1/16" measured 9" up on wheel. Adjusted in usual manner by loosening tie rod end clamps and rotating tie rod.

BRAKES:—Service—Lockheed hydraulic, double anchor type. Hand lever applies separate brake at rear of transmission. See article in Brake Section for complete adjustment directions.
Drum Diameter—12" (CT), 13" (CQ).
Lining (CT)—Moulded type. Width 1¾". Thickness 3/16". Length 21 23/32" per wheel.
Lining (CQ)—Moulded type. Width 2". Thickness 3/16". Length 23 9/16" per wheel.
Clearance (all models)—.012" toe, .006" heel each shoe.

Hand Brake:—External type on drum at rear of transmission.
Adjustment:—Place lever in released position, remove locking wire and turn anchor adjusting screw to give 1/16" clearance at this point. Turn adjusting nut at top of adjusting bolt to give 1/16" clearance around band. If necessary, loosen locknut and turn guide bolt nut so that clearance is uniform around band.
Drum Diameter—7".
Lining—Width 2". Thickness 5/32". Length 21 13/32".

SERIAL NUMBER:—On right front door hinge pillar post.

ENGINE NUMBER:—Stamped on boss on left side of cylinder block between #1 and #2 pistons.

ENGINE SPECIFICATIONS:—Eight cylinder, 'L' head type. Floating power engine mounting.
Bore—3½". **Stroke**—5".
Displacement—384.8 cubic inches.
Rated Horsepower—39.20.
Developed Horsepower—125 at 3200 R.P.M. (CH, CL), 135 at 3200 R.P.M. (CL*).
Compression Ratio—5.20-1 Std. (CH, CL), Optl. (CL*), 5.80-1 Std. (CL*).
Compression Pressure—Approximately 90 lbs. (5.20-1 head), 100 lbs. (5.80-1 head) at cranking speed.
Vacuum Reading—Gauge should show steady reading of 16-18" at idling speed.

PISTONS:—Nelson Bohnalite, aluminum alloy, Invar Strut, split skirt type. Piston length—4⅛".
Weight—Pistons of same size held to ¼ oz. maximum variation. Can be used interchangeably.
Removal—Pistons and rods removed from above.
Clearance—.017-.022" top, .0015" skirt.

Fitting New Pistons:—Use .0015 feeler stock ½" wide to check clearance. Cylinders should be reconditioned when taper or out-of-round exceeds .0015". Reconditioned cylinders must not be tapered or out-of-round more than .0005".

Installing Pistons:—Slot should be toward right or camshaft side of engine.

PISTON RINGS:—Four compression, one oil control ring per piston, all above pin. Compression rings are tongue-and-groove type. Clearance between rings in tongue-and-groove pair should be .003-.005".

Ring	Width	End Gap	Side Clearance
Comp. (all)	5/32"	.0035-.010"	.003" Max.
Oil Control	5/32"	.007-.015"	.003" Max.

PISTON PIN:—Diameter—55/64". **Length**—3". Pin floats in piston and rod. Held by retaining ring at each end. Heat piston in boiling water to remove or install pins. Pin hole in rod is bronze-bushed (2 bushings used).

Pin Fit in Piston—.0001-.0005" or tight thumb push fit with piston heated to boiling water temperature (212°F.).

Pin Fit in Rod Bushing—.0001-.0005" or tight thumb push fit at room temperature (70°F.).

CONNECTING ROD:—Length 10". **Weight**—Held to ¼ oz. maximum variation.
Crankpin Journal Diameter—2 3/16".

Lower Bearing—Spun babbitt ('32), removable steel-backed, babbitt-lined type (CL* '33). No shims
Clearance—.001-.00275". Sideplay .003-.009".

Adjustment:—None (no shims). Replace rods ('32) or bearings ('33). Do not file rods or caps. Install new bearings with small boss registering with groove in rod and cap.

Installing Rods:—Oil hole in lower bearing upper half must be toward camshaft on all rods.

CRANKSHAFT:—9 bearing. Integral counterweights.
Journal Diameters—2¾" all bearings.
Bearing Type—Removable bronze-backed, babbitt-lined. No shims.
Clearance—.001-.002".

Adjustment:—None (no shims). Replace bearings. Do not file bearing caps.

End Thrust:—Taken by #9 rear main bearing. Endplay .0015-.0045".

CAMSHAFT:—Six bearing. Non-adjustable chain drive.
Bearing Diameters—#1, 2¼"; #2, 2 7/32"; #3, 2 3/16"; #4, 2 5/32"; #5, 2⅛"; #6 1⅝".
Bearing Type—#1 bronze-backed, babbitt-lined. All others steel-backed, babbitt-lined.
Clearance—.0015-.0025". Endplay .003-.005".
End Thrust—Taken by thrust plate assembled behind camshaft sprocket hub.

Timing Chain:—Morse. Width 1½". Pitch .500". Length 26½" or 53 links.

Camshaft Setting:—Sprockets are marked. Mesh chain with sprockets turned so that marks are adjacent and in line with a straightedge across the shaft centers.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1 23/32"	.340-.341"	6 9/16"
Exhaust	1 21/32"	.340-.341"	6 9/16"

	Seat Angle	Lift	Stem Clearance
Intake	45°	11/32"	.001-.003"
Exhaust	45°	11/32"	.002-.004"

See Chrysler Special Shop Notes for Exhaust valve seat insert removal and installation instructions.

Tappet Clearance—.005" Int., .007" Exh. engine hot.

Valve Springs:—Do not compress springs to over-all length of less than 2⅛".

	Spring Pressure	Spring Length
Valve Closed	50-55 lbs.	2¾"
Valve Open	80-85 lbs.	2 7/16"

Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 6° ATDC. Close 46° ALDC.
Exhaust Valves—Open 42° BLDC. Close 8° ATDC.
To Check Valve Timing—Use regular timing gauge installed in timing hole over #8 piston. Set tappet clearance #8 intake valve at .008". This valve should open with the piston .017" past top dead center. Reset tappet clearance at .005" with engine hot.
Motor Gauge—Weidenhoff Adapter #103. Rod #12.

LUBRICATION:—Pressure type. Gear type oil pump located in crankcase.
Normal Oil Pressure—30-40 lbs. at 30 M.P.H.
Oil Pressure Relief Valve—Under cap on left hand side of crankcase. To adjust, remove cap, take out locking wire, turn slotted plug clockwise to increase, or counter-clockwise to decrease oil pressure, replace locking wire.
Crankcase Capacity—8½ quarts.

CLUTCH:—Borg & Beck Model 11A2. Single plate, dry disc type. See article in Clutch Section for relining and assembling directions. Bendix vacuum power 'automatic clutch' control used on all models.

Facings—Moulded type, 2 required. Thickness ⅛". Inside diameter 6⅛". Outside diameter 11 1/16".

Adjustment—Adjust pedal stopscrew at lower end of pedal under shaft for highest possible position of the pedal without interference with the floor board. Free movement of pedal must be 1⅛". To adjust, loosen locknut and turn adjusting screw on clutch release fork lever on clutch housing.

STEERING:—Steering Gear—Gemmer Worm-and-Roller type. See article in Steering Section for complete adjustment instructions.

Front Suspension:—Conventional 'I' beam section front axle with Elliott type ends and semi-elliptic springs.

Kingpin Inclination—7° crosswise.

Caster—1-3°. Adjust by inserting wedge shims between spring and spring pad on axle.

Camber—¼-¾°. No adjustment. Must be equal for both wheels.

Toe In—⅛" measured 9" up on wheel. Adjusted in usual manner by loosening clamp bolts and rotating tie rod.

BRAKES:—Lockheed Hydraulic, Double anchor type with vacuum power application. See article in Brake Section for complete adjustm't instructions.
Drum Diameter—15".
Lining—Moulded type. Width 2". Thickness 3/16". Length 28 23/32" per wheel.
Clearance—.012" toe, .006" heel each shoe.

Power Unit:—Bendix self-contained type vacuum cylinder connected to brake linkage. See article in Brake Section for complete data.

Hand Brake:—External type on drum at rear of transmission.
Adjustment—Place lever in released position, remove locking wire, turn anchor screw adjusting nut until clearance between lining and drum is 1/16" at this point. Loosen clamp bolt, turn adjusting sleeve until clearance at lower end of band is 1/16", tighten clamp bolt. Turn adjusting nut on upper end of adjusting bolt (in adjusting sleeve) until clearance at upper end of band is 1/16". Clearance should be uniform around drum.
Drum Diameter—8".
Lining—Width 2". Thickness 5/32". Length 24⅝".

ENGINE NUMBER:—Stamped on boss on left side of cylinder block between #1 and 2 cylinders. Letter 'A' following number indicates that cylinder bore is .020" larger than standard. Letter 'B' indicates that main and connecting rod bearings are .010" smaller than standard. Letters 'AB' indicate that bore and bearing sizes are as above.

ENGINE:—Six cylinder, 'L' head type. Floating power.
Bore—3⅜". **Stroke**—4½".
Piston Displacement—241.5 cubic inches.
Rated Horsepower—27.34 A.M.A.
Developed Horsepower—93 at 3400 R.P.M., 100 at 3400 R.P.M. with optl. head.
Compression Ratio—5.4-1 Std. (CA, CB), 6.0-1 Std. (C-6) heads. 6.5-1 optl. aluminum head.
Compression Pressure—(5.4-1 hd.) 90-95 lbs., (6.0-1 hd.) 100-105 lbs., (6.5-1 hd.) 110-115 lbs. at cranking speed.

Pistons:—Aluminum alloy, "T" slot, Cam ground type. Semi-finished pistons (head and ring grooves completely finished, skirt semi-finished) furnished for service where 'cam' grinding equipment is available in two sizes: (1) standard to .023" oversize, (2) .025" to .050" oversize. If cam grinding equipment not available, use finished replacement pistons furnished .003", .005", .010", .015", .020", .023", .025", .030", .040", .050", .060" oversize and finish cylinder bores to provide correct clearance. Piston length 3⅞.
Removal—Pistons and rods removed from above.
Weight—Held to 7 grams or ¼ oz. variation.
Clearance—Top .024". Bottom .0015" (CA, CB), .002" (C-6).
Fitting New Pistons—Use micrometer gauges to check cylinder bore and piston diameter.
Installing Pistons—Slot at left (away from valve).

Piston Rings:—Two compression, one undercut oil wiper ring (#3), one oil control ring per piston, all above pin. Lower ring grooves drilled radially with oil drain holes. Rings furnished in same oversizes as pistons (except .023").

Ring	Width	End Gap	Side Clearance
Comp all	⅛"	.007-.015"	.003"
Oil Wiper '34	⅛"	.007-.015"	.003"
Oil Control '34	3/16"	.007-.015"	.003"
Oil Control '35	5/32"	.007-.015"	.003"

Piston Pin:—Diameter 55/64". Length 2⅞". Pin floats in piston and rod. Held by retaining rings. Piston should be heated in boiling water to remove or install pins. Pins furnished .003", .005", .008" oversize.
Pin Fit in Piston—Tight thumb push fit with piston heated to 120°F.
Pin Fit in Rod Bushing—Tight thumb push fit with piston at room temperature (70°F).

Connecting Rod:—Weight—maximum variation held to 7 grams or ¼ oz. Length 8¾".
Crankpin Journal Diameter—2⅛".
Lower Bearing—Removable steel-backed, babbitt-lined type. No shims.
Clearance—.001-.00275". Sideplay .003-.009".
Adjustment—None (no shims). Replace bearings. Do not file rods or caps. Install new bearings with small boss registering with groove (both halves). Furnished .010" undersize and standard.
Installing Rods—Lower bearings are offset. Install rods with widest half of bearing toward rear of engine (#1, 3, 5), or toward front of engine (#2, 4, 6). Oil hole in upper half of bearing must be toward valve side on all rods.

Crankshaft:—4 bearing. Integral counterweights.
Journal Diameters—2½" all bearings.
Bearing Type—Removable steel-backed, babbitt-lined type. No shims.
Clearance—.001-.002".
Adjustment—None (no shims). Replace bearings. Do not file bearing caps. *See Chrysler Special Shop Notes for replacement bearing and bearing cap data.*
End Thrust—Taken by rear bearing. Endplay .003-.007".

Camshaft:—4 bearing. Non-adjustable chain drive.
Bearing Type—Removable steel-backed, babbitt-lined type (except #4, machined in crankcase).
Clearance—.0015-.0025". Endplay .003-.005".
End Thrust—Taken by thrust plate at rear of sprocket hub.
Timing Chain—Morse. Width 1". Pitch .500". Length 24" or 48 links.
Camshaft Setting—Sprockets are marked. Mesh chain with sprockets turned so that marks are adjacent and in line with a straightedge across the shaft centers.

Valves:—	Head Diam.	Stem Diam.	Length
Intake	1 17/32"	.340-.341"	5 5/16"
Exhaust	1 15/32"	.340-.341"	5 5/16"

	Seat Angle	Lift	Stem Clearance
Intake	45°	11/32"	.001-.003"
Exhaust	45°	11/32"	.003-.005"

See Chrysler Special Shop Notes for Exhaust valve seat insert removal and installation instructions.
Installing New Guides—Use special tool to remove and install guides. Intake guides installed with taper end up. exhaust guides with taper end down. Top of guide must be 13/16" below top of block. Finish ream new guides to inside diameter of .342-.343" intake, .344-.345" exhaust after installing.
Tappet Clearance—.006" Int., .008" Exh.. with engine hot. Set exhaust clearance at .010" for sustained high speed driving. Valves accesible by removing right front wheel and housing cover.
Valve Springs—Variable pitch type. Install springs with closer spaced coils at top. Do not compress springs to length of less than 1 11/16".

	Spring Pressure	Length '34	Length '35
Valve Closed	46-50 lbs.	2 1/16"	2 1/32"
Valve Open	104-110 lbs.	1 23/32"	1 22/32"

Valve Timing—See Camshaft Setting above.
Intake Valves—Open At TDC. Close 50° ALDC.
Exhaust Valves—Open 48° BLDC. Close 2° ATDC.
To Check Valve Timing—Set tappet clearance #1 intake and exhaust valves at .010". Intake valve should open at top dead center when 'O' mark on impulse neutralizer at front of engine lines up with pointer on chain case. Reset tappet clearance at .006" with engine hot.

Lubrication:—Pressure. Gear type oil pump located at right of crankcase.
Normal Oil Pressure—30-60 lbs. ('34), 40-50 lbs. ('35) at driving speeds.
Oil Pressure Relief Valve—Under plug on left hand side of crankcase. Operates at 40-45 lbs. Adjustable by changing spring. Standard spring unpainted. Heavy spring (to increase pressure) painted green. Lighter spring (to decrease pressure) painted red.
Capacity & Oil—6 qts. Use SAE. #30 (summer—or #40 for high speed driving or above 100°F), #20-W (winter 32° to 0°F), #10-W (0° to —15F°).

CLUTCH:—**Borg & Beck Model 10A3 ('34), 10A6 ('35).** Single plate. dry disc type. No adjustment required for wear.
See article in Mechanical Equipment Section for data.
Clutch Pedal Adjustment—Clutch pedal should just clear under side of toeboard with clutch engaged. To adjust, turn stopscrew located just above clutch pedal shaft. Free movement of pedal should be 1⅛" ('34), 1 1/16" ('35). To adjust, loosen locknut and turn adjusting nut (clevis) on clutch fork adjusting rod.
Clutch Facings—Woven asbestos, 2 required, 6⅛" I.D., 9⅞" O.D., .133" thick.
NOTE—To remove clutch first remove clutch fork and pivot by taking out pivot capscrew. Mark clutch cover and flywheel before disassembling and reassemble in same position. Install driven plate assembly with mark 'Flywheel Side' toward flywheel (hub is offset). Use special gauge plate and adaptor to set up release levers when reassembling clutch. Release lever heights must be equal within .005".

STEERING:—**Front Suspension**—Independent, linked parallelogram type with coil springs. All specifications and service adjustments same as for Model CZ (following) except kingpin inclination 10° plus or minus ½° (including camber angle), or 8¾-10¼° from vertical (without camber angle).
See article in Mechanical Equipment Section for data.
Steering Gear:—Gemmer Model, Worm-and-Roller type. See article in Steering Section for adjustments.

BRAKES:—**Service**—Lockheed Hydraulic, double anchor type. Hand lever applies brake at rear of transmission. See article in Brake Section for relining and complete brake adjustment.
Wheel Cylinders—Diameters—Front wheel (front end 1¼", rear 1⅜"), Rear wheel (front end 1⅛", rear 1¼").
NOTE—Wheel cylinder mark 'R'—for right brakes, 'L'—for left brakes and are not interchangeable.
Drum Diameter—11" ('34), 10" ('35).
Lining—Moulded type. Width 2". Thickness 3/16". Length per wheel 22 5/32" ('34), 19 13/16" ('35).
Clearance—.012" toe, .006" heel, for each shoe.

Hand Brake:—External type on drum at rear of transmission.
Adjustment ('34)—With lever in released position, remove anchor screw locking wire, turn anchor screw so that clearance between lining and drum is 1/16", lock anchor screw with wire. Then adjust hand brake adjusting bolt nut to give 1/16" clearance at each end of brake band.
Adjustment ('35)—With lever in released position, (on some cars, adjustment is provided for hand brake rod length; where this is found adjust hand brake rod nut to take up all slack or free play), remove anchor screw locking wire, turn anchor screw so that clearance between lining and drum is 1/16", lock anchor screw with wire. Adjust brake band guide bolt nut to give 1/16" clearance (as above), for lower portion of band, secure with locknut. Finally, adjust brake adjusting bolt nut to give 1/16" clearance (as above) for upper portion of brake band.
Drum Diameter—6".
Lining—Width 2". Thickness 5/32" ('34), 3/16" ('35). Length 18 13/32".
NOTE—When relining, cut out lining adjacent to anchor and chamfer ends. Clearance between anchor and sides of anchor saddle .005" maximum.

ENGINE NUMBER:—First Number, CZ-1001. Stamped on boss on left side of cylinder block between #1 and 2 cylinders.
See Chrysler Special Shop Note for Engine Number lettering data.

ENGINE:—Own. Eight cylinder, In line, 'L' head type. Floating power engine mounting.
Bore—3¼". Stroke—4⅛".
Piston Displacement—273.8 cubic inches.
Rated Horsepower—33.80 A.M.A.
Developed Horsepower—105 at 3400 R.P.M.
Compression Ratio—6.2-1 Std. cast-iron head, 7.0-1 special aluminum head.
Compression Pressure—125-135 lbs. (6.2-1 cast-iron head), 130-140 lbs. (7.0-1 al. head) at 1000 R.P.M. or approx. 105 lbs. (6.2-1), 117 lbs. (7.0-1) at cranking speed.
Vacuum Reading—Gauge should show steady reading of 16-18" with engine idling.

Pistons:—Aluminum alloy, 'T' slot, cam ground type. Semi-finished pistons (head and ring grooves completely finished, skirt semi-finished) furnished for service where 'cam' grinding equipment is available in two sizes: (1) standard to .023" oversize, (2) .025" to .050" oversize. If cam grinding equipment is not available, use finished replacement pistons furnished .003", .005", .010", .015", .020", .023", .025", .030", .040", .050", .060" oversize and finish cylinder bores to provide correct clearance. Piston length 3⅞".
Removal—Pistons and rods removed from above.
Weight—Held to 7 grams or ¼ oz. variation.
Clearance—Top .024". Skirt .002".
Fitting New Pistons—Use micrometer gauges to check cylinder bore and piston diameters.
Installing Pistons—Slot should be at left or away from valve side of engine.

Piston Rings:—Two compression, one undercut oil wiper ring (#3), one oil control ring per piston, all above pin. Oil ring grooves are drilled radially with oil drain holes. Rings furnished in same oversizes as pistons (except .023").

Ring	Width	End Gap	Side Clearance
Comp. All	⅛"	.007-.015"	.003"
Oil Cont. All	5/32"	.007-.015"	.003"

Piston Pin:—Diameter 55/64". Length 2¾". Pin floats in piston and rod. Held by retaining rings. Piston should be heated in boiling water to remove or install pins. Pins furnished .003", .005", .008" oversize for service.
Pin Fit in Piston—Tight thumb push fit with piston heated to 120°F.
Pin Fit in Rod Bushing—Light thumb push fit with both parts at room temperature (70°F.).

Connecting Rod:—Weight held to 7 grams or ¼ oz. maximum variation. Length 9 3/16".
Crankpin Journal Diameter—2 3/16".
Lower Bearing Type—Removable steel-backed, babbitt-lined type. No shims.
Clearance—.001-.00275". Sideplay, .003-.009".
Adjustment—None (no shims). Replace bearings. Do not file bearing caps. Install new bearings with small boss registering with groove in rod and cap. Bearings furnished for service .010" undersize and standard.
Installing Rods—Lower bearings are offset. Install rods with widest half of bearing toward rear (#1, 3, 5, 7) or toward front (#2, 4, 6, 8). Oil hole in upper half of bearing must be toward valve side of engine on all rods.

Crankshaft:—Five bearing. Integral counterweights.
Journal Diameters—2 45/64" all bearings.
Bearing Type—Interchangeable steel-backed, babbitt-lined type. No shims.
Clearance—.001-.002".
Adjustment—None (no shims). Replace bearings. Do not file caps. *See Chrysler Special Shop Notes for replacement bearings and bearing cap data.*
End Thrust—Taken by rear bearing. Endplay, .002-.005"

Camshaft:—Six bearing. Non-adjustable chain drive.
Bearing Type—Removable steel-backed babbitt-lined type (except #6 which is machined in crankcase).
Clearance—.0015-.0025". Endplay, .003-.005".
End Thrust—Taken by thrust plate between sprocket hub and front main bearing.
Timing Chain—Morse. Width 1¼". Pitch, .500". Length 24" or 48 links.
Camshaft Setting—Sprockets are marked. Mesh chain with sprockets turned so that marks are adjacent and in line with a straightedge across the shaft centers.

Valves:—

	Head Diameter	Stem Diameter	Length
Intake	1 15/32"	.340-.341"	5⅜"
Exhaust	1 13/32"	.340-.341"	5⅜"

	Seat Angle	Lift	Stem Clearance
Intake	45°	11/32"	.001-.003"
Exhaust	45°	11/32"	.003-.005"

See Chrysler Special Shop Notes for Exhaust valve seat insert removal and installation instructions.
Installing New Guides—See Model C6 for complete instructions.
Tappet Clearance—.006" intake, .008" exhaust. running clearance with engine hot. Set exhaust clearance at .010" for sustained high speed driving. Valves accessible by removing right front wheel and wheel housing cover under fender.
Valve Springs—Variable pitch type. Install springs with closer spaced coils at top. Do not compress springs to length of less than 1 11/16".

	Spring Pressure	Length
Valve Closed	46-50 lbs.	2 1/32"
Valve Open	104-110 lbs.	1 22/32"

Valve Timing—See Camshaft Setting above.
Intake Valves—Open 2° BTDC. Close 44° ALDC
Exhaust Valves—Open 46° BLDC. Close 4° ATDC.
To Check Valve Timing—Set tappet clearance #1 valves at .011" intake, .012" exhaust. Intake valve should open with piston 2° BTDC when 2° line on impulse neutralizer at front of engine lines up with pointer on chain case cover. Reset tappet clearance at .006" (engine hot).
Motor Gauge—Weidenhoff Adapter #103, Rod #12.

Lubrication:—Pressure. Gear type oil pump located on right hand side of crankcase.
Normal Oil Pressure—40-50 lbs. at driving speeds.
Oil Pressure Relief Valve—Located under cap on left hand side of crankcase. Operates at 40-45 lbs. See Model C-1 (following) for adjustments.
Capacity & Oil—6 qts. Use SAE. #30 (summer—#40 for sustained high speed driving or temperatures above 100°F), #20-W (winter 32° to 0°F), #10-W (winter 0° to —15°F.).

CLUTCH:—Borg and Beck Model 10A6. Single plate, dry disc type. No adjustment required for wear. *See article in Mechanical Equipment Section for data.*
Clutch Pedal Adjustment—Clutch pedal should just clear under side of toeboard with clutch engaged. To adjust, turn stopscrew located just above clutch pedal shaft. Free movement of pedal should be 1 1/16". To adjust, loosen locknut and turn adjusting nut (clevis) on clutch fork adjusting rod.
Clutch Facings—Woven asbestos, 2 required, 6⅛" I.D., 9⅞" O.D., .133" thick.
NOTE—To remove clutch first remove clutch fork and pivot by taking out pivot capscrew. Mark clutch cover and flywheel before disassembling and reassemble in same position. Install driven plate assembly with mark 'Flywheel Side' toward flywheel (hub is offset). Use special gauge plate and adaptor to set up release levers when reassembling clutch. Release lever heights must be equal within .005".

STEERING:—Front Suspension—Independent, linked parallelogram type with coil springs.
See article in Mechanical Equipment Section for data.
NOTE—Check spring heights first and make following checks with car weight on wheels.
Kingpin Inclination—4°30' (4¼-5¾° depending upon camber angle) alone, or 5°30' plus or minus ½° including camber angle.
Caster—1½° (½-2½°). To adjust, loosen upper and lower control arm yoke nuts, remove lubricant fitting in upper control arm yoke pin, loosen clamp bolts on upper yoke and upper end of knuckle support, insert special wrench in lubricant fitting hole, turn upper control arm yoke pin so as to move upper end of knuckle toward rear of car to increase caster angle, or toward front of car to decrease caster angle. Tighten yoke nuts and clamp bolts, replace lubricant fitting.
Camber—½° (¼-1°). Camber affected by caster adjustment and must be checked when caster angle is changed. Before changing camber, see that king pin pivot angle is correct and that loaded heights of front springs are equal (see paragraph below). To adjust camber, jack up car with jack placed under lower control arm or spring seat, so that weight of car is on springs but not on wheel, disconnect tie rod at wheel end. Remove upper control arm yoke nut, pull yoke out of control arm, add spacers between yoke and control arm to increase camber, or remove spacers to decrease camber (place spacers removed in this manner on inner face of control arm under yoke nut).
Toe In—1/16-⅛" measured at hub height on center of tread. Adjust by changing length of each tie rod equally. Measure tie rods to be certain that lengths between ends are equal.
Spring Heights—Distance from center line of lower control arm yoke pin to top of frame cross member (flat section) should be 7¼ to 7⅜" with car weight on wheels but no load in car. Heights must be equal on both sides within ⅛".

Steering Gear:—Gemmer Model, Worm-and-Roller type. See article in Steering Section for adjustments.

BRAKES:—Service—Lockheed Hydraulic, double anchor type. Hand lever applies brake at rear of transmission or rear wheel service brakes (on cars with overdrive). See article in Brake Section for complete adjustment procedure.
Wheel Cylinders—Diameters, Front Wheel (Front end 1¼", Rear 1⅜"), Rear Wheel (Front end 1⅛", Rear 1¼").
NOTE—Wheel cylinders marked 'R'—right side of car, 'L'—left side of car and not interchangeable.
Drum Diameter—11".
Lining—Moulded type. Width 2". Thickness 3/16". Length per wheel 22 5/32".
Clearance—.012" toe, .006" heel, for each shoe.

Hand Brakes:—External type on drum at rear of transmission. See Chrysler Model C6 (preceding page) for adjustments.
Drum Diameter—6".
Lining—Width 2". Thickness 5/32". Length 18 13/32".

ENGINE NUMBER:—First number, CU-1001, CV-1001, C1-1001. Stamped on boss on left side of cylinder block between #1 and 2 cylinders. Letter 'A' following number indicates that cylinder bore is .020" larger than standard. Letter 'B' indicates that main and connecting rod bearings are .010" smaller than standard. Letters 'AB' indicate that bore and bearing sizes are as above.

ENGINE SPECIFICATIONS CV, C1:—8 cyl., 'L' head.
Bore—3¼". **Stroke**—4⅞".
Displacement—323.5 cubic inches.
Rated Horsepower—33.80 (AMA).
Developed Horsepower—130 (CV), 115 (C1) at 3400 R.P.M.
Compression Ratio—Std. (C1) 6.2-1 cast-iron hd., 6.5-1 Std. (CV), Optl (C1) aluminum head.
Compression Pressure—(6.2-1 hd.) 105-110 lbs., (6.5-1 hd) 110-115 lbs. at cranking speed.
Vacuum Reading—Gauge should show steady reading of 16-18" with engine idling.

ENGINE SPECIFICATIONS CU:—8 cylinder, 'L' head.
Bore—3¼". **Stroke** 4½".
Displacement—298.6 cubic inches.
Rated Horsepower—33.80 (AMA).
Developed Horsepower—130 at 3400 R.P.M.
Compression Ratio—6.5-1 Std. aluminum head.
Compression Pressure—Approximately 110-115 lbs. at cranking speed.
Vacuum Reading—See above.
NOTE—Aluminum heads must be tightened cold.

PISTONS:—Aluminum alloy, 'T' slot, Cam ground type with anodized finish (special hard oxide formed on bearing surface). **Length**—3⅞". **Weight**—held to 7 grams or 1/10 oz. maximum variation.
Removal—Pistons and rods removed from above.
Clearance—Top .024-.025". Skirt .0015" (CU, CV), .002" (C1). See Fitting New Pistons.
Replacement Pistons:—Finished anodized pistons furnished in standard and .003", .005", .010", .015", .020", .023", .025", .030", .040", .050", .060" oversizes. Semi-finished pistons furnished: (1) standard to .023" oversize, (2) .025-.050" oversize, not interchangeable. Pistons should be sloted and then finished on cam grinding equipment.
Fitting New Pistons—Use micrometer gauges to check cylinder bore and piston diameters.
Installing Pistons—Slot should be at left or away from valve side of engine.
Piston Rings:—Two compression, one undercut oil wiper ring (#3), one oil control ring per piston, all above pin. Oil ring grooves are drilled radially with oil drain holes. Rings furnished in same oversizes as pistons (except .023").

Ring	Width	End Gap	Side Clearance
Comp. All	⅛"	.007-.015"	.003"
Oil Cont. All	5/32"	.007-.015"	.003"

Piston Pin:—Diameter 55/64". Length 2¾". Pin floats in piston and rod. Held by retaining rings. Piston should be heated in boiling water to remove or install pins. Pins furnished .003", .005", .008" oversize for service.
Pin Fit in Piston—Tight thumb push fit with piston heated to 120°F.
Pin Fit in Rod Bushing—Tight thumb push fit with both parts at room temperature (70°F).
Connecting Rod:—Weight held to 7 grams or ¼ oz. maximum variation. Length 9".
Crankpin Journal Diameter—2 3/16".
Lower Bearing Type—Removable steel-backed, babbitt-lined type. No shims.
Clearance—.001-.00275". Sideplay .003-.009".
Adjustment—None (no shims). Replace bearings. Do not file bearing caps. Install new bearings with small boss registering with groove in rod and cap. Bearings furnished for service .010" undersize and standard.
Installing Rods—Lower bearings are offset. Install rods with widest half of bearing toward rear (#1, 3, 5, 7) or toward front (#2, 4, 6, 8). Oil hole in upper half of bearing must be toward valve side of engine on all rods.

Crankshaft:—Five bearing. Integral counterweights.
Journal Diameters—2 45/64" all bearings.
Bearing Type—Interchangeable steel-backed, babbitt-lined type. No shims.
Clearance—.001-.002".
Adjustment—None (no shims). Replace bearings. Do not file bearing caps. *See Chrysler Special Shop Notes for replacement bearing and bearing cap data.*
End Thrust—Taken by rear bearing. Endplay .002-.005".

Camshaft:—Six bearing. Non-adjustable chain drive.
Bearing Type—Removable steel-backed, babbitt-lined type (except #6 which is machined in crankcase).
Clearance—.0015-.0025". Endplay .003-.005".
End Thrust—Taken by thrust plate between sprocket hub and front main bearing.
Timing Chain—Morse. Width 1¼". Pitch .500". Length 24" or 48 links.
Camshaft Setting—Sprockets are marked. Mesh chain with sprockets turned so that marks are adjacent and in line with a straightedge across the shaft centers.

Valves:—

	Head Diam.	Stem Diam.	Length
Intake	1 15/32"	.340-.341"	5 9/16"
Exhaust	1 13/32"	.340-.341"	5 9/16"

NOTE—On model CU only valve length for all valves 5½".

	Seat Angle	Lift	Stem Clearance
Intake	45°	11/32"	.001-.003"
Exhaust	45°	11/32"	.003-.005"

See Chrysler Special Shop Notes for Exhaust valve seat insert removal and installation instructions.
Installing New Guides—See Model C-6 for instructions.
Tappet Clearance—.006" Int., .008" Exh. running clearance with engine hot. Set exhaust clearance at .010" for sustained high speed driving. Valves accessible by removing right front wheel and housing cover under fender.
Valve Springs—Variable pitch type. Install springs with closer spaced coils at top. Do not compress springs to length of less than 1 11/16".

	Spring Pressure	Length
Valve Closed	46-50 lbs.	2 1/32"
Valve Open	104-110 lbs.	1 11/16"

Valve Timing—See Camshaft Setting above.
Intake Valves—Open 2° BTDC. Close 44° ALDC.
Exhaust Valves—Open 46° BLDC. Close 4° ATDC.
To Check Valve Timing—Set tappet clearance #1 valves at .011" Int., .012" Exh. Intake valve should open with piston 2° BTDC when 2° line on impulse neutralizer at front of engine lines up with pointer on chain case cover. Reset tappet clearance at .006" Int., .008" Exh. (engine hot).

Lubrication:—Pressure. Gear type oil pump located on right hand side of crankcase.
Normal Oil Pressure—40-50 lbs. at driving speeds.
Oil Pressure Relief Valve—Located under cap on left hand side of crankcase. Operates at 40-45 lbs. Adjustable. To adjust, remove cap, withdraw locking wire, turn slotted plug clockwise to increase pressure, or counter-clockwise to decrease pressure, replace locking wire and cap.
Crankcase Capacity—6 quarts.

CLUTCH:—**Borg & Beck Models 11A5 (CU, CV), 11A6 (C1).** Single plate, dry disc type. No adjustment required for wear. 11A5 marked 861, 11A6 marked 871 on cover.
See article in Mechanical Equipment Section for data.
Clutch Pedal Adjustment—Clutch pedal should just clear underside of toeboard with clutch engaged. To adjust, turn pedal stopscrew located above clutch pedal shaft. Free movement of clutch pedal must be 1" (CU, CV), 1 1/16" (C1). To adjust, C1—turn clutch shaft collar adjusting screw at right hand end of clutch pedal shaft; CU, CV—turn clutch release fork lever adjusting screw (with locknut released) at left end of clutch release fork lever.
Clutch Facings—Woven asbestos, 2 required, 6⅛" I.D., 11" O.D., .133" thick.
NOTE—Mark flywheel and clutch cover before disassembling clutch and replace in same position. Install driven plate assembly with mark 'Flywheel Side' toward flywheel (hub is offset). Use special gauge plate and adaptor to set up release levers when reassembling clutch. Release lever heights must be equal within .005".

STEERING:—**Front Suspension**—Conventional tubular section front axle with Reverse-Elliott ends and semi-elliptic springs.
Kingpin Inclination—(CU, CV) 9°, (C1) 4° crosswise.
Caster—2° plus or minus 1°. Adjust by inserting wedge shims between spring and axle pad on axle. Shims or angle plates furnished ½, 1, 2°.
Camber—½° plus or minus ¼°. No adjustment provided. Manufacturer recommends that no attempt be made to correct camber by bending tubular axle centers. Replace axle.
Toe In—1/16"-⅛" measured at hub height on center of tire tread. Adjust in usual manner by changing length of tie rod.
Steering Gear:—Gemmer Worm-and-Roller type.
See article in Mechanical Equipment Section for data.

BRAKES:—**Service**—Lockheed Hydraulic, double anchor type. Hand lever applies brake at rear of transmission. See article in Brake Section for relining and complete adjustment procedure. For cars with Bendix Vacuum Power unit see separate article in Brake Section.
NOTE—Wheel cylinders marked 'R'—right brakes, 'L'—left brakes and are not interchangeable.
Drum Diameter—13".
Lining—Moulded type. Width 2". Thickness ¼". Length 24 27/32" per wheel.
Clearance—.006" heel, .012" toe, for each shoe.
Hand Brake:—External at rear of transmission.
Adjustment—With lever in released position remove anchor screw locking wire, turn anchor screw so that clearance between lining and drum is 1/32", lock anchor screw with wire. Turn adjusting nut at top of adjusting bolt so that clearance around drum is 1/32". Loosen locknut and turn guide bolt, if necessary, to secure uniform clearance around drum.
Drum Diameter—6" (CU, CV); 7" (C1).
Lining—Woven type. Width 2" (CU, CV), 2¼" (C1). Thickness ¼" (CU, CV), 3/16" (C1). Length 18¼" (CU,CV), 21 13/16" (C1).
NOTE—When relining band, cut out lining adjacent to anchor and chamfer ends. Clearance between anchor and sides of anchor saddle .005" max.
Power Unit:—Bendix Internal Valve type.
See article in Mechanical Equipment Section for data.

ENGINE NUMBER:—First number, C2-1001, C3-1001. Stamped on boss on left side of cylinder block between #1 and 2 cylinders.
NOTE—Letter 'A' following numer indicates that bore is .020" larger than standard. Letter 'B' indicates that main and connecting rod bearings are .010" smaller than standard. Letters 'AB' indicate that bore and bearing sizes are as above.

ENGINE:—Own. Eight cylinder, In line, 'L' head type. Floating power engine mounting.
Bore—3¼". **Stroke**—4⅞".
Piston Displacement—323.5 cubic inches.
Rated Horsepower—33.80 A.M.A.
Developed Horsepower—130 at 3400 R.P.M. Std. 6.5-1 head, 138 at 3400 R.P.M. Optl. 7.45-1 head.
Compression Ratio—6.5-1 Std., 7.45-1 Optl.
Compression Pressure—(6.5-1 hd.) 145-155 lbs. at 1000 R.P.M. or approx. 117 lbs. at cranking speed (7.45-1 hd.).
NOTE—Both the 6.5 and 7.45 heads are aluminum. Aluminum heads must be tightened cold.
Vacuum Reading—Gauge should show steady reading of 16-18" with engine idling.

Pistons:—Aluminum alloy, 'T' slot, Cam ground type. Finished anodized pistons furnished in standard and .003", .005", .010", .015", .020", .023", .025", .030", .040", .050", .060" oversizes. Semi-finished pistons furnished in two sizes: (1) Standard to .023" oversize, (2) .025-.050" oversize, not interchangeable. Pistons should be slotted and finished on cam grinding equipment.
Removal—Pistons and rods removed from above.
Weight—Held to 7 grams or ¼ oz. variation.
Clearance—Top .024". Skirt .002".
Fitting New Pistons—Use micrometer gauges to check cylinder bore and piston diameter.
Installing Pistons—Slot should be at left or away from valve side of engine.

Piston Rings:—Two compression, one undercut oil wiper ring (#3), one oil control ring per piston, all above pin. Oil ring grooves are drilled radially with oil drain holes. Rings furnished in same oversizes as pistons (except .023").

Ring	Width	End Gap	Side Clearance
Comp. All	⅛"	.007-.015"	.003"
Oil Cont. All	5/32"	.007-.015"	.003"

Piston Pin:—Diameter 55/64". Length 2¾". Pin floats in piston and rod. Held by retaining rings. Piston should be heated in boiling water to remove or install pins. Pins furnished .003", .005", .008" oversize for service.
Pin Fit in Piston—Tight thumb push fit with piston heated to 120°F.
Pin Fit in Rod Bushing—Light thumb push fit with both parts at room temperature (70°F).

Connecting Rod:—Weight held to 7 grams or ¼ oz. maximum variation. Length 9".
Upper Bearing—Bronze bushing.
Crankpin Journal Diameter—2 3/16".
Lower Bearing Type—Removable steel-backed, babbitt-lined type. No shims.
Clearance—.001-.00275". Side play .003-.009".
Adjustment—None (no shims). Replace bearings. Do not file bearing caps. Install new bearings with small boss registering with groove in rod and cap. Bearings furnished for service .010" undersize and standard.
Installing Rods—Lower bearings are offset. Install rods with widest half of bearing toward rear (#1, 3, 5, 7) or toward front (#2, 4, 6, 8). Oil hole in upper half of bearing must be toward valve side of engine on all rods.

Crankshaft:—Five bearings. Integral counterweights.
Journal Diameters—2 45/64" all bearings.
Bearing Type—Interchangeable steel-backed, babbitt-lined type. No shims.
Clearance—.001-.002".
Adjustment—None (no shims). Replace bearings. Do not file bearing caps. *See Chrysler Special Shop Notes for replacement bearing and bearing cap data.*
End Thrust—Taken by rear bearing. Endplay .002-.005".

Camshaft:—Six bearing. Non-adjustable chain drive.
Bearing Type—Removable steel-backed, babbitt-lined type (except #6 which is machined in crankcase).
Clearance—.0015-.0025". Endplay .003-.005".
End Thrust—Taken by thrust plate between sprocket hub and front main bearing.
Timing Chain—Morse. Width 1¼". Pitch .500". Length 24" or 48 links.
Camshaft Setting—Sprockets are marked. Mesh chain with sprockets turned so that marks are adjacent and in line with a straightedge across the shaft centers.

Valves:—

	Head Diam.	Stem Diam.	Length
Intake	1 15/32"	.340-.341"	5 9/16"
Exhaust	1 13/32"	.340-.431"	5 9/16"

	Seat Angle	Lift	Stem Clearance
Intake	45°	11/32"	.001-.003"
Exhaust	45°	11/32"	.003-.005"

See Chrysler Special Shop Notes for Exhaust valve seat insert removal and installation instructions.
Installing New Guides—Use special tool to remove and install guides. Intake guides installed with taper end up, exhaust guides with taper end down. Top of guide must be 13/16" below top of block. Finish ream new guides to inside diameter of .342-.343" (intake), .344-.345 (exhaust) after installing.
Tappet Clearance—.006" Int., .008" Exh. running clearance with engine hot. Set exhaust clearance at .010" for sustained high speed driving. Valves accessible by removing right front wheel and wheel housing cover under fender.
Valve Springs—Variable pitch type. Install springs with closer spaced coils at top. Do not compress springs to over-all length of less than 1 11/16".

	Spring Pressure	Length
Valve Closed	46-50 lbs.	2 1/32"
Valve Open	104-110 lbs.	1 22/32"

Valve Timing—See Camshaft Setting above.
Intake Valves—Open 2° BTDC. Close 44° ALDC.
Exhaust Valves—Open 46° BLDC. Close 4°ATDC.
To Check Valve Timing—Set tappet clearance #1 valves at .011" Int., .012" Exh. Intake valve should open with piston 2° BTDC when 2° line on impulse neutralizer at front of engine lines up with pointer on chain case cover. Reset tappet clearance at .006" Int., .008" Exh. with engine hot.
Motor Gauge—Weidenhoff Adapter #103, Rod #12.

Lubrication:—Pressure. Gear type oil pump located on right hand side of crankcase.
Normal Oil Pressure—40-50 lbs. at driving speeds.
Oil Pressure Relief Valve—Located under cap on left hand side of crankcase. Operates at 40-45 lbs. Adjustable. To adjust, remove cap, withdraw locking wire, turn slotted plug clockwise to increase pressure, or counter-clockwise to decrease pressure, replace locking wire and cap.
Capacity & Oil—6 qts. Use SAE. #30 (summer—#40 for sustained high speed driving or temperatures above 100°F), #20-W (winter 32° to 0°F), #10-W (winter 0° to —15°F).

CLUTCH:—Borg and Beck Model 11A6. Single plate, dry disc type. No adjustment required for wear. ***See article in Mechanical Equipment Section for data.***
Clutch Pedal Adjustment—Clutch pedal should just clear underside of toeboard with clutch engaged. To adjust, turn pedal stopscrew located above clutch pedal shaft. Free movement of clutch pedal must be 1 1/16". To adjust, turn clutch shaft collar adjusting screw at right hand end of clutch pedal shaft.
Clutch Facings—Woven asbestos, 2 required, 6⅛" I.D., 11" O.D., .133" thick.
NOTE—Mark flywheel and clutch cover before diassembling clutch and replace in same position. Install driven plate with mark 'Flywheel Side' toward flywheel (hub is offset). Use special gauge plate and adaptor to set up release levers when reassembling clutch. Release lever heights must be equal within .005".

STEERING:—Front Suspension—Coventional tubular section front axle with Reverse-Elliott ends and semi-elliptic springs.
Kingpin Inclination—4° crosswise.
Caster—2° plus or minus 1°. Adjust by inserting wedge shims between spring and axle pad on axle. Shims or angle plates furnished, ½, 1, 2°.
Camber—½° plus or minus ¼°. No adjustment provided. Manufacturer recommends that no attempt be made to correct camber by bending tubular axle centers. Replace axle.
Toe In—1/16"-⅛" measured at hub height on center of tire tread. Adjust in usual manner by changing length of tie rod.
Steering Gear:—Gemmer Model Worm-and-Roller Type. See article in Steering Section for adjustments.

BRAKES:—Service—Lockheed Hydraulic, double anchor type. Hand lever applies brake at rear of transmission. See article in Brake Section for relining and complete adjustment procedure. For cars with Bendix Vacuum Power unit see separate article in Brake Section.
Wheel Cylinders—Diameters—Front wheel (front end 1¼", rear end 1⅜"), Rear wheel (front end 1", rear end 1⅛").
NOTE—Wheel cylinders marked 'R'—right brakes, 'L'—left brakes and are not interchangeable.
Drum Diameter—13".
Lining—Moulded type. Width 2". Thickness ¼". Length 24 27/32" per wheel.
Clearance—.006" heel, .012" toe, for each shoe.
Hand Brake:—External at rear of transmission.
Adjustment—With lever in released position, remove anchor screw locking wire, turn anchor screw so that clearance between lining and drum is 1/32", lock anchor screw with wire. Turn adjusting nut at top of adjusting bolt so that clearance around drum is 1/32". Loosen locknut and turn guide bolt, if necessary, to secure uniform clearance around drum.
Drum Diameter—7".
Lining—Woven type. Width 2¼". Thickness 3/16". Length 21 13/16" per wheel.
NOTE—When relining band, cut out lining adjacent to anchor and chamfer ends. Clearance between anchor and sides of anchor saddle .005" max.
Power Brake Unit:—Bendix Internal Valve type. See article in Brake Section.

ENGINE NUMBER:—Stamped on boss on left hand side of cylinder block between #1 and 2 cylinders.

ENGINE:—**Own.** Eight cylinder, In Line, 'L' head type. Floating Power engine mounting.
Bore—3½". **Stroke**—5".
Piston Displacement—384.8 cubic inches.
Rated Horsepower—39.20.
Developed Horsepower—150 at 3200 R.P.M.
Compression Ratio—6.5-1. No optional ratios.
Compression Pressure—135-140 lbs. at 1000 R.P.M.

NOTE—Cylinder head is aluminum. Washers are used under head nuts. Tighten head cold.

Pistons:—Nelson Bohnalite, aluminum alloy, Invar Strut, split skirt type. Piston length 4⅛".
Weight—Pistons of same size held to 2 gr. (1/10 oz.) maximum variation. Used interchangeably.
Removal—Pistons and rods removed from above.
Clearance—.002" at top of skirt.
Fitting New Pistons—Use .002" feeler stock ½" wide to check clearance. Cylinders should be reconditioned when taper or out-of-round exceeds .0015". Reconditioned cylinders must not be tapered or out-of-round more than .0005".
Installing Pistons—Slot should be toward right or camshaft side of engine.

Piston Rings:—Four compression, one oil control ring per piston, all above pin. Compression rings are 'Tungtite' tongue and groove type. Oil control ring is slotted.

Ring	Width	End Gap
Comp. All	5/32"	.007-.015"
Oil Cont. (#5)	3/16"	.007-.015"

Piston Pin:—Diameter 55/64". Length 3". Pin floats in piston and rod. Held by retaining ring at each end. Heat piston in boiling water to remove or install pins. Pin hole in rod is bronze bushed.
Pin Fit in Piston—Tight thumb push fit with piston heated to 160°F.
Pin Fit in Rod Bushing—Light thumb push fit at room temperature (70°F).

Connecting Rod:—Length 10". Weight held to 2 gr. (1/10 oz.) maximum variation.
Crankpin Journal Diameter—2 3/16".
Lower Bearing—Removable steel-backed, babbitt-lined type. No shims.
Clearance—.001-.00275". Sideplay .003-.009".
Adjustment—None (no shims). Replace bearings. Do not file rods or caps. Install new bearings with small boss registering with groove in rod and cap.
Installing Rods—Oil hole in upper half of lower bearing should be toward camshaft side on all rods.

Crankshaft:—Nine bearing. Integral counterweights.
Journal Diameters—2¾" all bearings.
Bearing Type—Interchangeable steel-backed, babbitt-lined. No shims.
Clearance—.001-.002".
Adjustment—None (no shims). Replace bearings. Do not file bearing caps. *See Chrysler Special Shop Notes for replacement bearing and bearing cap data.*
End Thrust—Taken by rear bearing. Endplay 0015-.0045".

Camshaft:—Six bearings. Non-adjustable chain drive.
Bearing Type—#1 bronze-backed, babbitt-lined. All others steel-backed, babbitt-lined.
End Thrust—Taken by thrust plate assembled behind camshaft sprocket hub.
Timing Chain—Morse. Width 1½". Pitch .500". Length 26½" or 53 links.
Camshaft Setting—Sprockets are marked. Mesh chain with sprockets turned so that marks are adjacent and in line with a straightedge across the shaft centers.

Valves:—

	Head Diameter	Stem Diameter	Length
Intake	1 23/32"	.340-.341"	6 9/16"
Exhaust	1 21/32"	.340-.341"	6 9/16"

	Seat Angle	Lift	Stem Clearance
Intake	45°	11/32"	.001-.003"
Exhaust	45°	11/32"	.002-.004"

See Chrysler Special Shop Notes for Exhaust valve seat insert removal and installation instructions.

Installing New Guides—Top of guides must be ⅞" below top of block. Finish ream new guides after installing to inside diameter of .342-.343" (intake), .344-.345" (exhaust).
Tappet Clearance—.006" Int., .008" Exh. with engine warm. Set exhaust clearance at .010" for sustained high speed driving. Valves accessible by removing right front wheel and cover plate under fender.
Valve Springs—Do not compress springs to overall length of less than 2⅛".

	Spring Pressure	Length
Valve Closed	50-55 lbs.	2¾"
Valve Open	80-85 lbs.	2 13/32"

Valve Timing—See Camshaft Setting above.
Intake Valves Open—2° BTDC. Close—44° ALDC.
Exhaust Valves Open—46° BLDC. Close 4° ATDC.
To Check Valve Timing—Use regular timing gauge installed over #1 piston. Set tappet clearance #1 intake valve at .008". This valve should open with piston 2° or .002" before top dead center. Reset tappet clearance at .006" with engine warm.

Lubrication:—Pressure type. Gear type oil pump located in crankcase.
Normal Oil Pressure—30-60 lbs. at normal driving speeds.
Oil Pressure Relief Valve—Located under plug on left hand side of crankcase. Adjustable type. To adjust, remove cap, withdraw locking wire, turn slotted plug clockwise to increase, or counterclockwise to decrease oil pressure, replace locking wire and cap.
Capacity and Oil—8 qts. (refill). Use SAE #30 (summer—normal conditions), #40 (summer—high speed driving or temperatures above 100°F.), #20-W (winter—down to 0°F.), #10-W (winter—0° to —15°F.).

CLUTCH:—**Long Model 12CB.** Single plate, dry disc type. No adjustment required for wear. See article in Clutch Section for complete data.
Clutch Pedal Adjustment—Clutch pedal should just clear under side of toeboard. Adjust by loosening locknut and turning stopscrew at rear of pedal above shaft. Free movement of pedal should be 1 5/32". Adjust by loosening locknut and turning clutch release fork lever setscrew.
Clutch Facings—Woven rubber or asbestos composition, 2 required, 6⅛" I.D., 11" O.D., .133" thick.

NOTE—Transmission should be removed before removing clutch. Mark clutch cover and flywheel and reassemble in same position.

STEERING:—**Front Suspension**—Conventional tubular section front axle with Reverse-Elliott ends and semi-elliptic springs.
Kingpin Inclination—10° crosswise.
Caster—1°. Adjust by inserting angle shims between spring and spring pad on axle.
Camber—½° (¼-¾°). No adjustment. Manufacturer recommends that no attempt be made to bend axle.
Toe In—1/16-⅛" measured at hub height on center of tread. Adjust in usual manner by loosening clamp bolts and turning tie rod.

Steering Gear:—Gemmer Model, Worm-and-Roller type. See article in Steering Section for adjustments.

BRAKES:—**Service**—Lockheed Hydraulic, double anchor type with Bendix Vacuum Power Unit. See separate articles in Brake Section for relining and complete adjustment of brakes, and power unit.
NOTE—Wheel cylinders are marked 'R' for right brakes, 'L' for left brakes, and are not interchangeable.
Drum Diameter—15".
Lining—Moulded type. Width 2½". Thickness ¼". Length 30¼" per wheel.
Clearance—.006" heel, .012" toe, for each shoe.

Hand Brake:—External at rear of transmission.
Adjustment—Adjust brake band to give 1/16" clearance.
Drum Diameter—8".
Lining—Woven type. Width 2⅜". Thickness ¼".

Power Brake Unit:—Bendix Internal Valve type. See article in Brake Section.

ENGINE NUMBER:—First number—Chrysler C-7-1001, Number is stamped on boss on left side of cylinder block between #1 and 2 cylinders. Letter 'A' following number indicates that cylinder bore is .020" larger than standard. Letter 'B' indicates that main and connecting rod bearings are .010" smaller than standard. Letters 'AB' indicate that bore and bearing sizes are as above.

ENGINE SPECIFICATIONS:—6 cylinder 'L' head.
Bore—3⅜". Stroke—4½".
Displacement—241.5 cubic inches.
Rated Horsepower—27.34 (AMA).
Developed Horsepower—93 HP. (Std. 6.0-1 Head), 100 HP. (Optl. 6.5-1 head) at 3400 R.P.M.
Compression Ratio—6.0-1 Std. Cast-iron head, 6.5-1 Optl. Aluminum head.
Compression Pressure—6.0-1 Std. Head 120-130 lbs. at 1000 R.P.M. or approx. 103 lbs. at cranking speed. **6.5-1 Optl. Head** 125-135 lbs. at 1000 R.P.M. or approx. 110 lbs. at cranking speed.
Vacuum Reading—Gauge should show steady reading of 16-18" with engine idling at 6 M.P.H.
NOTE—Aluminum heads should be tightened cold.

PISTONS:—Aluminum alloy, 'T' slot, Cam ground type with anodized finish (special hard oxide formed on bearing surface). **Length—3⅞". Weight**—Held to two gram max. variation.
Removal—Pistons and rods removed from above.
Clearance—Top .022". Skirt .002". See Fitting New Pistons.
Replacement Pistons:—Finished anodized pistons furnished in standard and .003", .005", .010", .015", .020", .023", .025", .030", .040", .050", .060" oversizes. Semi-finished pistons furnished: (1) standard to .023" oversize, (2) .025-.050" oversize, not interchangeable. Pistons should be slotted and then finished on cam grinding equipment.
Fitting New Pistons:—Micrometer gauge recommended. Using feeler gauge (.002") inserted between piston and cylinder wall on side opposite slot, pull required to withdraw feeler must be 3-4 lbs.
Installing Pistons:—Slot should be toward left.

PISTON RINGS:—Two compression, one undercut oil wiper ring (#3), one oil control ring per piston, all above pin. Lower ring grooves drilled radially with twelve ⅛" oil drain holes.

Ring	Width	End Gap	Side Clearance
Comp. all	⅛"	.007-.015"	.002-.003"
Oil (both)	5/32"	.007-.015"	.002-.003"

Replacement Rings:—Furnished in standard and .003", .010", .020", .030", .040" .050", .060" oversizes.
NOTE—Install undercut compression and oil wiper ring with step down.

PISTON PIN:—Diameter 55/64". Length 2⅞".
Pin floats in piston and rod. Held by locking rings at each end. Pin hole in rod is bronze bushed.
NOTE—Heat piston in boiling water to remove or install pins.
Pin Fit in Piston—Tight thumb push fit with piston heated to 120° F.
Pin Fit in Rod Bushing—Tight thumb push fit with pin and rod at 70° F.
Replacement Pins:—Pins furnished in standard and .003", .005", .008" oversizes. Ream rod bushing and pin holes in piston bosses for correct fit.

CONNECTING ROD:—Weight—Held within limits.
Length—8¾" (center-to-center).
Crankpin Journal Diameter—2⅛".
Lower Bearing—Removable steel-backed, copper-lead lined. Furnished standard and .010" undersize.
Clearance—.0005-.0025". Sideplay .0055-.0115".
Bearing Adjustment:—None (no shims). Replace bearings. Do not file rods or caps. Install new bearings so small bosses engage grooves in rod and cap.
Installing Rods:—Lower bearings are offset. Install rods with widest half of bearing toward rear (#1, 3, 5) or toward front (#2, 4, 6). Oil hole in lower bearing upper half must be toward camshaft on all rods.

CRANKSHAFT:—4 bearing. Integral counterweights.
Journal Diameters—2½" all bearings.
Bearing Type—Removable steel-backed, babbitt-lined. **Clearance**—.001-.002".
Bearing Adjustment:—None (no shims). Replace bearings. Do not file caps. *See Chrysler Special Shop Notes for replacement bearings and bearing cap data.*
End Thrust:—Taken by flange faces on rear (#4) bearing. Endplay .003-.007".

CAMSHAFT:—4 bearing. Non-adjustable chain drive.
Journal Diameters—#1, 2"; #2, 1 31/32"; #3, 1 15/16"; #4, 1⅜".
Bearing Type—Removable steel-backed, babbitt-lined (except #4, machined in crankcase).
Clearance—.001-.003" (#1), .0015-.0035" (all others).
NOTE—New bearings require no line-reaming.
End Thrust:—Taken by thrust plate at rear of sprocket hub. Endplay .003-.005".
Timing Chain:—Morse. Width 1". Pitch ½". Length 24" or 48 links.
Camshaft Setting:—Sprockets are marked. Mesh chain with sprockets turned so that 'O' marks are adjacent and in line with a straightedge across shaft centers.
NOTE—Engine must be supported under front end of oil pan and front engine support removed for work on timing chain and camshaft.

VALVES—	Head Diameter	Stem Diameter	Length
Intake	1 17/32"	.340-.341"	5 5/8"
Exhaust	1 15/32"	.340-.341"	5 5/8"

	Seat Angle	Lift	Stem Clearance
Intake	45°	11/32"	.001-.003"
Exhaust	45°	11/32"	.003-.005"

See Chrysler Special Shop Notes for Exhaust valve seat insert removal and installation instructions.
Tappet Clearance—.006" Int., .008" Exh., (hot). .010" Exh. recommended for sustained high speed.
Valve Guides:—Use special tool to remove and install guides. Insert guides with taper end up (intake) and down (exhaust). Top of guide must be 13/16" below top of block. After installing finish ream new guides to inside diam. of .342-.343" (Int.), .344-.345" (Exh.).
Valve Springs:—Variable pitch type. Install springs with close coil at top. Do not compress springs to over all length of less than 1½".

	Spring Pressure	Length
Valve Closed	46-50 lbs.	2 1/32"
Valve Open	104-110 lbs.	1 11/16"

Valve Lifters:—Mushroom type. Ream guides to take following oversizes: .001", .008", .030", .060".
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open TDC. Close 50° ALDC.
Exhaust Valves—Open 48° BLDC. Close 2° ATDC.
To Check Valve Timing—Set tappet clearance #6 intake valve at .010". Intake valve should open at top dead center when 'O' mark on impulse neutralizer at front of engine lines up with pointer on chain case cover. Reset tappet clearance at .006".
Motor Gauge—Weidenhoff Adapter #103, Rod #12. Gauge plug hole over #6 cylinder.

LUBRICATION:—Pressure. Gear type oil pump located at right of crankcase.
NOTE—Ignition timing should be checked whenever oil pump is installed in engine.
Normal Oil Pressure:—30-40 lbs. at 30 M.P.H.
Oil Pressure Relief Valve:—Under plug on left hand side of crankcase. Operates at 40 lbs. Adjustable by changing spring. Standard spring unpainted. Heavy spring (to increase pressure) painted green. Lighter spring (to decrease pressure) painted red.
Crankcase Capacity:—6 qts. (refill).

CLUTCH:—Borg & Beck Model 10A6. Single plate, dry disc type. See article in Clutch Section.
Facings—Woven type, 2 required. Inside Diam. 6⅛". Outside Diam. 9⅞". Thickness ⅛".
Adjustment—Clutch pedal should just clear underside of toe board with clutch engaged. To adjust, turn stopscrew located just above clutch pedal shaft. Free movement of pedal should be 1 1/16". To adjust, loosen locknut and turn adjusting nut (clevis) on clutch fork adjusting rod.
Removal—Disconnect clutch pedal linkage, remove fork pivot screw, take out clutch fork. Remove transmission (release bearing and spring are withdrawn with transmission), remove clutch housing pan, prick punch clutch cover and flywheel (install in same position to maintain balance), take out clutch mounting bolts, turning all bolts out evenly to release spring tension and avoid distortion of clutch cover. Remove clutch from below. Use pilot studs when removeing and installing transmission to avoid springing clutch plate.
Automatic Clutch:—See article in Clutch Section.

STEERING:—Steering Gear—Gemmer Model Worm-and-Roller type. See article in Steering Section.
Front Suspension:—Independent, linked parallelogram type with coil springs. See article in Steering Section. Following specifications apply with car weight on wheels (check suspension unit height first).
Wheel Setting (Front Suspension Height)—Distance from center line of lower control arm yoke pin to top of frame cross member should be 7¼-7 3/8" with car weight on wheels but no load in car.
Kingpin Inclination—10° plus or minus ½° (including camber angle), 8¾-10¼° (without camber).
Camber—¼°. Limits minus ¼°-plus ½°.
Caster—1½°. Toe In—0-⅛".

BRAKES:—Service—Lockheed Hydraulic, double anchor type. Hand lever applies brake at rear of transmission or rear wheel service brakes (on cars with overdrive). See article in Brake Section.
Wheel Cylinders—Diameters, Front Wheel (Front end 1¼", Rear 1⅜"), Rear Wheel (Front end 1⅛", Rear 1¼").
NOTE—Wheel cylinders marked 'R'—right side of car, 'L'—left side of car and not interchangeable.
Drum Diameter—11".
Lining—Moulded type. Width 2". Thickness 3/16". Length per wheel 22 5/32".
Clearance—.012" toe, .006" heel, for each shoe.
Hand Brake:—External type on drum at rear of transmission (cars without overdrive). See Service Brake for hand brake adjustment on cars with overdrive.
Adjustment—With lever in released position, remove anchor screw locking wire, turn anchor screw so that clearance between lining and drum is 1/16", lock anchor screw with wire. Adjust brake band guide bolt nut to give 1/16" clearance (as above) for lower portion of band, secure with locknut. Finally, adjust brake adjusting bolt nut to give 1/16" clearance (as above).
Drum Diameter—6".
Lining—Width 2". Thickness 5/32". Length 18 13/32".
NOTE—When relining, cut out lining adjacent to anchor and chamfer ends. Clearance between anchor and sides of anchor saddle .005" maximum.

ENGINE NUMBER:—First number—C8-1001. Stamped on left side of block between #1 and 2 cylinders. *See Chrysler Special Shop Notes for engine number lettering data.*

ENGINE SPECIFICATIONS:—8 cylinder, 'L' head.
Bore—3¼". **Stroke** 4⅛".
Displacement—273.8 cubic inches.
Rated Horsepower—33.80 (AMA).
Developed Horsepower—105 HP. at 3400 R.P.M. (Std. 6.2-1 head.)
Compression Ratio—6.2-1 Std. Cast-iron head, 7.0-1 Optl. aluminum head.
Compression Pressure—6.2-1 Std. Head 125-135 lbs. at 1000 R.P.M. or approx. 106 lbs. at cranking speed. **7.0-1 Optl. Head** 130-140 lbs. at 1000 R.P.M. or approx. 117 lbs. at cranking speed.
Vacuum Reading—Gauge should show steady reading of 16-18" with engine idling at 7-8 M.P.H.
NOTE—Aluminum heads should be tightened cold. Special head studs, head gaskets and spark plugs used with aluminum heads.

PISTONS:—Aluminum alloy, 'T' slot, Cam ground type with anodized finish (special hard oxide formed on bearing surface. **Length**—3⅞".
Weight—Held to two gram maximum variation.
Removal—Pistons and rods removed from above.
Clearance—Top .022". Skirt .002". See Fitting New Pistons.
Replacement Pistons:—Finished anodized pistons furnished in standard and .003", .005", .010", .015", .020", .023", .025", .030", .040", .050", .060" oversize. Semi-finished pistons furnished in two sizes: (1) standard to .023" oversize; (2) .025-.050" oversize (not interchangeable). Pistons should be slotted and then finished on cam grinding equipment.
Fitting New Pistons:—Micrometer gauge recommended. Using feeler gauge (.002") inserted between piston and cylinder wall on side opposite slot, pull required to withdraw feeler must be 3-4 lbs.
Installing Pistons:—Slot should be toward left or away from camshaft.

PISTON RINGS:—Two compression, one undercut oil wiper (#3), one oil control ring per piston, all above pin. Lower ring grooves drilled radially with twelve ⅛" oil drain holes.

Ring	Width	End Gap	Side Clearance
Comp.	⅛"	.007-.015"	.002-.003"
Oil (both)	.5/32"	.007-.015"	.002-.003"

Replacement Rings:—Rings furnished standard and .003", .010", .020", .030", .040", .050", .060" oversize.
NOTE—Install undercut compression and oil wiper ring with step down.

PISTON PIN:—**Diameter**—55/64". **Length**—2¾".
Pin floats in piston and rod. Held by locking rings at each end. Pin hole in rod is bronze bushed.
NOTE—Heat piston in boiling water to remove or install pins.
Pin Fit in Piston—Tight thumb push fit with piston heated to 120° F.
Pin Fit in Rod Bushing—Tight thumb push fit with pin and rod at 70° F.
Replacement Pins:—Pins furnished in standard and .003", .005" and .008" oversizes. Ream rod bushing and pin holes in piston bosses for correct fit.

CONNECTING ROD:—**Weight**—All rods held within limits.
Length—9 3/16" (center-to-center).
Crankpin Journal Diameter—2 3/16".
Lower Bearing—Removable steel-backed, copper-lead lined. Furnished standard and .010" undersize.
Clearance—.001-.003". Sideplay—.006-.011".
Bearing Adjustment:—None (no shims). Replace bearings. Do not file rods or caps. Install new bearings so small bosses engage grooves in rod and cap.
Installing Rods:—Lower bearings are offset. Install rods with widest half of bearing toward rear (#1, 3, 5, 7) or toward front (#2, 4, 6, 8). Oil hole in lower bearing must be toward camshaft on all rods.

CRANKSHAFT:—5 bearing. Integral counterweights.
Journal Diameters—2 45/64" all bearings.
Bearing Type—Removable steel-backed, babbitt-lined. **Clearance**—.001-.002".
Bearing Adjustment:—None (no shims). Replace bearings. Do not file caps. *See Chrysler Special Shop Notes for replacement bearings and bearing cap data.*
End Thrust:—Taken by flange faces on rear (#5) bearing. Endplay .003-.007".

CAMSHAFT:—6 bearing. Non-adjustable chain drive.
Journal Diameters—#1, 2 1/16"; #2, 2 1/32"; #3, 2"; #4, 1 31/32"; #5, 1 15/16"; #6, 1⅜".
Bearing Type—Removable steel-backed, babbitt-lined (except #6 which is machined in crankcase). **Clearance**—.0015-.0025" all bearings.
End Thrust:—Taken between the face of the removable cast-iron sleeve which carries the front bearing and the face of the camshaft sprocket. Adjusted by replacing sleeve. Endplay .003-.005".
Timing Chain:—Morse. Width 1¼". Pitch ½". Length 24" or 48 links.
Camshaft Setting:—Sprockets are marked. Mesh chain with sprockets turned so that 'O' marks are adjacent and in line with a straightedge across shaft centers.
NOTE—Engine must be supported under front end of oil pan and front engine support removed for work on timing chain and camshaft.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1 15/32"	.340-.341"	5½"
Exhaust	1 13/32"	.340-.341"	5½"

	Seat Angle	Lift	Stem Clearance
Intake	45°	11/32"	.001-.003"
Exhaust	45°	11/32"	.003-.005"

See Chrysler Special Shop Notes for Exhaust valve seat insert removal and installation instructions.
Tappet Clearance—.006" int., .008" exh., (hot). .010" exh., recommended for sustained high speed.
Valve Guides:—Use special tool to remove and install guides. Insert guides with taper end up (intake) and down (exhaust). Top of guide must be 13/16" below top of block. Finish ream guides after installation to inside diameter of .342-.343" Int., .344-.345" Exh.
Valve Springs:—Variable pitch type. Install springs with close coil at top. Do not compress springs to over all length of less than 1½".

	Spring Pressure	Spring Length
Valve Closed	46-50 lbs.	2 1/32"
Valve Open	104-110 lbs.	1 11/16"

Valve Lifters:—Mushroom type. Ream guides to take following oversizes: .001", .008", .030", .060".
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 2° BTDC. Close 44° ALDC.
Exhaust Valves—Open 46° BLDC. Close 4° ATDC.
To Check Valve Timing—Install timing gauge in timing plug hole over #8 piston. Set tappet clearance #8 intake valve at .011" (cold). This valve should open with piston 2° or .0015" BTDC. when 2° line BTDC. on impulse neutralizer at front of engine lines up with pointer on chain case cover. Reset tappet clearance at .006" with engine hot.
Motor Gauge—Weidenhoff Adapter #103, Rod #12.

LUBRICATION:—Pressure. Gear type oil pump on right side of crankcase.
NOTE—Ignition timing should be checked whenever oil pump is installed in engine.
Normal Oil Pressure:—30-45 lbs. at 30 M.P.H.
Oil Pressure Relief Valve:—Located under cap at left side of crankcase. Operates at 40-45 lbs. To adjust, remove cap, withdraw locking wire, turn slotted plug clockwise to increase pressure, counter-clockwise to decrease, replace locking wire and cap.
Crankcase Capacity:—6 qts. (refill).

CLUTCH:—**Borg & Beck Model 10A6.** Single plate, dry disc type. See article in Clutch Section for relining and assembling directions.
Facings—Woven type, 2 required. Inside Diam. 6⅛". Outside Diam. 9⅞". Thickness ⅛".
Adjustment—Clutch pedal should just clear underside of toe board with clutch engaged. To adjust, turn stopscrew located just above clutch pedal shaft. Free movement of pedal should be 1/16". To adjust, lossen locknut and turn adjusting nut (clevis) on clutch fork adjusting rod.
Removal—Disconnect clutch pedal linkage, remove fork pivot screw, take out clutch fork. Remove transmission (release bearing and spring are withdrawn with transmission), remove clutch housing pan, prick punch clutch cover and flywheel (install in same position to maintain balance), take out clutch mounting bolts, turning all bolts out evenly to release spring tension and avoid distortion of clutch cover. Remove clutch from below. Use pilot studs when removing and installing transmission to avoid springing clutch plate.
Automatic Clutch:—See article in Clutch Section.

STEERING:—**Steering Gear**—Gemmer Model Worm-and-Roller type. See article in Steering Section.
Front Suspension:—Independent, linked parallelogram type with coil springs. See article in Steering Section. Following specifications apply with car weight on wheels (check suspension unit height first).
Wheel Setting (Front Suspension Height)—Distance from center line of lower control arm yoke pin to top of frame cross member should be 7¼-7⅜" with car weight on wheels but no load in car. Heights must be equal on both sides within ⅛".
Kingpin Inclination—4¾-6° (incl. camber angle). **Camber**—Minus ¼°. Limits minus ¼ to plus ½°. **Caster**—1½°. **Toe In**—0-⅛".

BRAKES:—**Service**—Lockheed hydraulic, double anchor type. Hand lever applies brake at rear of transmission or rear wheel service brakes (on cars with overdrive). See article in Brake Section for complete adjustment procedure.
Wheel Cylinders—Diameters, Front Wheel (Front end 1¼", Rear 1⅜"), Rear Wheel (Front end 1⅛", Rear 1¼").
NOTE—Wheel cylinders marked 'R'—right side of car, 'L'—left side of car and not interchangeable.
Drum Diameter—11".
Lining—Moulded type. Width 2". Thickness 3/16". Length per wheel 22 5/32".
Clearance—.012" toe, .006" heel, for each shoe.
Hand Brakes:—External type on drum at rear of transmission. See Service Brake for Hand Brake on cars with overdrive.
Adjustment—With lever in released position, remove anchor screw locking wire, turn anchor screw so that clearance between lining and drum is 1/16", lock anchor screw with wire. Adjust brake band guide bolt nut to give 1/16" clearance (as above) for lower portion of band, secure with locknut. Finally, adjust brake adjusting bolt nut to give 1/16" clearance (as above), making sure that groove in bolt nut is lined up with ridge on lockwasher.
Drum Diameter—6".
Lining—Width 2". Thickness 5/32". Length 18 13/32".
NOTE—Clearance at anchor and saddle .005" max.

ENGINE NUMBER:—First number—C9, C10, or C11-1001. Stamped on boss back of water pump.
See Chrysler Special Shop Notes for engine number lettering data.

ENGINE SPECIFICATIONS:—8 cylinder, 'L' head.
Bore—3¼". Stroke—4⅞".
Piston Displacement—323.5 cubic inches.
Rated Horsepower—33.80 (AMA).
Developed Horsepower—For each model as follows:

Model	Comp. Ratio	HP. and R.P.M.
C9 Std.	6.2-1	105 at 3400
C9 Optl.	6.5-1	110 at 3400
C10, 11 Std.	6.5-1	130 at 3400
C10, 11 Optl.	7.45-1	138 at 3400

Compression Ratio—See above.
Compression Pressure—6.2-1 Cast-iron head 120-130 lbs. at 1000 R.P.M. or approx. 106 lbs. at cranking speed. **6.5-1 Al. head** 145-155 lbs. at 1000 R. P. M. or approx. 117 lbs. at cranking speed, **7.45-1 Al head** 160-170 lbs. at 1000 R.P.M. or approx. 124 lbs at cranking speed.
Vacuum Reading—Gauge should show steady reading of 16-18" with engine idling at 7-8 M.P.H.
NOTE—Aluminum heads should be tightened cold.

PISTONS:—Aluminum alloy, "T" slot, Cam ground type with anodized finish (special hard oxide formed on bearing surface). **Length—3⅞".**
Weight—Held to two grams maximum variation.
Removal—Pistons and rods removed from above.
Clearance—Top .022". Skirt .002". See Fitting New Pistons.
Replacement Pistons:—Finished anodized pistons furnished in standard and .003", .005", .010", .015", .020", .023", .025", .030", .040", .050", .060" oversizes. Semi-finished pistons furnished in two sizes: (1) Standard to .023" oversize, (2) .025"-.050" oversize, not interchangeable. Pistons should be slotted and finished on cam grinding equipment.
Fitting New Pistons:—Micrometer gauge recommended. Using feeler gauge (.002") inserted between piston and cylinder wall on side opposite slot, pull required to withdraw feeler must be 3-4 lbs.
Installing Pistons:—Slot should be toward left

PISTON RINGS:—Two compression, one undercut oil wiper (#3), one oil control ring per piston, all above pin. Lower ring groove drilled radially with twelve ⅛" oil drain holes.

Ring	Width	End Gap	Side Clearance
Comp. all	⅛"	.007-.015"	.002-.003"
Oil cont. all	.5/32"	.007-.015"	.002-.003"

Replacement Rings:—Rings furnished in standard and .003", .010", .020", .030", .040", .050", .060" oversize.
NOTE—Install undercut compression and oil wiper ring with step down.

PISTON PIN:—Diameter—55/64". Length—2¾".
Pin floats in piston and rod. Held by locking rings at each end. Pin hole in rod is bronze bushed.
NOTE—Heat piston in boiling water to remove or install pins.
Pin Fit in Piston—Tight thumb push fit with piston heated to 120° F.
Pin Fit in Rod Bushing—Tight thumb push fit with pin and rod at 70° F.
Replacement Pins:—Pins furnished in standard and .003", .005", and .008" oversizes. Ream rod bushing and pin holes in piston bosses for correct fit.

CONNECTING RODS:—Weight—Held within limits.
Length—9". (center-to-center).
Crankpin Journal Diameter—2 3/16".
Lower Bearing—Removable steel-backed, copper-lead lined. Furnished standard and .010" undersize.
Clearance—.001-.003". Sideplay .006-.011".
Bearing Adjustment:—None (no shims). Replace bearings. Do not file rods or caps. Install new bearings so small bosses engage grooves in rod and cap.
Installing Rods:—Lower bearings are offset. Install rods with widest half of bearing toward rear (#1, 3, 5, 7), or toward front (#2, 4, 6, 8). Oil hole in lower bearing must be toward camshaft on all rods.

CRANKSHAFT:—5 bearing. Integral counterweights.
Journal Diameters—2 45/64" all bearings.
Bearing Type—Removable steel-backed, babbitt-lined. **Clearance**—.001-.002".
Bearing Adjustment:—None (no shims). Replace bearings. Do not file caps. *See Chrysler Special Shop Notes for replacement bearings and bearing cap data.*
End Thrust:—Taken by flange faces on rear (#5) bearing. Endplay .003-.007".

CAMSHAFT:—6 bearing. Non-adjustable chain drive.
Journal Diameters—#1, 2 1/16"; #2, 2 1/32"; #3, 2"; #4, 1 31/32"; #5, 1 15/16"; #6, 1⅜".
Bearing Type—Removable steel-backed, babbitt-lined (except #6 which is machined in crankcase). **Clearance**—.0015-0025" all bearings.
NOTE—New bearings need not be line-reamed.
End Thrust:—Taken between the face of the removable cast-iron sleeve which carries the front bearing and the face of the camshaft sprocket. Adjusted by replacing sleeve. Endplay .003-.005".
Timing Chain:—Morse. Width 1¼". Pitch ½". Length 24" or 48 links.
Camshaft Setting:—Sprockets are marked. Mesh chain with sprockets turned so that 'O' marks are adjacent and in line with a straightedge across shaft centers.
NOTE—Engine must be supported under front end of oil pan and front engine support removed for work on timing chain and camshaft.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1 15/32"	.340-.341"	5½"
Exhaust	1 13/32"	.340-.341"	5½"

	Seat Angle	Lift	Stem Clearance
Intake	45°	11/32"	.001-.003"
Exhaust	45°	11/32"	.003-.005"

See Chrysler Special Shop Notes for Exhaust valve seat insert removal and installation instructions.
Tappet Clearance—.006" Int., .008" Exh. (hot). .010" Exh. recommended for sustained high speed.
Valve Guides:—Use special tool to remove and install guides. Insert guides with taper end up (intake) or down (exhaust). Top of guide must be 13/16" below top of block. Finish ream guides after installing to inside diameter of .342-.343" Int., .344-.345" Exh.
Valve Springs:—Variable pitch type. Install springs with close coil at top. Do not compress springs to over all length of less than 1½".

	Spring Pressure	Spring Length
Valve Closed	46-50 lbs.	2 1/32"
Valve Open	104-110 lbs.	1 11/16"

Valve Lifters:—Mushroom type. Ream guides to take following oversizes: .001", .008", .030", .060"
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 2° BTDC. Close 44° ALDC.
Exhaust Valves—Open 46° BLDC. Close 4° ATDC.
To Check Valve Timing—Install timing gauge in timing plug hole over #1 piston. Set tappet clearance #1 intake valve at .011" (cold). This valve should open with piston 2° or .0019" before top dead center when 2° line BTDC on impulse neutralizer at front of engine lines up with pointer on chain case cover. Reset tappet clearance at .006" hot.
Motor Gauge—Weidenhoff Adapter #103, Rod #12.
NOTE—Right front wheel and cover plate under fender should be removed for work on valves.

LUBRICATION:—Pressure. Gear type oil pump on right side of crankcase.
NOTE—Ignition timing should be checked whenever oil pump is installed in engine.
Normal Oil Pressure:—30-40 lbs. at 30 M.P.H.
Oil Pressure Relief Valve:—Located under cap at left side of crankcase. Operates at 40-45 lbs. To adjust, remove cap, withdraw locking wire, turn slotted plug clockwise to increase pressure, counter-clockwise to decrease, replace locking wire and cap.
Crankcase Capacity:—6 qts. (refill).

CLUTCH:—Borg & Beck Model 11A6. Single plate, dry disc type. See article in Clutch Section.
Facings—Woven type, 2 required. Inside Diam. 6⅛". Outside Diam. 11". Thickness ⅛".
Adjustment—Clutch pedal should just clear underside of toeboard with clutch engaged. To adjust, turn pedal stopscrew located above clutch pedal shaft. Free movement of clutch pedal must be 1 1/16". To adjust, turn clutch shaft collar adjusting screw at right hand end of clutch pedal shaft.
Removal—Disconnect clutch linkage, remove transmission (rotating clutch release fork shaft so that release bearing and spring are withdrawn with transmission), remove clutch housing pan, prick punch clutch cover and flywheel (install in same position to maintain balance), take out clutch mounting bolts, turning all bolts out evenly. Remove clutch from below.
Automatic Clutch:—See article in Clutch Section.

STEERING:—Steering Gear—Gemmer Model Worm-and-Roller type. See article in Steering Section.
Front Suspension:—Conventional tubular section front axle with Reverse-Elliott ends and semi-elliptic springs.
Kingpin Inclination—4½-5½° crosswise.
Caster—2° plus or minus 1°. Adjust by inserting wedge shims between spring and axle pad on axle. Shims or angle plates furnished ½, 1, 2°.
Camber—½° plus or minus ¼°. No adjustment. Manufacturer recommends that no attempt be made to correct camber by bending tubular axle.
Toe In—0-5/16" measured at hub height on center of tire tread. Adjust in usual manner by changing length of tie rod.

BRAKES:—Service—Lockheed hydraulic, double anchor type. Bendix Vacuum Power unit optional on Model C9 and standard on Models C10, C11. See article in Brake Section.
Wheel Cylinder—Diameters—Front Wheel (Front end 1¼", Rear end 1⅜"), Rear wheel (Front end 1", Rear end 1⅛").
NOTE—Wheel cylinders marked 'R'—right side of car, 'L'—left side of car and not interchangeable.
Drum Diameter—13".
Lining—Moulded type. Width 2". Thickness ¼". Length 24 27/32" per wheel.
Clearance—.012" toe, .006" heel for each shoe.
Hand Brake:—External at rear of transmission.
Adjustment—With lever in released position remove anchor screw locking wire, turn anchor screw so that clearance between lining and drum is 1/32", lock anchor screw with wire. Back off adjusting bolt nut until free. Adjust bracket bolt nuts for each end of brake band to 1/32" clearance (as above), secure with locknuts. Finally tighten adjusting bolt nut until tension on bracket bolt nuts is just relieved at either end.
Drum Diameter—7".
Lining—Woven type. Width 2½". Thickness 3/16". Length 21 5/8".
NOTE—Clearance at anchor and saddle .005" max.
Power Brake Unit:—Bendix Internal Valve type. See article in Brake Section.

NOTE:—Engine hood hinged at cowl and lifts from forward end. Turn radiator ornament counter-clockwise, raise hood about 1", push back safety catch at front under lower edge of hood releasing catch and raise hood. Side panels removed by freeing latches on inside lower edges of panels.

ENGINE NUMBER:—First number C-16-1001. Stamped on left side of block between #1 and #2 cylinders. *See Chrysler Special Shop Notes for engine number lettering data.*

ENGINE SPECIFICATIONS:—6 cylinder, 'L' head.
Bore—3⅜". **Stroke**—4¼".
Displacement—228.1 cubic inches.
Rated Horsepower—27.34 (AMA).
Developed Horsepower—93 HP. (std. 6.5-1 head), 100 HP. (optl. 7.0-1 head) at 3600 R.P.M.
Compression Ratio—Al. hds. (6.5-1 std., 7.0-1 optl.).
Compression Pressure—6.5-1 hd. (150-160 lbs. at 1000 R.P.M. or approx. 110 lbs. at cranking speed). **7.0-1 hd.** (160-170 lbs. at 1000 R.P.M. or approx. 117 lbs. at cranking speed).
Vacuum Reading—Gauge should show steady reading of 18-21" with engine idling at 6 M.P.H.

PISTONS:—Aluminum alloy, U-slot, cam ground type with anodized finish. **Length**—3⅞".
Weight—17.46 ounces (plus or minus 2 grams).
Removal—Pistons and rods removed from above.
Clearance—Top .022". Skirt .002".
Replacement Pistons:—*See Chrysler Shop Notes.*
Fitting New Pistons:—Check pistons at right angles to pin bosses at bottom of skirt) and cylinder bore with micrometer gauge. With feeler (.002") inserted between cylinder wall and piston (side opposite slot), pull required to withdraw feeler must be 5-7 lbs.
Installing Pistons:—Slot away from valves.

PISTON RINGS:—Two undercut compression, two oil control rings per piston, all above pin. Lower ring grooves drilled with ten ⅛" oil drain holes (#3), five (#4 groove).

Ring	Width	End Gap	Side Clearance
Compression	⅛"	.007-.015"	.0015-.003"
Oil Control	5/32"	.007-.015"	.0015-.003"

Replacement Rings:—Furnished standard and .003", .005", .010", .015", .020", .025", .030", .040", .050", .060" oversize.

PISTON PIN:—Diameter—55/64". **Length**—2⅞".
Floating type. Pin hole in rod bronze bushed.
Pin Fit in Piston—Thumb push fit at 130° F.
Pin Fit in Rod Bushing—Thumb push fit at 70° F.
Replacement Pins:—Furnished standard and .003", .005", .008" oversize. Ream bushing and pin hole to size.

CONNECTING ROD:—Weight 31.91 ozs. **Length** 8".
Crankpin Journal Diameter—2⅛".
Lower Bearing—Removable steel-backed, babbitt-lined. Furnished standard & .0015", .010" undersize.
Clearance—.0005-.0025". **Sideplay**—.0055-.0115".
Bearing Adjustment:—None. Install new bearings with bosses engaging grooves in rod and cap.
Installing Rods:—Oil hole in lower bearing upper half must be toward camshaft, all rods.

CRANKSHAFT:—4 bearing. Integral counterweights.
Journal Diameters—2½" all bearings.
Bearing Type—Removable steel-backed, babbitt-lined. Furnished standard & .0015", .010" undersize.
Clearance—.001-.002".
Bearing Adjustment:—*See Chrysler Shop Notes for Engine Removal (recommended), Front Main Bearing Cap Removal, Adjustment directions, and Replacement Bearing Cap data.*
End Thrust:—Taken by flange faces on rear (#4) bearing. **Endplay**—.003-.007".

CAMSHAFT:—4 bearing. Non-adjustable chain drive.
Journal Diameters—#1, 2"; #2, 1 31/32"; #3, 1 15/16"; #4, 1¼".
Bearing Type—Removable steel-backed, babbitt-lined (except #4 machined in crankcase).
Clearance—.0015-.003".
End Thrust:—Taken by thrust plate at rear of camshaft sprocket. **Endplay**—.002-.006".
Timing Chain:—Morse. Width 1". Pitch .500". Length 24" or 48 links.
Camshaft Setting:—Mesh chain with sprockets turned so that '0' marks are adjacent and in line with a straightedge across the shaft centers.

VALVES—	Head Diameter	Stem Diameter	Length
Intake	1 21/32"	.340-.341"	4 25/32"
Exhaust	1 17/32"	.340-.341"	4 25/32"

	Seat Angle	Lift	Stem Clearance
All valves	45°	11/32"	.001-.003"

See Chrysler Special Shop Notes for Exhaust valve seat insert removal and installation instructions.
Tappet Clearance—.008" Int., .010 Exh. (hot). Remove right fr. wheel and wheel housing to adjust.
NOTE—Exh. valve seat inserts furn. .010" oversize.
Valve Guides:—Must be ⅞" below top of block. Ream guides after installing .342-.343" (all).
Valve Springs:—1⅜" limit of compression.

	Spring Pressure	Spring Length
Valve Closed	40-45 lbs.	1¾"
Valve Open	101-109 lbs.	1 13/32"

Valve Lifters:—Mushroom type. Ream guides to take following oversizes: .001", .008", .030", .060".

VALVE TIMING:—See Camshaft Setting above.
Intake Valves—Open TDC. Close 50° ALDC.
Exhaust Valves—Open 48° BLDC. Close 2° ATDC.
To Check Timing:—Set tappet clearance #1 intake valve at .014". Intake valve should open at top dead center when '0' mark on crankshaft pulley at front of engine lines up with pointer on chain case cover. Reset tappet clearance at .008" (hot).
Motor Gauge—Weidenhoff Adapter #103, Rod #12.

LUBRICATION:—Gear type oil pump on right of engine.
NOTE—Check ignition timing whenever oil pump installed on engine. Tilt engine (with jack under pan) for pump removal.
Normal Oil Pressure:—30-45 lbs. at 30 M.P.H.
Oil Pressure Relief Valve:—Under plug on left side of engine. Operates at 40 lbs. Adjustable. Heavy (green) spring to increase pressure, lighter (red) spring to decrease pressure.
Crankcase Capacity:—5 quarts (refill).

CLUTCH:—Borg & Beck Mod. 10A7. Mod. #899 stamped on cover. Single plate, dry disc type.
See article in Mechanical Equipment Section for data.
Facings—Woven, 2 required. I.D. 6". O.D. 10". Thickness ⅛". *See Chrysler Special Shop Notes.*
Adjustment—Adjust stopscrew (just above clutch pedal shaft) so that pedal arm just clears floor board. Free movement of pedal should be 1 1/16" (adjust by turning release fork rod adjusting nut).
Removal:—Remove floor board, remove transmission (see Transmission Removal below), remove housing underpan, mark cover and flywheel, remove cover bolts evenly, remove assembly from below.

TRANSMISSION:—Own—All helical gear type with synchronizing shift on second and high gears. Warner Mod. AS25-T86 overdrive transmission optl.
See article in Mechanical Equipment Section for data.
Removal:—Disconnect front and rear U-joints, disconnect hand brake, remove nuts from studs at clutch housing, disconnect release fork pull-back spring and rod, pull release fork out of clutch housing, remove transmission cover assembly, remove unit with two pilot studs in upper stud holes.
NOTE—Run-out of clutch housing .003" maximum.

UNIVERSAL JOINTS:—Detroit-Universal. Series 4200. Ball and trunion type with roller bearings. 2 used.
NOTE—Three U-joints used on 7 pass. sedan.
See article in Mechanical Equipment Section for data.
Propeller Shaft Center Bearing:—Used on 7 Pass. models. *See Chrysler Shop Notes for data.*

REAR AXLE:—Own—Semi-floating, hypoid gear type with Hotchkiss drive.
See article in Mechanical Equipment Section for data.
Ratio—4.1-1 (std.). 4.3-1 (with overdrive and 7 pass. sedans).
Backlash—.006-.010". Shim adjustment.
Removal:—Remove axle shaft nut, hub and drum assembly (use hub puller, do not hammer out or bearing damage may result), disconnect brake line at wheel cylinder, remove backing plate (with oil seal). Use shaft puller to remove axle shaft and bearing. With axle shafts removed, differential carrier may be removed by disconnecting rear U-joint at flange and removing housing capscrews.
Wheel Bearing Adjustment—Controlled by shims between brake backing plates and flanged ends of housing. Remove brake backing plates (see above) and add or remove shims (equally on both sides) to give proper clearance. **Endplay**—.003-.008".
NOTE—Shims supplied .010", .0125", .030" thick.

SHOCK ABSORBERS:—Monroe—Direct acting type.
See article in Mechanical Equipment Section for data.

STEERING:—Steering Gear—Gemmer Mod. 300. Worm-and-Roller.
See article in Mechanical Equipment Section for data.
Front Suspension:—Independent, linked parallelogram type with coil springs.
See article in Mechanical Equipment Section for data.
Specifications below apply with no passenger load.
Kingpin Inclination—4¾-6°.
Camber—¼°. Limits minus ¼° to plus ½°.
Caster—1½°. Adjustable.
Toe In—0-⅛". 1/16" preferred. Set long tie rod to 31 7/32" (between ball centers). Adjust short rod for proper toe-in.
Steering Geometry—Outer wheel turned 20°. Inner wheel turned 22°40', 22°50' (7 pass.).

BRAKES:—Service—Lockheed hydraulic, double anchor type. Hand brake at rear of transmission.
See article in Mechanical Equipment Section for data.
Wheel Cylinders—Stepped or two-stage bore type:
Front Wheel—Front cyl. 1¼". Rear 1⅜".
Rear Wheel—Front cyl. 1⅛", Rear 1¼".
Drum Diameter—10".
Lining—Moulded. Width 2". Thickness .200". Length (rear wh.-rear shoe) 7 25/64", (all others) 9 29/32".
Clearance—.012 toe, .006" heel for each shoe.
Braking Power—55% front wheels, 45% rear.
Hand Brake:—On drum at rear of transmission.
Adjustment—Fully release hand brake lever. Remove anchor screw locking wire (left side), adjust anchor screw for .025" clearance between band and drum, set anchor screw with lock wire. Free large adjusting bolt nut (upper end of band), loosen locknut, adjust guide bolt nut to .025" clearance between band and drum, set with locknut. Tighten adjusting bolt nut until tension on either side of guide bolt is just relieved (groove in nut must align with ridge in lockwasher).
Drum Diameter—6".
Lining—Width 2". Thickness 5/32". Length 16 15/16".
NOTE—Clearance at anchor and saddle .005" max.

NOTE:—Engine Hood and Side Panel Removal—See Chrysler Model C16 Engine Note.

ENGINE NUMBER:—First number C-14-1001. Stamped on left side of block between #1 and #2 cylinders. *See Chrysler Special Shop Notes for engine number lettering data.*

ENGINE SPECIFICATIONS:—8 cylinder, 'L' head.
Bore—3¼". **Stroke**—4⅛".
Displacement—273.8 cubic inches.
Rated Horsepower—33.80 (AMA).
Developed Horsepower—110 HP. at 3600 R.P.M.
Compression Ratio & Pressure—As follows:

Ratio	Pressure at 1000 R.P.M.	At 100 R.P.M.
6.7-1 std. head	150-160 lbs.	Approx. 118 lbs.
7.4-1 optl. head	165-175 lbs.	Approx. 125 lbs.

Vacuum Reading—Gauge should show steady reading of 18-21" with engine idling at 6 M.P.H.

PISTONS:—Aluminum alloy, U-slot, cam ground type with anodized finish. **Length**—3⅞".
Weight—16.33 ounces (plus or minus 2 grams).
Removal—Pistons and rods removed from above.
Clearance—Top .022". Skirt .002".
Replacement Pistons:—*See Chrysler Shop Notes.*
Fitting New Pistons:—Check pistons (at right angles to pin bosses at bottom of skirt) and cylinder bore with micrometer gauge. With feeler (.002") inserted between cylinder wall and piston (side opposite slot), pull required to withdraw feeler must be 5-7 pounds.
Installing Pistons:—Slot away from valves.

PISTON RINGS:—Two undercut compression, two oil control rings per piston, all above pin. Lower ring grooves drilled with ten ⅛" oil drain holes (#3), five (#4 groove).

Ring	Width	End Gap	Side Clearance
Compression	⅛"	.007-.015"	.0015-.003"
Oil Control	5/32"	.007-.015"	.0015-.003"

Replacement Rings:—Furnished standard and .003", .005", .010", .015", .020", .025", .030", .040", .050", .060" oversize.

PISTON PIN:—Diameter—55/64. **Length**—2¾".
Floating type. Pin hole in rod bronze bushed.
Pin Fit in Piston—Thumb push fit at 130° F.
Pin Fit in Rod Bushing—Thumb push fit at 70° F.
Replacement Pins:—Furnished standard and .003", .005", .008" oversize. Ream bushing and pin hole to size.

CONNECTING ROD:—Weight—36.8 ounces.
Length—9 3/16".
Crankpin Journal Diameter—2 3/16".
Lower Bearing—Removable steel-backed, babbitt-lined. Furnished standard and .0015", .010" undersize.
Clearance—.001-.003". **Sideplay**—.006-.011".
Bearing Adjustment:—None. Install new bearings with bosses engaging grooves in rods and caps.
Installing Rods:—Lower bearings are offset. Install rods with widest half of bearing toward rear (#1, 3, 5, 7) or toward front (#2, 4, 6, 8). Oil hole in lower bearing must be toward camshaft on all rods.

CRANKSHAFT:—5 bearing. Integral counterweights.
Journal Diameters—2 45/64" all bearings.
Bearing Type—Removable steel-backed, babbitt-lined. Furnished standard and .0015", .010" undersize. **Clearance**—.001-.002".
Bearing Adjustment:—*See Chrysler Shop Notes for Engine Removal (recommended), Adjustment directions, and Replacement Bearing Cap data.*
End Thrust:—Taken by flange faces on rear (#5) bearing. **Endplay**—.003-.007".

CAMSHAFT:—6 bearing. Non-adjustable chain drive.
Journal Diameters—#1, 2 1/16"; #2, 2 1/32"; #3, 2"; #4, 1 31/32"; #5, 1 15/16"; #6, 1⅜".
Bearing Type—Removable steel-backed, babbitt-lined (except #6 machined in crankcase).
Clearance—.0015-.0035".
End Thrust:—Taken between face of removable cast-iron sleeve (carries front bearing) and face of camshaft sprocket. Replace if worn. **Endplay**—.001-.008".
Timing Chain:—Morse. Width 1¼". Pitch .500". Length 24" or 48 links.
Camshaft Setting:—Mesh chain with sprockets turned so that '0' marks are adjacent and in line with a straightedge across the shaft centers.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1 15/32"	.340-.341"	5 5/16"
Exhaust	1 13/32"	.340-.341"	5 5/16"

	Seat Angle	Lift	Stem Clearance
All valves	45°	11/32"	.001-.003"

See Chrysler Special Shop Notes for Exhaust valve seat insert removal and installation instructions.
Tappet Clearance—.006" Int., .010" Exh. (hot). Remove right front wheel and housing to adjust.
Valve Guides:—Must be 13/16" below top of block. Ream guides after installing .342-.343" (all).
Valve Springs:—1½" limit of compression.

	Spring Pressure	Spring Length
Valve Closed	46-50 lbs.	2 1/32"
Valve Open	104-110 lbs.	1 11/16"

Valve Lifters:—Mushroom type. Ream guides to take following oversizes: .001", .008", .030", .060".

VALVE TIMING:—See Camshaft Setting above.
Intake Valves—Open 2° BTDC. Close 44° ALDC.
Exhaust Valves—Open 46° BLDC. Close 4° ATDC.
To Check Timing:—Set tappet clearance #1 intake valve at .011". This valve should open with #1 piston 2° or .0015" BTDC. when 2° line BTDC. on impulse neutralizer at front of engine lines up with pointer on chain case cover. Reset tappet clearance at .006" with engine hot.
Motor Gauge—Weidenhoff Adapter #103, Rod #12.

LUBRICATION:—Gear type oil pump on rt. of engine.
NOTE—To remove oil pump, take out floor boards, loosen engine mountings and tilt engine (jack under oil pan). Check ignition timing whenever oil pump installed on engine.
Normal Oil Pressure:—30-45 lbs. at 30 M.P.H.
Oil Pressure Relief Valve:—Under cap on left side of crankcase. Adjust by turning slotted plug (with cap and locking wire removed) clockwise to increase counter-clockwise to decrease.
Crankcase Capacity:—6 quarts (refill).

CLUTCH:—Borg & Beck Mod. 10A6. Mod. #874 stamped on cover. Single plate, dry disc type.
See article in Mechanical Equipment Section for data.
Facings—Woven, 2 required, I.D. 9⅞". O.D. 6⅛". Thickness ⅛". *See Chrysler Special Shop Notes.*
Adjustment—Adjust stopscrew (just above clutch pedal shaft) so that pedal arm just clears floor board. Free movement of pedal should be 1 1/16" (adjust by turning release fork rod adjusting rod).
Removal:—Remove floor board, remove transmission (see Transmission Removal below), remove housing underpan, mark cover and flywheel, remove cover bolts evenly, remove assembly from below.

TRANSMISSION:—Own—All helical gear type with synchronizing shift on second and high gears. Warner Model AS25-T86 overdrive transmission optional.
See article in Mechanical Equipment Section for data.
Removal:—Disconnect front and rear U-joints, disconnect hand brake, remove nuts from studs at clutch housing, disconnect release fork pull-back spring and rod, pull release fork out of clutch housing, remove trans. cover assembly, remove unit with two pilot studs in upper stud holes.
NOTE—Run-out of clutch housing .003" maximum.

UNIVERSAL JOINTS:—Detroit Universal. Series 5150. Cross type with roller bearings. 2 used.
See article in Mechanical Equipment Section for data.

REAR AXLE (C-14, C-15):—Own—Semi-floating, hypoid gear type with Hotchkiss drive.
See article in Mechanical Equipment Section for data.
Ratio (C-14)—4.1-1 (sedans), 3.91-1 (coupes), 4.3-1 (with overdrive).
Ratio (C-15)—4.55-1.
Backlash—.006-.010". Shim adjustment.
Removal:—Remove axle shaft nut, hub and drum assembly (use hub puller, do not hammer out or bearing damage may result), disconnect brake line at wheel cylinder, remove backing plates with oil seal). Use shaft puller to remove axle shaft and bearing. With axle shafts removed, differential carrier may be removed by disconnecting rear U-joint at flange and removing housing capscrews.
Wheel Bearing Adjustment—Controlled by shims between brake backing plates and flanged ends of housing. Remove brake backing plates (see above) and add or remove shims (equally on both sides) to give proper clearance. **Endplay**—.003-.008".
NOTE—Shims supplied .010", .0125", .030" thick.

SHOCK ABSORBERS:—Monroe—Direct acting type.
See article in Mechanical Equipment Section for data.

STEERING (C-14, C-15):—Steering Gear—Gemmer Models 330 (C-14), 370 (C-15).
See article in Mechanical Equipment Section for data.
Front Suspension (C-14, C-15):—Independent, linked parallelogram type with coil springs.
See article in Mechanical Equipment Section for data.
Specifications below apply with no passenger load.
Kingpin Inclination—4¾-6°.
Camber—¼°. Limits minus ¼° to plus ½°.
Caster—1½° (C-14). 2° (C-15). Adjustable.
Toe In—0-⅛". 1/16" preferred. **C-14**—Adjust short tie rod (long rod 30 15/16" non-adjustable). **C-15**—Adjust tie rods equally in usual manner.
Steering Geometry—Outer wheel turned 20°. Inner wheel turned 22°0' (C-14), 22°15' (C-15).

BRAKES (C-14, C-15):—Service—Lockheed hydraulic, double anchor type. Hand lever applies brake at rear of transmission.
See article in Mechanical Equipment Section for data.
Wheel Cylinders—Stepped or two-stage bore type:
Front Wheel—Front cyl. 1¼", Rear 1⅜".
Rear Wheel—Front cyl. 1⅛", Rear 1¼".
Drum Diameter—11" (C-14), 13" (C-15).
Lining—Moulded. Width 2". Thickness .200" (C-14), .262" (C-15). Length 22 5/32" (C-14), 24 27/32" (C-15).
Clearance—.012" toe, .006" heel, for each shoe.
Braking Power—55% front wheels, 45% rear.
Hand Brake:—On drum at rear of transmission.
Adjustment—Fully release hand brake lever. Remove anchor screw locking wire (left side), adjust anchor screw for .025" clearance between band and drum, set anchor screw with lock wire. Free large adjusting bolt nut (upper end of band), loosen locknut, adjust guide bolt nut to .025" clearance between band and drum, set with locknut. Tighten adjusting bolt nut until tension on either side of guide bolt is just relieved (groove in nut must align with ridge in lockwasher).
Drum Diamter—6" (C-14), 7" (C-15).
Lining—Width 2". Thickness 5/32" (C-14), 3/16" (C-15). Length 16 15/16" (C-14), 21½" (C-15).
NOTE—Clearance at anchor and saddle .005" max.

NOTE:—C-15 Oil Pan Removal. With steering wheel in extreme left position and #1 piston half way down on stroke, pan may be removed or installed.

C-15 Hood Side Panel Removal—See Chrysler C-16 Engine Note.

ENGINE NUMBER:—First number (C-15) C-15-1001. Stamped on left side of block between #1 and #2 cylinders. (C-17) C-17-1001. Stamped on boss back of water pump.

See Chrysler Special Shop Notes for engine number lettering data.

ENGINE SPECIFICATIONS:—8 cylinder, 'L' head.
Bore—3¼". **Stroke**—4⅞".
Piston Displacement—323.5 cubic inches.
Rated Horsepower—33.80 (AMA).
Developed Horsepower—130 at 3400 R.P.M.
Compression Ratio & Pressure—As follows:

Ratio	Pressure at 1000 R.P.M.	At 100 R.P.M.
6.50-1 std. head	145-155 lbs.	Approx. 117 lbs.
7.45-1 optl. head	160-170 lbs.	Approx. 124 lbs.

Vacuum Reading—18-21" steady at 6 M.P.H.

PISTONS:—Aluminum alloy, U-slot, cam ground type with anodized finish. **Length**—3⅞".
Weight—16.33 ounces (plus or minus 2 grams).
Removal—Pistons and rods removed from above.
Clearance—Top .022". Skirt .002".
Replacement Pistons:—*See Chrysler Special Shop Notes.*
Fitting New Pistons:—Check pistons (at right angles to pin bosses at bottom of skirt) and cylinder bore with micrometer gauge. With feeler (.002") inserted between cylinder wall and piston (side opposite slot), pull to withdraw feeler 5-7 lbs.
Installing Pistons:—Slot away from valves.

PISTON RINGS:—Two undercut compression, two oil control rings per piston, all above pin. Lower ring grooves drilled with ten ⅛" oil drain holes (#3), five (#4 groove).

Ring	Width	End Gap	Side Clearance
Compression	⅛"	.007-.015"	.0015-.003"
Oil Control	5/32"	.007-.015"	.0015-.003"

Replacement Rings:—Furnished standard and .003", .005", .010", .015", .020", .025", .030", .040", .050", .060" oversize.

PISTON PIN:—Diameter—55/64". **Length**—2¾".
Floating type. Pin hole in rod bronze bushed.
Pin Fit in Piston—Thumb push fit at 130° F.
Pin Fit in Rod Bushing—Thumb push fit at 70° F.
Replacement Pins:—Furnished standard and .003", .005", .008" oversize. Ream bushing and pin hole.

CONNECTING ROD:—Weight 36.1 ozs. **Length** 9".
Crankpin Journal Diameter—2 3/16".
Lower Bearing—Removable steel-backed, babbitt-lined. Furnished standard and .0015", .010 undersize.
Clearance—.001-.003". **Sideplay**—.006-.011".
Bearing Adjustment:—None. Install new bearings with bosses engaging grooves in rods and caps.
Installing Rods:—Lower bearings are offset. Install rods with widest half of bearing toward rear (#1, 3, 5, 7) or toward front (#2, 4, 6, 8). Oil hole in lower bearing must be toward camshaft on all rods.

CRANKSHAFT:—5 bearing. Integral counterweights.
Journal Diameters—2 45/64" all bearings.
Bearing Type—Removable steel-backed, babbitt-lined. **Clearance**—.001-.002".
Bearing Adjustment:—*See Chrysler Shop Notes for Engine Removal (recommended), Adjustment directions, Replacement Bearings & Bearing Cap data.*
End Thrust:—Taken by flange faces on rear (#5) bearing. **Endplay**—.003-.007".

CAMSHAFT:—6 bearing. Non-adjustable chain drive.
Journal Diameters—#1, 2 1/16"; #2, 2 1/32"; #3, 2"; #4, 1 31/32"; #5, 1 15/16"; #6, 1⅜".
Bearing Type—Removable steel-backed, babbitt-lined (except #6 machined in crankcase).
Clearance—.0015-.0035".
End Thrust:—Taken between face of removable cast-iron sleeve (carries front bearing) and face of camshaft sprocket. Replace if worn. **Endplay**—.001-.008"
Timing Chain—Morse. Width 1¼". Pitch .500". Length 24" or 48 links.
Camshaft Setting:—Mesh chain with sprockets turned so that '0' marks are adjacent and in line with a straightedge across the shaft centers.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1 15/32"	.340-.341"	5 5/16"
Exhaust	1 13/32"	.340-.341"	5 5/16"

	Seat Angle	Lift	Stem Clearance
All valves	45°	11/32"	.001-.003"

See Chrysler Special Shop Notes for Exhaust valve seat insert removal and installation instructions.
Tappet Clearance—.006" Int., .010" Exh. (hot). Remove right front wheel & housing to adjust.
Valve Guides:—Must be 13/16" below top of block. Ream guides after installing .342-.343" (all).
Valve Springs:—1½" limit of compression.

	Spring Pressure	Spring Length
Valve Closed	46-50 lbs.	2 1/32"
Valve Open	104-110 lbs.	1 11/16"

Valve Lifters:—Mushroom type. Ream guides to take following oversizes: .001", .008", .030", .060".

VALVE TIMING:—See Camshaft Setting above.
Intake Valves—Open 2° BTDC. Close 44° ALDC.
Exhaust Valves—Open 46° BLDC. Close 4° ATDC.
To Check Timing:—Set tappet clearance #1 intake valve at .011". This valve should open with #1 piston 2° or .002" BTDC. when 2° line BTDC. on impulse neutralizer at front of engine lines up with pointer on chain case cover. Reset tappet cl. .006" (hot).
Motor Gauge—Weidenhoff Adapter #103, Rod #12.

LUBRICATION:—Gear type oil pump on right of engine.
NOTE—Check ignition timing whenever oil pump removed. On C-15 oil pump removal as follows: take out floor boards, loosen engine mountings and tilt engine (jack under oil pan).
Normal Oil Pressure:—30-45 lbs. at 30 M.P.H.
Oil Pressure Relief Valve:—Under cap on left side of crankcase. Adjust by turning slotted plug (with cap and locking wire removed) clockwise to increase pressure, counter-clockwise to decrease.
Crankcase Capacity:—6 quarts (refill).

CLUTCH:—Borg & Beck Model 11A6. Model #871 stamped on cover. Single plate, dry disc type.
See article in Mechanical Equipment Section for data.
Facings—Woven, 2 required. I.D. 6⅛", O.D. 11". Thickness ⅛". *See Chrysler Special Shop Notes.*
Adjustment—Adjust pedal stopscrew so that pedal arm just clears floor board. Free movement of pedal should be 1 1/16". Adjust by turning release fork rod adjusting nut (C-15) or pedal shaft collar adjusting nut on (C-17), at right of brake pedal stopscrew.
Removal:—Remove floor board, transmission, see Transmission Removal below), remove housing underpan, mark cover and flywheel, remove cover bolts evenly, remove assembly from below.

TRANSMISSION:—Own—All helical gear type with synchronizing shift on second and high gears. Warner Model AS15-T85 overdrive standard on C-17, optional on C-15.
See article in Mechanical Equipment Section for data.
Removal:—Disconnect front and rear U-joints, disconnect hand brake, remove nuts from studs at clutch housing, disconnect release fork pull-back spring and release rod, remove transmission cover assembly, remove unit with two pilot studs in upper stud holes.

UNIVERSAL JOINTS:—Detroit Universal—Series 5350. Cross type with roller bearings.
See article in Mechanical Equipment Section for data.

REAR AXLE (C-15):—See C-14 previous page for data.

REAR AXLE (C-17):—Own—Semi-floating, spiral bevel gear type with Hotchkiss drive.
See article in Mechanical Equipment Section for data.
Ratio 4.3-1. **Backlash** .006-.010". Shim adjustment.
Removal:—Remove axle shaft nut, hub and assembly (use hub puller, do not hammer out or bearing damage may result), disconnect brake line at wheel cylinder, remove backing plate (with oil seal). Use shaft puller to remove axle shaft and bearing. With axle shafts removed, differential carrier may be removed by disconnecting rear U-joint at flange and removing housing capscrews.
Wheel Bearing Adjustment—Controlled by shims between inner bearing outer race and flanged end of housing. Remove axle shafts and bearings. Add or remove shims (equally on both sides).
Endplay—.0025-.005".
NOTE—Shims supplied .010", .0125", .030" thick.

SHOCK ABSORBERS:—(C-15) Monroe. Direct acting type. **(C-17) Delco.** Double acting type.
See article in Mechanical Equipment Section for data.

STEERING:—Steering Gear—Gemmer Model 370. Worm-and-Roller.
See article in Mechanical Equipment Section for data.

Front Suspension (C-15):—See previous page on Model C-14 for specifications.

Front Suspension (C-17):—Conventional tubular section front axle with Reverse-Elliott ends and semi-elliptic springs.
Kingpin Inclination—4½-5½° crosswise.
Caster—2° plus or minus 1°. Adjust by inserting wedge shims between spring and axle pad on axle. Shims or angle plates furnished ½, 2°.
Camber—½° plus or minus ¼°. No adjustment. Manufacturer recommends that no attempt be made to correct camber by bending tubular axle.
Toe In—0-⅛". 1/16" preferred. Adjust by changing length of tie rod.
Steering Geometry—Outer wheel turned 20°. Inner wheel turned 22°10'.

BRAKES (C-15):—See C-14 previous page for data.

BRAKES (C-17):—Service—Lockheed hydraulic, double anchor type with Bendix Vacuum Power unit. Hand lever applies brake at rear of transmission.
See article in Mechanical Equipment Section for data.
Wheel Cylinders—Stepped or two-stage bore type: Front wheel: Front cyl. 1¼", Rear 1⅜".
Rear wheel: Front cyl. 1", Rear 1⅛".
Drum Diameter—13".
Lining—Moulded type. Width 2". Thickness ¼". Length 24 27/32" per wheel.
Clearance—.012" toe, .006" heel for each shoe.
Braking Power—60% front wheels, 40% rear.
Hand Brake:—External at rear of transmission.
Adjustment—With lever in released position remove anchor screw locking wire, turn anchor screw so that clearance between lining and drum is .025", lock anchor screw with wire. Back off adjusting bolt nut until free. Adjust bracket bolt nuts for each end of brake band to .025" clearance (as above), secure with locknuts. Finally tighten adjusting bolt nut until tension on bracket bolt nuts is just relieved at either end.
Drum Diameter—7".
Lining—Woven type. Width 2½". Thickness 3/16". Length 21⅝".
NOTE—Clearance at anchor & saddle .005" max.
Power Brake Unit:—Bendix Internal Valve type. See article in Brake Section.

SERIAL NUMBER:—First number 7,532,801 (Detroit), 9,709,266 (Canada). On right front door hinge post.
ENGINE NUMBER:—First number C-18-1001. Stamped on left side of block between #1 and #2 cylinders.
See Chrysler Shop Notes for engine number lettering ('Special Standard' bore and bearing sizes).
ENGINE SPECIFICATIONS:—6 cylinder, 'L' head.
Bore—3⅜". **Stroke**—4½".
Displacement—241.5 cubic inches.
Rated Horsepower—27.34 (A.M.A.).
Developed Horsepower—95 HP. (Std. 6.2-1 head), 102 HP. (Optl. 7.0-1 head) at 3600 R.P.M.
Compression Ratio and Pressure—As follows:

Ratio	Pressure at 1000 RPM.	At100 RPM.
6.2-1 Std. C.I. hd.	140-150 lbs.	Approx. 115 lbs.
7.0-1 Optl. Al. hd.	155-165 lbs.	Approx. 120 lbs.

Vacuum Reading—Gauge should show steady reading of 18-21" with engine idling at 6 M.P.H.
PISTONS:—Aluminum alloy, U-slot, cam ground type with anodized finish. **Length**—3⅞".
Weight—17.45 ozs. (plus or minus 2 grams).
Removal—Pistons and rods removed from above.
Clearance—Top .022". See Fitting New Pistons.
Replacement Pistons:—*See Chrysler Shop Notes.*
Fitting New Pistons:—Check piston size with micrometer across large diameter at bottom of skirt. Insert .002" feeler between cylinder wall and piston (pin removed) on side opposite slot. With piston and block at 70°F. pull to withdraw feeler must be 5-7 lbs.
Installing Pistons:—Slot away from camshaft.
PISTON RINGS:—2 undercut compression, 2 slotted oil rings per piston, all above pin.

Ring	Width	End Gap	Side Clearance
Compression	⅛"	.007-.015"	.002-.0035"
Oil	5/32"	.007-.015"	.0015-.003"

Replacement Rings:—Furnished std. and .003", .005", .010", .015", .020", .025", .030", .040", .050", .060" oversize.
PISTON PIN:—Diameter—55/64". **Length**—2⅞".
Floating type. Pin hole in rod bronze bushed.
Pin Fit in Piston—Thumb push fit with piston heated to 130°F.
Pin Fit in Rod Bushing—Thumb push fit at 70°F.
Replacement Pins:—Furnished std., and .003", .005", .008" oversize. Ream bushing and pin hole to size.
CONNECTING ROD:—Weight 31.70 ozs. **Length** 7⅞".
Crankpin Journal Diameter—2⅛".
Lower Bearing—Removable steel-backed, babbitt-lined. Furnished std. and .002", .010", .012" undersize.
Clearance—.0005-.0025". **Sideplay**—.0055-.0115".
Bearing Adjustment:—None. Install new bearings with bosses engaging grooves in rod and cap.
Installing Rods:—Oil spit hole toward camshaft.
CRANKSHAFT:—4 bearing, 9 counterweights (center bolted). Impulse neutralizer mounted on front end.
Journal Diameters—2½" all bearings.
Bearing Type—Steel-backed, babbitt-lined type.
Clearance—.001-.002".
Bearing Adjustment:—*See Chrysler Shop Notes for Engine Removal (recommended), Front Main Bearing Cap Removal, Adjustment directions, and Replacement Bearings and Bearing Caps, Crankshaft Oil Seals.*
End Thrust:—Taken by flange faces on rear (#4) main bearing. **Endplay**—.003-.007".
CAMSHAFT:—4 bearing. Non-adjustable chain drive.
Journal Diameters—#1, 2"; #2, 1 31/32"; #3, 1 15/16"; #4, 1¼".
Bearing Type—Removable steel-backed, babbitt-lined bushings (except #4 machined in block).
Clearance—.001-.003" (#1), .0015-.0035" (all others).
NOTE—Replacement bushings finish reamed.
End Thrust:—Taken by thrust plate behind camshaft sprocket hub. **Endplay**—.002-.006".
Timing Chain:—Morse #1866 (restricted bend). Width 1". Pitch .500". Length 24" or 48 links.
See Chrysler Special Shop Notes for front end removal for work on timing chain.
Camshaft Setting:—Mesh chain with sprockets turned so that '0' marks are adjacent and in line with a straightedge across shaft centers.
VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1 21/32"	.340-.341"	4 25/32"
Exhaust	1 17/32"	.340-.341"	4 25/32"

	Seat Angle	Lift	Stem Clearance
All valves	45°	11/32"	.001-.003"

Tappet Clearance—.008" Intake, .010" Exhaust (hot). .012" Exh. setting recommended for sustained high speed driving. Valves excessible by removing right front wheel and fender panel.
NOTE—Self-locking tappet screws used.
See Chrysler Special Shop Notes for Exhaust Valve seat insert removal and installation.
Valve Guides:—Install with taper end up to ⅞" below top of block, then ream to .342-.343".
Valve Springs:—Free length approx. 2". Limit of compression 1⅜".

	Spring Pressure	Spring Length
Valve Closed	40-45 lbs.	1¾"
Valve Open	101-109 lbs.	1 13/32"

Valve Lifters:—Mushroom type. Ream guides from above for following oversizes: .001", .008", .030", .060".
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 8° BTDC. Close 42° ALDC.
Exhaust Valves—Open 48° BLDC. Close 2° ATDC.
To Check Timing—Set tappet clearance #1 intake valve at .014". This valve should open with piston 8° (.0281") before top dead center with 8° BTDC. mark on impulse neutralizer at front of engine lined up with pointer on chain case cover. Reset tappet clearance at .008" (hot).
Motor Gauge—Weldenhoff Adapter #103, Rod #12.
LUBRICATION:—Gear type oil pump, right of engine.
See Chrysler Special Shop Notes for oil pump removal and installation instructions.
Normal Oil Pressure:—30-45 lbs. at 30 M.P.H.
Oil Pressure Relief Valve:—Under plug on left side of engine. Operates at 40 lbs. Adjustable. Change to heavy (green) spring to increase pressure, light (red) spring to decrease.
Crankcase Capacity:—5 quarts (refill).
COOLING SYSTEM:—Water Pump. Centrifugal, belt-driven, packless type.
See article in Mechanical Equipment Section for data.
Removal—With water drained and fan belt removed, remove fan blades and pulley (attached by 4 capscrews), disconnect pump hoses, remove nuts from pump mounting studs and lift assembly out.
Thermostat:—Fulton. In water outlet on head.
NOTE—Install thermostat with bellows down.
Setting—Start to open 150-155°F. Fully open 176°F.
Water Capacity:—20 quarts.
Drain Valves:—At lower left corner of radiator and on left side of block in front of distributor.
CLUTCH:—Borg & Beck Model 10A7, 11A6 (Taxi). Model #913, 917 (Taxi) stamped on cover. Single plate, dry disc type with new spiral groove type facings and clutch pressure plate oil baffle.
See article in Mechanical Equipment Section for data.
Facings—Molded-woven (spiral grooved), 2 required. Thickness ⅛". Inside diameter 6", 6½" (Taxi). Outside diameter 10", 11" (Taxi).
Adjustment—Adjust stopscrew (to rear of pedal) so that pedal arm just clears floor board. Pedal free movement must be 1". Adjusting nut on fork rod next to release fork.
Removal:—Remove floor board, release fork pull-back spring, free clevis pin on release fork rod. Remove transmission (see Transmission Removal below), remove housing underpan, mark cover and flywheel, remove cover bolts, take out assembly from below.
TRANSMISSION:—Own make. All helical gear type with synchro-mesh for second and high speeds. Warner Mod. AS1-T86A overdrive transmission optl.
See article in Mechanical Equipment Section for data.
Removal:—Remove floor boards, propeller shaft (see Propeller Shaft Center Bearing below for 7 pass. models), disconnect hand brake cable (remove brake band on cars with overdrive). Remove two front cover screws, take off nuts on mounting studs (remove two upper mounting studs by installing 2 nuts on outer end of stud and turning studs out), install two pilot studs and withdraw transmission.
UNIVERSAL JOINTS:—Detroit-Universal. Series 4200. Ball and trunnion type with roller bearings. 2 used.
NOTE—Three universals used on 7-pass. sedan.
See article in Mechanical Equipment Section for data.
Propeller Shaft Center Bearing:—Used on 7 passenger sedans. *See Chrysler Shop Notes for data.*
REAR AXLE:—Own make. Semi-floating, hypoid gear type with Hotchkiss drive.
See article in Mechanical Equipment Section for data.
Ratio—Standard 4.1-1 (Sedans), 3.9-1 (Coupes), 4.3-1 (7 pass. sedan—all cars with overdrive).
Backlash—.006-.010". Screw adjustment.
Removal:—Remove wheel, hub, and drum assembly (using screw type hub puller). Place block under brake pedal, disconnect brake line, remove backing plate and oil seal, pull axle shaft and bearing (Tool C-158). With shafts removed, carrier may be removed by disconnecting rear universal at flange, and removing housing capscrews.
Wheel Bearing Adjustment—Controlled by shims at flanged ends of axle housing. With wheel and hub removed measure endplay with dial indicator. To adjust remove backing plate (see above) and add or remove shims (equally at both sides) to proper clearance. **Endplay**—.003-.008".
NOTE—Shims supplied .010", .015", .030" thick.
SHOCK ABSORBERS:—Monroe—Front #676739, Rear #682604. Direct acting, hydraulic type.
NOTE—Delco Direct acting used for export.
See article in Mechanical Equipment Section for data.
STEERING:—Steering Gear—Gemmer Model 305 Worm-and-Roller type with 'Push-Pull' adjustment.
See article in Mechanical Equipment Section for data.
Front Suspension:—Independent, linked parallelogram type with coil springs.
See article in Mechanical Equipment Section for data.
Specifications below apply with no passenger load.
Kingpin Inclination—4¾-6°.
Camber—Plus ¼°. Limits minus ¼° to plus ½°.
Toe In—1/16" (0-⅛"). Set long tie rod to 31⅝" (between ball centers). Adjust short rod.
Steering Geometry—Outer wheel 20°. Inner wheel 22°40', 22°50' (7 passenger sedans).
BRAKES:—Service—Lockheed hydraulic, double anchor type. Hand brake at rear of transmission.
See article in Mechanical Equipment Section for data.
Wheel Cylinders—Stepped or two-stage bore type:
Front Wheel—Front cylinder 1¼". Rear 1⅜".
Rear Wheel—Front cylinder 1⅛", Rear 1¼".
Drum—Centrifuse. Diameter—11".
Lining—Moulded. Width 2". Thickness 13/64". Length (front shoe) 11 15/32", (rear shoe) 7 31/32".
Clearance—.012" toe, .006" heel for each shoe.
Braking Power—55% front, 45% rear.
Hand Brake:—External at rear of transmission.
Adjustment—*See Chrysler Special Shop Notes.*
Drum—Cast-Iron. Diameter—6".
Lining—Width 2". Thick. 5/32". Length 17 1/16".

SERIAL NUMBER:—First number 6,734,001. Stamped on plate on right front door hinge pillar post.

ENGINE NUMBER:—First number C-19-1001. Stamped on left side of block between #2 and #3 cylinders. *See Chrysler Special Shop Notes for engine number lettering data.*

ENGINE SPECIFICATIONS:—8 cylinder, 'L' head.
Bore—3¼". **Stroke**—4½".
Displacement—298.6 cubic inches.
Rated Horsepower—33.80 (A.M.A.).
Developed Horsepower—110 HP. (std. 6.2-1 hd.), 115 HP. (optl. 6.5-1 hd.) 122 HP. (optl. 7.4-1 hd.). at 3400 R.P.M.
Compression Ratio and Pressure—As follows:

Ratio	Pressure at 1000 RPM	At 100 RPM
6.2-1 std. C.I. hd.	140-150 lbs.	Approx. 115 lbs.
6.5-1 optl. AL. hd.	150-160 lbs.	Approx. 117 lbs.
7.4-1 optl. AL. hd.	160-170 lbs.	Approx. 124 lbs.

Vacuum Reading—Steady 18-21" idling at 6 MPH.

PISTONS:—Aluminum alloy, U-slot, cam ground type with anodized finish. **Length**—3⅞".
Weight—16.33 ozs. (plus or minus 2 grams).
Removal—Pistons and rods removed from above.
Clearance—Top .021". See Fitting New Pistons.
Replacement Pistons:—*See Chrysler Special Shop Notes.*
Fitting New Pistons:—Check piston size with micrometer at right angles to pin bosses at bottom of skirt. Insert .002" feeler between cylinder wall and piston on side opposite slot. With piston and block at 70°F. pull to withdraw feeler 5-7 lbs.
Installing Pistons:—Slot away from camshaft.

PISTON RINGS:—2 undercut compression, 2 slotted oil rings per piston, above pin.

Ring	Width	End Gap	Side Clearance
Comp. (#1)	⅛"	.007-.015"	.002-.0035"
Comp. (#2)	⅛"	.007-.015"	.0015-.003"
Oil	5/32"	.007-.015"	.0015-.003"

Replacement Rings:—Furnished .003", .005", .010", .015", .020", .025", .030", .040", .050", .060" oversize.

PISTON PIN:—**Diameter**—55/64". **Length**—2¾".
Floating type. Pin hole in rod bronze bushed.
Pin Fit in Piston—Thumb push fit with piston heated to 130°F.
Pin Fit in Rod Bushing—Thumb push fit at 70°F.
Replacement Pins:—Furnished std. and .003", .005", .008" oversize. Ream bushing and pin hole to size.

CONNECTING ROD:—**Weight** 35.38 ozs. **Length** 9 3/16".
Crankpin Journal Diameter—2 3/16".
Lower Bearing—Removable steel-backed, babbitt-lined. Furnished .002", .010", .012" undersize.
Clearance—.0005-.0025". **Sideplay**—.005-.0115".
Bearing Adjustment:—None. Install new bearings with bosses engaging grooves in rods and caps.
Installing Rods:—Install rods with widest half of bearing toward rear (#1, 3, 5, 7), toward front (#2, 4, 6, 8). Oil spit hole toward camshaft.

CRANKSHAFT:—5 bearing, 8 counterweights, with impulse neutralizer mounted on forward end.
Journal Diameters—2 45/64" all bearings.
Bearing Type—Steel-backed, babbitt-lined type.
Clearance—.001-.002".
Bearing Adjustment:—*See Chrysler Shop Notes for Engine Removal (recommended), Adjustment directions, Replacement Bearings and Bearing Caps, Crankshaft Oil Seals.*
End Thrust:—Taken by flange faces on rear (#5) bearing. **Endplay**—.003-.007".

CAMSHAFT:—6 bearing. Non-adjustable chain drive.
Journal Diameters—#1, 2 1/16"; #2, 2 1/32"; #3, 2"; #4, 1 31/32"; #5, 1 15/16"; #6, 1⅜".
Bearing Type—Removable steel-backed, babbitt-lined bushings (except #6 machined in crankcase).
Clearance—.001-.003" (#1), .0015-.0035" (all others).
End Thrust:—Taken between face of removable cast-iron sleeve (carries front bearing) and face of camshaft sprocket. Replace if worn. **Endplay**—.001-.008".
Timing Chain:—Morse #1866 (restricted bend). Width 1¼". Pitch .500". Length 47 links or 23½". NOTE—Whitney #CLG-205 optional (same specifications). *See Chrysler Special Shop Notes for front end removal for work on timing chain.*
Camshaft Setting:—Mesh chain with sprockets turned so that '0' marks are adjacent and in line with a straightedge across the shaft centers.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1 15/32"	.340-.341"	5½"
Exhaust	1 13/32"	.340-.341"	5½"

	Seat Angle	Lift	Stem Clearance
All valves	45°	11/32"	.001-.003"

See Chrysler Special Shop Notes for Exhaust Valve seat insert removal and installation.
Tappet Clearance—.006" Intake, .010" Exhaust (hot). .012" Exh. setting recommended for sustained high speed driving. Valves accessible by removing right front wheel and fender panel.
NOTE—Self-locking tappet screws used.
Valve Guides:—Install with taper end up 13/16" below top of block, then ream to .342-.343".
Valve Springs:—Constant pitch type. Free length approx. 2 19/64". Limit of compression 1 29/64".

	Spring Pressure	Spring Length
Valve Closed	52-58 lbs.	2 1/32"
Valve Open	122-130 lbs.	1 11/16"

Valve Lifters:—Mushroom type. Ream guides from above for following oversizes: .001", .008", .030", .060".
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 2° BTDC. Close 44° ALDC.
Exhaust Valves—Open 46° BLDC. Close 4° ATDC.
To Check Timing—Set tappet clearance #1 intake valve at .011". This valve should open with #1 piston 2° (.0017") before top dead center with 2° line BTDC. on impulse neutralizer at front of engine lined up with pointer on chain case cover. Reset tappet clearance at .006" (hot).
Motor Gauge—Weidenhoff Adapter #103, Rod #12.

LUBRICATION:—Gear type oil pump, right of engine. *See Chrysler Special Shop Notes for oil pump removal and installation instructions.*
Normal Oil Pressure:—30-45 lbs. at 30 M.P.H.
Oil Pressure Relief Valve:—Under cap on left side of engine. Adjust by turning slotted plug (with cap and lock wire removed) clockwise to increase pressure, counter-clockwise to decrease pressure.
Crankcase Capacity:—6 quarts (refill).

COOLING SYSTEM:—**Water Pump**—Centrifugal, belt-driven, packless type.
See article in Mechanical Equipment Section.
Removal—With water drained and fan belt removed, remove fan blades and pulley (attached by 4 capscrews), disconnect pump hoses, remove nuts from pump mounting studs and lift assembly out.
Thermostat:—Fulton. In water outlet on cyl. head.
NOTE—Install thermostat with bellows down.
Setting—Start to open 150-155°F. Fully open 176°F.
Water Capacity:—20 quarts.
Drain Valves:—At lower left corner of radiator and on left side of block in front of distributor.

CLUTCH:—**Borg & Beck Model 11A6.** Model #916 stamped on cover. New clutch pressure plate oil baffle and spiral grooved type facings used.
See article in Mechanical Equipment Section for data.
Facings—Molded-woven (spiral grooved) type, 2 required. Inside Diam. 6½". Outside Diam. 11". Thickness ⅛".
Adjustment—Adjust stopscrew (to rear of pedal) so that pedal arm just clears floor board. Pedal free movement must be 1". Adjusting nut on fork rod next to release fork.
Removal:—Remove floor board, release fork pull-back spring, free clevis pin on release fork rod. Remove transmission (see Transmission Removal below), remove housing underpan, mark cover and flywheel, remove cover bolts, lower assembly out.

TRANSMISSION:—**Own make**—All helical gear type with synchro-mesh for second and high speeds. Warner Mod. AS2-T85A overdrive transmission optl.
See article in Mechanical Equipment Section for data.
Removal:—Remove floor boards, propeller shaft, disconnect hand brake cable (remove brake band and drum on cars with overdrive). Place jack under engine, remove engine rear supports. Remove two front cover screws, nuts on mounting studs, install two pilot studs and withdraw transmission.

UNIVERSAL JOINTS:—**Detroit Universal.** Series 4400. Ball and trunnion type with roller bearings. 2 used. NOTE—Design identical with 4200 except larger.
See article in Mechanical Equipment Section.

REAR AXLE:—**Own make.** Semi-floating, hypoid gear type with Hotchkiss drive.
See article in Mechanical Equipment Section for data.
Ratio—3.91-1 (std.). 4.3-1 (with overdrive).
Backlash—.006-.010". Screw adjustment.
Removal:—Remove wheel, hub, and drum assembly (use screw type hub puller). Place block under brake pedal, disconnect brake line, remove backing plate and oil seal, pull axle shaft and bearing (Tool C-158). With shafts removed, carrier may be removed by disconnecting rear universal at flange and removing housing capscrews.
Wheel Bearing Adjustment—Controlled by shims at flanged ends of axle housing. With wheel and hub removed measure endplay with dial indicator. To adjust, remove backing plate (see above) and add or remove shims (equally at both sides) to proper clearance. **Endplay**—.003-.008".
NOTE—Shims supplied .010", .015", .030" thick.

SHOCK ABSORBERS:—**Monroe**—Front #683091. Rear #682604. Direct acting hydraulic type.
See article in Mechanical Equipment Section.

STEERING:—**Steering Gear**—Gemmer Mod. 335 Worm-and-Roller type with 'Push-pull' adjustment.
See article in Mechanical Equipment Section for data.
Front Suspension:—Independent, linked parallelogram type with coil springs.
See article in Mechanical Equipment Section for data.
Specifications below apply with no passenger load.
Kingpin Inclination—4¾-6° crosswise.
Camber—Plus ¼°. Limits minus ¼° to plus ½°.
Caster—Limits ½-2½°.
Toe In—1/16" (0-⅛"). Set long tie rod to 30 25/32" (between ball centers). Adjust short rod.
Steering Geometry—Outer wheel turned 20°. Inner wheel 22°0'.

BRAKES:—**Service**—Lockheed hydraulic, double anchor type. Hand brake at rear of transmission.
See article in Mechanical Equipment Section for data.
Wheel Cylinders—Stepped or two-stage bore type: Front wheel—Front cylinder 1¼". Rear 1⅜". Rear Wheel—Front cylinder 1⅛". Rear 1¼".
Drum—Centrifuse. Diameter—12".
Lining—Moulded. Width 2". Thickness 13/64". Length per shoe 12 9/16".
Clearance—.012" toe, .006" heel, for each shoe.
Braking Power—55% front, 45% rear.
Hand Brake:—External at rear of transmission.
Adjustment:—*See Chrysler Shop Notes.*
Drum—Cast-iron. Diameter—6".
Lining—Width 2". Thick. 5/32". Length 17 1/16".

SERIAL NUMBER:—First number 7,850,501. On plate on right front door hinge pillar post.

ENGINE NUMBER:—First number C-20-1001. Stamped on left side of block between #2 and #3 cylinders. *See Chrysler Special Shop Notes for engine number lettering data.*

ENGINE SPECIFICATIONS:—8 cylinder, 'L' head.
Bore—3¼". **Stroke**—4⅞".
Displacement—323.5 cu. ins. **Rated HP.**—33.80.
Developed Horsepower—130 (Std. 6.5-1 hd), 138 (Optl. 7.45-1 hd.) at 3400 R.P.M.
Compression Ratio and Pressure—As follows:

Ratio	Pressure at 1000 RPM	At 100 RPM
6.5-1 std. head	150-160 lbs.	Approx. 118 lbs.
7.45-1 optl. head	160-170 lbs.	Approx. 124 lbs.

Vacuum Reading—18-21" steady at 6 M.P.H.

PISTONS:—Aluminum alloy, U-slot, cam ground type with anodized finish. **Length**—3⅞".
Weight—16.33 ozs. (plus or minus 2 grams).
Removal—Pistons and rods removed from above.
Clearance—Top .021". See Fitting New Pistons.
Replacement Pistons:—*See Chrysler Special Shop Notes.*
Fitting New Pistons:—Check piston size with micrometer at right angles to pin bosses at bottom of skirt. Insert .002" feeler between cylinder wall and piston on side opposite slot. With piston and block at 70°F. pull to withdraw feeler 5-7 lbs.
Installing Pistons:—Slot away from camshaft.

PISTON RINGS:—2 undercut compression, 2 slotted oil rings per piston, above pin.

Ring	Width	End Gap	Side Clearance
Comp. (#1)	⅛"	.007-.015"	.002-.0035"
Comp. (#2)	⅛"	.007-.015"	.0015-.003"
Oil	5/32"	.007-.015"	.0015-.003"

Replacement Rings:—Furnished .003", .005", .010", .015", .020", .025", .030", .040", .050", .060" oversize.

PISTON PIN:—Diameter—55/64". **Length**—2¾".
Floating type. Pin hole in rod bronze bushed.
Pin Fit in Piston—Thumb push fit with piston heated to 130°F.
Pin Fit in Rod Bushing—Thumb push fit at 70°F.
Replacement Pins:—Furnished std. and .003", .005", .008" oversize. Ream bushing and pin hole to size.

CONNECTING ROD:—Weight 34.37 ozs. **Length** 9".
Crankpin Journal Diameter—2 3/16".
Lower Bearing—Removable steel-backed, babbitt-lined. Furnished .002", .010", .012" undersize.
Clearance—.0005-.0025". **Sideplay**—.005-.0115".
Bearing Adjustment:—None. Install new bearings with bosses engaging grooves in rods and caps.
Installing Rods:—Install rods with widest half of bearing toward rear (#1, 3, 5, 7), toward front (#2, 4, 6, 8). Oil spit hole toward camshaft.

CRANKSHAFT:—5 bearing, 8 counterweights, with impulse neutralizer mounted on forward end.
Journal Diameters—2 45/64" all bearings.
Bearing Type—Steel-backed, babbitt-lined type.
Clearance—.001-.002".
Bearing Adjustment:—*See Chrysler Shop Notes for Engine Removal (recommended), Adjustment directions, Replacement Bearings and Bearing Caps, Crankshaft Oil Seals.*
End Thrust:—Taken by flange faces on rear (#5) bearing. **Endplay**—.003-.007".

CAMSHAFT:—6 bearing. Non-adjustable chain drive.
Journal Diameters—#1, 2 1/16"; #2, 2 1/32"; #3, 2"; #4, 1 31/32"; #5, 1 15/16"; #6, 1⅜".
Bearing Type—Removable steel-backed, babbitt-lined bushings (except #6 machined in crankcase).
Clearance—.001-.003" (#1), .0015-.0035" (all others). NOTE—Replacement bushings finish reamed.
End Thrust:—Taken between face of removable cast-iron sleeve (carries front bearing) and face of camshaft sprocket. Replace if worn. **Endplay**—.001-.008".
Timing Chain:—Morse #1866 (restricted bend). Width 1¼". Pitch .500". Length 47 links or 23½". NOTE—Whitney #CLG-205 optional (same specifications). *See Chrysler Special Shop Notes for front end removal for work on timing chain.*
Camshaft Setting:—Mesh chain with sprockets turned so that '0' marks are adjacent and in line with a straightedge across the shaft centers.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1 15/32"	.340-.341"	5½"
Exhaust	1 13/32"	.340-.341"	5½"

	Seat Angle	Lift	Stem Clearance
All valves	45°	11/32"	.001-.003"

See Chrysler Special Shop Notes for Exhaust Valve seat insert removal and installation.
Tappet Clearance—.006" Intake, .010" Exhaust (hot). .012" Exh. setting recommended for sustained high speed driving. Valves accessible by removing right front wheel and fender panel.
NOTE—Self-locking tappet screws used.
Valve Guides:—Install with taper end up 13/16" below top of block, then ream to .342-.343".
Valve Springs:—Constant pitch type. Free length approx. 2 19/64". Limit of compression 1 29/64".

	Spring Pressure	Spring Length
Valve Closed	52-58 lbs.	2 1/32"
Valve Open	122-130 lbs.	1 11/16"

Valve Lifters:—Mushroom type. Ream guides from above for following oversizes: .001", .008", .030", .060".
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 2° BTDC. Close 44° ALDC.
Exhaust Valves—Open 46° BLDC. Close 4° ATDC.
To Check Valve Timing—Set tappet clearance #1 intake valve at .011". This valve should open with #1 piston 2° (.0019") BTDC. when 2° BTDC. line on impulse neutralizer at front of engine lines up with pointer on chain case cover. Reset tappet clearance .006" (hot).
Motor Gauge—Weidenhoff Adapter #103, Rod #12.

LUBRICATION:—Gear type oil pump, right of engine. *See Chrysler Special Shop Notes for oil pump removal and installation instructions.*
Normal Oil Pressure:—30-45 lbs. at 30 M.P.H.
Oil Pressure Relief Valve:—Under cap on left side of engine. Adjust by turning slotted plug (with cap and lock wire removed) clockwise to increase pressure, counter-clockwise to decrease pressure.
Crankcase Capacity:—6 quarts (refill).

COOLING SYSTEM:—Water Pump—Centrifugal, belt-driven, packless type.
See article in Mechanical Equipment Section.
Removal—With water drained and fan belt removed, remove fan blades and pulley (attached by 4 capscrews), disconnect pump hoses, remove nuts from pump mounting studs and lift assembly out.
Thermostat:—Fulton. In water outlet on cyl. head. NOTE—Install thermostat with bellows down.
Setting—Start to open 150-155°F. Fully open 176°F.
Water Capacity:—20 quarts.
Drain Valves:—At lower left corner of radiator and on left side of block in front of distributor.

CLUTCH:—Borg & Beck Model 11A6. Model #915 stamped on cover. Single plate dry disc type with new spiral grooved type facings and clutch pressure plate oil baffle.
See article in Mechanical Equipment Section for data.
Facings—Molded-woven (spiral grooved type). 2 required. I.D. 6½". O.D. 11". Thickness ⅛".
Adjustment—Adjust pedal stopscrew so that pedal just clears floor board. Free movement of pedal should be 1". To adjust, turn adjusting nut on upper end of throwout shaft connecting rod.
Removal:—Remove transmission (see Transmission Removal following), remove housing underpan, mark cover and flywheel, remove cover bolts evenly, take out assembly from below.

TRANSMISSION:—Warner Model AS18-T85. Helical gear type with synchro-mesh on second and high speeds, overdrive transmission.
See article in Mechanical Equipment Section for data.
Removal:—Remove floor boards, disconnect hand brake cable, remove propeller shaft. Disconnect clutch release fork pull rod (at clevis pin) and spring (release bearing assembly attached to transmission and withdraw with it). Place jack under rear of engine, remove rear engine supports. Remove two front cover screws, take off nuts on mounting studs, install two pilot studs in upper holes and withdraw transmission. NOTE—When installing, release fork fingers must align with groove in release bearing sleeve.

UNIVERSAL JOINTS:—Detroit Universal. Series 5350. Cross type with roller bearing. Two used.
See article in Mechanical Equipment Section.

REAR AXLE:—Own. Semi-floating, hypoid gear type with Hotchkiss drive.
See article in Mechanical Equipment Section for data.
***Ratio**—4.55-1. **Backlash**—.006-.010". Screw adj'mt.*
Removal:—Remove wheel, hub, and drum assembly (use screw type hub puller). Place block under brake pedal, disconnect brake line, remove backing plate and oil seal, pull axle shaft and bearing (Tool C-158). With shafts removed, carrier may be removed by disconnecting rear universal at flange and removing housing capscrews.
Wheel Bearing Adjustment—Controlled by shims at flanged ends of axle housing. With wheel and hub removed measure endplay with dial indicator. To adjust, remove backing plate (see above) and add or remove shims (equally at both sides) to proper clearance. **Endplay**—.003-.008".

SHOCK ABSORBERS:—Monroe—Front #683091. Rear #682604. Direct acting hydraulic type.
See article in Mechanical Equipment Section.

STEERING:—Steering Gear. Gemmer Mod. 375. Worm-and-Roller type with 'Push-Pull' adjustment.
See article in Mechanical Equipment Section for data.
Front Suspension:—Independent, linked parallelogram type with coil springs.
See article in Mechanical Equipment Section for data.
Specifications below apply with no passenger load.
Kingpin Inclination—4¾-6°.
Camber—¼° preferred. Minus ¼° to plus ½°.
Caster—Limits 1-3°.
Toe In—1/16" (0-⅛"). Adjust rods equally.
Steering Geometry—Outer wheel turned 20°. Inner wheel turned 22°15'.

BRAKES:—Service—Lockheed hydraulic, double anchor type with Bendix Vacuum Power unit. Hand lever applies brake at rear of transmission.
See article in Mechanical Equipment Section for data.
Wheel Cylinders—Stepped or two-stage bore type.
Drum—14". Centrifuse.
Lining—Molded. Width 2½". Thickness ¼". Length per shoe 14 21/32".
Clearance—Toe .012", Heel .006", for each shoe.
Braking Power—55% Front wheels, 45% Rear.
Hand Brake:—External at rear of transmission.
Adjustment—*See Chrysler Shop Notes.*
Drum—7". Cast-iron.
Lining—Width 2½". Thick. 3/16". Length 21½".
Power Brake Unit:—Bendix Internal Valve type.
See article in Mechanical Equipment Section for data.

FRONT END ASSEMBLY (UNIT) REMOVAL:—Should be removed as a unit for work on front of engine. *See Chrysler Shop Notes for directions.*

SERIAL NUMBER:—On right front door hinge post. First number: Detroit—7,574,001 (Royal), 6,948,301 (Royal Windsor). Canada—9,712,121 (All models).

ENGINE NUMBER:—First number C-22-1001. Stamped on left side of block between #1 and #2 cylinders. *See Chrysler Shop Notes for engine number lettering ('Special Standard' bore and bearing sizes).*

ENGINE SPECIFICATIONS:—6 cylinder, 'L' head.
Bore—3⅜". **Stroke**—4½".
Displacement—241.5 cu. ins. **Rated HP.**—27.34.
Developed Horsepower—100 (Std. 6.5-1 hd.), 107 HP. (Optl. 7.0-1 hd.—Std. 7 pass) at 3600 RPM.
Compression Ratio and Pressure—As follows:

Ratio	Pressure at 1000 RPM.	At 100 RPM.
6.5-1 cast-iron hd.	140-150 lbs.	Approx. 115 lbs.
7.0-1 aluminum hd.	150-160 lbs.	Approx. 120 lbs.

Vacuum Reading—Steady 18-21" idling at 6 MPH. *See Chrysler Shop Notes for engine removal instructions.*

PISTONS:—Aluminum alloy, U-slot, Cam-ground, with Anodic finish. **Length**—3⅞". **Weight**—17.45 ozs.
Removal—Pistons and rods removed from above.
Clearance—Top .022". Skirt .0005-.0010".
Original Bore & Piston Sizes, Replacement Pistons:—*See Chrysler Shop Notes for sizes and markings.*
Fitting New Pistons:—Check piston size with micrometer across large diameter at bottom of skirt. Insert .002" feeler between cylinder wall and piston (pin removed) on side opposite slot. With piston and block at 70° F. pull to withdraw feeler 5-7 lbs.
Installing Pistons:—Slot away from camshaft.

PISTON RINGS:—4 rings, all above pin—#1 Compression (upper inner edge beveled), #2 Comp. (lower outer edge stepped), #3 & 4 (slotted oil rings).

Ring	Width	End Gap	Side Clearance
Comp. (Top)	⅛"	.007-.015"	.002-.004"
Comp. (#2)	⅛"	.007-.015"	.0015-.0035"
Oil Control	5/32"	.007-.015"	.0015-.003"

Replacement Rings:—Std. & .003", .005", .010", .015", .020", .025", .030", 040", .050", .060" oversize.

PISTON PIN:—**Diameter**—55/64". **Length**—2⅞". Floating type. Pin hole in rod bronze bushed.
Pin Fit in Piston—Thumb push fit with piston heated to 130° F.
Pin Fit in Rod Bushing—Thumb push fit at 70° F.
Replacement Pins:—Std. & .003", .005", .008" oversize.

CONNECTING ROD:—**Weight** 31.70 ozs. **Length** 7⅞".
Crankpin Journal Diameter—2⅛".
Lower Bearing—Removable, steel-backed, babbitt-lined. Furnished std. & .002", .010", .012" undersize.
Clearance—.0005-.0025". **Sideplay**—.0055-.0115".
Bearing Adjustment:—None (no shims). Install bearings with boss engaging groove in rod and cap.
Installing Rods:—Oil spit hole toward camshaft.

CRANKSHAFT:—4 bearing type with 9 counterweights. *See Chrysler Shop Notes for Replacement Main Bearing Caps and Crankshaft Front and Rear Oil Seals.*
Journal Diameters—2½" all bearings.
Bearing Type—Removable, precision type steel-backed, babbitt-lined. **Clearance**—.001-.002".
Bearing Adjustment:—*See Chrysler Shop Notes for Engine Removal (recommended), front main bearing cap removal, replacement bearings and adjustment data.*
End Thrust:—Taken by flange faces on rear (#4) main bearing. **Endplay**—.003-.007".

CAMSHAFT:—4 bearing. Non-adjustable chain drive.
Journal Diameters—#1, 2"; #2, 1 31/32"; #3, 1 15/16"; #4, 1¼".
Bearing Type—Removable steel-backed, babbitt-lined bushings (except #4 machined in block).
Clearance—.001-.003" (#1), .0015-.0035" (all others).
End Thrust:—Taken by thrust plate behind camshaft sprocket hub. **Endplay**—.002-.006".
Timing Chain:—Morse Type 1866-N, No. 2661. Width 1". Pitch .500". Length 24" or 48 links.
Camshaft Setting:—Mesh chain with sprockets turned to that '0' marks are adjacent and in line with a straightedge across the shaft centers.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1 21/32"	.340-.341"	4 25/32"
Exhaust	1 17/32"	.340-.341"	4 25/32"

	Seat Angle	Lift	Stem Clearance
All Valves	45°	11/32"	.001-.003"

See Chrysler Shop Notes for Exh. Valve Seat Insert data.
Tappet Clearance:—.008" Int., .010" Exh. (hot). .002" additional exhaust clearance recommended for sustained high speed driving. NOTE—Tappet screws self-locking type (no locknuts). Remove right front wheel and housing panel for access to valves.
Valve Guides:—Remove from above. Press new guides in (tapered end up) so upper end ⅞" below top of block, then finish ream to .342-.343".
Valve Springs:—Free length approx. 2". Limit of compression 1⅜".

	Spring Pressure	Length
Valve Closed	40-45 lbs.	1¾"
Valve Open	101-109 lbs.	1 13/32"

Valve Lifters:—Mushroom type. Stem diam. ⅝". Ream holes from above (pilot in valve stem guide) for lifters furnished .001", .008", .030", .060" oversize.
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 8° BTDC. Close 42° ALDC.
Exhaust Valves—Open 48° BLDC. Close 2° ATDC.
Valve Timing Check—Set tappet clearance #6 intake valve at .014". This valve should open with piston 8° (.0281") before top dead center with 8° BTDC. mark on impulse neutralizer aligned with pointer on chain cover. Reset tappet cl. at .008" hot.

LUBRICATION:—Gear type pump, right of engine.
Normal Oil Pressure:—30-45 lbs. at 30 M.P.H.
Oil Pressure Regulator:—Under cap below starter. Opens at 40-45 lbs. To increase pressure use heavy (green) spring, to decrease use light (red) spring.
Crankcase Capacity:—5 quarts (refill).

COOLING SYSTEM:—**Capacity**—17 quarts.
Radiator Core Removal—*See Chrysler Shop Notes.*
Water Pump:—Packless type, belt-driven. *See article in Mechanical Equipment Section for data.*
Removal—Drain water, remove hood side panels, fan blade assembly, pulley, radiator outlet hose at pump, by-pass (with small hose), pump mounting stud nuts, fan belt adjusting strap at generator.
Thermostat:—Fulton. In water outlet on cyl. head.
Setting—Start to open 157-162° F. Fully open 183°F.
Temperature Gauge:—Motometer (Auto-Lite) Vapor tension type. Part No. H-9063. *See article in Mechanical Equipment Section for data.*

CLUTCH:—**Borg & Beck Model 10A7, 11A6 (Taxi).** #930 (10A7), #931 (11A6) stamped on cover. Single plate, dry disc type with spiral groove facings, pressure plate oil baffle and new Over-center return spring *See article in Mechanical Equipment Section for data.*
Facings—Woven & compressed, 2 required. Inside Diam. 7" (10A7), 6½" (11A6). Outside Diam. 10" (10A7), 11" (11A6). Thickness .125" (all).
Adjustment:—Pedal should just clear toeboard (adjust stopscrew on lower end) and have 1" free movement (adjusting nut on link rod at clutch fork).
Removal:—Remove floorboard, unhook clutch fork pull-back spring and take out clevis pin in connecting link. Remove transmission (see below) and housing underpan, mark cover and flywheel, remove clutch cover screws evenly, lower assembly out.

TRANSMISSION:—**Warner.** All helical gear, constant-mesh, synchro-mesh (second & high), sliding gear (low & reverse). Model AS3-T86A overdrive transmission with electrical 'kick-down' control optl.
Transmission Control:—Remote control type. *See articles in Mechanical Equipment Section for data.*
Removal:—Remove floor boards, battery ground cable, disconnect front and rear U-joints (see Chrysler Shop Notes for Propeller Shaft Center Bearing Removal on 7 pass.), hand brake cable at clevis, speedometer cable, and gearshifter rod and cable at lever on case. Remove mounting stud nuts, cover assembly and 2 upper mounting studs (insert pilot studs).
Overdrive Transmission Removal—Same as above, plus the following: Remove hand brake assembly (U-joint flange, brake drum, band, and support). Disconnect solenoid wires (remove coil) and overdrive cable at case. To remove, turn assembly over on left side while withdrawing until shaft free at release bearing, then push up at forward end (shaft just above bearing), then forward (shaft between clutch fingers). Lower assembly at rear, pull out.

UNIVERSAL JOINTS:—**Detroit-Universal Series 4200.** Ball and trunnion type with roller bearings. *See article in Mechanical Equipment Section for data.*
Propeller Shaft Center Bearing:—On 7 pass. sedans. *See Chrysler Shop Notes for service data.*

REAR AXLE:—**Own Make.** Semi-floating, hypoid gear type with Hotchkiss drive. *See article in Mechanical Equipment Section for data.*
Ratio—3.9-1 (Coupe), 4.1-1 (5 pass. sedan), 4.3-1 (7 pass.—others with OD.), 4.56-1 (7 pass. with OD.).
Backlash—.006-.010". Screw adjustment.
Removal:—Disconnect drive shaft at rear universal. Remove axle shafts (see below) and capscrews on carrier flange. Pull carrier assembly out.
Axle Shaft Removal—Remove wheel, hub, and drum assembly (use screw type hub puller—Tool C-319), block brake pedal, disconnect brake line at wheel cylinder, take off backing plate with oil seal, pull shaft and bearing (Tool C-158).
Wheel Bearing Adjustment:—Shims between backing plate and axle housing. With wheel and hub removed check endplay with dial indicator. To adjust, remove backing plate (see above), add or remove shims equally (both wheels). **Endplay**—.003-.008".

SHOCK ABSORBERS:—**Delco.** Direct acting type. Domestic—Front 1110-C. Rear 1111-T. Exp.—1114-C & 1115-T, or 1134-E & 1130-W. *See articles in Mechanical Equipment Section for data.*

STEERING:—**Steering Gear.** Gemmer Model 305 Worm-and-Roller type with 'Push-pull' adjustment. *See article in Mechanical Equipment Section for data.*
Front Suspension:—Independent, linked parallelogram type with coil springs. *See article in Mechanical Equipment Section for data.*
Kingpin Inclination—4¾-6°.
Camber—Plus ¼°. Limits minus ¼° to plus ¾°.
Caster—Limits ½-2½°.
Toe In—1/16" (0-⅛"). Set long tie rod to 31⅝" (between ball centers). Adjust short tie rod.
Steering Geometry—Inner wheel 22°40'. Outer 20°.

BRAKES:—**Service.** Lockheed hydraulic, double anchor type. Hand lever applies independent shaft brake. *See article in Mechanical Equipment Section for data.*
Wheel Cylinders—Stepped or two-stage bore type.
Drums—Cast-iron. Diameter 11".
Lining—Molded. Width 2". Thickness 13/64". Length (front shoe) 11 15/32"; rear shoe (7 31/32").
Clearance—.012" toe, .006" heel, for each shoe.
Hand Brake:—On drum at rear of transmission.
Adjustment—*See Chrysler Shop Notes for data.*
Drum—Cast-iron. Diameter 6".
Lining—Width 2". Thick. 5/32". Length 17 1/16".

FRONT END ASSEMBLY (UNIT) REMOVAL:—Should be removed as a unit for work on front of engine. *See Chrysler Shop Notes for directions.*

SERIAL NUMBER:—Stamped on plate on right front door hinge pillar post. First number for each model

C-23	Saratoga	NewYorker	C-24
6,742,201	6,672,701	6,609,901	7,806,201

ENGINE NUMBER:—First number C-23—C-23-1001, C-24—C-24-1001. Stamped on left side of engine between #2 and #3 cylinders.
See Chrysler Shop Notes for Engine Number Lettering ('Special Standard' bore and bearing sizes).

ENGINE SPECIFICATIONS: Own. Eight cylinder, 'L' head type.
Bore—3¼". **Stroke**—4⅞".
Displacement—323.5 cubic inches.
Rated Horsepower—33.80 (A.M.A.).
Developed Horsepower—130 HP. (C23—6.8-1 Hd.), 132 HP. (C24—6.8-1 Hd.), 138 HP. (All—7.45-1 AL. Hd.) at 3400 R.P.M.
Compression Ratio and Pressure—As follows:

Ratio	Pressure at 1000 RPM.	At 100 RPM.
6.8-1 hd. (see Note)	150-160 lbs.	Approx. 118 lbs.
7.45-1 aluminum hd.	160-170 lbs.	Approx. 124 lbs.

NOTE—Cast-iron head (C23), Aluminum (C24).
Vacuum Reading—Gauge should show steady reading of 18-21" with engine idling at 6 M.P.H.
See Chrysler Shop Notes for Engine Removal data.

PISTONS:—Aluminum alloy, U-slot, cam ground type with anodic finish.
Length—3⅞".
Weight—16.33 ounces (plus or minus 2 grams).
Removal—Pistons and rods removed from above.
Clearance—Top .021". Skirt .0005-.0010". See Fitting New Pistons (following).
Original Bore & Piston Sizes, Replacement Pistons:—*See Chrysler Shop Notes for sizes and markings.*
Fitting New Pistons:—Check piston size with micrometer at bottom of skirt with gauge at right angles to pin bosses. Insert .002" feeler between cylinder wall and piston (with pin removed) opposite piston slot. Pull to withdraw feeler should be 5 to 7 lbs. Cylinders should be reconditioned when taper exceeds .0015" or out-of-round .002". Reconditioned cylinder bores should be within limits of .0005".
Installing Pistons:—U-slot away from camshaft.

PISTON RINGS:—Four rings, all above pin. #1 Compression ring (upper inner edge beveled), #2 Compression (lower outer edge stepped), #3 and #4 oil rings (slotted type).

Ring	Width	End Gap	Side Clearance
Comp. (Top)	⅛"	.007-.015"	.002-.004"
Comp. (#2)	⅛"	.007-.015"	.0015-.0035"
Oil Control	5/32"	.007-.015"	.0015-.003"

Replacement Rings:—Furnished standard and .003", .005", .010", .015", .020", .025", .030", .040", .050", and .060" oversize.

PISTON PIN:—Diameter—55/64". **Length**—2¾".
Pin floats in piston and rod. Held by retaining ring at each end. Pin hole in rod bronze bushed.
Pin Fit in Piston—Thumb push fit with piston heated to 130° F.
Pin Fit in Rod Bushing—Thumb push fit at 70° F.
Replacement Pins:—Furnished in standard and .003", .005", and .008" oversizes. Ream bushing and pin hole to size.

CONNECTING ROD:—Weight—34.37 oz. **Length**—9".
Crankpin Journal Diameter—2 3/16".
Lower Bearing—Removable, precision type, steel-backed, babbitt-lined. Furnished in standard and .002", .010", and .012" undersizes.
Clearance—.001-.003". **Sideplay**—.006-.011".
Bearing Adjustment:—None (no shims). Replace bearings. Do not file rods or caps. Install new bearings with boss engaging groove in rod and cap.
Installing Rods:—Lower bearings are offset. Install rods with widest portion of bearing toward the rear on #1, #3, #5, and #7, toward the front on #2, #4, #6, and #8. Oil hole in upper bearing half must be toward camshaft side of engine on all rods.

CRANKSHAFT:—Five bearing type with eight integral counterweights. Impulse neutralizer mounted on forward end.
See Chrysler Shop Notes for Replacement Main Bearing Caps and Crankshaft Front and Rear Oil Seals.
Journal Diameters—2 45/64" all bearings.
Bearing Type—Interchangeable precision type, steel-backed, babbitt-lined.
Clearance—.001-.002".
Bearing Adjustment:—*See Chrysler Shop Notes for Engine Removal (recommended), replacement bearings and adjustment data.*
End Thrust:—Taken by flange faces on rear (#5) main bearing. **Endplay**—.003-.007".

CAMSHAFT:—Six bearing type with non-adjustable chain drive.
Journal Diameters—#1, 2 1/16"; #2, 2 1/32"; #3, 2"; #4, 1 31/32"; #5, 1 15/16"; #6, 1⅜".
Bearing Type—Removable steel-backed, babbitt-lined bushings (except #6 machined in crankcase).
Clearance—.001-.003" (#1), .0015-.0035" (all others).
NOTE—Replacement bushings are furnished finish reamed.
End Thrust:—Taken by thrust plate assembled behind camshaft sprocket hub. **Endplay**—.002-.006".
Timing Chain:—Whitney #668983 Center link guide type. Width 1¼". Pitch .500" (½"). Length 47 links or 23½".
Camshaft Setting:—Sprockets are marked. Mesh chain with sprockets turned so that marks are adjacent and in line with straightedge across the shaft centers.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1 17/32"	.340-.341"	5⅞"
Exhaust	1 11/32"	.340-.341"	5⅞"

	Seat Angle	Lift	Stem Clearance
All Valves	45°	⅜"	.001-.003"

See Chrysler Shop Notes for Exhaust Valve Seat Insert Removal and Installation Instructions.
Tappet Clearance:—.008" Intake, .010" Exhaust (with engine hot). .002" additional exhaust tappet clearance recommended by car manufacturer for cars driven at sustained high speeds. NOTE—Tappet screws are self-locking type (no lock nuts used). Remove right front wheel and housing panel for access to valves.
Valve Guides:—Remove from above. Press new guides in place so upper end 13/16" below top of cylinder block. Install exhaust guide with counterbored end up, intake guide with tapered end up. Ream guides to inside diameter of .342-.343" (intake and exhaust) and counterbore exhaust guides at top to diameter of .365-.375" and depth of ⅜" after installing.
Valve Springs:—Free length approximately 2 19/64". Limit of compression 1 29/64".

	Spring Pressure	Spring Length
Valve Closed	52-58 lbs.	2 1/32"
Valve Open	129-137 lbs.	1 21/32"

NOTE—Spring #685616 used on first C23 cars same as above except: Pressure (valve open) 122-130 lbs. at 1 11/16". Spring #699190 (C23 later cars, all C24 cars) specifications shown above.
Valve Lifters:—Mushroom type. Remove from below with camshaft and valves out. Stem diameter ⅝". Ream guide holes from above (with reamer piloted in valve guide to insure alignment of lifter). Lifters furnished for service in standard and .001", .008", .030", and .060" oversizes.
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 6° BTDC. Close 50° ALDC.
Exhaust Valves—Open 44° BLDC. Close 12° ATDC.
Valve Timing Check—Set tappet clearance for #8 intake valve at .011" (remove right front wheel and wheel housing for access to valves). This valve should open with piston 6° (.0170") before top dead center with 6° BTDC. mark (sixth graduation to left of '0' mark) on impulse neutralizer opposite pointer on chain case cover at front of engine. Reset tappet clearance at .008" (engine hot).
Motor Gauge—Weidenhoff Adapter #103, Rod #12. Separate timing hole over #8 piston (remove plug).

LUBRICATION:—Pressure system with gear type oil pump mounted on right side of crankcase.
Normal Oil Pressure—30-45 lbs. at car speed of 30 M.P.H. 15 lbs. idling.
Oil Pressure Regulator:—Located under plug on left hand side of crankcase. Adjustable type. To adjust, remove cap, withdraw locking wire, turn slotted plug clockwise to increase pressure, or counter-clockwise to decrease pressure.
Crankcase Capacity:—6 quarts (refill).

COOLING SYSTEM:—Capacity—24 quarts.
Radiator Core Removal—*See Chrysler Shop Notes.*
Water Pump:—Packless type with factory-lubricated and sealed ball-bearing shaft.
See article in Mechanical Equipment Section for data.
Removal—Drain cooling system, remove hood side panels and fan shroud-to-radiator core bolts. Rotate fan shroud around radiator inlet hose (to free shroud) and lift out. Take out fan blade-to-pulley screws and remove blades. Remove pulley and free fan belt by pushing pulley and belt off pump shaft. Take out by-pass elbow-to-pump body capscrews. Free large water pump inlet hose and remove pump body capscrews and nut (on lower edge of pump body) pushing pump off stud and block. NOTE—Back-plate assembled between cylinder block and pump. When removing pump take care to remove proper nut at lower edge of pump. Nut below pump body secures back plate to cylinder block. Also, pump body to cylinder block stud may have to be removed in order to take out pump.
Water Pump Back-plate Removal—Remove water pump as directed above. Take off fan belt adjusting strap by removing bolt at generator and strap stud nut. Remove flat headed screw on face of back-plate (this screw flush on forward face of plate). Then remove stud nut on lower right hand corner of back-plate. Plate can then be removed.
Thermostat:—Fulton. In cylinder head water outlet elbow. Install thermostat with bellows down.
Setting—Starts to open at 157° F. to 162° F. Fully open at 183° F.
Temperature Gauge:—Motometer (Auto-Lite) Vapor tension type. Part No. H-9063.
See article in Mechanical Equipment Section for data.
Drain Valves:—Two drain valves used. Radiator drain valve located at lower left rear corner of radiator. Cylinder block drain valve located on lower left side of block near distributor.

CLUTCH (C-23):—Borg & Beck Model 11A6. #929 stamped on cover. Single plate, dry disc type with spiral grooved facings, pressure plate oil baffle and new Over-center return spring (hooked in clutch pedal).
See article in Mechanical Equipment Section for data.

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Facings—Woven and compressed (spiral grooved type), 2 required. Inside Diameter 6½". Outside Diameter 11". Thickness .125".

Adjustment:—Clutch pedal should just clear under side of toeboard. To adjust, loosen locknut and turn stopscrew located at rear of pedal above shaft. Free movement of pedal should be 1". To adjust, turn clutch release fork adjusting nut on connector link

Removal:—Remove floorboard. Take out clutch release fork pull-back spring, and cotter pin and clevis pin in clutch release fork rod. Pull clutch release fork out. Remove transmission (see Transmission Removal following for instructions) and clutch housing underpan. Mark cover and flywheel with punch mark (assemble to these marks when re-installing assembly). Remove clutch cover screws and washers (release spring tension evenly by turning each screw a few turns at a time). Assembly can then be lowered out through pan opening.

CLUTCH (C-24):—Borg & Beck Model 10A6. #933 stamped on cover. Single plate, dry disc type with spiral grooved facings, pressure plate oil baffle and new Over-center return spring (hooked to pedal).

See article in Mechanical Equipment Section for data.

Facings—Woven and compressed (spiral grooved type), 2 required. Inside Diameter 6". Outside Diameter 10". Thickness .125".

Adjustment and Removal:—Same as for Model C-23 (above) except that frame cross member under clutch housing must be removed after transmission taken out. Clutch assembly mounted on clutch driving plate which is secured at rear of fluid drive unit.

FLUID DRIVE (USED ON MODEL C-24 ONLY):—Consists of fluid coupling assembled to rear of engine in place of conventional flywheel.

See article in Mechanical Equipment Section for data.

Removal:—Remove floorboard, clutch release fork pull-back spring, and cotter pin and clevis pin from end of clutch release fork rod. Pull out clutch release fork. Remove transmission (see Transmission Removal for Model C24 following). Take off frame cross-member (see Note below) and clutch housing underpan. Mark clutch cover and clutch driving plate with punch (assemble to these marks when re-installing assembly). Remove clutch cover mounting screws and lower assembly out through pan opening. Turn fluid drive unit to place one filler plug at bottom, remove plug with Allen type wrench and allow unit to drain. Remove engine oil pan and rear main bearing cap. Remove crankshaft-to-fluid drive bolt nuts (secures fluid drive unit to crankshaft flange), pull drive unit to rear until free from crankshaft flange. Then entire assembly (with clutch driving plate attached) may be lowered out through pan opening.

NOTE—On first cars this cross-member riveted in place. Remove by drilling out rivets and use bolts and lockwashers when re-installing—make certain that bolts securely tightened. On later cars, this cross-member held by bolts and can be removed by taking out bolts.

TRANSMISSION (C-23):—Warner. All helical gear type with constant-mesh, synchro-mesh (second and high), sliding gears (low and reverse).

See article in Mechanical Equipment Section for data.

Overdrive Transmission:—Warner Model AS5-T85A overdrive transmission with electrical kick-down control, optional equipment.

See article in Mechanical Equipment Section for data.

Transmission Control:—Own design steering column mounted remote control shift.

See article in Mechanical Equipment Section for data.

Removal—Remove floorboard. Disconnect battery ground cable at transmission. Disconnect front and rear universal joints. Remove hand brake cable clevis pin at rear of transmission. Take off speedometer cable. Disconnect gearshifter rod and cable at lever on transmission case. Remove transmission cover capscrews and lift cover assembly out. Block up rear of engine until load on transmission supports just relieved (CAUTION—Car must be level so that engine alignment maintained. If front of car raised, engine will set toward rear due to rocking on front rubber support, this in turn may prevent transmission from being withdrawn). Then loosen transmission side supports at frame, place jack under transmission to support weight, and remove support bracket frame bolts. Remove transmission-to-clutch housing stud nuts and two upper studs (install two nuts on end of stud and turn stud out), install two pilot studs. Take off transmission supports from frame and transmission case. Pull transmission out.

Overdrive Transmission Removal—Same instructions as listed below for Model C-24 except that one propeller shaft only used. Remove shaft in conventional manner by disconnecting front and rear universal joints.

TRANSMISSION (C-24):—Warner Model AS5-T85A. All helical gear type with constant-mesh, synchro-mesh (second and high), sliding gear (low and reverse) overdrive transmission with electrical kick-down control.

See article in Mechanical Equipment Section for data.

Transmission Control:—Own design steering column mounted remote control shift.

See article in Mechanical Equipment Section for data.

Removal—Remove floorboards. Disconnect battery ground cable at case. Remove rear propeller shaft, four front companion flange nuts, four frame-to-center bearing mounting screws, slide bearing and front shaft back through frame X-member opening (If spacer used between frame and bearing mounting, replace spacer when re-installing). Remove universal joint flange and brake drum from shaft, and clevis pin from brake cable. Take off brake assembly from overdrive case. Disconnect solenoid wires and remove coil. Remove speedometer cable at case. Disconnect gearshifter rod and cable at lever on case and overdrive control cable. Remove cover capscrews and lift cover out. Block up rear of engine until load on transmission supports just relieved (CAUTION—Car must be level so that engine alignment maintained. If front of car only raised, engine will set toward rear due to rocking on front rubber support, this in turn may prevent transmission from being withdrawn). Loosen transmission side supports at frame, place jack under transmission and overdrive assembly to support weight, and remove support bracket frame bolts. Remove mounting stud nuts at clutch housing and two upper studs (install two nuts on end of stud and turn stud out), install two pilot studs. Remove transmission supports from frame and case. To remove, turn assembly over on left side while withdrawing until shaft free of release bearing, then push up on forward end until shaft above bearing, then push assembly forward with shaft extending between two clutch fingers. Assembly can then be lowered at rear and withdrawn.

UNIVERSAL JOINTS:—Detroit-Universal Series 4400 (C-23), Series 5350 (C-24). Ball and trunnion type with roller bearings (C-23). Cross type with roller bearings (C-24). Three joints used on C-24.

See article in Mechanical Equipment Section for data.

Propeller Shaft Center Bearing (C-24):—*See Chrysler Shop Notes for removal and installation data.*

REAR AXLE:—Own. Semi-floating, hypoid gear type with Hotchkiss drive.

See article in Mechanical Equipment Section for data.

Ratio (C-23)—3.91-1 (standard). 4.1-1 (special). 4.3-1 (cars with overdrive).

Ratio (C-24)—4.9-1.

Backlash—.006-.010". Screw adjustment.

Removal:—Disconnect drive shaft at rear universal. Remove axle shafts (see below) and capscrews on carrier flange. Lift carrier assembly out.

Axle Shaft Removal—Remove wheel, hub, and drum assembly (use screw type hub puller—Tool C-319), block brake pedal, disconnect brake line at wheel cylinder, take off backing plate with oil seal, pull shaft and bearing (Tool C-158).

Wheel Bearing Adjustment:—Shims between backing remove backing plate (see above), add or remove plate and axle housing. With wheel and hub removed, check endplay with dial indicator. To adjust, shims equally (at both wheels). **Endplay**—.003-.008".

SHOCK ABSORBERS:—Delco or Monroe. Direct acting, hydraulic types. Delco types are adjustable except on Model C-23 (Domestic).

Model	Make	Front	Rear
C-23 (Domestic)	Delco	1110-C	1111-T
" (Domestic)	Monroe	696240	696242
" (Export)	Delco	1114-C	1115-T
" (Export)	Delco	1134-E	1130-W
C-24 (Dom. & Exp.)	Delco	1134-E	1130-W
" (Domestic)	Monroe	696241	696242

See article in Mechanical Equipment Section for data.

STEERING:—Steering Gear. Gemmer Model 335 (C-23), 375 (C-24) Worm-and-Roller type with 'Push-pull' adjustment.

See articles in Mechanical Equipment Section for data.

Front Suspension:—Independent, linked parallelogram type with coil springs.

See article in Mechanical Equipment Section for data.

Specifications below apply with no passenger load.

Kingpin Inclination—5¾-7° (C-23), 4¾-6° (C-24).

Camber—0° preferred (C-23), ¼° preferred (C-24). Limits minus ¼° to plus ½°.

Caster—Minus ½° to plus 1½° (C-23). 1-3° (C-24).

Toe In (C-23)—1/16" preferred, limits 0-⅛". Set long tie rod to 30 25/32" (between ball centers) and adjust short rod only for toe-in adjustment.

Toe In (C-24)—1/16" preferred, limits 0-⅛". Adjust both tie rods equally.

Steering Geometry (Toe-out on Turns)—Inner wheel turned 22°0' (C-23), 22°15' (C-24). Outer wheel 20°.

BRAKES:—Service. Lockheed hydraulic, double anchor type. Bendix vacuum power unit used on Model C-24. Hand lever applies independent shaft brake.

See article in Mechanical Equipment Section for data.

Wheel Cylinders—Stepped or two-stage bore type. Front Wheel—Front cylinder 1¼". Rear 1⅜".
Rear Wheel—Front cylinder 1⅛". Rear 1¼".

Drums—Centrifuse. Diameter 12" (C23), 14" (C24).

Lining (C-23)—Molded. Width 2". Thickness 13/64". Length per shoe 12 9/16".

Lining (C-24)—Molded. Width 2¼". Thickness ¼". Length per shoe 14 21/32".

Clearance—.012" toe, .006" heel, for each shoe.

Braking Power—55% front, 45% rear.

Hand Brake:—On drum at rear of transmission.

Adjustment—*See Chrysler Shop Notes.*

Drum—Cast-iron. Diameter—6".

Lining—Width 2". Thickness 5/32". Length 17 1/16".

Power Brake Unit:—Bendix Internal Valve type.

See article in Mechanical Equipment Section for data.

NOTE:—Engine hood is hinged at the cowl and is held down by latch under top louvre of radiator grill at center in front. To free hood, place hand on latch and lift. See that hood is latched in place when down. Complete engine and drive unit (including steering gear) mounted on separate assembly which is bolted to main body side members in front of cowl.

ENGINE NUMBER:—First number—FB-100. Stamped on left side at front of engine block.

ENGINE SPECIFICATIONS:—Lycoming Model FB. Eight cylinder, 90° Vee, 'L' head type.
NOTE—Engine is reversed in chassis with flywheel and clutch at forward end and timing chain at rear. Crankshaft rotation is clockwise at timing chain end (rear) so that rotation as viewed from front of car is counter-clockwise.
Bore—3½". Stroke—3¾".
Piston Displacement—288.6 cubic inches.
Rated Horsepower—39.2 (AMA).
Developed Horsepower—125 at 3500 R.P.M.
Compression Ratio—6.5-1 Std. aluminum head.
Compression Pressure—Approximately 110 lbs. at cranking speed of 130 R.P.M.
Vacuum Reading—Gauge should show steady reading of 18-20" with engine idling at 6 M.P.H.
NOTE—Capscrews used to hold down the aluminum cylinder head are of unequal length and must be installed in correct position. 6 long screws (2 1/32") used in top or inner row on head, fourteen medium screws (1 21/32") in two rows across middle of head, four short screws (1 5/16") in lower or outer row on head.

PISTONS:—Ray Day, aluminum alloy, Expansion type with Dome head.
Weight—1.65 lbs. with rings and pin.
Removal—Pistons and rods removed from above.
Clearance—.002-.0025" skirt. See Fitting Pistons.
Replacement Pistons:—Pistons furnished 005", .010", .015" oversize.
Fitting New Pistons:—Check piston diameter and cylinder bore with micrometers. Clearance must be .002-.0025". If .002" feeler gauge ½" wide used, pull required to withdraw feeler from between piston and cylinder wall on side opposite slot must be within 6-11 lbs.
Installing Pistons:—Slot should be toward camshaft for pistons in both banks.

PISTON RINGS:—Two compression, two oil control rings per piston, all above pin. Lower ring grooves drilled with eight 1/16" oil drain holes (#3), eight ⅛" oil drain holes and holes to pin bosses (#4).

Ring	Width	End Gap	Side Clear.
Comp. (top)	3/32"	.0075-.0155"	.002"
Comp. (2nd)	3/32"	.0075-.0155"	.0015-.002"
Oil (top)	⅛"	.0075-.0155"	.0015-.003"
Oil (2nd)	3/16"	.0075-.0155"	.0015-.003"

PISTON PIN:—Diameter ⅞". Length 2 19/32". Pin floats in piston and rod. Held by locking ring at each end. Pin hole in connecting rod bronze bushed.
Pin Fit in Piston—Tight palm push fit at 70° F.
Pin Fit in Rod Bushing—.0003-.0005" clearance.

CONNECTING ROD:—Weight 30¾ ozs. Length 7⅝".
Crankpin Journal Diameter—2".
Lower Bearing—Spun babbitt. No shims.
Clearance—.001-.0025". Sideplay .006-.010" (total).
Bearing Adjustment:—No shims. Rods serviced on exchange basis. Cap faces can be filed to reduce clearance.
Installing Rods:—Rods mounted side-by-side on crankpin with right hand rods to front and left hand rods to rear. Install rods with large chamfer on counterbore against shaft (toward crankshaft cheek) and oil jet hole toward top of block for all rods.

CRANKSHAFT:—3 bearing. Integral counterweights.
Journal Diameters—2½" all bearings.
Bearing Type—Removable bronze-backed, babbitt-lined. No shims.
Clearance—.0015-.00375".
Bearing Adjustment:—None (no shims). Replace bearings. Bearing caps can be filed to reduce clearance. Check clearance by assembling .0015" shim ½" wide between shaft and cap. Shaft should turn freely with shim in place and bearing cap tight.
End Thrust:—Taken by #2 (center) bearing. Endplay .004-.009". Serviced by replacing bearing.

CAMSHAFT:—5 bearing. Non-adjustable chain drive.
Bearing Type—Removable bushings.
Clearance—.002-.003".
Adjustment—Replace bushings.
End Thrust:—Taken by flange on front bushing. Endplay .003-.007". Serviced by replacing bushing.
Timing Chain:—Whitney. Width 1¼". Pitch ½". Length 29" or 58 links.
Camshaft Setting:—Sprockets are punch-marked. Camshaft sprocket located by dowel and bolted on camshaft flange. Turn engine to #4L top dead center position with punch mark on camshaft sprocket approximately 100° from vertical. Mesh chain so that there are 15 chain teeth between marks.

VALVES:—Valves actuated by rocker arm which contacts cam through roller mounted on arm. Rocker arms carried on twin rocker shafts.

	Head Diameter	Stem Diameter	Length
Intake	1 23/32"	.3420-.3425"	5 17/64"
Exhaust	1 33/64"	.3420-.3425"	5 9/32"

	Seat Angle	Lift	Stem Clear.
Intake	30°	11/32"	.0025-.001"
Exhaust	45°	11/32"	.0025-.001"

NOTE—Stem clearance measured at bottom of guide.
Tappet Clearance—.008" all valves, engine cold. Adjusting screw located on end of rocker arm.
Valve Guides:—Press fit in block.
Valve Rockers:—Shaft hole in rocker arm bronze-bushed. Rockers mounted vertically on tubular shaft. Shaft held in place by setscrew at forward end. See that drilled holes in shafts line up with setscrew holes in bosses and setscrews fully engage lock holes to insure oil holes lining up (rocker arms oiled through hollow shaft). Install rocker arm assembly (first cars) between each pair of crankcase ribs, from front to rear as follows: Right bank—Rocker Arm, Spacer, Rocker Arm, Spring. Left bank—Rocker Arm, Spring, Rocker Arm (front cylinder), Spring, Rocker Arm, Spacer, Rocker Arm (all others). *For assembly after Engine No. FB-1310 see 1937 data (next page).*
Clearance—.0005-.0025".
Rocker Arm Roller—Mounted on pin at middle of rocker arm. Clearance on pin .002-.003". Sideplay .005-.008".
Valve Springs:—Single spring type.

	Spring Pressure
Valve Closed	42-47 lbs.
Valve Open	88-94 lbs.

Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 7½° BTDC. Close 37½° ALDC.
Exhaust Valves—Open 50° BLDC. Close 5° ATDC.
To Check Valve Timing—Set tappet clearance #4L (rear cylinder—left bank) intake valve at .016". This valve should be about to open (with clearance not yet taken up) with piston 7½° or .0200" before top dead center when point on flywheel approximately 3 teeth before mark '4L' lines up with pointer in inspection hole in right hand side of clutch housing. Reset tappet clearance at .008".

LUBRICATION:—Pressure system with gear type oil pump mounted in crankcase.
NOTE—Ignition timing not disturbed by oil pump removal.
Normal Oil Pressure:—30-40 lbs. with warm oil.
Oil Pressure Regulator:—Mounted on oil pump. Operates at 40 lbs. Adjustable by turning screw.
Crankcase Capacity—7 qts.

CLUTCH:—Long Mod. 10CF-CI. Semi-centrifugal, single plate, dry disc type. See article in Clutch Section for complete relining and assembling directions.
Facings—Woven type, 2 required. Inside Diam. 6". Outside Diam. 10". Thickness .137".
Adjustment:—Pedal free movement should be 1¼". To adjust, remove clevis pin in clutch throw-out lever at forward end of connecting rod, loosen locknut at rear end of rod, turn rod in or out of rear clevis. Check operation of Transmission Control clutch pedal circuit breaker (Master Shift Switch) whenever clutch adjusted (see article in Mechanical Equipment Section for directions).
NOTE—Linkage changed after Serial No. 810-1544 to insure softer action by bolting extension on clutch throw-out shaft lever. Clutch pedal must have 7" travel (pedal 7" above floor when engaged). Adjust by changing position of stop clamp on pedal shaft under floor.
Removal—Remove kingpins, remove drive shaft at inner universal by knocking out taper pin in shaft, remove both inner universals attached to side of transmission case, then remove driving unit. Remove clutch bell housing, take out capscrews mounting clutch on flywheel (turning all screws out evenly), lift clutch out.

DRIVING UNIT:—Transimission and differential assembly mounted in single case bolted to forward (flywheel) end of engine.
See article in Mechanical Equipment Section for data.
Removal:—Procedure same as outlined for Model 812. *See Cord Model 812 'M' page (following).*

STEERING:—Steering Gear—Gemmer Worm-and-Roller type. See article in Steering Section for complete adjustment procedure.
Front Suspension:—Independent type. Each front wheel carried on rear end of longitudinal arm pivoted at front and linked to end of transverse spring.
Kingpin Inclination—6° crosswise.
Caster—1-2½° positive. Adjusted by changing length of suspension bolts on longitudinal arm at end of spring. Tighten nut to increase caster.
Camber—1°. No adjustment provided.
Toe In—0-⅛" **toe out** (wheels point out at front). Adjusted by changing length of each tie rod equally (loosen clamp bolts and turn tie rod).

BRAKES:—Lockheed Hydraulic, Two shoe, Single anchor type. Hand lever applies rear wheel brakes. *See article in Mechanical Equipment Section for data.*
Wheel Cylinders—Stepped or two stage bore type. Installed with large end of cylinder toward front of car and not interchangeable
Drum Diameter—11".
Lining—Moulded type. Width 2¼". Thickness 3/16". Length 19" per wheel (front), 11" (rear).
Clearance—.010" toe, .005" heel on each shoe.
Hand Brake Adjustment:—See Service Brakes.

NOTE:—Complete engine and drive unit (including steering gear) mounted on separate assembly which is bolted to main body side members in front of cowl.

Rotation:—Counter-clockwise viewed from front (engine reversed in chassis).

Engine Hood:—Hinged at cowl, lifts from forward end. To free latch, lift up at point under top radiator louvre at center in front.

ENGINE NUMBER:—Stamped on left side of engine block at front end.

ENGINE SPECIFICATIONS:—Lycoming, Model FB (Std. 812), FC (Schgd. 812) Eight cylinder, 90° Vee.
Bore—3½". **Stroke**—3¾".
Piston Displacement—288.6 cubic inches.
Rated Horsepower—39.2 A.M.A.
Developed Horsepower—125 at 3500 RPM. (Std. 812), 175 at 4200 RPM. (Schgd. 812).
Compression Ratio—6.5-1.
Compression Pressure—Approx. 110 lbs., 130 R.P.M.
Vacuum Reading—18-20" idling at 6 M.P.H.

PISTONS:—Ray Day, aluminum alloy, strut type with domed head. **Length**—3 15/16".
Weight—1.65 lbs. with rings and pin.
Clearance—.002-.0025" skirt. See Fitting Pistons.
Removal—Pistons and rods removed from above.
Replacement Pistons:—.005", .010", .015" oversize.
Fitting New Pistons:—Check piston skirt and cylinder bore with micrometers or use .002" feeler ½" wide between piston and wall on side opposite slot. Tension to withdraw feeler must be 6-11 lbs.
Installing Pistons:—Slot toward camshaft (all pist.).

PISTON RINGS:—Two compression, two oil control rings, all above pin. Oil ring grooves drilled with eight 1/16" oil drain holes (#3), eight ⅛" holes and oil holes to pin bosses (#4).

Ring	Width	End Gap	Side Clearance
Comp. (#1)	3/32"	.0075-.0155"	.002"
Comp. (#2)	3/32"	.0075-.0155"	.0015-.002"
Oil (#3)	⅛"	.0075-.0155"	.0015-.003"
Oil (#4)	3/16"	.0075-.0155"	.0015-.003"

PISTON PIN:—Diameter—⅞". **Length**—2 19/32". Pin floats in piston and rod. Held by locking ring at each end. Pin hole in connecting rod bronze-bushed.
Pin Fit in Piston—Tight palm push fit at 70° F.
Pin Fit in Rod Bushing—.0003-.0005" clearance.

CONNECTING ROD:—Weight—30¾ ozs. **Length**—7⅝".
Crankpin Journal Diameter—2".
Lower Bearing—Spun babbitt type. No shims.
Clearance—.001-.0015". Sideplay .006-.010" total.
Bearing Adjustment:—None (no shims). Rods serviced on exchange basis. Bearing caps can be filed.
Installing Rods:—Rods for right bank toward front, left bank toward rear (side-by-side mounting) with large chamfer on counter-bore toward crankshaft cheek and oil jet hole toward top of block.

CRANKSHAFT:—3 bearing. Integral counterweights.
Journal Diameters—2½" all bearings.
Bearing Type—Bronze-backed, babbitt-lined.
Clearance—.0015-.00375".
Bearing Adjustment:—No shims. Bearing caps can be filed or bearings replaced. Use .0015" shim ½" square assembled in cap to check clearance.
End Thrust:—Taken by center main bearing. Endplay .004-.009". Adjusted by replacing bearing.

CAMSHAFT:—5 bearing. Non-adjustable chain drive.
Bearing Type—Removable bushings.
Clearance—.002-.003". **Endplay**—.003-.007".
Camshaft Removal:—Remove from front (flywheel) end. Take out 5/16" setscrew behind water pump drive pulley which holds oil pump and distributor drive assembly, lift drive assembly out of crankcase.
Timing Chain:—Whitney. Width 1¼". Pitch .500". Length 29" or 58 links.

NOTE—Chains with master link can be split at this link. On chains without master link, remove and install chain 'endless' with sprocket off engine.
Camshaft Setting:—Sprockets are marked. Turn crankshaft until piston #4L on top dead center with timing mark '4L' at indicator. Turn camshaft until intake valve in this cylinder about to open. Mesh chain so that there are exactly 15 chain teeth or links between marks.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1 23/32"	3405-.3425"	5 17/64"
Exhaust	1 33/64"	3405-.3425"	5 9/32"

	Seat Angle	Lift	Stem Clearance
Intake	30°	11/32"	.001-.0025"
Exhaust	45°	11/32"	.0015-.003"

NOTE—Measure stem clearance at bottom of guide.
Tappet Clearance:—.008" (Std. 812), .008-.010" (Schgd. 812) all valves with engine cold.
Valve Rockers:—Mounted vertically on tubular shaft at lower end and contact valve stem directly at upper end. Rocker arm shaft hole is bronze-bushed.
Clearance on Shaft—.0005-.0025".
Rocker Arm Roller—Clearances on rocker arm pin .002-.003". Sideplay .005-.008".
Rocker Arm Assembly—Tubular shafts held by setscrew at forward end. Rocker arms pressure-oiled through the hollow shaft. See that drilled holes in forward ends line up with setscrews in bosses and that setscrews fully engage lock holes to insure oil holes lining up. To remove shafts, remove ½" pipe plugs at forward end (flywheel off engine), take out setscrews, pull shafts out. To install rocker arms, assemble as follows: Right bank (front to rear)—rocker arm, spring, rocker arm, large spacer, small spacer (for each cylinder—between crankcase ribs); Left bank (front to rear)—small spacer, large spacer, rocker arm, spring, rocker arm (except for front cylinder where no spacers used).

Valve Springs:—	Pressure	Length
Valve Closed	59½ lbs.	2 3/16"
Valve Open	122 lbs.	1 27/32"

Valve Timing:—See Camshaft Setting above.

Standard 812
Intake Valves—Open 7½° BTDC. Close 37½° ALDC.
Exhaust Valves—Open 50° BLDC. Close 5° ATDC.

Supercharged 812
Intake Valves—Open 9° BTDC. Close 44° ALDC.
Exhaust Valves—Open 50° BLDC. Close 10° ATDC.
To Check Timing—Set tappet clearance #4L piston (rear piston, left bank) at .016". This valve should begin to open with piston 7½° or .0200" (Std. 812), 9° or .0287" (Schgd. 812) before top dead center when point on flywheel 3 teeth (Std. 812), 3½ teeth (Schgd. 812) before dead center mark '#4L' lines up with indicator in inspection hole in right side of housing. Reset tappet clearance.

LUBRICATION:—Pressure system with gear type oil pump mounted in crankcase. Oil pump or distributor may be removed without disturbing drive.
Normal Oil Pressure—30-40 lbs. with warm oil.
Oil Pressure Regulator—Located on oil pump cover. Operates at 40 lbs. **Crankcase Capacity**—7 quarts.

CLUTCH:—Long, Model 10CF-CI. Semi-centrifugal, single plate, dry disc type.
See article in Mechanical Equipment Section for data.
Facings—Molded type, 2 required. Inside Diam. 6", Outside Diam. 10". Thickness .137".
Adjustment:—Free movement of clutch pedal must be 1¼". To adjust, remove clevis pin in clutch throw-out lever at forward end of connecting rod, loosen locknut at rear end of rod, turn rod.

NOTE—See that pedal has 7" travel (pedal 7" above carpet when clutch engaged). Adjust by changing position of stop clamp on pedal shaft under floor.
NOTE—Check operation of Transmission Control clutch pedal circuit breaker (Master Shift Switch) whenever clutch adjusted. See article in Mechanical Equipment Section.
Removal:—Remove Driving Unit (see section below), remove clutch bell housing, take out mounting screws in clutch cover flange on flywheel.

DRIVING UNIT:—Transmission and differential assembly mounted in single case bolted to forward (flywheel) end of engine.
See article in Mechanical Equipment Section for data.
Removal:—Remove louvre assembly, radiator, and sheet metal cover over drive unit. Raise front end of car with jacks under support arms so that wheels just clear floor. Remove front wheels, top and bottom kingpins, rubber bumper on frame siderail above drive shaft, disconnect tie rod at spindle arms. Drive groove pins out of outer end of inner universal assemblies, remove outer universal and shaft (pull out to clear at splined joint), place these assemblies on floor so as to not strain front brake tubes. Remove capscrews in inner universal housing flange, remove inner universal assemblies. Take out bolts in engine mounting bracket on front cross-member, support engine at forward end, take out mounting bolts on driving unit flange on clutch bell housing.

TRANSMISSION:—Own Make. 4 speed (over-drive on fourth). Constant mesh, helical gears, synchromesh (except low and reverse), sliding spur gears low and reverse). No direct drive.
Removal—See Driving Unit section above.

DIFFERENTIAL ASSEMBLY:—Own Make. Spiral bevel gear type (in Driving Unit). Drives to front wheels through individual shafts with universal joints at inner and outer ends.
Backlash—.004-.008". Screw adjustment.
Removal—See Driving Unit Section above.

UNIVERSAL JOINTS:—Bendix, Constant-velocity Ball type, 4 used (one at each end of each shaft).

SHOCK ABSORBERS:—Delco Model 1741-U, T (front), 1748-C, D (rear). Double acting hydraulic type.
See article in Mechanical Equipment Section for data.

STEERING:—Steering Gear—Gemmer Model 330. Worm-and-Roller type.
See article in Mechanical Equipment Section for data.
Front Suspension:—Own design, independent type. Each front wheel mounted on rear end of suspension arm which is pivoted on frame at forward end. Transverse front spring linked to suspension arm by special suspension bolt at outer ends.
Kingpin Inclination—6° crosswise.
Caster—2½°. Suspension arm built with 1° caster. To adjust, turn nut at upper end of suspension bolt (tighten nut to increase caster).
Camber—1°. No adjustment provided.
Toe In—0-⅛" **toe out** (wheels must point out at front). To check, see that intermediate steering arm centered (forward ends equal distances from frame), loosen tie rod clamps, turn rods equally.

BRAKES:—Service—Lockheed Hydraulic, Two shoe, Single Anchor type. Hand lever applies rear wheel service brakes.
See article in Mechanical Equipment Section for data.
Wheel Cylinders—Stepped bore type. Install with large end of cylinder forward. Not interchangeable.
Drum Diameter—11".
Lining—Molded & Woven type. Width 2¼". Thickness 3/16". Length 19" per wheel (front), 11" (rear).
Clearance—.010" toe, .005" heel on each shoe.
Hand Brake:—See Service Brakes above.

ENGINE REMOVAL NOTE:—Engine removal from chassis required for all service work. *See Crosley Special Shop Notes for removal directions.*

SERIAL NUMBER:—First number 390-10000. Stamped on front face of cowl below battery shelf (in engine compartment).

ENGINE NUMBER:—First number C-10000. Stamped on top center of engine block at rear of carburetor.

ENGINE SPECIFICATIONS:—**Waukesha.** Two cylinder, 'L' head, horizontal opposed, air-cooled type with shrouded cylinders and air circulating fan built in flywheel.

Bore—3". **Stroke**—2¾". **Rated Horsepower**—7.2.

Displacement—38.87 cubic inches.

Developed Horsepower—13.5 at 4000 R.P.M.

Compression Ratio—5.5-1.

Compression Pressure—90 lbs. at cranking speed.

Vacuum Reading—No means of connecting gauge.

PISTONS:—Electric furnace cast iron. Matched for equal weight within ⅛ oz.

Weight—18.5 ozs. (with pin). **Length** 2⅝".

Removal—Pistons & rods removed from above with engine out of chassis. *See Crosley Special Shop Notes for engine removal instructions.*

Clearance—.004-.0055". See Fitting Pistons.

Fitting New Pistons:—Use feeler gauges installed between piston and cylinder wall at right angles to pin hole. Piston should pass through bore on .004" feeler and lock on .0055" feeler.

Replacement Pistons:—Finished pistons furnished Standard and .010", .020", .040" oversize.

PISTON RINGS:—Two compression, one oil control ring per piston, all above pin.

Ring	Width	End Gap	Side Clearance
Compr. #1	⅛"	.010-.015"	.002-.0035"
Compr. #2	⅛"	.010-.015"	.0015-.003"
Oil Contr.	3/16"	.010-.018"	.001-.0025"

NOTE—Install oil ring with scraper edge down.

Replacement Rings:—Furnished Standard and .010", .020", .040" oversize.

PISTON PIN:—**Diameter** ⅝". Pin floats in piston and rod, held by locking ring at each end.

Pin Fit in Piston—.0002" clearance or thumb push fit at normal temperature.

Pin Fit in Rod Bushing—.0003" clearance. Ream new bushings with ⅝" reamer for this clearance.

Replacement Pins:—Std. and .005", .010" oversize.

CONNECTING ROD:—**Weight** 12.5 ozs. **Length** 4⅝".

Lower Bearing—Removable steel-backed, babbitt lined type.

Crankpin Journal Diameters—1½".

Clearance—.0025". **Sideplay**—.008".

Adjustment:—None (no shims). Replace bearings. Do not file bearing caps.

Replacement Bearings:—Furnished Std. and .003" undersize. Install bearings with locating lugs fitted in notches in rod and cap. NOTE—Bearings can be renewed through pan opening without removing engine from chassis.

CRANKSHAFT:—Two bearing, counterweighted type. *See Crosley Special Shop Notes for Engine Removal directions for main bearing and crankshaft oil seal servicing.*

Journal Diameters—Front 1⅝". Rear 2¼".

Bearing Type—Steel-backed, babbitt-lined bushings (not split). Front bearing mounted in timing gear housing cover.

Clearance—.001-.003" (frt.), .0015-.003" (rear).

Adjustment:—None. Replace bearings. *See Crosley Special Shop Notes for Crankshaft Removal directions.*

End Thrust:—Taken by rear bearing. Adjustable by replacing fiber thrust washer. **Endplay**—.003-.005".

CAMSHAFT:—Proferal (alloy iron). Two bearing, gear driven.

Bearing Type—Removable bushing in rear cover (front), machined in crankcase (rear).

Clearance—.001-.003".

Endplay—.006-.009". Controlled by timing gear. *See Crosley Special Shop Notes for Camshaft Removal and front bushing servicing data.*

Timing Gears:—Allowable runout .001". To renew gears, remove camshaft (see Crosley Shop Notes for data), use puller to remove old gears.

Camshaft Setting:—Mesh gears so that 'C' mark on camshaft gear and punchmark on crankshaft gear line up (install gears with these marks forward).

VALVES:—

	Head Diameter	Stem Diameter
Intake	1⅜"	5/16"
Exhaust	1 5/32"	5/16"

	Seat Angle	Lift	Stem Clearance
Intake	45°	.300"	.002-.003"
Exhaust	45°	.300"	.003-.004"

Tappet Clearance—.006-.0065" Intake, .007-.0075" Exhaust, Cold. Not adjustable. NOTE—After grinding valves, check tappet clearance with feeler gauge. Grind off end of valve stem if clearance less than minimum above.

Valve Guides:—Guides can be removed and renewed with engine out of car and dismantled (See Shop Notes for engine removal directions). Ream new guides with 5/16" reamer for correct stem clearance (above).

Valve Lifters:—Mushroom type. Remove from below with camshaft out of engine (see Shop Notes for Camshaft removal directions).

Lifter Clearance—.0005-.0015".

Valve Timing:—See Camshaft Setting above. Intake Valves—Open 20° BTDC. Close 60° ALDC. Exhaust Valves—Open 60° BLDC. Close 20° ATDC.

To Check Valve Timing—Intake valve should open when point on flywheel 5.5 teeth before TDC mark (half round notch on rim of flywheel) lines up with small ribcast on top center of crankcase. Exhaust closing point is 5.5 teeth past TDC point.

LUBRICATION:—Pressure to crankshaft, connecting rod and camshaft bearings.

Oil Pump:—Rotary vane type mounted on timing gear cover and driven directly from camshaft.

Removal—Take out 4 screws mounting pump on timing gear cover, remove pump. Serviced by replacement. Use new gasket when installing pump.

Normal Oil Pressure:—30-45 lbs. with warm oil.

Oil Pressure Regulator:—On timing gear case cover. Adjustable by varying valve spring tension (increase tension to increase oil pressure).

Crankcase Capacity—2 quarts.

COOLING:—Air-cooled by suction fan built in flywheel which draws air past cylinder barrel and head fins through ducts formed by shroud bolted over cylinders.

Cooling Fan Capacity—700 cu. ft. of air per minute at 3600 R.P.M.

CLUTCH:—**Rockford.** Single plate dry disc type. *See article in Mechanical Equipment Section for data.*

Facings—Not furnished separately (each facing consists of 4 segments).

Adjustment:—Clutch pedal free travel should be 1.5". To adjust, loosen locknut and turn clevis on connector cable at lower end of throw-out yoke.

Removal:—Remove transmission (see Transmission Removal below) and rear axle as an assembly (do not disconnect drive shaft at rear of transmission case as for transmission removal only). Disconnect clevis at bottom of clutch yoke, remove throw-out bearing from top of yoke, take out six capscrews mounting clutch lever brackets on flywheel, remove clutch assembly.

TRANSMISSION:—**Warner Model AS1-T92.** Sliding spur gear type (all speeds). *See article in Mechanical Equipment Section for data.*

Removal:—Hoist rear of car to remove weight from springs, disconnect springs at rear axle, disconnect brake cables and conduits at backing plates, shock absorber links, exhaust pipe and muffler at torque tube. Block up rear of engine, disconnect speedometer cable and clutch cable clamp on bottom of transmission case, take off control housing and remove shift lever assembly. Take out capscrews in torque tube flange on rear face of transmission case, pull rear axle and propeller shaft assembly to rear **being careful not to lose spring and two washers on shaft at rear of speedometer gear.** Take out four capscrews mounting transmission on flywheel housing, pull transmission straight back and remove.

UNIVERSAL JOINTS:—None used.

REAR AXLE:—**Spicer (Salisbury) Model 11.** Semi-floating spiral bevel gear type with Torque Tube drive. *See article in Mechanical Equipment Section for data.*

Ratio—5.14-1 or 5.57-1.

Backlash—.004-.008". Shim adjustment.

Removal:—Disconnect shock absorber links, brake cables and conduits at backing plate. Hoist rear end of car to remove weight from springs, disconnect springs at axle. Free exhaust pipe and muffler from torque tube, block up rear end of transmission (supported by torque tube). Take out capscrews in torque tube flange on rear of transmission case, pull torque tube and rear axle assembly to rear and remove **being careful not to lose spring and two washers on front end of propeller shaft at rear of speedometer gear.**

Axle Shaft Removal—Remove hub cap, wheel, axle nut, pull hub (use puller No. 202318). Disconnect brake cable and conduit on backing plate, take out four capscrews and remove backing plate being careful not to lose bearing adjusting shims (between backing plate and axle housing flange). Pull axle and bearing out.

Wheel Bearing Adjustment:—Check endplay with dial indicator. Adjust by removing backing plate (see Axle Shaft Removal above) and adding or removing shims between backing plate and axle housing.

Endplay—.002-.007" between shaft and thrust block (total for both shafts).

TORQUE TUBE & PROPELLER SHAFT ASSEMBLY:—Spicer No. 98-1107X. Shaft is supported by bearing at center of torque tube and has splined joint at each end to engage transmission mainshaft (front), rear axle pinion shaft (rear). Torque tube has flanged ends which bolt directly to transmission case and rear axle housing.

Propeller Shaft Removal—Remove rear axle and torque tube as a unit (see Rear Axle Removal above), withdraw propeller shaft through forward end of torque tube.
CAUTION—When installing assembly in car make certain that spring and washers assembled on forward end of propeller shaft (necessary to prevent endplay in shaft).

SHOCK ABSORBERS:—Delco Model 1201G, H (front), 1201J, K (rear). Single acting, hydraulic type.
See article in Mechanical Equipment Section for data.

STEERING:—Steering Gear—Ross Model S-12. Cam-and-Lever type.
See article in Mechanical Equipment Section for data.

Front Suspension:—Conventional 'I' beam section front axle with reverse Elliott ends and semi-elliptic springs.

Kingpin Inclination—6°30' crosswise.

Camber—2°. No adjustment provided.

Caster—9°. No adjustment provided.

Toe In—3/64-1/16". Adjust in usual manner by loosening tie rod clamp bolts and turning rod.

BRAKES:—Service—Hawley. Four wheel, mechanical type with 'floating' lining. Hand lever applies all four service brakes.
See article in Mechanical Equipment Section for data.

Drum Diameter—6".

Lining—Width 1". Thickness 5/32". Length 18⅜" per wheel. NOTE—Lining furnished in correct length to fit loosely around shoe assembly with 1/16-⅛" gap at ends (not riveted on shoes).

Clearance—Just clear of drag.

Hand Brake:—See Service Brakes above.

CROSLEY SPECIAL SHOP NOTES

ENGINE REMOVAL (FOR SERVICING):—Engine should be removed from chassis for all major service work as follows: Disconnect battery ground cable, distributor cables, choke and throttle connections, oil gauge tube line at engine. Close shut-off valve at gasoline tank, disconnect gas line at sediment bulb. Remove exhaust pipe (connecting manifold and muffler), accelerator bracket, generator, starting motor (accessible by removing plate in driver's compartment). Disconnect clutch cable bracket on transmission case, clutch cable clevis at clutch yoke, speedometer cable at transmission. Block up front end of car and remove front axle assembly and wheels. Drain oil, remove oil pan and oil suction tube (pan retained by Phillips type screws). Remove hold-down bolts in front motor support, block engine and transmission up, take out capscrews mounting transmission on flywheel housing, pull engine forward. Take out capscrews mounting torque tube on rear face of transmission case, remove transmission. Lower engine to floor, raise front end of car, remove engine from below.
Installation—Install engine in same manner. Check ignition timing if distributor disturbed.

PISTON & CONNECTING ROD REMOVAL:—With engine removed from chassis (above), take out 7 Phillips screws in each shroud, remove shrouds from cylinders. Remove cylinder heads and oil pan (pan retained by 9 Phillips screws). Take out connecting rod bearing cap screws, push piston and rod assembly out through cylinder barrel.

CAMSHAFT REMOVAL:—With engine removed from chassis (above), remove intake and exhaust manifold assembly, cylinder shrouds (retained by 7 Phillips screws in each shroud), cylinder heads, and oil pan (retained by 9 Phillips screws). Remove connecting rod and piston assemblies, gear housing cover (with oil pump), and valve cover. Block up valves by placing 5/16"x¾" capscrew between crankcase and spring washer on each valve, pull camshaft and timing gear assembly out through front of crankcase.

CRANKSHAFT REMOVAL:—For Main Bearing & Crankshaft Oil Seal Servicing. With engine removed from chassis (above), dismantle engine and remove camshaft (see Camshaft Removal above). Take out 4 capscrews mounting flywheel on crankshaft flange, pull flywheel. Pull crankshaft out through front end of crankcase by hand.

Main Bearing Renewal—Drive old bearings out (rear bearing in crankcase, front bearing in gear housing cover), drive new bearing bushings in place. Bearings are precision type and need not be reamed.

Oil Seal Renewal—Drive old oil seals out of crankcase (rear), gear housing cover (front) with drift pin. Use mandril or hardwood block to drive new seals in place. CAUTION—When installing crankshaft use care not to damage leather oil seals.

CAMSHAFT BUSHING RENEWAL:—Take out 8 capscrews in gear housing cover and Phillips screws in oil pan which enter gear cover, remove gear cover. Drive or press camshaft bushing out of timing gear cover and install new bushing in same manner.

NOTE—Rear camshaft bushing is integral with crankcase and cannot be serviced.

FRONT WHEEL & AXLE ASSEMBLY REMOVAL: For Engine Removal from chassis. Raise front end of car until front wheels clear floor, disconnect brake cables at levers on backing plates and cable conduit from backing plate clamps. Disconnect drag link at pitman arm, disconnect shock absorber links at axle. Remove front spring 'U' bolts at axle. Hoist front end of car and roll wheel and axle assembly out from under car.

SERIAL NUMBER:—First number (SC Std) 5,040,001, (SC Cust.) 6,005,001. (SD Std.) 5,056,001, (SD Cust.) 6,013,001. On right front door hinge pillar post.

ENGINE NUMBER:—Stamped on boss on left side of cylinder block between #1 and #2 cylinders.
NOTE—Letter 'A' following engine number indicates that bore .020" larger than standard. Letter 'B' indicates main and connecting rod bearings .010" smaller than standard. Letters 'AB' indicate bore and bearing sizes as above.

ENGINE SPECIFICATIONS:—6 cylinder, 'L' head type. Floating Power engine mounting (SD 1933).
Bore—3¼". **Stroke**—4¼" (SC), 4⅜" (SD).
Displacement—211.5 cu.ins. (SC), 217.7 cu.ins. (SD).
Horsepower—Rated 25.35. Developed 75 at 3400 R.P.M. (SC), 79 at 3400 R.P.M. (SD Std. 5.35-1 head), 86 at 3400 R.P.M. (SD Optl. 6.2-1 head).
Compression Ratio—5.35-1 (Std. head SC, SD), 6.2-1 (Optl. head SD).
Compression Pressure—Approximately 90-95 lbs. (std. head), 100-105 lbs. (Optl head) at cranking speed.
Vacuum Reading—Gauge should show steady reading of 16-18" at idling speed.
NOTE—Special cylinder head gaskets, head studs and spark plugs (long thread) used with optional aluminum heads. Aluminum heads must be tightened cold.

PISTONS:—Nelson Bohnalite, aluminum alloy, Invar strut, split skirt type. Recondition cylinders when taper exceeds .0015" or out-of-round exceeds .002". Reconditioning limits .0005". Use finished replacement pistons.
Weight—Held to ¼ oz. maximum variation.
Removal—Pistons and rods removed from above.
Clearance—.022" top, .0015-.002" skirt. See Fitting Pistons.

Replacement Pistons:—Finished pistons furnished .003", .005", .010", .015", .020", .023", .025", .030", .040", .050", .060" oversize. Install same oversize in all cylinders to maintain balance.

Fitting New Pistons:—Use micrometer gauge to check piston diameter and cylinder bore. Finish bore to size for correct clearance. Feeler gauge .0015" thick can be used on side opposite slot.

Installing Pistons:—Slot should be to left or away from valves.

PISTON RINGS:—Two special tongue-and-groove type compression rings, one oil wiper ring, one oil control ring per piston, all above slot. Clearance between rings in tongue-and-groove pair should be .003-.005".

Ring	Width	End Gap	Side Clearance
Compression	9/64"	.005-.010"	.003" max.
Oil Wiper (#3)	⅛"	.007-.015"	.003" max.
Oil Cont. (#4)	5/32"	.007-.015"	.003" max.

PISTON PIN:—Diameter 55/64". Length 2¾". Pin floats in piston and rod. Held by locking rings. Pin hole in rod is bronze bushed.
Pin Fit in Piston—Tight thumb push fit with piston heated to temperature of boiling water (212°F.).
Pin Fit in Rod Bushing—Tight thumb push fit at temperature of (70° F.).

CONNECTING ROD:—Length 8 13/16". Weight held to ¼ oz. maximum variation.
Crankpin Journal Diameter—1 15/16".
Lower Bearing—Spun babbitt-lined type integral with rod and cap.
Clearance—.001-.00275. Sideplay .003-.009".
Adjustment:—None (no shims). Replace rods. Do not file rods or caps.
Installing Rods:—Lower bearings offset. Install rods with widest half of bearing toward rear of engine (cylinders #1, 3, 5) or toward front of engine (cylinders #2, 4, 6). Oil hole in upper half of lower bearing must be toward camshaft on all rods.

CRANKSHAFT:—Four bearing. Integral counterwghts.
Journal Diameters—2¼" all bearings.
Bearing Type—Removable bronze-backed, babbitt-lined.
Clearance—.001-.002".
Adjustment:—None (no shims). Replace bearings. Do not file bearing caps.
End Thrust:—Taken by #4 rear main bearing. Endplay .004-.005".

CAMSHAFT:—Four bearing. Non-adjustable chain drive.
Journal Diameters—#1, 2 1/16"; #2, 1 31/32"; #3 1 15/16"; #4, 1⅜".
Bearing Type—Removable steel-backed, babbitt-lined type except #4 which is machined in crankcase.
Clearance—.0015-.0025". Endplay .003-.005".
End Thrust—Taken by thrust plate, front bearing.
Timing Chain:—Morse. Width 1¼". Pitch ½". Length 24" or 48 links.
Camshaft Setting:—Sprockets are marked. Mesh chain with sprockets turned so that marks are adjacent and in line with a straightedge across the shaft centers. Install chain endless with camshaft sprocket off hub.

VALVES:—	Head Diameter	Stem Diameter	Length
Intake	1 17/32"	11/32"	5¼"
Exhaust	1 15/32"	11/32"	5¼"

	Seat Angle	Lift	Stem Clearance
Intake	45°	5/16"	.001-.003"
Exhaust	45°	5/16"	.003-.005"

See Chrysler Special Shop Notes for Exhaust valve seat insert removal and installation instructions.
Tappet Clearance—.005" Int., .007" Exh. engine hot.
Valve Springs:—Do not compress springs to over-all length of less than 1¾".

	Spring Pressure	Spring Length
Valve Closed	40-44 lbs.	2 1/16"

Intake Valves—Open 6° BTDC. Close 46° ALDC.
Exhaust Valves—Open 42° BLDC. Close 8° ATDC.
To Check Valve Timing—Use regular timing gauge installed in timing hole over #6 piston. Set tappet clearance #6 intake valve at .011". This valve should open with piston .014" past top dead center. Reset tappet clearance at .005" with engine hot.
Motor Gauge—Weldenhoff Adapter #103. Rod #12.

LUBRICATION:—Pressure type. Gear type oil pump located at right of crankcase.
Normal Oil Pressure—15 lbs. idling, 30-40 lbs. at 20 M.P.H.
Oil Pressure Relief Valve—Under cap on left hand side of crankcase. To adjust, remove cap, take out locking wire, turn slotted plug clockwise to increase, or counter-clockwise to decrease oil pressure, replace locking wire.
Crankcase Capacity—6 qts.

CLUTCH:—Borg and Beck. (SC) Model 9A1 marked 514 on cover, (SD) Model 10A1 marked 611 on cover. Single plate, dry disc type. See article in Clutch Section for complete relining and asembling directions.
Facings (SC-9A1)—Moulded type, 2 required. Thickness ⅛". Inside Diameter 6⅛". Outside Diameter 8⅞".
Facings (SD—10A1)—Moulded type, 2 required. Thickness ⅛". Inside Diameter 6¾". Outside Diameter 9⅞".
Adjustment—Adjust pedal stopscrew (at rear of pedal below pedal shaft) for highest position of pedal without interference with floor. Pedal free movement must be 1¼". To adjust, loosen locknut and turn clutch fork adjusting screw in front of pedal shaft.

STEERING:—Steering Gear—Gemmer Worm-and-Sector type. See article in Steering Section for compelte adjustment directions.
Front Suspension—Conventional 'I' beam section front axle with Elliott type ends and semi-elliptic springs.
Kingpin Inclination—7° crosswise.
Caster—1-3°. Adjust by inserting wedge shims between spring and spring pad on axle.
Camber—0-1¼°. No adjustment. Must be equal for both wheels.
Toe In—1/16" measured 9" up on wheels. Adjusted in usual manner by loosening tie rod ends and turning tie rod.

BRAKES:—Service—Lockheed Hydraulic, double anchor type. Hand lever applies separate brake at rear of transmission. See article in Brake Section for complete adjustment directions.
Drum Diameter—11".
Lining—Moulded type. Width 1½". Thickness 3/16". Length 20 7/32" per wheel.
Clearance—.012" toe, .006" heel for each shoe.
Hand Brake:—External type on drum at rear of transmission.
Adjustment—Place lever in released position, remove locking wire and turn anchor adjusting screw to give 1/16" clearance between lining and drum at this point. Turn adjusting nut at top of adjusting bolt to give 1/16" clearance around band. If necessary, loosen locknut and turn guide bolt nut so that clearance is uniform around band.
Drum Diameter—7".
Lining—Width 2". Thickness 5/32". Lgth., 21 13/32".

ENGINE NUMBER:—Stamped on left side of cylinder block between #1 and 2 cylinders. Letter 'A' following number indicates that bore is .020" larger than standard. Letter 'B' indicates that main and connecting rod bearings are .010" smaller than standard. Letter 'AB' indicates that bore and bearing sizes are as above.

SERIAL NUMBER:—First number (SE) 5,068,501; (SG) 5,082,501 (Detroit), 9,603,436 (Windsor, Canada). Located on right front door hinge pillar post.

ENGINE:—Own. 6 cylinder, 'L' head. Floating power.
Bore—3⅜". **Stroke**—4½".
Piston Displacement—241.5 cubic inches.
Rated Horsepower—27.34 A.M.A.
Developed Horsepower—100 at 3400 R.P.M. with standard heads.
Compression Ratio—(SE) 6.2-1 Std. aluminum hd. No Optl. (SG) 6.5-1 Std. aluminum head, 7.0-1 optl.
Compression Pressure—Approximately 105 lbs. (6.2-1 hd.), 110 lbs. (6.5-1 hd.), 117 lbs. (7.0-1 hd.) at cranking speed.
Vacuum Reading—Gauge should show steady reading of 16-18" with engine idling.
NOTE—Aluminum heads should be tightened cold.

Pistons:—Aluminum alloy, 'T' slot, cam ground type. Semi-finished pistons (head and ring grooves completely finished, skirt semi-finished) furnished for service where 'cam' grinding equipment is available in two sizes: (1) standard to .023" oversize, (2) .025" to .050" oversize. If cam grinding equipment is not available, use finished replacement pistons furnished .003", .005", .010", .015", .020", .023", .025", .030", .040"," .050", .060" oversize and finish cylinder bores to provide correct clearance. Piston length 3⅞".
Removal—Pistons and rods removed from above.
Weight—Held to 7 grams or ¼ oz. variation.
Clearance—Top .022". Skirt .002".
Fitting New Pistons—Use micrometer gauges to check cylinder bore and piston diameter.
Installing Pistons—Slot at left (away from valves).

Piston Rings:—Two compression, one undercut oil wiper, ring (#3), one oil control ring per piston, all above pin. Lower ring grooves drilled radially with oil drain holes. Rings furnished in same oversizes as pistons (except .023").

Ring	Width	End Gap	Side Clearance
Comp. All	⅛"	.007-.015"	.003"
Oil Cont. All	5/32"	.007-.015"	.003"

Piston Pin:—Diameter 55/64". Length 2⅞". Pin floats in piston and rod. Held by retaining rings. Piston should be heated in boiling water to remove or install pins. Pins furnished .003", .005", .008" oversize.
Pin Fit in Piston—Tight thumb push fit with piston heated to 120°F.
Pin Fit in Rod Bushing—Light thumb push fit with piston at room temperature (70°F).

Connecting Rod:—Weight, maximum variation held to 7 grams or ¼ oz. Length 8¾".
Crankpin Journal Diameter—2⅛".
Lower Bearing—Removable steel-backed, babbitt-lined type. No shims.
Clearance—.001-.00275". Sideplay .003-.009".
Adjustment—None (no shims). Replace bearings. Do not file rods or caps. Install new bearings with small boss registering with groove (both halves). Furnished .010" undersize and standard.
Installing Rods:—Lower bearings are offset. Install rods with widest half of bearing toward rear of engine (#1, 3, 5), or toward front of engine (#2, 4, 6). Oil hole in upper half of bearing must be toward valve side on all rods.

Crankshaft:—Four bearing. Integral counterwgts.
Journal Diameter—2½" all bearings.
Bearing Type—Removable steel-backed, babbitt-lined type. No shims.
Clearance—.001-.002".
Adjustment—None (no shims). Replace bearings. Do not file bearing caps. *See Chrysler Special Shop Notes for Replacement Bearings and Bearing Caps.*
End Thrust—Taken by rear bearing. Endplay .003-.007".

Camshaft:—4 bearing. Non-adjustable chain drive.
Bearing Type—Removable steel-backed, babbitt-lined type (except #4, machined in crankcase).
Clearance—.0015-.0025" radial, .003-.005" endplay.
End Thrust—Taken by thrust plate at rear of sprocket hub.
Timing Chain—Morse. Width 1". Pitch .500". Length 24" or 48 links.
Camshaft Setting—Sprockets are marked. Mesh chain with sprockets turned so that marks are adjacent and in line with a straightedge across the shaft centers.

Valves:—

	Head Diameter	Stem Diameter	Length
Intake	1 17/32"	.340-.341"	5 5/16"
Exhaust	1 15/32"	.340-.341"	5 5/16"

	Seat Angle	Lift	Stem Clearance
Intake	45°	11/32"	.001-.003"
Exhaust	45°	11/32"	.003-.005"

See Chrysler Special Shop Notes for Exhaust valve seat insert removal and installation instructions.
Installing New Guides—Use special tool to remove and install guides. Intake guides installed with taper end up, exhaust guides with taper end down. Top of guide must be 13/16" below top of block. Finish ream new guides to inside diameter of .342-.343" intake, .344-.345" exhaust after installing.
Tappet Clearance—.006" Int., .008" Exh. with engine hot. Set exhaust clearance at .010" for sustained high speed driving. Tappet adjustment accessible by removing right front wheel and cover plate under front fender.
Valve Springs—Variable pitch type. Install springs with closer spaced coils at top. Do not compress springs to over-all length of less than 1 11/16".

	Spring Pressure	Spring Length
Valve Closed	46-50 lbs.	2 1/32"
Valve Open	104-110 lbs.	1 11/16"

Valve Timing:—See Camshaft Seting above.
Intake Valves—Open at TDC. Close 50° ALDC.
Exhaust Valves—Open 48° BLDC. Close 2° ATDC.
To Check Valve Timing—Set tappet clearance #1 intake and exhaust valves at .010". Intake valve should open at top dead center when 'O' mark on impulse neutralizer at front of engine lines up with pointer on chain case. Reset tappet clearance at .006" Int., .008" Exh. (engine hot).

Lubrication:—Pressure. Gear type oil pump located at right of crankcase.
Normal Oil Pressure—30-40 lbs. at 30 M.P.H.
Oil Pressure Relief Valve—Under plug on left hand side of crankcase. Operates at 40-45 lbs. Adjustable by changing spring. Standard spring unpainted. Heavy spring (to increase pressure) painted green. Lighter spring (to decrease pressure) painted red.
Capacity & Oil—6 qts. Use SAE. #30 (summer—#40 for high speed driving or temperatures above 100°F), #20-W (winter 32° to 0°F), #10-W (winter 0° to —15°F).

CLUTCH:—Borg & Beck Model 10A3 (SE), 10A6 (SG). Model No. stamped on cover (SE) 855, (SG) 883. Single plate, dry disc type. No adjustment required for wear. See article in Clutch Section for relining and assembly directions.
Clutch Pedal Adjustment—Clutch pedal should just clear underside of toeboard with clutch engaged. To adjust, turn stopscrew located just above clutch pedal shaft. Free movement of pedal should be 1" (SE), 1 1/16" (SG). To adjust, SE—turn clutch release fork lever adjusting screw (with locknut released) at left end of clutch release fork lever; (SG)—turn clutch shaft adjusting screw at right hand end of clutch pedal shaft.
Clutch Facings—Woven asbestos, 2 required, 6⅛" I.D., 9⅞" O.D., .133" thick.
NOTE—To remove clutch first remove clutch fork and pivot by taking out pivot capscrew. Mark clutch cover and flywheel before disassembling and install in same position. Install driven plate assembly with mark 'Flywheel Side' toward flywheel (hub is offset). Use special gauge plate and adaptor to set up release levers when reassembling clutch. Release lever heights must be equal with in .005".

STEERING:—Front Suspension—Conventional tubular section front axle with Reverse-Elliott ends and semi-elliptic springs.
Kingpin Inclination—9° (SE), 4° (SG) crosswise.
Caster—2° plus or minus 1°. Adjust by wedge shims inserted betwen springs and spring pad on axle. Shims or angle plates furnished ½, 1, 2°.
Camber—½° plus or minus ¼°. No adjustment provided. Manufacturer recommends that no attempt be made to correct camber by bending tubular axle centers.
Toe In—1/16-⅛" measured at hub height. Adjust as usual by changing length of tie rod.
Steering Gear:—Gemmer Model, Worm-and-Roller type. See article in Steering Section for adjustmts.

BRAKES:—Service—Lockheed hydraulic, double anchor type. Hand lever applies brakes at rear of transmission. See article in Brake Section for relining and complete adjustment procedure.
Wheel Cylinders—Diameters—Front Wheel (front shoe 1¼", rear shoe 1⅜"); Rear Wheel (SE—front shoe 1⅛", rear shoe 1¼"), (SG—front shoe 1", rear shoe 1⅛").
NOTE—Wheel cylinders marked 'R' right side of car, 'L' left side of car, and are not interchangeable.
Drum Diameter—11".
Lining—Moulded type. Width 2". Thickness 3/16". Length per wheel 22 5/32".
Clearance—.012" toe, .006" heel, for each shoe.
Hand Brake:—External type at rear of transmission.
Adjustment—With lever in released position remove anchor screw locking wire, turn anchor screw so that clearance between lining and drum is 1/32", lock anchor screw with wire. Turn adjusting nut at top of adjusting bolt so that clearance around drum is 1/32". Loosen locknut and turn guide bolt, if necessary, to secure uniform clearance around drum.
Drum Diameter—6" (SE), 7" (SG).
Lining—Woven type. Width 2½". Thickness ¼" (SE), 3/16" (SG). Length 18¼" (SE), 21 13/32" (SG).
NOTE—When relining, cut out lining adjacent to anchor and chamfer ends. Clearance between anchor and sides of anchor saddle .005" maximum.

SERIAL NUMBER:—First number, 6,023,501 (Detroit), 9,664,001 (Windsor, Canada). On right front door hinge pillar post.

ENGINE NUMBER:—Stamped on boss on left side of cylinder block between #1 and 2 cylinders. Letter 'A' following number indicates that bore is .020" larger than standard. Letter 'B' indicates that main and connecting rod bearings are .010" smaller than standard. Letters 'AB' indicates that bore and bearing sizes are as above.

ENGINE:—Own. Six cylinder, 'L' head type.
Bore—3⅜". Stroke, 4½".
Displacement 241.5 cu. ins. **Rated HP.** 27.34.
Developed Horsepower—91 at 3400 R.P.M.
Compression Ratio—6.0-1 Std. cast-iron head, 6.5-1 special aluminum head.
Compression Pressure—120-130 lbs. (6.0-1 head), 125-135 lbs. (6.5-1 head) at 1000 R.P.M. or approx. 103 lbs. (6.0-1), 110 lbs. (6.5-1) at cranking speed.
Vacuum Reading—Gauge should show steady reading of 16-18" with engine idling.

Pistons:—Aluminum alloy, 'T' slot, Cam ground type. Semi-finished pistons (head and ring grooves completely finished, skirt semi-finished) furnished for service where 'cam' grinding equipment is available in two sizes: (1) standard to .023" oversize, (2) .025" to .050" oversize. If cam grinding equipment is not available, use finished replacement pistons furnished .003", .005", .010", .015", .020", .023", .025", .030", .040", .050", .060" oversize and finish cylinder bores to provide correct clearance. Piston length 3⅞".
Removal—Pistons and rods removed from above.
Weight—Held to 7 grams or ¼ oz. variation.
Clearance—Top .025", Skirt .002".
Fitting New Pistons—Use micrometer gauges to check cylinder bore and piston diameter.
Installing Pistons—Slot at left (away from valves).

Piston Rings:—Two compression, one undercut oil wiper ring (#3), one oil control ring per piston, all above pin. Lower ring grooves drilled radially with oil drain holes. Rings furnished in same oversizes as pistons (except .023").

Ring	Width	End Gap	Side Clearance
Comp. All	⅛"	.007-.015"	.003"
Oil Cont. All	5/32"	.007-.015"	.003"

Piston Pin:—Diameter 55/64". Length 2⅞". Pin floats in piston and rod. Held by retaining rings. Piston should be heated in boiling water to remove or install pins. Furnished .003", .005", .008" oversize.
Pin Fit in Piston—Tight thumb push fit with piston heated to 120°F.
Pin Fit in Rod Bushing—Tight thumb push fit with piston at room temperature (70°F.).

Connecting Rod:—Weight—maximum variation held to 7 grams or ¼ oz. Length, 8¾".
Crankpin Journal Diameter—2⅛".
Lower Bearing—Removable steel-backed, babbitt-lined type. No shims.
Clearance—.001-.00275". Sideplay .003-.009".
Adjustment—None (no shims). Replace bearings. Do not file rods or caps. Install new bearings with small boss registering with groove (both halves). Bearings furnished .010" undersize and standard.
Installing Rods—Lower bearings are offset. Install rods with widest half of bearing toward rear of engine (#1, 3, 5), or toward front of engine (#2, 4, 6). Oil hole in upper half of bearing must be toward valve side on all rods.

Crankshaft:—Four bearing. Integral counterweights.
Journal Diameters—2½" all bearings.
Bearing Type—Removable steel-backed, babbitt-lined type. No shims.
Adjustment—None (no shims). Replace bearings. Do not file bearing caps. *See Chrysler Special Shop Notes for Replacement Bearings and Bearing Caps.*
End Thrust — Taken by rear bearing. Endplay .003-.007".

Camshaft:—4 bearing. Non-adjustable chain drive.
Bearing Type—Removable steel-backed, babbitt-lined type (except #4 machined in crankcase).
Clearance—.0015-.0025". Endplay .003-.005".
End Thrust—Taken by thrust plate at rear of sprocket hub.
Timing Chain—Morse. Width 1". Pitch .500". Length 24" or 48 links.
Camshaft Setting—Sprockets are marked. Mesh chain with sprockets turned so that marks are adjacent and in line with a straightedge across the shaft centers.

Valves:—

	Head Diameter	Stem Diameter	Length
Intake	1 17/32"	.340-.341"	5 5/16"
Exhaust	1 15/32"	.340-.341"	5 5/16"

	Seat Angle	Lift	Stem Clearance
Intake	45°	11/32"	.001-.003"
Exhaust	45°	11/32"	.003-.005"

See Chrysler Special Shop Notes for Exhaust valve seat insert removal and installation instructions.
Installing New Guides—Use special tool to remove and install guides. Intake guides installed with taper end up, exhaust guides with taper end down. Top of guide must be 13/16" below top of block. Finish ream new guides to inside diameter of .342-.343" intake, .344-.345" exhaust after installing.
Tappet Clearance—.006 Int., .008" Exh. with engine hot. Set exhaust clearance at .010" for sustained high speed driving. Valves accessible by removing right front wheel and housing cover under fender.
Valve Springs—Variable pitch type. Install springs with closer spaced coils at top. Do not compress springs to over-all length of less than 1 11/16".

	Spring Pressure	Spring Length
Valve Closed	46-50 lbs.	2 1/32"
Valve Open	104-110 lbs.	1 22/32"

Valve Timing—See Camshaft Setting above.
Intake Valves—Open at TDC. Close 50° ALDC.
Exhaust Valves—Open 48° BLDC. Close 2° ATDC.
To Check Valve Timing—Set tappet clearance #1 intake and exhaust valves at .010". Intake valve should open at top dead center when '0' mark on impulse neutralizer at front of engine lines up with pointer on chain case. Reset tappet clearance at .006" Int., .008" Exh., with engine hot.
Motor Gauge—Weidenhoff Adapter #103, Rod #12.

Lubrication:—Pressure. Gear type oil pump located at right of crankcase.
Normal Oil Pressure—40-45 lbs. at driving speeds.
Oil Pressure Relief Valve—Under plug on left hand side of crankcase. Operates at 40-45 lbs. Adjustable by changing spring. Standard spring unpainted. Heavy spring (to increase pressure) painted green. Lighter spring (to decrease) red.
Crankcase Capacity—6 quarts.

CLUTCH:—Borg & Beck, Model 10A6. Single plate, dry disc type. No adjustment required for wear. *See article in Mechanical Equipment Section for data.*
Clutch Pedal Adjustment—Clutch pedal should just clear underside of toeboard with clutch engaged. To adjust, turn stopscrew located just above cutch pedal shaft. Free movement of pedal should be 11/16". To adjust, loosen locknut and turn adjusting nut (clevis) on clutch fork adjusting rod.
Clutch Facings—Woven asbestos, 2 required, 6⅛" I.D., 9⅞" O.D., .133" thick.
NOTE—To remove clutch first remove clutch fork and pivot by taking out pivot capscrew. Mark clutch cover and flywheel before disassembling and install in same position. Install driven plate assembly with mark "Flywheel Side' toward flywheel (hub is offset). Use special gauge plate and adaptor to set up release levers when reassembling clutch. Release lever heights must be equal within .005".

STEERING:—Front Suspension—Independent, linked parallelogram type with coil springs.
See article in Mechanical Equipment Section for data.
King Pin Angle—10° plus or minus ½° (including camber angle) or 8¾-10¼° from vertical (without camber angle).
NOTE—Following specifications apply with car weight on wheels (check spring height first).
Caster—1½° (½-2½°). To adjust, jack up car with jack placed under lower control arm or spring seat so that weight of car is not on wheels. Loosen upper and lower control arm yoke nuts, remove lubricant fitting at front end of upper control arm yoke pin, loosen clamp bolts on upper yoke and upper end of knuckle support, insert special caster adjusting wrench in lubricant fitting hole in front end of upper yoke, turn upper control arm yoke pin so as to move upper end of knuckle support toward rear to increase caster angle, or toward front to decrease caster angle. Tighten clamp bolts and yoke nuts.
Camber—½° (¼—1°). Camber affected by caster adjustment and must be checked when caster angle is changed. Before changing camber, see that king pin pivot angle is correct and that loaded heights of front springs are equal (see paragraph below). To adjust camber, jack up car with jack placed under lower control arm so that weight of car is on spring but not on wheel, disconnect tie rod at wheel end, remove upper control arm yoke nut, pull yoke out of control arm, add spacers between yoke and control arm to increase camber, or remove spacers to decrease camber (place spacers removed in this manner on inner face of control arm under yoke nut).
Toe In—1/16-⅛" measured at hub height on center of tire tread. Adjust by changing length of each tie rod equally. Measure tie rods to be certain that lengths are equal after adjusting).
Spring Heights—Distance from center line of lower control arm yoke pin to top of frame cross member (flat section) should be 7¼" to 7⅜" with car weight on wheels but no load in car). Heights on each side of car must be equal within ⅛".

Steering Gear:—Gemmer Model, Worm-and-Roller type. See article in Steering Section for adjustmts.

BRAKES:—Service—Lockheed hydraulic, double anchor type. Hand lever applies brake at rear of transmission. See article in Brake Section for relining and complete adjustment procedure.
Wheel Cylinders—Diameters—Front Wheel (front shoe 1¼", rear shoe 1⅜"); Rear Wheel (front shoe 1⅛", rear shoe 1¼").
NOTE—Wheel cylinders not interchangeable.
Drum Diameter—10".
Lining—Moulded type. Width 2". Thickness 3/16". Length per wheel 19 13/16".
Clearance—.012" toe, .006" heel, for each shoe.

Hand Brake:—External type at rear of transmission.
Adjustment—Place lever in released position, remove locking wire and turn anchor adjusting screw until clearance between lining and drum is 1/16" at this point. Turn adjusting nut at upper end of adjusting bolt until clearance around drum is 1/16". If necessary, loosen locknut and turn guide bolt nut to secure uniform clearance around drum.

ENGINE NUMBER:—First number—S1-1001. Stamped on boss on left side of cylinder block between #1 and 2 cylinders. Letter 'A' following number indicates that cylinder bore is .020" larger than standard. Letter 'B' indicates that main and connecting rod bearings are .010" smaller than standard. Letters 'AB' indicate that bore and bearing sizes are as above.

ENGINE SPECIFICATIONS:—6 cylinder 'L' head.
Bore—3⅜". **Stroke**—4½".
Displacement—241.5 cubic inches.
Rated Horsepower—27.34 (AMA).
Developed Horsepower—93 HP. (Std. 6.0-1 Head), 100 HP. (Optl. 6.5-1 head) at 3400 R.P.M.
Compression Ratio—6.0-1 Std. Cast-iron head, 6.5-1 Optl. Aluminum head.
Compression Pressure—6.0-1 Std. Head 120-130 lbs. at 1000 R.P.M. or approx. 103 lbs. at cranking speed. **6.5-1 Optl. Head** 125-135 lbs. at 1000 R.P.M. or approx. 110 lbs. at cranking speed.
Vacuum Reading—Gauge should show steady reading of 16-18" with engine idling at 6 M.P.H.
NOTE—Aluminum heads should be tightened cold.

PISTONS:—Aluminum alloy, 'T' slot, Cam ground type with anodized finish (special hard oxide formed on bearing surface). **Length**—3⅞". **Weight**—Held to two gram max. variation.
Removal—Pistons and rods removed from above.
Clearance—Top .022". Skirt .002". See Fitting New Pistons.
Replacement Pistons:—Finished anodized pistons furnished in standard and .003", .005", .010", .015", .020", .023", .025", .030", .040", .050", .060" oversizes. Semi-finished pistons furnished: (1) standard to .023" oversize, (2) .025-.050" oversize, not interchangeable. Pistons should be slotted and then finished on cam granding equipment.
Fitting New Pistons:—Micrometer gauge recommended. Using feeler gauge (.002") inserted between piston and cylinder wall on side opposite slot, pull required to withdraw feeler must be 3-4 lbs.
Installing Pistons:—Slot should be toward left.

PISTON RINGS:—Two compression, one undercut oil wiper ring (#3), one oil control ring per piston, all above pin. Lower ring groves drilled radially with twelve ⅛" oil drain holes.

Ring	Width	End Gap	Side Clearance
Comp. all	⅛"	.007-.015"	.002-.003"
Oil (both)	5/32"	.007-.015"	.002-.003"

Replacement Rings:—Furnished in standard and .003", .010", .020", .030", .040", .050",. 060" oversizes. NOTE—Install undercut compression and oil wiper ring with step down.

PISTON PIN:—Diameter 55/64". **Length** 2⅞".
Pin flots in piston and rod. Held by locking rings at each end. Pin hole in rod is bronze bushed.
NOTE—Heat piston in boiling water to remove or install pins.
Pin Fit in Piston—Tight thumb push fit with piston heated to 120° F.
Pin Fit in Rod Bushing—Tight thumb push fit with pin and rod at 70° F.
Replacement Pins:—Pins furnished in standard and .003", .005", .008" oversizes. Ream rod bushing and pin holes in piston bosses for correct fit.

CONNECTING ROD:—Weight—Held within limits.
Length—8¾" (center-to-center).
Crankpin Journal Diameter—2⅛".
Lower Bearing—Removable steel-backed, copper-lead lined. Furnished standard and .010" undersize.
Clearance—.0005-.0025". Sideplay .0055-.0115".
Bearing Adjustment:—None (no shims). Replace bearings. Do not file rods or caps. Install new bearings so small bosses engage grooves in rod and cap.
Installing Rods:—Lower bearings are offset. Install rods with widest half of bearing toward rear (#1, 3, 5) or toward front (#2, 4, 6). Oil hole in lower bearing upper half must be toward camshaft on all rods.

CRANKSHAFT:—4 bearing. Integral counterweights.
Journal Diameters—2½" all bearings.
Bearing Type—Removable steel-backed, babbitt-lined. Furnished standard and .010" undersize.
Clearance—.001-.002".
Bearing Adjustment:—None (no shims). Replace bearings. Do not file caps. *See Chrysler Special Shop Notes for Replacement Bearings and Bearing Caps.*
End Thrust:—Taken by flange faces on rear (#4) bearing. Endplay .003-.007".

CAMSHAFT:—4 bearing. Non-adjustable chain drive.
Journal Diameters—#1, 2"; #2, 1 31/32"; #3, 1 15/16"; #4, 1⅜".
Bearing Type—Removable steel-backed, babbitt-lined (except #4, machined in crankcase).
Clearance—.001-.003" (#1), .0015-.0035" (all others).
NOTE—New bearings require no line-reaming.
End Thrust:—Taken by thrust plate at rear of sprocket hub. Endplay .003-.005".
Timing Chain:—Morse. Width 1". Pitch ½". Length 24" or 48 links.
Camshaft Setting:—Sprockets are marked. Mesh chain with sprockets turned so that 'O' marks are adjacent and in line with a straightedge across shaft centers.
NOTE—Engine must be supported under front end of oil pan and front engine support removed for work on timing chain and camshaft.

VALVES—

	Head Diameter	Stem Diameter	Length
Intake	1 17/32"	.340-.341"	5⅝"
Exhaust	1 15/32"	.340-.341"	5⅝"

	Seat Angle	Lift	Stem Clearance
Intake	45°	11/32"	.001-.003"
Exhaust	45°	11/32"	.003-.005"

See Chrysler Special Shop Notes for Exhaust valve seat insert removal and installation instructions.
Tappet Clearance—.006" Int., .008" Exh., (hot). .010" Exh. recommended for sustained high speed.
Valve Guides:—Use special tool to remove and install guides. Insert guides with taper end up (intake) and down (exhaust). Top of guide must be 13/16" below top of block. After installing finish ream new guides to inside diam. of .342-.343" (Int.), .344-.345" (Exh.).
Valve Springs:—Variable pitch type. Install springs with close coil at top. Do not compress springs to over all length of less than 1½".

	Spring Pressure	Length
Valve Closed	46-50 lbs.	2 1/32"
Valve Open	104-110 lbs.	1 11/16"

Valve Lifters:—Mushroom type. Ream guides to take following oversizes: .001", .008", .030", .060".
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open TDC. Close 50° ALDC.
Exhaust Valves—Open 48° BLDC. Close 2° ATDC.
To Check Valve Timing—Set tappet clearance #6 intake valve at .010". Intake valve should open at top dead center when 'O' mark on impulse neutralizer at front of engine lines up with pointer on chain case cover. Reset tappet clearance at .006".
Motor Gauge—Weidenhoff Adapter #103, Rod #12. Gauge plug hole over #6 cylinder.

LUBRICATION:—Pressure. Gear type oil pump located at right of crankcase.
NOTE—Ignition timing should be checked whenever oil pump is installed in engine.
Normal Oil Pressure:—30-40 lbs. at 30 M.P.H.
Oil Pressure Relief Valve:—Under plug on left hand side of crankcase. Operates at 40 lbs. Adjustable by changing spring. Standard spring unpainted. Heavy spring (to increase pressure) painted green. Lighter spring (to decrease pressure) painted red.
Crankcase Capacity:—6 qts. (refill).

CLUTCH:—Borg & Beck Model 10A6. Single plate, dry disc type. See article in Clutch Section.
Facings—Woven type, 2 required. Inside Diam. 6⅛". Outside Diam. 9⅞". Thickness ⅛".
Adjustment—Clutch pedal should just clear underside of toe board with clutch engaged. To adjust, turn stopscrew located just above clutch pedal shaft. Free movement fo pedal should be 1 1/16". To adjust, loosen locknut and turn adjusting nut (clevis) on clutch fork adjusting rod.
Removal—Disconnect clutch pedal linkage, remove fork pivot screw, take out clutch fork. Remove transmission (release bearing and spring are withdrawn with transmission), remove clutch housing pan, prick punch clutch cover and flywheel (install in same position to maintain balance), take out clutch mounting bolts, turning all bolts out evenly to release spring tension and avoid distortion of clutch cover. Remove clutch from below. Use pilot studs when removing and installing transmission to avoid springing clutch plate.
Automatic Clutch:—See article in Clutch Section.

STEERING:—Steering Gear—Gemmer Model Worm-and-Roller type. See article in Steering Section.
Front Suspension:—Independent, linked parallelogram type with coil springs. See article in Steering Section. Following specifications apply with car weight on wheels (check suspension unit height first).
Wheel Setting (Front Suspension Height)—Distance from center line of lower control arm yoke pin to top of frame cross member should be 7¼-7⅜" with car weight on wheels but no load in car.
Kingpin Inclination—10° plus or minus ½° (including camber angle), 8¾-10¼° (without camber).
Camber—¼°. Limits minus ¼°-plus ½°.
Caster—1½°. **Toe In**—0-⅛".

BRAKES:—Service—Lockheed Hydraulic, double anchor type. Hand lever applies brake at rear of transmission or rear wheel service brakes (on cars with overdrive). See article in Brake Section.
Wheel Cylinders—Diameters, Front Wheel (Front end 1¼", Rear 1⅜"), Rear Wheel (Front end 1⅛", Rear 1¼").
NOTE—Wheel cylinders marked 'R'—right side of car. 'L'—left side of car and not interchangeable.
Drum Diameter—10" (Del.), 11" (Cst.).
Lining—Moulded type. Width 2". Thickness 13/64" (Del.), 3/16" (Cst.). Length per wheel 19 13/16" (Del.), 22 5/32" (Cst.).
Clearance—.012" toe, .006" heel, for each shoe.
Hand Brake:—External type on drum at rear of transmission (cars without overdrive). See Service Brake for hand brake adjustment on cars with overdrive.
Adjustment—With lever in released position, remove anchor screw locking wire, turn anchor screw so that clearance between lining and drum is 1/16", lock anchor screw with wire. Adjust brake band guide bolt nut to give 1/16" clearance (as above) for lower portion of band, secure with locknut. Finally, adjust brake adjusting bolt nut to give 1/16" clearance (as above).
Drum Diameter—7 13/16".
Lining—Width 2". Thickness ¼". Length 24 3/16".
NOTE—When relining, cut out lining adjacent to anchor and chamfer ends. Clearance between anchor and sides of anchor saddle .005" maximum.

ENGINE NUMBER:—First number—S2-1001. Stamped on boss above water pump. Letter 'A' following number indicates bore .020" larger than standard. 'B' indicates main and connecting rod bearings .010" smaller than standard. 'AB' indicates that bore and bearing sizes are as above.

ENGINE SPECIFICATIONS:—6 cylinder, 'L' head.
Bore—3⅜". **Stroke**—4½".
Displacement—241.5 cubic inches.
Rated Horsepower—27.34(AMA).
Developed Horsepower—100 HP. (Std. 6.5-1 head), 105 HP. (Optl. 7.0-1 head) at 3400 R.P.M.
Compression Ratio—6.5-1 Std. aluminum head, 7.0-1 Optl. aluminum head.
Compression Pressure—6.5-1 Std. head, 125-135 lbs. at 1000 R.P.M. or approx. 110 lbs. at cranking speed. **7.0-1 Optl. head** 130-140 lbs. at 1000 R.P.M. or approx. 117 lbs. at cranking speed.
Vacuum Reading—Gauge should show steady reading of 16-18" with engine idling at 6 M.P.H.
NOTE—Aluminum heads should be tightened cold. Special head studs, head gaskets and spark plugs used on aluminum head engines.

PISTONS:—Aluminum alloy, 'T' slot, Cam ground type with anodized finish (special hard oxide formed on bearing surface). **Length**—3⅞".
Weight—Held to two gram max. variation.
Removal—Pistons and rods removed from above.
Clearance—Top .022". Skirt .002". See Fitting New Pistons.
Replacement Pistons:—Finished anodized pistons furnished in standard and .003", .005", .010", .015", .020", .023", .025", .030", .040", .050", .060" oversizes. Semi-finished pistons furnished: (1) standard to .023" oversize, (2) .025-.050" oversize, not interchangeable. Pistons should be slotted and then finished on cam-grinding equipment.
Fitting New Pistons:—Micrometer gauge recommended. Using ½" feeler gauge (.002") inserted between piston and cylinder wall on side opposite slot, pull required to withdraw feeler must be 3-4 lbs.
Installing Pistons:—Slot should be toward left or away from camshaft.

PISTON RINGS:—Two compression, one undercut oil wiper ring (#3), one oil control ring per piston, all above pin. Lower ring grooves drilled radially with twelve ⅛" oil drain holes.

Ring	Width	End Gap	Side Clearance
Comp. all	⅛"	.007-.015"	.002-.003"
Oil (both)	5/32"	.007-.015"	.002-.005"

Replacement Rings:—Furnished in standard and .003", .010", .020", .030", .040", .050", .060" oversizes.
NOTE—Install undercut compression and oil wiper ring with step down.

PISTON PIN:—**Diameter** 55/64". **Length** 2⅞". Pin floats in piston and rod. Held by locking rings at each end. Pin hole in rod is bronze bushed.
NOTE—Heat piston in boiling water to remove or install pins.
Pin Fit in Piston—Tight thumb push fit with piston heated to 130° F.
Pin Fit in Rod Bushing—Tight thumb push fit with pin and rod at 70° F.
Replacement Pins:—Pins furnished in standard and .003", .005", .008" oversizes. Ream rod bushing and pin holes in piston bosses for correct fit.

CONNECTING ROD:—**Weight**—All rods held within limits.
Length—8¾" (center-to-center).
Crankpin Journal Diameter—2⅛".
Lower Bearing—Removable steel-backed, copper-lead lined. Furnished standard and .010" undersize.
Clearance—.0005-.0025". **Sideplay** .0055-.0115".
Bearing Adjustment:—None (no shims). Replace bearings. Do not file rods or caps. Install new bearings with small bosses engaging grooves in rod and cap.
Installing Rods:—Lower bearings are offset. Install rods with widest half of bearing toward rear (#1, 3, 5) or toward front (#2, 4, 6). Oil hole in lower bearing upper half must be toward camshaft on all rods.

CRANKSHAFT:—4 bearing. Integral counterweights.
Journal Diameters—2½" all bearings.
Bearing Type—Removable steel-backed, babbitt-lined. Furnished standard and .010" undersize.
Clearance—.001-.002".
Bearing Adjustment:—None (no shims). Replace bearings. Do not file caps. *See Chrysler Special Shop Notes for Replacement Bearings and Bearing Caps.*
End Thrust:—Taken by flange faces on rear (#4) bearing. Endplay .003-.007".

CAMSHAFT:—4 bearing. Non-adjustable chain drive.
Journal Diameters—#1, 2"; #2, 1 31/32"; #3 1 15/16"; #4, 1⅜".
Bearing Type—Removable steel-backed, babbitt-lined (except #4 machined in crankcase).
Clearance—.001-.003" (#1), .0015-.0035" (all others).
NOTE—New bearings require no line-reaming.
End Thrust:—Taken by thrust plate at rear of sprocket hub. Endplay .003-.005".
Timing Chain:—Morse. Width 1". Pitch ½". Length 24" or 48 links.
Camshaft Setting:—Sprockets are marked. Mesh chain with sprockets turned so that 'O' marks are adjacent and in line with a straightedge across shaft centers.
NOTE—Engine must be supported under front end of oil pan and front engine support removed for work on timing chain and camshaft.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1 17/32"	.340-.341"	5⅝"
Exhaust	1 15/32"	.340-.341"	5⅝"

	Seat Angle	Lift	Stem Clearance
Intake	45°	11/32"	.001-.003"
Exhaust	45°	11/32"	.003-.005"

See Chrysler Special Shop Notes for Exhaust valve seat insert removal and installation instructions.
Tappet Clearance—.006" Int., .008" Exh., (hot). .010" Exh. recommended for sustained high speed.
Valve Guides:—Use special tool to remove and install guides. Insert guides with taper end up (intake) and down (exhaust). Top of guide must be 13/16" below top of block. After installing finish ream new guides to inside diameter of .342-.343" (Int.) .344-.345" (Ex.)
Valve Springs:—Variable pitch type. Install springs with close coil at top. Do not compress springs to over all length of less than 1½".

	Spring Pressure	Length
Valve Closed	46-50 lbs.	2 1/32"
Valve Open	104-110 lbs.	1 11/16"

Valve Lifters:—Mushroom type. Ream guides to take following oversizes: .001", .008", .030", .060".
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open TDC. Close 50° ALDC.
Exhaust Valves—Open 48° BLDC. Close 2° ATDC.
To Check Valve Timing—Set tappet clearance #1 intake valve at .010". Intake valve should open at top dead center when 'O' mark on impulse neutralizer at front of engine lines up with jointer on chain case cover. Reset tappet clearance at .006" hot.
Motor Gauge—Weidenhoff Adapter #103, Rod #12. Gauge plug hole over #1 cylinder.

LUBRICATION:—Pressure. Gear type oil pump located at right of crankcase.
NOTE—Ignition timing should be checked whenever oil pump is installed in engine.
Normal Oil Pressure:—30-40 lbs. at 30 M.P.H.
Oil Pressure Relief Valve:—Under plug on left hand side of crankcase. Operates at 40 lbs. Adjustable by changing spring. Standard spring unpainted. Heavy spring (to increase pressure) painted green. Lighter spring (to decrease pressure) painted red.
Crankcase Capacity:—6 qts. (refill).

CLUTCH:—**Borg & Beck Model 10A6.** Single plate, dry disc type. See article in Clutch Section for relining and assembly directions.
Facings—Woven type, 2 required. Inside Diam. 6⅛". Outside Diam. 9⅞". Thickness ⅛".
Adjustment—Clutch pedal should just clear under side of toeboard. To adjust, turn stopscrew located above clutch pedal shaft. Free movement of clutch pedal should be 1 1/16". To adjust, turn clutch shaft collar adjusting screw at right hand end of clutch pedal shaft.
Removal—Disconnect clutch linkage, remove transmission (rotating clutch release fork shaft so that release bearing and spring are withdrawn with transmission), remove clutch housing pan, prick punch clutch cover and flywheel (install in same position to maintain balance), take out clutch mounting bolts, turning all bolts out evenly to release spring tension and avoid distortion of clutch cover. Remove clutch from below. Use pilot studs when removing and installing transmission to avoid springing clutch plate.
Automatic Clutch:—See article in Clutch Section.

STEERING:—**Steering Gear**—Gemmer Model. Worm-and-Roller type. See article in Steering Section for adjustments.
Front Suspension:—Conventional tubular section front axle with Reverse-Ellittt ends and semi-elliptic springs.
Kingpin Inclination—9½° plus or minus ½°. Crosswise.
Caster—2°. Limits 1-3°. Adjust by wedge shims inserted between springs and spring pad on axle. Shims or angle plates furnished ½, 1, 2°.
Camber—½°. Limits ¼-¾°. No adjustment. Manufacturer recommends that no attempt be made to correct camber by bending tubular axle centers.
Toe In—0-⅛" measured at hub height. Adjust as usual by changing length of tie rod.

BRAKES:—**Service**—Lockheed Hydraulic, double anchor type. Hand lever applies brake at rear of transmission. See artcle in Brake Section for complete adjustment procedure.
Wheel Cylinders—Diameters, Front Wheel (Front end 1¼", Rear end 1 3/8"). Rear Wheel (Front end 1", Rear end 1⅛").
NOTE—Wheel cylinders marked 'R' right side of car, 'L' left side of car. Not interchangeable.
Drum Diameter—11".
Lining—Moulded type. Width 2". Thickness 3/16". Length 22 5/32" per wheel.
Clearance—.012" toe, .006" heel, for each shoe.
Hand Brake:—External type on drum at rear of transmission.
Adjustment—With lever in released position remove anchor screw locking wire, turn anchor screw so that clearance between lining and drum is 1/32", lock anchor screw with wire. Back off adjusting bolt nut until free. Adjust bracket bolt nuts for each end of brake band to 1/32" clearance (as above), secure with locknuts. Finally, tighten adjusting bolt nut until tension on bracket bolt nuts is just relieved at either end.
Drum Diameter—7".
Lining—Width 2½". Thickness 3/32". Length 21⅝".
NOTE—Clearance at anchor and saddle .005" max.

NOTE:—Engine hood hinged at cowl and lifts from forward end. Turn radiator ornament counter-clockwise, raise hood about 1", push safety catch at front under lower edge of hood releasing catch and raise hood. Side panels removed by freeing latches on inside lower edge of panels.

ENGINE NUMBER:—First number S-3-1001. Stamped on left side of block between #1 and #2 cylinders. *See Chrysler Special Shop Notes for engine number lettering data.*

ENGINE SPECIFICATIONS:—6 cylinder, 'L' head.
Bore—3⅜". **Stroke**—4¼".
Displacement—228.1 cubic inches.
Rated Horsepower—27.34 (AMA).
Developed Horsepower—93 HP. (std 6.5-1 head) 100 HP. (optl. 7.0-1 head) at 3600 R.P.M.
Compression Ratio—al. hds. (6.5-1 std., 7.0-1 optl.).
Compression Pressure—**6.5-1 hd.** (150-160 lbs. at 1000 R.P.M. or approx. 110 lbs. at cranking speed). **7.0-1 hd.** (160-170 lbs. at 1000 R.P.M. or approx. 117 lbs. at cranking speed).
Vacuum Reading—Gauge should show steady reading of 18-21" with engine idling at 6 M.P.H.

PISTONS:—Aluminum alloy, U-slot, cam ground type with anodized finish. **Length**—3⅞".
Weight—17.46 ounces (plus or minus 2 grams).
Removal—Pistons and rods removed from above.
Clearance—Top .022". Skirt .002".
Replacement Pistons:—*See Chrysler Shop Notes.*
Fitting New Pistons:—Check pistons (at right angles to pin bosses at bottom of skirt) and cylinder bore with micrometer gauge. With feeler (.002") inserted between cylinder wall and pistons (side opposite slot), pull required to withdraw feeler must be 5-7 pounds.
Installing Pistons:—Slot away from valves.

PISTON RINGS:—Two undercut compression, two oil control rings per piston, all above pin. Lower ring grooves drilled with ten ⅛" oil drain holes (#3), five (#4 groove).

Ring	Width	End Gap	Side Clearance
Compression	⅛"	.007-.015"	.0015-.003"
Oil Control	5/32"	.007-.015"	.0015-.003"

Replacement Rings:—Furnished standard and .003", .005", .010", .015", .020", .025", .030", .040", .050", .060" oversize.

PISTON PIN:—Diameter—55/64. **Length**—2⅞". Floating type. Pin hole in rod bronze bushed.
Pin Fit in Piston—Thumb push fit at 130° F.
Pin Fit in Rod Bushing—Thumb push fit at 70° F.
Replacement Pins:—Furnished standard and .003", .005", .008" oversize. Ream bushing and pin hole to size.

CONNECTING ROD:—Weight 31.91 ozs. **Length** 8".
Crankpin Journal Diameter—2⅛".
Lower Bearing—Removable steel-backed, babbitt-lined. Furnished stand. and .0015", .010" undersize.
Clearance—.0005-.0025". **Sideplay**—.0055-.0115".
Bearing Adjustment:—None. Install new bearings with bosses engaging grooves in rod and cap.
Installing Rods:—Oil hole in lower bearing upper half must be toward camshaft, all rods.

CRANKSHAFT:—4 bearing. Integral counterweights.
Journal Diameters—2½" all bearings.
Bearing Type—Removable steel-backed, babbitt-lined. Furnished stand. and .0015", .010" undersize.
Clearance—.001-.002".
Bearing Adjustment:—*See Chrysler Shop Notes for Engine Removal (recommended), Front Main Bearing Cap Removal, Adjustment directions, and Replacement Bearing Cap data.*
End Thrust:—Taken by flange faces on rear (#4) bearing. **Endplay**—.003-.007".

CAMSHAFT:—4 bearing. Non-adjustable chain drive.
Journal Diameters—#1, 2"; #2, 1 31/32"; #3, 1 15/16"; #4, 1¼".
Bearing Type—Removable steel-backed, babbitt-lined (except #4 machined in crankcase).
Clearance—.0015-.0035".
End Thrust:—Taken by thrust plate at rear of camshaft sprocket. **Endplay**—.002-.006".
Timing Chain:—Morse. Width 1". Pitch .500". Length 24" or 48 links.
Camshaft Setting:—Mesh chain with sprockets turned so that '0' marks are adjacent and in line with a straightedge across shaft centers.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1 21/32"	.340-.341"	4 25/32"
Exhaust	1 17/32"	.340-.341"	4 25/32"

	Seat Angle	Lift	Stem Clearance
All valves	45°	11/32"	.001-.003"

See Chrysler Special Shop Notes for Exhaust valve seat insert removal and installation instructions.
Tappet Clearance—.010" Int. and Exh. Engine hot. Remove right fr. wheel & wheel housing to adjust. NOTE—Exh. valve seat inserts furn. .010" oversize.
Valve Guides:—Must be ⅞" below top of block. Ream guides after installing .342-.343" (all).
Valve Springs:—1⅜" limit of compression.

	Spring Pressure	Spring Length
Valve Closed	40-45 lbs.	1¾"
Valve Open	101-109 lbs.	1 13/32"

Valve Lifters:—Mushroom type. Ream guides to take following oversizes: .001", .008", .030", .060".

VALVE TIMING:—See Camshaft Setting above.
Intake Valves—Open TDC. Close 50° ALDC.
Exhaust Valves—Open 48° BLDC. Close 2° ATDC.
To Check Timing:—Set tappet clearance #1 intake valve at .014". Intake valve should open at top dead center when '0' mark on crankshaft pulley at front of engine lines up with pointer on chain case cover. Reset tappet clearance at .010" (hot).
Motor Gauge—Weidenhoff Adapter #103, Rod #12.

LUBRICATION:—Gear type oil pump on r't. of engine. NOTE—Check ignition timing whenever oil pump installed on engine. Tilt engine (with jack under pan) for pump removal.
Normal Oil Pressure:—30-45 lbs. at 30 M.P.H.
Oil Pressure Relief Valve:—Under plug on left side of engine. Operates at 40 lbs. Adjustable. Heavy (green) spring to increase pressure, lighter (red) spring to decrease pressure. Std. spring unpainted.
Crankcase Capacity:—5 quarts (refill).

CLUTCH:—Borg & Beck Mod. 10A7. Mod. #899 stamped on cover. Single plate, dry disc type.
See article in Mechanical Equipment Section for data.
Facings—Woven, 2 required. I.D. 6". O.D. 10". Thickness ⅛". *See Chrysler Special Shop Notes.*
Adjustment—Adjust stopscrew (just above clutch pedal shaft) so that pedal arm just clears floor board. Free movement of pedal should be 1 1/16" (adjust by turning release fork rod adjusting nut).
Removal:—Remove floor board, remove transmission (see Transmission Removal below), remove housing underpan, mark cover and flywheel, remove cover bolts evenly, remove assembly from below.

TRANSMISSION:—Own—All helical gear type with synchronizing shift on second and high gears. Warner Mod. AS25-T86 overdrive transmission optl.
See article in Mechanical Equipment Section for data.
Removal:—Disconnect front and rear U-joints, disconnect hand brake, remove nuts from studs at clutch housing, disconnect release fork pull-back spring and rod, pull release fork out of clutch housing, remove transmission cover assembly, remove unit with two pilot studs in upper stud holes. NOTE—Run-out of clutch housing .003" maximum.

UNIVERSAL JOINTS:—Detroit-Universal. Series 4200. Ball and trunnion type with roller bearings. 2 used. NOTE—Three U-joints used on 7 pass. sedan.
See article in Mechanical Equipment Section for data.
Propeller Shaft Center Bearing:—Used on 7 Pass. models. *See Chrysler Shop Notes for data.*

REAR AXLE:—Own—Semi-floating, hypoid gear type with Hotchkiss drive.
See article in Mechanical Equipment Section for data.
Ratio—4.1-1 (std.). 4.3-1 (with overdrive and 7 pass. sedans).
Backlash—.006-.010". Shim adjustment.
Removal:—Remove axle shaft nut, hub and drum assembly (use hub puller, do not hammer out or bearing damage may result), disconnect brake line at wheel cylinder, remove backing plate (with oil seal). Use shaft puller to remove axle shaft and bearing. With axle shafts removed differential carrier may be removed by disconnecting rear U-joint at flange and removing housing capscrews.
Wheel Bearing Adjustment—Controlled by shims between brake backing plates and flanged ends of housing. Remove brake backing plates (see above) and add or remove shims (equally on both sides) to give proper clearance. **Endplay**—.003-.008". NOTE—Shims supplied .010", .0125", .030" thick.

SHOCK ABSORBERS:—Delco—Model 1162-G (front), 1163-U (rear). Direct acting type.
See article in Mechanical Equipment Section for data.

STEERING:—Steering Gear—Gemmer Mod. 300. Worm-and-roller.
See article in Mechanical Equipment Section for data.
Front Suspension:—Independent, linked parallelogram type with coil springs.
See article in Mechanical Equipment Section for data. Specifications below apply with no pass. load.
Kingpin Inclination—4¾-6°.
Camber—¼°. Limits minus ¼° to plus ½°.
Caster—1½°. Adjustable.
Toe In—0-⅛". 1/16" preferred. Set long tie rod to 31 7/32" (between ball centers). Adjust short rod for proper toe-in.
Steering Geometry—Outer wheel turned 20°. Inner wheel turned 22°40', 22°50' (7 pass.).

BRAKES:—Service—Lockheed hydraulic, double anchor type. Hand brake at rear of transmission.
See article in Mechanical Equipment Section for data.
Wheel Cylinders—Stepped or two-stage bore type: Front Wheel—Front cyl. 1¼", Rear 1⅜". Rear Wheel—Front cyl. 1⅛", Rear 1¼".
Drum Diameter—10".
Lining—Moulded. Width 2". Thickness .200". Length (Rear wh.-rear shoe) 7 25/64", (all others) 9 29/32".
Clearance—.012" toe, .060" heel for each shoe.
Braking Power—55% front wheels, 45% rear.
Hand Brake:—On drum at rear of transmission.
Adjustment—Fully release hand brake lever. Remove anchor screw locking wire (left side), adjust anchor screw for .025" clearance bet. band & drum, set anchor screw with lock wire. Free large adjusting bolt nut (upper end of band), loosen locknut, adjust guide bolt nut to .025" cl. bet. band & drum, set with locknut. Tighten adjusting bolt nut until tension on either side of guide bolt is just relieved (groove in nut must align with ridge in lockwash'r).
Drum Diameter—6".
Lining—Width 2". Thickness 5/32". Lgth. 16 15/16".
NOTE—Clearance at anchor and saddle .005" max.

SERIAL NUMBER:—First number 5,598,301 (Detroit), 9,666,936 (Canada). On right front door hinge post.

ENGINE NUMBER:—First number S-5-1001. Stamped on left side of block between #1 and #2 cylinders. *See Chrysler Special Shop Notes for engine number lettering data.*

ENGINE SPECIFICATIONS:—6 cylinder, 'L' head.
Bore—3⅜". **Stroke**—4¼".
Displacement—228.1 cubic inches.
Rated Horsepower—27.34 (A.M.A.).
Developed Horsepower—93 HP. (Std. 6.5-1 head), 100 HP. (Optl. 7.0-1 head) at 3600 R.P.M.
Compression Ratio and Pressure—As follows:

Ratio	Pressure at 1000 RPM.	At 100 RPM.
6.5-1 Std. C.I. hd.	140-150 lbs.	Approx. 115 lbs.
7.0-1 Optl. Al. hd.	150-160 lbs.	Approx. 117 lbs.

Vacuum Reading—Gauge should show steady reading of 18-21" with engine idling at 6 M.P.H.

PISTONS:—Aluminum alloy, U-slot, cam ground type with anodized finish. **Length**—3⅞".
Weight—17.45 ozs. (plus or minus 2 grams).
Removal—Pistons and rods removed from above.
Clearance—Top .022". See Fitting New Pistons.
Replacement Pistons:—*See Chrysler Shop Notes.*
Fitting New Pistons:—Check piston size with micrometer across large diameter at bottom of skirt. Insert .002" feeler between cylinder wall and piston (with pin removed) on side opposite slot. With piston and block at 70°F. pull to withdraw feeler 5-7 lbs.
Installing Pistons:—Slot away from camshaft.

PISTON RINGS:—2 undercut compression, 2 slotted oil rings per piston, above pin. Lower ring grooves drilled with ten ⅛" oil drain holes (#3), five (#4).

Ring	Width	End Gap	Side Clearance
Compression	⅛"	.007-.015"	.002-.0035"
Oil	5/32"	.007-.015"	.0015-.003"

Replacement Rings:—Furnished std., .003", .005", .010", .015", .020", .025", .030",. 040", .050", .060" oversize.

PISTON PIN:—Diameter—55/64". **Length**—2⅞". Floating type. Pin hole in rod bronze bushed.
Pin Fit in Piston—Thumb push fit with piston heated to 130°F.
Pit Fit in Rod Bushing—Thumb push fit at 70°F.
Replacement Pins:—Furnished std. & .003", .005", .008" oversize. Ream bushing and pin hole to size.

CONNECTING ROD:—Weight—32.80 ozs. **Length**—8".
Crankpin Journal Diameter—2⅛".
Lower Bearing—Removable steel-backed, babbitt-lined. Furnished std. & .002", .010", .012" undersize.
Clearance—.0005-.0025". **Sideplay**—.0055-.0115".
Bearing Adjustment:—None. Install new bearings with bosses engaging grooves in rod and cap.
Installing Rods:—Oil spit hole toward camshaft.

CRANKSHAFT:—4 bearing, 7 counterweights with impulse neutralizer mounted on forward end.
Journal Diameters—2½" all bearings.
Bearing Type—Removable steel-backed, babbitt.
Clearance—.001-.002".
Bearing Adjustment:—*See Chrysler Shop Notes for Engine Removal (recommended), Front Main Bearing Cap Removal, Adjustment directions, and Replacement Bearings and Bearing Caps, Crankshaft Oil Seals.*
End Thrust:—Taken by flange faces on rear (#4) main bearing. **Endplay**—.003-.007".

CAMSHAFT:—4 bearing. Non-adjustable chain drive.
Journal Diameters—#1, 2"; #2, 1 31/32"; #3, 1 15/16"; #4, 1¼".
Bearing Type—Removable steel-backed, babbitt-ned bushings (except #4 machined in block).
Clearance—.001-.003" (#1), .0015-.0035" (all others).
Thrust:—Taken by thrust plate behind camshaft sprocket hub. **Endplay**—.002-.006".
Timing Chain:—Morse #1866 (restricted bend). Width 1". Pitch .500". Length 24" or 48 links.
See Chrysler Special Shop Notes for front end removal for work on timing chain.
Camshaft Setting:—Mesh chain with sprockets turned so that 'O' marks are adjacent and in line with a straightedge across the shaft centers.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1 21/32"	.340-.341"	4 25/32"
Exhaust	1 17/32"	.340-.341"	4 25/32"

	Seat Angle	Lift	Stem Clearance
All valves	45°	11/32"	.001-.003"

See Chrysler Special Shop Notes for Exhaust valve seat insert removal and installation.
NOTE—Self-locking tappet adjusting screws used.
Tappet Clearance—.008" Intake, .010" Exhaust (hot). .012" Exh. setting recommended for sustained high speed driving. Valves accessible by removing right front wheel and fender panel.
Valve Guides:—Install with taper end up to ⅞" below top of block, then ream to .342-.343".

Valve Springs:—Free length approx. 2". Limit of compression 1⅜".

	Spring Pressure	Spring Length
Valve Closed	40- 45 lbs.	1 3/4"
Valve Open	101-109 lbs.	1 13/32"

Valve Lifters:—Mushroom type. Ream guides from above for following oversizes: .001",.008",.030",.060".
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 8° BTDC. Close 42° ALDC.
Exhaust Valves—Open 48° BLDC. Close 2° ATDC.
To Check Timing—Set tappet clearance #1 intake valve at .014". This valve should open with piston 8° (.0260") before top dead center with 8° BTDC. mark on impulse neutralizer at front of engine lined up with pointer on chain case cover. Reset tappet clearance at .008" (hot).
Motor Gauge—Weidenhoff Adapter #103, Rod #12.

LUBRICATION:—Gear type oil pump right of engine.
See Chrysler Special Shop Notes for oil pump removal and installation instructions.
Normal Oil Pressure:—30-45 lbs. at 30 M.P.H.
Oil Pressure Relief Valve:—Under plug on left side of engine. Operates at 40 lbs. Adjustable. Change to heavy (green) spring to increase pressure, light (red) spring to decrease pressure.
Crankcase Capacity:—5 quarts (refill).

COOLING SYSTEM:—Water Pump—Centrifugal, belt-driven, packless type.
See article in Mechanical Equipment Section.
Removal—With water drained and fan belt removed, remove fan blades and pulley (attached by 4 capscrews), disconnect pump hoses, remove nuts on pump mounting studs and lift assembly out.
Thermostat:—Fulton. In water outlet on cyl. head.
NOTE—Install thermostat with bellows down.
Setting—Start to open 150-155°F. Fully open 176°F.
Water Capacity:—20 quarts.
Drain Valves:—At lower left corner of radiator and on left side of block in front of distributor.

CLUTCH:—Borg & Beck Model 10A7, 11A6 (Taxi). Model #913, 917 (Taxi) stamped on cover. Single plate, dry disc type with new spiral grooved type facings and clutch pressure plate oil baffle.
See article in Mechanical Equipment Section for data.
Facings—Molded-woven (spiral grooved), 2 required. Thickness ⅛". Inside diameter 6", 6½" (Taxi). Outside diameter 10", 11" (Taxi).
Adjustment—Adjust stopscrew (to rear of pedal) so that pedal arm just clears floor board. Pedal free movement must be 1". Adjusting nut on fork rod next to release fork.
Removal:—Remove floor board, release fork pull-back spring, free clevis pin on release fork rod. Remove transmission (see Transmission Removal below), remove housing underpan, mark cover and flywheel, remove cover bolts, lower assembly out.

TRANSMISSION:—Own make. All helical gear type with synchro-mesh for second and high speeds. Warner Model AS1-T86A overdrive optional.
See article in Mechanical Equipment Section for data.
Removal:—Remove floor boards, propeller shaft (see Propeller Shaft Center Bearing below for 7 pass. models), disconnect hand brake cable (remove brake band on cars with Gas Saver). Remove two front cover screws, take off nuts on mounting studs (remove two upper mounting studs by installing 2 nuts on outer end of stud and turning studs out), install two pilot studs and withdraw transmission.

UNIVERSAL JOINTS:—Detroit-Universal. Series 4200. Ball and trunnion type with roller bearings, 2 used.
NOTE—Three universals used on 7-pass. sedan.
See article in Mechanical Equipment Section.
Propeller Shaft Center Bearing:—Used on 7 pass. sedans. *See Chrysler Special Shop Notes for removal and installation instructions.*

REAR AXLE:—Own make. Semi-floating, hypoid gear type with Hotchkiss drive.
See article in Mechanical Equipment Section for data.
Ratio—4.1-1 (std.). 4.3-1 (7 pass. & Gas. Saver tr.).
Backlash—.006-.010". Screw adjustment.
Removal:—Remove wheel, hub, and drum assembly (using screw type hub puller). Place block under brake pedal, disconnect brake line, remove backing plate and oil seal, pull axle shaft and bearing (Tool C-158). With shafts removed, carrier may be removed by disconnecting rear universal at flange, and removing housing capscrews.
Wheel Bearing Adjustment—Controlled by shims at flanged ends of axle housing. With wheel and hub removed measure endplay with dial indicator. To adjust remove backing plate (see above) and add or remove shims (equally at both sides) to proper clearance. **Endplay**—.003-.008".

SHOCK ABSORBERS:—Delco. Model 1162D (front), 1163U (rear). Direct acting, hydraulic type.
See article in Mechanical Equipment Section.

STEERING:—Steering Gear—Gemmer Model 305 Worm-and-Roller type with 'Push-Pull' adjustment.
See article in Mechanical Equipment Section for data.
Front Suspension:—Independent, linked parallelogram type with coil springs.
See article in Mechanical Equipment Section for data.
Specifications below apply with no passenger load.
Kingpin Inclination—4¾-6°.
Camber—Plus ¼°. Limits minus ¼° to plus ½°.
Caster—Limits ½-2½°.
Toe In—1/16" (0-⅛"). Set long tie rod to 31⅝" (between ball centers). Adjust short rod.
Steering Geometry—Outer wheel 20°. Inner wheel 22°40', 22°50' (7 passenger sedans).

BRAKES:—Service—Lockheed hydraulic, double anchor type. Hand brake at rear of transmission.
See article in Mechanical Equipment Section for data.
Wheel Cylinders—Stepped or two-stage bore type.
Front Wheel—Front cylinder 1¼". Rear 1⅜".
Rear Wheel—Front cylinder 1⅛". Rear 1¼".
Drum—Cast-iron. Diameter—11".
Lining—Moulded. Width 2". Thickness 13/64" Length (front shoe) 11 15/32", (rear shoe) 7 31/32".
Clearance—.012" toe, .006" heel for each shoe.
Braking Power—55% front, 45% rear.
Hand Brake:—External at rear of transmission.
Adjustment—*See Chrysler Shop Notes.*
Drum—Cast-iron. Diameter—6".
Lining—Width 2". Thick. 5/32". Length 17 1/16".

FRONT END ASSEMBLY (UNIT) REMOVAL:—Should be removed as a unit for work on front of engine. *See Chrysler Shop Notes for directions.*

SERIAL NUMBER:—First number 5,634,001 (Detroit), 9,668,606 (Canada). On right front door hinge post.

ENGINE NUMBER:—First number S-6-1001. Stamped on left side of block between #1 and #2 cylinders. *See Chrysler Shop Notes for engine number lettering ('Special Standard' bore and bearing sizes).*

ENGINE SPECIFICATIONS:—6 cylinder, 'L' head.
Bore—3⅜". **Stroke**—4¼".
Displacement—228.1 cu. ins. **Rated HP.**—27.34.
Developed Horsepower—93 HP. (Std. 6.5-1 hd.), 100 HP. (Optl. 7.0-1 hd.—Std. 7 pass) at 3600 RPM.
Compression Ratio and Pressure—As follows:

Ratio	Pressure at 1000 RPM.	At 100 RPM.
6.5-1 cast-iron hd.	140-150 lbs.	Approx. 115 lbs.
7.0-1 aluminum hd	150-160 lbs.	Approx. 117 lbs.

Vacuum Reading—Steady 18-21" idling at 6 MPH. *See Chrysler Shop Notes for engine removal instructions.*

PISTONS:—Aluminum alloy, U-slot, Cam-ground, with Anodic finish. **Length** 3⅞". **Weight** 17.45 ozs.
Removal—Pistons and rods removed from above.
Clearance—Top .021". Skirt .0005-.0010".
Original Bore & Piston Sizes, Replacement Pistons:—*See Chrysler Shop Notes for sizes and markings.*
Fitting New Pistons:—Check piston size with micrometer across large diameter at bottom of skirt. Insert .002" feeler between cylinder wall and piston (pin removed) on side opposite slot. With piston and block at 70°F. pull to withdraw feeler 5-7 lbs.
Installing Pistons:—Slot away from camshaft.

PISTON RINGS:—4 rings, all above pin—#1 Compression (upper inner edge beveled), #2 Comp. (lower outer edge stepped), #3 & 4 (slotted oil rings).

Ring	Width	End Gap	Side Clearance
Comp. (Top)	⅛"	.007-.015"	.002-.004"
Comp. (#2)	⅛"	.007-.015"	.0015-.0035"
Oil Control	5/32"	.007-.015"	.0015-.003"

Replacement Rings:—Std. & .003", .005", .010", .015", .020", .025", .030", .040", .050", .060" oversize.

PISTON PIN:—**Diameter**—55/64". **Length**—2⅞".
Floating type. Pin hole in rod bronze bushed.
Pin Fit in Piston—Thumb push fit with piston heated to 130° F.
Pin Fit in Rod Bushing—Thumb push fit at 70° F.
Replacement Pins:—Std. & .003", .005", .008" oversize.

CONNECTING ROD:—**Weight**—32.80 ozs. **Length**—8".
Crankpin Journal Diameter—2⅛".
Lower Bearing—Removable, steel-backed, babbitt-lined. Furnished std. & .002", .010", .012" undersize.
Clearance—.0005-.0025". **Sideplay**—.0055-.0115"
Bearing Adjustment:—None (no shims). Install bearings with boss engaging groove in rod and cap.
Installing Rods:—Oil spit hole toward camshaft.

CRANKSHAFT:—4 bearing type with 7 counterweights. *See Chrysler Shop Notes for Replacement Main Bearing Caps and Crankshaft Front and Rear Oil Seals.*
Journal Diameters—2½" all bearings.
Bearing Type—Removable, precision type steel-backed, babbitt-lined. **Clearance**—.001-.002".
Bearing Adjustment:—*See Chrysler Shop Notes for Engine Removal (recommended), front main bearing cap removal, replacement bearings and adjustment data.*
End Thrust:—Taken by flange faces on rear (#4) main bearing. **Endplay**—.003-.007".

CAMSHAFT:—4 bearing. Non-adjustable chain drive.
Journal Diameters—#1, 2"; #2, 1 31/32"; #3, 1 15/16"; #4, 1¼".
Bearing Type—Removable steel-backed, babbitt-lined bushings (except #4 machined in block).
Clearance—.001-.003" (#1), .0015-.0035" (all others).
End Thrust:—Taken by thrust plate behind camshaft sprocket hub. **Endplay**—.002-.006".
Timing Chain:—Morse Type 1866-N, No. 2661. Width 1". Pitch .500". Length 24" or 48 links.
Camshaft Setting:—Mesh chain with sprockets turned so that '0' marks are adjacent and in line with a straightedge across the shaft centers.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1 21/32"	.340-.341"	4 25/32"
Exhaust	1 17/32"	.340-.341"	4 25/32"

	Seat Angle	Lift	Stem Clearance
All Valves	45°	11/32"	.001-.003"

See Chrysler Shop Notes for Exh. Valve Seat Insert data.
Tappet Clearance:—.008" Int., .010" Exh. (hot). .002" additional exhaust clearance recommended for sustained high speed driving. NOTE—Tappet screws self-locking type (no locknuts). Remove right front wheel and housing panel for access to valves.
Valve Guides:—Remove from above. Press new guides in (tapered end up) so upper end ⅞" below top of block, then finish ream to .342-.343".

Valve Springs:—Free length approx. 2". Limit of compression 1⅜".

	Spring Pressure	Length
Valve Closed	40-45 lbs.	1 3/4"
Valve Open	101-109 lbs.	1 13/32"

Valve Lifters:—Mushroom type. Stem diam. ⅝". Furnished .001", .008", .030", .060" oversize.
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 8° BTDC. Close 42° ALDC.
Exhaust Valves—Open 48° BLDC. Close 2° ATDC.
These figures correct with .014. tappet clearance.
Valve Timing Check—Set tappet clearance #6 intake valve at .014". This valve should open with piston 8° (.0260") before top dead center with 8° BTDC. mark on impulse neutralizer aligned with pointer on chain cover. Reset tappet cl. at .008" hot.

LUBRICATION:—Gear type pump, right of engine.
Normal Oil Pressure:—30-45 lbs. at 30 M.P.H.
Oil Pressure Relief Valve:—Under cap below starter. Opens at 40-45 lbs. To increase pressure use heavy (green) spring, to decrease use light (red) spring.
Crankcase Capacity:—5 quarts (refill).

COOLING SYSTEM:—**Capacity**—19 quarts.
Radiator Core Removal—*See Chrysler Shop Notes.*
Water Pump:—Packless type, belt-driven.
See article in Mechanical Equipment Section for data.
Removal—Drain water, remove hood side panels, fan blade assembly, pulley, radiator outlet hose at pump, by-pass (with small hose), pump mounting stud nuts, fan belt adjusting strap at generator.
Thermostat:—Fulton. In water outlet on cyl. head.
Setting—Start to open 157-162°F. Fully open 183°F.
Temperature Gauge:—Motometer (Auto-Lite) Vapor tension type. Part No. H-9039.
See article in Mechanical Equipment Section for data.

CLUTCH:—**Borg & Beck Model 10A7, 11A6 (Taxi).** #928 (10A7), #931 (11A6) stamped on cover. Single plate, dry disc type with spiral grooved facings, pressure plate oil baffle and new Over-center return spring *See article in Mechanical Equipment Section for data.*
Facings—Woven & compressed, 2 required. Inside Diam. 7" (10A7), 6½" (11A6). Outside Diam. 10" (10A7), 11" (11A6). Thickness .125" (all).
Adjustment:—Pedal should just clear toeboard (adjust stopscrew on lower end) and have 1" free movement (adjusting nut on link rod at clutch fork).
Removal:—Remove floorboard, unhook clutch fork pull-back spring and take out clevis pin on connecting link. Remove transmission (see below) and housing underpan, mark cover and flywheel, remove clutch cover bolts evenly, lower assembly out.

TRANSMISSION:—**Warner.** All helical gear, constant-mesh, synchro-mesh (second & high), sliding gear (low & reverse). Model AS3-T86A overdrive transmission with electrical kick-down control optl.
Transmission Control:—Remote control type.
See articles in Mechanical Equipment Section for data.
Removal:—Remove floor boards, battery ground cable, disconnect front and rear U-joints (see Chrysler Shop Notes for Propeller Shaft Center Bearing Removal on 7 pass.), hand brake cable at clevis, speedometer cable, and gearshifter rod and cable at lever on case. Remove mounting stud nuts, cover assembly, and 2 upper mounting studs (insert pilot studs). Withdraw transmission assembly.
Overdrive Transmission Removal—Same as above except: Remove hand brake assembly (U-joint flange, brake drum, band, and support), disconnect solenoid wires and remove coil and control cable at case. Turn transmission assembly over on left side while it is being withdrawn until shaft clears release bearing, then push up at forward end (shaft just above bearing) and forward with shaft between clutch fingers until rear end can be lowered.

UNIVERSAL JOINTS:—**Detroit-Universal Series 4200.** Ball and trunnion type with roller bearings.
See article in Mechanical Equipment Section for data.
Propeller Shaft Center Bearing:—On 7 pass. sedans.
See Chrysler Shop Notes for service data.

REAR AXLE:—**Own Make.** Semi-floating, hypoid gear type with Hotchkiss drive.
See article in Mechanical Equipment Section for data.
Ratio—4.1-1 (Std. 5 pass.). 4.3-1 (5 pass. with overdrive, Std. 7 pass.). 4.56-1 (7 pass. with Ov-Dr.).
Backlash—.006-.010". Screw adjustment.
Removal:—Disconnect drive shaft at rear universal. Remove axle shafts (see below) and capscrews on carrier flange. Pull carrier assembly out.
Axle Shaft Removal—Remove wheel, hub, and drum assembly (use screw type hub puller—Tool C-319), block brake pedal, disconnect brake line at wheel cylinder, take off backing plate with oil seal, pull shaft and bearing (Tool C-158).
Wheel Bearing Adjustment:—Shims between backing plate and axle housing. With wheel and hub removed check endplay with dial indicator. To adjust, remove backing plate (see above), add or remove shims equally (at both ends). **Endplay**—.003-.008".

SHOCK ABSORBERS:—**Delco.** Direct acting type. Domestic—Front 1110-C. Rear 1111-T. Exp.—1114-C & 1115-T, or 1134-E & 1130-W.
See articles in Mechanical Equipment Section for data.

STEERING:—**Steering Gear.** Gemmer Model 305 'push-pull' adjustment. Worm-and-roller.
See article in Mechanical Equipment Section for data.
Front Suspension:—Independent, linked parallelogram type with coil springs.
See article in Mechanical Equipment Section for data.
Kingpin Inclination—4¾-6°.
Camber—Plus ¼°. Limits minus ¼° to plus ¾°.
Caster—Limits ½-2½°.
Toe In—1/16" (0-⅛"). Set long tie rod to 31⅝" (between ball centers). Adjust short tie rod.
Steering Geometry—Inner wheel 22°40'. Outer 20°.

BRAKES:—Service. Lockheed hydraulic, double anchor type. Hand lever applies independent shaft brake.
See article in Mechanical Equipment Section for data.
Wheel Cylinders—Stepped or two-stage bore type.
Drums—Cast-iron. Diameter 11".
Lining—Molded. Width 2". Thickness 13/64". Length (front shoe) 11 15/32"; (rear shoe) 7 31/32".
Clearance—.012" toe, .006" heel for each shoe.
Hand Brake:—On drum at rear of transmission.
Adjustment—*See Chrysler Shop Notes for data.*
Drum—Cast-iron. Diameter 6".
Lining—Width 2". Thick. 5/32". Length 17 1/16".

SERIAL NUMBER:—First number (DL) 3,558,101, (DP) 3,579,001. On right front door hinge pillar post.

ENGINE NUMBER:—Stamped on boss on left side of cylinder block between #1 and #2 cylinders.

ENGINE SPECIFICATIONS:—Six cylinder, 'L' head type. Floating power engine mountings.
Bore—(DL) 3¼", (DP) 3⅛". **Stroke**—4⅜".
Displacement—217.7 cu. ins. (DL), 201.31 cu. ins. (DP).
Rated Horsepower—25.34 (DL), 23.43 (DP).
Developed Horsepower—79 at 3400 R.P.M. (DL), 75 at 3600 R.P.M. (DP Std. Head), 83 at 3600 R.P.M. (DP Optl. head).
Compression Ratio—5.35-1 (DL), 5.5-1 (DP Std. head), 6.5-1 (DP Optl. aluminum head).
Compression Pressure—Approximately 90-95 lbs. (5.35 and 5.5 heads), 110 lbs. (6.5-1 head) at cranking speed.
Vacuum Reading—Gauge should show steady reading of 16-18" at idling speed.

PISTONS:—Nelson Bohnalite, aluminum alloy, Invar strut, Slit skirt type. Length—3 11/16".
Weight—Held to ¼ oz. maximum variation.
Removal—Pistons and rods removed from above.
Clearance—.022" head, .0015-.002" skirt.
.003", .005", .010", .015", .020", .023", .025", .030", .040", .050", .060" oversize. Install same size in all cylinders to maintain balance.

Fitting New Pistons:—Use .002" feeler stock ½" wide to check clearance. Pull required to withdraw feeler from between piston and cylinder wall on side opposite slot should be 7-14 lbs.

Installing Pistons:—Slot should be toward left or away from valves.

PISTON PIN:—Diameter—55/64". **Length**—2¾" (DL), 2⅝" (DP). Pin floats in piston and rod. Pin hole in rod bronze-bushed.
Pin Fit in Piston—Tight thumb push fit with piston heated to temperature of boiling water (212F.).
Pin Fit in Rod Bushing—Tight thumb push fit at room temperature (70°F.).

PISTON RINGS:—Two tongue-and-groove compression rings, one undercut oil wiper ring, one oil control ring per piston all above pin. Clearance between tongue-and-groove ring pairs should be .003-.005".

Ring	Width	End Gap	Side Clearance
Comp. (DL)	9/64"	.005-.010"	.003" Max.
Comp (DP)	⅛"	.005-.010"	.003" Max.
Oil Wiper	⅛"	.007-.015"	.003" Max.
Oil Control	5/32"	.007-.015"	.003" Max.

CONNECTING ROD:—Length—8 13/16" (DL), 7 15/16" (DP).
Weight—Held to ¼ oz. maximum variation.
Crankpin Journal Diameter—1 15/16".
Lower Bearing Type—Spun babbitt (DL), removable steel-backed, babbitt-lined (DP).
Clearance—.001-.00275". Sideplay .003-.009".

Adjustment:—None (no shims). Replace rods (DL), or bearings (DP). Do not file rods or caps.

Installing rods:—Lower bearings offset. Install rods with widest half of bearing toward rear (cylinders #1, 3, 5) or toward front (cylinders #2, 4, 6). Oil hole in upper half of lower bearing should be toward camshaft on all rods.

CRANKSHAFT:—4 bearing, integral counterweights.
Journal Diameters—2¼" all bearings.
Bearing Type—Removable steel-backed, babbitt-lined. No shims.
Clearance—.001-.002".
Adjustment:—None (no shims). Replace bearings. Do not file caps. *See Chrysler Shop Notes for Front Main Bearing Cap removal, and installation and adjustment of Replacement Bearing caps.*
End Thrust:—Taken by #4 rear main bearing. Endplay .004-.005".

CAMSHAFT:—4 bearing. Non-adjustable chain drive.
Bearing Diameters—#1, 2"; #2, 1 31/32"; #3, 1 15/16"; #4, 1¼".
Bearing Type—Steel-backed, babbitt-lined except #4 which is machined in crankcase.
Clearance—.0015-.0025". Endplay .003-.005".
End Thrust—Taken by thrust plate at front bearing.

Timing Chain:—Morse. Width 1¼" (DL), 1" (DP). Pitch .500". Length 24" or 48 links.

Camshaft Setting:—Sprockets are marked. Mesh chain with sprockets turned so that marks are adjacent and in line with a straightedge across the shaft centers. Install chain endless with camshaft sprocket off hub.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake (DL)	1 17/32"	11/32"	5¼"
Intake (DP)	1 15/32"	11/32"	5¼"
Exhaust	1 15/32"	11/32"	5¼"

	Seat Angle	Lift	Stem Clearance
Intake	45°	5/16"	.001-.003"
Exhaust	45°	5/16"	.002-.004"

See Chrysler Special Shop Notes for Exhaust valve seat insert removal and installation instructions.
Tappet Clearance—.005" Int., .007" Exh. engine hot.

Valve Springs:—Do not compress springs to over-all length of less than 1¾".

	Spring Pressure	Spring Length
Valve Closed	40-44 lbs.	2 1/16"
Valve Open	75-81 lbs.	1¾"

Valve Timing:—See camshaft setting above.
Intake Valves—Open 6° ATDC. Close 46° ALDC.
Exhaust Valves—Open 42° BLDC. Close 8° ATDC.
To Check Valve Timing—Use regular timing gauge installed in timing hole over #6 piston. Set tappet clearance #6 intake valve at .011". This valve should open with piston .015" past top dead center. Reset tappet clearance at .005" with engine hot.
Motor Gauge—Weidenhoff Adapter #103. Rod #12.

LUBRICATION:—Pressure type. Gear type oil pump mounted on right side of crankcase.
Normal Oil Pressure—15 lbs. idling, 30-40 lbs. at 20 M.P.H.
Oil Pressure Relief Valve—Located under cap on left side of crankcase. To adjust, remove cap, take out locking wire, turn slotted screw clockwise to increase or counter-clockwise to decrease pressure, replace locking wire.
Model DP—Relief valve in oil pump cover at right of crankcase. No adjustment provided.

CLUTCH:—Borg and Beck Model 10A1 (DL), 9A1 (DP). Single plate dry disc type. See article in Clutch Section for relining and assembling directions.
Facings (DL)—Moulded type, 2 required. Thickness ⅛". Inside diameter 6⅛". Outside diameter 8⅞".
Facings (DP)—Moulded type, 2 required. Thickness ⅛". Inside diameter 5¾". Outside diameter 9".
Adjustment (DL)—Adjust clutch stopscrew so that front face of release bearing is exactly 5/32" from clutch release levers. Then adjust clutch fork adjusting collar setscrews (2) to locate clutch pedal as high as possible without interference with floor boards. Free movement of pedal should be 1 7/16"-1 9/16" and will be correct if above adjustments correctly made.
Adjustment (DP)—Adjust clutch pedal stopscrew at lower end of pedal at rear of pedal shaft for highest possible pedal position without interference with the floor board. Free movement of pedal should be 1¼". To adjust, loosen locknut and turn clutch fork release lever setscrew.

STEERING—Steering Gear—Gemmer Worm-and-Sector type. See article in Steering Section for complete adjustment directions.

Front Suspension:—Conventional 'I' beam section front axle with Elliott type ends (DL), tubular section with Reverse Elliott type ends (DP). Semi-elliptic springs on both models.
Kingpin Inclination—7° (DL), 9° (DP) crosswise.
Caster—1½-2° (DL), 1-2° (DP). Adjust by inserting wedge shims between spring and spring pad on axle.
Camber—½-2° (DL), 0-1¼° (DP). No adjustment. Camber must be equal for both wheels.
Toe In—1/16" measured 9" up on wheels. Adjusted in usual manner by loosening clamp bolts and rotating tie rod.

BRAKES:—Service—Lockheed Hydraulic, double anchor chor type. See article in Brake Section for complete adjustment instructions.
Drum Diameter—12" (DL), 10" (DP).
Lining (DL)—Moulded type. Width 1¾". Thickness 3/16". Length 21 23/32" per wheel.
Lining (DP)—Moulded type. Width 1½". Thickness 3/16". Length 18 5/16" per wheel.
Clearance—.012" toe, .006" heel each shoe.

Hand Brake:—External type on drum at rear of transmission.
Adjustment—Place lever in released position, remove locking wire and turn anchor adjusting screw until clearance between lining and drum is 1/16" at this point. Turn adjusting nut at upper end of adjusting bolt until clearance around drum is 1/16". If necessary, loosen locknut and turn guide bolt nut to secure uniform clearance around drum.
Drum Diameter—7" (DL), 6" (DP).
Lining—Width 2". Thickness 5/32". Length 21 13/32" (DL), 18 13/32" (DP).

SERIAL NUMBER:—First number, (DR '34) 3,680,001, (DS '34) 4,528,651, (DU '35) 3,756,501 (Detroit), 9,403,286 (Canada). On right front door hinge pillar post.

ENGINE NUMBER:—Stamped on boss on left side of cylinder block between #1 and #2 cylinders. *See Chrysler Shop Notes for engine number lettering (denoting special bore and bearing sizes).*

ENGINE:—Own. Six cylinder, 'L' head type. Floating power engine mounting.
Bore—3¼". **Stroke**—4⅜".
Displacement 217.8 cu. ins. **Rated HP.** 25.35.
Developed Horsepower—(DR, DS)—82 HP., (std. hd.), 87 HP. (Optl. hd.), at 3600 R.P.M. (DU)—85 HP. at 3600 R.P.M.
Compression Ratio—(DR, DS)—5.6-1 std. cast-iron head, optl. 6.5-1 aluminum head. (DU)—Std. 6.5-1 alloy iron head.
Compression Pressure—Approximately 97 lbs. (5.6-1 head), 110 lbs. (6.5-1 head) at cranking speed.
Vacuum Reading—Gauge should show steady reading of 16-18" with engine idling.

PISTONS:—Aluminum alloy, Invar strut, slotted skirt type. **Length**—3 11/16".
Replacement Pistons:—Semi-finish pistons furnished for service in two sizes (1) standard to .023" oversize, (2) .025" to .050" oversize. Pistons should be slotted and then finished to size (.001" smaller diameter at bottom of skirt than at top). If piston finishing equipment not available, use finished replacement pistons furnished .003", .005", .010", .015", .020", .023", .025", .030", .040", .050", .060" oversize and recondition cylinders to standard oversize.
Weight—Maximum allowable variation ¼ oz.
Removal—Pistons and rods removed from above.
Clearance—Top .022". Bottom .0015-.002".
Fitting New Pistons—Use .002" feeler stock ½" wide to check clearance. Pull required to withdraw feeler from between piston and cylinder wall on side opposite slot should be 7-14 lbs.
Installing Pistons—Slot should be at left or away from valves.

Piston Rings:—Four rings per piston, all above pin; (DR, DS '34)—#1 plain compression ring, #2 and #3 tongue and groove type with lower ring undercut to act as an oil wiper, #4 oil control ring. (DU '35)—Two undercut compression rings, two oil control rings, lower ring grooves drilled radially with oil drain holes.

Ring	Width	End Gap	Side Clearance
Compression	⅛"	.007-.015"	.002-.003"
(#2 & 3—DR, DS)	9/64"	.007-.015"	.002-.003"
Oil Control—all	5/32"	.007-.015"	.002-.003"

Replacement Rings—Furnished in same oversizes as pistons.

Piston Pin:—Diameter 55/64". Pin floats in piston and rod. Held by retaining rings. Piston can be heated in boiling water to remove or install pins. Pins furnished .003", .005", .008" oversize.
Pin Fit in Piston—Tight thumb push fit with piston at 160° F.
Pin Fit in Rod Bushing—Tight thumb push fit with piston at room temperature (70°F.).

Connecting Rod:—Weight maximum variation allowable ¼ oz. Length 7 15/16".
Crankpin Journal Diameters—2 1/16".
Lower Bearing—Removable steel-backed, babbitt-lined type. No shims.
Clearance—.001-.00275". Sideplay .003-.009".
Adjustment—None. Replace bearings. Do not file bearing caps. Install new bearings with small boss registering with groove (both halves). Bearings furnished .010" undersize and standard size.
Installing Rods—Lower bearings are offset. Install rods with widest half of bearing toward rear of engine (#1, 3, 5) or toward front (#2, 4, 6). Oil hole in upper half of bearing must be toward camshaft on all bearings.

Crankshaft:—Four bearings. Integral counterweights.
Journal Diameters—2½". all bearings.
Bearing Type—Removable steel-backed, babbitt-lined type. No shims.
Clearance—.001-.002".
Adjustment—None. Replace bearings. Do not file bearing caps. *See Chrysler Shop Notes for Front Main Bearing Cap Removal, and installation and adjustment of Replacement Bearings and Bearing Caps.*
End Thrust—Taken by #4 (rear) bearing. Endplay .003-.007".

Camshaft:—Four bearings. Non-adjustable chain drive.
Bearing Type—Removable steel-backed, babbitt-lined type (except #4 machined in crankcase).
Clearance—.0015-.0025". Endplay .003-.005".
End Thrust—Taken by thrust plate at rear of sprocket hub.
Timing Chain—Morse. Width 1". Pitch .500". Length 24" or 48 links.
Camshaft Setting—Sprockets are marked. Mesh chain with sprockets turned so that marks are adjacent and in line with a straightedge across the shaft centers. Install chain endless with camshaft sprocket off engine.

Valves:—

	Head Diameter	Stem Diameter	Length
All Valves	1 15/32"	.3405"	4 27/32"

	Seat Angle	Lift	Stem-to-Guide Clearance
Intake	45°	5/16"	.001-.003"
Exhaust	45°	5/16"	.003-.005"

See Chrysler Special Shop Notes for Exhaust valve seat insert removal and installation instructions.
Installing New Guides—Use special tool to remove and install guides. Intake guides installed with taper end up, exhaust guides with taper end down. Top of guides must be ⅞" below top of block. Finish ream new guides to inside diameter of .342-.343" (Int.), .344-.345" (Exh.) after installing.
Tappet Clearance—.006" Int., .008" Exh. engine hot. Set exhaust clearance at .010" for sustained high speed driving. Adjustment accessible by removing cover plate under right front wheel.
Valve Springs—Variable pitch type. Install springs with closer spaced coils at top. Do not compress spring to over-all length of less than 1 7/16".

	Spring Pressures	Length
Valves Closed	34-38 lbs.	1¾"
Valves Open	77-83 lbs.	1 7/16"

Valve Timing—See Camshaft Setting above.
Intake Valves—Open 6° ATDC. Close 46° ALDC.
Exhaust Valves—Open 42° BLDC. Close 8° ATDC.
To Check Valve Timing—Set tappet clearance #6 valves at .011" Int., .012" Exh. Install regular timing gauge in timing plug hole over #6 piston. Intake valve should open with piston .015" past top dead center. Reset tappet clearance at .006" Int., .008" Exh. with engine hot.

Lubrication:—Pressure. Gear type oil pump located on right hand side of crankcase.
Normal Oil Pressure—30-40 lbs. at 30 M.P.H.
Oil Pressure Relief Valve—Under plug on left hand side of crankcase. Operates at 40-45 lbs. Adjustable by changing spring. Standard springs unpainted. Heavy springs (to increase pressure) are painted green. Lighter spring (to decrease pressure) painted red.
Capacity & Oil—5 qts.

CLUTCH:—**Borg & Beck Models 10A3 (DR, DS), 10A6 (DU).** Model No. stamped on cover, 854 (10A3), 870 10A6). Single plate, dry disc type. No adjustment required for wear. See article in Clutch Section for adjustment and relining procedure.
Clutch Pedal Adjustment—Clutch pedal should just clear under side of toeboard. Adjust by turning stop screw located just above clutch pedal shaft at rear. Free movement of pedal must be 1 1/16". To adjust—(DR, DS)—Turn clamp screw on release fork adjusting collar for clearance. (DU)—Adjust by loosening lock nut and turning release fork rod adjusting nut (at clutch release fork).
Clutch Facings—Moulded asbestos (flywheel side), woven asbestos (pressure plate side), one of each required, 6⅛" I.D., 9⅞" O.D., .133" thick.
NOTE—Mark clutch cover and flywheel before disassembling and reassemble in same position.

STEERING:—**Steering Gear**—Gemmer Model Worm-and-Roller type. See article in Steering Section.
Front Suspension (DU):—Conventional tubular section front axle with Reverse-Elliott ends and semi-elliptic springs.
Kingpin Inclination—9½° crosswise.
Caster—2° (1½-2½°). Adjust by inserting wedge plates between springs and axle pads. Wedges furnished in ½, 1, 2° angles.
Camber—½° (¼-¾°). No adjustment provided. Axle may be bent cold not more than ½° to correct camber. Replace axle if out more than ½°.
Toe In—1/16" (0-⅛"). Adjust in usual manner by loosening tie rod end clamps and turning tie rod.
Front Suspension (DR, DS):—Independent, linked, parallelogram type with coil springs. See article in Steering Section. Specifications below apply with car weight on wheels.
Kingpin Inclination—10° plus or minus ½°.
Caster—1½°. **Toe In**—1/16-⅛".
Camber—¼-1° Limits. ½° preferred.

BRAKES:—**Service**—Lockheed hydraulic, double anchor type. Hand lever applies brake at rear of transmission. See article in Brake Section for relining and complete adjustment procedure.
Wheel Cylinders—Diameters (DR, DS—straight bore) Front wheel—1¼". Rear wheel 1⅛". (DU—step cut bore) Front wheel (front shoe 1¼", rear shoe 1⅜"), Rear wheel (front shoe 1⅛", rear shoe 1¼").
NOTE—Wheel cylinders marked 'R' for right brakes, 'L' for left brakes, not interchangeable.
Drum Diameter—10".
Lining—Moulded type. Width 2". Thickness 3/16". Length per wheel (DR, DS—15 25/32"; DU—19 13/16").
Clearance—.012" toe, .006" heel, for each shoe.

Hand Brake:—External type on drum at rear of transmission.
Adjustment—With lever in released position, remove anchor screw locking wire, turn anchor screw so that clearance is 1/16" between lining and drum, lock anchor screw with wire. Adjusting bolt nut should then be adjusted to give correct clearance (as above) for both ends of brake band. On DU model, loosen locknut and turn guide bolt, if necessary, to secure uniform clearance around drum.
NOTE—On first DR, DS models thru Serial Number 3,816,194 adjustment is provided on hand brake rod at hand brake lever end below ratchet.
Drum Diameter—6".
Lining—Width 2". Thickness 5/32". Length 18 13/32".
NOTE—When relining, cut out lining adjacent to anchor and chamfer ends. Clearance between anchor and sides of anchor saddle .005" maximum.

SERIAL NUMBER:—First number 4,015,051 (Detroit), 9,405,681 (Canada). On right front door hinge pillar post.

ENGINE NUMBER:—First Number—D2-1001. Stamped on boss on left side of cylinder block between #1 and #2 cylinders. *See Chrysler Shop Notes for engine number lettering data (denoting special bore and bearing sizes).*

ENGINE SPECIFICATIONS:—6 cylinder, 'L' head.
Bore—3¼". **Stroke**—4⅜".
Displacement—217.8 cubic inches.
Rated Horsepower—25.35 (AMA).
Developed Horsepower—87 HP at 3600 R.P.M.
Compression Ratio—6.5-1 Std. cast-iron head. No optl. ratios.
Compression Pressure—135-145 lbs. at 1000 R.P.M. or approx. 110 lbs. at cranking speed.
Vacuum Reading—Gauge should show steady reading of 16-18" with engine idling at 7-8 M.P.H.

PISTONS:—Aluminum alloy, Invar strut, slotted skirt type.
Length—3 11/16".
Weight—Held to two gram max. variation.
Removal—Pistons and rods removed from above.
Clearance—Top .022". Bottom .0015-.002". See Fitting New Pistons.

Replacement Pistons:—Finished anodized pistons furnished in standard and .003", .005", .010", .015", .020", .023", .025", .030", .040", .050", .060" oversizes. Semi-finished pistons furnished: (1) standard to .023" oversize, (2) .025-.050" oversize, not interchangeable. Pistons should be slotted and then finished to correct fit.

Fitting New Pistons:—Micrometer gauge recommended. Using feeler gauge (.002") inserted between piston and cylinder wall on side opposite slot, pull required to withdraw feeler must be 7-10 lbs.

Installing Pistons:—Slot should be toward left or away from camshaft.

PISTON RINGS:—Two undercut compression rings, two oil control rings per piston, all above pin. Lower ring grooves drilled with oil drain holes.

Ring	Width	End Gap	Side Clearance
Comp. all	⅛"	.007-.015"	.001-.003"
Oil (both)	5/32"	.007-.015"	.003-.005"

Replacement Rings:—Furnished in standard and .003", .010", .020", .030", .040", .050", .060" oversizes. NOTE—Install compression rings with step down.

PISTON PIN:—Diameter—55/64". **Length**—2¾". Pin floats in piston and rod. Held by retaining rings. Pin hole in rod is bronze bushed.
NOTE—Heat piston in boiling water to remove or install pins.
Pin Fit in Piston—Tight thumb push fit with piston heated to 160° F.
Pin Fit in Rod Bushing—Tight thumb push fit with piston and rod at 70° F.

Replacement Pins:—Pins furnished in standard and .003", .005", .008" oversizes. Ream rod bushing and pin holes in piston bosses for correct fit.

CONNECTING ROD:—Weight All rods held to ¼ oz. maximum variation. **Length** 7 15/16" (center-to-center).
Crankpin Journal Diameter—2 1/16".
Lower Bearing—Steel-backed, copper-lead lined, interchangeable. Furnished standard and .010" undersize.
Clearance—.001-.003". Sideplay .0055-.0115".

Bearing Adjustment:—None (no shims). Replace bearings. Do not file rods or caps. Install new bearings with small bosses engaging groves in rod and cap.

Installing Rods:—Lower bearings are offset. Install rods with widest half of bearing toward rear (#1, 3, 5) and toward front (#2, 4, 6). Oil hole in lower bearing upper half must be toward camshaft on all rods.

CRANKSHAFT:—4 bearing. Integral counterweights.
Journal Diameters—2¼" (all bearings).
Bearing Type—Removable steel-backed, babbitt-lined (#1 and 4), copper-lead or cadmium-nickel (#2 and 3). Furnished standard and .010" undersize.
Clearance—(#1 and 4) .001-.002". (#2 and 3) .0015-.0025".

Bearing Adjustment:—None (no shims). Replace bearings. Do not file caps. *See Chrysler Shop Notes for Front Main Bearing Cap Removal, and installation & adjustment of Replacement Bearings & Caps.*

End Thrust:—Taken by flange faces on rear (#4) bearing. Endplay .003-.007".

CAMSHAFT:—4 bearing. Non-adjustable chain drive.
Journal Diameters—#1, 2"; #2, 1 13/32"; #3, 1 15/16"; #4, 1¼".
Bearing Type—Removable steel-backed, babbitt-lined (except #4 machined in crankcase).
Clearance—.001-.003" (#1), .0015-.0035" (all others).
NOTE—New bearings require no line-reaming.

End Thrust:—Taken by thrust plate at rear of sprocket hub. Endplay .002-.006".

Timing Chain:—Morse. Width 1". Pitch .500". Length 24" or 48 links.

Camshaft Setting:—Sprockets are marked. Mesh chain with sprockets turned so that 'O' marks are adjacent and in line with a straightedge across shaft centers. Install chain endless.
NOTE—Engine must be supported under front end of oil pan and front engine support removed for work on timing chain and camshaft.

VALVES:—

	Head diam.	Stem diam.	Length
All valves	1 15/32"	.340-.341"	4 25/32"

	Seat Angle	Lift	Stem Clearance
Intake	45°	5/16"	.001-.003"
Exhaust	45°	5/16"	.003-.005"

See Chrysler Special Shop Notes for Exhaust valve seat insert removal and installation instructions.

Tappet Clearance—.006" Int., .008 Exh. (hot). .010" Exh. recommended for sustained high speed.

Valve Guides:—Use special tool to remove and install guides. Insert guides with taper end up (intake) and down (exhaust). Top of guide must be ⅞" below top of block. Finish ream new guides to inside diameter of .342-.343" (Int.), .344-.345" (Exh.).

Valve Springs:—Variable pitch type. Install springs with close coil at top. Do not compress springs to over all length of less than 1⅜".

	Spring Pressure	Spring Length
Valve Closed	34-38 lbs.	1¾"
Valve Open	77-83 lbs.	1 7/16"

Valve Lifters:—Mushroom type. Ream guides to take following oversizes: .001", .008", .030", .060".

Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 6° ATDC. Close 46° ALDC.
Exhaust Valves—Open 42° BLDC. Close 8° ATDC.
To Check Valve Timing—Install regular timing gauge in timing plug hole over #6 piston, set tappet clearance #6 valves at .011" (intake), .012" (exhaust). Intake valve should open with piston .015" past top dead center, and exhaust valve close with piston .027" past top dead center. Reset tappet clearance at .006" Int., .008" Exh., hot.
Motor Gauge—Weidenhoff Adapter #103, Rod #12.

LUBRICATION:—Pressure. Gear type oil pump located at right of crankcase.
NOTE—Ignition timing should be checked whenever oil pump is installed in engine.
Normal Oil Pressure—30-40 lbs. at 30 M.P.H.
Oil Pressure Relief Valve:—Under plug on left hand side of crankcase. Operates at 40 lbs. Adjustable by changing spring. Stand. spring unpainted. Heavy spring (to increase pressure) painted green. Lighter spring (to decrease pressure) painted red.
Crankcase Capacity—5 qts. (refill).

CLUTCH:—Borg & Beck Model 10A6. Single plate, dry disc type. See article in Clutch Section for relining and assembling directions.
Facings—Woven (pressure plate side), molded (flywheel side), Inside Diam. 6⅛". Outside Diam. 9⅞". Thickness ⅛".
Adjustment—Clutch pedal should just clear underside of toe board with clutch engaged. To adjust, turn stopscrew located just above clutch pedal shaft. Free movement of pedal should be 1 1/16". To adjust, loosen locknut and turn adjusting nut (clevis) on clutch fork adjusting rod.
Removal—Disconnect clutch pedal linkage, remove fork pivot screw, take out clutch fork. Remove transmission (release bearing and spring are withdrawn with transmission), remove clutch housing pan, prick punch clutch cover and flywheel (install in same position to maintain balance), take out clutch mounting bolts, turning all bolts out evenly to release spring tension and avoid distortion of clutch cover. Remove clutch from below. Use pilot studs when removing and installing transmission to avoid springing clutch plate.

Automatic Clutch:—See article in Clutch Section.

STEERING:—Steering Gear—Gemmer Worm-and-Roller type. See article in Steering Section for adjustment.

Front Suspension:—Conventional tubular section front axle with Reverse-Elliott ends and semi-elliptic springs.

Kingpin Inclination—9½° crosswise. Limits 9-10°.
Caster—2° (1-3°). Adjust by inserting wedge plates between springs and axle pads. Wedges available in ½, 1, 2° angles.
Camber—½° (¼-¾°). No adjustment. Replace tubular axle if camber is out more than ½°.
Toe In—0-⅛". Adjust in usual manner by loosening tie rod end clamps and rotating tie rod.

BRAKES:—Service—Lockheed hydraulic, double anchor type. Hand lever applies brake at rear of transmission or rear wheel service brakes (on 7 pass. sedan). See article in Brake Section for complete adjustment procedure.
Wheel Cylinders—Diameters, Front Wheel (Front end 1¼", Rear end 1⅜"). Rear Wheel (Front end 1⅛", Rear end 1¼").
NOTE—Wheel cylinders marked 'R' right side of car, 'L' left side of car. Not interchangeable.
Drum Diameter—10".
Lining—Moulded type. Width 2". Thickness 13/64". Length per wheel 19 13/16".
Clearance—.012" toe, .006" heel, for each shoe.

Hand Brake:—External type on drum at rear of transmission. See Service Brake (above) for cars with Rear wheel hand brake.
Adjustment—With lever in released position, remove anchor screw locking wire, turn anchor screw so that clearance between lining and drum is 1/16", lock anchor screw with wire. Adjust brake band guide bolt nut to give 1/16" clearance (as above) for lower portion of band, secure with locknut. Finally, adjust brake adjusting bolt nut to give 1/16" clearance (as above), making sure that groove in bolt nut is lined up with ridge lockwasher.
Drum Diameter—6".
Lining—Width 2". Thickness 5/32". Length 18 13/32".
NOTE—When relining, cut out lining adjacent to anchor and chamfer ends. Clearance between anchor and sides f anchor saddle .005" maximum.

SERIAL NUMBER:—First number 4,530,451 (Detroit), 9,409,056 (Canada). Stamped on right front door hinge pillar post.

ENGINE NUMBER:—First number D-5-1001. Stamped on left side of block between #1 and #2 cylinders. *See Chrysler Shop Notes for engine number lettering data (denoting special bore and bearing sizes).*

ENGINE SPECIFICATIONS:—6 cylinder, 'L' head.
Bore—3¼". **Stroke**—4⅜".
Displacement—217.8 cubic inches.
Rated Horsepower—25.35 (AMA).
Developed Horsepower—87 HP. at 3600 R.P.M.
Compression Ratio—6.5-1 cast-iron head.
Compression Pressure—135-145 lbs. at 1000 R.P.M. or approximately 110 lbs. at cranking speed.
Vacuum Reading—Gauge should show steady reading of 18-21" with engine idling at 7-8 M.P.H.

PISTONS:—Aluminum alloy, Invar strut, slotted skirt type. **Length**—3 11/16".
Weight—17.92 ozs. (plus or minus 2 grams).
Removal—Pistons and rods removed from above.
Clearance—Top .022". Skirt .0005". Limits .0005-.001".
Replacement Pistons:—Finished pistons furnished standard and .003", .005", .010", .015", .023", .025", .030", .040", .050", .060" oversizes. Semi-finished pistons furnished (1) standard to .023" oversize (2) .025-.050" oversize, not interchangeable. Pistons should be slotted, then finished by cam grinding.
Fitting New Pistons:—Micrometer gauge recommended. Using feeler gauge (.002") inserted between piston and cylinder wall on side opposite slot, pull required to withdraw feeler 7-14 lbs.
Installing Pistons:—Slot to left, away from valves.

PISTON RINGS:—Two undercut compression, two oil control rings per piston, all above pin. Oil ring grooves drilled with oil drain holes.

Ring	Width	End Gap	Side Clearance
Compression	⅛"	.007-.015"	.0015-.003"
Oil Control	5/32"	.007-.015"	.0015-.003"

Replacement Rings:—Furnished standard and .003", .005", .010", .015", .020", .025", .030", .040", .050", .060" oversizes.
NOTE—Install compression rings with step down.

PISTON PIN:—**Diameter**—55/64". **Length**—2¾". Floating type. Pin hole in rod bronze bushed.
Pin Fit in Piston—Thumb push fit at 160° F.
Pin Fit in Rod Bushing—Thumb push fit at 70° F.
Replacement Pins:—Furnished standard and .003", .005", .008" oversizes. Ream bushing and pin hole to size.

CONNECTING ROD:—**Weight**—30.6 ounces.
Length—7 15/16".
Crankpin Journal Diameter—2 1/16".
Lower Bearing—Steel-backed, babbitt-lined, interchangeable. Furnished std. & .0015", .010" undersize.
Clearance—.0005-.0025". **Sideplay**—.005-.0115".
Bearing Adjustment:—None. Install new bearings with bosses engaging grooves in rod and cap.
Installing Rods:—Lower bearings offset. Install wide portion to rear on #1, 3, 5, to front on #2, 4, 6. Oil hole in lower bearing upper half toward valves.

CRANKSHAFT:—4 bearing. Integral counterweights.
Journal Diameters—2½" (all bearings).
Bearing Type—Removable steel-backed, babbitt-lined. Furnished std. and .0015", .010" undersize.
Clearance—.001-.002".
Bearing Adjustment:—*See Chrysler Shop Notes for Front Main Bearing Cap removal, adjustment directions, and Replacement Bearing Cap data.*
End Thrust:—Taken by flange faces on rear (#4) bearing. **Endplay**—.003-.007".

CAMSHAFT:—4 bearing. Non-adjustable chain drive.
Journal Diameters—#1, 2"; #2, 1 31/32"; #3, 1 15/16"; #4, 1¼".
Bearing Type—Removable steel-backed, babbitt-lined (except #4 machined in block).
Clearance—.0015-.0035".
End Thrust:—Taken by thrust plate at rear of camshaft sprocket hub. **Endplay**—.002-.006".
Timing Chain:—Morse. Width 1". Pitch .500". Length 24" or 48 links.
Camshaft Setting:—Mesh chain with sprockets turned so that '0' marks are adjacent and in line with a straightedge across shaft centers.

VALVES—

	Head Diameter	Stem Diameter	Length
All Valves	1 15/32"	.340-.341"	4 25/32"

	Seat Angle	Lift	Stem Clearance
Intake	45°	5/16"	.001-.003"
Exhaust	45°	5/16"	.003-.005"

See Chrysler Special Shop Notes for Exhaust valve seat insert removal and installation instructions.
Tappet Clearance—.006" Int., .008" Exh. (hot). Remove front wheel and wheel housing to adjust.
Valve Guides:—Guides must be ⅞" below top of block. Ream guides after installing (.342-343" Int., .344-345" Exh.).
Valve Springs:—1⅜" limit of compression.

	Spring Pressure	Spring Length
Valve Closed	34-38 lbs.	1¾"
Valve Open	77-83 lbs.	1 7/16"

Valve Lifters:—Mushroom type. Ream guides to take following oversizes: .001", .008", .030", .060".

VALVE TIMING:—See Camshaft Setting above.
Intake Valves—Open 6° ATDC. Close 46° ALDC.
Exhaust Valves—Open 42° BLDC. Close 8° ATDC.
To Check Valve Timing:—Install timing gauge in hole over #6 piston, set intake valve at .011" (cold). Valve should open with piston .015" past top dead center. Reset tappet clearance .006" (hot).
Motor Gauge—Weidenhoff Adapter #103, Rod #12.

LUBRICATION:—Gear type oil pump on right of engine.
NOTE—Check ignition timing whenever oil pump installed on engine.
Normal Oil Pressure:—30-45 lbs. at 30 M.P.H.
Oil Pressure Relief Valve:—Under plug on left side of crankcase. Operates at 40-50 lbs. Adjustable. Heavy (green) spring to increase pressure, lighter (red) spring to decrease pressure.
Crankcase Capacity:—5 quarts (refill).

CLUTCH:—**Borg &Beck Mod. 10A7.** Model #899 stamped on cover. Single plate, dry disc type.
See article in Mechanical Equipment Section for data.
Facings—Woven (press. plate side), moulded (flywheel side). 1 of each required. I.D. 6". O.D. 10". ⅛" thick. *See Chrysler Special Shop Notes.*
Adjustment—Adjust stopscrew (just above clutch pedal shaft) so that pedal just clears floor board. Free movement of pedal should be 1 1/16" (adjust by turning release fork rod adjusting nut).
Removal:—Remove transmission (see Transmission Removal below), remove housing under-pan, mark cover and flywheel, remove cover bolts evenly, remove assembly from below.

TRANSMISSION:—**Own**—All helical gear type with synchronizing shift on second and high gears.
See article in Mechanical Equipment Section for data.
Removal:—Disconnect front and rear U-joints, disconnect hand brake, remove nuts from studs at clutch housing, disconnect release fork pull-back spring, pull release fork out of clutch housing, remove transmission cover assembly, remove unit with two pilot studs in upper stud holes.
NOTE—Run-out of clutch housing .003" maximum.

UNIVERSAL JOINTS:—**Detroit-Universal Series 4200.** Ball and trunion type with roller bearings. 2 used.
NOTE—Three U-joints used on 7 passenger sedan.
See article in Mechanical Equipment Section for data.
Propeller Shaft Center Bearing:—Used on 7 Pass. models. *See Chrysler Shop Notes for data.*

REAR AXLE:—**Own**—Semi-floating, hypoid gear type with Hotchkiss drive.
See article in Mechanical Equipment Section for data.
Ratio—4.1-1 (5 pass.), 3.9-1 (coupes), 4.3-1 (7 pass.).
Backlash—.006-.010". Shim adjustment.
Removal:—Remove axle shaft nut, hub and drum assembly (use hub puller, do not hammer out or bearing damage may result), disconnect brake line at wheel cylinder, remove backing plate (with oil seal). Use shaft puller to remove axle shaft and bearing. With axle shafts removed, differential carrier may be removed by disconnecting rear U-joint at flange and removing housing capscrews.
Wheel Bearing Adjustment—Controlled by shims between brake backing plates and flanged ends of housing. Remove brake backing plates (see above) and add or remove shims to give proper clearance.
Endplay—.003-.008".
NOTE—Shims supplied .010", .0125", .030" thick.

SHOCK ABSORBERS:—**Delco.** Direct acting, hydraulic type (made by Chrysler).
See article in Mechanical Equipment Section for data.

STEERING:—**Steering Gear**—Chrysler (Gemmer design Model 300). Worm-and-Roller type.
See article in Mechanical Equipment Section for data.
Front Suspension:—Conventional tubular section axle, Reverse-Elliott ends, semi- elliptic springs.
Kingpin Inclination—4½-5½° crosswise.
Caster—2° (1-3°). Adj. by inserting wedge shims between springs & axle pad. ½° & 2° wedges supplied.
Camber—½° (¼-¾°). No adjustment.
Toe In—1/16" (0-⅛"). Adjust by turning tie rod.
Steering Geometry—Outer wheel turned 20°. Inner wheel turned 22°50', 22°20' (7 pass.).

BRAKES:—**Service**—Lockheed hydraulic, double anchor type. Hand brake at rear of transmission.
See article in Mechanical Equipment Section for data.
Wheel Cylinders—Stepped or two-stage bore type: Front Wheel—Front cyl. 1¼", Rear 1⅜".
Rear Wheel—Front cyl. 1⅛", Rear 1¼".
Drum Diameter—10".
Lining—Moulded. Width 2". Thickness .200". Length rear wh.-rear shoe) 7 25/64", (all others) 9 29/32".
Clearance—.012" toe, .006" heel for each shoe.
Braking Power—55% front wheels, 45% rear.
Hand Brake:—On drum at rear of transmission.
Adjustment—Fully release hand brake lever. Remove anchor screw locking wire (left side), adjust anchor screw for .025" clearance between band and drum, set anchor screw with lock wire. Free large adjusting bolt nut (upper end of band), loosen locknut, adjust guide bolt nut to .025" clearance between band and drum, set with locknut. Tighten adjusting bolt nut until tension on either end of guide bolt is just relieved (groove in nut must align with ridge in lockwasher).
Drum Diameter—6".
Lining—Width 2". Thick. 5/32". Length 16 15/16".
NOTE—Clearance at anchor and saddle .005" max.

SERIAL NUMBER:—On right front door hinge pillar post. First number: 30,000,001 (Detroit), 40,000,001 (Evansville), 9,413,746 (Canada).

ENGINE NUMBER:—First number D-8-1001. Stamped on left side of block between #1 and #2 cylinders. *See Chrysler Shop Notes for engine number lettering ('Special Standard' bore and bearing sizes).*

ENGINE SPECIFICATIONS:—6 cylinder, 'L' head.
Bore—3¼". **Stroke**—4⅜".
Displacement—217.8 cubic inches.
Rated Horsepower—25.35 (A.M.A.)
Developed Horsepower—87 HP. at 3600 R.P.M.
Compression Ratio—6.5-1 cast-iron hd. No optl.
Compression Pressure—135-145 lbs. at 1000 R.P.M. or approximately 110 lbs. at cranking speed.
Vacuum Reading—Gauge should show steady reading of 18-21" with engine idling at 6 M.P.H.

PISTON:—Aluminum alloy, split skirt, steel strut type.
Length—3 11/16". **Weight**—17.45 ozs.
Removal—Pistons and rods removed from above.
Clearance—Top .022". See Fitting New Pistons.
Replacement Pistons:—*See Chrysler Shop Notes.*
Fitting New Pistons:—Check piston size with micrometer gauge on skirt across piston pin support ribs. Insert .002" feeler between cylinder wall and piston on side opposite slot. With piston and block at 70°F. pull to withdraw feeler must be 7-14 lbs.
Installing Pistons:—Slot away from camshaft.

PISTON RINGS:—2 undercut compression, 2 slotted oil rings per piston, all above pin.
NOTE—Install top ring with step on inner edge to top. #2 ring with step on outer edge down.

Ring	Width	End Gap	Side Clearance
Comp. (#1)	⅛"	.007-.015"	.002-.0035"
Comp. (#2)	⅛"	.007-.015"	.0015-.003"
Oil Control	5/32"	.007-.015"	.0015-.003"

Replacement Rings:—Furnished std. and .003", .005", .010", .015",. 020", .023", .025", .030", .040", .050", .060" oversize.

PISTON PIN:—**Diameter**—55/64". **Length**—2¾".
Floating type. Pin hole in rod bronze bushed.
Pin Fit in Piston—Thumb push fit with piston heated to 160°F.
Pin Fit in Rod Bushing—Thumb push fit at 70°F.
Replacement Pins:—Furnished std. & .003", .005", .008" oversize. Ream bushing and pin hole to size.

CONNECTING ROD:—**Weight** 30.01 oz. **Lgth.**—7 15/16".
Crankpin Journal Diameter—2 1/16".
Lower Bearing—Removable steel-backed, babbitt-lined. Furnished std. & .002", .010", .012" undersize.
Clearance—.0005-.0025". **Sideplay**—.0055-.0115".
Bearing Adjustment:—None. Install new bearings with bosses engaging grooves in rod and cap.
Installing Rods:—Install rods with wide portion of bearing to rear on #1, 3, 5, to front on #2, 4, 6. Oil spit hole to camshaft (all rods).

CRANKSHAFT:—4 bearing type. Impulse neutralizer mounted on forward end.
Journal Diameters—2½" all bearings.
Bearing Type—Steel-backed, babbitt-lined type.
Clearance—.001-.002".
Bearing Adjustment:—*See Chrysler Shop Notes for Front Main Bearing Cap Removal, Replacement Bearings and Bearing Caps, Bearing adjustment data and Crankshaft Oil Seals.*
End Thrust:—Taken by flange faces on rear (#4) bearing. **Endplay**—.003-.007".

CAMSHAFT:—4 bearing. Non-adjustable chain drive.
Journal Diameters—#1, 2".; #2, 1 31/32"; #3, 1 15/16"; #4, 1¼".
Bearing Type—Removable steel-backed, babbitt-lined bushings (except #4 machined in block).
Clearance—.001-.003" ,#1), .0015-.0035" (all others).
NOTE—Replacement bushings finish reamed.
End Thrust:—Taken by thrust plate behind camshaft sprocket hub. **Endplay**—.002-.006".
Timing Chain:—Morse #1866 (restricted bend). Width 1". Pitch .500". Length 24" or 48 links.
See Chrysler Special Shop Notes for front end removal for work on timing chain.
Camshaft Setting:—Mesh chain with sprockets turned so that 'O' marks are adjacent and in line with a straightedge cross the shaft centers.

VALVES:

	Head Diameter	Stem Diameter	Length
All valves	1 15/32"	.340-.341"	4 25/32"

	Seat Angle	Lift	Stem Clearance
Intake	45°	5/16"	.001-.003"
Exhaust	45°	5/16"	.003-.005"

See Chrysler Special Shop Notes for Exhaust Valve Seat insert removal and installation.
Tappet Clearance—.006" Int., .008" Exh. (hot). .010" Exh. setting recommended for sustained high speed driving. Valves accessible by removing right front wheel and wheel housing panel.
Valve Guides:—Install with round end up to ⅞" below top of block. Finish ream guides after installing to .342-.343" Int., .344-.345" Exh.
Valve Springs:—Free length approx. 2 3/32". Limit of compression 1 9/32".

	Spring Pressure	Spring Length
Valve Closed	34-38 lbs.	1¾"
Valve Open	77-83 lbs.	1 7/16"

Valve Lifters:—Mushroom type. Ream guides from above for following oversizes: .001", .008", .030", .060".
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 6° ATDC. Close 46° ALDC.
Exhaust Valves—Open 42° BLDC. Close 8° ATDC.
To Check Timing—Set tappet clearance #6 intake valve at .011". This valve should open with piston 6° (.0153") past top dead center when 6° ATDC. mark on impulse neutralizer at front of engine lines up with pointer on chain case cover. Reset tappet clearance at .006" (hot).
Motor Gauge—Weidenhoff Adapter #103, Rod #12.

LUBRICATION:—Gear type oil pump on right of engine.
Normal Oil Pressure:—30-45 lbs. at 30 M.P.H.
Oil Pressure Relief Valve:—Under plug on left side of engine. Operates at 40 lbs. Adjustable. Change to heavy (green) spring to increase pressure, light (red) spring to decrease.
Crankcase Capacity:—5 quarts (refill).

COOLING SYSTEM:—**Water Pump.** Centrifugal, belt-driven, packless type.
See article in Mechanical Equipment Section for data.
Removal—With water drained and fan belt removed, remove fan blades and pulley (attached by 4 capscrews), disconnect pump hoses, remove nuts from pump mounting studs and lift out.
Thermostat:—Fulton. In water outlet on head.
NOTE—Install thermostat with bellows down.
Setting—Start to open 150-155°F. Fully open 176°F.
Water Capacity:—15 quarts.
Drain Valves:—At lower left corner of radiator and on left side of block in front of distributor.

CLUTCH:—**Borg & Beck Model 10A7, 11A6 (Taxi).** Model 913, 917 (Taxi) stamped on cover. Single plate, dry disc type with new spiral grooved type facings and clutch pressure plate oil baffle.
See article in Mechanical Equipment Section for data.
Facings—Molded-woven (spiral grooved), 2 required. Thickness ⅛". Inside diameter 6", 6½" (Taxi). Outside diameter 10", 11" (Taxi).
Adjustment—Adjust stopscrew (to rear of pedal) so that pedal arm just clears floor board. Pedal free movement must be 1 1/16". Adjusting nut provided on fork rod next to release fork.
Removal:—Remove floor board, release fork pull-back spring, free clevis pin on release fork rod. Remove transmission (see Transmission Removal below), remove housing underpan, mark cover and flywheel, remove cover bolts evenly, take out assembly

TRANSMISSION:—**Own Make.** All helical gear type with synchro-mesh on second and high speeds.
See article in Mechanical Equipment Section for data.
Removal:—Remove floor boards, battery cable, disconnect front and rear universals (see Propeller Shaft Center Bearing below for 7 pass. sedan), free hand brake cable at clevis. Take off nuts on mounting studs, disconnect clutch release fork pull-back spring, free clevis pin on release fork rod, remove cover (gear-shifter assembly), insert 2 pilot studs in top holes and withdraw transmission.

UNIVERSAL JOINTS:—**Detroit-Universal.** Series 4200. Ball and trunnion type with roller bearings. 2 used.
NOTE—Three universals used on 7 pass. sedan.
See article in Mechanical Equipment Section for data.
Propeller Shaft Center Bearing:—Used on 7 passenger models. *See Chrysler Shop Notes.*

REAR AXLE:—**Own make.** Semi-floating, hypoid gear type with Hotchkiss drive.
See article in Mechanical Equipment Section for data.
Ratio—Standard 4.1-1 (Sedans), 3.9-1 (Coupes), 4.3-1 (7 pass. sedan & cars with 6.00 X 18 tires).
Backlash—.006-.010". Screw adjustment.
Removal:—Remove wheel, hub, and drum assembly (using screw type hub puller). Place block under brake pedal, disconnect brake line, remove backing plate and oil seal, pull axle shaft and bearing (Tool C-158). With shafts removed, carrier may be removed by disconnecting rear universal at flange, and removing housing capscrews.
Wheel Bearing Adjustment—Controlled by shims at flanged ends of axle housing. With wheel and hub removed measure endplay with dial indicator. To adjust remove backing plate (see above) and add or remove shims (equally at both sides) to proper clearance. **Endplay**—.003-.008".

SHOCK ABSORBERS:—**Delco**—Model 1183-U (front), 1184-U (rear). Direct acting, hydraulic type.
See article in Mechanical Equipment Section for data.

STEERING:—**Steering Gear**—Chrysler (Gemmer design Model 300). Worm-and-Roller type.
See article in Mechanical Equipment Section for data.
Front Suspension:—Conventional tubular section axle, Reverse-Elliott ends, semi-elliptic springs.
Kingpin Inclination—4½-5½° crosswise.
Caster—2° (1-3°). Adjust by inserting wedge plates between springs and axle center. Thick portion to rear increases caster, to front decreases caster.
Camber—½° (¼-¾°). Not adjustable.
Toe In—1/16" (0-⅛"). Turn tie rod to adjust.
Steering Geometry—Outer wheel 20°. Inner wheel 22°50'.

BRAKES:—**Service**—Lockheed hydraulic, double anchor type. Hand brake at rear of transmission.
See article in Mechanical Equipment Section for data.
Wheel Cylinders—Stepped or two-stage bore type:
Front Wheel—Front cylinder 1¼", Rear 1⅜".
Rear Wheel—Front cylinder 1⅛", Rear 1¼".
Drum—Cast-iron. Diameter—11".
Lining—Moulded. Width 2". Thickness 13/64". Length (front shoe) 11 15/32", (rear shoe) 7 31/32".
Clearance—.012" toe, .006" heel for each shoe.
Braking Power—55% front, 45% rear.
Hand Brake:—External at rear of transmission.
Adjustment—*See Chrysler Special Shop Notes.*
Drum—Cast-iron. Diameter—6".
Lining—Width 2". Thick. 5/32". Length 17 1/16".

FRONT END ASSEMBLY (UNIT) REMOVAL:—Should be removed as a unit for work on front of engine. *See Chrysler Shop Notes for directions.*

SERIAL NUMBER:—On right front door hinge post.

	Detroit	Canada
Deluxe	30,100,001 & up	9,416,686 & up
Special	4,267,701 & up	

ENGINE NUMBER:—First number D-11-1001. Stamped on left side of block between #1 and #2 cylinders. *See Chrysler Shop Notes for Engine Number Lettering ('Special Standard' bore and bearing sizes).*

ENGINE SPECIFICATIONS:—6 cylinder, 'L' head.
Bore—3¼". **Stroke**—4⅜".
Displaccment—217.8 cu. ins. **Rated HP.**—25.35.
Developed Horsepower—87 HP. at 3600 R.P.M.
Compresion Ratio—6.5-1 cast-iron head. No optl.
Compression Pressure—135-145 lbs. at 1000 R.P.M. or approximately 110 lbs. at cranking speed.
Vacuum Reading—Steady 18-21" idling at 6 M.P.H. *See Chrysler Shop Notes for Engine Removal data.*

PISTONS:—Aluminum alloy, cam ground, split skirt, steel strut type. **Length**—3 11/16". **Weight**—17.45 oz.
Removal—Pistons and rods removed from above.
Clearance—Top .022". Skirt .0005" desired.
Original Bore & Piston Sizes, Replacement Pistons:—*See Chrysler Shop Notes for sizes and markings.*
Fitting New Pistons:—Check piston size with micrometer gauge on skirt across piston pin support ribs. Insert .002" feeler between cylinder wall and piston on side opposite slot. With piston and block at 70° F. pull to withdraw feeler should be 10-16 lbs.
Installing Pistons:—Slot away from camshaft.

PISTON RINGS:—4 rings, all above pin—#1 Compression (upper inner edge stepped), #2 Comp. (lower outer edge stepped), #3 & 4 (slotted oil rings).

Ring	Width	End Gap	Side Clearance
Comp. (Top)	⅛"	.007-.015"	.002-.004"
Comp. (#2)	⅛"	.007-.015"	.0015-.0035"
Oil Control	5/32"	.007-.015"	.0015-.003"

Replacement Rings:—Std. & .003", .005", .010", .015", .020", .023", .025", .030", .040", .050", .060" oversize.

PISTON PIN:—**Diameter**—55/64". **Length**—2¾". Floating type. Pin hole in rod bronze bushed.
Pin Fit in Piston—Thumb push fit with piston heated to 160° F.
Pin Fit in Rod Bushing—Thumb push fit at 70° F.
Replacement Pins:—Furnished std. & .003", .005", .008" oversize. Ream bushing and pin hole to size.

CONNECTING ROD:—**Weight** 30.01 oz. **Length** 7 15/16".
Crankpin Journal Diameter—2 1/16".
Lower Bearing—Removable, steel-backed, babbitt-lined. Furnished std. & .002", .010", .012" undersize.
Clearance—.0005-.0025". **Sideplay**—.0055-.0115".
Bearing Adjustment:—None (no shims). Install bearings with boss engaging groove in rod and cap.
Installing Rods:—Wide portion of bearing to rear (#1, 3, 5), to front (#2, 4, 6). Oil hole to camshaft.

CRANKSHAFT:—4 bearing type with 7 counterweights. *See Chrysler Shop Notes for Replacement Main Bearing Caps and Crankshaft Front and Rear Oil Seals.*
Journal Diameters—2½" all bearings.
Bearing Type—Removable, precision type steel-backed, babbitt-lined. **Clearance**—.001-.002".
Bearing Adjustm't:—*See Chrysler Shop Notes for Front Main Bearing Cap removal, and replacement bearings.*
End Thrust:—Taken by flange faces on rear (#4) bearing. **Endplay**—.003-.007".

CAMSHAFT:—4 bearing. Non-adjustable chain drive.
Journal Diameters—#1, 2"; #2, 1 31/32"; #3, 1 15/16"; #4, 1¼".
Bearing Type—Removable steel-backed, babbitt-lined bushings (except #4 machined in block).
Clearance—.001-.003" (#1), .0015-.0035" (all others).
End Thrust:—Taken by thrust plate behind camshaft sprocket hub. **Endplay**—.002-.006".
Timing Chain:—Morse Type 1866-N, No. 2661. Width 1". Pitch .500". Length 24" or 48 links.
Camshaft Setting:—Mesh chain with sprockets turned so that '0' marks are adjacent and in line with a straightedge across the shaft centers.

VALVES:—

	Head Diameter	Stem Diameter	Length
All valves	1 15/32"	.340-.341"	4 25/32"

	Seat Angle	Lift	Stem Clearance
Intake	45°	5/16"	.001-.003"
Exhaust	45°	5/16"	.003-.005"

See Chrysler Shop Notes for Exh. Valve Seat Insert data.
Tappet Clearance:—.006" Intake, .008" Exh. (Hot). .002" additional exhaust clearance recommended for sustained high speed driving. NOTE—Tappet screws self-locking type (no locknuts). Remove right wheel and housing panel for access to valves.
Valve Guides:—Remove from above. Press new guides in (tapered end up) so top ⅞" below top of block, then finish ream to .342-.343" Int., .344-.345" Exh.
Valve Springs:—Free length approx. 2 3/32". Limit of compression 1 9/32".

	Spring Pressure	Length
Valve Closed	34-38 lbs.	1¾"
Valve Open	77-83 lbs.	1 7/16"

Valve Lifters:—Mushroom type. Stem diam. ⅝". Ream holes from above (pilot in valve stem guide) for lifters furnished .001", .008", .030", .060" oversize.
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 6° ATDC. Close 46° ALDC.
Exhaust Valves—Open 42° BLDC. Close 8° ATDC. Correct with tappet clearance of .011" Int., .012" Exh.
Valve Timing Check—Set tappet clearance #6 intake valve at .011". This valve should open with piston 6° (.0153") past top dead center when 6° ATDC. mark on impulse neutralizer at front of engine lines up with pointer. Reset tappet cl. .006" hot.
Motor Gauge—Weidenhoff Adapter #103, Rod #12.

LUBRICATION:—Gear type pump, right of engine.
Normal Oil Pressure:—30-45 lbs. at 30 M.P.H.
Oil Pressure Regulator:—Under cap below starter. Opens at 40-45 lbs. To increase pressure use heavy (green) spring, to decrease use light (red) spring.
Crankcase Capacity:—5 quarts (refill).

COOLING SYSTEM:—**Capacity**—15 quarts.
Radiator Core Removal—*See Chrysler Shop Notes.*
Water Pump:—Packless type, belt-driven. *See article in Mechanical Equipment Section for data.*
Removal—Drain water, remove hood side panels, fan blade assembly, pulley, radiator outlet hose at pump, by-pass (with small hose), pump mounting stud nuts, fan belt adjusting strap at generator.
Thermostat:—Fulton. In water outlet on cyl. head. **Setting**—Start to open 157-162° F. Fully open 183°.
Temperature Gauge:—Motometer (Auto Lite) Vapor Tension type. Part No. H-9022. *See article in Mechanical Equipment Section for data.*

CLUTCH:—**Borg & Beck Model 10A7, 11A6 (Taxi).** #928 (10A7), #931 (11A6) stamped on cover. Single plate, dry disc type with spiral grooved facings, pressure plate oil baffle and new Over-center return spring (hooked to pedal). *See article in Mechanical Equipment Section for data.*
Facings—Woven & compressed, 2 required. Inside Diam. 7" (10A7), 6½" (11A6). Outside Diam. 10" (10A7), 11" (11A6). Thickness .125" (all).
Adjustment:—Pedal should just clear toeboard (adjust stopscrew on lower end) and have 1" free movement (adjusting nut on link rod at clutch fork).
Removal:—Remove floorboard, unhook clutch fork pull-back spring and take out clevis pin in connector link. Remove transmission (see below) and housing underpan, mark cover and flywheel, remove clutch cover bolts evenly, lower assembly out.

TRANSMISSION:—**Own make (Warner design).** All helical gear, constant-mesh, synchro-mesh (second & high), sliding gear (low & reverse). Synchronizers made by Warner.
Transmission Control:—Remote control type. *See articles in Mechanical Equipment Section for data.*
Removal:—Remove floor boards, battery ground cable, disconnect front and rear U-joints (see Chrysler Shop Notes for Propeller Shaft Center Bearing Removal on 7 pass.), hand brake cable at clevis, speedometer cable, and gearshifter rod and cable at lever on case. Remove mounting stud nuts, cover assembly, and 2 upper mounting studs (insert pilot studs). Withdraw transmission assembly.

UNIVERSAL JOINTS:—**Detroit-Universal Series 4200.** Ball and trunnion type with roller bearings. *See article in Mechanical Equipment Section for data.*
Propeller Shaft Center Bearing:—On 7 pass. sedans. *See Chrysler Shop Notes for Propeller Shaft Center Bearing Removal and Installation instructions.*

REAR AXLE:—**Own Make.** Semi-floating, hypoid gear type with Hotchkiss drive. *See article in Mechanical Equipment Section for data.*
Ratio—3.9-1 (Coupes), 4.1-1 (5 pass.), 4.3-1 (7 pass. and cars with 6.00x18 & 5.25x20 tires).
Backlash—.006-.010". Screw adjustment.
Removal:—Disconnect drive shaft at rear universal, remove axle shafts (see below), remove capscrews on carrier flange, pull carrier assembly out.
Axle Shaft Removal—Remove wheel, hub and drum assembly (use screw type hub puller—Tool C-319), block brake pedal, disconnect brake line at wheel cylinder, take off backing plate with oil seal, pull shaft and bearing (Tool C-158).
Wheel Bearing Adjustment:—Shims between backing plate and axle housing. With wheel and hub removed check endplay with dial indicator. To adjust, remove backing plate (see above), add or remove shims equally (at both sides). **Endplay**—.003-.008".

SHOCK ABSORBERS:—**Delco.** Direct acting type. Domestic—Front 1110-C. Rear 1111-T, W (20" wh.). Exp.—Front 1114-C. Rear 1115-T, W (20" wh.). Adj. Exp.—Front 1134-E. Rear 1130-W, Y (20" wh.). Adj. *See article in Mechanical Equipment Section for data.*

STEERING:—**Steering Gear**—Chrysler (Gemmer design Model 300 standard, 305 'push-pull' adjustment 7 passenger sedan). Worm-and-roller type. *See article in Mechanical Equipment Section for data.*
Front Suspension:—Independent, linked parallelogram type with coil springs. *See article in Mechanical Equipment Section for data.*
Kingpin Inclination—5¼-6½° (4¾-6°—7 pass.).
Caster—Minus ½° to plus 1½° (minus ¼° to plus ¾° —¼° preferred—7 passenger).
Camber—0° preferred. Limits minus ¼° to plus ½°. Plus ½° to plus 2½° (7 passenger).
Toe In—1/16" (0-⅛"). Set long tie rod to 31 11/16" (between ball centers). Adjust short rod only.
Steering Geometry (Toe-out on Turns)—Outer wheel turned 20°. Inner wheel 22°30'.

BRAKES:—**Service.** Lockheed hydraulic, double anchor type. Hand lever applies independent shaft brake. *See article in Mechanical Equipment Section for data.*
Wheel Cylinders—Stepped or two-stage bore type.
Drums—Cast-iron. Diameter—11".
Lining—Molded. Width 2". Thickness 13/64". Length (front shoe) 11 15/32"; (rear shoe) 7 31/32".
Clearance—.012" toe, .006" heel for each shoe.
Hand Brake:—On drum at rear of transmission.
Adjustment—*See Chrysler Shop Notes for data.*
Drum—Cast-iron. Diameter—6".
Lining—Width 2". Thick. 5/32". Length 17 1/16".

ENGINE NUMBER:—Stamped on left rear engine support.

ENGINE:—Eight cylinder, In line, Overhead valve type. Two intake and two exhaust valves per cylinder operated by two camshafts on cylinder head (exh. camshaft right, int. camshaft left).
Bore—3¾". **Stroke**—4¾".
Piston Displacement—420 cubic inches.
Rated Horsepower—45.
Developed Horsepower—(J) 265 at 4200 R.P.M.
Compression Ratio—5.2-1 Std. cast-iron head.
Compression Pressure—110 lbs. at 80 R.P.M.

Pistons:—Ray-Day, aluminum alloy, split, full skirt type. Skirt is separated from head by horizontal slot. Piston length 4⅜". **Weight**—20 ounces.
Removal—Pistons and rods removed from below.
Clearance—Top .032". Lands .027". Bottom .0035-.004".

Piston Rings:—Four rings per piston, three compression, one oil control, all above pin. Lower ring groove drilled radially with oil drain holes.

Ring	Width	End Gap	Wall Thickness
Comp. All	⅛"	.014-.016"	.150"
Oil Cont.	3/16"	.014-.016"	.150"

Piston Pin:—Diameter 1 1/16". Length 3 17/64". Pin floats in piston and rod. Held by two locking rings at each end. Pin hole in connecting rod is bushed and diamond-bored to size.
Pin Fit in Piston—Slight driving fit at room temperature (pin holes reamed to 1.06225-1.06175").
Pin Fit in Rod Bushing—Free push fit (bushing diamond bored to inside diameter of 1.0625".

Connecting Rod:—Weight 18 ozs. (without cap bolts or bushing). Length 9 13/16". Rod is a Duralumin forging used with a steel bearing cap.
Lower Bearing—Poured 'Mogul alloy' lined type.
Clearance—.0015-.002".
Adjustment—None (no shims). Bearings should not require adjustment during life of engine. Caps can be reduced with fine emery cloth on a surface plate if necessary.

Crankshaft:—Five bearings. Integral counterweights. Special mercury-cartridge type damper.
Journal Diameters—2¾" all bearings.
Bearing Type—'Mogul alloy' lined type.
Clearance—.0015".
Adjustment—None (no shims). Bearings should not require adjustment during life of engine. Caps can be reduced with fine emery cloth on a surface plate if necessary.
End Thrust—Taken by front main bearing. Thrust washer assembled between bearing and crankshaft sprocket. Endplay .0015-.003".

Camshaft:—Two camshafts on cylinder head. Each camshaft supported by five bearings.
Journal Diameters—1¼" all bearings.
Bearing Type—'Mogul alloy' lined type.
Clearance—.0015".
End Thrust—Taken by front bearing. Endplay, .0015-.003".
Timing Chains—Link Belt. **Upper Chain**—Width 1 11/16", Pitch ⅜", Length 51¾". **Lower Chain**—Width 2", Pitch ⅜", Length 47¼". Both camshafts are driven in tandem by upper chain from transfer sprocket on front of engine. Transfer sprocket driven in tandem with two accessory sprockets by lower chain from crankshaft. Automatic idler take-ups used on both chains.
Camshaft Setting—To change or set valve timing, turn engine over (by prying on flywheel ring gear with pry-bar inserted through inspection plate hole in housing) until #8 piston is slightly before top dead center entering power stroke (distributor rotor will be opposite #8 segment in distributor cap), stop when flywheel mark '/INT. OPENS' lines up with reference line on housing. This mark is exactly ⅝" before top dead center mark '1&8/CL'. Take off upper chain case cover, release idler sprocket by taking off cotter pin and plain washer, pry forward on sprocket bushing and spring until spring is nearly released, use tool #J-7016 to release spring tension, withdraw bushing lift chain off sprocket, remove sprocket, block chain up at lower end to prevent it dropping off transfer sprocket. Then set each camshaft as follows:
Intake Camshaft. Take out 6 capscrews, remove intake camshaft sprocket, set tappet clearance #1 intake valve at .025" (see note on tappet clearance), turn intake camshaft in direction of rotation until intake valve begins to open (use straddle clamp to twist valve tappet, valve opens when clearance is taken up and cam grips valve tappet), mesh sprocket in chain, keep driving side of chain taut, slip chain on sprocket one tooth at a time until sprocket can be mounted on camshaft without disturbing position of shaft or transfer sprocket, insert capscrews. Check ignition timing.
Exhaust Camshaft. With #8 piston slightly past top dead center entering power stroke and flywheel mark '/EXH.CLOSES', which is 1¼" past top dead center mark '1&8/CL', at reference line on housing, take off 6 cap screws, remove exhaust camshaft sprocket, set tappet clearance #1 exhaust valve at .025", turn exhaust camshaft in direction of rotation (clockwise) until #1 exhaust valve begins to close (use straddle clamp to twist valve tappet, valve closes when tappet is just released by cam so that tappet can be turned easily), mesh sprocket in chain, keep driving side of chain taut, slip chain on sprocket one tooth at a time until sprocket can be mounted on camshaft without disturbing position of camshaft or transfer sprocket, insert cap screws.
Idler Sprocket Assembly:—Mesh idler sprocket in chain, insert bushing and spring, use special tool to wind up spring 12 notches or two complete turns, assemble washer and cotter pin. Turn engine over with starter to allow chain to assume normal running position, then release spring tension, change setting to 9 notches or 1½ turns. See Equipment Section for complete data on Link Belt automatic idler sprockets.

Valves:—	Head Diam.	Stem Diam.	Stem Lgth
Intake	1½"	11/32"	5.002"
Exhaust	1 7/16"	11/32"	4.992"

Seat Angle—30° (all valves). **Lift** .350".
Stem-to-Guide Clearance—.002".
Valve Springs—Double springs used on all valves.

Inner Springs—	Pressure	Length
Valve Closed	26 lbs.	1 15/16"
Valve Open	36-40 lbs.	1 19/32"
Outer Springs—	**Pressure**	**Length**
Valve Closed	35-40 lbs.	2¼"
Valve Open	65-70 lbs.	1 29/32"

Tappet Clearance—.025" (cold) all valves.
NOTE:—To change or set tappet clearance, use feeler gauge and check actual tappet clearance of each valve (clearance between heel of cam and tappet). Remove camshafts, tappets, tappet adjusting nuts. Use shims of various thickness to change length of adjusting nut so that clearance when assembled will be .025" (measure length of adjusting nut with 1" micrometer, add or remove shims as necessary, recheck adjusting nut with micrometer).

Valve Timing

Intake Valves open 6° BTDC. Close 40° ALDC.
Exhaust Valves open 40° BLDC. Close 14° ATDC.
To Check Valve Timing:—Check tappet clearance #1 intake and exhaust valves (set at .025" cold). #1 intake valve should open with #8 piston slightly before top dead center entering power Stroke when flywheel mark '/INT.OPENS' lines up with reference line on housing. This mark is exactly ⅝" before top dead center mark '1&8/CL'. #1 exhaust valve should close with #8 piston slightly past top dead center when flywheel mark '/EXH.CLOSES' lines up with reference line. This mark is 1¼" past top dead center mark '1&8/CL'.

Lubrication:—Pressure type. Gear type oil pump located in oil pan.
Oil Pressure—2-10 lbs. (low idling speeds) increasing approximately 1 lb. per M.P.H. Maximum pressure, 80-100 lbs (high speed operation).
Oil Pressure Relief Valve—Built into oil pump. Controlled by adjustment nut located on lower left hand side of crankcase directly in front of oil float gauge indicator. Turn adjustment nut clockwise to increase, or counter-clockwise to decrease pressure. **Capacity**—12 qts.

CLUTCH:—Long Model 31-A. Double plate, dry disc type. No adjustment required for wear. See article in Clutch Section for complete data.
Clutch Pedal Adjustment—Free movement of clutch pedal must be 1-1½".
Clutch Facings—Special moulded composition, 4 required, 6½" I.D., 11" O.D., .137" thick.
NOTE:—Manufacturer recommends that cover plate assembly and driven member assembly be returned to factory for reconditioning.
Clutch Assembly—The three center driving plate adjusting screws (round-headed screws) must be backed off until the ends are flush with the pressure plate before the cover plate is bolted on the flywheel. Adjust these screws by turning in until they bottom and then backing each screw off exactly 4 notches.

STEERING:—Front Suspension—Conventional 'I' beam section front axle with Reverse-Elliott ends and semi-elliptic springs.
Caster—1°. Shim adjustment. **Camber**—1°.
Toe In—⅛-¼". Adjust in usual manner by loosening tie rod end clamps and rotating tie rod.
KingPin Bearing Adjustment—Kingpins are carried on a double-row ball bearing at the top and a ball thrust bearing at the bottom. Adjustment for end-thrust (up-and-down movement) is provided at lower bearing. To adjust, remove locking bar in adjusting nut below kingpin, back off adjusting nut, remove shims until there is no perceptible up- and-down movement of steering knuckle with adjusting nut tightened, or there is is a slight drag on steering knuckle when revolved around kingpin. Replace locking bar.

Steering Gear:—Ross Cam-and-Lever type. See article in Steering Section for complete data.

BRAKES:—Service—Lockheed Hydraulic, double anchor type. Hand lever applies brake at rear of transmission. See article in Brake Section.
Drum Diameter—15".
Lining—Moulded. Width 2¼". Thickness ¼". Length per wheel 28¾".
Clearance—.010" between lining and drum.

MERCURY NOTE:—All '95' Engine data below applies to Mercury as well as Ford models with '95' Engine.

1938 (ALL), 1939 (STD. MODELS)

HOOD, SIDE PANEL & GRILLE REMOVAL:—Turn radiator ornament counter-clockwise to free latch, lift hood up at forward end.

Side Panels:—To remove, take out three screws along top edge as follows: (1) extreme front corner at top of grille emblem, (2) at radiator shell, (3) extreme rear corner at cowl. Remove two thumbnuts on lower edge (inside), lift panel out.

Front Grille:—Made up of right and left sections but can be removed as an assembly. To remove, take out four bolts on fender edge on each side, one bolt on each side at splash shield edge on bottom,

1939 MODELS

HOOD (DELUXE FORD & MERCURY):—To raise hood, release latch by pulling up on latch handle on front of hood at upper edge of grille, raise hood slightly, press down on safety latch handle (to right of latch handle under hood). Separate side panels not used.

1936-39 MODELS

OIL PAN REMOVAL:—To remove oil pan, disconnect radius rods at rear end, remove oil level indicator and tube, attach hoist to front bumper bars and raise front end of car, push radius rods down and install block between bolt and cross-member. Remove oil pan screws, maneuver pan off.

1938 MODELS

STARTER SUPPORT BRACE:—To correct thump or pound in engine when accelerated between 18 and 28 M.P.H., special starter motor to oil pan brace 82-A-11140-A1 (60 Engine), 81-A-11140 (85 Engine) should be installed. Fasten this brace or bracket to starter through-bolt at starter end, remove one oil pan to cylinder block bolt and replace with special bolt 20426-S (60 Engine), 20426-S2 (85 Engine) to hold opposite end.

1937-38-39 MODELS

REPLACEMENT PISTONS ('60' ENGINES):—Steel-alloy pistons only used on these models. Finished pistons furnished in following sizes:

Part No.	Piston Sizes
52-6110-A	Standard
52-6110-B	.0025" Oversize
52-6110-C	.005" Oversize
52-6110-D	.015" Oversize
52-6110-E	.030" Oversize
52-6110-F	.045" Oversize

1932-39 MODELS

REPLACEMENT PISTONS ('85' ENGINES):—Flat head (aluminum) pistons used on all 1932-35 engines and part production 1936. Dome head pistons (aluminum or steel-alloy) used on part production 1936 and all 1937-38-39 engines.

IMPORTANT—Flat head type pistons and Dome head pistons are not interchangeable. Dome head pistons used only with special cylinder heads.

Aluminum (flat head)—Finished pistons furnished for 1932-36 engines in following sizes: Part No. 40-6110-A2 (Std.), B2 (.0025" O.S.), C2 (.005" O.S.), D2 (.015" O.S.), E2 (.030" O.S.), F2 (.045" O.S.), G2 (.060" O.S.).

Steel-alloy (dome head)—Finished pistons available for 1936 to 1939 engines as follows:

1936-37-38 — Part No.	— 1939	Piston Sizes
68-6110-A1	91-A-6110-A	Standard
68-6110-B1	91-A-6110-B	.0025" Oversize

NOTE—For .005" to .060" oversize pistons on these engines use aluminum (dome head) listed below.

Aluminum (dome head)—Finished pistons furnished for part production 1936 and all 1937-38-39 engines as follows:

Part No.	Piston Sizes
81-A-6110-C	.005" Oversize
81-A-6110-D	.015" Oversize
81-A-6110-E	.030" Oversize
81-A-6110-F	.045" Oversize
81-A-6110-G	.060" Oversize

1939 MODELS

REPLACEMENT PISTONS ('95' ENGINES):—Steel-alloy (dome head) pistons only used as follows:

Part No.	Piston Sizes
99-A-6110-A	Standard
99-A-6110-B	.0025" Oversize

1932-39 MODELS

CONNECTING ROD BEARING SERVICING:—Bearings float between connecting rods and crankpin. Special Replacement bearings furnished oversize on outer diameter (for oversize rods) and undersize on inner diameter (undersize crankpins) as follows:

'60' Engine (1937-38-39)

Part No.	Connecting Rod Oversize	Crankpin Undersize
52-6211-A	Std.	Std.
52-6211-B	Std.	.003"
52-6211-C	Std.	.010"
52-6211-D	.004"	.003"
52-6211-E	.008"	.010"
52-6211-F	.008"	.003"
52-6211-G	.004"	.010"
52-6211-H	.004"	Std.
52-6211-J	.008"	Std.

'85' Engine (1932 to 38)

48-6211-A	Std.	Std.
48-6211-BRP	Std.	.003"
48-6211-CRP	Std.	.010"
48-6211-D	.004"	.003"
48-6211-E	.008"	.010"
48-6211-FRP	.004"	.003"
48-6211-GRP	.004"	.010"

'85' & '95' Engines (1939)

Part Numbers 85	95	Con. Rod Oversize	Crankpin Undersize
81-A-6211-A	99-A-6211-A	Std.	Std.
81-A-6211-D	99-A-6211-B	.004"	.003"
81-A-6211-E	99-A-6211-C	.008"	.010"
81-A-6211-F	99-A-6211-D	.008"	.003"
81-A-6211-G	99-A-6211-E	.004"	.010"
81-A-6211-J	99-A-6211-G	.004"	Std.
81-A-6211-K	99-A-6211-H	.008"	Std.

1936-39 MODELS

CRANKSHAFT BEARINGS:—Replacement bearings furnished in Standard Size and Undersizes as shown below. In addition, Rear Main Bearings (flanged on both ends—take crankshaft end thrust) furnished in special lengths as follows:

'60' Engine (1937-38-39)

Part Number Frt. & Center	Rear	Size
52-6333-A	52-6331-A	Standard
52-6333-B	52-6331-B	.005" Undersize
52-6333-C	52-6331-C	.010" Undersize
52-6333-E*	52-6331-D**	Standard
	52-6331-E*	Standard
	52-6331-F**	.005" Undersize
	52-6331-G**	.010" Undersize

'85' Engine (1936-37-38)

68-6333-A	68-6331-A	Standard
68-6333-B	68-6331-B	.005" Undersize
68-6333-C	68-6331-C	.010" Undersize
68-6333-E*	68-6331-D**	Standard
	68-6331-E*	Standard
	68-6331-F**	.005" Undersize
	68-6331-G**	.010" Undersize
68-6333-F	68-6331-H	.015" Undersize

'85' & '95' Engines (1939)

Part Number Frt. & Center	Rear	Size
81-A-6333-A	81-A-6331-A	Standard
81-A-6333-B	81-A-6331-B	.005" Undersize
81-A-6333-C	81-A-6331-C	.010" Undersize
81-A-6333-D	81-A-6331-H	.015" Undersize
81-A-6333-E*	81-A-6331-D**	Standard
	81-A-6331-E*	Standard
	81-A-6331-F**	.005" Undersize
	81-A-6331-G**	.010" Undersize

**—These bearings .015" oversize in length.

*—O.D. .015" oversize, .015" undersize within flanges.

1932-39 MODELS

PISTON PIN FITTING:—Steel Pistons. Pins can be removed and installed without heating pistons. Pins, pistons, and rod bushings held to close limits so no fitting required. Check clearance as follows:

Pin Fit in Piston—With piston and pin at same temperature and clean, pin should drop through pin hole in piston (clearance .0007" maximum).

Pin Fit in Rod Bushing—With pin installed, hold pin so that rod hangs vertically, then rotate pin. Lower end of rod should move upward through arc of ½" max. before dropping back to vertical.

Aluminum Pistons:—Pistons must be heated by immersion in boiling water for one minute, or on special piston heater to a temperature not to exceed 200°F. for pin removal and installation. Pins, pistons, and rod bushings held to close limits so that no fitting required. Check clearances as follows:

Pin Fit in Piston—Pin should be hard hand push fit in piston with piston at room temperature.

Pin Fit in Rod Bushing—Same as for steel pistons

1933-39 MODELS

VALVE SERVICING (ALL FORD AND MERCURY ENGINES):—Complete valve assembly (valve, spring, guide) should be removed as follows:

Valve Assembly Removal:—Use special bar type lifter V-78 (All Fords and Mercury) inserting the end of lifter through valve spring coils to engage flanged lower end of guides, pull guide down slightly, withdraw 'C' type guide retainer, lift valve assembly out through top of block.

Valve Assembly Dismantling:—Use special bench fixture V-130 (85 Valves), S-214 (60 Valves). Consists of special press by which valve spring can be compressed to free spring retainer (fixture has stop which prevents excessive valve spring compression).

Valve Grinding and Tappet Clearance Note for all V8 Models):—To perform these operations with minimum amount of hand cranking, note which valves are fully open (first column in table below), grind or check valves listed on same line of table—then turn shaft 'til next 'valve open' point reached.

Valves Open	Valves to Grind
1. 4X & 1N	3X, 8N, 6N, 7X, 3N, 2X
2. 3X & 8N	1X, 7N, 5X, 2N, 4X, 1N
3. 1X & 7N	8X, 5N, 6X, 4N
OR	
1. 8X & 5N	1X, 7N, 6N, 7X, 3N, 2X
2. 6N & 7X	5X, 2N, 4X, 1N, 8X, 5N
3. 5X & 2N	6X, 4N, 3X, 8N

NOTE—'X' Exhaust Valve. 'N' Intake Valve.

Tappet Clearance Checking (All Models):—Use special two-step feeler to check clearance with valve lifter on heel of cam (see above). First .0125" step should be 'go', second .0135" 'no go'.

Exhaust Valve Seat Insert Grinding Note:—Seat inserts are exceedingly hard (high-tungsten, chrome-alloy steel). Manufacturer recommends eccentric-grinding equipment be used to reface these inserts.

OIL PAN REMOVAL:—To remove oil pan for work on engine, drain radiator, disconnect radiator hose connections, loosen front motor support, hoist motor, take out pan screws and maneuver pan off.

SERIAL NUMBER:—Same as Engine Number. Stamped on top of clutch housing and on left frame side member in front of dash bracket.

ENGINE NUMBER:—See Serial Number.

ENGINE:—Eight cylinder, 90 degree V, 'L' head type.

Dimensions—Bore, 3 1/16". Stroke, 3¾". Displacement, 221 cu. ins.

Horsepower—Rated 30.0. Developed—65 at 3400 R.P.M.

Compression—Ratio 5.5-1 cast-iron ('32), 6.3-1 aluminum (Std. '33, Optl. '32). Pressure 115 lbs. at 1800 R.P.M. or approximately 100 lbs. at cranking speed (5.5-1). 138 lbs. at 1600 R.P.M. or approximately 105 lbs. at cranking speed (6.3-1).

Vacuum Reading—Gauge should show steady reading of 18-20" at idling speed.

NOTE—Same cylinder head gasket used for both banks. Install gasket so that word 'Front' is toward front of engine on both banks.

Pistons:—Aluminum, split skirt, cam ground type. Piston diameter is slightly less across piston pin bosses. Skirt also tapered from top to bottom (approximately .001" greater diameter at bottom of skirt). Recondition cylinders to standard oversize. Pistons furnished in standard oversizes of .0025", .005", .015", .030", .045".

Weight—287-291 grams (stripped), 389.5-396.9 grams (with rings and pin).

Removal—Piston and rod assembly removed from top of engine.

Clearance—Skirt, 002" minimum, .003" maximum (see Fitting New Pistons).

Fitting New Pistons—Use micrometer gauge to check pistons size and cylinder bore. Measurement on piston should be be made at top of skirt (directly below slot and to left of piston skirt split). Measurement of cylinder bore should be made at right angles to crankshaft at point 2" above bottom of cylinder bore. Piston selected for cylinder should show correct clearance (difference between two measurements). Pistons cannot be ground and cylinders should be reconditioned to take standard replacement piston. New pistons should be measured before installing pin. Do not use feeler gauges.

NOTE:—Install pistons with slot to left (viewed from driver's seat).

Piston Rings:—Three rings per piston, #1 and 2—compression rings, #3—oil control ring. All rings above piston pin. Lower ring groove drilled radially with oil drain holes.

Ring	Width	End Gap	Wall Thickness	Groove Depth in Piston
Comp. (all)	.0915-.092"	.009-.015"	.140"	.154-.159"
Oil Cont.	.1545-.155"	.005-.009"	.140"	.154-.159"

Piston Pin:—Diameter, .7501-.7504". Length, 2.77". Pin floats in piston and rod and is held by retainer ring in rod (engages slot in center of pin). Piston should be heated to 200°F. (dip in boiling water for one minute) to remove or install pins.

Pin Fit in Piston—Slight drag with piston heated to 200°F.

Pin Fit in Rod—.0002". Pin hole in rod is diamond-bored to provide this clearance. With correct clearance, rod should rock on pin of its own weight but piston should not rock (make test before retainer is installed).

NOTE:—Use a taper pilot inserted ahead of piston pin to expand retainer ring when pins are installed.

Connecting Rod:—Weight, 469-473 grams. Length, 7" (center-to-center).

Big End Bearing—Separate babbitted bearing sleeves assembled on crankpin. Bearing diameter, 2" (inside), 2.218" (outside). Length, 1.937" (on crankpin).

Clearance—.003". Sideplay .010-.022". No shims used.

Adjustment—None (no shims used). Replace bearings.

NOTE:—A new tool, Part #V-131, has been developed to test bearings with connecting rod caps tightened. Tool is used to grasp bearing flanges and test fit by rotating bearings. Bearings should rotate freely. If bearings cannot be turned, or turns hard, check for bent connecting rods, distorted or burred bearings.

Crankshaft:—Three bearing, 90° type with integral counterweights.

Journal Sizes—2" diameter (all bearings).

Bearing Type—Babbitt bearing surface integral with cap and case.
Clearance—.001-.003".
Adjustment—None (no shims used).
End Thrust—Taken by #3 (rear) main bearing. Endplay, .002-.006".

Camshaft:—Three bearing type. Camshaft drive—Gears.
Camshaft Bearings—1.812" diameter (all bearings).
Gears—Crankshaft gear, steel. Camshaft gear, Bakelized Fabric.
Camshaft Setting—Gears are marked. Mesh marked tooth on crankshaft gear opposite space between gears marked by straight line on camshaft gear.
NOTE:—Backlash between gears should not exceed .004".

Valves:—	Head Diameter	Stem Diameter	Length	Seat Angle	Lift
All valves	1.537"	.3105"-.3115"	4.750-.4.751"	45°	.295"

See Ford Special Shop Note for complete Valve Servicing data.

Stem-to-Guide Clearance—.0015-.0035" (all valves).
Tappet Clearance—.0125-.0135" all valves. Not adjustable. Use special two step feeler gauge to check clearance (.0125" step 'go,' .0135" step 'no-go.' Replace valves if clearance is excessive, or grind off end of stem slightly if insufficient.

NOTE—Valve guides are split type and must be removed before valves can be taken out (valve stem has large end which will not clear). To remove valves, remove valve spring lock, remove valve spring, pull valve up slightly, insert special offset guide remover through valve port, press guides out and remove from below. Valves can then be lifted out.

Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 9°30' Before TDC. Close 54°30' After LDC.
Exhaust Valves—Open 57°30' Before LDC. Close 6°30' After TDC.
To Check Valve Timing—No flywheel marks or other means provided to check valve timing. If dead center point for piston #1 established on flywheel, #1 intake valve opening will be approximately 2.96 teeth before this point with piston .0327" before top dead center.

LUBRICATION:—Pressure type. Gear type oil pump located in crankcase and driven by gears at rear of camshaft (under cover in back of rear bearing).
Normal Oil Pressure—30 lbs. at 55 M.P.H.
Oil Pressure Relief Valve—Operates at 30 lbs. Not adjustable. Located under plug directly above camshaft front bearing.
NOTE—First type relief valve fitted with adjusting setscrew and locknut should be replaced with later non-adjustable type whenever found.
Crankcase Capacity—5 qts. Use SAE. #40 (summer), #20 or #10 (winter).

CLUTCH:—Long Model 9AB. Single plate, dry disc type. See article in Clutch Section for relining and assembling directions.
Facings—Moulded type, 2 required. Thickness .137". Inside diameter 5¾". Outside Diameter 9".
Adjustment—Free movement of clutch pedal must be 1-1¼". To adjust, take out clevis pin on clutch release lever at forward end of clutch pedal rod, turn clevis on rod.

STEERING:—Steering Gear—Gemmer Worm-and-Sector type. See article in Steering Section for complete adjustment directions.

Front Suspension:—Ford type. 'I' beam section front axle with Reverse Elliott ends and transverse cantilever spring. Axle positioned by forked radius rod anchored at rear end at frame 'X' member cross member.
Kingpin Inclination—7° crosswise.
Caster—4½-9°. Must be equal within ½° for both wheels. No adjustment.
NOTE—Caster should be 3-5° and equal within ½° for 131½ and 157" WB. trucks.
Camber—1¼-2° (8¼-9° with kingpin inclination). No adjustment.
Toe In—3/32". Must be proportional to camber in ratio of 10-1. Adjusted in usual manner by changing length of tie rod.

BRAKES:—Service—Own design. Two shoe, internal expanding, mechanically operated type. Hand lever applies all four service brakes. See article in Brake Section for complete adjustment instructions.
Drum Diameter—12".
Lining—Semi-moulded type. Thickness 3/16". Width 1½" Length 31" per wheel.
NOTE—Lining should be ground concentrically when installed on shoes.

Hand Brake:—See Service Brake above and adjustment instructions.

OIL PAN REMOVAL:—To remove pan for work on engine, it is necessary to drain radiator, disconnect water pump hose connections, loosen front motor support, hoist motor, maneuver oil pan off.

ENGINE NUMBER:—Stamped on top of clutch housing and on left frame side member in front of dash bracket.

ENGINE:—Own Model 48. Eight cylinder, 90 degree 'Vee', 'L' head type. Both cylinder banks and crankcase cast integrally.
Bore—3.062". Stroke—3.75".
Piston Displacement—221 cubic inches.
Rated Horsepower—30.
Developed Horsepower—90 at 3800 R.P.M.
Compression Ratio—6.3-1 (Std. aluminum head). 5.32-1 (cast-iron head) 131" & 157" WB. trucks.
Compression Pressure—105 lbs. at cranking speed or 138 lbs. at 1600 R.P.M. (passenger cars), 109 lbs. at 2500 R.P.M. (131" and 157" WB. trucks with 5.32-1 cast-iron head).
Vacuum Reading—Gauge should show steady reading of 18-20" with engine idling.

Pistons:—Aluminum alloy, open split skirt, cam ground type. Skirt is tapered from top to bottom (.001-.002" greater diameter at bottom of skirt measured at right angles to bosses). Recondition cylinders to take replacement pistons furnished .0025", .005", .015", .030", .045", .060" oversize. Piston length 2.97".
Weight—287-291 grams (stripped), 389.5-396 grams (with rings and pin).
Removal—Pistons and rods removed from above.
Clearance—Skirt .002" min., .003" max.

Replacement Pistons:—*See Ford Special Shop Notes.*
Fitting New Pistons—Use .002" feeler ½" wide inserted between piston and cylinder wall at right angles to pin on side opposite slot, Pull to withdraw feeler must be within 5-10 lbs.
Installing Pistons—Slot should be toward left viewed from driver's seat.

Piston Rings:—Two compression rings, one oil control ring per piston, all above pin. Oil ring groove drilled radially with oil drain holes.

Ring	Width	End Gap	Wall Thickness
Comp. All	.0915-.092"	.009-.015"	.140"
Oil Cont.	.1545-.155"	.005-.009"	.140"

Piston Pin:—Diameter .7501-.7504". Length 2.77". Pin floats in piston and rod and is held by retainer ring in rod which engages groove in pin. Heat piston to 200°F. (dip in boiling water for one minute) to remove or install pins.
Pin Fit in Piston—Slight drag with piston at 200°F.
Clearance in Rod—.0002". With this clearance rod should rock on piston of its own weight, but piston should not rock on rod. This test should be made before retainer ring is installed.
Installing Pins—Use a taper pilot inserted ahead of pin to expand retainer ring.

Connecting Rod:—Weight 469-473 grams. Length 7".
Lower Bearing Type—Separate copper-lead type bearing sleeves assembled on crankpin.
Crankpin Journal Diameter—1.999".
Bearing Size—2" I.D., 2.218" O.DD., 1.937" long on crankpin.
Clearance—.003". Sideplay .010-.022".
Adjustment—None. Replace bearings.
NOTE—Use tool, #V-131, to check bearing fit with rod caps tightened. Tool grasps bearing flanges and allows bearings to be rotated to test fit. Bearings should rotate freely. If bearings cannot be turned or turn hard, check for bent rods, distorted bearings, or burrs. This tool now has serrations on the jaws to engage the smaller diameter flanges of the copper-lead type bearings. First type tool without serrations can be adapted by filing notches 1/16" wide on face of jaws.

Crankshaft:—3 bearing. Integral counterweights.
Journal Diameters—1.999" (all bearings).
Bearing Type—Babbitt bearing surface integral with crankcase and bearing cap.
Clearance—.001-.003". Endplay .002-.006".
Adjustment—None (no shims). Do not file caps.
End Thrust—Taken by rear bearing.

Camshaft:—Three bearings. Gear driven.
Bearing Diameters—1.812" all bearings.
Timing Gears—Crankshaft gear steel. Camshaft gear Bakelized fabric. Gears have been changed from 10 pitch to 8 pitch. Camshaft gear 44 teeth (new), 56 teeth (old). Crankshaft gear 22 teeth (new), 28 teeth (old).
Gear Backlash—.004" maximum.
Camshaft Setting—Gears are marked. Mesh marked tooth on crankshaft gear with space on camshaft gear marked by straight line.

Valves:—

	Head Diameter	Stem Diameter	Length
All valves	1.537"	.3105-.3115"	4.750-4.751"

	Seat Angle	Lift	Stem Clearance
All Valves	45°	.292"	.0015-.0035"

See Ford Special Shop Notes for Valve Servicing data.
Tappet Clearance—.0125-.0135" all valves. No adjustment. Use special two-step feeler as Go-No Go gauge. First step (.0125") should pass between valve stem and lifter with lifter on heel of cam. Second step (.0135") should be 'no go'. Replace valves if clearance is excessive or grind off end of valve stem if clearance is insufficient.
Valve Springs—See note on Valve Assembly below. Spring free length 2.38".

	Spring Pressure	Length
Valve Closed	39-44 lbs.	2.13"
Valve Open	62-65 lbs.	1.84"

NOTE—Split type valve guide bushings retained by a 'C' washer type retainer on lower end are used. To remove valves, use V-78 bar type valve lifter, insert tongue of lifter between valve spring coils and engage flanged lower end of valve guide bushing, pull bushing down and remove valve guide bushing retainer, then pull valve assembly out from above. Use special fixture #V-130 to disassemble valve units. Insert valve assembly in fixture, compress spring with lever engaging valve head, remove valve spring retainers. With this fixture the valve head acts as a stop to prevent excessive compression of the valve spring.
Valve Timing—See Camshaft Setting above.
Intake Valves—Open 9½° BTDC. Close 54½° ALDC.
Exh. Valves—Open 57½° BLDC. Close 6½° ATDC.
Valve Timing Check—No flywheel marks or other means of checking timing provided. If dead center point for piston #1 is established on flywheel. #1 intake opening will be approximately 2.96 teeth before this point.
Motor Gauge—Weidenhoff Adapter #104, Rod #40.

Lubrication:—Pressure. Gear type oil pump located in crankcase. Driven by gears from camshaft.
Normal Oil Pressure—30 lbs. at 55 M.P.H.
Oil Pressure Relief Valve—Operates at 30 lbs. Located under plug directly above camshaft front bearing. Not adjustable.
Oil Pressure Gauge—Electrical type. See complete article in Mechanical Equipment Section on King-Seeley Gauges (used on 1935 model only).
Capacity and Oil—5 qts. Use SAE. #40 (summer 32° to 100°F), #50 (summer above 90°F), #30 (20° to 65°F), #20 or 20-W (winter 50° to 30°F), #10-W (30° to —15°F).

CLUTCH:—Long Models 9AB (1934 all), 9CF (1935), 11CF ('35 Trucks).
See article in Mechanical Equipment Section for data.
1934—Single plate, dry disc type. **1935**—Semi-centrifugal single plate, dry disc type. Release levers have weights at outer ends which increase clutch pressure from 810 lbs (engine stopped) to 1980 lbs. (at 4000 R.P.M.) by centrifugal force. Pedal pressure has been reduced to 25 lbs. at idling speed. No adjustment required for wear. See article on each type in Clutch Section for complete data.
Facings—Molded asbestos, 2 required.

	Inside Diam.	Outside Diam.	Thick.
Pass. Cars	5.76"	9.0"	.140"
Trucks '34	5.5"	9.75"	.138"
Trucks '35	6.5"	11.0"	.140"

Clutch Pedal Adjustment—Free movement of clutch pedal must be 1-1½" (1934), 1½-2" (1935). The greater clearance on 9CF and 11CF models must be maintained to provide clearance for release bearing when release levers move back under centrifugal action. To adjust, remove clevis pin on clutch lever adjusting rod (at upper end of clutch release lever), turn clevis on forward end of adjusting rod.
NOTE—1935 clutch cover plate bolted directly to flat surface of flywheel by six special pilot cap screws. Driven plate has six springs in vibration damper instead of 12 springs on old design.

STEERING:—Front Suspension—Front axle 'I' beam section with Reverse-Elliott ends and transverse-cantilever spring.
Kingpin Inclination—7° crosswise.
Caster—9° Max., 4½° Min. (Pass. Cars), 5° Max., 3° Min. (Trucks). Must be alike within ½°. No adjustment provided.
Camber—1° Max., ¼° Min. No adjustment.
Toe In—3/32" (Pass. Cars), 0" (Trucks). On trucks, toe in increases with load and should be set with truck empty. Adjust all models by loosening tie rod clamp bolts and turning rod.
Steering Geometry (Toe out on turns)—Inner wheel turned 23 1/3° (Pass. Cars), 22 2/3° (131½" W.B. Trucks), 22¼° (157" W.B. Trucks), outer wheel turned 20° (all models). Allowable variation ½°.
Steering Gear:—Gemmer model, Worm-and-Sector. ***See article in Mechanical Equipment Section for data.***

BRAKES:—Service—Own make. Mechanical type. Hand lever applies all four service brakes. See article in Brake Section for relining and complete adjustment procedure.
Drum Diameter—12".
Lining—Semi-moulded type. Width 1.5" ('34), 1.75" ('35). Thickness .172" ('34), .185" ('35). Length per wheel 31" ('34), 26.5" ('35).
Hand Brake Adjustment:—See Service Brakes.

OIL PAN REMOVAL:—*See Ford Shop Notes.*

NOTE:—Engine changes made during year as follows: New type steel-alloy piston (requiring special cylinder head) superseding aluminum alloy pistons. Heavier crankshaft with removable main bearings, new oil pump, new oil pan. Data on all types given below. Engines with each type equipment identified as follows:
Aluminum Alloy Pistons—Block not marked. Head marked '40'.
Steel-alloy Pistons—Black marked 'SP' or 'SPG' on upper front end of left cylinder block near water coupling. Head marked '46' on top.
Heavier Crankshaft—Engine not marked but new pan with greater bearing clearance used.

ENGINE NUMBER:—First number—68-2,207,111 (Sept. 4, 1935). Stamped on top of clutch housing, and on left frame side member in front of dash bracket.

ENGINE SPECIFICATIONS MODEL 68 and 67:—Own Model 68. Eight cylinder, 90° Vee, 'L' head type with both cylinder blocks and crankcase cast enbloc.
Bore—3.062". **Stroke**—3.75".
Piston Displacement—221 cubic inches.
Rated Horsepower—30.
Developed Horsepower—90 at 3800 R.P.M.
Compression Ratio—6.3-1 Std. aluminum head.
Compression Pressure—140 lbs. at 2500 R.P.M. or 105 lbs. at cranking speed of 100 R.P.M.
Vacuum Reading—Gauge should show steady reading of 18-20" with engine idling at 5-7 M.P.H.

ENGINE SPECIFICATIONS MODEL 51 (TRUCK):— Same as above model except as follows:
Developed Horsepower—80 at 3800 R.P.M.
Compression Ratio—5.32-1 Std. cast-iron head.
Compression Pressure—110 lbs. at 2500 R.P.M. or 90 lbs. at cranking speed of 100 R.P.M.

PISTONS—ALUMINUM ALLOY TYPE:—Split skirt, Cam ground type. Length 2.97". Recondition engines to take finished replacement pistons.
Weight—287-291 grams (stripped), 389.5-396.5 grams with rings and pin.
Removal—Pistons and rods removed from above.
Clearance—.002" Min., .003" Max. See Fitting New Pistons.
Replacement Pistons:—*See Ford Special Shop Notes.*
Fitting New Pistons:—Use .002" feeler ½" wide inserted between piston and cylinder wall at right angles to pin on side opposite slot. Pull to withdraw feeler must be within 5-10 lbs.
Installing Pistons:—Slot to left (viewed from driver's seat) for all pistons.

PISTONS—STEEL ALLOY TYPE:—Heat treated, steel-alloy, Cam ground type with domed head and cut-away skirt. Recondition cylinders to take finished replacement pistons.
NOTE—Original equipment steel-alloy pistons furnished as an assembly with fitted pins and connecting rods. For replacement, separate pistons, pins, and connecting rods must be used. Piston assembly with fitted pins and rods discontinued.
Replacement Pistons:—*See Ford Special Shop Notes.*
Fitting New Pistons:—Use .0025" feeler ½" wide inserted between piston and cylinder wall at right angles to pin. Pull required to withdraw feeler must be within 7-12 lbs.
Installing Pistons: See rod data.

PISTON RINGS—ALL PISTONS:—Two compression, one oil control ring per piston, all above pin. Oil ring groove drilled with eight ⅛" oil drain holes (slot on each side also used on aluminum pistons).

Ring	Width	End Gap	Wall Thick.
Comp.	.0915-.092"	.009-.015"	.140"
Oil Cont.	.1545-.155"	.005-.009"	.140"

PISTON PIN—ALUMINUM PISTONS:—Diam.—.7501-.7504". **Length**—2.77". Pin floats in piston and rod and is held by retaining ring in connecting rod. Heat piston to 200° F. (dip in boiling water for one minute) to remove or install pins.
Pin Fit in Piston—.0001" clearance.
Pin Fit in Rod—.0002" clearance. Rod should just rock on piston of own weight but piston should not rock on rod (retainer not installed).
Installing Pins:—Use tapered pilot inserted ahead of pin to expand retainer in rod.

PISTON PIN—STEEL PISTONS:—Original equipment pins retained by plugs expanded in groove in piston bosses. These pins cannot be removed in the field. See NOTE under Steel-alloy pistons above.
See Ford Shop Notes for Pin Servicing Directions.

CONNECTING ROD—ALL PISTONS:—Length 7".
Weight—469-473 grams.
Crankpin Journal Diameter—1.999".
Lower Bearing—Copper-lead, Cadmium-nickel, or Cadmium-silver type. Bearing surface on outer face (in rod), and inner face (on crankpin). Bearing halves float in rods (side-by-side rod mounting).
Bearing Dimensions—2" inside diameter, 2.218" outside diameter, 1.937" length on crankpin.
Clearance—.0015-.0035" (total diametrical), .010-.022" (total endplay).
Bearing Adjustment:—None (no shims). Replace bearings. Do not file caps. Use tool, Part No. V-131, to check bearing fit. Bearings should rotate freely with bearing caps tight.
Replacement Bearings:—*See Ford Shop Notes for Bearings for Oversize Rods and undersize crankpins.*
Installing Rods:—Rods and caps marked 'R1', 'L1' etc. Install rods in same numbered cylinder with mark on rod and cap together and pointing down.

CRANKSHAFT—FIRST TYPE:—Three bearing, integral counterweights. Weight 56.5 lbs.
Journal Diameters—1.999" (all bearings).
Bearing Type—Babbitt bearing surface integral with crankcase and bearing caps.
Clearance—.001-.003".
Bearing Adjustment:—None (no shims). Do not file bearing caps. Engine must be taken down and new bearings poured in crankcase and caps.
End Thrust:—Taken by #3 (rear) main bearing. Endplay .002-.006". Adjusted by replacing bearing.

CRANKSHAFT—SECOND TYPE:—Larger journal diameters and heavier than first type.
Journal Diameters—2.399" (all bearings).
Bearing Type—Removable steel-backed, copper-lead lined. Bearings furnished for service std., .003", .010" undersize.
NOTE—Install bearings with tongue or lug in groove and assemble caps so that groove in block and cap are on same side.
Clearance—.001-.003".
Bearing Adjustment:—None (no shims). Replace bearings. Do not file bearing caps.
Replacement Bearings:—*See Ford Shop Notes for Undersizes and special long rear bearings.*
End Thrust:—Same as for first type above.
NOTE—New design oil pan with greater clearance for main bearing studs used with this crankshaft. Interchangeable with old pan. Old pan can be used with new crankshaft by denting pan with ball-pein hammer to increase clearance.

CAMSHAFT:—Three bearing. Hellical gear drive.
Journal Diameters—1.797" (all bearings).
Bearing Type—Steel-backed, babbitt-lined.
Bearing Clearance—.001-.002".
End Thrust:—Taken by gear hub and front bearing and by hub and cover plate. Endplay .005". Adjusted by replacing bearing or cover plate.
Timing Gears:—Crankshaft gear alloy steel. Camshaft gear Bakelized Fabric. Backlash between gears .004" maximum.
Camshaft Setting:—Mesh crankshaft gear tooth marked 'O' with camshaft gear space marked '/'.

VALVES:—	Head. Diam.	Stem.Diam.	Length
All Valves	1.537"	.3105-.3115"	4.750-4.751"

	Seat Angle	Lift	Stem Clearance
All Valves	45°	.292"	.0015-.0035"

See Ford Special Shop Notes for Valve Servicing data.
NOTE—High tungsten chrome alloy steel exhaust valve seat inserts are used.
Tappet Clearance—.0125-.0135" all valves. No adjustment. Grind off valve stem end if clearance insufficient or replace valves if excessive.
Valve Guides:—Split type. See Valve Assembly Removal.
Valve Lifters:—Alloy-iron type operating in reamed holes in block. Serviced by installing oversize lifters.
Diameter—.999-.9995". **Clearance**—.0005-.001".
Valve Springs:—Free length 2.42". See Valve Assembly removal below.

	Spring Pressure	Spring Length
Valve Closed	37-40 lbs.	2.13"
Valve Open	76-80 lbs.	1.84"

Valve Assembly Removal:—Insert end of V-78 bar type valve lifter between spring coils to engage flanged lower end of guide, pry down on guide until 'C' washer at upper end can be removed, remove assembly from above. Use special fixture V-130 to compress spring and remove spring retainer. Install valves in same manner.

VALVE TIMING:—See Camshaft Setting above.
Intake Valves—Open 9°30' BTDC. Close 54°30' ALDC.
Exh. Valves—Open 57°30' BLDC. Close 6°30' ATDC.
To Check Valve Timing—No flywheel marks or other means provided to check valve timing. If dead center point for any piston is established on flywheel, intake opening for valve in this cylinder will be approximately 2.96 teeth before this point with piston .0327" before top dead center.
Motor Gauge—Weidenhoff #104 Adapter, #40 Rod.

LUBRICATION:—Pressure System. Gear type oil pump located in oil pan at rear of engine.
NOTE—Two types of oil pump have been used. Interchangeable except that oil return pipe from rear main bearing must be removed when new type oil pump installed.
Normal Oil Pressure—30 lbs. at 55 M.P.H.
Oil Pressure Regulator—Located under plug directly above front camshaft bearing. Operates at 30 lbs. Not adjustable.
Oil Pressure Gauge—King-Seeley Electric type. Ford Part No. 48-9273 (dash unit—68 Deluxe and 51 Truck), 48-9278 (engine unit for above).
See article in Mechanical Equipment Section for data.
NOTE—Model 68 Std. and 67 Comm. not regularly equipped. Part No. 68-18426 gasoline gauge and oil pressure gauge assembly may be installed replacing regular gasoline gauge. Same engine unit as above.
Crankcase Capacity—5 qts.

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NOTE:—Engine hood hinged at cowl and lifts from forward end. Free latch by turning radiator ornament counter-clockwise. Side panels can be removed for work on engine by taking out screw in top flange at rear and bolt at front. Washers installed under flange on rear screw to adjust panel height.

OIL PAN REMOVAL:—*See Ford Special Shop Notes.*

ENGINE NUMBER:—Stamped on top of clutch housing and on left frame side member in front of dash bracket.

ENGINE SPECIFICATIONS:—Own Model 60. Eight cylinder, 90° Vee, 'L' head type.
Bore—2.6". **Stroke**—3.2".
Piston Displacement—136 cubic inches.
Rated Horsepower—21.6.
Developed Horsepower—60 at 4200 R.P.M.
Compression Ratio—6.6-1 Std. aluminum head.
NOTE—Aluminum head superseded by cast-iron head with 6.75-1 compression ratio.
Compression Pressure—150 lbs. at 2800 R.P.M. (aluminum head), 158 lbs. at 3200 R.P.M. (cast-iron head) or approximately 105 lbs. at cranking speed of 100 R.P.M.
Vacuum Reading—18-20" steady reading with engine idling at 5-7 M.P.H.

PISTONS:—Cast alloy steel, Cam ground type. Recondition cylinders to take finished replacement pistons.
Weight—228-232 grams (stripped), 302.65 grams (with rings and pin).
Removal—Pistons and rods removed from above.
Clearance—See Fitting New Pistons.

Replacement Pistons:—*See Ford Special Shop Notes.*

Fitting New Pistons:—Use .0015" feeler inserted between piston and wall at right angles to pin bosses. Pull required to withdraw feeler must be within 7-12 lbs.

PISTON RINGS:—Two compression, one oil control ring per piston, all above pin. Oil ring groove drilled with oil drain holes. Replacement rings furnished standard and .005", .010", .020", .025" oversize.

Ring	Width	End Gap	Side Clear.
Comp. (top)	.092-.0925"	.005-.012"	.003"
Comp. (#2)	.092-.0925"	.005-.012"	.0015"
Oil Cont.	.1545-.155"	.005-.012"	.0015"

PISTON PIN:—Diameter—.6876-.6879". **Length**—2.365-2.368". Pin floats in piston and rod. Held by locking ring at each end. Pin hole in rod bronze-bushed.
Pin Fit in Piston—.0004" clearance.
Pin Fit in Rod Bushing—.0001" clearance. Bushing diamond-bored to diameter of .6878-.6881".
See Ford Shop Notes for Pin Fitting directions.

CONNECTING ROD:—Length 6.125". **Weight** 268-272 grams. **Lower Bearing Diameter**—1.800".
Crankpin Journal Diameter—1.600".
Lower Bearing Type—Steel-backed, special alloy lined. Bearing surface on outer face (in rod) and inner face (on crankpin). Bearings extend through both rods (rods mounted side-by-side) and are free to rotate. Bearings furnished standard and .003", .010" undersize.
Bearing Dimensions—Thickness .09995". Length 1.535".
Clearance—.0005-.0025" (total diametrical), .010-.022" (total sideplay).

Bearing Adjustment:—None (no shims). Replace bearings. Do not file caps. Bearings must turn freely with caps tight. Use special tool to check bearings.

Replacement Bearings:—*See Ford Shop Notes for Bearings for Oversize Rods and undersize crankpins.*

Installing Rods:—Rods and caps marked 'R1', 'L1' etc. Install rods in same numbered cylinders with marks on rods and caps together and pointing down.

CRANKSHAFT:—Cast-steel. Three bearing type with integral counterweights. Weight 45 lbs. 6 ozs.
Journal Diameters—1.999" (all bearings).
Bearing Type—Steel-backed, babbitt-lined.
Clearance—.0005-.0025".

Bearing Adjustment:—None (no shims). Replace bearings. Do not file bearing caps. Bearings furnished standard and .005", .010", .015" undersize.

End Thrust:—Taken by #3 (rear) main bearing. Endplay .002-.006". Adjusted by replacing bearing (special .015" undersize bearing which is .015" longer furnished for this purpose).

Replacement Bearings:—*See Ford Shop Notes for Undersize and special long rear bearings.*

CAMSHAFT:—Three bearing. Helical gear driven.
Journal Diameters—1.498" (all bearings).
Bearing Type—Steel-backed, babbitt-lined bushings.
Clearance—.002".

End Thrust:—Taken by gear hub and front bearing and by gear hub and cover plate. Endplay .004-.008". Adjusted by replacing bearing or cover plate.

Timing Gears:—Crankshaft gear cast alloy-steel. Camshaft gear Bakelized fabric.

Camshaft Setting:—Mesh crankshaft gear tooth marked '0' with camshaft gear space marked '/'. Camshaft gear hub similarly marked and both marks must be in line.

VALVES:—

	Head Diameter	Stem Diameter	Length
All valves	1.281"	2785-.2795"	4.375"

	Seat Angle	Lift	Stem Clearance
All valves	45°	.251"	.0015-.0035"

See Ford Special Shop Notes for Valve Servicing data.

Tappet Clearance:—.0125-.0135" all valves. No adjustment. Use special two-step feeler to check clearance. First step (.0125") should be 'Go', second step (.0135") should be 'No Go'. Replace valves if clearance excessive, grind off end of valve stem if clearance insufficient.

Valve Guides:—Split type. See Valve Assembly Removal.

Valve Lifters:—Alloy iron type operating in reamed holes in block.
Diameter—.8290-.8295". **Clearance**—.0005-.001".

Valve Springs:—See Valve Assembly Removal.

	Spring Pressure	Spring Length
Valve Closed	26-30 lbs.	2.05"
Valve Open	48-52 lbs.	1.80"

Valve Assembly Removal:—Insert end of V-78 bar type valve lifter between spring coils and engage flanged lower end of guide, pry down on guide until 'C' washer at upper end can be removed, remove valve assembly from above. Use special fixture to compress spring and remove spring retainer. Install valves in same manner.

Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 9°30' BTDC. Close 54°30' ALDC.
Exh. Valves—Open 57°30' BLDC. Close 6°30' ATDC.
To Check Valve Timing—No flywheel marks provided. If dead center point for any cylinder established on flywheel, intake valve for this cylinder should open approximately 3.22 flywheel teeth befor this point with piston .0270" BTDC.
Motor Gauge—Weidenhoff Adapter #114, Rod #40.

LUBRICATION:—Pressure system. Gear type oil pump mounted on front main bearing cap in crankcase and driven by bakelite gear meshed with crankshaft gear. Oil delivered by pump flows through channel in pump bracket and crankcase web to front crankshaft bearing and front camshaft bearing to oil tube above camshaft for distribution to other bearings.
Normal Oil Pressure—30 lbs. at 3200 R.P.M.
Oil Pressure Regulator—Opens at 30 lbs. Located above front camshaft bearing between cylinder banks. Overflow from valve oils timing gears. Not adjustable.
Crankcase Capacity—4 qts.

CLUTCH (74):—Long Model 8½CB-CS6. Single plate, dry disc type.
See article in Mechanical Equipment Section for data.
Facings—Molded type, 2 required. Inside diameter 6". Outside diameter 8½". Thickness .125".

Adjustment:—Clutch pedal free travel should be ¾-1". To adjust, remove clevis pin at end of clutch pedal adjusting rod, turn clevis on rod.

Removal:—Disconnect rear spring at frame connection in center, rear shock absorber links, rear brake cables, speedometer cable. Support engine, take out rear engine mounting bolts, take out clutch housing mounting screws, slide drive unit (transmission and rear end) to rear to expose clutch. Take out clutch mounting screws in cover flange on flywheel.

CLUTCH (73, 75):—Long Model 9CF-CS. Semi-centrifugal, single plate, dry disc type.
See article in Mechanical Equipment Section for data.
Facings—Molded (asbestos composition) type, 2 required. Inside Diam. 5¾". Outside Diam. 9". Thickness .140".

Adjustment & Removal:—Same as for Model 74 (above) except that pedal travel should be 1.5-1.75".

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TRANSMISSION (MODELS 73, 74):—Own make. 3 speed, Helical constant-mesh, synchro-mesh gears (second and high), sliding spur gear (low and reverse).
See article in Mechanical Equipment Section for data.

NOTE—This transmission optional equipment on Model 77.

Removal:—Disconnect rear shock absorbers and brake cables, disconnect rear spring at frame connection in center, disconnect speedometer drive cable. Take out universal joint ball housing screws, slide rear end back to disengage drive shaft at splined joint of universal yoke. Support engine, take out rear engine mounting bolts, take out clutch housing screws, pull transmission straight back.

TRANSMISSION (MODEL 75):—Own make. 4 speed, sliding spur gears (all speeds).
See article in Mechanical Equipment Section for data.

Removal:—Take out all except top bolt in intermediate universal joint ball housing (frame bolts), remove all screws in front universal joint cover, slide cover back 6" on housing, take out screws in universal joint flange directly back of universal, disengage by pushing flange back on shaft against spring, take out remaining bolt at intermediate universal, pull shaft down at front to clear frame cross-member, pull forward until intermediate universal is free of shaft at spline joint, remove shaft assembly. Support engine, remove rear engine mounting bolts ,take out clutch housing mounting screws, pull transmission straight back and remove.

UNIVERSAL JOINTS:—Spicer. Steel bushing type (73, 74), needle bearing type (75). Single universal joint mounted in housing at rear of transmission case (all models), intermediate universal mounted on frame cross-member between front and rear propeller shafts (trucks only).
See article in Mechanical Equipment Section.

REAR AXLE (MODELS 73, 74):—Own make. 3/4 floating, spiral-bevel gear type with straddle mounted pinion and torque tube drive.
See article in Mechanical Equipment Section for data.

Ratio—4.44-1 Std., 4.55-1 Optl.

Backlash—.010" maximum. Adjusted by changing gasket thickness between axle housing and differential housing.

Removal:—Disconnect rear shock absorber links, rear brake cables, speedometer cable, and rear spring center connection on frame. Take out universal joint ball housing screws, pull axle assembly to rear to disengage drive shaft at splined joint in universal joint rear yoke.

Axle Shaft Removal—Remove wheels and wheel hubs, take out axle housing flange screws in differential housing, remove housing, dismantle differential, pull axle shafts out at inner end (shaft and differential side gear integral).

Wheel Bearing Adjustment:—None. Wheel bearings retained in hub by grease retainer and lock ring.

REAR AXLE (MODEL 75):—Own Make. Full floating, spiral bevel gear type with straddle-mounted pinion and torque tube drive.
See article in Mechanical Equipment Section for data.

Ratio—6.67-1 Std., 5.14-1, 5.83-1 Optl.

Backlash—.004-.016".

Removal:—Same as for passenger car models (above) except that rear springs are semi-elliptic and drive shaft is disconnected at intermediate universal joint.

Axle Shaft Removal—Remove rear wheel hub cap, take off nuts on eight hub studs which hold axle flange in place, install two special screws in tapped holes in flange, turn screws up evenly to break flange away from hub, back screws off, strike axle shaft flange at center to loosen cones on studs, remove cones, pull axle shaft out (does not disturb wheel bearing adjustment).

Wheel Bearing Adjustment:—Remove axle shaft (see above), unscrew outer bearing nut, remove adjusting nut retainer and grease retainer. Use special bearing adjusting wrench, turn inner adjusting nut up tight and then back off ⅛ turn, install retainer, grease retainer, outer bearing nut, turn outer nut up tight.

SHOCK ABSORBERS:—Ford (Houde). Hydraulic type.
See article in Mechanical Equipment Section.

STEERING (ALL MODELS):—Steering Gear—Gemmer Model 305 Worm-and-Roller type with push-pull adjustment.
See article in Mechanical Equipment Section for data.

Front Suspension:—Conventional 'I' beam section front axle with Reverse Elliott type ends and transverse cantilever spring. Axle positioned by radius rods at spring ends.

Kingpin Inclination—8° crosswise (all models).

Caster—4½-9° (73, 74), 3-5° (75). Must be equal for both wheels within ½°. Axle may be bent cold to correct caster provided that proper equipment (including wedges and blocks to prevent crushing axle flange) used.

Camber—¼-1° (all models). Camber must be equal for both wheels within ¼° (camber for right wheel must never be greater than left wheel). Axle may be bent cold providing proper equipment used (see Caster adjustment).

Toe In—1/16" (73, 74), 0" (75). Toe-in should be set at 10-1 ratio to camber. Toe in on trucks increases with load and should be set at 0" with truck empty. Adjusted in usual manner by loosening clamp bolts and turning tie rod on all models.

Steering Geometry (Toe out on turns)—Outer wheel turned 20°, Inner wheel turned 23 1/3° (73, 74), 22 2/3° (75-134" W.B.). Allowable variation ½°. No adjustment.

BRAKES (MODELS 73, 74):—Service—Own make, Mechanical, two shoe, self-energizing type. New design with cable actuation for all wheels. Hand lever applies all four service brakes.
See article in Mechanical Equipment Section for data.

Drum Diameter—12". Cast iron alloy type.

Lining—Two types used. May be identified by brass wire (primary shoe), zinc wire (secondary shoe). Width 1.75". Thickness .185". Length 13.25" per shoe.

Hand Brake:—See Service Brakes above.

BRAKES (MODEL 75):—Service—Own make, Mechanical, two shoe, four wheel type.
See article in Mechanical Equipment Section for data.

Drum Diameter—14". Cast iron type.

Lining—Brass wire type (all shoes). Width 2.5". Thickness .25". Length 17.5" per shoe.

Hand Brake:—Applies independent self-energizing band in each rear wheel.

Lining—Brass wire type. Width 1.5". Thickness .187". Length 41.12" per wheel.

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CLUTCH:—Long Model 9CF-CI (68, 67), 11CF-CI (51). Semi-centrifugal, single plate, dry disc type.
See article in Mechanical Equipment Section for data.

Facings—Moulded type, 2 required. Inside Diam. 5.76". Outside Diam. 9" (68, 67), 11" (51), Thickness .140".

Clutch Pedal Adjustment—Free movement of pedal must be 1½-2". To adjust, remove clevis pin in end of clutch lever adjusting rod, turn clevis.

Removal:—Disconnect rear spring at frame connection in center, take out clutch housing screws, slide rear end and transmission to rear as a unit exposing clutch, take out capscrews mounting clutch on flywheel.

STEERING:—Steering Gear—Gemmer Worm-and-Sector type. See article in Steering Section.

Front Suspension:—Conventional 'I' beam section front axle with Reverse-Elliott ends and transverse cantilever spring.

Kingpin Inclination—8° crosswise.

Caster (68 and 67)—7° loaded (9° max., 4½° min.). Must be alike within ½° for both wheels. No adjustment. **(51 Truck)**—3-3½° empty (5° max., 3° min.). Increase ¾° for each ton of load.

Camber—¾° (1° Max., ¼° Min.) all models. Must be alike within ¼° for both wheels and camber of right wheel must not exceed left wheel. No adjustment.

Toe In (68, 67 Comm.)—1/16" (1/16" min., ⅛" max.). **(51 Truck)**—0° empty. Increases with load and must be set with truck empty. All models adjusted by loosening tie rod end clamp bolts and turning tie rod.

Steering Geometry—Inner wheel turned 23 1/3° (68, 67), 22 2/3° (51—131½" W.B.), 22¼° (51—157" W.B.), outer wheel turned 20° (all models).

BRAKES:—Service—Own make. Mechanical type. Hand lever applies all four service brakes (68, 67), or operates independent rear wheel brake (51).
See article in Mechanical Equipment Section for data.

Drum Diameter—12" (68, 67), 14" (51).

Lining (68, 67)—Semi-moulded type. Width 1.75", Thickness .185", Length 26.5" per wheel.

Lining (51)—Width 2.5". Thickness .25", Length 17.5" per shoe (all shoes interchangeable).

Hand Brake:—See Service Brake adjustment.

Lining (51)—Width 1.5", Thickness .187", Length 41.1" per band.

NOTE:—Engine hood hinged at cowl and lifts from forward end. Free latch by turning radiator ornament counter-clockwise. Side panels can be removed for work on engine by taking out screw in top flange at rear and bolt at front. Washers installed under flange on rear screw to adjust panel height.

Oil Pan Removal—To remove oil pan, remove oil level indicator and tube, remove right front engine splash shield, attach hoist to front bumper bars and raise front of car, push radius rods down and insert 12" block between bolt and cross member. Take out screws and maneuver pan off.

ENGINE NUMBER:—Stamped on top of clutch housing and on left frame side member in front of dash bracket.

ENGINE SPECIFICATIONS:—Own Model 85. Eight cylinder, 90° Vee, 'L' head type.
Bore—3.062". **Stroke**—3.75".
Piston Displacement—221 cubic inches.
Rated Horsepower—30.
Developed Horsepower—85 at 3800 R.P.M.
Compression Ratio—6.12-1.
NOTE—Aluminum head superseded by cast-iron head with same compression ratio.
Compression Pressure—135 lbs. at 2500 R.P.M. (Aluminum head), 147 lbs. at 2200 R.P.M. (cast-iron head) or approximately 105 lbs. at cranking speed of 100 R.P.M.
Vacuum Reading—18-20" steady reading with engine idling at 5-7 M.P.H.

PISTONS:—Cast alloy steel, Cam ground type. Recondition cylinders to take finished replacement pistons.
Weight—301-305 grams (stripped), 408-416.8 grams with rings and pin.
Removal—Pistons and rods removed from above.
Clearance—See Fitting New Pistons.
Replacement Pistons:—*See Ford Special Shop Notes.*
Fitting New Pistons:—Use .0025" feeler inserted between piston and cylinder wall at right angles to pin. Pull required to withdraw feeler must be 7-12 lbs. NOTE—If aluminum pistons (split skirt type) used, fit pistons with .002" feeler to 6-10 lbs. pull.

PISTON RINGS:—Two compression, one oil control ring per piston, all above pin. Oil ring groove drilled with oil drain holes. Rings furnished standard and .005", .015", .030", .045", .060" oversize.

Ring	Width	End Gap	Side Clear.
Comp. (Top)	.0915-.092"	.012-.017"	.003"
Comp. (#2)	.0915-.092"	.012-.017"	.0015"
Oil Cont.	.1545-.155"	.012-.017"	.0015"

PISTON PIN:—Diameter—.7501-.7504". **Length**—2.847-2.850". Pin floats in rod and piston. Held by locking ring at each end. Pin hole in rod is bronze-bushed.
Pin Fit in Piston—.0005" clearance.
Pin Fit in Rod Bushing—.0001" clearance. Bushing diamond-bored to diameter of .7503-.7506".
See Ford Shop Notes for Pin Fitting directions.

CONNECTING ROD:—Length 7". **Weight** 451-455 grams.
Rod Lower Bearing Diameter—2.2195-2.220".
Crankpin Journal Diameters—1.999".
Bearing Type—Steel-backed, special alloy type. Bearing surface on outer face (in rod) and inner face (on crankpin). Bearings extend through both rods (rods mounted side-by-side) and are free to rotate. Bearings furnished standard and .003", .010" undersize.
Bearing Dimensions—Thickness .1095". Length 1.933".
Clearance—.0005-.0025" (total diametrical), .010-.022" (total sideplay).

Bearing Adjustment:—None (no shims). Replace bearings. Do not file caps. Bearings must turn freely with caps tight. Use V-131 tool to check bearings.

Replacement Bearings:—*See Ford Shop Notes for Bearings for Oversize Rods and undersize crankpins.*

Installing Rods:—Rods and caps marked 'R1', 'L1' etc. Install rods in same numbered cylinders with marks on rods and caps together and pointing down.

CRANKSHAFT:—Cast-steel, three bearing type with integral counterweights. Weight 63.5 lbs.
Journal Diameters—2.399" (all bearings).
Bearing Type—Removable steel-backed, babbitt-lined. Furnished standard and .005", .010", .015" undersize.
Clearance—.0005-.0025".

Bearing Adjustment:—None (no shims). Replace bearings. Do not file bearing caps.

End Thrust:—Taken by #3 (rear) main bearing. Endplay .002-.006". Adjusted by replacing bearing (special .015" undersize bearing furnished .015" longer for this purpose).

Replacement Bearings:—*See Ford Shop Notes for Undersize and special long rear bearings.*

CAMSHAFT:—Three bearing. Helical gear drive.
Journal Diameters—1.797" (all bearings).
Bearing Type—Steel-backed, babbitt-lined bushings.
Clearance—.002".

End Thrust:—Taken by gear hub and front bearing and by hub and cover plate. Endplay .005". Adjusted by replacing bearing or cover plate.

Timing Gears:—Crankshaft gear cast alloy-steel. Camshaft gear Bakelized fabric.
Backlash—.004" maximum.

Camshaft Setting:—Mesh crankshaft gear tooth marked '0' with camshaft gear space marked '/'. Camshaft gear hub similarly marked and both marks should be in line.

VALVES:—

	Head Diam.	Stem Diam.	Length
All valves	1.537"	.3105-.3115"	4.750-4.751"

	Seat Angle	Lift	Stem Clearance
All valves	45°	.292"	.0015-.0035"

See Ford Special Shop Notes for Valve Servicing data.

Tappet Clearance:—.0125-.0135" all valves. No adjustment. Use special two-step feeler to check clearance. First step (.0125") should be 'Go', second step (.0135") should be 'No Go'. Replace valves if clearance excessive, grind off end of valve stem if clearance insufficient.

Valve Guides:—Split type. See Valve Assembly Removal.

Valve Lifters:—Alloy iron type operating in reamed holes in block.
Diameter—.999-.9995". **Clearance**—.0005-.001".

Valve Springs:—See Valve Assembly Removal.

	Spring Pressure	Spring Length
Valve Closed	37-40 lbs.	2.13"
Valve Open	76-80 lbs.	1.84"

Valve Assembly Removal:—Insert end of V-78 bar type valve lifter between spring coils and engage flanged lower end of guide, pry down on guide until 'C' washer at upper end can be removed, remove valve assembly from above. Use special fixture V-130 to compress spring and remove spring retainer. Install valves in same manner.

VALVE TIMING:—See Camshaft Setting above.
Intake Valves—Open 9°30' BTDC. Close 54°30' ALDC
Exh. Valves—Open 57°30' BLDC. Close 6°30' ATDC.
To Check Valve Timing—No flywheel marks or other means provided to check timing. If dead center for any piston is established on flywheel, intake valve opening for this cylinder will be approximately 2.96 teeth before this point with piston .0327" before top dead center.
Motor Gauge—Weidenhoff Adapter #104, Rod #40.

LUBRICATION:—Pressure. Gear type oil pump located in crankcase at rear of engine.
Normal Oil Pressure—30 lbs. at 2600 R.P.M.
Oil Pressure Regulator—Located under plug directly above front camshaft bearing. Operates at 30 lbs. Not adjustable.
Oil Pressure Gauge—King-Seeley Electric type. Ford Part No. 78-9273 (dash unit), 48-9278 (engine unit).
NOTE—Use dash unit Ford Part No. 81A-9273A for replacement.
See article in Mechanical Equipment Section for data.
Crankcase Capacity—5 quarts.

CLUTCH:—Long Model 9CF-CS (77, 78). 11CF-CS (79). Semi-centrifugal, single plate ,dry disc type.
See article in Mechanical Equipment Section for data.
Clutch Pedal Adjustment—Free movement of pedal must be 1½-1¾". To adjust, remove clevis pin in end of clutch pedal adjusting rod, turn clevis.
Clutch Facings—Molded asbestos composition, 2 required.

	Inside Diam.	Outside Diam.	Thickness
9CF-CS	5¾"	9"	.140"
11CF-CS	6½"	11"	.140"

Removal:—Disconnect rear spring at frame connection in center, rear shock absorber links, rear brake cables, speedometer cable. Support engine, take out rear engine mounting bolts, take out clutch housing mounting screws, slide drive unit (transmission and rear end) to rear to expose clutch. Take out mounting screws in clutch cover flange on flywheel, remove clutch.

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TRANSMISSION (MODELS 77,78):—Own make. 3 speed, Helical gears (all speeds). Constant-mesh, synchromesh (second and high), sliding gear (low and reverse).

See article in Mechanical Equipment Section for data.

NOTE—Model 51 4-Speed Transmission Optional on Model 77 Commercial cars.

Removal:—Disconnect rear shock absorbers and brake cables, disconnect rear spring at frame connection in center, disconnect speedometer drive cables. Take out universal joint ball housing screws, slide rear end back to disengage drive shaft at splined joint of universal yoke. Support engine, take out rear engine mounting bolts, take out clutch housing screws, pull transmission straight back.

TRANSMISSION (MODEL 79):—Own Make. 4 speed, sliding spur gears (all speeds).
NOTE—Three speed transmission (Helical gears with Spur type low-speed gear) Optl.

See article in Mechanical Equipment Section for data.

Removal:—Take out all except top bolt in intermediate universal joint ball housing (frame bolts), remove all screws in front universal joint cover, slide cover back 6" on housing, take out screws in universal joint flange directly back of universal, disengage by pushing flange back on shaft against spring, take out remaining bolt at intermediate universal, pull shaft down at front to clear frame cross-member, pull forward until intermediate universal is free of shaft at spline joint, remove shaft assembly. Support engine, remove rear engine mounting bolts, take out clutch housing mounting screws, pull transmission straight back and remove.

UNIVERSAL JOINTS:—Spicer. Steel bushing type, (77, 78), needle bearing type (79). Single universal joint mounted in housing at rear of transmission case (all models), intermediate universal mounted on frame cross-member between front and rear propeller shafts (79 trucks only).

See article in Mechanical Equipment Section for data.

REAR AXLE (MODELS 77, 78):—Own Make. 3/4 floating, spiral-bevel gear type with straddle-mounted pinion and torque tube drive.

See article in Mechanical Equipment Section for data.

Ratio	Standard	Optional
Models 77, 78	3.78-1	4.11-1, 3.54-1

Backlash—.010" maximum. Adjusted by changing gasket thickness between axle housing and differential housing.

Removal:—Disconnect rear shock absorber links, rear brake cables, speedometer cable, and rear spring center connection on frame. Take out universal joint ball housing screws, pull axle assembly to rear to disengage drive shaft at splined joint in universal joint rear yoke.

Axle Shaft Removal—Remove wheels and wheel hubs, take out axle housing flange screws in differential housing, remove housing, dismantle differential, pull axle shafts out at inner end (shaft and differential side gear integral).

Wheel Bearing Adjustment:—None. Wheel bearings retained in hub by grease retainer and lock ring.

REAR AXLE (MODEL 79):—Own Make. Full floating, spiral bevel gear type with straddle-mounted pinion and torque tube drive.

See article in Mechanical Equipment Section for data.

Ratio—6.67-1 Std., 5.14-1, 5.83-1 Optl.

Backlash—.010".

Removal:—Same as for passenger car models (above) except that rear springs are semi-elliptic and drive shaft is disconnected at intermediate universal joint.

Axle Shaft Removal—Remove rear wheel hub cap, take off nuts on eight hub studs which hold axle flange in place, install two special screws in tapped holes in flange, turn screws up evenly to break flange away from hub, back screws off, strike axle shaft flange at center to loosen cones on studs, remove cones, pull axle shaft out (does not disturb wheel bearing adjustment).

Wheel Bearing Adjustment:—Remove axle shaft (see above), unscrew outer bearing nut, remove adjusting nut retainer and grease retainer. Use special bearing adjusting wrench, turn inner adjusting nut up tight and then back off ⅛ turn, install retainer, grease retainer, outer bearing nut, turn outer nut up tight.

SHOCK ABSORBERS:—Ford (Houde). Hydraulic type.

See article in Mechanical Equipment Section for data.

STEERING (ALL MODELS):—Steering Gear—Gemmer Model 305 Worm-and-Roller type with push-pull type adjustment.

See article in Mechanical Equipment Section for data.

Front Suspension:—Conventional 'I' beam section front axle with Reverse Elliott type ends and transverse cantilever spring. Axle positioned by radius rods at spring ends.

Kingpin Inclination—8° crosswise (all models).

Caster—4½-9° (77, 78), 3-5° (79). Must be equal for both wheels within ½ degree. Axle may be bent cold to correct caster provided that proper equipment (including wedges and blocks to prevent crushing axle flange) used.

Camber—¼-1° (All Models). Camber should be equal for both front wheels within ¼° (camber for right wheel must never be greater than left wheel). Axle may be bent cold providing proper equipment used (see Caster adjustment).

Toe In—1/16" (77, 78), 0" (79). Toe-in should be set at 10-1 ratio to camber. Toe-in on trucks increases with load and should be set at 0" with truck empty. Adjusted in usual manner by loosening clamp bolts and turning tie rod on all models.

Steering Geometry (toe out on turns)—Outer wheel turned 20°, Inner wheel turned 23 1/3° (77, 78), 22 2/3° (79—131½" W. B.), 22¼° (79—157" W.B.). Allowable variation ½°. No adjustment.

BRAKES (MODELS 77, 78):—Service—Own make Mechanical, two shoe, self-energizing type. New design with cable actuation for all wheels. Hand lever applies all four service brakes.

See article in Mechanical Equipment Section for data.

Drum Diameter—12". Cast iron alloy type.
Lining—Two types used. May be identified by brass wire (primary shoe), zinc wire (secondary shoe). Width 1.75". Thickness .185". Length 13.25" per shoe.

Hand Brake:—See Service Brakes above.

BRAKES (MODEL 79):—Service—Own make, Mechanical, two shoe, four wheel type.

See article in Mechanical Equipment Section for data.

Drum Diameter—14". Cast iron type.
Lining—Brass wire type (all shoes). Width 2.5". Thickness .25". Length 17.5" per shoe.

Hand Brake:—Applies independent self-energizing band in each rear wheel.
Lining—Brass wire type. Width 1.5". Thickness .187". Length 41.12" per wheel.

NOTE:—All engine data given below applies also to the 1938 truck, Model 82Y, with '60' Engine.

HOOD & SIDE PANEL REMOVAL:—*See Ford Shop Notes.*
OIL PAN REMOVAL:—*See Ford Shop Notes.*

SERIAL & ENGINE NUMBER:—Stamped on top of clutch housing and on left frame side member in front of dash bracket.

ENGINE SPECIFICATIONS:—Own Model. 8 Cylinder 90° V, L head. Both banks & crankcase cast enbloc.
Bore—2.6". **Stroke**—3.2". **Displm't**—136 cu. ins.
Rated Horsepower—21.6.
Developed Horsepower—60 at 3500 R.P.M.
Compression Ratio—6.6-1 Std. No Optl. ratios.
Compression Pressure—158 lbs. at 2800 R.P.M. or 105 lbs. at cranking speed of 100 R.P.M.
Vacuum Reading—18-20" steady at 5-7 M.P.H.

PISTONS:—Light weight steel alloy, Cam ground type. Recondition cylinders to take finished replacement pistons.
Weight—228-232 grams stripped, 302.65 grams with rings and pin.
Removal—Pistons and rods removed from above.
Clearance—See Fitting New Pistons.
Replacement Pistons:—*See Ford Shop Notes.*
Fitting Pistons:—Use .0015" feeler ½" wide inserted between piston and cylinder wall at right angles to pin. Pull required to withdraw feeler should be 7-12 lbs.

PISTON RINGS:—Two compression, one oil ring, all above pin. Oil ring groove drilled with drain holes.

Ring	Width	End Gap	Side Clearance
Compr. #1	.092-.0925"	.009-.012"	.003"
Compr. #2	.092-.0925"	.009-.012"	.0015"
Oil Contr.	1545-155"	.005-.012"	.0015"

Replacement Rings:—Furnished Std. and .005", .015", .030", .045", .060" oversize (sets in cartons only).

PISTON PIN:—Diam. .6876-6879". Length 2.365-2.368". Pin floats in piston and rod (held by locking ring at each end). Pin hole in rod bronze-bushed.
Pin Fit in Piston—.0004" clearance.
Pin Fit in Rod Bushing—.0001" clearance. *See Ford Shop Notes for Pin Fitting Directions.*

CONNECTING ROD:—Length 6.125". Weight 268-272 grams.
Rod Lower Bearing Diameter—1.800".
Crankpin Journal Diameter—1.600".
Bearing Type—Steel-backed, special alloy lined. Bearing floats in both rods (side-by-side mounting) with bearing surface on inner face (on crankpin), outer face (in rod).
Bearing Dimensions—Thickness .09995". Length 1.535".
Clearance—.0005-.0025" (total diametrical).
Bearing Adjustment:—None (no shims). Do not file.
Replacement Bearings:—*See Ford Shop Notes for Bearings for Oversize Rods and undersize crankpins.*
Installing Rods:—Rods and caps marked. Marks must be together and rods installed in same numbered cylinders with marks pointing down toward pan.

CRANKSHAFT:—3 Bearing. Integral counterweights.
Journal Diameters—1.999" (all bearings).
Bearing Type—Steel-backed, Special-alloy lined.
Clearance—.0005-.0025".
Bearing Adjustment:—None (no shims). Do not file.
End Thrust:—Taken by rear bearing. Adjusted by replacing bearing. **Endplay**—.002-.005".
Replacement Bearings:—*See Ford Shop Notes for Undersizes and special long rear bearings.*

CAMSHAFT:—Three bearing. Helical gear drive.
Journal Diameters—1.498" (all bearings).
Bearings—Steel-backed, babbitt-lined bushings.
Clearance—.002".
End Thrust:—Taken by gear hub and cover plate. Adjusted by replacing coverplate. Endplay .004-.008".
Timing Gears:—Crankshaft—cast alloy-steel, camshaft—bakelized fabric. Backlash .004" Max.
Camshaft Setting:—Mesh '0' marked tooth of crankshaft gear with '/' marked space on camshaft gear (this mark must line up with mark on gear hub).

VALVES:—	Head Diameter	Stem Diameter	Length
All Valves	1.281"	.2785-.2795"	4.375"

	Seat Angle	Lift	Stem Clearance
All Valves	45°	.251"	.0015-.0035"

See Ford Shop Notes for Valve Servicing data.
NOTE—Tungsten, chrome alloy seat inserts used for exhaust valves.
Tappet Clearance:—.0125-.0135". No adjustment.
Valve Guides:—Split type retained by 'C' washer and valve spring. *See Ford Shop Notes for Removal.*
Valve Lifters:—Alloy iron barrel type in reamed holes. **Diameter**—.8290-.8295". **Clearance**—.0005-.001".

Valve Springs:—	Pressure	Length
Valve Closed	26-30 lbs.	2.05"
Valve Open	48-52 lbs.	1.80"

Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 9°30' BTDC. Close 54°30' ALDC.
Exh. Valves—Open 57°30' BLDC. Close 6°30' ATDC.
To Check Valve Timing—No flywheel marks provided. If dead center point for any cylinder established on flywheel, intake valve for this cylinder should open approximately 3.22 flywheel teeth before this point with piston .027" BTDC.
Motor Gauge—Weidenhoff Adapter #114. Rod #40.

LUBRICATION:—Pressure. Gear type oil pump mounted on front main bearing cap in crankcase.
Normal Oil Pressure—30 lbs. at 3200 R.P.M.
Oil Pressure Regulator—Under plug above front camshaft bearing. Opens at 30 lbs. Not adjustable.
Oil Pressure Gauge—King-Seeley Electric. Ford No. 81-A-9273-A (dash unit—Std.), 81-A-9273-B (dash unit—Deluxe), 48-9278 (motor unit—all).
See article in Mechanical Equipment Section.
Crankcase Capacity—4 quarts.

COOLING SYSTEM:—Water Pump—Centrifugal, packless type, 2 used (1 pump for each cyinder bank).
See article in Mechanical Equipment Section.
Removal—Slack off belt adjustment, unscrew large mounting nut behind pulley, pull pump out.
Thermostat:—In outlet hose for each bank (2 used).
Water Capacity—15 qts. (82A), 16 qts. (82C, 82Y).
Drain Valves:—On each side at bottom of radiator.

CLUTCH:—Long Model 8½CB-CS6 (Std. 82A), 9CF-CS (Std. 82C, Optl. on 82A Sedan Delivery). Single plate, dry disc type. Mod. 9CF-CS semi-centrif. type.
See article in Mechanical Equipment Section for data.
Facings—Molded Asbestos Composition, 2 required. Inside Diameter 6" (8½CB), 5¾" (9CF), Outside Diameter 8.5" (8½CB), 9" (9CF), Thickness .125" (8½CB), .137" (9CF).
Adjustment—Pedal free movement should be .75-1" (8½CB), 1.5-1.75" (9CF). To adjust, remove clevis pin at end of connecting rod, turn clevis on rod.
Removal:—Slide transmission and rear axle to rear as a unit to expose clutch (see Transmission removal), take out mounting screws in clutch cover flange on flywheel.

TRANSMISSION (STD.):—Own Make. Constant-mesh, Synchro-mesh (second and high), sliding gear (low and reverse), all helical gears (82A), second and high only (82C). NOTE—4-speed transmission with all spur gears Optl. on Model 82-C.
See article in Mechanical Equipment Section for data.
Removal:—Disconnect rear shock absorbers, brake cables, speedometer drive cable. Disconnect rear spring at center frame connection. Take out universal joint ball housing screws, slide rear axle assembly back to disengage drive shaft at splined joint. Support engine at rear, take out rear engine mounting bolts, remove clutch housing screws, pull transmission straight back.

UNIVERSAL JOINT:—Spicer. Steel bushing type. Single universal at rear of transmission.
See article in Mechanical Equipment Section.

REAR AXLE (82A, 82C):—Own Make. ¾ floating, Spiral Bevel Gear type with Torque Tube drive.
See article in Mechanical Equipment Section for data.
Ratio—4.44-1 Std., 4.11-1, 4.55-1 Optl.
Backlash—.010" Maximum.
Removal:—Disconnect rear shock absorber links, brake cables, speedometer cable, rear spring at center frame connection. Take out universal joint ball housing mounting screws, pull axle assembly to rear to disengage driveshaft at splined joint.
Axle Shaft Removal—Axle must be dismantled and shafts removed from inner end (see Disassembly directions in Rear Axle Section).

SHOCK ABSORBERS:—Houde (Houdaille) Type BBDE (Front), BBDU (Rear). Double acting, hydraulic, adjustable. *See data in Mechanical Equipment Section.*

STEERING:—Steering Gear. Gemmer Model 305 Worm-and-Roller type with 'Push-Pull' adjustment.
See article in Mechanical Equipment Section for data.
Front Suspension:—Conventional 'I' beam section front axle with Reverse Elliott ends and transverse spring. Axle positioned by radius rods.
Kingpin Inclination—8° crosswise (all models).
Caster—9° Max., 4½° Min. (all). Must be equal within ½°. Axle may be bent cold to correct caster if proper tools (wedges and blocks to prevent crushing of axle flange) used.
Camber—1° Max., ¼° Min. (all). Must be equal within ¼°, right wheel must not exceed left. Axle may be bent cold to correct camber.
Toe In—1/16". Adjust in usual manner by loosening tie rod clamp bolts and turning tie rod.
Steering Geometry (Toe out on turns)—Outer wheel turned 20°, Inner wheel turned 23 1/3°. Allowable variation ½°. No adjustment.

BRAKES:—**Service.** Own Make. Mechanical, two shoe, self-energizing type with cable actuation. Hand lever applies all service brakes.
See article in Mechanical Equipment Section for data.
Drums—Cast iron. Diameter 12".
Lining—Molded (primary), Woven (secondary). Width 1.75", Thickness .185", Length per shoe 13.25".
Hand Brake:—See Service Brakes above.

NOTE:—All engine data given below applies also to 1938 truck models with '85' engines.

HOOD & SIDE PANEL REMOVAL:—*See Ford Shop Notes.*

OIL PAN REMOVAL:—*See Ford Shop Notes.*

SERIAL & ENGINE NUMBER:—Stamped on top of clutch housing and on left frame side member in front of dash bracket.

ENGINE SPECIFICATIONS:—Own Model. 8 Cylinder, 90° V, L head. Both banks & crankcase cast enbloc.

Bore 3.062". Stroke 3.75". **Displm't.** 221 cu. ins.

Rated Horsepower—30.

Developed Horsepower—85 at 3800 R.P.M.

Compression Ratio—6.12-1 Std. Optl. H.C. head 81-A-6050-B available for Alt. or special fuel.

Compression Pressure—141 lbs. at 2400 R.P.M., 100 lbs. at cranking speed of 100 R.P.M.

Vacuum Reading—18-20" steady at 5-7 M.P.H.

PISTONS:—Steel alloy (Pass. Cars), Aluminum alloy (Trucks), Domed, cam ground type. Recondition cylinders for finished replacement pistons.

Weight—301-305 grams (stripped), 408.8-416.8 grams (with rings and pin).

Removal—Pistons and rods removed from above.

Clearance—See Fitting New Pistons.

Replacement Pistons:—*See Ford Shop Notes.*

Fitting New Pistons:—Use .0025" feeler (Steel Pistons), .002" feeler (Al. Pistons) ½" wide inserted between piston and cylinder wall at right angles to pin. Pull required to withdraw feeler should be 7-12 lbs. (steel pistons), 6-10 lbs. (Al. pistons).

PISTON RINGS:—Two compression, one oil ring, all above pin. Oil ring groove drilled with drain holes.

Ring	Width	End Gap	Side Clearance
Compr. #1	.0915-.092"	.012-.017"	.003"
Compr. #2	.0915-.092"	.012-.017"	.0015"
Oil Contr.	.1545-.155"	.012-.017"	.0015"

Replacement Rings:—Furnished Std. and .005", .015", .030", .045", .060" oversize (sets in cartons only).

PISTON PIN:—Diam. .7501-.7504". **Length** 2.847-2.850". Pin floats in piston and rod (held by locking ring at each end). Pin hole in rod bronze-bushed.

Pin Fit in Piston—.0005" clearance.

Pin Fit in Rod Bushing—.0001" clearance.

See Ford Shop Notes for Pin fitting directions.

CONNECTING ROD:—Length 7". **Weight** 451-455 grams.

Rod Lower Bearing Diameter—2.220".

Crankpin Journal Diameter—1.999".

Bearing Type—Steel-backed, special alloy lined. Bearing floats in both rods (side-by-side mounting) with bearing surface on inner face (on crankpin), outer face (in rod).

Bearing Dimensions—Thickness .1095". Length 1.933".

Clearance—.0005-.0025" (total diametrical).

Bearing Adjustment:—None (no shims). Do not file.

Replacement Bearings:—*See Ford Shop Notes for Bearings for Oversize Rods and undersize crankpins.*

Installing Rods:—Rods and caps marked. Marks must be together and rods installed in same numbered cylinders with marks pointing down toward pan.

CRANKSHAFT:—3 Bearing. Integral counterweights.

Journal Diameters—2.399" (all bearings).

Bearing Type—Steel-backed, Special-alloy lined.

Clearance—.0005-.0025".

Bearing Adjustment:—None (no shims). Do not file.

End Thrust:—Taken by rear bearing. Adjusted by replacing bearing. **Endplay** .002-.006".

Replacement Bearings—*See Ford Shop Notes for Undersizes and special long rear bearings.*

CAMSHAFT:—Three bearing. Helical gear drive.

Journal Diameters—1.797" (all bearings).

Bearings—Steel-backed, babbitt-lined bushings.

Clearance—.002".

End Thrust:—Taken by gear hub and cover plate. Adjust by replacing coverplate. Endplay .005".

Timing Gears:—Crankshaft—cast alloy-steel, camshaft—bakelized fabric. Backlash .004" Max.

Camshaft Setting:—Mesh 'O' marked tooth of crankshaft gear with '/' marked space on camshaft gear (this mark must line up with mark on gear hub).

VALVES:—

	Head Diameter	Stem Diameter	Length
All Valves	1.537"	.3105-.3115"	4.750-4.751"

	Seat Angle	Lift	Stem Clearance
All Valves	45°	.292"	.0015-.0035"

See Ford Shop Notes for Valve Servicing data.

Tappet Clearance:—.0125-.0135". No adjustment.

Valve Guides:—Split type retained by 'C' washer and valve spring. *See Ford Shop Notes for Removal.*

Valve Lifters:—Alloy-iron barrel type in reamed holes. **Diameter** .999-.9995". **Clearance** .0005-.001"

Valve Springs:—	Pressure	Length
Valve Closed	37-40 lbs.	2.13"
Valve Open	76-80 lbs.	1.84"

Valve Timing:—See Camshaft Setting above.

Intake Valves—Open at TDC. Close 44° ALDC.

Exhaust Valves—Open 48° BLDC. Close 6° ATDC.

To Check Timing—No flywheel marks provided. Intake valve opens with piston on top dead center.

LUBRICATION:—Pressure. Gear type oil pump in crankcase at rear of engine.

Normal Oil Pressure—30 lbs. at 2000 R.P.M.

Oil Pressure Regulator—Under plug above front camshaft bearing. Opens at 30 lbs. Not adjustable.

Oil Pressure Gauge—King-Seeley Electric. Ford No. 81-A-9273-A (dash unit—Std), 81-A-9273-B (dash unit—deluxe), 48-9278 (motor unit—all).

See article in Mechanical Equipment Section.

Crankcase Capacity—5 quarts.

COOLING SYSTEM:—Water Pump—Centrifugal, packless type, 2 used (1 pump for each cylinder bank).

See article in Mechanical Equipment Section.

Removal—Slack off belt adjustment, support engine at forward end, remove front engine mounting bolts, take out mounting screws in pump body.

Thermostat:—In outlet hose for each bank (2 used).

Water Capacity:—22 qt.(81A,C,Y), 24 qt.(81T,U,817T).

Drain Valves:—One each side at bottom of radiator.

CLUTCH:—Long Model 9CF-CS. Semi-centrifugal, single plate, dry disc type.

See article in Mechanical Equipment Section for data.

Facings—Molded Asbestos Comp., 2 required. Inside Diam. 5.76". Outside Diam. 9". Thickness .137".

Adjustment—Pedal free movement should be 1.5-1.75". To adjust, remove clevis pin, turn release rod.

Removal:—Slide transmission and rear axle to rear as a unit to expose clutch (see Transmission removal below), take out mounting screws in clutch cover flange on flywheel.

TRANSMISSION:—Own Model 68. Three speed, constant-mesh, synchro-mesh (second & high), sliding gear (low and reverse), all helical gear type Std. NOTE—Model 67 3-speed, spur gear type Optl. on 81A, 81C. Model 51 4-speed, all spur gear type Optl. on Model 81C.

See article in Mechanical Equipment Section for data.

Removal:—Disconnect rear shocks, brake cables speedometer drive cable. Disconnect rear spring at center frame connection. Take out universal joint ball housing screws, slide rear axle assembly back to disengage drive shaft at splined joint. Support engine at rear, take out rear engine mounting bolts, remove clutch housing screws, pull unit back.

UNIVERSAL JOINTS:—**Spicer.** Steel bushing type. Single universal at rear of transmission.

See article in Mechanical Equipment Section.

REAR AXLE (81A, 81C):—Own Make. 3/4 floating, Spiral bevel gear type with straddle mounted pinion and Torque Tube drive. **Backlash**—.010" Max.

See article in Mechanical Equipment Section for data.

Ratio—3.78-1 Std., 3.54-1, 4.11-1 Optl.

Removal:—Disconnect rear shock absorber links, brake cables, speedometer cable, rear spring at center frame connection. Take out universal joint ball housing mounting screws, pull axle assembly to rear to disengage driveshaft at splined joint.

Axle Shaft Removal—Must be dismantled to remove shafts. *See article in Mechanical Equipment Section for directions.*

SHOCK ABSORBERS:—Houde (Houdaille) Type BBDE (Front), BBDU (Rear). Double acting, hydraulic, adjustable. *See data in Mechanical Equipment Section.*

STEERING:—Steering Gear—Gemmer Model 305 Worm-and-Roller type with 'Push-Pull' adjustment.

See article in Mechanical Equipment Section for data.

Front Suspension:—Conventional 'I' beam section front axle with Reverse Elliott ends and transverse spring. Axle positioned by radius rods.

Kingpin Inclination—8° crosswise (all models).

Caster—9° Max., 4½° Min. Must be equal for both wheels within ½°. Axle may be bent cold to correct caster if proper tools (wedges and blocks to prevent crushing axle flange) are used.

Camber—1° Max., ¼° Min. (all). Must be equal within ¼°, right wheel must not exceed left.

Toe In—1/16". Adjust in usual manner by loosening tie rod clamp bolts and turning tie rod.

Steering Geometry (toe out on turns)—Outer wheel turned 20°, Inner wheel 23 1/3°. Allowable variation ½°. No adjustment.

BRAKES:—Service. Own Make, Mechanical, two shoe, self-energizing type with cable actuation. Hand lever applies all service brakes.

See article in Mechanical Equipment Section for data.

Drum—Cast iron. Diameter 12".

Lining—Molded (primary), Woven (secondary). Width 1.75". Thickness .185". Length per shoe 13.25".

Hand Brake:—See Service Brakes above.

MODEL DESIGNATION:—Models, Engine type, and wheel-bases for all 1938 Trucks are as follows:

One Tonner

Model	Engine	Wheelbase
81Y	85	122"
82Y	60	122"

Cab-Over-Engine Models

811W, Z	85	101"
81W	85	134"
817W	85	157"

Other Truck Models

81T, U	85	134"
811T School Bus	85	191"
817T	85	157"

SERIAL & ENGINE NUMBER:—Stamped on top of clutch housing.

ENGINE SPECIFICATIONS & SERVICE DATA:—*See Ford '60' and '85' 1938 M pages for complete data.* All data on Pistons, Pins, Rings, Connecting Rods, Main Bearings, Camshaft, Valves and Valve Timing, Lubrication and Cooling System same as for passenger car models except as noted.

CLUTCH:—Long Model 9CF-CS (82Y), 11CF-CS (all others). Semi-centrifugal, single plate, dry disc type. *See article in Mechanical Equipment Section for data.*

Facings—Molded type. 2 required. Inside Diam. 5.76" (9CF), 6.5" (11CF), Outside Diam. 9" (9CF), 11" (11CF). Thickness .137" (all).

Adjustment:—Pedal free movement should be 1.5-1.75". To adjust, remove clevis pin at end of pedal connector rod, turn clevis on rod.

Removal:—Disconnect front propeller shaft (coupling shaft) and remove transmission (see Transmission Removal below), take out mounting screws in clutch cover flange, remove clutch assembly.

TRANSMISSION (3 SPD.):—Own Model 73A (Std. 82Y), 67 (Std. 81Y), 70B, 70C (Optl. on other Trucks). Constant mesh, helical gears (Second and High), sliding spur gears (Low and Reverse). Synchro-mesh for second and high on Models 73A, 67 only.

NOTE—Model 75 4-spd. transmission optional on Model 82Y.

See article in Mechanical Equipment Section for data.

Removal:—Disconnect and remove front propeller shaft (coupling shaft) as directed below. Support engine at rear end, take out rear engine mounting bolts, take out clutch housing mounting screws, pull transmission straight back and remove.

NOTE—Models 811-W, Z have one universal joint only (no coupling shaft used).

Front Propeller Shaft (Coupling Shaft) Removal:—Remove as follows: Take out all except top bolt in intermediate universal joint ball housing (at frame) remove all screws in front universal joint cover, slide cover back 6" on housing, take out screws in universal joint flange directly in back of universal, disengage by pushing flange back on shaft against spring tension, take out remaining bolt at intermediate universal, pull shaft down at front to clear cross-member, pull shaft forward until free at rear splined joint, remove shaft assembly.

TRANSMISSION (4 SPD.):—Model 51 (Std. except 81Y, 82Y; Optl. on 82Y). Sliding spur gear type. *See article in Mechanical Equipment Section for data.*

Removal:—Same as for 3-speed type (above).

UNIVERSAL JOINT:—Spicer. Two used (one at rear of transmission case, additional joint at frame cross-member between front and rear driveshafts. Steel bushing type (1 Ton), Needle bearing (others). NOTE—One joint only used on Models 811-W, Z. *See article in Mechanical Equipment Section for data.*

REAR AXLE (STD.):—Own Make. Full floating, spiral gear type with straddle mounted pinion and torque tube drive. *See article in Mechanical Equipment Section for data.*

Ratio—Std. 6.67-1 (except 81Y), 4.857-1 (81Y). Optl. 5.14-1, 5.83-1 (except 81Y), 4.11-1 (81Y).
NOTE—No Optl. ratios offered for Model 82Y.

Backlash—.004-.016".

Removal:—Disconnect brake cables, speedometer cable, rear springs (semi-elliptic type). Take out universal joint ball housing bolts (rear joint), pull axle assembly to rear to free splined joint, remove assembly from under truck.

Axle Shaft Removal. Remove wheel hub cap by taking out two screws, take off nuts on 8 hub studs which hold axle flange in place, install two special screws in tapped holes in flange, turn screws up evenly to break flange loose from hub, **back these screws out** and strike axle shaft flange at center to loosen centering cones on studs, remove cones, pull axle shaft out (wheel bearings not disturbed).

NOTE—When installing axle shaft, make certain that gasket in place under shaft flange, cones in place on studs, and that the two loosening screws backed off sufficientily so that stud nuts can be securely tightened. Then turn the two loosening screw in just enough to prevent loosening in service.

Wheel Bearing Adjustment. Remove axle shaft (above), use special bearing adjusting wrench BB-17033-B and remove outer or bearing locknut, pull out nut retainer and grease retainer. Inner bearing adjusting nut can then be adjusted or removed. To adjust, turn nut up tight, back off ⅛ turn, install nut retainer, grease retainer and outer bearing nut, turning outer nut up tight.

REAR AXLE GEAR CHANGE (TRUCKS):—Ring and pinion gears have been changed from 'Generated' type to 'Formate' type. These gears not interchangeable singly (use both ring and pinion gear of same type). Formate gears stamped 'SS'.

REAR AXLE (OPTL.):—Two speed type with planetary reduction gear set built in differential case. *See article in Mechanical Equipment Section for data.*

Ratio—5.83-1 (Direct), 8.11-1 (Second speed).

Backlash—.006-.020".

Removal:—Same as for standard axle (above) except that control linkage must also be disconnected.

SHOCK ABSORBERS:—Houde (Houdaille). Double acting, hydraulic, adjustable type. Used on front end only. *See article in Mechanical Equipment Section for data.*

STEERING:—Steering Gear—Gemmer Model 305 Worm-and-Roller type with push-pull adjustments. *See article in Mechanical Equipment Section for data.*

Front Suspension:—Conventional 'I' beam section front axle with Reverse Elliott ends and semi-elliptic springs (Cab over engine trucks), transverse spring (others). Axle positioned by radius rods.

Kingpin Inclination—8° crosswise (except Cab over Engine Trucks—7°).

Caster—9° Max., 4½° Min. (81Y, 82Y), 3½° Max., 1° Min. (Cab over engine trucks), 50 Max., 3° Min. (others). Must be equal within ½°. Axle may be bent cold to correct caster providing that proper tools used (wedges and blocks to prevent crushing axle flange).

Camber—1° Max., ¼° Min. (all models). Must be equal within ¼° and right wheel must not exceed left. Correct in same manner as caster (above).

Toe In—1/16" (Cab over engine trucks), 0" (others). Set at 10-1 ratio with camber. Toe in increases with load on trucks and should be set with truck empty. Adjust by loosening clamp bolts and turning tie rod.

Steering Geometry (toe out on turns)—Outer wheel turned 20°, Inner wheel turned 23° (81Y, 82Y), 23¾° (101" WB. models), 22 2/3° (134" WB. models), 22¼° (157" WB. models). Allowable variation ½°. No adjustment.

BRAKES:—Service—Own make, mechanical, two-shoe, self-energizing type with cable actuation. Hand lever applies all service brakes (81Y, 82Y), separate brake band in rear wheels (others). *See article in Mechanical Equipment Section for data.*

Drum—Cast iron. Diameter 12" (81Y, 82Y front wheels), 15.12" (all others—including 81Y, 82Y rear wheels).

	Width	Thickness	Length per shoe
81Y, 82Y Front	1.75"	.185"	13.25"
All Others	2.5"	.25"	18.41"

Hand Brake (except 81Y, 82Y):—Independent internal expanding brake band in each rear wheel.

Drum—Diameter 14".

Lining—Woven type. Width 1.5". Thickness .185". Length 41.12" per band.

HOOD & SIDE PANEL REMOVAL:—*See Ford Shop Notes.*

OIL PAN REMOVAL:—*See Ford Shop Notes for data.*

SERIAL & ENGINE NUMBER:—Stamped on top of clutch housing and on left frame side member in front of dash bracket.

ENGINE SPECIFICATIONS:—**Own '60'.** 8 Cylinder, 90° Vee, L head. Both banks & crankcase cast enbloc. **Bore**—2.6". **Stroke**—3.2". **Displacement**—136 cu. ins. **Rated Horsepower**—21.6. **Developed Horsepower**—60 at 3500 R.P.M. **Compression Ratio**—6.6-1 Std. No Optl. ratios. **Compression Pressure**—158 lbs. at 2800 R.P.M. max., or 105 lbs. at cranking speed of 100 R.P.M. **Vacuum Reading**—18-20" steady at 5-7 M.P.H.

PISTONS:—Steel alloy, light wgt., cam-ground. Recondition cylinders for finished replacement pistons. **Weight**—230 grams (without rings or pin). **Removal**—Pistons and rods removed from above. **Clearance**—See Fitting New Pistons.
Replacement Pistons:—*See Ford Shop Notes for data.*
Fitting New Pistons:—Use .0015" feeler, .50" wide, inserted between piston and cylinder wall at right angles to pin. Feeler should withdraw with 7-12 lbs. pull.

PISTON RINGS:—Two compression, one oil ring, all above pin. Oil ring groove drilled with drain holes. NOTE—Expander used with #2 Compr. and oil ring.

Ring	Width	End Gap	Side Clearance
Compr. #1	.092-.0925"	.009-.012"	.003"
Compr. #2	.092-.0925"	.009-.012"	.0015"
Oil Cont.	.1535-.154"	.005-.012"	.0015"

Replacement Rings:—Furnished (sets in cartons only) Std. and .005", .015", .030", .045" oversize.

PISTON PIN:—**Diameter** .6876-.6879". **Length** 2.368". Floating type (locking rings in piston at each end). Pin hole in connecting rod bronze-bushed. **Pin Fit in Piston**—.0004" clearance. **Pin Fit in Rod Bushing**—.0001" clearance. *See Ford Shop Notes for Pin Fitting Directions.*
Replacement Pins:—Furnished Std. and .002" under- and over-size.

CONNECTING ROD:—**Length** 6.125". **Weight** 270 grams. **Crankpin Journal Diameter**—1.600" (connecting rod diameter on crankpin 1.800"). **Bearing Type**—Steel-backed, special-alloy lined. Bearing floats in both rods (side-by-side mounting) with bearing surface on both inner and outer face. **Bearing Dimensions**—Length 1.535". Thickness .09995". **Clearance**—.0005-.0025" (total diametrical).
Bearing Adjustment:—None (no shims). Do not file.
Replacement Bearings:—*See Ford Shop Notes for special bearings for Oversize Rods & Undersize Crankpins.*
Installing Rods:—Marks on rods and caps must be together and installed in same numbered cylinder with marks pointing down toward oil pan.

CRANKSHAFT:—3 bearing. Integral counterweights. **Journal Diameters**—1.999" (all bearings). **Bearing Type**—Steel-backed, special-alloy lined. **Clearance**—.0005-.0025".
Bearing Adjustment:—None (no shims). Do not file.
End Thrust:—Taken by rear bearing. Adjust by replacing bearing. **Endplay**—.002-.005".
Replacement Bearings:—*See Ford Shop Notes for Undersizes and special long bearings.*

CAMSHAFT:—Three bearings. Helical gear drive. **Bearing Diameters**—1.498" (all bearings). **Bearings**—Steel-backed, babbitt-lined bushings. **Clearance**—.002".
End Thrust:—Taken by gear hub and cover plate. Adjust by replacing coverplate. **Endplay**—.004-.008".
Timing Gears:—Cast alloy steel (crankshaft), Bakelized Fabric (Camshaft). **Backlash**—.004" max.
Camshaft Setting:—Mesh '0' marked tooth of crankshaft gear with '/' marked space on camshaft gear (this mark must line up with mark on gear hub).

VALVES:—

	Head Diameter	Stem Diameter	Length
All Valves	1.281"	.2795"	4.375"
	Seat Angle	**Lift**	**Stem Clearance**
All Valves	45°	.251"	.0015-.0035"

See Ford Shop Notes for Valve Servicing data.
NOTE—Inserts used for exhaust valves only.
Tappet Clearance:—.0125-.0135". No adjustment.
Valve Guides:—Split type retained by 'C' washer and valve spring. *See Ford Shop Notes for servicing data.*
Valve Lifters:—Barrel type in reamed holes in block. **Diameter**—.8295". **Clearance**—.0005-.001".

Valve Springs:—	Pressure	Length
Valve Closed	26-30 lbs.	2.05"
Valve Open	48-52 lbs.	1.80"

Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 9½° BTDC. Close 54½° ALDC.
Exhaust Valves—Open 57½° BLDC. Close 6½° ATDC
To Check Valve Timing—No flywheel marks provided. If dead center point established for any cylinder on flywheel, intake valve for this cylinder should open approximately 3.22 flywheel teeth before this point with the piston .027" BTDC.
Motor Gauge—Weidenhoff Adapter #114. Rod #40.

LUBRICATION:—Pressure. Gear type oil pump mounted on front main bearing cap in crankcase.
Normal Oil Pressure:—30 lbs. at 2000 R.P.M.
Oil Pressure Regulator:—Under plug above front camshaft bearing. Opens at 30 lbs. Not adjustable.
Oil Pressure Gauge:—King-Seeley Electric. Ford No. 91-A-9273-A (dash unit), No. 48-9278 (Engine unit).
See article in Mechanical Equipment Section for data.
Crankcase Capacity:—4 qts.

COOLING SYSTEM:—**Capacity** 15 qt. (922A), 16 (922C).
Water Pump:—Packless 2 used (1 for each bank).
See article in Mechanical Equipment Section for data.
Removal—Slack off belt adjustment, unscrew large mounting nut behind pulley, pull pump out.
Thermostat:—In each cylinder head outlet (2 used). **Setting**—Starts to open at 145°F. Fully open 180°.
Temperature Gauge:—King-Seeley (Not Electric). Ford No. 91-A-10883-A.
See article in Mechanical Equipment Section for data.
Drain Valves:—At lower right front corner of radiator.

CLUTCH:—**Long Model 8½CB-CS (922A), 9CF-CS** (922C). Single plate, dry disc type. Semi-centrifugal (9CF-CS only).
See article in Mechanical Equipment Section for data.
Facings—Moulded type, 2 required. Inside Diam. 6" (8½CB), 5.76" (9CF). Outside Diam. 8.5" (8½CB), 9" (9CF). Thickness .125" (8½CB), .137" (9CF).
Adjustment:—Pedal free movement should be .75-1" (8½CB), 1.5-1.75" (9CF). To adjust, remove clevis pin at end of connector rod, turn clevis on rod.
Removal:—Slide rear axle and transmission to rear as a unit to expose clutch (see Transmission Removal below), take out mounting screws in clutch cover.

TRANSMISSION:—**Own Model 74-B (922A), 73-B (Std.** (922C), **73-A (Optional** 922C). Constant-mesh, synchro-mesh (second & high), sliding gear (low & reverse), all helical gears (74-B, 73-B), second & high only (73-A).
Optional Transmission (922C)—**Model 75:**—Four speed, sliding spur gear type.
See articles in Mechanical Equipment Section for data.
Removal (922A, 922C):—Disconnect hand brake cable, hydraulic brake line at torque tube connection (bleed lines when re-connected), speedometer cable, shock absorber links. Disconnect rear spring at center frame connection. Take out universal joint ball housing screws, slide rear axle assembly back to disengage drive shaft at splined joint. Support engine at rear, take out rear engine mounting bolts, remove clutch housing screws, pull transmission straight back.

UNIVERSAL JOINT:—**Spicer Model 7990-SF.** Steel-bushing type. Single joint at rear of transmission (all models), additional joint at frame cross-member between front and rear drive shafts (92Y only).
See article in Mechanical Equipment Section for data.

REAR AXLE (922A, 922C):—**Own Make.** ¾ floating, Spiral Bevel gear type with Torque Tube drive.
See article in Mechanical Equipment Section for data.
Ratio—4.44-1 Std. **Backlash**—.010" maximum.
Removal:—Disconnect hand brake cables, hydraulic brake line at torque tube connection (bleed lines when re-connected), speedometer cable, shock absorber links. Disconnect rear spring at center frame connection. Take out universal joint ball housing mounting screws, pull axle assembly to rear to disengage drive shaft at splined joint.
Axle Shaft Removal—Axle must be dismantled and shaft removed through differential housing at inner end. *See Ford Axle article in Mechanical Equipment Section for data.*

SHOCK ABSORBERS:—**Houde (Houdaille) Type BBDK (Frt.), BBDW (Rear).** Double acting, hydraulic, adjustable. *See data in Mechanical Equipment Section.*

STEERING:—**Steering Gear**—Gemmer Model 305 Worm -and-Roller type with 'push-pull' adjustment.
See article in Mechanical Equipment Section for data.
Front Suspension:—Conventional 'I' beam section front axle with Reverse Elliott ends and transverse spring. Axle positioned by radius rods.
Kingpin Inclination—8° crosswise (all models).
Caster—9° Max., 4½° Min. (all models). Must be equal within ½°. Axle may be bent cold to correct caster if proper tools (wedges and blocks to prevent crushing axle flange) are used.
Camber—1° Max., ¼° Min. (all models). Must be equal within ¼°, right wheel must not exceed left. Adjust as for caster (see caster data above).
Toe In—1/16". Set at 10-1 ratio to Camber. Adjust by loosening clamp bolts and turning tie rod.
Steering Geometry (Toe out on turns)—Outer wheel turned 20°. Inner wheel 23⅓°. Allowable variation ½°. No adjustment.

BRAKES:—**Service**—Lockheed Hydraulic, double anchor, non-energizing type. Hand lever applies rear wheel service brakes.
See article in Mechanical Equipment Section for data.
Wheel Cylinders—Stepped type as follows:

	Front Wheel		Rear Wheel	
	Front End	**Rear End**	**Front End**	**Rear End**
922A, C	1.25"	1.00"	1.125"	1.00"

Drums—Cast iron. Diameter 12".
Lining—Woven type (forward shoe—all wheels), Moulded type (rear shoe—all wheels). Width 1.75". Thickness .20". Length per shoe 13.18" (forward shoe —all wheels), 10.1" (rear shoe—all wheels).
Clearance—Least possible amount without drag.
Hand Brake:—See Service Brakes above.

ENGINE HOOD NOTE:—To raise hood, release lock by pulling up on latch handle at front of hood above grille, raise hood slightly, press down on safety latch handle (to right of latch under hood).

OIL PAN REMOVAL:—*See Ford Shop Notes for data.*

SERIAL & ENGINE NUMBER:—Stamped on top of clutch housing and on left frame member in front of dash bracket.

ENGINE SPECIFICATIONS (91A,C):—Own 85, 8 cyl., 90° Vee, L head. Both banks & crankcase cast Enbloc. **Bore**—3.062". **Stroke**—3.75".
Rated Horsepower—30. **Displacement** 221 cu. ins.
Developed Horsepower—85 at 3800 R.P.M.
Compression Ratio—6.15-1 (Pass. Cars, Comm'l., 1 Ton), 5.87-1 (Other Trucks). Cast iron head.
Compression Pressure—145 lbs. (6.15-1 hd.), 130 lbs. (5.87-1 hd). at 2200 R.P.M. Max., 100 lbs. at cranking speed of 100 R.P.M.
Vacuum Reading—Steady 18-20" at 5 M.P.H.

ENGINE SPECIFICATIONS (99C):—Own 95. See Mercury 'M' Page for complete 95 Engine data.

PISTONS:—Steel alloy, light wgt., cam ground type. Recondition for finished replacement pistons.
Weight—335 grams (without rings or pin).
Removal—Pistons and rods removed from above.
Clearance—See Fitting New Pistons.
Replacement Pistons:—*See Ford Shop Notes for data.*
Fitting New Pistons:—Use .0025" feeler, .50" wide, inserted between piston and cylinder wall at right angles to pin. Pull to withdraw feeler—7-12 lbs.
NOTE—If aluminum pistons fitted, use .002" feeler with 6-10 lbs. pull.

PISTON RINGS:—Two compression, one slotted oil ring, all above pin (drain holes in oil ring groove).
NOTE—Expander used with #2 Compr. and oil ring.

Ring	Width	End Gap	Side Clearance
Compr. #1	.0915-.0920"	.012-.017"	.003"
Compr. #2	.0915-.0920"	.012-.017"	.0015"
Oil Cont.	.1535-.1540"	.012-.017"	.0015"

Replacement Rings:—Furnished (sets in cartons only) Std. and .005", .015", .030", .045", .060" oversize.

PISTON PIN:—**Diameter** .7501-.7504". **Length** 2.850". Floating type (locking ring in piston at each end). Pin hole in connecting rod bronze-bushed.
Pin Fit in Piston—.0005" clearance.
Pin Fit in Rod Bushing—.0001" clearance. *See Ford Shop Notes for Pin Fitting directions.*
Replacement Pins:—Std. & .002" over- & under-size.

CONNECTING ROD:—Length 7.00". **Weight** 476 grams.
Crankpin Journal Diameter—1.999" (connecting rod diameter on crankpin—2.220").
Bearing Type—Steel-backed, special-alloy lined. Bearing floats in both rods (side-by-side mounting) with bearing surface on inner and outer faces.
Bearing Dimensions—Length 1.747". Thickness .1095". These bearings do not have end flanges.
Clearance—.0005-.0025". (total diametrical).
Bearing Adjustment:—None (no shims). Do not file.
Replacement Bearings:—*See Ford Shop Notes for special bearings for oversize rods and undersize crankpins.*
Installing Rods:—Marks on rods and caps must be together and installed in same numbered cylinder with marks pointing down toward oil pan.

CRANKSHAFT:—3 bearing. Integral counterweights.
Journal Diameters—2.499" (all bearings).
Bearing Type—Steel-backed, special-alloy lined.
Clearance—.0005-.0025".
Bearing Adjustment:—None (no shims). Do not file.
End Thrust:—Taken by rear main bearing. Adjust by replacing bearing. **Endplay**—.002-.006".
Replacement Bearings:—*See Ford Shop Notes for Unundersizes and special long main bearings.*

CAMSHAFT:—Three bearing. Helical gear drive.
Bearing Diameters—1.797" (all bearings).
Bearings—Steel-backed, babbitt-lined bushings.
Clearance—.002".
End Thrust:—Taken by gear hub and cover plate. Adjust by replacing coverplate. **Endplay**—.004-.008".
Timing Gears:—Cast alloy iron (crankshaft), Bakelized Fabric (camshaft). **Backlash**—.004" max.
Camshaft Setting:—Mesh '0' marked tooth of crankshaft gear with '/' marked space on camshaft gear (this mark must be in line with mark on hub).

VALVES:—

	Head Diameter	Stem Diameter	Length
All Valves	1.537"	.3115"	4.750-4.751"

	Seat Angle	Lift	Stem Clearance
All Valves	45°	.292"	.0015-.0035"

See Ford Shop Notes for Valve Servicing data.
NOTE—Seat inserts used for all valves.
Tappet Clearance:—.0125-.0135". No adjustment.
Valve Guides:—Split type retained by 'C' washer and valve spring. *See Ford Shop Notes for servicing data.*
Valve Lifters:—Barrel type in reamed holes in block. **Diameter**—.9995". **Clearance**—.0005-.001".

Valve Springs:	Pressure	Length
Valve Closed	37-40 lbs.	2.13"
Valve Open	76-80 lbs.	1.84"

Valve Timing:—See Camshaft Setting above.
Intake Valves—Open at TDC. Close 44° ALDC.
Exhaust Valves—Open 48° BLDC. Close 6° ATDC.
To Check Valve Timing—No flywheel marks provided. Intake valve opens with piston at TDC.

LUBRICATION:—Pressure. Gear type oil pump mounted in crankcase at rear of engine.
Normal Oil Pressure:—30 lbs. at 2000 R.P.M.
Oil Pressure Regulator:—Under plug above front camshaft bearing. Opens at 30 lbs. Not adjustable.
Oil Pressure Gauge:—King-Seeley Electric. Ford Nos: Dash Unit—91-A-9273-B (Deluxe Pass. Cars), 91-A-9273-A (all others). Engine Unit—48-9273 (all).
See article in Mechanical Equipment Section for data.
Crankcase Capacity:—5 qts.

COOLING SYSTEM:—**Capacity**—22 qts. (Std. Pass. Cars, Comm'l., 1 Ton), 21 qts. (Deluxe Pass. Cars), 24 qts. (Trucks).
Water Pump:—Packless type, 2 used (1 for each bank). *See Mechanical Equipment Section for data.*
Removal—Slack off drive belt, support engine at forward end, remove front engine mounting bolts, take out mounting screws in pump body.
Thermostat:—In each cylinder head outlet (2 used).
Setting—Start to open at 145°F. Fully open 180°.
Temperature Gauge:—King-Seeley (not electric). Ford No. 91-A-10883-B (Deluxe Pass Cars), 91-A-10883-A (all others).
See article in Mechanical Equipment Section for data.
Drain Valves:—One at lower right front corner of radiator.

CLUTCH:—**Long Model 9CF-CS.** Semi-centrifugal, single plate, dry disc type.
See article in Mechanical Equipment Section for data.
Facings—Molded type, 2 required. Inside Diam. 5.76". Outside Diam. 9". Thickness .137".
Adjustment:—Pedal free movement should be 1.5-1.75". To adjust, remove clevis pin at end of connector rod, adjust clevis on rod.
Removal:—Slide rear axle and transmission to rear as a unit to expose clutch (see Transmission Removal below), take out mounting screws in cover.

TRANSMISSION:—**Own Model 68 (Std.), 67 (Optl.).** Constant-mesh, synchro-mesh, helical gears (Second & High), sliding helical gear (Low & Reverse—68), spur gear (Low & Reverse—67).
NOTE—Model 51 4 spd. type optl. on Comm'l.
See article in Mechanical Equipment Section for data.
Removal:—Disconnect rear shock absorbers, hand brake cables, hydraulic brake line at torque tube connection (bleed lines when re-connected), speedometer cable. Disconnect rear spring at center frame connection, take out universal joint ball housing screws, slide rear axle assembly back to disengage drive shaft at splined joint. Support engine at rear, take out rear engine mounting bolts, remove clutch housing screws, pull transmission straight back.

UNIVERSAL JOINT:—**Spicer Model 6454-FS.** Steel bushing type. Single joint at rear of transmission case.
See article in Mechanical Equipment Section for data.

REAR AXLE:—**Own Make.** ¾ Floating, Spiral Bevel gear type with straddle-mounted pinion and Torque tube drive.
Optional Axle:—Columbia Two-speed type.
See article in Mechanical Equipment Section for data.
Ratio—3.78-1 Std.; 3.54-1, 4.11-1 Optl.
Backlash—.010" Max.
Removal:—Disconnect rear shock absorbers, hand brake cables, hydraulic brake line at torque tube connection (bleed lines when re-connected), speedometer cable. Disconnect rear spring at center frame connection, take out universal joint ball housing screws, pull axle assembly to rear to disengage splined joint, remove axle assembly.
Axle Shaft Removal—Axle assembly must be dismantled as follows: Remove wheels and hubs, disconnect spring, remove axle housing mounting screws in differential housing, remove housing. Dismantle differential assembly, pull axle shafts out at inner end (integral with differential side gear).

SHOCK ABSORBERS:—**Houde (Houdaille) BBDK (frt.), BBDW (rear).** Double acting, hydraulic, adjustable.
See article in Mechanical Equipment Section for data.

STEERING:—**Steering Gear**—Gemmer Model 305 Worm-and-Roller type with 'push-pull' adjustment.
See article in Mechanical Equipment Section for data.
Front Suspension:—Conventional 'I' beam section front axle with Reverse Elliott ends and transverse front spring. Axle positioned by radius rods.
Kingpin Inclination—8° crosswise.
Caster—9° Max., 4½° Min. Must be equal within ½°. Axle may be bent cold to correct caster if proper tools (wedges and blocks to prevent crushing axle flange) are used.
Camber—1° Max., ¼° Min. Must be equal within ¼° and right wheel must not exceed left. Adjust as for Caster (see Caster adjustment above).
Toe In—1/16". Set at 10-1 ratio to Camber. Adjust by loosening tie rod clamp bolts and turning tie rod.
Steering Geometry (Toe out on Turns)—Outer wheel turned 20°, Inner wheel 23⅓°. Allowable variation ½°. No adjustment.

BRAKES:—**Service**—Lockheed hydraulic, double anchor, non-energizing type. Hand lever applies rear wheel service brakes.
See article in Mechanical Equipment Section for data.
Drums—Cast iron. Diameter 12".
Wheel Cylinders—Stepped type with larger end of cylinder actuating forward shoe. Not interchangeable (front wheel cylinders larger) as follows:

	Front Wheel		Rear Wheel	
	Front	Rear	Front	Rear
All Models	1.25"	1.00"	1.125"	1.00"

Lining—Woven type (forward shoe, all wheels), Molded type (rear shoe, all wheels) as follows: Width 1.75". Thickness .20". Length per shoe 13.18" (forward shoe, all wheels), 10.1" (rear shoe, all wheels).
Clearance—Least possible amount without drag.
Hand Brake:—See Service Brakes above.

MODEL DESIGNATION:—Models, Engine type, and Wheelbases for all trucks are as follows:

1 Tonner

Model	Engine	Wheelbase
91Y	85	122"
92Y	60	122"

Cab-Over-Engine Models

911W, Z	85	101"
91W	85	134"
917W	85	157"
991W, Z	95	101"
99W	95	134"
997W	95	157"

Other Trucks

91T, U	85	134"
917T	85	157"
911T (School Bus)	85	191"
99T, U	95	134"
997T	95	157"
991T (School Bus)	95	191"

SERIAL & ENGINE NUMBER:—Stamped on top of clutch housing.

ENGINE SPECIFICATIONS & SERVICE DATA:—*See Ford '60', Ford '85', and Mercury (for '95' Engine) 'M' pages for complete data.* All data (Pistons, Pins, Rings, Connecting Rods, Main bearings, Camshaft, Valves, Lubrication and Cooling System) same as for passenger car models except as noted.

CLUTCH:—Long Model 9CF-CS (92Y), 11CF-CI (all others). Semi-centrifugal, single plate, dry disc type.
See article in Mechanical Equipment Section for data.
Facings—Molded type, 2 required. Inside Diam. 5.76" (9CF), 6.5" (11CF). Outside Diam. 9" (9CF), 11" (11CF). Thickness .137" (all).

Adjustment:—Pedal free movement should be 1.5-1.75". To adjust, remove clevis pin at end of connector rod, adjust clevis on rod.

Removal:—Disconnect front propeller shaft (coupling shaft) and remove transmission (see Transmission Removal below). Take out mounting screws in clutch cover flange.

TRANSMISSION (3 SPD.):—Own Model 67 (Std. 1 Ton), Models 70-B, 70-C (Optl. Others). Constant-mesh, synchro-mesh, helical gears (Second & High), sliding spur gear (Low & Reverse).
NOTE—4 Spd. Trans. Optl. on 1 Ton models.
See article in Mechanical Equipment Section for data.

Removal:—Remove front propeller shaft (coupling shaft) as follows: Take out all except top bolt in intermediate universal joint ball housing (frame bolts), remove all screws in front universal joint cover, slide cover back 6" on housing, take out screws in universal joint flange directly in back of universal, disengage coupling by pushing it back on shaft against spring tension, take out remaining bolt at intermediate universal joint, pull shaft down at front end to clear cross-member, pull forward until free at splined joint at rear end, remove shaft assembly. Support engine at rear end, take out rear engine mounting bolts, take out clutch housing mounting screws, pull transmission straight back and remove.
NOTE—Models 911-W, Z have one universal joint only (no coupling shaft used).

TRANSMISSION (4 SPD.):—Own Model 51. Std. on all models except 1 Ton. Sliding spur gear type.
See article in Mechanical Equipment Section for data.
Removal:—Same as for 3 Spd. transmission above.

UNIVERSAL JOINT:—Spicer. Two used (one at rear of transmission case, additional joint at frame cross-member between front and rear driveshafts. Steel bushing type (1 Ton), Needle bearing (others).
NOTE—One joint only used on Models 911-W, Z.
See article in Mechanical Equipment Section for data.

REAR AXLE (STD.):—Own Make. Full floating, Spiral bevel gear type with straddle-mounted pinion and Torque tube drive.
See article in Mechanical Equipment Section for data.
Ratio—4.857-1 Std., 4.11 Optl. (1 Ton), 6.67-1 Std., 5.14-1, 5.83-1 Optl. (others).
Backlash—.004-.016".

Removal:—Disconnect hand brake cables, hydraulic brake line (at torque tube connection—bleed lines when re-connected), speedometer cable. Disconnect rear springs (semi-elliptic type), take out universal joint ball housing bolts (rear joint), pull axle assembly to rear to disconnect splined joint, remove assembly.
Axle Shaft Removal—Take out two screws and remove hub cap, remove nuts on 8 hub studs which hold axle shaft flange in place, turn the two special screws (in tapped holes in flange) up evenly to break flange loose from wheel hub, **back these screws out,** strike axle shaft flange at center to loosen centering cones on studs, remove cones, pull axle shaft out (wheel not disturbed).
Wheel Bearing Adjustment—Remove axle shaft (above), use special bearing adjusting wrench and remove bearing locknut (outer nut), nut retainer, and grease retainer. Adjust inner bearing adjusting nut by turning up until tight and then backing off ⅛ turn, install grease retainer, bearing nut retainer, outer bearing locknut, turn locknut up tight.
NOTE—When installing axle shaft, make certain that gasket in place under shaft flange, cones in place on studs and that two loosening screws backed off sufficiently so that stud nuts can be tightened securely. Turn the two loosening screws in just enough to prevent loosening in service.

REAR AXLE (OPTL.):—Two-speed type.
See article in Mechanical Equipment Section for data.
Ratio—5.83-1 (Direct), 8.11-1 (2nd speed).
Backlash—.006-.020".

Removal:—Same as for standard axle (above) except that control linkage must also be disconnected.

SHOCK ABSORBERS:—Houde (Houdaille). Double acting, hydraulic, adjustable type. Used on front end only.
See article in Mechanical Equipment Section for data.

STEERING:—Steering Gear—Gemmer Model 305 Worm-and-Roller type with 'Push-pull' adjustment.
See article in Mechanical Equipment Section for data.

Front Suspension:—Conventional 'I' beam section front axle with Reverse Elliott ends and transverse spring positioned by radius rods (except Cab over Engine models), semi-elliptic springs (Cab over Engine models).

Kingpin Inclination—8° crosswise (except Cab-Over-Engine Trucks—7°).

Caster—9° Max., 4½° Min. (1 Ton); 3½° Max., 1° Min. (Cab-Over-Engine), 5° Max., 3° Min. (others). Must be equal within ½°. NOTE—Axle may be bent cold to correct caster provided that proper tools (wedges and blocks to prevent crushing axle flange) used.

Camber—1° Max., ¼° Min. (all models). Must be equal within ¼° and right wheel must not exceed left wheel. Adjust as for Caster (see Caster Note).

Toe In—1/16" (Cab-Over-Engine), 0" (other trucks—empty). Set at 10-1 ratio to camber. Toe in increases with load on trucks and should be set with truck empty. Adjust by loosening clamp bolts and turning tie rod.

Steering Geometry (Toe out on turns)—Outer wheel turned 20°, Inner wheel turned 23° (1 Ton), 23¾° (101" WB. models), 22⅔° (134" WB. models), 22¼° (157" WB. models). Allowable variation ½°.

BRAKES:—Service—Lockheed hydraulic, double anchor, non-energizing type. Hand lever applies rear wheel service brakes (1 Ton), separate brake band in rear wheels (others).
See article in Mechanical Equipment Section for data.
Drums—Cast iron. Diameter 12" (1 Ton—front wheel), 14" (1 Ton—rear wheel, Other trucks—front wheel), 15" (all models except 1 Ton—rear wheel).
Wheel Cylinders—Not interchangeable (larger cylinders used for rear wheels, stepped type cylinders used for 1 Ton front wheels only). Cylinder sizes (front & rear end given for 1 Ton front cylinder only) as follows:

	Front Wheel	Rear Wheel
1 Ton	1.25"-1.00"	1.375"
All Others	1.375"	1.50"

Lining—Molded type (all shoes except 1 Ton forward shoes, front wheel which are Woven type).

	Width	Thickness	Length per Shoe Forward	Rear
1 Ton (front)	1.75"	.20"	13.18"	10.1"
1 Ton (rear)	2.00"	.268"	15.53"	10.75"
Others (front)	2.00"	.268"	15.53"	10.75"
Others (rear)	3.50"	.33"	16.64"	11.52"

Clearance—Least possible amount without drag.

Hand Brake (1 Ton):—See Service Brakes above.

Hand Brake (Others):—Independent internal expanding band in each rear wheel.
Lining—Width 1.50". Thickness .185". Length per wheel 41.12".

1936-1939 MODELS

CYLINDER HEAD REMOVAL ON SUPERCHARGER MODELS:—Not necessary to remove Supercharger. Remove nuts holding supercharger bracket to cylinder block and at cylinder head, remove screws and nuts holding intake cross-tube to manifold and supercharger, disconnect gasoline line to carburetor, water pipes to supercharger, vacuum line to distributor. Tip supercharger away from engine block and proceed with cylinder head removal (do not disconnect carburetor throttle and choke connections).

1937-1939 MODELS

PISTONS:—Pistons are full skirt type (no slot) with special oil groove extending entirely around piston at lower end of skirt and four vertical grooves on one side (pistons must be installed with these grooves toward camshaft). These grooves are part of the piston and cylinder wall metered-lubrication system.

1937-1939 MODELS

PISTON & CYLINDER WALL LUBRICATION SYSTEM:—Oil channel in block at side of lifter guide holes feeds oil from engine pressure system to oil groove on side of valve lifters (barrel type). When lifter raised by cam, this groove registers with drilled hole through cylinder wall and oil is fed to piston oil groove (see above) for piston and cylinder wall lubrication. This action occurs twice for each stroke of the piston.

Servicing—Clean out oil channels and drilled holes when pistons and lifters removed.

1937-1939 MODELS

PISTON RINGS:—Compression and top oil ring are special types and must be installed as follows:

Installing Rings:—Compression rings are taper-faced and must be installed with marks on edge of ring up. Top oil ring (wiper ring) is X-90 type. Install this ring with expander joint at back of ring, springs seated in notches at ring ends, word 'NO.' on expander right side up and visible in ring joint, and oil groove on ring face down.

Replacement Rings:—Compression and oil rings (except X-90) furnished standard and .010", .020", .030" oversize. X-90 ring furnished standard and .020" oversize.

1936-1939 MODELS

MAIN BEARING SERVICING:—Front Bearing 1938-39. Consists of a special bushing (not split) inserted in hole in front face of crankcase. This bearing cannot be adjusted and must be replaced if clearance excessive.

Front Bearing Replacement—Remove radiator, vibration dampener, chain case cover. Remove nut holding camshaft sprocket, pull camshaft and crankshaft sprockets together (to avoid damage to chain), remove front bearing bushing.

Bearing Replacement (All except #1 1938-39):—To determine correct size for replacement bearing, install .003" feeler 1" long in bearing cap between bearing and crankshaft, tighten cap securely. If bearing is tight on this feeler, install standard replacement bearing. If crankshaft turns freely with this feeler in place, install .001" undersize bearing.

NOTE—No undersize bearings furnished on following models: 80, 80A, 85, 90, 90A, 110.

Bearing Installation—Not necessary to remove crankshaft. New upper bearing halves can be 'rotated' in place. Bearing caps are doweled to crankcase to insure alignment.

Bearing Clearance—Check clearance of new bearings by installing .002" feeler 1" long under bearing cap. With bearing cap tight, shaft should bind with feeler in place but should be free with feeler removed. Face bearing cap with emery cloth on surface plate to secure this fit.

Endplay Adjustment:—Remove radiator, vibration dampener, chain case cover. Check endplay with feeler gauge. To adjust, pull camshaft and crankshaft sprockets together, add or remove shims between crankshaft shoulder and steel thrust washer (furnished .002" & .008" thick). See that floating bronze thrust washer is in place between steel washer and main bearing.

1936-1939 MODELS

VALVE GUIDE REMOVAL & INSTALLATION:—Use special puller mounted on top of block (install steel plate under puller legs to distribute strain on block) and pull old guides up through top of block (if guides stick, use knock-out bar to loosen guide and avoid strain on puller draw-bar). Install new guides in same manner pulling guides up into holes in block from below.

1937-1939 MODELS

SUPERCHARGER:—Supercharger is entirely separate unit mounted on left hand side of engine block and belt driven from the crankshaft.

Supercharger Drive:—Two exposed Vee belt drive taken from crankshaft pulley at front of engine.

Belt Adjustment—None (automatic). Belt tension maintained by automatic take-up consisting of driven pulley mounted on pivoted arm with light coil spring pressing outward on arm and held by ratchet (allows outward movement to take up slack only).

1936-1939 MODELS

Supercharger Removal:—Disconnect throttle and choke linkage, fuel line from pump, vacuum line to carburetor. Remove nuts holding supercharger bracket to cylinder block and at cylinder head, take out screws and nuts connecting cross-tube to supercharger cover at top and oil line to supercharger case at bottom, remove bolts in lower mounting bracket, lift supercharger and carburetor assembly out.

1938-1939 MODELS

HAND BRAKE:—Consists of an external-contracting band on a drum at rear of the transmission. Hand lever is linked directly to operating lever on band.

Adjustment—With hand lever in released position, remove anchor screw locking wire, turn anchor screw to give .025" clearance between lining and drum, lock anchor screw with wire. Back off brake adjusting bolt nut (at top), loosen locknut on guide bolt and adjust to give .025" clearance for lower portion of band, tighten locknut, finally turn adjusting bolt nut to .025" clearance for upper portion of band (tension on guide bolt should just be relieved).

SERIAL NUMBER:—First number 1,605,001 (65), 1,615,001 (68). On plate under floor mat near right rear door or under front seat.

ENGINE NUMBER:—First number 1,620,001 (68). On plate on side of engine block.

ENGINE:—Six cylinder, 'L' head type. Cylinders cast enbloc.

Dimensions—Bore, 3¼". Stroke, 4½". Displacement, 224 cu. ins.

Horsepower—Rated, 25.35. Developed, 85 H.P. at 3400 R.P.M.

Compression—6.5-1. Compression pressure, 110 lbs. at cranking speed.

NOTE:—Cylinder head is aluminum.

Pistons:—Nelson Bohnalite, Invar strut, split skirt type.
Weight—17 ozs. (stripped). Length, 3 23/32".
Removal—Piston and rod assembly removed through bottom of engine.
Clearance—.0015" (skirt).

Piston Rings:—Three rings per piston, #1 and 2—compression rings, #3—oil control ring.

Ring	Width	End Gap	Wall Thickness
Comp. (#1, 2)	⅛"	.008-.012"	.145"
Oil Cont. (#3)	3/16"	.008-.012"	.145"

Piston Pin:—Diameter, 13/16". Length, 2 13/16". Pins are clamped in rod.
Pin Fit in Piston—Push fit.

Connecting Rod:—Length, 9¼".
Crankpin Journal Diameter—2¼".
Big End Bearing—Babbitt-lined type. Shims used.
Clearance—.002". Sideplay .005".
Adjustment—Shims provided for adjustment.

Crankshaft:—Seven main bearing type.
Journal Sizes—2½" diameter (all bearings).
Bearing Type—Removable bronze-backed (65), steel-backed (68), babbitt-lined.
Clearance—.002".
Adjustment—None (no shims).
End Thrust—Taken by #1 (front) main bearing. Endplay, .006".

Camshaft:—Four bearing type. Three-sprocket adjustable chain drive (65), two-sprocket non-adjustable chain drive (68).
Timing Chain (65 '33):—Link Belt. Width 1¼". Pitch ½". Length 34" or 68 links. See Chain adjustment below.
Timing Chain (68 '34):—Link Belt. Width 1¼". Pitch ½". Length 26" or 52 links.
Camshaft Setting—Sprockets are marked. Mesh chain so there are exactly ten links or eleven teeth (inclusive) between marks on sprockets.
Timing Chain Adjustment (Model 65 only):—Adjust chain at 6000 mile intervals. To take up chain, losen two flange mounting screws on accessory sprocket mounting (water pump bracket), back off adjustment screw locknut, turn up adjusting screw until chain hums with engine running, back off adjusting screw until chain runs noiselessly, tighten locknut and mounting screws.

Model 65 (1933) Specifications

VALVES:—	Head Diameter	Stem Diameter	Length	Seat Angle	Lift
Intake	1.562"	.34075"	5.5"	30°	.318"
Exhaust	1.467"	.34075"	5.5"	45°	.327"

Model 68 (1934) Specifications

Intake	1.567-1.557"	.341-.3405"	5.515-5.485"	30°	.318"
Exhaust	1.255-1.245"	.341-.3405"	4.906-4.876"	45°	.327"

Tappet Clearance—.010" (all valves—engine hot).
Valve Springs—1⅞" with load of 94-96 pounds.

Valve Timing

Intake Valves Open—At TDC.	Close—40° ALDC.
Exhaust Valves Open—40° BLDC.	Close—10° ATDC.

To Check Valve Timing—Set tappet clearance #6 exhaust valve at .012". This valve should close with piston 10° after top dead center when flywheel mark 'EC-1' lines up with pointer on housing in inspection hole right front face of flywheel housing. Reset tappet clearance at .010".

Motor Gauge—Weidenhoff Adapter #102. Rod #2.

Lubrication:—Pressure type. Gear type oil pump located in crankcase.
Normal Oil Pressure—50 lbs. at 30 M.P.H.
Oil Pressure Relief Valve—Operates at 50 lbs. Located under plug on side of crankcase (oil pressure signal switch built in regulator case). Adjustable by adding or removing shims or washers above relief valve spring in plug.
Capacity and Oil—6 qts. Use SAE #50 (summer above 70°F.), #40 (40° to 70°F.), #30 (winter 20° to 40°F.), #20-W (winter 0° to 20°F.).

CLUTCH:—**Long Model 9AB.** Single plate, dry disc type. See article in Clutch Section for complete relining and assembling instructions.
Facings—Moulded type, 2 required. Thickness .137". Inside Diameter 5¾". Outside Diameter 9¼".
Adjustment—Free movement of clutch pedal should be 1¼" Adjust when this has decreased to ½". To adjust, loosen locknut and back off adjusting setscrew at lower end of clutch pedal.

STEERING:—**Steering Gear**—Ross Cam-and-Lever type (65), Cam-and-Roller type (68). See article in Steering Section for complete adjustment instructions.

Front Suspension:—Conventional 'I' beam section front axle with Reverse Elliott ends and outboard mounted semi-elliptic springs.
Kingpin Inclination—7° crosswise.
Caster—1½°. Adjust by inserting wedge shims between spring and spring pad on axle.
Camber—1½°. No adjustment provided.
Toe In—⅛-3/16". Adjusted in usual manner by loosening clamp bolts and turning tie rod.

BRAKES:—**Service**—Lockheed Hydraulic, double anchor type. See article in Brake Section for complete adjustment instructions.
Drum Diameter—13".
Lining—Woven type. Width 1¾". Thickness 3/16". Length 27¾" per wheel.
Clearance—.012" toe, .006" heel for each shoe.

Hand Brake:—External type on drum at rear of transmission.
Adjustment—Place hand lever in released position, turn anchor adjusting screw until clearance is 1/32" at this point. Then loosen locknut and turn guide bolt nut until clearance at lower end of band is 1/32". Finally turn adjusting nut at top of adjusting bolt until clearance is 1/32". Clearance should be 1/32" and uniform around brake band.
Drum Diameter—6".
Lining—Width 2". Thickness 5/32". Length 18 9/16"

NOTE:—Supercharged Special Eights use the Custom Eight Model 69 engine. See data on Custom Eight Model 69 (following) for Engine Specifications.

SERIAL NUMBER:—First number (57) 1,015,001, (57A) 1,020,001, (64) 1,800,001, (67) 1,805,001. On plate under floor mat near right rear door or under front seat cushion.

ENGINE NUMBER:—On plate on side of crankcase.

ENGINE:—Eight cylinder, In Line, 'L' head type. Cylinders cast enbloc.

Dimensions—Bore, 3⅛". Stroke, 4". Displacement, 245.5 cu. ins.

Horsepower—Rated 31.25. Developed 90 HP. (57), 95 HP. (57A, 64, 67) at 3400 R.P.M.

Compression—Ratio 6.5-1 (57), 6.7-1 (57A, 64, 67). Pressure 110 lbs. at cranking speed.

Pistons:—Nelson Bohnalite, Invar strut, split skirt type.

Weight—16 ozs. (stripped). Piston length, 3 19/32".

Removal—Piston and rod assembly removed through bottom of engine.

Clearance—.0015" (skirt).

Piston Rings:—Three rings per piston, #1 and 2—compression rings, #3—oil control ring.

Ring	Width	End Gap	Wall Thickness
Comp. (#1, 2)	⅛"	.008-.012"	.140"
Oil Cont. (#3)	3/16"	.008-.012"	.140"

Piston Pin:—Diameter, 13/16". Length, 2⅝". Pin is clamped in rod.

Pin Fit in Piston—Push fit.

Connecting Rod:—Length, 8⅝".

Crankpin Journal Diameter—2⅛".

Big End Bearing—Spun babbitt-lined type. Shims used.

Clearance—.002". Sideplay .005".

Adjustment—Shims provided for adjustment.

Crankshaft:—Five bearing type.

Journal Sizes—2½" diameter—all bearings.

Bearing Type—Removable bronze-backed, babbitt-lined type.

Clearance—.002".

Adjustment—None (no shims).

End Thrust—Taken by #1 (front) main bearing. Endplay, .006".

Camshaft:—Six bearing type. Camshaft drive—Adjustable chain.

Chain—Link belt. Width, 1¼". Length, 67 links. Pitch, ½".

Camshaft Setting—Sprockets are marked. Mesh chain so there are exactly ten links or eleven teeth (inclusive) between marks on sprockets.

Chain Adjustment—Chain adjusted by shifting accessory sprocket (water pump bracket). To adjust, loosen two flange mounting screws, back off adjustment set screw lock nut, turn up adjustment set screw until chain hums with engine running, back off set screw until chain runs noiselessly, tighten lock nut and mounting screws.

Valves:—

Model 57 (1932) Specifications

	Head Diameter	Stem Diameter	Length	Seat Angle	Lift
Intake	1.4375"	.341-.3405"	4.9375"	45°	.3145"
Exhaust	1.3125"	.341-.3405"	4.9375"	45°	.3195"

Model 57A, 64, 67 (1933-34) Specifications

Intake	1.375"	.341-.3405"	4.894"	45°	.3145"
Exhaust	1.350"	.341-.3405"	4.894"	45°	.3195"

Tappet Clearance—.010" (all valves—engine hot).

Valve Springs:—Double springs used on first Model 57 cars. Can be replaced by new type single spring used on later models.

	Spring Pressure	Spring Length
Valve Closed	47½-52½ lbs.	2 3/16"
Valve Open	103-109 lbs.	1⅞"

Valve Timing

Intake Valves Open—AT TDC. Close—40° ALDC.
Exhaust Valves Open—40° BLDC. Close—10° ATDC.

To Check Valve Timing—Set tappet clearance #8 exhaust valve at .012". This valve should close with piston 10° past top dead center when flywheel mark 'EC-1' lines up with pointer in inspection hole in right hand front face of flywheel housing. Reset tappet clearance at .010".

Motor Gauge—Weidenhoff Adapter #102. Rod #40 (67), #2 (all others).

Lubrication:—Pressure type. Gear type oil pump located in crankcase.

Normal Oil Pressure—50 lbs. at 30 M.P.H.

Oil Pressure Relief Valve—Operates at 50 lbs. Located under plug on side of crankcase (oil pressure signal switch built in regulator case). Adjustable by adding or removing shims or washers above relief valve spring under plug.

Capacity and Oil—6 qts. Use SAE. #50 (summer above 70°F.), #40 (summer 40° to 70°F.), #30 (winter 20° to 40° F.), #20-W (winter 0° to 20°F.).

CLUTCH:—**Long Model 9-AB.** Single plate, dry disc type. See article in Clutch Section for complete relining and assembling instructions.

Facings—Moulded type, 2 required. Thickness 9/64". (.137"). Inside Diameter 5½". Outside Diameter 9¾".

Adjustment—Free movement of clutch pedal should be 1". Adjust when this decreases to ½". To adjust, loosen locknut and back off adjusting setscrew at lower end of pedal.

STEERING:—**Steering Gear**—Ross Cam-and-Roller type. See article in Steering Section for complete adjustment instructions.

Front Suspension:—Conventional 'I' beam section front axle with Reverse Elliott ends and outboard mounted semi-elliptic springs.

Kingpin Inclination—7° crosswise.

Caster—1½°. Adjust by inserting wedge shims between spring and spring pad on axle.

Camber—1½°. No adjustment provided.

Toe In—⅛-3/16". Adjust in usual manner by loosening clamp bolts and turning tie rod.

BRAKES:—**Service**—Lockheed Hydraulic, double anchor type. See article in Brake Section for complete adjustment instructions.

Drum Diameter—13".

Lining—Moulded type (1932), Woven type (1933-34). Width 2". Thickness 3/16". Length 27¾" per wheel.

Clearance—.012" toe, .006" heel for each shoe.

Hand Brake:—External type on drum at rear of transmission.

Adjustment—Place lever in released position, turn up anchor adjusting screw until clearance at this point 1/32". Loosen locknut and turn nut on guide bolt until clearance at lower end of band is 1/32". Turn adjusting nut at top of adjusting bolt until clearance is 1/32". Clearance must be uniform around band.

Drum Diameter—6".

Lining—Width 2". Thickness 5/32". Length 18 9/16".

ENGINE NUMBER: — First number, 1,705,001. On plate on left hand side of crankcase and on chassis serial number plate.

ENGINE:—Own. Model 74. Six cylinder, 'L' head type.

Bore—3". Stroke—4".

Piston Displacement—169.6 cubic inches.

Rated Horsepower—21.6 A.M.A.

Developed Horsepower—60 at 3500 R.P.M.

Compression Ratio—5.8-1 Std. cast-iron head, 6.87-1 optl. aluminum head.

Compression Pressure—95-100 lbs. (5.8-1 head), 115 lbs. (6.87-1 head) at 50 R.P.M.

Vacuum Reading—Gauge should show steady reading of 18-20" with engine idling.

Pistons:—Bohn Bohnalite, aluminum alloy, Invar strut, split skirt type. Length—3 41/64".

Weight—14 ounces. Held to 2 gram variation.

Removal—Pistons and rods removed from below.

Clearance—Skirt .002" see Fitting Pistons.

Fitting New Pistons—Use .002" feeler stock ½" wide inserted between piston and cylinder wall on side opposite slot. Pull required to withdraw feeler should be within 10-17 lbs.

Installing Pistons—Slot should be toward left or away from valves.

Piston Rings:—Two compression, one oil control ring per piston, all above pin. Lower ring groove drilled radially with eight 9/64" oil drain holes.

Ring	Width	End Gap
Comp. all	⅛"	.005-.010"
Oil Cont.	3/16"	.005-.010"

Piston Pin:—Diameter 13/16". Length 2 9/16". Pin is locked in the connecting rod.

Pin Clearance in Piston—.0001" or push fit.

Connecting Rod:—Length 7" (center-to-center).

Crankpin Journal Diameter—1 15/16".

Lower Bearing Type—Interchangeable, steel-backed, cadmium-nickel lined type, no shims.

Clearance—.001-.0025". Sideplay .005-.008".

Adjustment—None (no shims). Replace bearings.

Installing Rods—Oil hole in upper side of rod lower bearing must be toward right or camshaft side of engine on all rods.

Crankshaft:—Four bearings. Integral counterweights.

Journal Diameters—2¼" all bearings.

Bearing Type — Interchangeable, steel-backed, cadmium nickel-lined type.

Clearance—.001-.0027".

Adjustment—None (no shims). Replace bearings.

End Thrust—Taken by front bearing. Endplay .004-.006".

Camshaft:—Four bearing. Non-adjustable chain drive.

Bearing Type—#1 and 4 steel-backed, babbitt-lined type. #2 and 3 are cast-iron.

Clearance—#1 and 4—.0015-.002". #2 and 3—.002-.003".

End Thrust—Taken by spring-loaded plunger in camshaft sprocket and thrust plate on chain case cover.

Timing Chain—Link Belt. Width 1". Pitch ½". Length 23" or 46 links.

Camshaft Setting—Sprockets are marked. Mesh chain so that there are nine links or ten teeth (inclusive) between marks on sprockets.

Valves:—

	Head Diameter.	Stem Diameter.	Length.
Intake	1 33/64"	3125"	5 3/16"
Exhaust	1 13/64"	3125"	5 3/16"

	Seat Angle	Lift	Stem Clearance
Intake	30°	9/32"	.001-.0026"
Exhaust	30°	9/32"	.002-.0036"

Tappet Clearance—.010" all valves — engine hot.

Valve Springs	Spring Pressure	Length
Valve Closed	32.2-34.2 lbs.	1 21/32".
Valve Open	71-75 lbs.	1 3/8".

Valve Timing—See Camshaft Setting above.
Intake Valves—Open 2° BTDC. Close 42° ALDC.
Exhaust Valves—Open 42° BLDC. Close 8° ATDC.

To Check Valve Timing—Set tappet clearance #1 exhaust valve at .012". This valve should close with piston #1 .025" past top dead center when flywheel mark 'EC-1' lines up with indicator in right front face of flywheel housing. Reset tappet clearance at .010" with engine hot.

Motor Gauge—Weidenhoff Adapter #102, Rod #2.

Lubrication:—Pressure. Gear type oil pump located in crankcase.

Normal Oil Pressure—50 lbs. at 30 M.P.H.

Oil Pressure Relief Valve—Operates at 40-45 lbs. Located within crankcase. Adjustable by adding or removing shims or washers in plug above spring.

Capacity & Oil—5 qts. Use SAE. #50 (summer above 70°F), #40 (summer 40° to 70°F), #30 (winter 20° to 40°F), #20-W (winter 0° to 20°F).

CLUTCH:—Illinois. Single plate, dry disc type. Clutch consists of pressure plate assembly bolted directly to flywheel by six capscrews in release lever mounting brackets. Adjusting shims located between bracket and face of flywheel (see clutch pedal adjustment for details of shims).
See article in Mechanical Equipment Section for data.

Clutch Pedal Adjustment—Free movement of clutch pedal must be 1-1¼". To adjust, take out cotter pin at either end of clutch pedal connecting link, turn turnbuckle to secure correct lash, replace cotter pin, tighten turnbuckle locknut. When limit of adjustment is reached, loosen two capscrews in each clutch mounting bracket slightly, pull out shim under bracket (shim holes are slotted — not necessary to take out capscrews completely), tighten bracket screws. This will provide new range of adjustment on connecting link. Shims can be discarded. New shims of correct thickness are supplied with new driven plate.

Clutch Facings—Manufacturer recommends that no attempt be made to reline driven plate in the field as it is important that driven plate thickness under pressure be maintained accurately. Driven plate with new facings are furnished with new shims of correct thickness. These shims should be installed under bracket mounting screws.

Clutch Facings—Moulded type, 2 required, 5⅛" I.D., 7⅞" O.D., ⅛" thick.
NOTE:—Release levers are pivoted on eccentric pins which are correctly positioned and peened in place when clutch is assembled. Levers and pins should not be disturbed.

STEERING:—Front Suspension — Conventional 'I' beam section front axle with Reverse-Elliott ends and outboard-mounted semi-elliptic springs.

Kingpin Inclination—7½° crosswise.

Caster—2½°. Use wedge shims inserted between spring and spring pad on axle to correct caster.

Camber—1°.

Toe In—⅛". Adjust in usual manner by changing length of tie rod.

Steering Gear:—Cam-and-Lever type. See article in Steering Section for adjustments.

BRAKES:—Service—'Graham' Hydraulic, double anchor type. Hand lever applies rear wheel service brakes. See article in Brake Section for complete adjustment procedure.

Drum Diameter—9".

Lining—Moulded type. Width 1¾". Thickness .200". Length per wheel 18".

Clearance—.008" between lining and drum.

Hand Brake Adjustment:—See Service Brakes.

ENGINE NUMBER:—First number, 1,640,001. On plate on right hand side of crankcase and on chassis serial number plate.

ENGINE:—**Own, Model 73.** Six cylinder, 'L' head type.
Bore—3¼". **Stroke**—4½".
Piston Displacement—224 cubic inches.
Rated Horsepower—25.35 A.M.A.
Developed Horsepower—85 at 3400 R.P.M.
Compression Ratio—6.5-1. Std. aluminum head.
Compression Pressure—105 lbs. at cranking speed (60 R.P.M.).
Vacuum Reading—Gauge should show steady reading of 18-20" with engine idling.

Pistons:—Bohn Bohnalite, aluminum alloy, Invar strut, split skirt type. Length, 3 23/32".
Weight—17 ozs. Held to 2 gram variation.
Removal—Pistons and rods removed from below.
Clearance—Top .020". Skirt .002". See Fitting Pistons.
Fitting New Pistons—Use .002" feeler stock ½" wide inserted between piston and cylinder wall on side opposite slot. Pull required to withdraw feeler should be between 10-16 lbs.
Installing Pistons—Slot should be toward left or camshaft side of engine.

Piston Rings:—Two compression, one oil control ring per piston, all above pin. Lower ring groove drilled radially with eight 9/64" oil drain holes.

Ring	Width	End Gap	Wall Thickness
Comp. All	⅛"	.007-.015"	.145"
Oil Cont.	3/16"	.010-.015"	.145"

Piston Pin:—Diameter 13/16". Length 2 13/16". Pin is locked in the connecting rod.
Pin Clearance in Piston—.0001" or push fit.

Connecting Rod:—Weight 34¼ ozs. Length 9¼".
Crankpin Journal Diameter—2¼".
Lower Bearing Type—Spun babbitt-lined type.
Clearance—.002". Sideplay .005".
Adjustment—Laminated shims provided. Do not file rods or bearing caps.
Installing Rods—Oil hole in upper side of rod lower bearing must be toward right or away from camshaft on all rods.

Crankshaft:—Seven bearing. Crankshaft is machined and crank throws bored out to reduce rotating weight (no counterweights).
Journal Diameters—2 47/64" all bearings.
Bearing Type—Interchangeable, steel-backed, babbitt-lined, except #1—bronze-backed, babbitt-lined type.
Clearance—.002".
Adjustment—None (no shims). Replace bearings.
End Thrust—Taken by front bearing. Endplay .004-.006".

Camshaft:—Four bearing. Non-adjustable chain drive.
Bearing Type—Babbitt-lined.
Clearance—.001-.0025" on diameters.
End Thrust—Taken by spring-loaded plunger in camshaft sprocket and thrust plate on chain case cover.
Timing Chain—Link Belt. Width 1". Pitch .500". Length 26" or 52 links.
Camshaft Setting—Sprockets are marked. Mesh chain so that there are exactly 10 links or 11 teeth (inclusive) between marks on sprockets.

Valves:—	Head Diameter	Stem Diameter	Length
Intake	1 9/16"	.341"	5½"
Exhaust	1 15/32"	.341"	5½"

	Seat Angle	Lift	Stem Clearance
Intake	30°	.3125"	.001"
Exhaust	45°	.3175"	.001"

Tappet Clearance—.010" all valves, engine hot.

Valve Springs	Spring Pressure	Length
Valve Closed	50-55 lbs.	2 3/16"
Valve Open	94-99 lbs.	1⅞"

Valve Timing—See Camshaft Setting above.
Intake Valves—Open at TDC. Close 40° ALDC.
Exhaust Valves—Open 40° BLDC. Close 10° ATDC.

To Check Valve Timing—Set tappet clearance #1 exhaust valve at .012". This valve should close with piston #1 .0422" past top dead center when flywheel mark 'EC-1' lines up with indicator in inspection hole in right front face of flywheel housing. Reset tappet clearance at .010" with engine hot.
Motor Gauge—Weidenhoff Adapter #102, Rod #2.

Lubrication:—Pressure. Gear type oil pump located in crankcase.
Normal Oil Pressure—50 lbs. at 30 M.P.H.
Oil Presure Relief Valve—Operates at 40-45 lbs. Located under plug on right side of crankcase. Adjustable by adding or removing shims or washers in plug above spring.
Capacity and Oil—6 qts. Use SAE. #50 (summer above 70°F.), #40 (40° to 70°F.), #30 (winter 20° to 40°F.), #20-W (winter 0° to 20°F.).

CLUTCH:—**Long Model 9AB-M.** Single plate, dry disc type. No adjustment for wear required.
See article in Mechanical Equipment Section for data.
Clutch Pedal Adjustment—Free movement of clutch pedal should be 1¼". Adjust whenever free movement has decreased to ½". To adjust, turn set screw at lower end of clutch pedal (unscrew to increase free movement).
Clutch Facings—Moulded type, 2 required, 5¾" I.D., 9" O.D., 9/64" thick.

STEERING:—**Front Suspension**—Conventional 'I' beam section front axle with Reverse-Elliott ends and outboard-mounted semi-elliptic springs.
Kingpin Inclination—7° crosswise.
Caster—2°. Use wedge shims inserted between spring and spring pad on axle to correct caster.
Camber—1°.
Toe In—⅛". Adjust in usual manner by changing length of tie rod.

Steering Gear:—Ross Cam-and-Lever type. See article in Steering Section for adjustments.

BRAKES:—**Service**—Lockheed Hydraulic, double anchor type. Hand lever applies brake at rear of transmission. See article in Brake Section for complete adjustment procedure.
Drum Diameter—11".
Lining—Moulded type. Width 1¾". Thickness ¼". Length per wheel 24".
Clearance—.006" heel, .012" toe, between lining and drum for each shoe.

Hand Brake:—External type on drum at rear of transmission.
Adjustment—With lever in released position, remove anchor screw locking wire, turn anchor screw to give 1/32" clearance betwen lining and drum, lock anchor screw with wire. Adjust brake band bolt nut to give 1/32" clearance for lower half of band, secure with locknut. Finally, adjust brake adjusting bolt nut to give 1/32" clearance (as above) for upper portion of band.
Drum Diameter—6".
Lining—Width 2". Thickness 5/32". Length 18 9/16".

ENGINE NUMBER:—First number, 1,815,001. On plate on right side of crankcase and on chassis serial number plate.

ENGINE:—**Own Model 72.** Eight cylinder, In Line, 'L' head type.
Bore—3⅛". Stroke—4".
Piston Displacement—245.4 cubic inches.
Rated Horsepower——31.25 A.M.A.
Developed Horsepower—95 at 3400 R.P.M.
Compression Ratio—6.7-1. Std. aluminum head.
Compression Pressure—115 lbs. at cranking speed (60 R.P.M.).
Vacuum Reading—Gauge should show steady reading of 18-20" with engine idling.

Pistons:—Bohn, Bohnalite, aluminum alloy, Invar strut, split skirt type. Length 3 19/32".
Weight—16 ounces. Held to 2 gram variation.
Removal—Pistons and rods removed from below.
Clearance—Top .025". Skirt .002" (see Fitting Pistons).
Fitting New Pistons—Use .002" feeler stock ½" wide to check clearance. Pull required to withdraw feeler from between piston and cylinder wall on side opposite slot must be between 10-16 lbs.
Installing Pistons—Slot should be toward left or on camshaft side of engine.

Piston Rings:—Two compression, one oil control ring per piston, all above pin. Lower ring groove drilled radially with eight 9/64" oil drain holes.

Ring	Width	End Gap	Wall Thickness
Comp. All	⅛"	.010-.015"	.140"
Oil Cont.	3/16"	.007-.015"	.140"

Piston Pin:—Diameter 13/16". Length 2⅝". Pin is locked in the connecting rod.
Pin Clearance in Piston—.0001" or push fit.

Connecting Rod:—Weight 30¾ ozs. Length 8⅝".
Crankpin Journal Diameter—2⅛".
Lower Bearing Type—Spun babbitt-lined type.
Clearance—.002". Sideplay .005".
Adjustment—Laminated shims provided. Do not file rods or caps.
Installing Rods—Oil hole in upper side of rod lower bearing must be toward right or away from camshaft on all rods.

Crankshaft:—Five bearing. Lanchester vibration dampener.
Journal Diameter—2⅜" all bearings.
Bearing Type—Interchangeable bronze-backed, babbitt-lined type. No shims.
Clearance—.002".
Adjustment—None (no shims). Replace bearings.
End Thrust—Taken by front bearing. Endplay .006".

Camshaft:—Six bearing. Adjustable chain drive.
Bearing Type—Babbitt-lined type.
Clearance—.0015-.002".
End Thrust—Taken by spring-loaded plunger in camshaft gear and thrust plate on chain case cover.
Timing Chain—Link Belt. Width 1¼". Pitch ½". Length 33⅛" or 67 links.
Chain Adjustment—Chain adjusted by shifting accessory sprocket (water pump bracket). To adjust, loosen two flange mouting screws, back off adjustment set screw lock nut, turn up adjustment set screw until chain hums with engine running, back off screw until chain runs noiselessly, tighten lock nut and mounting screws.
Camshaft Setting—Sprockets are marked. Mesh chain so there are exactly ten links between marks on sprockets or eleven teeth inclusive of teeth meshed opposite marks.

Valves:—	Head Diameter	Stem Diameter	Length
Intake	1⅜"	.341"	4⅞"
Exhaust	1¼"	.341"	4⅞"

	Seat Angle	Lift	Stem Clearance
Intake	45°	.3145"	.001"
Exhaust	45°	.3195"	.001"

Tappet Clearance—.010" all valves—engine hot.

Valve Springs—	Spring Pressure	Length
Valve Closed	50 lbs.	2 3/16"
Valve Open	106 lbs.	1⅞"

Valve Timing—See Camshaft Setting above.
Intake Valves—Open at TDC. Close 40° ALDC.
Exhaust Valves—Open 40° BLDC. Close 10° ATDC.
To Check Valve Timing—Set tappet clearance #1 exhaust valve at .012". This valve should close with piston #1 .037" past top dead center when flywheel mark 'EC-1' lines up with pointer in inspection hole in right hand front face of flywheel housing. Reset tappet clearance at .010" with engine hot.
Motor Gauge—Weidenhoff Adapter #102, Rod #40.

Lubrication:—Pressure. Gear type oil pump located in crankcase.
Normal Oil Pressure—50 lbs. at 30 M.P.H.
Oil Pressure Relief Valve—Operates at 40-50 lbs. Located under plug on side of crankcase. Adjustable by adding or removing shims or washers in plug above spring.
Capacity and Oil—7 qts. Use SAE. #50 (summer above 70°F.), #40 (summer 40° to 70°F.), #30 (winter 20° to 40°F.), #20-W (winter 0° to 20°F.).

CLUTCH:—**Long Model 9AB-M.** Single plate, dry disc type. No adjustment required for wear.
See article in Mechanical Equipment Section for data.
Clutch Pedal Adjustment—Free movement of clutch pedal should be 1¼". Adjust whenever free movement has decreased to ½". To adjust, turn set screw at lower end of clutch pedal (unscrew to increase free movement).
Clutch Facings—Moulded type, 2 required, 5½" I.D., 9¾" O.D., 9/64" thick.

STEERING:—Front suspension—Conventional 'I' beam section front axle with Reverse-Elliott ends and outboard-mounted semi-elliptic springs.
Kingpin Inclination—7° crosswise.
Caster—2°. Use wedge shims inserted between spring and spring pad on axle to correct caster.
Camber—1°.
Toe In—⅛". Adjust in usual manner by changing length of tie rod.
Steering Gear:—Ross Cam-and-Lever type. See article in Steering Section for adjustments.

BRAKES:—**Service**—Lockheed Hydraulic, double anchor type. Hand lever applies brake at rear of transmission. See article in Brake Section for complete adjustment procedure.
Drum Diameter—13".
Lining—Moulded type. Width 2". Thickness 3/16". Length per wheel 26".
Clearance—.006" heel, .012" toe, between lining and drum for each shoe.
Hand Brake:—External type on drum at rear of transmission.
Adjustment—With lever in released position, remove anchor screw locking wire, turn anchor screw to give 1/32" clearance betwen lining and drum, lock anchor screw with wire. Adjust brake band bolt nut to give 1/32" clearance for lower half of band, secure with locknut. Finally, adjust brake adjusting bolt nut to give 1/32" clearance (as above) for upper portion of band.
Drum Diameter—6".
Lining—Woven type. Width 2". Thickness 5/32". Length 18 9/16".
Clearance—1/32". See Hand Brake Adjustment (above).

ENGINE NUMBER:—First number—1,030,001 (67, 69), 1,040,001 (75). On plate on right hand side of crankcase.

ENGINE:—Own Make. Eight cylinder, In Line, 'L' head type. Engine is supercharged. Centrifugal type supercharger located between carburetor and manifold (downdraft carburetor is mounted on top of supercharger housing). No special directions required for servicing this engine.
Bore—3¼". **Stroke—4".**
Piston Displacement—265.4 cubic inches.
Rated Horsepower—33.8 A.M.A.
Developed Horsepower—135 (67, 69), 140 (75) at 4000 R.P.M.
Compression Ratio—6.7-1 Std. aluminum head.
Compression Pressure—120 lbs. at cranking speed (60 R.P.M.).
Vacuum Reading—Gauge should show steady reading of 18-20" with engine idling.

Pistons:—Bohn Bohnalite, aluminum alloy, Invar strut, split skirt type. Length 3 23/32".
Weight—17 ounces. Held to 2 gram variation.
Removal—Pistons and rods removed from below.
Clearance—Skirt .002". See Fitting Pistons.
Fitting New Pistons—Use .002" feeler stock ½" wide to check clearance. Pull required to withdraw feeler from between piston and cylinder wall on side opposite slot must be between 10-16 lbs.
Installing Pistons—Slot should be toward left or camshaft side of engine.

Piston Rings:—Two compression, one oil control ring per piston, all above pin. Lower ring groove drilled radially with eight 9/64" oil drain holes.

Ring	Width	End Gap	Wall Thickness
Comp. All	⅛"	.010-.015"	.145"
Oil Cont.	3/16"	.007-.015"	.145"

Piston Pin:—Diameter 13/16". Length 2 13/16". Pin is locked in the connecting rod.
Pin Clearance in Piston—.0001" or push fit.

Connecting Rod:—Weight 30¾ ozs. Length 8⅝".
Crankpin Journal Diameter—2⅛".
Lower Bearing Type—Spun-babbitt lined type.
Clearance—.002". Sideplay .005".
Adjustment—Laminated shims provided. Do not file rods or caps.
Installing Rods—Oil hole in upper side of rod lower bearing must be toward right or away from camshaft on all rods.

Crankshaft:—Five bearing. Lanchester vibration dampener.
Journal Diameter—2½" (67, 69), 2⅜" (75) all bearings.
Bearing Type—Interchangeable bronze-backed, babbitt-lined type. No shims.
Clearance—.002".
Adjustment—None (no shims). Replace bearings.
End Thrust—Taken by front bearing. Endplay .006".

Camshaft:—Six bearing. Adjustable chain drive.
Bearing Type—Babbitt-lined type.
Clearance—.0015-.002".
End Thrust—Taken by spring-loaded plunger in camshaft gear and thrust plate on chain case cover.
Timing Chain—Link belt. Width 1½". Pitch ½". Length 34" or 68 links.
NOTE—On first 100 engines, chain length 67 links.
Chain Adjustment—Chain adjusted by shifting accessory sprocket (water pump bracket). To adjust, loosen two flange mounting screws, back off adjutsment setscrew locknut, turn up adjustment setscrew until chain hums with engine running, back off screw until chain runs noiselessly, tighten locknut and mounting screws.
Camshaft Setting—Sprockets are marked. Mesh chain so there are exactly ten links between marks on sprockets ar eleven teeth inclusive of teeth meshed opposite marks.

Valves:—	Head Diam.	Stem Diam.	Length
Intake	1½"	.341"	4⅞"
Exhaust	1⅜"	.341"	4⅞"

	Seat Angle	Lift	Stem Clearance
Intake	45°	.3145"	.001"
Exhaust	45°	.3195"	.001"

Tappet Clearance—.010" all valves—engine hot.

Valve Springs—	Spring Pressure	Length
Valve Closed	50 lbs.	2 3/16"
Valve Open	106 lbs.	1⅞"

Valve Timing—See Camshaft Setting above.
Intake Valves—Open at TDC. Close 40° ALDC.
Exhaust Valves—Open 40° BLDC. Close 10° ATDC.
To Check Valve Timing—Set tappet clearance #1 exhaust valve at .012". This valve should close with piston #1 .037" past top dead center when flywheel mark 'EC-1' lines up with pointer in inspection hole in right hand front face of flywheel housing. Reset tappet clearance at .010" with engine hot.
Motor Gauge—Weidenhoff Adapter #104, Rod #40.

SUPERCHARGER:—Centrifugal type. Carburetor mounted directly on top of case (Supercharger blower between carburetor and engine).
See article in Mechanical Equipment Section for data.

Supercharger Drive:—Through a flexible coupling by an extension of the water pump shaft.
Chain Adjustment—Chain adjusted by shifting accessory sprocket (water pump bracket). To adjust, loosen flange mounting screws, back off adjustment setscrew locknut, turn up adjustment setscrew until chain hums with engine running, back off screw until chain runs noiselessly, tighten locknut and mounting screws. This is the only adjustment necessary for supercharger operation.

Lubrication:—Pressure. Gear type oil pump located in crankcase.
Normal Oil Pressure—50 lbs. at 30 M.P.H.
Oil Pressure Relief Valve—Operates at 40-45 lbs. Located under plug on side of crankcase. Adjustable by adding or removing shims or washers in plug above spring.
Crankcase Capacity—6 quarts (67, 69), 7 qts. (75).

CLUTCH:—Long Model 9AB-M. Single plate, dry disc type. No adjustment required for wear.
See article in Mechanical Equipment Section for data.
Clutch Pedal Adjustment—Free movement of clutch pedal should be 1¼". Adjust whenever free movement has decreased to ½". To adjust, turn setscrew at lower end of clutch pedal (unscrew to increase free movement).
Clutch Facings—Moulded type, 2 required, 5½" I.D., 9¾" O.D., 9/64" thick.

STEERING:—Front Suspension—Conventional 'I' beam section front axle with Reverse-Elliott ends and outboard-mounted semi-elliptic springs.
Kingpin Inclination—7° crosswise.
Caster—1½° (67, 69), 2° (75). Use wedge shims inserted between spring and spring pad on axle to correct caster.
Camber—1½° (67, 69), 1° (75).
Toe In—⅛-3/16". Adjust by loosening clamp bolts at either end of tie rod and turning rod.

Steering Gear:—Ross Model, Cam-and-Lever type.
See article in Mechanical Equipment Section for data.

BRAKES:—Service—Lockheed Hydraulic, double anchor type. Hand lever applies brake at rear of transmission. See article in Brake Section for complete adjustment procedure.
Drum Diameter—13".
Lining—Moulded type. Width 2". Thickness 3/16". Length per wheel 27¾" (67, 69), 26" (75).
Clearance—.006" heel, .012" toe, between lining and drum for each shoe.

Hand Brake:—External type on drum at rear of transmission
Adjustment—With lever in released position, remove anchor screw locking wire, turn anchor screw to give 1/32" clearance betwen lining and drum, lock anchor screw with wire. Adjust brake band bolt nut to give 1/32" clearance for lower half of band, secure with locknut. Finally, adjust brake adjusting bolt nut to give 1/32" clearance (as above) for upper portion of band.
Drum Diameter—6".
Lining—Woven type. Width 2". Thickness 5/32". Length 18 9/16".
Clearance—1/32". See Hand Brake Adjustment (above).

ENGINE NUMBER:—First number 305,001 (80, 80A), 320,001 (85). Stamped on plate on right side of engine and on serial number plate.

ENGINE SPECIFICATIONS:—6 cylinder, 'L' head.
Bore—3". **Stroke**—4".
Displacement—169.6 cubic inches.
Rated Horsepower—21.6 (AMA).
Developed Horsepower—70 at 3500 R.P.M.
Compression Ratio—6.7-1 Std. 7.0-1 Optl.
Compression Pressure—130 lbs. at cranking speed.
Vacuum Reading—Gauge should show steady reading of 15-17" with engine idling at 5-7 M.P.H.

PISTONS:—Bohn Bohnalite, aluminum alloy, Invar strut, split skirt type.
NOTE—1937 pistons are plated (bearing metal bearing surface).
Length—3 11/16".
Weight—14 ozs. Held to two gram variation.
Removal—Pistons and rods removed from above.
Clearance—Skirt .002". See Fitting New Pistons.
Replacement Pistons:—Finished replacement pistons furnished 2.997" to 3.006" (in .001" steps), 3.006" to 3.022" (in .002" steps) and 3.030" oversizes.
NOTE—Piston size stamped on head of piston.
Fitting New Pistons:—Use .002" feeler ½" wide inserted between piston and cylinder wall on side opposite slot. Pull required to withdraw feeler should be 10-15 lbs.
Installing New Pistons:—Slot should be toward left or away from valves (on opposite side from head of piston pin clamp screw and oil hole in lower end of rod).

PISTON RINGS:—Two compression, one oil control ring per piston, all above pin. Lower ring groove drilled radially with eight 9/64" oil drain holes.
NOTE—Oil ring groove depth increased from .161" to .175" on 85, after engine number 320586.

Ring	Width	End Gap
Comp. all	⅛"	.008-.012"
Oil Cont.	3/16"	.008-.012"

NOTE—Side clearance for all rings .0015" min.
NOTE—Oil ring is #X-90 (with inner ring).
Replacement Rings:—Rings furnished standard and .010", .020", .030" oversize (Compression), standard and .020" oversize only (X-90 oil ring).

PISTON PIN:—Diameter 13/16". Length 2⅜".
Pin is locked in connecting rod with clamp screw.
Pin Fit in Piston—.0005" clearance (hand push fit).
Replacement Pins:—Pins furnished standard and .002", .005", .010" oversizes.
NOTE—Pin oiled by four 5/32" oil holes in upper part of piston bosses.

CONNECTING ROD:—Length 7". Bearing caps dowelled on rods and held by capscrews in blind tapped holes.
Crankpin Journal Diameter—1 15/16".
Lower Bearing—Removable steel-backed, cadmium-silver lined type.
Clearance—.002". **Sideplay**—.004-.006".
Bearing Adjustment:—None (no shims). Replace bearings. New bearings should be tight with .002" feeler 1" long installed under cap (cap can be sanded on face plate to secure this fit). Install new bearings with tang engaging groove in rod and cap.
Installing Rods:—Lower bearings are offset. Install rods with widest half of bearing toward rear (#1, 3, 5) and toward front (#2, 4, 6). Oil hole in lower bearing upper half must be toward camshaft on all rods.
NOTE—Head of piston pin clamp screw should be toward camshaft on all rods.

CRANKSHAFT:—4 bearing. Integral counterweights.
Journal Diameters—2¼" (all bearings).
Bearing Type—Removable steel-backed, cadmium-silver lined.
Clearance—.002".
Bearing Adjustment & Replacement:—*See Graham Special Shop Notes for Main Bearing Servicing.*
End Thrust:—Taken by thrust plate at front (#1) bearing. Adjusted by adding or removing shims. Endplay .004-.006".

CAMSHAFT:—4 bearing. Non-adjustable chain drive.
Journal Diameters—#1, 1⅞"; #2, 1 13/16"; #3, 1¾"; #4, 1¼".
Bearing Type—Bronze.
End Thrust:—Taken by spring-loaded plunger in forward end of camshaft.
NOTE—Make certain that plunger and spring are in place when installing chain case cover.
Timing Chain:—Link-Belt. Width 1". Pitch .500". Length 23" or 46 links.
Camshaft Setting:—Sprockets are marked. Mesh chain so there are exactly 9 links between marks on sprockets or 10 pins inclusive of pins meshed opposite marks.

VALVES:

	Head Diameter	Stem Diameter	Length
Intake	1 33/64"	.3145"	4 61/64"
Exhaust	1 13/64"	.3135"	4 61/64"

	Seat Angle	Lift	Stem Clearance
Intake	30°	5/16"	.001-.0026"
Exhaust	45°	5/16"	.002-.0036"

Tappet Clearance—.010" all valves. Engine hot.
Valve Guides:—Length 2¾". Finished inside diameter .3164" for all guides. Guides counterbored to .329" for 11/32" at upper end.
Valve Springs:—Free length 1 15/16".

	Spring Pressure	Spring Length
Valve Closed	36 lbs.	1 21/32"
Valve Open	87 lbs.	1 3/8"

Valve Lifters:—Single piece cast-iron, cylindrical type 1" diameter. Lifter guides 1 21/32" long, integral with block. Finished to give .0005-.0015" clearance for lifters.
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 4½° BTDC. Close 47½° ALDC.
Exh. Valves—Open 47½° BLDC. Close 4½° ATDC.
To Check Valve Timing—Set tappet clearance #1 exhaust valve at .012". This valve should close with #1 piston .0079" past top dead center when flywheel mark 'EC-1' lines up with indicator in right front face of flywheel housing. Reset tappet clearance at .010" with engine hot.
Motor Gauge—Weidenhoff Adapter #114, Rod #2.

LUBRICATION:—Pressure. Gear type oil pump located in crankcase.
NOTE—Ignition timing should be checked whenever oil pump is installed in engine.
Normal Oil Pressure:—40 lbs. at 30 M.P.H.
Oil Pressure Regulator:—Mounted on right hand side of crankcase. Opens at 50 lbs. Adjusted by adding or removing shims or washers above spring within cover plug.
Crankcase Capacity:—5 quarts (refill).

CLUTCH:—Illinois (All '36 and first '37 models). Long Model 9CF-CS (Later '37 models). Single plate, dry disc type. Long clutch is semi-centrifugal type.
See article in Mechanical Equipment Section for data.
Facings (Illinois)—Moulded type, 2 required. Inside Diameter 5⅛". Outside Diameter 7⅞". Thickness ⅛".
Facings (Long)—Woven type, 2 required. Inside Diameter 5¾". Outside Diameter 9". Thickness .125".
Adjustment—Free movement of clutch pedal must be 1¼". To adjust, take out cotter pin at each end of clutch pedal connecting link, turn turnbuckle to secure correct lash, replace cotter pin, tighten turnbuckle locknut.
NOTE—On Illinois clutch when adjustment limit reached, loosen two capscrews in clutch mounting bracket slightly (reached through hand opening in bottom of clutch bell housing), pull out shim under bracket (shim holes are slotted—not necessary to take out capscrews completely), tighten bracket screws. This will provide new range of adjustment on connecting link. Shims can be discarded. New shims of correct thickness are supplied with new driven plate.
Removal:—Remove transmission (see Transmission Section below), remove clutch bell housing, take out clutch bracket mounting bolts (Illinois) or clutch housing mounting screws, turning all screws out evenly to avoid distorting cover (Long).

TRANSMISSION:—Warner Model AS4-TC84C (1937). Helical gear, constant mesh, synchro-mesh (second and high), sliding spur gear (low and reverse).
See article in Mechanical Equipment Section for data.
Removal:—Disconnect drive shaft front and rear universals, hand brake linkage and clutch linkage. Support engine at rear, remove rear engine mounting, take out transmission mounting bolts, pull transmission straight back and remove.

UNIVERSAL JOINTS:—Spicer. Needle bearing type, 2 used.
See article in Mechanical Equipment Section for data.

REAR AXLE:—Spicer. Semi-floating, spiral bevel gear type with Hotchkiss drive.
See article in Mechanical Equipment Section for data.
Ratio—4.54-1 Std. 4.9-1 Optional.
Backlash—.004-.008". Shim adjustment.
Removal:—Jack up rear of car, remove wheels, disconnect brake line and brake cables, disconnect rear shock absorbers, disconnect drive shaft at rear universal, take off spring bolts at axle housing, disconnect rear spring rear shackles, remove axle assembly.
Wheel Bearing Adjustment—Before No. 315202 (std. ratio), 315529 (optl. ratio)—Jack up car, remove wheel and hub assembly, disconnect brake line, take out bolts and remove oil seal and backing plate. Remove shims between backing plate and axle housing flange until axle shaft clearance at thrust block in differential housing is .002-.007" total.
Adjustment (After No. 315202 or 315529)—No adjustment (New Departure sealed bearings used).

SHOCK ABSORBERS:—Delco. Direct acting, hydraulic type. 1937 (Delco) Model Nos. 1165-L (frt.), 1165-K (rear).
See article in Mechanical Equipment Section for data.

STEERING:—Steering Gear—Ross Model S-14. Cam-and-Lever type.
See article in Mechanical Equipment Section for data.
Front Suspension:—Conventional 'I' beam section front axle with Reverse-Elliott ends and semi-elliptic springs.
Kingpin Inclination—7½° crosswise.
Caster—4½-5½°. Use wedge shims inserted between spring pad on axle to correct caster.
Camber—1°. Axle can be bent cold for minor corrections.
Toe In—⅛-3/16". Adjust in usual manner by changing length of tie rod.

BRAKES:—Service—'Graham' Hydraulic, double anchor type. Hand lever applies rear wheel service brakes.
See article in Mechanical Equipment Section for data.
Drum Diameter—9".
Lining—Moulded type. Width 1¾". Thickness 3/16". Length 18" per wheel.
Hand Brake:—See Service Brake (above).

ENGINE NUMBER:—First number—205,001 (90), 210,001 (90-A), 105,001 (110). On plate on right side of crankcase and on chassis serial number plate.

ENGINE SPECIFICATIONS:—6 cylinder, 'L' head.
Bore—3¼". **Stroke**—4" (90-A), 4⅜" (90, 110).
Displacement—199.1 cu. in. (90A), 217.8 cu. in. (90, 110).
Rated Horsepower—25.35 (AMA).
Developed Horsepower—90 (85 @ 3300 R.P.M.), 90-A (80 @ 3300 R.P.M.), 110 (112 @ 4000 R.P.M.).
Compression Ratio—6.7-1 Std. 7.0-1 Optl.
Compression Pressure—130 lbs. at cranking speed.
Vacuum Reading—Gauge should show steady reading of 15-17" with engine idling at 5-7 M.P.H.

PISTONS:—Bohn Bohnalite, aluminum alloy, Invar strut, Cam-ground type. Pistons are not slotted.
NOTE—After engine Nos. 207707 (90), 217398 (90A), 110182 (110), silicon alloy pistons used.
Length—3⅝".
Weight—17 ozs. Held to two gram variation.
Removal—Pistons and rods removed from above.
Clearance—Skirt .0025". See Fitting New Pistons.
Replacement Pistons:—Finished replacement pistons furnished in oversizes of 3.247 to 3.252" (in .001" steps), 3.252 to 3.274" (in .002" steps) and 3.277".
NOTE—Piston size stamped on head of piston.
Fitting New Pistons:—Use .0025" feeler ½" wide inserted between piston and cylinder wall at right angles to pin. Pull required to withdraw feeler must be 10-15 lbs. at all points in cylinder.

PISTON RINGS:—Two compression (#2 grooved), two oil control rings per piston, all above pin. Lower ring grooves drilled radially with twelve 9/64" oil drain holes.
NOTE—Oil ring groove depth increased from .166" to .171" on aluminum pistons after engine Nos. 207459 (90), 216409 (90A), 109214 (110). Oil ring groove depth .171" for all silicon alloy pistons.

Ring	Width Al. pistons	Width Sil. pistons	End Gap
Comp. (#1)	3/32"	3/32"	.010-.017"
Comp. (#2)	1/8"	3/32"	.010-.017"
Oil (#1)	5/32"	3/16"	.010-.017"
Oil (#2)	5/32"	5/32"	.010-.017"

NOTE—Side clearance for all rings .0015" min.
Replacement Rings:—Furnished in standard and .010", .020", .030" oversizes.
NOTE—Install #2 compression ring with groove down.

PISTON PIN:—Diameter 13/16". Length 2 13/16".
Pin is locked in rod with clamp screw.
Pin Fit in Piston—.0005" clearance (hand push fit).
Replacement Pins:—Pins furnished standard and .002", .005", .010 oversizes.
NOTE—Pin oiled by four 5/32" oil holes in upper part of piston bosses.

CONNECTING ROD:—Length 7". Bearing caps dowelled on rods and held by capscrews in blind tapped holes.
Crankpin Journal Diameter—1 15/16".
Lower Bearing—Removable steel-backed, cadmium-silver-lined type. No shims.
Clearance—.002". Sideplay .004-.006".
Bearing Adjustment:—None (no shims). Replace bearings. New bearings should be tight with .002" feeler 1" long installed under cap (cap can be sanded on face plate to secure this fit). Install new bearings with tang engaging groove in rod and cap.
Installing Rods:—Lower bearings are offset. Install rods with widest half of bearing toward rear (#1, 3, 5) and toward front (#2, 4, 6). Oil hole in lower bearing upper half toward camshaft on all rods.
NOTE—Head of piston pin clamp screw should be toward camshaft on all rods.

CRANKSHAFT:—4 bearing. Integral counterweights.
Journal Diameters—2¼" (all bearings).
Bearing Type—Removable steel-backed, cadmium-silver-lined type. No shims. **Clearance**—.002".
Bearing Adjustment & Replacement:—*See Graham Special Shop Notes for Main Bearing Servicing.*
End Thrust:—Taken by thrust plate at front (#1) bearing. Adjusted by adding or removing shims. Endplay .004-.006".

CAMSHAFT:—4 bearing. Non-adjustable chain drive.
Journal Diameters—#1, 1⅞"; #2, 1 13/16"; #3, 1¾"; #4, 1¼". **Bearing Type**—Bronze.
End Thrust:—Taken by spring-loaded plunger in forward end of camshaft.
NOTE—Make certain that plunger and spring are in place when installing chain case cover.
Timing Chain:—Link-Belt. Width 1". Pitch .500". Length 23" or 46 links.
Camshaft Setting:—Sprockets marked. Mesh chain so that there are nine links between marks on sprockets or ten pins inclusive of pins meshed opposite marks.

VALVES:	Head Diameter	Stem Diameter	Length
Intake	1 33/64"	.3145"	4 61/64"
Exhaust	1 21/64"	.3135"	4 61/64"

	Seat Angle	Lift	Stem Clearance
Intake	30°	5/16"	.001-.0026"
Exhaust	45°	5/16"	.002-.0036"

Tappet Clearance—.010" all valves. Engine hot.
Valve Guides:—Length 2¾". Finished inside diameter .3164" for all guides. Guides counterbored to .329" for 11/32" at upper end.
Valve Springs:—Free length 1 15/16".

	Spring Pressure	Spring Length
Valve Closed	36 lbs.	1 21/32"
Valve Open	87 lbs.	1 3/8"

Valve Lifters:—Single piece cast-iron, cylindrical type 1" diameter. Lifter guides 1 21/32" in length, integral with block. Finished to give .0005-.0015" clearance
Valve Timing:—See Camshaft Setting above.

Models 90 and 110
Intake Valves—Open 4½° BTDC. Close 47½° ALDC.
Exhaust Valves—Open 47½° BLDC. Close 4½° ATDC.

Model 90-A
Intake Valves—Open 2° ATDC. Close 54° ALDC.
Exhaust Valves—Open 41° BLDC. Close 11° ATDC.
To Check Valve Timing—Set tappet clearance #1 exhaust valve at .012". This valve should close with #1 piston .0088" past top dead center (90 & 110) and .0472" past top dead center (90-A) when flywheel mark 'EC-1' lines up with indicator in right front face of flywheel housing. Reset tappet clearance at .010" with engine hot.
Motor Gauge—Weidenhoff Adapter #114, Rod #2.

SUPERCHARGER:—Model 110 only. Centrifugal type supercharger located between carburetor and manifold (carburetor mounted on Supercharger).
See article in Mechanical Equipment Section for data.
Supercharger Drive:—Separate chain taken from crankshaft sprocket at front of engine.
Supercharger Drive Chain—Link-Belt. Width 1½". Pitch ⅜". Length 27¾" or 74 links.
Chain Adjustment—Chain adjusted by shifting supercharger drive sprocket. To adjust, loosen flange mounting screws, back off adjustment setscrew locknut, turn up adjustment setscrew until chain hums with engine running, back off screw until chain runs noiselessly, tighten locknut and mounting screws. This is the only adjustment necessary for supercharger operation.

LUBRICATION:—Pressure. Gear type oil pump located in crankcase.
Normal Oil Pressure:—50 lbs. at 30 M.P.H.
Oil Pressure Relief Valve:—Located on right hand side of crankcase under plug. Maintains pressure in crankcase at 50 lbs. Adjustable by adding or removing shims or washers in plug above spring.
Crankcase Capacity:—5 quarts (refill).

CLUTCH:—Illinois. Single plate, dry disc type.
See article in Mechanical Equipment Section for data.
Facings—Moulded type, 2 required. Inside Diam. 5½". Outside Diam. 8⅞". Thickness ⅛".
NOTE—Long 9CF-CS driven member used on 90, 110 starting with engine number 207437 (90), 109174 (110). Furnished for replacement on 90, 90-A, 110 after May 15, 1936.
Adjustment:—Free movement of clutch pedal must be 1-1¼". To adjust, loosen locknut on left hand end of clutch pedal shaft at pedal, shift pedal on shaft (pedal threaded on shaft), tighten locknut.
NOTE—For all car models equipped with Illinois clutch, when the limit of the Clutch adjustment is reached, loosen two capscrews in clutch mounting bracket slightly (reached through hand opening in bottom of clutch bell housing), pull out shim under bracket (shim holes are slotted—not necessary to take out capscrews completely), tighten bracket screws. This will provide new range of adjustment on connecting link. Shims can be discarded. New shims of correct thickness are supplied with new driven plate.
Removal—Disconnect clutch linkage, drop driveshaft, remove transmission supporting engine at rear of oil pan, remove clutch bell housing, take out two bolts in clutch mounting bracket, remove clutch assembly.

STEERING—Steering Gear. Ross Model 540 (90 & 110) Cam-and-Roller type. Ross Model 140 (90-A) Cam-and-Lever type. See article in Steering Section for adjustments.
Front Suspensions:—Conventional 'I' beam section front axle with Reverse-Elliott ends and semi-elliptic springs.
Kingpin Inclination—7½° crosswise.
Caster—2½°. Use wedge shims inserted between spring and spring pad on axle to correct caster.
Camber—1°. No adjustment.
Toe In—⅛-3/16". Adjust in usual manner by changing length of tie rod.

BRAKES:—Service—Lockheed Hydraulic, double anchor type. Hand lever applies brake at rear of transmission (90 & 110), rear wheel service brakes (90-A).
See article in Mechanical Equipment Section for data.
Drum Diameter—11" (90 & 110), 9" (90-A).
Lining—Moulded type. Width 1¾". Thickness ¼" (90 & 110), .200" (90-A). Length per wheel 23" (90 & 110), 18" (90-A).
Clearance—.006" heel, .010" toe, for each shoe (90 & 110); .008" between lining and drum (90-A).
Hand Brake:—External type on drums at rear of transmission (90 & 110).
Adjustment—With lever in released position, remove anchor screw locking wire, turn anchor screw to give 1/32" clearance between lining and drum, lock the anchor screw with wire. Adjust guide bolt nut to give 1/32" clearance for lower half of band, secure with locknut. Finally, adjust brake adjusting bolt nut to give 1/32" clearance (as above) for upper portion of band.
Drum Diameter—6".
Lining—Width 2". Thickness 5/32". Length 17¾".
NOTE—Hand Brake data above for Models 90 & 110 only. See Service Brake (above) for Model 90-A Hand Brake.

NOTE:—Engines on these models are similar except that Supercharger used on Model 116 with increased power output.

ENGINE NUMBER:—First number 220,000 (95), 135,000 (116). Stamped on plate on right side of crankcase and on chassis serial number plate.

ENGINE SPECIFICATIONS:—Six cylinder, 'L' head
Bore—3¼". **Stroke**—4".
Displacement—199.1 cubic inches.
Rated Horsepower—25.35 (AMA).
Developed Horsepower—(95) 85 at 3300 R.P.M., (116) 106 at 4000 R.P.M.
Compression Ratio—6.7-1 Std. 7.0-1 Optl.
Compression Pressure—130 lbs. at cranking speed.
Vacuum Reading—15-17" steady at 5-7 M.P.H.

PISTONS:—Bohn, Autothermic, Silicon alloy, cam ground, plated type with special cylinder wall lubrication system. *See Graham Special Shop Notes.*
Weight—17 ozs. **Length**—3⅝".
Removal—Pistons and rods removed from above.
Clearance—Top .024-.030". Skirt .0025". See Fitting New Pistons.
Replacement Pistons:—Finished pistons (with pins) furnished in oversizes of 3.247-3.252" (in .001" steps), 3.252-3.274" (in .002" steps), and 3.277".
NOTE—Piston size stamped on head of piston.
Fitting New Pistons:—Pull required to withdraw .0025" feeler ½" wide from between piston and cylinder wall at right angles to pin must be within 10-15 lbs. at all points in cylinder.
Installing Pistons:—Vent hole in oil groove in skirt should be away from camshaft.

PISTON RINGS:—Two compression, two oil control rings per piston, all above pin.

Ring	Width	End Gap
Compression	3/32"	.007-.017"
Oil (upper)	3/16"	.007-.017"
Oil (lower)	5/32"	.007-.017"

NOTE—Side clearance for all rings .0015" min.
Replacement Rings & Installation Directions:—*See Graham Special Shop Notes for data.*

PISTON PIN:—**Diameter** 13/16". **Length** 2 13/16" Pin locked in rod by clampscrew. Pin holes in piston oiled by four 5/32" oil holes. Pins furnished standard and .002", .005", .010" oversize.
Pin Fit in Piston—.0005" clearance (hand push fit).

CONNECTING ROD:—**Length** 7". Bearing caps dowelled on rods and held by capscrews in blind tapped holes.
Crankpin Journal Diameter—2 1/16".
Lower Bearing—Removable steel-backed, cadmium-silver lined type. Bearings not grooved.
Clearance—.002". **Sideplay**—.004-.006".
Bearing Adjustment:—None (no shims). Replace bearings. New bearings should be tight with .002" feeler 1" long installed under cap (cap can be sanded on face plate to secure this fit). Install new bearings with tang engaging groove in rod and cap.
Installing Rods:—Lower bearings offset. Install rod with widest half of bearing toward rear (#1, 3, 5) and toward front (#2, 4, 6). No oil holes used.
NOTE—Head of piston pin clamp screw should be toward camshaft on all rods.

CRANKSHAFT:—Four bearing. Integral counterweights. Lanchester type vibration dampener at front.
Journal Diameters—2¼" all bearings.
Bearing Type—Removable steel-backed, cadmium-silver-lined type. No shims. **Clearance**—.002".
Bearing Adjustment & Replacement:—*See Graham Special Shop Notes for Main Bearing Servicing.*
End Thrust:—Taken by #1 front bearing. Endplay .004-.006". Adjusted by shims furnished .002", .008", .036" thick.

CAMSHAFT:—4 bearing. Non-adjustable chain drive.
Journal Diameters—#1, 1⅞", #2 1 13/16", #3, 1¾", #4, 1¼". **Bearing Type**—Bronze bushings.
End Thrust:—Taken by spring-loaded plunger in forward end of camshaft.
NOTE—Make certain that plunger and spring are in place when installing chain case cover.
Timing Chain:—Link-Belt. Width 1". Pitch .500". Length 23" or 46 links.
Camshaft Setting:—Sprockets are marked. Mesh chain so that there are nine links between marks on sprockets or ten pins inclusive of pins meshed opposite marks.

VALVES:

	Head Diameter	Stem Diameter	Length
Intake	1 33/64"	.3145"	4 61/64"
Exhaust	1 21/64"	.3135"	4 61/64"

	Seat Angle	Lift	Stem Clearance
Intake	30°	5/16"	.001-.0026"
Exhaust	45°	5/16"	.002-.0036"

NOTE—Exh. valve stem diameter increased to .3407" after engine nos. 221394 (95), 136292 (116).
Tappet Clearance:—.010" all valves, engine hot.
Valve Guides:—Length 2¾". Finished inside diameter .3164" for all guides. Guides counterbored to .329" for 11/32" at upper end.
NOTE—Counterbore increased to .356" and exhaust guide inside diam. increased to .3435" after engine nos. 221394 (95), 136292 (116).
Valve Springs:—Free length 1 15/16".

	Spring Pressure	Spring Length
Valve Closed	36 lbs.	1 21/32"
Valve Open	87 lbs.	1 3/8"

Valve Lifters:—Cylindrical type. Diameter 1". Operate in guide holes 1 21/32" long finished directly in block. Pressure lubricated. Lifter groove meters oil for piston and cylinder wall lubrication.
Lifter Clearance in Guide—.0005-.0015".
Valve Timing:—See Camshaft Setting above.
Model 95
Intake Valves—Open 2° ATDC. Close 54° ALDC.
Exhaust Valves—Open 41° BLDC. Close 11° ATDC.
Model 116
Intake Valves—Open 4½° BTDC. Close 47½° ALDC.
Exh. Valves—Open 47½° BLDC. Close 4½° ATDC.
To Check Timing—Set tappet clearance #1 exhaust valve at .012". This valve should close with #1 piston 11° or .0472" (95) and 4½° or .0079" (116) after top dead center when flywheel mark 'EC-1' lines up with indicator under cover in right front face of flywheel housing. Reset tappet clearance at .010" with engine hot.
Motor Gauge—Weidenhoff Adapter #114, Rod #2.

SUPERCHARGER:—Model 116 only. All data same as for Model 120 (see next page).
See article in Mechanical Equipment Section for data.

LUBRICATION:—Pressure system. Gear type oil pump located in crankcase.
Normal Oil Pressure—40 lbs. at 30 M.P.H.
Oil Pressure Regulator—Located on right side of crankcase. Opens at 50 lbs. (overflow lubricates timing chain). Adjustable by adding or removing shims above spring within cover plug.
Oil Pressure Gauge—King-Seeley Electric type. K-S No. 6090 (all except Cabriolet), 6610 (Cabriolet) dash unit, No. 6125 (engine unit).
NOTE—Dash unit an assembly with gasoline gauge.
See article in Mechanical Equipment Section for data.
Crankcase Capacity—5 qts.

CLUTCH:—**Long Model 9CF-CS.** Semi-centrifugal, single plate, dry disc type.
See article in Mechanical Equipment Section for data.
Facings—Woven, 2 required. I.D. 5¾". O.D. 9". Thickness .125".
Adjustment:—Free movement of clutch pedal must be 1¼". To adjust, loosen locknut on left hand end of clutch pedal shaft at pedal, shift clutch pedal on shaft (shaft threaded), tighten locknut.
Removal:—Remove Transmission (see Transmission Section below), remove clutch bell housing, take out clutch housing mounting screws in flywheel, turn screws out evenly to avoid distorting cover.

TRANSMISSION:—**Warner**—Model AS4-T84C (Std. (95). Model AS12-T86 (Std. 116). Overdrive Transmission Model AS30-T86 (Optl. 95, 116). Helical gear, constant mesh, synchro-mesh (second and high), sliding helical gear (low and reverse) except for Std. 95 model which has sliding spur gear (low and reverse).
See article in Mechanical Equipment Section for data.
Removal:—Disconnect hand brake and clutch linkage. Drop driveshaft, support engine at rear, remove transmission mounting bolts, remove rear engine mounting, pull unit back and remove.

UNIVERSAL JOINT:—**Detroit-Universal Series 4200.** Ball and trunnion type with roller bearings. 2 used.
See article in Mechanical Equipment Section for data.

REAR AXLE:—**Spicer**—Semi-floating, spiral bevel gear type with Hotchkiss drive.
See article in Mechanical Equipment Section for data.
Ratio—4.45-1 (95), 4.27-1 (116). 4.7-1 (std. with overdrive).
Backlash—.004-.008". Shim adjustment.
Removal:—Hoist rear of car, disconnect rear universal, brake line at housing, shock absorbers, remove spring U-bolts, disconnect rear spring shackles and withdraw assembly. Bleed brake lines when installing assembly.
Wheel Bearing Adjustment—None (sealed bearings).

SHOCK ABSORBERS:—**Delco**—Model 1166-K (front and rear). Two way direct acting, hydraulic type.
See article in Mechanical Equipment Section for data.

STEERING:—**Steering Gear**—Ross Model S-14 (95) Cam-and-Lever type. Model T-14 (116) Cam-and-Twin Lever type.
See article in Mechanical Equipment Section for data.
Front Suspension:—Spicer, conventional 'I' beam section front axle with Reverse-Elliott ends and semi-elliptic springs.
Kingpin Inclination—7½° crosswise.
Caster—4-4½° (95). 3-4° (116). Adjusted by inserting wedge shims between spring and pad on axle.
Camber—1°. No adjustment.
Toe In—⅛-3/16". Adjusted in usual manner by changing length of tie rod.

BRAKES:—**Service**—Lockheed Hydraulic, double anchor type. Hand lever applies independent brake at rear of transmission.
See article in Mechanical Equipment Section for data.
Drum Diameter—9" (95), 11" (116).
Lining—Moulded type. Width 1¾". Thickness 3/16" (95), ¼" (116). Length per wheel 18" (95), 23" (116).
Clearance—.006" heel, .010" toe, for each shoe.
Hand Brake:—External type on drum at rear of transmission.
Adjustment—With hand lever in released position, remove anchor screw locking wire, turn anchor screw to give 1/32" clearance between lining and drum, lock anchor screw with wire. Back off brake adjusting bolt nut (at top), loosen locknut on guide bolt and adjust to give 1/32" clearance for lower portion of band, tighten locknut, finally turn adjusting bolt nut to 1/32" clearance for upper portion of band (tension on guide bolt should just be relieved).
Drum Diameter—6" (all models).
Lining—**Width 2". Thickness 5/32". Length 17¾".**

ENGINE NUMBER:—First number 115,000. Stamped on plate on right side of crankcase and on serial number plate on floor inside right hand door.

ENGINE SPECIFICATIONS:—6 cylinder, 'L' head type.
Bore—3¼". **Stroke**—4⅜".
Displacement—217.8 cubic inches.
Rated Horsepower—25.35 (AMA).
Developed Horsepower—116 at 4000 R.P.M.
Compression Ratio—6.7-1 Std. 7.0-1 Optl.
Compression Pressure—130 lbs. at cranking speed.
Vacuum Reading—15-17" steady reading at 5-7 MPH.

PISTONS:—Bohn, Autothermic, Silicon alloy, cam ground, plated type with special cylinder wall lubrication system. *See Graham Special Shop Notes.*
Weight—17 ozs. **Length**—3⅝".
Removal—Pistons and rods removed from above.
Clearance—Top .024-.030". Skirt .0025". See Fitting New Pistons.

Replacement Pistons:—Finished pistons (with pins) furnished in oversizes of 3.247-3.252" (in .001" steps), 3.252-3.274" (in .002" steps), and 3.277".
NOTE—Piston size stamped on head of piston.

Fitting New Pistons:—Pull required to withdraw .0025" feeler ½" wide from between piston and cylinder wall at right angles to pin must be within 10-15 lbs.

Installing Pistons:—Vent hole in oil groove in skirt should be away from camshaft.

PISTON RINGS:—Two compression, two oil control rings per piston, all above pin.

Ring	Width	End Gap
Compression	3/32"	.007-.017"
Oil (upper)	3/16"	.007-.017"
Oil (lower)	5/32"	.007-.017"

NOTE—Side clearance for all rings .0015" min.

Replacement Rings & Installation Directions:—*See Graham Special Shop Notes for data.*

PISTON PIN:—**Diameter 13/16". Length 2 13/16".** Pin locked in rod by clampscrew. Pin holes in piston oiled by four 5/32" oil holes. Pins furnished standard and .002", .005", .010" oversize.
Pin Fit in Piston—.0005" clearance (hand push fit).

CONNECTING ROD:—**Length 7".** Bearing caps dowelled on rods and held by capscrews in blind tapped holes.
Crankpin Journal Diameter—2 1/16".
Lower Bearing—Removable steel-backed, cadmium-silver lined type. Bearings not grooved.
Clearance—.002". **Sideplay**—.004-.006".

Bearing Adjustment:—None (no shims). Replace bearings. New bearings should be tight with .002" feeler 1" long installed under cap (cap can be sanded on face plate to secure this fit). Install new bearings with tang engaging groove in rod and cap.

Installing Rods:—Lower bearings offset. Install rod with widest half of bearing toward rear (#1, 3, 5) and toward front (#2, 4, 6). No oil holes used.
NOTE—Head of piston pin clamp screw should be toward camshaft on all rods.

CRANKSHAFT:—Four bearing. Integral counterweights. Lanchester type vibration dampener at front.
Journal Diameters—2¼" all bearings.
Bearing Type—Removable steel-backed, cadmium-silver-lined type. No shims.
Clearance—.002".

Bearing Adjustment & Replacement:—*See Graham Special Shop Notes for Main Bearing Servicing.*

End Thrust:—Taken by #1 front bearing. Endplay .004-.006". Adjusted by shims furnished .002", .008", .036" thick.

CAMSHAFT:—4 bearing. Non-adjustable chain drive.
Journal Diameters—#1, 1⅞", #2, 1 13/16", #3, 1¾", #4, 1¼".
Bearing Type—Bronze bushings.

End Thrust:—Taken by spring-loaded plunger in forward end of camshaft.
NOTE—Make certain that plunger and spring are in place when installing chain case cover.

Timing Chain:—Link-Belt. Width 1". Pitch .500". Length 23" or 46 links.

Camshaft setting:—Sprockets are marked. Mesh chain so that there are nine links between marks on sprockets or ten pins inclusive of pins meshed opposite marks.

VALVES:

	Head Diameter	Stem Diameter	Length
Intake	1 33/64"	.3145"	4 61/64"
Exhaust	1 21/64"	.3135"	4 61/64"

	Seat Angle	Lift	Stem Clearance
Intake	30°	5/16"	.001-.0026"
Exhaust	45°	5/16"	.002-.0036"

NOTE—Exhaust valve stem diameter increased to .3704" after engine number 115726.

Tappet Clearance:—.010" all valves, engine hot.

Valve Guides:—Length 2¾". Finished inside diameter .3164" for all guides. Guides counterbored to .329" for 11/32" at upper end.
NOTE—Counterbore increased to .356" and exhaust guide inside diam. increased to .3435" after engine number 115726.

Valve Springs:—Free length 1 15/16".

	Spring Pressure	Spring Length
Valve Closed	36 lbs.	1 21/32"
Valve Open	87 lbs.	1 3/8"

Valve Lifters:—Cylindrical type. Diameter 1". Operate in guide holes 1 21/32" long finished directly in block. Pressure lubricated. Lifter groove meters oil for piston and cylinder wall lubrication.
Lifter Clearance in Guide—.0005-.0015".

Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 4½° BTDC. Close 47½° ALDC.
Exhaust Valves—Open 47½° BLDC. Close 4½° ATDC.
To Check Timing—Set tappet clearance #1 exhaust valve at .012". This valve should close with piston 4½° or .0088" past top dead center when flywheel mark 'EC-1' lines up with indicator under cover in right front face of flywheel housing. Reset tappet clearance at .010" with engine hot.
Motor Gauge—Weidenhoff Adapter #114, Rod #2.

SUPERCHARGER:—**Model 120 & 116.** Centrifugal type supercharger (design unchanged) located between carburetor and manifold (downdraft carburetor is mounted on top of supercharger).
See article in Mechanical Equipment Section for data.
Supercharger Removal & Drive Data:—*See Graham Special Shop Notes for data.*

LUBRICATION:—Pressure system. Gear type oil pump located in crankcase.
Normal Oil Pressure—40 lbs. at 30 M.P.H.
Oil Pressure Regulator—Located on right side of crankcase. Opens at 50 lbs. (overflow lubricates timing chain). Adjustable by adding or removing shims above spring within cover plug.
Oil Pressure Gauge—King-Seeley Electric type, K-S No. 6090 (all except Cabriolet), 6610 (Cabriolet) dash unit, No. 6125 (engine unit).
NOTE—Dash unit an assembly with gasoline gauge.
See article in Mechanical Equipment Section for data.
Crankcase Capacity—5 qts.

CLUTCH:—**Long Model 9CF-CS. Semi-centrifugal, single plate, dry disc type.**
See article in Mechanical Equipment Section for data.
Facings—Woven, 2 required. I.D. 5¾". O.D. 9". Thickness .125".

Adjustment:—Free movement of clutch pedal must be 1¼". To adjust, loosen locknut on left hand end of clutch pedal shaft at pedal, shift clutch pedal on shaft (pedal threaded on shaft), tighten locknut.

Removal:—Remove Transmission (see Transmission Section below), remove clutch bell housing, take out clutch housing mounting screws in flywheel, turning all screws out evenly to avoid distorting cover.

TRANSMISSION:—**Warner Model AS12-T86 Std., AS30-T86 (with Overdrive) Optional.** Helical gear, constant mesh, synchro-mesh (second and high), sliding helical gear (low and reverse).
See article in Mechanical Equipment Section for data.

Removal:—Disconnect hand brake and clutch linkage. Drop driveshaft, support engine at rear, remove transmission mounting bolts, remove rear engine mounting, pull unit back and remove.

UNIVERSAL JOINT:—**Detroit-Universal Series 4200.** Ball and trunnion type with roller bearings. 2 used.
See article in Mechanical Equipment Section for data.

REAR AXLE:—**Spicer**—Semi-floating, spiral bevel gear type with Hotchkiss drive.
See article in Mechanical Equipment Section for data.
Ratio—4.27-1 Std., 4.7-1 (Mountain Ratio) Std. on cars with overdrive.
Backlash—.004-.008". Shim adjustment.

Removal:—Hoist rear of car, disconnect rear universal, brake line at housing, shock absorbers, remove spring U-bolts, disconnect rear spring shackles and withdraw assembly. Bleed brake lines when installing assembly.
Wheel Bearing Adjustment—None (sealed bearings).

SHOCK ABSORBERS:—**Delco**—Model 1166-K (front and rear). Two way direct acting, hydraulic type.
See article in Mechanical Equipment Section for data.

STEERING:—**Steering Gear**—Ross model T-14, Cam-and-Twin-Lever type.
See article in Mechanical Equipment Section for data.

Front Suspension:—Spicer, conventional 'I' beam section front axle with Reverse-Elliott ends and semi-elliptic springs.
Kingpin Inclination—7½° crosswise.
Caster—3-4°. Adjusted by inserting wedge shims between spring and spring pad on axle.
Camber—1°.
Toe In—⅛-3/16". Adjust in usual manner by changing length of tie rod.

BRAKES:—**Service**—Lockheed Hydraulic, double anchor type. Hand lever applies independent brake at rear of transmission.
See article in Mechanical Equipment Section for data.
Drum Diameter—11".
Lining—Moulded type. Width 1¾". Thickness ¼". Length per wheel 23".
Clearance—.006" heel, .010" toe, for each shoe.

Hand Brake:—External type on drum at rear of transmission.
Adjustment—With hand lever in released position, remove anchor screw locking wire, turn anchor screw to give 1/32" clearance between lining and drum, lock anchor screw with wire. Back off brake adjusting bolt nut (at top), loosen locknut on guide bolt and adjust to give 1/32" clearance for lower portion of band, tighten locknut, finally turn adjusting bolt nut to 1/32" clearance for upper portion of band (tension on guide bolt should just be relieved).
Drum Diameter—6" (all models).
Lining—Width 2". Thickness 5/32". Length 17¾".

SERIAL NUMBER:—Stamped on plate on floor inside right rear door (Sedans), on seat frame (Coupe).

	Serial Number		Engine Number	
	1938	1939	1938	1939
96	225,000	600,001	230,000	610,001
97	140,000	500,001	145,000	510,001

ENGINE NUMBER:—Stamped on plate on right side of crankcase and on Serial No. Plate (see above).

ENGINE SPECIFICATIONS:—Six cylinder, 'L' head. Engines same for both models except that Supercharger installed on Model 97 engine only.
Bore—3¼". **Stroke** 4⅜". **Displacement** 217.8 cu. ins.
Rated Horsepower—25.35 A.M.A.
Developed Horsepower—(96) 90 at 3600 R.P.M., (97) 116 at 4000 R.P.M. with standard 6.7-1 head.
Compression Ratio—6.7-1 Al. head Std. 96 '38, 97 '38-39, Optl. 96 '39. 6.4-1, 6.6-1 Cast iron head Std. 96 '39. 7.25-1 Optl. 96, 97 '38.
Compression Pressure—120 lbs. (6.4-1, 6.6-1 hd), 130 lbs. (6.7-1 hd). at cranking speed.
Vacuum Reading—15-17" idling at 5-7 M.P.H.

PISTONS:—Bohn autothermic, aluminum alloy, cam ground, plated type with special cylinder wall lubrication system. *See Graham Shop Notes for data.*
Weight—14⅛ ozs. (stripped). **Length**—3⅝".
Removal—Pistons and rods removed from above.
Clearance—Top .024". Skirt .0025".
Replacement Pistons:—Finished pistons (with pins fitted) furnished in oversizes of 3.247" to 3.252" (in .001" steps), 3.252" to 3.274" (in .002" steps) and 3.277". NOTE—Piston size stamped on head.
Fitting New Pistons:—Use .0025" feeler ½" wide inserted between piston and cylinder wall at right angles to pin. Pull required to withdraw feeler must be 10-15 lbs. at all points in cylinder.
Installing Pistons:—Install pistons with four vertical grooves on skirt toward camshaft (right side).

PISTON RINGS:—Two compression, two oil control rings per piston, all above pin.

Ring	Width	End Gap	Side Clearance
Compr.	3/32"	.007-.015"	.0015" Min.
Oil Cont.	5/32"	.007-.015"	.0015" Min.

Replacement Rings & Installation Directions:—*See Graham Shop Notes for complete data.*

PISTON PIN:—**Diameter** 13/16". **Length** 2 13/16". Pin locked in rod by clampscrew.
Pin Fit in Piston—.0005" clearance (hand push fit).
Replacement Pins:—Furnished Std. and .002", .005", .010" oversize (new pistons have fitted pins).

CONNECTING ROD:—Length 7". Bearing caps dowelled on rods and held by capscrews in blind tapped holes
Crankpin Journal Diameters—2 1/16".
Lower Bearing—Removable steel-backed, cadmium-silver-lined type (not grooved, no oil spray hole). **Clearance**—.002". **Sideplay**—.004-.006".
Bearing Adjustment:—None (no shims). Replace bearings. New bearings should be tight with .002" feeler 1" long installed under cap (cap can be sanded on face plate to secure this fit). Install new bearings with tang engaging groove in rod and cap.
Installing Rods:—Lower Bearings offset. Install rod with widest half of bearing toward rear (#1, 3, 5), toward front (#2, 4, 6). Head of piston pin clampscrew should be toward camshaft on all rods.

CRANKSHAFT:—4 bearing, integral counterweights with Lanchester type Vibration dampener.
Journal Diameters—2⅜" all bearings.
Bearing Type (Front)—Cadmium-silver lined bushing inserted in hole in crankcase from forward end with bushing flange doweled to crankcase.
Bearing Type (Others)—Conventional removable steel-backed, cadmium-silver lined type.
Clearance (All Bearings)—.002".
Bearing Adjustment & Replacement:—*See Graham Shop Notes for Crankshaft Bearing data.*
End Thrust:—Taken by front bearing. Adjusted by adding or removing shims furnished .002", .008" thick. **Endplay**—.004-.006".

CAMSHAFT:—4 Bearing. Non-adjustable Chain Drive.
Journal Diameters—#1, 1⅞"; #2, 1 13/16"; #3, 1¾"; #4, 1¼". **Bearing Type**—Bronze bushings.
End Thrust:—Taken by spring-loaded plunger in forward end of camshaft.
Timing Chain:—Link-Belt No. 336. Width 1". Pitch .500". Length 23" or 46 links.
Camshaft Setting:—Sprockets are marked. With #1 and #6 pistons on top dead center and marks on both sprockets on upper left side, mesh chain so there are exactly 9 links or 10 pins (inclusive of pins meshed opposite marks) between marks.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1 33/64"	.3145"	4 61/64"
Exhaust	1 21/64"	.3407"	4 61/64"

	Seat Angle	Lift	Stem Clearance
Intake	30°	5/16"	.001-.0026"
Exhaust	45°	5/16"	.002-.0035"

Tappet Clearance:—.010" all valves, engine hot.
Valve Guides:—Length 2¾". Finished inside diameter .3164" Int., .3435" Exh. All guides counterbored to .356" for 11/32" at upper end.
Valve Springs:—Free length 1 15/16" ('38), 2" ('39).

	1938—Pressure—1939	Spring Length
Valve Closed	36 lbs.	42-46 lbs.	1 21/32"
Valve Open	87 lbs.	89-97 lbs.	1⅜"

Valve Lifters:—Cylindrical type. Diameter 1". Operate in guide holes 1 21/32" long finished in block. **Lifter Clearance in Guide**—.0005-.0015".
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 4½° BTDC. Close 47½° ALDC.
Exhaust Valves—Open 47½° BLDC. Close 4½° ATDC.
To Check Timing—Set tappet clearance #6 exhaust valve at .012". This valve should close when flywheel mark 'EC-1' lines up with indicator under cover on right front face of flywheel housing. Reset tappet clearance at .010" with engine hot.

SUPERCHARGER:—**Model 97 only.** Centrifugal type. Carburetor mounted directly on top of case (Supercharger blower between carburetor and engine).
See article in Mechanical Equipment Section for data.
Supercharger Removal & Drive Data:—*See Graham Special Shop Notes for complete data.*

LUBRICATION:—Pressure system. Gear type oil pump located in crankcase.
Normal Oil Pressure:—45 lbs. at 30 M.P.H.
Oil Pressure Regulator:—Located on right side of crankcase at rear of engine number plate. Opens at 50 lbs. Adjusted by adding or removing washers between spring and plunger.
Oil Pressure Gauge:—King-Seeley Electric. K-S No. 6926 dash unit (96 '38-39, 97 '38), 7480 dash unit (97 '39). 6125 Engine Unit. NOTE—6926 stamped 'O'.
See article in Mechanical Equipment Section for data.
Crankcase Capacity:—5 quarts (refill).

COOLING SYSTEM:—**Capacity**—14 qts. (96), 15 (97).
Water Pump:—Packless type, sealed ball bearing shaft.
See article in Mechanical Equipment Section for data.
Removal—Remove fan belt, pump mounting bolts, and remove fan and pump as an assembly.
Thermostat:—Fulton ('38), Detroit Lubricator ('39). **Setting**—Starts to open 140-145° ('38), 150° ('39). Optl. thermostat (for heaters) opens at 165-170°.
Temperature Gauge:—King-Seeley Electric. K-S No. Dash Units—6923 ('38), 7490 (96 '39), 7465 (97 '39), Tank Units—5700 ('38), 7000 ('39), NOTE—7490 stamped 'W'.
See article in Mechanical Equipment Section for data.

CLUTCH:—**Long Model 9½CF-CS.** Semi-centrifugal, single plate, dry disc type.
See article in Mechanical Equipment Section for data.
Facings—Chevron or Spiral wound Moulded type, 2 required. I.D. 6". O.D. 9½". Thickness .125".
Adjustment—Free movement of clutch pedal must be about 1¼". To adjust, loosen lock nut above pivot block at pedal, turn adjusting nut below pivot block on connector rod until proper clearance obtained.
Removal:—Remove Transmission (See Transmission below), take off clutch housing underpan, take out clutch mounting screws in cover flange (turning all screws out evenly, remove clutch from below.

TRANSMISSION:—**Warner.** Horizontal type (shift lever and cover on side of case). All helical gear type.
See article in Mechanical Equipment Section for data.
Overdrive Transmission:—Warner (1938-39), Model AS9-T88 with electrical 'kick-down' control (later 1939 cars).
Transmission Control:—Evans-Graham vacuum type (1938), Own remote control (1939).
See articles in Mechanical Equipment Section for data.
Removal:—Disconnect hand brake and clutch linkage, disconnect propeller shaft at front universal, support engine at rear, remove rear engine mounting cross-member, take out transmission mounting bolts, pull transmission straight back and remove. NOTE—On cars with remote gear shift, disconnect shifter rods at side of transmission case.

UNIVERSAL JOINTS:—**Detroit-Universal Series 4200.** Ball-and-trunnion type with roller bearings, 2 used.
See article in Mechanical Equipment Section for data.

REAR AXLE:—**Spicer Model 41-2.** Semi-floating, Hypoid Gear type with Hotchkiss drive.
See article in Mechanical Equipment Section for data.
Ratio—4.27-1 Std., 4.55-1 Optl.
Backlash—.004-.008" Shim adjustment.
Removal:—Hoist rear of car, disconnect propeller shaft at rear universal, brake line, and shock absorbers, remove spring U-bolts, disconnect rear spring shackles, withdraw axle assembly.
Wheel Bearing Adjustment—Shims provided between flanged end of axle housing and brake backing plate. To adjust, remove wheel, hub, and drum assembly. Remove shims. **Endplay** .002-.007".

SHOCK ABSORBERS:—**Delco.** Front—B1161-K ('38), 1112-J ('39), Rear—B1163-P ('38), 1120-N ('39). Direct acting, hydraulic type. NOTE—Models 1737-C, D & 1721-J, K double acting type used for Export.
See article in Mechanical Equipment Section for data.

STEERING:—**Steering Gear**—Ross Model T-14, Cam-and-Twin lever type.
See article in Mechanical Equipment Section for data.
Front Suspension:—Spicer, conventional 'I' beam section front axle with Reverse-Elliott ends and semi-elliptic springs.
Kingpin Inclination—7½° crosswise.
Caster—3-4°. Adjusted by inserting wedge shims between spring and spring pad on axle.
Camber—1°.
Toe In—⅛". Adjust in usual manner by changing length of tie rod.

BRAKES:—**Service**—'Graham-Lockheed' hydraulic type. Hand lever applies independent shaft brake.
See article in Mechanical Equipment Section for data.
Drum—11". Centrifuse.
Lining—Moulded type. Width 1¾". Thickness ¼". Length per wheel 23".
Clearance—.006" heel, .010" toe, for each shoe.
Hand Brake:—On drum at rear of transmission.
Adjustment—*See Graham Shop Notes for data.*
Drum Diameter—6".
Lining—Width 2". Thickness 5/32". Length 18 9/16".

1938 MODELS

ENGINE HOOD AND SIDE PANELS:—**'112' only**—Hood hinged at front. Secured by handle on each side panel. To raise, turn one handle (handles interconnected), grasp hood along edge and lift forward until self-locking hinge support locks hood in raised position. Hinge support released by raising hood slightly and pushing lower half to rear.

Side Panels—When removing panels, free hood handle from tie rod at clamp bolt on one panel, remove other panel with handle and tie rod attached as an assembly.

1939 MODELS

ENGINE HOOD (BONNET) LOCK:—Hood hinged at front and secured by lock handle in driver's compartment on lower edge of instrument panel to left of steering column (operates rod on engine side of dash which engages each side of hood). To unlock hood, push down on handle. Hood can then be raised by lifting on either side at rear (press support hinge forward before releasing hood).

Hood and Support Removal—Remove front bumper. Raise hood, take out 3 cap screws and tapping plate at front hood hinge, hood support upper pin springs, pins and washers, freeing hood. Remove cotter pins and washers at ends of support lower rod, unhook springs freeing hood support.

Hood Alignment—Check alignment at cowl, side panels, and at name plate. To align, raise hood, loosen 3 cap screws at front hinge, shift hood at front end until aligned, raise hood, tighten screws.

Side Panel Removal (91, 92, 93, 95, 97)—Raise hood, remove 3 bolts at shell extension and 1 capscrew at cowl. Remove 1 capscrew attaching fender to front lower frame bonnet side panel (accessible through hole in top of radiator shell after removing horn). Loosen but do not remove capscrews on lower edge of panel (holes in panel slotted). Lift panel out. CAUTION—On cars equipped with bonnet side panel lamps, pull sockets out.

Side Panel Removal (90 & 98)—Raise hood, remove bolts at radiator shell and along lower edge. Take out screw at cowl and lift panel out.

Right Front Fender Dust Shield Removal (91, 92, 93, 95, 97)—For work on right side of engine (valves, etc.) remove shield as follows: Raise hood, remove 4 capscrews along top edge of shield (in engine compartment), 4 capscrews along front edge at radiator shell, and 3 capscrews along frame side member. Jack up front end of car and remove right front wheel. Take off fender stone guard at fender and dust shield. Pull out lower edge and remove.

Right Front Fender Dust Shield Removal (90 & 98)—Remove as follows: Raise hood, remove bolts at hood side panel, radiator shell and frame side member (in engine compartment). Jack up front end of car and remove right front wheel. Remove capscrews at fender and one dust shield fender brace bolt. Pull out lower edge of shield and remove.

1939 MODELS

RADIATOR CORE REMOVAL:—Remove bonnet and support (see *Hood and Support Removal*). Drain cooling system. Remove shell* extension-to-side panel bolts and spacers (except 90, 98) and radiator hoses. Take out shell-to-core bolts. Remove water pump, fan belt, front engine splash guard and 2 radiator anchor bolt nuts. Lift out radiator core. IMPORTANT—When reassembling, reverse procedure listed above. **Install water pump after core installed.**

1939 MODELS

ENGINE ASSEMBLY REMOVAL:—All engines can be removed as follows: Remove bonnet (see Hood and Support Removal) and radiator (see Radiator Core Removal). Disconnect generator, starter, temperature gauge and oil check valve wires. Remove wire harness along left side of engine, spark plug cables (with brackets) and distributor cap. Disconnect flexible fuel pump feed line and remove fuel line to carburetor. Disconnect throttle linkage and choke wire (if used). Remove accelerator cross shaft, carburetor and air cleaner. Disconnect exhaust pipe. Remove front motor support bolts, flywheel guard, accelerator pedal, floor mat, transmission hole cover, clutch housing-to-engine support bolts, engine ground strap and exhaust pipe bracket at rear engine support. Hoist engine out of car (move engine forward carefully to disconnect from transmission mainshaft). Finally, remove distributor, generator, fuel pump and clutch.

Installation—Reverse procedure listed above and note following points. Wrap a piece of soft wire around clutch throwout bearing oil seal with ends of wire extending up through clutch housing, lower engine in place (use care not to damage clutch driving plate assembly when engaging transmission mainshaft), pull wire out (this will prevent edge of seal from being curled by clutch cover). Install starter after engine in place.

1939 MODELS

CRANKSHAFT SIZE CODE:—Cars equipped with .010" undersize main bearing pins and connecting rods pins identified by marks stamped on left front corner of cylinder block on bottom face beside oil reservoir gasket (visible without removing oil reservoir) as follows:

MU—.010" undersize main bearing pins.
PU—.010" undersize connecting rod pins.
PMU—.010" undersize main and connecting rod pins.
NOTE—These pins require .010" undersize bearings.

1935-39 MODELS

ORIGINAL BORE SIZE:—Original production (new engine) bore size indicated by code mark stamped on lower edge of valve chamber opposite cylinders. See table below for size and code marks.

Code Mark	Cylinder Diameter	Code Mark	Cylinder Diameter
A	3.000"	AO	3.010"
B	3.0005"	BO	3.0105"
C	3.001"	CO	3.011"
D	3.0015"	DO	3.0115"
E	3.002"	EO	3.012"

Note—Recondition cylinders to size for which replacement pistons and rings available (see below).

1935-39 MODELS

REPLACEMENT PISTONS:—Standard and oversize pistons marked by letter stamped on head and furnished for **cylinder diameter sizes** listed below. See table following for piston rings.

Piston Mark	Cylinder Diameter	Piston Mark	Cylinder Diameter
B	3.000" & 3.0005"	BO	3.010" & 3.0105"
D	3.001" & 3.0015"	DO	3.011" & 3.0115"
F	3.002" & 3.0025"	FO	3.012" & 3.0125"
J	3.004"	LO	3.015"
L	3.005"	BB	3.020"
		DD	3.021"
		FF	3.022"

Piston Mark	Piston Size	Piston Mark	Piston Size
B	2.9985"	DO	3.0095"
D	2.9995"	FO	3.0105"
F	3.0005"	LO	3.0135"
J	3.0025"	BB	3.0185"
L	3.0035"	DD	3.0195"
BO	3.0085"	FF	3.0205"

Piston Weight—Stamped on piston head in ounces and ¼ ozs. Pistons in one block same weight.

1939 MODELS

PISTON RINGS:—**Compression.** 'Granoseal' treated rings used starting with car number 25000. This treatment gives hardened wearing surface and longer ring life. Rings have a dark coating and may be used on earlier cars.

Oil Ring Change—Lower oil ring (below pin) changed during production as follows: Ring width reduced to 5/32" starting with following car numbers: (90) 24626, (91) all cars, (92) 24903, (93) 24896, (95 & 97) 28659, (98) 24502. NOTE—Top oil ring width unchanged (3/16").

1935-39 MODELS

REPLACEMENT RINGS:—Use standard or oversize rings for replacement pistons listed above. Ring size and pistons for which each ring size applies listed in table below.

Ring Size	Piston Mark	Ring Size	Piston Mark
3.000"	B, D, F	3.010"	BO, DO, FO
3.003"	J	3.015"	LO
3.005"	L	3.020"	BB, DD, FF

Note—If rings filed, keep clearance at pin uniform with end gap (.005" minimum).

1938-39 MODELS

CONNECTING ROD CHANGE:—On 1938 engines starting with following car numbers: (80 and 88) 54885, (81) 53909, (82) 54165, (83) 54382, (84, 85, 87) 54616 and all 1939 engines (except early '112' which started with car number 901625) new rods used. These connecting rods are drop forged steel with thinner (.015" thick) large end bearings ('Bermax' alloy). Thrust now taken by sides of rod (formerly by bearing flanges). These rods may be used for replacement on earlier cars either singly or in sets. IMPORTANT—**Do not file rods or caps.** If bearing clearance excessive, replace rods. No shims used.

1938-39 MODELS

CONNECTING ROD PALNUTS:—Palnut (locknut) used in place of cotter pin for locking connecting rod bolt nut. Consists of single thread tempered steel nut with turned up edges.

Installation—After tightening connecting rod bolt nuts to 630 in. lbs. with tension wrench, install palnut (smooth face to nut), turn palnut on bolt with fingers until tight, then lock in place by turning with wrench an additional ¼-⅓ turn. NOTE—Manufacturer recommends use of new palnuts.

1934-39 MODELS

CRANKSHAFT REMOVAL:—**1934-38 Models.** Crankshaft must be removed for main bearing replacement. To remove shaft, remove vibration dampener (see below) and timing gear cover. Remove crankshaft gear with Gear Puller J-471, oil reservoir, transmission (see Car Model 'M' page) and clutch. Disconnect connecting rods. Remove main bearing caps (use Puller J-377 for removal of Front and Rear caps) and lower crankshaft out.

1939 Models—Remove engine (see Engine Assembly Removal), vibration dampener, timing gear cover and oil reservoir. Disconnect connecting rods and remove main bearing caps as directed above.

Installation:—Reverse procedure listed above for removal and note following points. Front and rear oil seal grooves in caps and case must be cleaned of all oil packing. After caps secured in place, drive new packing in grooves using Tool J-392 (install in horizontal groove first on front cap). See Connecting Rod Palnuts (above) for 1938-39 models. Use Tool

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J-843 to press crankshaft gear and dampener in place. Check oil seal on timing gear cover and do not fold or damage when installing. See Checking Oiling System (following) for oil reservoir installation instructions.

1934-39 MODELS

VIBRATION DAMPENER REMOVAL:—1934-38. Remove fan belt, radiator shell, and radiator. Unscrew starting jaw. Pull dampener using Tool J-676. Install dampener using Tool J-483.

1939 Models—Dampener can be removed from beneath car without removing radiator core or shell as follows: Remove fan belt, raise front end of car, unscrew starting jaw, pull dampener using Tool J-676 (set puller tool screw in place through starting crank hole in frame cross member) and remove from below. Install dampener using Tool J-483.

Servicing—No adjustment other than replacing 2 rubber discs (drive flywheel from hub) if worn.

1934-39 MODELS

MAIN BEARINGS:—Adjustment—Laminated shims provided on top of caps. Remove caps (use Puller J-377 for front and rear caps) and remove shims until clearance is .001". See Crankshaft Installation above for bearing cap installation data.

Replacement Bearings:—Finished bearings (with attaching screws) furnished standard and .010" undersize (see Crankpin Size Code for original bearing sizes). Unfinished bearings furnished with 1/32" extra stock and must be line-reamed (see below).

Removal:—Bearing shells are removable type and are held in case and caps by screws. To replace bearings, crankshaft must be removed (see Crankshaft Removal above). With shaft out, take out screws securing shells in cap and case.

Installation:—With crankshaft removed, secure bearing shells in case and cap with machine screws. If unfinished bearings installed, line-ream as directed below. Install crankshaft (see Crankshaft Installation). Add or remove shims on bearing caps until .001" clearance obtained. Secure caps in place.

Line-Reaming Main Bearings:—Where unfinished bearings used for replacement, bearings must be line-reamed to size as follows: install bearings in cap and case, place .021" shims between case and cap and tighten cap, then line ream bearings. Thrust flange on center (Six), #3 (Eight) bearing must be faced for .006" endplay.

1939 MODELS

CAMSHAFT REMOVAL:—Remove bonnet (see Hood and Support Removal) and radiator (see Radiator Core Removal). Raise front end of engine and remove front engine guard. Remove radiator center grille (all except 112) which is attached by 8 sheet metal screws. Remove radiator shell on 112 only. Unscrew starting crank jaw. Remove vibration dampener, timing gear case cover, and camshaft gear. Remove right front wheel and fender dust shield (see Right Front Fender Dust Shield Removal). Remove valve covers, cylinder head, valves, tappets, oil pump, fuel pump, distributor, camshaft, thrust button and spring. If camshaft will not clear radiator shell splash guard, guard can be pressed down until shaft clears.

1939 MODELS

CAMSHAFT 'GRANOSEAL' TREATMENT:—All 1939 camshafts are 'Granoseal' treated. This operation gives hardened wearing surface to shaft and adds to life of shaft. This treatment leaves a somewhat rough surface and blackened appearance. IMPORTANT—All service operations same as before. Do not remove black finish from shaft surfaces.

1938-39 MODELS

VALVE TOOLS:—Valve stem diameter reduced to 11/32" on 1938-39 valves (was 3/8"). Due to this decrease in stem diameter, new pilot size necessary for valve servicing tools. Tool numbers as follows:

Tool	Tool No.
Valve Stem Guide Replacer Pilot	J883-6
Valve Stem Guide Reamer Pilot	J129-2
Valve Stem Guide Remover Pilot	J267
Valve Seat Reamer Pilot	J491-12

1934-39 MODELS

VALVE LIFTER REMOVAL:—Tappets (lifters) may be removed without removing cylinder head as follows: Remove right front fender dust shield (see above), remove valve covers (right side of engine below intake manifold), valve spring seat retainer, seat, dampener and spring, tappet adjusting screw (replace with short screw with thin head), guide clamp screw and clamp. Lift tappet and guide assembly out. NOTE—This method recommended only where one or two tappets to be removed. For removal of all lifters, time saved by removing head and valves.

1934-39 MODELS

CHECKING OILING SYSTEM:—See that oil lines securely in place and not bent or damaged. Drop oil reservoir and clean thoroughly every six months. When installing oil reservoir, check flapper valve on rear main bearing oil return tube (soldered in rear of reservoir). Valve must work freely and should be slightly open with reservoir level. Holes in gaskets between crankcase and oil dipper tray and between tray and reservoir must align with oil return tube (tube registers with hole in bearing)

1939 MODELS

1939 OILING SYSTEM CHANGES ON '112' & SIX CYLINDER ENGINES:—Oil passages from oil pump through cylinder block to front and rear of engine have been relocated. Front line now delivers oil directly to #1 trough in oil tray (formerly directed oil to timing gear compartment). Timing gears now lubricated by splash from connecting rods and higher oil level in gear compartment maintained by use of baffle on timing gear cover and elimination of oil drain hole in front main bearing cap (formerly used to supply oil to front of oil pan). Rear line from oil pump delivers oil to check valve (operates oil signal on instrument panel) which has been relocated farther forward in cylinder block allowing direct oil passage to #6 trough in oil tray.

Oil Pan Tray ('112' Engine)—New type conveyors used at front and rear ends of tray. Oil dams now used opposite #1 and #2 troughs and #5 and #6 troughs which direct oil draining from right side of cylinder block directly into #1 and #6 troughs. REPLACEMENT NOTE—1939 trays can be used on earlier cars. Old type cannot be used on 1939 cars.

Oil Pan Tray (Six Engine)—New baffles used between #1 and #2 troughs and between #5 and #6 troughs which maintain higher oil levels in #1 and #6 troughs and overflow from these troughs fed to remaining troughs. REPLACEMENT NOTE—Same as for '112' above.

Oil Suction Pipe Seal ('112' & Six Engines)—New synthetic rubber suction pipe seal fitted in counterbore in cylinder block flange at point where suction pipe passes through oil pan flange. Seal fits around pipe and oil pan gasket widened at this point. Seal compressed by pan when pan screws tightened. NOTE—Use new seal whenever pan installed.

1939 MODELS

OIL SUCTION PIPE SEAL (EIGHT ENGINE):—Same as for '112' and Six engines above.

1934-39 MODELS

CLUTCH OIL:—Servicing—Hudsonite (oil) in clutch must be renewed every 5000 miles. Turn engine over until hexagonal drain plug on front face of flywheel is visible in timing inspection hole on left side of motor rear support above starting motor. Remove drain plug (using special wrench J-472), turn engine over 1/3 revolution until star on flywheel is at inspection hole, allow engine to stand in this position one minute to drain old oil, turn engine over until filler plug is again at inspection hole, insert 1/3 pint Hudsonite (use J-485 gun), replace plug. **Capacity & Oil—1/3 pt. Hudsonite Clutch Compound.**

1938-39 MODELS

KING PIN THRUST BEARING:—King pin end thrust taken by 5 loose balls in upper bushing above king pin. Ball seat in bushing and on king pin end.

Installation—To install king pin, insert king pin from below until it enters top bushing (with keyways aligned and 'Corprene' seal in place under top bushing). Drop 5 loose balls through lubrication fitting hole on top of bushing, insert driver J-479-1 in hole to position balls, drive king pin into place (keyways aligned).

1936-39 MODELS

TORQUE ARMS:—Assembled between bracket on each frame siderail and rear of front axle. When removing axle, disconnect each torque arm at frame bracket (use Bolt Press J-885 to remove bolts from rubber grommets) and remove axle with torque arms attached. When assembling axle to springs (with torque arms mounted on axle), adjust U-bolt nuts so torque arms will fall slowly of own weight when raised at rear end, install jam nuts on U-bolts. Finally connect torque arms to frame brackets by assembling rubber grommets in eye of each arm (immerse rubber in gasoline before installing to allow bolt to enter freely), insert bolt through bracket and arm, tighten nut.

1939 MODELS

AUTOPOISE CONTROL:—Used on all 1939 Passenger Cars—New type linkage (similar to stabilizer) connecting front wheels together and helps maintain front wheels in straight ahead position. Consists of transverse bar suspended in rubber bushings mounted in brackets bolted to frame (ahead of front axle). Ends of bar curve to rear and are attached to brackets bolted to spindles by rubber bushed link at each end. In operation, bar is twisted or sprung whenever wheels turned away from straight ahead position which results in wheels being returned to straight ahead position when turning force on steering wheel released. A slight increase in force required to turn wheel results.

NOTE—Autopoise Control may be installed on all 1937-38 Hudson and Terraplane models for improvement in car control and for the elimination of wander and shimmy.

1939 MODELS

BRAKE LINING CHANGE:—Later cars have new type primary shoe lining. This lining is harder than first type and provides less sensitive brake. New lining should be installed on first cars in complete sets only (Brake Shoe and Lining Sets).

ENGINE NUMBER:—First number 2001. Stamped on left side of cylinder bank opposite #3 cylinder.

ENGINE:—Own. Six cylinder, 'L' head type.
Bore—2 15/16". **Stroke**—4¾".
Piston Displacement—193 cubic inches.
Rated Horsepower—20.7.
Developed Horsepower—73 at 3200 R.P.M. (Std. hd.), 80 at 3200 R.P.M. (Optl. high comp. head).
Compression Ratio—6.2-1 Std., 7.1-1 Optl.
Compression Pressure—116 lbs. at 220 R.P.M. (Std. 6.2-1 head), 125 lbs. at 200 R.P.M. (Optl. 7.1-1 head) when motored with all spark plugs removed and throttle wide open.
Vacuum Reading—Gauge should show steady reading of 18-19" at idling speed.
NOTE—High compression (7.1-1) engines marked by plate on left side of block and ethyl fuel must be used.

Pistons:—Own, Lo-Ex silicon-aluminum alloy, 'T' slot, cam ground type. Refinish cylinders to take finished replacement pistons (see Reconditioning).
Weight—9¼ ozs. stripped.
Removal—Pistons and rods removed from below by first removing crankshaft counterweights.
Clearance—.0015-.002" top of skirt, .0005-.001" at bottom.

Reconditioning Cylinders:—Size of original bore indicated by letter stamped on lower edge of valve chamber opposite cylinder as follows: 'A' 2.9375", 'B' 2.938", 'C' 2.9385", 'D' 2.939", 'E' 2.9395", 'AO' 2.9475", 'BO' 2.948", 'CO' 2.9485", 'DO' 2.949", 'EO' 2.9495". Recondition cylinder to standard size for which piston and piston rings are available (see piston and ring data below).

Replacement Pistons:—Standard and oversize pistons marked by letter stamped on head furnished for cylinder bores of size indicated: 'B' 2.9375-2.938", 'D' 2.9385-2.939", 'F' 2.9395-2.940", 'J' 2.9415", 'L' 2.9425", 'BO' 2.9475-2.948", 'DO' 2.9485-2.949", 'FO' 2.9495-2.950", 'LO' 2.9525", 'BB' 2.9575", 'DD' 2.9585", 'FF' 2.9595". All pistons in same engine should be of same weight.
Fitting New Pistons—Use feeler gauge .0015-.002" thick to check clearance. It should be possible to withdraw feeler from between piston and cylinder wall on side opposite slot when grasped between thumb and forefinger (3-4 lb. pull).
Installing Pistons—Slot should be to left or away from valves.

Piston Rings:—Two compression, two oil control rings per piston, all above pin. Rings are positioned by pin in ring groove.
NOTE—Use standard or oversize rings of size indicated for replacement pistons marked as follows: 'B, D, F' 2.937", 'J' 2.940", 'L' 2.942", 'BO, DO, FO' 2.947", 'LO' 2.952", 'BB, DD, FF' 2.957".

Ring	Width	End Gap
Compression	3/64"	.009-.011"
Oil Control (#3)	⅛"	.009-.011"
Oil Control (#4)	9/64"	.009-.011"

Piston Pin:—Diameter ¾". Length 2 7/16". Pin floats in piston and rod. Held by retaining rings. Pins furnished standard and .002", .005", .010" oversize. Pin hole in connecting rod is bronze-bushed.

Connecting Rod:—Weight 28.96 ozs. Length 8 3/16".
Lower Bearing—Spun-babbitt lined type.
Clearance—.001". Sideplay .006-.010".
Adjustment—Shims (laminated type). Do not file rod or caps.
Crankpin Journal Diameter—1 15/16".
Installing Rods—Connecting rod lower bearings are offset. Install rods with right hand offset (widest half of bearing toward rear) in cylinders #1, 2, 4, and rods with left hand offset (widest half of bearing toward front) in #3, 5, 6.

Crankshaft:—3 bearing. Integral counterweights.
Journal Diameters—#1 2 11/32", #2 2⅜", #3 2 13/32".
Bearing Type—Removable bronze-backed, babbitt-lined.
Clearance—.001".
Adjustment—Laminated shims. Do not file caps.
End Thrust—Taken by #2 (center) bearing. Endplay .006-.012".

Camshaft:—Three bearing. Gear driven.
Timing Gears—Crankshaft gear Steel. Camshaft gear GE. Bakelite.
End Thrust—Taken by spring-loaded plunger in camshaft gear and thrust plate on gear cover.
Camshaft Setting:—Gears are marked. Mesh marked tooth on crankshaft gear between two marked teeth on camshaft gear.

Valves:—	Head Diameter	Stem Diam.	Length
All Valves	1⅜"	5/16"	5 3/32"

	Seat Angle	Lift	Stem Clearance
Intake	45°	11/32"	.0015-.003".
Exhaust	45°	11/32"	.003-.005".

Tappet Clearance—.003-.005" Intake, .005-.007" Exhaust with engine hot.
Spring Pressure—53 lbs. (valve closed).
Valve Timing—See Camshaft Setting (above).
Intake Valves—Open 10°40' BTDC. Close 60° ALDC.
Exhaust Valves—Open 50° BLDC. Close 18°44' ATDC.
To Check Valve Timing—Set tappet clearance #1 intake valve at .010". This valve should open with piston 10°40' or .0528" before top dead center when a point on the flywheel approximately 3.17 teeth before top dead center mark 'UDC. 1-6' lines up with indicator. Reset tappet clearance at .006" with engine warm and running.

Lubrication:—Duo-flow (splash) system with positive pump feed to oil troughs and timing gears. Oscillating plunger type oil pump mounted on right side of crankcase.
Normal Oil Pressure—3 lbs.
Oil Pressure Relief Valve—Operates at 3 lbs. Located on right hand side of crankcase at rear (combined with oil pressure signal light switch). *See article in Electrical Equipment Section for data.*
Capacity & Oil—5 qts. (refill), 6 qts. (dry). Use SAE, #30 (above 40°F), 20-W (40° to 0°F), #10-W (0° to —15°F.).

CLUTCH:—Own make. Single plate type operating in oil. No adjustment for wear required.
Clutch Pedal Adjustment—Free movement of clutch pedal must 1½". To adjust, loosen locknut on clutch pedal connecting link, remove clevis pin at lower end of link, turn clevis until free movement of pedal is 1½", replace pin and tighten locknut.
Clutch Lubrication—Oil in clutch should be drained and replaced at 5000-15000 mile intervals. To drain oil, turn flywheel until filler plug is visible in inspection hole in right front face of flywheel housing. Remove plug, turn flywheel so that hole is down, allow at least one minute in this position for draining, refill with mixture of 1/6 pint light engine oil, 1/6 pint kerosene, replace plug securely.
Facings—10" driven plate with cork inserts.

STEERING: — Front Suspension—Conventional 'I' beam section front axle with Reverse Elliott ends and semi-elliptic springs.
Kingpin Inclination—7° crosswise.
Caster—0-1°. Adjust by inserting wedge shim between spring and spring pad on axle.
Camber—1°. No adjustment. Axle may be bent cold for minor corrections.
Toe In—⅛" measured 10" above ground. Adjust by loosening tie rod end clamp bolts and rotating tierod in direction that wheels revolve to increase, or in opposite direction to decrease toe-in.
NOTE—End thrust on kingpin is taken by five ball bearings in plug above kingpin. Bearing lower race is machined directly in kingpin end.

Steering Gear:—Gemmer Worm-and-Sector type. *See article in Mechanical Equipment Section for data.*

BRAKES:—Service—Bendix Mechanical, Duo-Servo, single-anchor type. Hand lever applies all four service brakes. See article in Brake Section for complete adjustment directions.
Drum Diameter—11".
Lining—Moulded type. Width 1¾". Thickness 5/32". Length 21" per wheel.
Clearance—.008" anchor pin end, .014" adjusting screw end for each shoe.
Hand Brake:—See Service Brakes above.

ENGINE NUMBER:—First number (1932) 50,001, (1933) 63,501. Stamped on left side of cylinder block opposite #1 cylinder.

ENGINE SPECIFICATIONS:—Eight cylinder, 'L' head type.
Bore—3". Stroke 4½".
Displacement—254 cubic inches.
Rated Horsepower—28.8.
Developed Horsepower—(Std. 5.8-1 head) 101 at 3600 R.P.M. (Optl. 7.0-1 head) 110 at 3600 R.P.M.
Compression Ratio—5.8-1 Std. 7.0-1 Optl. Ratio marked by figure cast in upper surface of head casting.
Compression Pressure—80 lbs. at 125 R.P.M. (Std. head), 128 lbs. at 150 R.P.M. (Optl. 7.0-1 head).
Vacuum Reading—Gauge should show steady reading of 18-19" at idling speed.

PISTONS:—Own Lo-Ex aluminum alloy, 'T' slot, Cam ground type. Use finished replacement pistons when reconditioning engine. See Reconditioning paragraph.
Weight—9¾ ozs. stripped. Stamped on piston head.
Length—3 3/16".
Removal—Pistons and rods removed from below by first removing crankshaft counterweights.
Clearance—Skirt Clearance .0015-.002" top, .0005-.001" bottom. See Fitting new pistons.

Reconditioning Cylinders:—Size of original bore indicated by letter stamped on lower edge of valve chamber opposite cylinder as follows: A—3.000", B—3.0005", C—3.001", D—3.0015", E—3.002", AO—3.010", BO—3.0105", CO—3.011", DO—3.0115", EO—3.012". Recondition cylinder to standard oversize for which replacement piston and rings are available (see piston and ring data below).

Replacement Pistons:—Standard and oversize pistons marked by letter on head available for cylinder bores of size indicated: 'B'—3.000 & 3.0005", 'D'—3.001 & 3.0015", 'F'—3.002 & 3.0025", 'J'—3.004", 'L'—3.005", 'BO'—3.010 & 3.0105", 'DO'—3.011 & 3.0115", 'FO'—3.012 & 3.0125", 'LO'—3.015", 'BB'—3.020", 'DD'—3.021", 'FF'—3.022". All pistons installed in engine must be of same weight as indicated by mark on head.

Fitting New Pistons:—Use .0015" feeler ½" wide on side oposite slot at right angles to pin bosses to check clearance. Tension to withdraw feeler must be 3-4 lbs.

Installing Pistons:—Slot toward left or away from camshaft.

PISTON RINGS:—Two compression, two oil control rings per piston, all above pin. Oil ring grooves drilled radially with oil drain holes.

Ring	Width	End Gap
Comp.	3/32"	.009-.011"
Oil Cont. (#3)	⅛"	.009-.011"
Oil Cont. (#4)	9/64"	.009-.011"

NOTE—Use standard or oversize rings of size indicated for replacement pistons (see replacement piston section above): 3.000"—B, D, F; 3.003"—J; 3.005"—L; 3.010"—BO, DO, FO; 3.015"—LO; 3.020"—BB, DD, FF. If rings are filed, clearance at pin must be kept uniform with end gap.

PISTON PIN—Diameter ¾". Length 2 7/16". Pin floats in piston and rod. Held by locking rings at each end. Pin hole in rod is bronze-bushed. Pins furnished for service standard and .002", .005", .010" oversize.
Pin Fit in Piston—Hand push fit with piston heated to 200° F.
Pin Fit in Rod Bushing—.0003" clearance. Rod should just turn in piston of own weight.

CONNECTING ROD:—Length 8 3/16". Weight 29.44 ozs.
Crankpin Journal Diameter—1 15/16".
Bearing Type—Spun babbitt lined integral with rod and cap.
Clearance—.001-.0015". Sideplay .006-.010".

Adjustment:—Shims (laminated type). Do not file rods or bearing caps.

Installing Rods:—Lower bearings offset. Install rods with right hand offset in cylinders #1, 3, 5, 7 and left hand offset in #2, 4, 6, 8.

CRANKSHAFT:—Five bearings. Integral counterwghts.
Journal Diameters—#1, 2 9/32", #2, 2 5/16", #3, 2 11/32", #4, 2⅜", #5, 2 13/32".
Bearing Type—Removable bronze- backed, babbitt-lined.
Clearance—.001-.0015".

Adjustment:—Shims (laminated type). Do not file bearing caps.

End Thrust:—Taken by #3 center main bearing. Endplay .006-.012".

CAMSHAFT:—Adjustable chain drive from crankshaft.
Timing Chain—Morse. Width 1¼". Pitch ½". Length 28½" or 57 links.
Chain Adjustment—Chain should be adjusted at 5000 mile intervals or whenever play on circumference of accessory drive shaft coupling exceeds ⅛". To adjust, loosen three mounting bolts on accessory bracket at right of engine on rear of chain case, remove inner upper and lower bolts (these pass through notches in eccentric and prevent rotation of the eccentric necessary for chain adjustment). Insert special wrench between accessory bracket and chain case, rotate eccentric clockwise (viewed from rear) until play on shaft coupling is ⅛". Insert bracket bolts and tighten securely (back off adjustment slightly, if necessary, to allow bolts to enter).
NOTE—Whenever accessory bracket is removed from engine, plug directly above shaft should be removed and ½ pint engine oil injected before engine is run.

Camshaft Setting:—Two pins on chain 20 links marked and two adjacent teeth on each sprocket also marked. Mesh chain so that marked pin is between marked teeth on both camshaft and crankshaft sprockets.

VALVES:—	Head Diam.	Stem Diam.	Length
Intake	1½"	5/16"	5 3/32" see note.
Exhaust	1⅜"	5/16"	5 3/32" see note.

NOTE—Valve length for 1932 5 1/32".

	Seat Angle	Lift	Stem Clearance
Intake	45°	11/32"	.0015-.003"
Exhaust	45°	11/32"	.003 - .005"

Tappet Clearance—.004" Intake, .006" Exhaust (1932), .006" Intake, .008" Exhaust (1933) with engine hot.

Valve Springs:—	Pressure	Length
Valve Closed	53 lbs.	2"

Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 10° 40' BTDC. Close 60° ALDC.
Exhaust Valves—Open 50° BLDC. Close 18° 44' ATDC.
NOTE—These figures correct for .010" tappet clearance.
To Check Valve Timing—Set tappet clearance #1 intake valve at .010". This valve should open with piston .0494" before top dead center when a point on the flywheel approximately 3.17 teeth before top dead center mark lines up with indicator in inspection hole in right front face of flywheel housing. Reset tappet clearance at .004" ('32), .006" ('33) with engine hot.
Motor Gauge—Weidenhoff Adapter #104 (Std. head), #114 (H.C. head), Rod #2 (Std. head), #42 (Optl. head).

LUBRICATION:—Duo-flow (splash) system with positive feed to oil troughs and timing chain by oscillating plunger type pump. Pump mounted on rear face of accessory bracket at right of engine.
Normal Oil Pressure—3 pounds.
Oil Pressure Relief Valve—Operates at 3 lbs. Not adjustable. Located on right side of crankcase at rear of engine. Combined with oil pressure signal light switch.
See article in Electrical Equipment Section for data.
Capacity & Oil—8 qts. Use SAE #30 (above 40° F), #20W (40° to 0° F).

CLUTCH:—Own make. Single plate type operating in oil. No adjustment for wear required.
Facings—Driven member is 10" in diameter. Facing consists of cork inserts in plate.
Adjustment—Clearance between pedal and underside of toeboard must be ¾". To adjust, loosen stopscrew locknut and turn stopscrew. Free movement of pedal must be 1½". To adjust, remove clevis pin at forward end of clutch pedal link, loosen locknut, turn clevis on link.

STEERING:—Steering Gear—Gemmer Worm-and-Sector type. See article in Steering Section for complete adjustment directions.

Front Suspension:—Conventional 'I' beam section front axle with Reverse Elliott ends and semi-elliptic springs.
Kingpin Inclination—7° crosswise.
Caster—0-1°. Adjust by inserting wedge shims between spring and spring pad on axle.
Camber—1°. No adjustment. Axle may be bent cold for minor corrections.
Toe In—0-⅛". Adjusted in usual manner by loosening clamp bolts and turning tie rod.

BRAKES:—Service—Bendix Mechanical, Duo-Servo, Single-anchor type. Hand lever applies all four service brakes. See article in Brake Section for complete adjustment directions.
Drum Diameter—13".
Lining—Moulded type. Width 1¾". Thickness 7/32". Length 25" per wheel.
Clearance—.008" anchor end, .014" adjusting screw end for each shoe.

Hand Brake:—See Service Brakes above.

ENGINE NUMBER:—First number ('34) 30,000, ('35) 55,000. Stamped on left side of cylinder block opposite #1 cylinder ('34), #8 cylinder ('35).

ENGINE:—**Own.** Eight cylinder, In line, 'L' head type. **Bore**—3". **Stroke**—4½".
Piston Displacement—254.47 cubic inches.
Rated Horsepower—28.8.
Developed Horsepower, Compression Ratio & Pressures—To check pressures, remove spark plugs, crank engine with wide open throttle:

Model	Ratio	Horsepower	Press. @ 150 R.P.M.
LL	5.75-1	108 @ 3200	80 lbs.
LT	6.25-1	113 @ 3800	116 lbs.
LL, LT	7.0-1	121 @ 4000	128 lbs.
HT, HU, HHU	6.0-1	113 @ 3800	110 lbs.
HT, HU, HHU	7.0-1	124 @ 4000	128 lbs.

NOTE—6.25-1 and 7.0-1 heads are aluminum composite. High octane fuel must be used with these heads.
Vacuum Reading—Gauge should show steady reading of 18-20" with engine idling.

Pistons:—Own Lo-Ex, silicon-aluminum alloy, 'T' slot, cam ground type. Use finished replacement pistons when reconditioning engine. See Reconditioning paragraph .
Weight—9.6 ozs. ('34), 10.88 ozs. ('35) stripped; 14.5 ozs. ('34), 12.99 ozs. ('35) with rings and pin.
Length—3 3/16".
Removal—Pistons and rods removed from above.
Clearance—Top .016". Bottom .0005" ('34), .002" ('35).
NOTE—1935 pistons may be installed in 1934 engines as complete sets only.
Reconditioning Cylinders—Size of original bore indicated by letter stamped on lower edge of valve chamber opposite cylinder as follows: A-3.000", B-3.0005", C-3.001", D-3.0015", E-3.002", AO-3.010", BO-3.0105", CO-3.011", DO-3.0115", EO-3.012". Recondition cylinder to standard oversize for which replacement piston and rings are available (see piston and ring data below).
Replacement Pistons—Standard and oversize pistons marked by letter on head available for **cylinder bores** of size indicated: 'B'-3.000 & 3.0005", 'D'-3.001 & 3.0015", 'F'-3.002 & 3.0025", 'J'-3.004", 'L'-3.005". 'BO'-3.010 & 3.0105", 'DO'-3.011 & 3.0115", 'FO'-3.012 & 3.0125", 'LO'-3.015", 'BB'-3.020", 'DD'-3.021, 'FF'-3.022". All pistons installed in engine must be of same weight as indicated by mark on head.
Fitting New Pistons—Use feeler stock .0015-.002" thick to check clearance. It should be possible to withdraw feeler from between piston and cylinder bore on side opposite slot when grasped between thumb and forefinger with 3-4 lbs. pull.
Installing Pistons—Slot should be to left or away from valves.

Piston Rings:—Four rings per pistons, two compression, two oil control rings ('34—all rings above pin, '35—lower oil control ring below pin). Lower ring groove drilled radially with oil drain holes. Rings are positioned by pin in piston ring groove.

1934 Piston Rings

Ring	Width	End Gap	Wall Thickness
Comp. (all)	3/32"	.006-.016"	.123"
Oil Cont. (upper)	⅛"	.006-.016"	.128"
Oil Cont. (lower)	3/16"	.006-.016"	.128"

1935 Piston Rings

Ring	Width	End Gap.	Wall Thickness
Comp.	.093"	.006-.016"	.123"
Oil Cont.	.187"	.006-.016"	.128"

NOTE—Use standard or oversize rings of size indicated for replacement pistons (see Replacement Piston section above); 3.000"—B, D, F,; 3.003"—J; 3.005"—L; 3.010"—BO, DO, FO; 3.015"—LO; 3.020"—BB, DD, FF. If rings are filed, clearance at pin must be kept uniform with end gap.

Piston Pin:—Diameter ¾". Length 2 7/16". Pin floats in piston and rod. Held by retaining rings. Pins furnished standard, .002", .005", .010" oversize.
Pin Fit in Piston—Snug fit with piston at 200°F.
Clearance in Rod Bushing—.0003".

Connecting Rod:—Weight 28.96 ozs. Length 8 3/16".
Lower Bearing—Spun-babbitt lined type.
Crankpin Journal Diameter—1 15/16".
Clearance—.001". Sideplay, .006-.010".
Adjustment—Laminated shims. Do not file caps.
Installing Rods—Connecting rod lower bearings offset. Install rods with right hand offset (widest half of bearing toward rear) in cylinders #1, 3, 5, 7 and rods with left hand offset (widest half toward front) in cylinders #2, 4, 6, 8.

Crankshaft:—Five bearings. Eight counterweights.
Journal Diameters—#1, 2 9/32"; #2, 2 5/16"; #3, 2 11/32"; #4, 2⅝"; #5, 2 13/32".
Bearing Type—Removable bronze-backed, babbitt-lined.
Clearance—.001".
Adjustment—Laminated shims. Do not file caps.
End Thrust—Taken by #3 center bearing. Endplay, .006-.012".

Camshaft:—Five bearing. Gear driven.
Timing Gears—Crankshaft gear Steel. Camshaft gear GE. Bakelite.
End Thrust—Taken by spring-loaded plunger in camshaft gear and thrust plate on gear cover.
Camshaft Setting—Gears are marked. Mesh marked tooth on crankshaft gear between two marked teeth on camshaft gear.

Valves:—

	Head Diameter	Stem Diameter	Length
Intake	1½"	5/16"	5 3/32"
Exhaust	1⅜"	5/16"	5 3/32"

	Seat Angle	Lift	Stem Clearance
Intake	45°	11/32"	.0015-.003"
Exhaust	45°	11/32"	.003-.005"

Tappet Clearance—.006" Int., .008" Exh. engine hot.
Valve Springs—Cages installed on all springs at bottom. Install with open side toward cylinder.

	Spring Pressure	Length
Valve Closed	44 lbs.	2"
Valve Open	102 lbs.	1 21/32"

Valve Timing—See Camshaft Setting (above).
Intake Valves—Open 10°40' BTDC. Close 60° ALDC.
Exhaust Valves—Open 50° BLDC. Close 18°44' ATDC.
To Check Valve Timing—Set tappet clearance #1 intake valve at .010". This valve should open with piston 10°40' or .0494" before top dead center when a point in the flywheel approximately 3.97 teeth before the dead center mark 'UDC.1-8' lines up with the indicator on the housing.
Motor Gauge—Weidenhoff Adapter #114, Rod #44.

Lubrication:—Duo-flow (splash) system with positive pump feed to oil troughs and timing gears. Oscillating plunger type oil pump mounted on right side of crankcase.
Normal Oil Pressure—3 lbs.
Oil Pressure Relief Valve—Operates at 3 lbs. Located on right hand side of crankcase at rear (combined with oil pressure signal light switch). *See article in Electrical Equipment Section for data.*
Capacity and Oil—7 qts. (refill), 9 qts. (dry). Use SAE. #30 (above 40°F.), #20-W (40° to 0°F.), #10-W (0° to —15°F.).

CLUTCH:—Own make. Single plate type operating in oil. No adjustment for wear required. *See article in Mechanical Equipment Section for data.*
Clutch Pedal Adjustment—Free movement of clutch pedal must be 1½". To adjust, loosen lock nut on clutch pedal connecting link, remove clevis pin at lower end of link, turn clevis until free movement of pedal is 1½", replace pin and tighten lock nut. See adjustment for automatic clutch linkage below.
Automatic Clutch Control—On cars with automatic clutch, check control linkage whenever clutch pedal is adjusted. Depress accelerator pedal, pull back on clutch control unit cable (left side of engine), check clearance between back of slot in cable yoke and clevis pin which attaches it to operating lever. This clearance should be ⅞".
Clutch Lubrication—Oil in clutch should be drained and replaced at 5000-15000 mile intervals. To drain oil, turn flywheel until filler plug is visible in inspection hole (left hand front face of flywheel above starter), remove plug, turn flywheel until star stamped on flywheel face is visible in inspection hole, allow at least 1 minute in this position for draining, turn flywheel until filler plug is visible, insert 1/3 pint Hudsonite Clutch Compound, replace filler plug.
Clutch Facings—Driven plate is 6⅜" I.D., 9¾" O.D., .203" thick. Facing consists of 108 cork inserts mounted on driven plate.

STEERING:—Front Suspension—Conventional 'I' beam section front axle with Elliott type ends and semi-elliptic springs, or Axleflex articulated axle. Data and adjustment for both types are the same.
Kingpin Inclination—7° crosswise.
Caster—2½-3½° ('34), 4-4½° ('35). Adjusted by inserting wedge shims between springs and spring pad on axle.
Camber—1-1½°. No adjustment. Axle may be bent cold to correct camber.
Toe In—⅛" measured 10" from ground. Adjust by loosening tie rod end clamp bolts and rotating tie rod.
NOTE—End thrust on kingpin is taken by five ball bearings in plug above kingpin. Bearing lower race is machined directly in kingpin end.

Steering Gear:—Gemmer Worm-and-Sector type. *See article in Mechanical Equipment Section for data.*

BRAKES:—Service—Bendix mechanical, Duo-Servo, Single anchor type. Hand lever applies all service brakes. See article in Brake Section for complete adjustment procedure.
NOTE—See Hudson GH (previous article) for Service Brake specifications on Hudson 8 Models LT, LTS, HT and HU. Specifications below apply to Models LL and HHU only.
Drum Diameter—11".
Lining—Moulded type. Width 1¾". Thickness 3/16". Length per wheel 23 13/16".
Clearance—.014" heel, .008" toe, for each shoe.

Hand Brake Adjustment:—See Service Brakes.

AUTOMATIC SHIFT: (ELECTRIC HAND):—Bendix electro-pneumatic type optional on Models HT, HU, standard on Model HHU. See article in Mechanical Equip. Section for complete description, wiring diagram and trouble shooting on 1935 Type Electric Hand.

ENGINE NUMBER:—First number, 70,000. Stamped on left side of cylinder block opposite #6 cylinder.

ENGINE:—**Own.** Six cylinder, 'L' head type.

Bore—3". **Stroke**—5".

Piston Displacement—212.058 cubic inches.

Rated Horsepower—21.6.

Developed Horsepower—93 at 3800 R.P.M. (Std. 6.25-1 head), 100 at 3800 R.P.M. (7.0-1 head).

Compression Ratio—6.25-1 (Std. cast-iron head), 7.0-1 (optl. composite aluminum-iron head).

Compression Pressure—116 lbs. at 219 R.P.M. (6.25-1 head), 127 lbs. at 207 R.P.M. (7.0-1 head) with all spark plugs removed and throttle wide open.

NOTE—High-octane type fuel must be used in engines with 7.0-1 ratio composite head.

Vacuum Reading—Gauge should show steady reading of 18-20" with engine idling.

Pistons:—Own, Lo-Ex silicon-aluminum alloy, 'T' slot, cam ground type. Use refinished replacement pistons when reconditioning engine. See Reconditioning paragraph.

Weight—10.88 ozs. stripped, 12.99 ozs. with rings and pin.

Length—3 3/16".

Removal—Pistons and rods removed from above.

Clearance—Top .016". Bottom .001".

Reconditioning Cylinders—Size of original bore indicated by letter stamped on lower edge of valve chamber opposite cylinder as follows: A-3.000", B-3.0005", C-3.001", D-3.0015", E-3.002", AO-3.010", BO-3.0105", CO-3.011", DO-3.0115", EO-3.012". Recondition cylinder to standard oversize for which replacement piston and rings are available (see piston and ring data below).

Replacement Pistons—Standard and oversize pistons marked by letter on head available for **cylinder bores** of size indicated: 'B'-3.000 & 3.0005", 'D'-3.001 & 3.0015", 'F'-3.002 & 3.0025", 'J'-3.004", 'L'-3.005". 'BO'-3.010 & 3.0105", 'DO'-3.011 & 3.0115", 'FO'-3.012 & 3.0125", 'LO'-3.015", 'BB'-3.020", 'DD'-3.021, 'FF'-3.022". All pistons installed in engine must be of same weight as indicated by mark on head.

Fitting New Pistons—Use feeler gauge .0015-.002" thick to check clearance. It should be possible to withdraw feeler from between piston and cylinder wall on side opposite slot when grasped between thumb and forefinger with 3-4 lbs. pull.

Installing Pistons—Slot should be to left or away from valves.

Piston Rings:—Two compression rings, one oil control ring above pin, one oil control ring below pin. Lower ring groove drilled radially with oil drain holes.

Ring	Width	End Gap	Wall Thickness
Comp.	.093"	.006-.016"	.123"
Oil Cont.	.187"	.006-.016"	.128"

NOTE—Use standard or oversize rings of size indicated for replacement pistons (see Replacement Piston section above); 3.000"—B, D, F,; 3.003"—J; 3.005"—L; 3.010"—BO, DO, FO; 3.015"—LO; 3.020"—BB, DD, FF. If rings are filed, clearance at pin must be kept uniform with end gap.

Piston Pin:—Diameter ¾". Length 2 7/16". Pin floats in piston and rod. Held by retaining rings.

Pin Fit in Piston—Snug fit with piston at 200°F.

Clearance in Rod Bushing—.0003".

Connecting Rod:—Weight 28.96 ozs. Length 8 3/16".

Crankpin Journal Diameter—1 15/16".

Lower Bearing—Spun babbitt-lined type.

Clearance—.001". Sideplay .006-.010".

Adjustment—Shims (laminated type). Do not file rod or caps.

Installing Rods—Connecting rod lower bearings are offset. Install rods with right hand offset (widest half of bearing toward rear) in cylinders #1, 2, 4, and rods with left hand offset (widest half of bearing toward front) in cylinders #3, 5, 6.

Crankshaft: — Three bearings. Integral counterweights.

Journal Diameters—#1 2 11/32", #2 2⅜", #3 2 13/32".

Bearing Type—Removable bronze-backed, babbitt-lined.

Clearance—.001".

Adjustment—Laminated shims. Do not file caps.

End Thrust—Taken by #2 (center) bearing. Endplay .006-.012".

Camshaft:—Three bearing. Gear driven.

Timing Gears—Crankshaft gear steel. Camshaft gear GE. Bakelite.

End Thrust—Taken by spring-loaded plunger in camshaft gear and thrust plate on gear cover.

Camshaft Setting—Gears are marked. Mesh marked tooth on crankshaft gear between two marked teeth on camshaft gear.

Valves:

	Head Diameter	Stem Diameter	Length
All Valves	1⅜"	5/16	5 11/32"

	Seat Angle	Lift	Stem Clearance
Intake	45°	11/32"	.0015-.003"
Exhaust	45°	11/32"	.003-.005"

Tappet Clearance—.006" Int., .008" Exh., engine hot.

Valve Springs—Cages installed on all springs at bottom. Install with open side toward cylinder.

	Spring Pressure	Length
Valve Closed	44 lbs.	2"
Valve Open	102 lbs.	1 21/32"

Valve Timing—See Camshaft Setting (above)

Intake Valves—Open 10°40' BTDC. Close 60° ALDC.

Exh. Valves—Open 50° BLDC. Close 18°44' ATDC.

To Check Valve Timing—Set tappet clearance #1 intake valve at .010". This valve should open with piston 10°40' or .0562" before top dead center when a point on the flywheel approximately 3.17 teeth before the dead center mark 'UDC.1-6' lines up with the pointer on the housing. No flywheel mark provided.

Motor Gauge—Weidenhoff Adapter #114, Rod #44.

Lubrication:—Duo-flow (splash) system with positive pump feed to oil troughs and timing gears. Oscillating plunger type oil pump mounted on right side of crankcase.

Normal Oil Pressure—3 lbs.

Oil Pressure Relief Valve—Operates at 3 lbs. Located on right hand side of crankcase at rear (combined with oil pressure signal light switch). *See article in Electrical Equipment Section for data.*

Capacity and Oil—5 qts. (refill), 6 qts. (dry). Use SAE. #30 (above 40°F.), #20-W (40° to 0°F.), #10-W (0° to —15°F.).

CLUTCH:—**Own make.** Single plate type operating in oil. No adjustment for wear required.

See article in Mechanical Equipment Section for data.

Clutch Pedal Adjustment—Free movement of clutch pedal must 1½". To adjust, loosen lock nut on clutch pedal connecting link, remove clevis pin at lower end of link, turn clevis until free movement of pedal is 1½", replace pin and tighten lock nut. See adjustment for Automatic Clutch linkage below.

Automatic Clutch Control—On cars with Automatic Clutch, check control linkage whenever clutch pedal is adjusted. Depress accelerator pedal, pull back on clutch control unit cable (left side of engine), check clearance between back of slot in cable yoke and clevis pin which attaches it to operating lever. This clearance should be ⅞".

Clutch Lubrication—Oil in clutch should be drained and replaced at 5000-15000 mile intervals. To drain oil, turn flywheel until filler plug is visible in inspection hole (left hand front face of flywheel housing), remove plug, turn flywheel until star stamped on flywheel is visible in inspection hole, allow at least one minute in this position for draining, turn flywheel until filler plug hole is visible, insert 1/3 pint Hudsonite Clutch Compound, replace filler plug.

Clutch Facings—Driven plate is 5⅜" I.D., 8⅝" O.D., .203" thick. Facing consists of 90 cork inserts mounted on driven plate.

STEERING:—**Front Suspension**—Conventional 'I' beam section front axle with Elliott type ends and semi-elliptic springs (standard), or Axle-flex articulated axle (optional). Data and adjustments for both types are the same.

Kingpin Inclination—7° crosswise.

Caster—3¼-3¾°. Adjust by inserting wedge shims between springs and spring pad on axle.

Camber—½°. No adjustment. Axle may be bent cold to correct camber.

Toe In—⅛" measured 10" above ground. Adjust by loosening tie rod end clamp bolts and rotating tie rod in direction that wheels revolve to increase toe-in, or in opposite direction to decrease toe-in.

NOTE—End thrust on kingpin is taken by five ball bearings in plug above kingpin. Bearing lower race is machined directly in kingpin end.

Steering Gear:—Gemmer Worm-and-Sector type.

See article in Mechanical Equipment Section for data.

BRAKES:—**Service**—Bendix mechanical, Duo-Servo, Single anchor type. Hand lever applies all service brakes. See article in Brake Section for complete adjustment procedure.

Drum Diameter—9".

Lining—Moulded type. Width 2¼". Thickness 3/16". Length per wheel 19 3/16".

Clearance—.014" heel, .008" toe, between lining and drum for each shoe.

Hand Brake Adjustment:—See Service Brakes.

AUTOMATIC SHIFT (ELECTRIC HAND):—Bendix electro-pneumatic type optional on these cars. See article in Mechanical Equipment Section on Electric Hand 1935 Type for complete description, wiring diagram, and trouble shooting.

ENGINE NUMBER:—First number—79,000. Stamped on left side of cylinder block opposite #6 cylinder.

ENGINE SPECIFICATIONS:—**Type**—6 cyl .,'L' head.
Bore—3". **Stroke**—5".
Displacement—212 cubic inches.
Rated Horsepower—21.6 (AMA).
Developed Horsepower—93 at 3800 R.P.M. (Std. 6.25-1 head), 100 at 3800 R.P.M. (Optl. 7.0-1 head).
Compression Ratio & Pressure—To check pressures, remove spark plugs, crank engine with throttle wide open.
Std. 6.25-1 Head.....116 lbs. at 219 R.P.M.
Optl. 7.0-1 Head.....127 lbs. at 207 R.PM..
Vacuum Reading—Gauge should show steady reading of 18-19" of HG. with engine idling at 350 R.P.M. or 7 M.P.H.
NOTE—High Octane fuel must be used in engines with optional high compression 7.0-1 head.

PISTONS:—Own Lo-Ex aluminum alloy, 'T' slot, Cam ground type. Use finished replacement pistons when reconditioning engine. See Reconditioning paragraph.
Weight—10.5 ozs. stripped. Stamped on piston head.
Length—3 3/16".
Removal—Pistons and rods removed from above.
Clearance—Top .016". Skirt .002". See Fitting new Pistons.
NOTE—These pistons interchangeable with 1935 and may be installed in complete sets on 1934 model.
Reconditioning Cylinders:—Size of original bore indicated by letter stamped on lower edge of valve chamber opposite cylinder as follows: A-3.000", B-3.0005", C-3.001", D-3.0015", E-3.002", AO-3.010", BO-3.0105", CO-3.011", DO-3.0115", EO-3.012". Recondition cylinder to standard oversize for which replacement piston and rings are available (see piston and ring data below).
Replacement Pistons:—Standard and oversize pistons marked by letter on head available for cylinder bores of size indicated: 'B'-3.000 & 3.0005", 'D'-3.001 & 3.0015", 'F'-3.002 & 3.0025", 'J'-3.004", 'L'-3.005". 'BO-3.010 & 3.0105", 'DO'-3.011 & 3.0115", 'FO'-3.012 & 3.0125", 'LO'-3.015", 'BB'-3.020", 'DD'-3.021, 'FF'-3.022". All pistons installed in engine must be of same weight as indicated by mark on head.
Fitting New Pistons:—Use .0015" feeler ½" wide on side opposite slot at right angles to pin bosses to check clearance. Tension to withdraw feeler must be 3-4 lbs.
Installing Pistons:—Slot toward left or away from camshaft.

PISTON RINGS:—Two compression, one oil ring above pin, one oil ring below pin per piston. Upper oil ring groove drilled with twelve 5/16" oil drain holes and two 5/16" holes to pins. Lower oil ring groove drilled with four 5/16" holes and two oil drain slots. Rings are straight cut and are positioned by pin in piston ring groove.

Ring	Width	End Gap	Wall Thickness
Comp.	3/32"	.005" Min.	.123"
Oil (both)	3/16"	.005" Min.	.128"

NOTE—Use standard or oversize rings of size indicated for replacement pistons (see replacement piston section above): 3.000"—B, D, F; 3.003"—J; 3.005"—L; 3.010"—BO, DO, FO; 3.015"—LO; 3.020"—BB, DD, FF. If rings are filed, clearance at pin must be kept uniform with end gap.

PISTON PIN:—**Diameter ¾". Length 2 7/16".**
Pin floats in piston and rod. Held by locking ring at each end. Pin hole in rod is bronze-bushed. Pins furnished standard, .002", .005", .010" oversize.
Pin Fit in Piston—Hand push fit with piston heated to 200° F.
Pin Fit in Rod Bushing—.0003" clearance. With this clearance rod will just turn of own weight.

CONNECTING ROD:—Weight 29.4 ozs. Length 8 3/16".
Crankpin Journal Diameter—1 15/16".
Lower Bearing—Spun-babbitt lined type. Rods serviced on 'exchange' basis.
Clearance—.001". **Sideplay**—.006-.010".
Bearing Adjustment:—Laminated shims. Do not file rods or caps.
Installing Rods:—Lower bearings are offset. Install rods with right hand offset (widest half of bearing toward rear) in cylinders #1, 2, 4, and rods with left hand offset (widest half of bearing toward front) in cylinders #3, 5, 6. Oil scoop on bearing must be toward camshaft on all rods.

CRANKSHAFT:—Three bearing. Integral counterw'ts. *See Hudson Shop Notes for Crankshaft and Vibration Dampener removal, Main Bearing Removal, Installation and Line-Reaming data.*
Journal Diameters—#1, 2 11/32"; #2, 2⅜"; #3, 2 13/32".
Bearing Type—Removable bronze-backed, babbitt-lined. Bearings furnished for service reamed to standard size or unfinished (1/32" extra stock).
Clearance—.001".
Bearing Adjustment:—Shims. *See Hudson Shop Notes.*
End Thrust:—Taken by flanges on #2 (center) main bearing. Endplay .006-.012". Adjusted by replacing bearing.

CAMSHAFT:—Three bearing. Gear driven.
Journal Diameters—#1, 2"; #2, 1 31/32". #3, 1½".
Bearing Clearance—.0015".
End Thrust:—Taken by spring loaded plunger in end of camshaft and thrust plate on gear case cover.
NOTE—If gear case cover removed, see that spring and plunger are in place when cover replaced.
Timing Gears:—Crankshaft gear cast-iron. Camshaft gear GE. or Continental Diamond Fibre Bakelite.
Camshaft Setting:—Gears are marked. Mesh marked tooth of crankshaft gear between two marked teeth on camshaft gear.

VALVES:

	Head Diameter	Stem Diameter	Length
All Valves	1 ⅜"	⅜"	5 11/32"

	Seat Angle	Lift	Stem Clearance
Intake	45°	11/32"	.0015-.003"
Exhaust	45°	11/32"	.003-.005"

Tappet Clearance:—.006" Intake, .008" Exhaust (hot).
Valve Guides:—Removable type. Pressed in block. Finish ream guides after installation to size giving correct clearance.
Valve Springs:—Cages installed on bottom of all springs. Springs should be installed with open side of cage toward cylinder.

	Spring Pressure	Spring Length
Valve Closed	44 lbs.	2"
Valve Open	102 lbs.	1 21/32"

Valve Lifters:—Slipper type operating in individual removable guides. Lifter is prevented from turning by pin in guide.
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 10°40' BTDC. Close 60° ALDC.
Exhaust Valves—Open 50° BLDC. Close 18°44' ATDC.
These figures correct with .010" tappet clearance.
To Check Timing—Set tappet clearance #1 intake valve at .010". This valve should open with piston 10°40' or .0562" before top dead center when point on flywheel appoximately 3.94 teeth before 'UDC. 1-6/' mark lines up with indicator in hole in left front face of flywheel housing. Reset tappet clearance at .006" hot.
Motor Gauge—Weidenhoff #114 Adapter. #44 Rod.

LUBRICATION:—Duo-flow (splash) system. Force feed by oil pump to connecting rod troughs and timing gears. Splash to all other bearing points from troughs.
Normal Oil Pressure—3 lbs.
Oil Pressure Regulator—Operates at 3 lbs. Located on right side of crankcase. Not adjustable.
Crankcase Capacity—6 qts. refill.
Oil Pump:—Oscillating plunger type pump mounted on right side of crankcase and driven by gears from the camshaft.
Oil Pressure Indicator:—Consists of signal light on instrument panel and switch built in oil pressure regulator.
See article in Electrical Equipment Section for data.

CLUTCH:—**Own Make**—Single plate, cork insert type operating in oil. Driven plate can be recorked but is customarily replaced.
See article in Mechanical Equipment Section for data.
Clutch Plate—Thickness .203". Inside diameter 5.375". Outside diameter 8.625". Facing consists of 90 cork inserts.
Adjustment—Free movement of clutch pedal must be 1½" at all times. To adjust, remove clevis pin in clutch pedal link rod (between frame and leg of 'X' member below clutch pedal shaft), loosen locknut at top of clevis, turn clevis to shorten or lengthen rod as required, tighten locknut, replace clevis pin. On cars with automatic clutch control, check linkage whenever clutch is adjusted.
Automatic Clutch Linkage Adjustment—Hold accelerator pedal in depressed position, pull backward on clutch control power unit rod at left of engine. With rod in extreme rear position check clearance between back of slot in rod yoke and clevis pin which attaches it to operating lever. Clearance at this point must be ⅞".
Clutch Oil Servicing:—*See Hudson Shop Notes for data.*

STEERING:—**Steering Gear**—Gemmer Model Worm-and-Sector type. See article in Steering Section for adjustments.
NOTE—An adjustable drag link with ¾" adjustment (made by shifting shims from front to rear of pitman arm ball seat) is used on cars after #633110 (except 633153 to 633185 inclusive).
Front Suspension:—Conventional 'I' beam section front axle with Elliott type ends and semi-elliptic springs. Torque arm at each end of axle connected to frame at rear by rubber-bushed bolt maintains axle alignment.
Specifications & Adjustment—Kingpin inclination, Caster, Camber, Toe In, Steering Geometry, and Kingpin thrust bearing specifications and adjustment same as for Hudson Eight (see next page).

BRAKES:—**Service**—Bendix Hydraulic, Duo-Servo, Single Anchor type. Brake pedal connected to rear wheel brakes through cable linkage for additional reserve mechanical application of brakes. Hand lever applies rear wheel brakes through this same linkage. *See article in Mechanical Equipment Section.*
Brake Drum Diameters—10 1/16".
Brake Lining—Moulded & Woven type. Width 1¾". Thickness 7/32". Length 22⅛" per wheel.
Brake Clearance—.010" heel and toe of each shoe.
Brake Pedal Adjustment:—For correct mechanical follow-up feature, adjust position of nut on connecting rod so that clearance between face of nut and end of push rod is 1 29/32" with equalizer against stop.
Hand Brake:—See Service Brakes above.

AUTOMATIC SHIFT (ELECTRIC HAND):—Bendix electro-pneumatic type. Optional equipment.
See article in Mechanical Equipment Section for data.

ENGINE NUMBER:—First number—1000 (all models). Stamped on left side of engine block near top.

ENGINE SPECIFICATIONS:—Type—8 cyl., 'L' head.
Bore—3". **Stroke** 4½".
Displacement—254 cubic inches.
Rated Horsepower—28.8 (AMA).
Developed Horsepower—113 at 3800 R.P.M. (Std. 6.0-1 head), 124 at 4000 R.P.M. (Optl. 7.0-1 head).
Compression Ratio & Pressure—To check pressures, remove spark plugs, crank engine with throttle wide open.
Std. 6.0-1 Head.....110 lbs. at 150 R.P.M.
Optl. 7.0-1 Head .....128 lbs. at 150 R.P.M.
Vacuum Reading—Gauge should show steady reading of 18-19" of HG. with engine idling at 350 R.P.M. or 7 M.P.H.
NOTE—High Octane fuel must be used in engines with high compression 7.0-1 heads.

PISTONS:—Own Lo-Ex aluminum alloy, 'T' slot, Cam ground type. Use finished replacement pistons when reconditioning engine. See Reconditioning Section.
Weight—10.88 ozs. stripped. Stamped on piston head.
Length—3 3/16".
Removal—Pistons and rods removed from above.
Clearance—Top .016". Skirt .0015". See Fitting New Pistons.
NOTE—These pistons interchangeable with 1935 and may be installed in complete sets on 1932-33-34 models.
Reconditioning Cylinders:—Original cylinder size marking same as for Hudson Six and should be reconditioned in same manner (see previous page).
Replacement Pistons:—Furnished in same sizes as for Hudson Six (see previous page).
Fitting New Pistons:—Pistons fitted in same manner as on Hudson Six (see previous page).
Installing Pistons:—Slot toward left or away from camshaft.

PISTON RINGS:—Two compression, one oil ring above pin, one oil ring below pin per piston. Upper oil ring groove drilled with twelve 5/16" oil drain holes and two 5/16" holes to pins. Lower oil ring groove drilled with four 5/16" holes and two oil drain slots. Rings are straight cut and positioned by pin in groove.

Ring	Width	End Gap	Wall Thickness
Comp.	3/32"	.005" Min.	.123"
Oil (both)	3/16"	.005" Min.	.128"

NOTE—See Hudson Six (previous page) for ring oversizes and pistons for which used. If rings are filed, clearance at pin must be kept uniform with end gap.

PISTON PIN:—**Diameter** ¾". **Length** 2 7/16".
Pin floats in piston and rod. Held by locking ring at each end. Pin hole in rod is bronze-bushed. Pins furnished standard, .002", .005", .010" oversize.
Pin Fit in Piston—Hand push fit with piston heated to 200° F.
Pin Fit in Rod Bushing—.0003" clearance. With this clearance rod will just turn of own weight.

CONNECTING RODS:—**Weight** 29.4 ozs. **Length** 8 3/16".
Crankpin Journal Diameter—1 15/16".
Lower Bearing—Spun-babbitt lined type. Rods serviced on 'exchange' basis.
Clearance—.001". **Sideplay**—.006-.010".
Bearing Adjustment:—Laminated shims. Do not file rods or caps.
Installing Rods:—Lower bearings are offset. Install rods with right hand offset (widest half of bearing toward rear) in cylinders #1, 3, 5, 7 and rods with left hand offset (widest half of bearing toward front) in cylinders # 2, 4, 6, 8. Oil scoop on bearing cap must be toward camshaft on all rods.

CRANKSHAFT:—Five bearing. Integral counterweights. *See Hudson Shop Notes for Crankshaft and Vibration Dampener removal, Main Bearing Removal, Installation and Line-Reaming data.*
Journal Diameters—#1, 2 9/32"; #2, 2 5/16"; #3, 2 11/32"; #4, 2⅜"; #5, 2 13/32".
Bearing Type—Removable bronze-backed, babbitt-lined. Bearings furnished for service reamed to standard size or unfinished with 1/32" stock to permit reaming to desired size.
Clearance—.001".
Bearing Adjustment:—Shims. *See Hudson Shop Notes.*
End Thrust:—Taken by flanges on #3 center bearing. Endplay .006-.012". Adjusted by replacing bearing.

CAMSHAFT:—Five bearing. Gear driven.
Journal Diameters—#1, 2 1/32"; #2, 2"; #3, 1 31/32"; #4, 1 15/16"; #5, 1½".
Bearing Clearance—.0015".
End Thrust:—Taken by spring loaded plunger in end of gear and thrust plate on gear case cover.
NOTE—If gear case cover removed, see that spring and plunger are in place when cover replaced.
Timing Gears:—Crankshaft gear cast-iron. Camshaft gear GE. or Continental Diamond Fibre Bakelite.
Camshaft Setting:—Gears are marked. Mesh marked tooth of crankshaft gear between two marked teeth on camshaft gear.

VALVES:—

	Head Diam.	Stem Diam.	Length
Intake	1½"	⅜"	5 3/32"
Exhaust	1⅜"	⅜"	5 3/32"

	Seat Angle	Lift	Stem Clearance
Intake	45°	11/32"	.0015-.003"
Exhaust	45°	11/32"	.003-.005"

Tappet Clearance—.006" intake, .008" exhaust hot.
Valve Guides:—Removable. Pressed in block. Finish ream after installation to size for correct clearance.
Valve Springs:—Cages installed on bottom of all Springs. Install springs with open side of cage toward cylinder.

	Spring Pressure	Spring Length
Valve Closed	44 lbs.	2"
Valve Open	102 lbs.	1 21/32"

Valve Lifters:—Slipper type operating in individual removable guides. Lifter is prevented from turning by pin in guide.
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 10°40' BTDC. Close 60° ALDC.
Exhaust Valves—Open 50° BLDC. Close 18°44' ATDC.
To Check Valve Timing—Set tappet clearance #1 intake valve at .010".' This valve should open with piston 10°40' or .0494" BTDC. when point on flywheel approximately 3.97 teeth before 'UDC. 1-8/' mark lines up with indicator in hole in left front face of flywheel housing. Reset tappet clearance at .006".
Motor Gauge—Weidenhoff #114 Adapter, #44 Rod.

LUBRICATION:—Duo-flow (splash) system. Force feed by oil pump to connecting rod troughs and timing gears. Splash to all other points from troughs.
Normal Oil Pressure—3 lbs.
Oil Pressure Regulator—Operates at 3 lbs. Not adjustable. Located on right side of crankcase at rear.
Crankcase Capacity—9 qts.
Oil Pump:—Oscillating plunger type pump mounted on right side of crankcase and driven by gears from camshaft.
Oil Presure Indicator:—Consists of signal light on instrument panel and switch built in oil pressure regulator.
See article in Electrical Equipment Section for data.

CLUTCH:—**Own Make**—Single plate, cork insert type operating in oil. Driven plate can be recorked but is customarily replaced.
See article in Mechanical Equipment Section for data.
Clutch Plate—Thickness .203". Inside diameter 6.375". Outside diameter 9.75". Facing consists of 108 cork inserts.
Adjustment:—Free movement of clutch pedal must be 1½" at all times. To adjust, remove clevis pin in clutch pedal link rod (between frame and leg of 'X' member below clutch pedal shaft), loosen locknut at top of clevis, turn clevis to shorten or lengthen rod as required, tighten locknut, replace clevis pin. On cars with automatic clutch control, check linkage whenever clutch is adjusted.
Automatic Clutch Linkage Adjustment—Hold accelerator pedal in depressed position, pull backward on clutch control power unit rod at left of engine. With rod in extreme rear position check clearance between back of slot in rod yoke and clevis pin which attaches it to operating lever. Clearance at this point must be ⅞".
Clutch Oil Servicing:—*See Hudson Shop Notes for data.*
Capacity & Oil—1/3 pt. Hudsonite Clutch Lubricant

STEERING:—**Steering Gear**—Gemmer Model Worm-and Sector type. See article in Steering Section.
NOTE—An adjustable drag link with ¾" adjustment made by shifting shims from front to rear of pitman arm ball seat is used on cars after #641008 (except 641134 to 641135 inclusive), #65374, #661791, and #671681.
***Front Suspension:**—Conventional 'I' beam section* front axle with Elliott type ends and semi-elliptic springs. Torque arm at each end of axle connected to frame by rubber-bushed bolt used to maintain axle alignment.
King Pin Inclination—7° crosswise.
NOTE—Kingpin end thrust taken by five loose balls in upper bushing above king pin. Ball seat formed in bushing and on king pin end. To install king pin, assemble sufficient shims to allow .006-.010" endplay below spindle, insert king pin until it enters top bushing, drop 5 loose balls through lubrication fitting hole on top of bushing, insert driver J-479-1 in hole to position balls, drive king pin up into place.
Caster—3½-4½°. To adjust, loosen nut on horizontal arm attaching torque arm to axle yoke, take out capscrew between arm and yoke at top, decrease shim thickness between arm and yoke to increase caster, or increase shim thickness to decrease caster. .060" difference in shim thickness changes caster 1°. Shim thickness on both sides of car must be kept equal.
Camber—1-1½°. No adjustment. Axle may be bent cold for minor corrections.
Toe In—⅛" (0-⅛"). Adjusted in usual manner by loosening clamp nuts and turning tie rod.
Steering Geometry—Inner wheel turned 20°, outer wheel 17°. Check tie rod ends and steering arms for looseness, replace steering arms if bent.

BRAKES:—**Service**—Bendix Hydraulic, Duo-Servo, Single Anchor type. Brake pedal connected to rear wheel brakes through cable linkage for additional reserve mechanical application of brakes. Hand lever applies rear wheel brakes through this same linkage. *See article in Mechanical Equipment Section.*
Brake Drum Diameters—11 1/16".
Brake Lining—Moulded & Woven type. **Width** 1¾". Thickness 7/32". Length 23 15/16" per wheel.
Brake Clearance—.010" heel and toe of each shoe.
Brake Pedal Adjustment:—For correct mechanical follow-up feature. See article in Brake Section.
Hand Brake Adjustment:—See Service Brakes.

AUTOMATIC SHIFT (ELECTRIC HAND):—Bendix electro-pneumatic type. Optional equipment.
See article in Mechanical Equipment Section for data.

SERIAL NUMBER:—First number 73101. Stamped on plate on right front door hinge pillar post.

ENGINE NUMBER:—First number 90,000. Stamped on left side of cylinder block opposite #6 cylinder.

ENGINE SPECIFICATIONS:—6 cylinder, 'L' head type.
Bore—3". **Stroke** 5". **Displacement**—212 cu. ins.
Rated Horsepower—21.6 A.M.A.
Developed Horsepower—101 (Std. 6.25-1 Head), 107 (Optl. 7.0-1 head) at 4000 R.P.M.
Compression Ratio & Pressure—Check at cranking speed, spark plugs removed, throttle wide open.
Std. 6.25-1 head .....103 lbs. at 170 R.P.M.
Optl. 7.0-1 head .....119 lbs. at 170 R.P.M.
Vacuum Reading—18-21" at 350 R.P.M. or 7 M.P.H.

PISTONS:—Own Lo-Ex aluminum alloy, 'T' slot, cam ground type. Use finished replacement pistons.
Weight—10.5 ozs. stripped. **Length**—3 3/16".
Removal—Pistons and rods may be removed from above or below.
Clearance—.016" top, .002" skirt (see below).
Original Bore Size:—*See Hudson Shop Notes.*
Replacement Pistons:—*See Hudson Shop Notes.*
Fitting New Pistons:—3-4 lb. tension should be required to withdraw .0015" feeler ½" wide from between piston and cylinder wall on side opposite slot at right angles to pin bosses.
Installing Pistons:—Slot away from camshaft side.

PISTON RINGS:—Two compression, one oil ring above pin, one oil ring below pin. Rings positioned by pin in groove.

Ring	Width	End Gap	Side Clearance
Compression	3/32"	.009-.011"	.001"
Oil (both)	3/16"	.009-.011"	.001"

Replacement Rings:—*See Hudson Shop Notes.*

PISTON PIN:—Diameter—¾". **Length**—2 7/16".
Pin floats in piston and rod, held by locking rings. Pin hole in rod bronze-bushed. Pins furnished std., .002", .005", .010" oversize.
Pin Fit in Piston—.0003" clearance or hand push fit with piston heated to 200° F.
Pin Fit in Rod Bushing—.0003" clearance.

CONNECTING ROD:—Weight 29.4 ozs. **Length** 8 3/16".
Crankpin Journal Diameter—1 15/16".
Lower Bearing—Spun-babbitt. Rods exchanged. Finished bearings furnished standard and undersize (special order).
Clearance—.001". **Sideplay**—.006-.010".
Bearing Adjustment:—Laminated shims. Do not file.
Installing Rods:—Offset. Install rods with widest half of bearing toward rear (#1, 2, 4), toward front (#3, 5, 6). Oil scoop on all rods toward camshaft.

CRANKSHAFT:—3 bearing, integral counterweights *See Hudson Shop Notes for Crankshaft and Vibration Dampener removal, Main Bearing Removal, Installation and Line-Reaming data.*
Journal Diameters—#1, 2 11/32; #2, 2⅜"; #3, 2 13/32".
Bearing Type—Bronze-backed, babbitt-lined. Furnished std., and unfinished (1/32" extra stock—ream to desired undersize). **Clearance**—.001".
Bearing Adjustment:—Shims. *See Hudson Shop Notes.*
End Thrust:—Taken by center bearing. Replace bearing to adjust. Endplay.006-.012".

CAMSHAFT:—Three bearing. Gear driven.
Journal Diameters—#1, 2"; #2, 1 31/32"; #3, 1½".
Bearing Clearance—.0015".
End Thrust:—Taken by thrust washer assembled between front face of crankcase and rear side of camshaft front flange, and by spring-loaded button in camshaft hub and thrust plate on gear cover. See that spring and button in place under cover.
Timing Gears:—Crankshaft gear cast-iron. Camshaft gear GE. or Continental Diamond Fibre Bakelite.
Camshaft Setting:—Gears marked. Mesh marked tooth of crankshaft gear between two marked teeth on camshaft gear.

VALVES:—

	Head Diameter	Stem Diameter	Length
All Valves	1⅜"	⅜"	5 11/32"

	Seat Angle	Lift	Stem Clearance
Intake	45°	11/32"	.0015-.003"
Exhaust	45°	11/32"	.003-.005"

Tappet Clearance—.006" Int., .008" Exh., engine hot.
Valve Guides:—2 9/16" long. Top 1 1/16" below top of block. Finish ream to size after installation.
Valve Springs:—Cadmium plated. Install spring seat and spring dampener on bottom of all springs. Spring check (out of engine)—34 lbs. (min.). at 2".

	Spring Pressure	Spring Length
Valve Closed	44 lbs.	2"
Valve Open	102 lbs.	1 21/32"

Valve Lifters:—Roller shoe type, fitted in removable guides. *See Hudson Shop Notes for lifter removal.*
Valve Timing:—See camshaft setting above.
Intake Valves—Open 14° 40' BTDC. Close 60° ALDC.
Exhaust Valves—Open 50° BLDC. Close 18°44' ATDC.
These figures correct with .010" tappet clearance.
To Check Timing—Set tappet clearance #1 intake valve at .010". This valve should open with piston 10°40' or .0562" BTDC. when point on flywheel approximately 3.94 teeth before 'UDC.1-6/' mark lines up with pointer in hole in left front face of flywheel housing. Reset tappet clearance at .006" hot.
Motor Gauge—Weidenhoff Adapter #114, Rod #44.

LUBRICATION:—Duo-flow (pressure and positive splash) system.
Oil Pump:—Oscillating plunger type, gear driven by camshaft. Mounted on right side of crankcase.
Normal Oil Pressure—3 lbs. (no gauge).
Oil Pressure Regulator:—Located on right side of crankcase at rear. Opens at 3 lbs. Not adjustable.
Oil Pressure Indicator:—Teleflash Oil Pressure indicator. *See article in Electrical Equipment Section.*
Checking Oiling System:—*See Hudson Shop Notes.*
Crankcase Capacity:—5 qts. (refill), 6 qts. (dry).

COOLING SYSTEM:—Water Pump. Centrifugal, belt-driven, packless type.
See article in Mechanical Equipment Section for data.
Removal—With water drained and fan belt removed, disconnect two inlet and one outlet hoses, remove mounting bolts and lift off fan and pump assembly.
Thermostat:—Mounted in cylinder head water outlet.
Setting—Start to open 150-155°F. Fully open 185°F.
Water Capacity:—13 quarts.

CLUTCH:—Own make. Single plate, cork insert type, operating in oil.
See article in Mechanical Equipment Section for data.
Driven Member—Thickness .203". Inside Diameter 5.375", Outside Diam. 8.625". Facing 90 cork inserts.
Automatic Clutch Control:—Optional equipment.
See article in Mechanical Equipment Section for data.
Adjustment:—Pedal free movement must be 1½". To adjust, remove clevis pin at lower end of connecting link on throw-out shaft lever, loosen locknut, turn clevis. On cars with Automatic Clutch control, check setting whenever clutch adjusted.
Clutch Oil Servicing:—*See Hudson Shop Notes for data.*
Removal:—Remove transmission (see Transmission Removal following), take out 16 clutch cover capscrews and remove clutch assembly from below.

TRANSMISSION:—Own make. Constant-mesh, helical gears with synchronizing unit (second speed only). Sliding spur gears (low and reverse). Shifter rail locks linked to clutch shaft prevent gear engagement with clutch engaged.
See article in Mechanical Equipment Section for data.
Electric Hand Transmission Control—Optional.
See article in Mechanical Equipment Section for data.
Removal:—Remove Electric Hand and Automatic Clutch Control units and wiring from transmission first, if car so equipped. See separate articles in Mechanical Equipment Section for necessary adjustments on these units when reinstalling. Disconnect transmission side bumpers, interlock straps, speedometer cable, driveshaft at front universal. Take out bell housing-to-engine mounting bolts, pull transmission straight back and remove.

UNIVERSAL JOINTS:—Spicer. 1271 (front), 1278 (rear). Needle bearing type.
See article in Mechanical Equipment Section for data.

REAR AXLE:—Own make. Semi-floating, spiral bevel gear type.
See article in Mechanical Equipment Section for data.
Ratio—4.11-1 Std., 4.56-1 Optl. 3.89-1, 3.56-1 Special.
Backlash—.0005-.003". Screw adjustment.
Removal:—Remove rear wheel and hub assembly (use screw type hub puller only), take out four nuts on bearing cap bolts, push bolts out through backing plate (allows cap removal without disturbing hand brake operating link), remove shims, pull wheel bearing and axle shaft, disconnect drive shaft at rear universal joint, remove 8 nuts from axle housing stud bolts, withdraw differential carrier.
Wheel Bearing Adjustment:—Controlled by shims under bearing cap. To adjust, remove bearing caps (as directed above), add or remove shims equally at both wheels. **Endplay**—.004-.010".

SHOCK ABSORBERS:—Delco Model 1175S (front), 1174T (rear). Direct acting, hydraulic type.
See article in Mechanical Equipment Section for data.

STEERING:—Steering Gear—Gemmer Model 305. Worm-and-Roller type.
See article in Mechanical Equipment Section for data.
Front Suspension:—Conventional 'I' beam section front axle with Elliott type ends and semi-elliptic springs. Axle alignment maintained by torque arm at each end (rubber-bushed bolt at frame).
Torque Arms—*See Hudson Special Shop Notes.*
Kingpin Inclination—7° crosswise. NOTE—Loose ball type thrust bearing used. See 1936 page for data.
Caster—1-2° and equal within ½° for both wheels. To adjust, loosen capscrews at forward end of torque arm, insert shim between arm and axle at upper screw, or remove shim at lower screw to decrease caster, remove shim at upper screw or insert shim at lower screw to increase caster. Shims .020" thick, change caster ½°.
Camber—1-1½°. No adjustment. Make minor corrections by bending axle cold.
Toe In—0-⅛" measured 10" up from ground. Adjust by loosening clamp bolts and turning tie rod.
Steering Geometry—Inner wheel 20°. Outer 17¾°.

BRAKES:—Service—Bendix hydraulic, Duo-Servo, Single anchor type. Mechanical follow-up (pedal linked to hand brake cables) provided. Hand lever applies rear service brakes.
See article in Mechanical Equipment Section for data.
Drum—Alloy-steel. Diameter—10 1/16".
Lining—Moulded & woven type. Width 1¾". Thickness 7/32". Length 22⅛" per wheel.
Clearance—.010" heel and toe of each shoe.
Hand Brake:—See Service Brakes above.
Hill-Holder:—Optional on all models.
See article in Mechanical Equipment Section for data.

SERIAL NUMBER:—First number 74101 (74), 75101 (75), 76101 (76), 77101 (77). Stamped on plate on right front door hinge pillar post.

ENGINE NUMBER:—First number 18000 (all models). Stamped on left side of block near front end.

ENGINE SPECIFICATIONS:—8 cylinder, 'L' head type.
Bore—3". **Stroke**—4½".
Displacement—254 cubic inches.
Rated Horsepower—28.8 A.M.A.
Developed Horsepower—122 HP. at 4200 R.P.M.
Compression Ratio—6.25-1 No Optl. Ratios.
Compression Pressure—103 lbs. at 170 R.P.M. cranking speed (plugs removed, throttle wide open).
Vacuum Reading—18-21" at 350 R.P.M. or 7 MPH.

PISTONS:—Own Lo-Ex aluminum alloy, 'T' slot, cam ground type. Use finished replacement pistons.
Weight—10.5 ozs. stripped. **Length**—3 3/16".
Removal—Pistons and rods may be removed from above or below.
Clearance—.016" top, .002" skirt (see below).
Original Bore Size: *See Hudson Shop Notes.*
Replacement Pistons:—*See Hudson Shop Notes.*
Fitting New Pistons:—3-4 lbs. tension should be required to withdraw .0015" feeler ½" wide from between piston and cylinder wall on side opposite slot at right angles to pin bosses.
Installing Pistons:—Slot away from camshaft side.

PISTON RINGS:—Two compression, one oil ring above pin, one oil ring below pin. Rings positioned by pin in groove.

Ring	Width	End Gap	Side Clearance
Compression	3/32"	.009-.011"	.001"
Oil (both)	3/16"	.009-.011"	.001"

Replacement Rings:—*See Hudson Shop Notes.*

PISTON PIN:—Diameter—¾". **Length**—2 7/16".
Pin floats in piston and rod, held by locking rings. Pin hole in rod bronze-bushed. Pins furnished std., .002", .005", .010" oversize.
Pin Fit in Piston—.0003" clearance or hand push fit with piston heated to 200° F.
Pin Fit in Rod Bushing—.0003" clearance.

CONNECTING ROD:—Weight 29.4 ozs. **Length** 8 3/16".
Crankpin Journal Diameter—1 15/16".
Lower Bearing—Spun babbitt. Rods exchanged. Finished bearings furnished standard and undersize (special order).
Clearance—.001". **Sideplay**—.006-.010".
Bearing Adjustment:—Laminated shims. Do not file.
Installing Rods:—Offset. Install rods with widest half of bearing toward rear (#1, 3, 5, 7), toward front (#2, 4, 6, 8). Oil scoop on all rods toward camshaft.

CRANKSHAFT:—5 bearing, integral counterweights.
See Hudson Shop Notes for Crankshaft and Vibration Dampener removal, Main Bearing Removal, Installation and Line-Reaming data.
Journal Diameters—#1, 2 9/32"; #2, 2 5/16"; #3, 2 11/32"; #4, 2⅜"; #5, 2 13/32".
Bearing Type—Bronze-backed, babbitt-lined. Furnished std. and unfinished (1/32" extra stock—ream to desired undersize). **Clearance**—.001".
Bearing Adjustment:—Shims. *See Hudson Shop Notes.*
End Thrust:—Taken by center bearing. Replace bearing to adjust. Endplay .006-.012".

CAMSHAFT:—Five bearing. Gear driven.
Journal Diameters—#1, 2 1/32"; #2, 2"; #3, 1 31/32"; #4, 1 15/16"; #5, 1½".
Bearing Clearance—.0015".
End Thrust:—Taken by thrust washer assembled between front face of crankcase and rear side of camshaft front flange, and by spring-loaded button in camshaft hub and thrust plate on gear cover. See that spring and button in place under cover.
Timing Gears:—Crankshaft gear cast-iron. Camshaft gear GE. or Continental Diamond Fibre Bakelite.
Camshaft Setting:—Gears are marked. Mesh marked tooth of crankshaft gear between two marked teeth on camshaft gear.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1½"	⅜"	5 3/32"
Exhaust	1⅜"	⅜"	5 3/32"

	Seat Angle	Lift	Side Clearance
Intake	45°	11/32"	.0015-.003"
Exhaust	45°	11/32"	.003 -.005"

Tappet Clearance—.006" Int., .008" Exh., engine hot.
Valve Guides:—2 9/16" long. Top 15/16" below top of block. Finish ream to size after installation.
Valve Springs:—Cadmium plated. Install spring seat and spring dampener on bottom of all springs.

	Spring Pressure	Spring Length
Valve Closed	44 lbs.	2"
Valve Open	102 lbs.	1 21/32"

Valve Lifters:—Roller shoe type, fitted in removable guides. *See Hudson Shop Notes for lifter removal.*
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 10°40' BTDC. Close 60° ALDC.
Exhaust Valves—Open 50° BLDC. Close 18°44' ATDC.
These figures correct with .010" tappet clearance.
To Check Timing—Set tappet clearance #1 intake valve at .010". This valve should open with piston 10°40' or .0494" BTDC. when point on flywheel approximately 3.97 teeth before 'UDC.1-8/' mark lines up with pointer in hole in left front face of flywheel housing. Reset tappet clearance at .006" hot.
Motor Gauge—Weidenhoff Adapter #114, Rod #44.

LUBRICATION:—Duo-flow (pressure and positive splash) system.
Oil Pump:—Oscillating plunger type, gear driven by camshaft. Mounted on right side of crankcase.
Normal Oil Pressure—3 lbs. (no gauge).
Oil Pressure Regulator:—Located on right side of crankcase at rear. Opens at 3 lbs. Not adjustable.
Oil Pressure Indicator:—Teleflash Oil Pressure indicator. *See article in Electrical Equipment Section.*
Checking Oiling System:—*See Hudson Shop Notes.*
Crankcase Capacity:—7 qts. (refill), 9 qts. (dry).

COOLING SYSTEM:—Water Pump. Centrifugal, belt-driven, packless type.
See article in Mechanical Equipment Section for data.
Removal—With water drained and fan belt removed, disconnect pump hoses, remove mounting bolts and lift off fan and pump assembly.
Thermostat:—Mounted in cylinder head water outlet.
Setting—Start to open 150-155°F. Fully open 185°F.
Water Capacity:—20 quarts.

CLUTCH:—Own make. Single plate, cork insert type operating in oil.
Automatic Clutch Control:—Optional equipment.
See article in Mechanical Equipment Section for data.
Driven Member—Thickness .203". Inside Diameter 6.375", Outside Diam. 9.75". Facing 108 Cork Inserts.
Adjustment:—Pedal free movement must be 1½". To adjust, remove clevis pin at lower end of connecting link on throw-out shaft lever, loosen locknut, turn clevis. On cars with Automatic Clutch Control, check setting whenever clutch adjusted.
Clutch Oil Servicing:—*See Hudson Shop Notes.*
Removal:—Remove transmission (see Transmission Removal following), take out 16 clutch cover cap-screws and remove clutch assembly from below.

TRANSMISSION:—Own make. Constant-mesh, helical gears with synchronizing unit (second speed only), sliding spur gears (low and reverse). Shifter rail locks linked to clutch shaft prevent gear engagement with clutch engaged.
See article in Mechanical Equipment Section for data.
Electric Hand Transmission Control—Optl.
See article in Mechanical Equipment Section for data.
Removal:—Remove Electric Hand and Automatic Clutch Control units and wiring from transmission first, if cars so equipped. See separate articles in the Mechanical Equipment Section for necessary adjustments on these units when reinstalling. Disconnect transmission side bumpers, interlock straps, speedometer cable, drive shaft at front universal. Take out bell housing-to-engine mounting bolts, pull transmission straight back and remove.

UNIVERSAL JOINTS:—Spicer. 1281 (front), 1278 (rear). Needle bearing type.
See article in Mechanical Equipment Section for data.

REAR AXLE:—Own make. Semi-floating, spiral bevel gear type.
See article in Mechanical Equipment Section for data.
Ratio—4.11-1 Std., 4.56-1 Optl., 3.89-1, 3.56-1 Special.
Backlash—.0005-.003". Screw adjustment.
Removal:—Remove rear wheel and hub assembly (use screw type hub puller only), take out four nuts on bearing cap bolts, push bolts out through backing plate (allows cap removal without disturbing hand brake operating link), remove shims, pull wheel bearing and axle shaft, disconnect driveshaft at rear universal joint, remove 8 nuts from axle housing stud bolts, withdraw differential carrier.
Wheel Bearing Adjustment:—Controlled by shims under bearing cap. Measure endplay by dial indicator clamped to backing plate with plunger against end of axle shaft. To adjust, remove bearing caps (as directed above), add or remove shims equally at both wheels. **Endplay**—.004-.010".

SHOCK ABSORBERS:—Delco Model 1175S (front), 1174T (rear). Direct acting, hydraulic type.
See article in Mechanical Equipment Section for data.

STEERING:—Steering Gear—Gemmer Model 305. Worm-and-roller type.
See article in Mechanical Equipment Section for data.
Front Suspension:—Conventional 'I' beam section front axle with Elliott type ends and semi-elliptic springs. Axle alignment maintained by torque arm at each end (rubber-bushed bolt at frame).
Torque Arms—*See Hudson Special Shop Notes.*
Kingpin Inclination—7° crosswise. NOTE—Loose ball type thrust bearing used. See 1936 page for data.
Caster—1-2° and equal within ½° for both wheels. To adjust, loosen capscrews at forward end of torque arm, insert shim between arm and axle at upper screw or remove shim at lower screw to decrease caster, remove shim at upper screw or insert shim at lower screw to increase caster. Shims .020" thick, change caster ½°.
Camber—1-1½°. Not adjustable.
Toe In:—0-⅛" measured 10" up from ground. Adjust by loosening clamp bolts and turning tie rod.
Steering Geometry—Inner wheel 20°. Outer 17¾°.

BRAKES:—Service—Bendix Hydraulic, Duo-servo, Single anchor type. Mechanical follow-up (pedal linked to hand brake cables) provided. Hand lever applies rear service brakes.
See article in Mechanical Equipment Section for data.
Drum—Alloy-steel. Diameter—11 1/16".
Lining—Moulded & Woven type. Width 1¾". Thickness 7/32". Length 23 15/16" per wheel.
Clearance—.010" at heel and toe of each shoe.
Hand Brake:—See Service Brakes above.
Hill-Holder:—Optional on all models.
See article in Mechanical Equipment Section for data.

ENGINE HOOD AND SIDE PANELS:—*See Hudson Shop Notes for complete data.*

SERIAL NUMBER:—First number 8928566. Stamped on plate on right front door hinge pillar post.

ENGINE NUMBER:—First number 8928566. Stamped on top of cylinder block between #1 and #2 exhaust manifold flanges.

ENGINE SPECIFICATIONS:—6 cylinder, 'L' head type.
Bore—3". **Stroke**—4⅛".
Displacement—175 cubic inches.
Rated Horsepower—21.6 (A.M.A.)
Developed Horsepower—83 HP at 4000 R.P.M.
Compression Ratio—6.50-1 cast-iron head.
Compression Pressure—Approx. 100-105 lbs. at 170 R.P.M. Check with plugs removed and wide open throttle.
Vacuum Reading—18-21" steady at 7 M.P.H.

PISTONS:—Own Lo-Ex aluminum alloy, 'T' slot, cam ground type. Use finished replacement pistons.
Weight—10.5 ozs. (stripped). **Length**—3 3/16".
Removal—Pistons and rods removed from above.
Clearance—Top .016". Skirt .002".
Original Bore Sizes & Replacement Pistons:—*See Hudson Shop Notes for complete data.*
Fitting New Pistons:—Insert .0015" feeler ½" wide in extreme right of cylinder, insert piston with slot to left and pin bosses parallel to crankshaft. Tension to withdraw feeler must be within 3-4 lbs.
Installing Pistons:—Slot away from camshaft side.

PISTON RINGS:—Pinned type, 2 compression, 1 oil ring above pin, one oil ring below pin. 5/16" oil drain holes, 12 drain holes (2 to pin bosses) in upper oil ring groove, 4 holes and 2 slots drilled in lower groove. Rings positioned by pin in grooves.

Ring	Width	End Gap	Side Clearance
Compression	3/32"	.005-.010"	.001"
Oil (both)	3/16"	.005"	.001"

Replacement Rings:—*See Hudson Shop Notes.*

PISTON PIN:—Diameter—¾". **Length**—2 7/16".
Pin floats in piston and rod, held by locking rings. Pin hole in rod bronze bushed. Pins furnished standard and .002", .005" and .010" oversize.
Pin Fit in Piston—.0003" clearance (hand push fit) with piston heated to 200°F.
Pin Fit in Rod Bushing—.0003" clearance.

CONNECTING ROD:—Weight 30½ oz. **Length** 8⅝".
Crankpin Journal Diameter—1 15/16".
See Hudson Shop Notes for Connecting Rod change.
Lower Bearing—Spun-babbitt. Rods exchanged. Finished bearings furnished standard and undersize (special order).
Clearance—.001". **Sideplay**—.006-.010".
Bearing Adjustment:—None (no shims). Replace rods. After tightening bolt nuts, install new palnut (smooth face to nut), turn palnut on bolt with fingers until tight, then lock in place by turning with wrench an additional ¼-⅓ turn.
Installing Rods:—Offset. Install rods with widest half of bearing toward rear (#1, 2, 4), toward front (#3, 5, 6). Oil scoop on all rods toward camshaft.

CRANKSHAFT:—3 bearing, integral counterweights
See Hudson Shop Notes for Crankshaft and Vibration Dampener removal, Main Bearing Removal, Installation and Line-Reaming data.
Journal Diameters—#1, 2 11/32"; #2, 2⅜"; #3, 2 13/32".
Bearing Type—Bronze-backed, babbitt-lined. Furnished std. and unfinished (1/32" extra stock).
Clearance—.001".
Bearing Adjustment:—Shims. *See Hudson Shop Notes.*
End Thrust:—Taken by center bearing. Replace bearing to adjust. **Endplay**—.006-.012".

CAMSHAFT:—Three bearing. Gear driven.
Journal Diameters—#1, 2"; #2, 1 31/32"; #3, 1½".
Bearing Clearance—.0025".
End Thrust:—Taken by thrust washer assembled between front face of crankcase and rear side of camshaft front flange, and by spring loaded button in camshaft hub and thrust plate on gear cover. See that spring and button in place under cover.
Timing Gears:—Crankshaft gear cast-iron. Camshaft gear GE. or Continental Diamond Fibre Bakelite.
Camshaft Setting:—Gears marked. Mesh marked tooth of crankshaft gear between two marked teeth on camshaft gear.

VALVES:—

	Head Diameter	Stem Diameter	Length
All valves	1⅜"	11/32"	5 11/32"

	Seat Angle	Lift	Stem Clearance
Intake	45°	11/32"	.0015-.003"
Exhaust	45°	11/32"	.003-.005"

See Hudson Shop Notes for valve tool data.
Tappet Clearance—.006" Int., .008" Exh., engine hot.
Valve Guides: 2 9/16" long. Top 1 1/16" below top of block. Finish ream to size after installation.
Valve Springs:—Cadmium plated. Install spring seat and spring dampener on bottom of all springs. Spring check (out of engine)—34 lbs. (min.) at 2".

	Spring Pressure	Spring Length
Valve Closed	44 lbs.	2"
Valve Open	102 lbs.	1 21/32"

Valve Lifters:—Roller shoe type, fitted in removable guides. *See Hudson Shop Notes for valve lifter removal instructions.*
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 10°40' BTDC. Close 60° ALDC.
Exhaust Valves—Open 50° BLDC. Close 18°44'ATDC.
These figures correct with .010" tappet clearance.
To Check Timing—Set tappet clearance #1 intake valve at .010". This valve should open with piston 10°40' or .0441" before top dead center when a point on the flywheel approximately 3.97 teeth before dead center mark 'U.D.C.1-6/' lines up with pointer in inspection hole in front face of left rear motor support. Reset tappet clearance at .006" with engine warm.
Motor Gauge—Weidenhoff Adapter #114, Rod #44.

LUBRICATION:—Duo-flow (pressure and positive splash) system. Force feed by oil pump to connecting rod oil troughs and timing gears, splash to all other bearing points.
Oil Pump:—Oscillating plunger type, gear driven by camshaft. Mounted on right center of crankcase.
Normal Oil Pressure—3 lbs. (no gauge).
Oil Pressure Regulator:—Located at right side of crankcase at rear. Opens at 3 lbs. Not adjustable.
Oil Pressure Indicator:—Teleflash Oil Pressure indicator. Operated by oil pressure regulator.
See article in Electrical Equipment Section.
Checking Oiling System:—See Hudson Shop Notes.
Crankcase Capacity:—5½ qts. (dry), 4½ qts. refill).

COOLING SYSTEM:—Water Pump. Centrifugal, belt-driven, packless type.
See article in Mechanical Equipment Section for data.
Removal—With water drained and fan belt removed, disconnect hoses at pump, remove mounting bolts, lift fan and pump assembly off.
Thermostat:—Mounted in cylinder head water outlet.
Setting—Start to open 150-155°F. Fully open 185°F.
Water Capacity:—12 quarts.

CLUTCH:—Own make. Single plate, cork insert type operating in oil.
See article in Mechanical Equipment Section for data.
Driven Member—Thickness .203". Inside Diameter 5.375". Outside Diam. 8.625". Facing 90 cork inserts.
Adjustment:—Pedal free movement must be 1½". To adjust, remove clevis pin at lower end of connecting link on throw-out shaft lever, loosen locknut, turn clevis for proper clearance.
Clutch Oil Servicing:—*See Hudson Shop Notes.*
Removal:—Remove transmission (see Transmission Removal following), take out 16 clutch cover capscrews and remove clutch assembly from below.

TRANSMISSION:—Own make. Constant-mesh, helical gears with synchronizing unit (second and high speeds), sliding spur gears (low and reverse).
See article in Mechanical Equipment Section for data.
Removal:—Disconnect speedometer cable and drive shaft at front universal. Support engine at rear and take out rear mounting bolts. Remove bell housing to engine mounting bolts, pull transmission straight back and remove.

UNIVERSAL JOINTS:—Spicer. 1271 (front), 1278 (rear). Needle bearing type.
See article in Mechanical Equipment Section for data.

REAR AXLE:—Own make. Semi-floating, spiral bevel gear type.
See article in Mechanical Equipment Section for data.
Ratio—4 1/9 Std. 4 5/9 optional.
Backlash—.0005-.003". Screw adjustment.
Removal:—Remove rear wheel and hub assembly (use screw type puller only), take out four nuts on bearing cap bolts, push bolts out through backing plate (allows cap removal without disturbing hand brake operating link), remove shims, pull wheel bearing and axle shaft, disconnect drive shaft at rear universal joint, remove 8 nuts from axle housing-to-carrier stud bolts, withdraw differential carrier assembly without disturbing axle housing.
Wheel Bearing Adjustment:—Controlled by shims under bearing cap. Measure endplay by dial indicator clamped to backing plate with plunger against end of axle shaft. To adjust, remove bearing caps (as directed above), add or remove shims equally at both wheels. **Endplay**—.004-.010".

SHOCK ABSORBERS:—Monroe—156778 (front), 156578 or 156779 (rear). Hydraulic, direct acting type.
See article in Mechanical Equipment Section for data.

STEERING:—Steering Gear—Gemmer Model 305. Worm-and-roller type.
See article in Mechanical Equipment Section for data.
Front Suspension:—Conventional 'I' beam front axle with Elliott ends and semi-elliptic springs.
Kingpin Inclination—7° crosswise. See Kingpin Thrust bearing data in Hudson Shop Notes.
Caster—2-2½° and equal within ½° for both wheels. Adjusted in usual manner by wedge shims between spring seat on axle and spring.
Camber—1-1½°. No adjustment. Make minor corrections by bending axle cold.
Toe In—0-⅛". Measured 10" up from ground. Adjust by loosening clamp bolts and turning tie rod.

BRAKES:—Service—Bendix Hydraulic, Duo-Servo, double anchor type. Mechanical follow-up (pedal linked to hand brake cables) provided. Hand lever applies rear service brakes.
See article in Mechanical Equipment Section for data.
Drum—Alloy-steel. Diameter—9 1/16".
Lining—Moulded (primary), woven (secondary). Width 1¾". Thickness 3/16". Length per wheel 19".
Clearance—.010" at heel and toe of each shoe.
Hand Brake:—See Service Brakes above.

SERIAL NUMBER:—First number 83101. Stamped on plate on right front door hinge pillar post.

ENGINE NUMBER:—First number 83101. On boss on left side of block near top front or on top of block between #1 and #2 exhaust manifold flanges.

ENGINE SPECIFICATIONS:—6 cylinder, 'L' head type. **Bore**—3". **Stroke**—5". **Displacement**—212 cu. ins. **Rated Horsepower**—21.6 A.M.A. **Developed Horsepower**—101 (Std. 6.25-1 Head), 107 (Optl. 7.0-1 head) at 4000 R.P.M. **Compression Ratio & Pressure**—Check at cranking speed, spark plugs removed, throttle wide open.

Std. 6.25-1 head .....103 lbs. at 170 R.P.M.
Optl. 7.0-1 head .....119 lbs. at 170 R.P.M.

Vacuum Reading—18-21" at 350 RPM. or 7 MPH.

PISTONS:—Own Lo-Ex aluminum alloy, 'T' slot, cam ground type. Use finished replacement pistons. **Weight**—10.5 ozs. stripped. **Length**—3 3/16". **Removal**—Pistons and rods may be removed from above or below. **Clearance**—.016" top, .002" skirt (see below).

Original Bore Size:—*See Hudson Shop Notes.*

Replacement Pistons:—*See Hudson Shop Notes.*

Fitting New Pistons:—3-4 lb. tension should be required to withdraw .0015" feeler ½" wide from between piston and cylinder wall on side opposite slot at right angles to pin bosses.

Installing Pistons:—Slot away from camshaft side.

PISTON RINGS:—Two compression, one oil ring above pin, one oil ring below pin. Rings positioned by pin in groove.

Ring	Width	End Gap	Side Clearance
Compression	3/32"	.005-.010"	.001"
Oil (both)	3/16"	.005"	.001"

Replacement Rings:—*See Hudson Shop Notes.*

PISTON PIN:—Diameter—¾". **Length**—2 7/16". Pin floats in piston and rod, held by locking rings. Pin hole in rod bronze-bushed. Pins furnished std., .002", .005", .010" oversize.

Pin Fit in Piston—.0003" clearance or hand push fit with piston heated to 200° F.

Pin Fit in Rod Bushing—.0003" clearance.

CONNECTING ROD:—Weight—30.3 oz. **Length** 8 3/16". **Crankpin Journal Diameter**—1 15/16". *See Hudson Shop Notes for Connecting Rod change.* **Lower Bearing**—Spun-babbitt. Rods exchanged. Finished bearings furnished standard and undersize (special order). **Clearance**—.001". **Sideplay**—.006-.010".

Bearing Adjustment:—None (no shims). Replace rods. *See Hudson Shop Notes for connecting rod palnut (locknut) installation instructions.*

Installing Rods:—Offset. Install rods with widest half of bearing toward rear (#1, 2, 4), toward front (#3, 5, 6). Oil scoop on all rods toward camshaft.

CRANKSHAFT:—3 bearing, integral counterweights *See Hudson Shop Notes for Crankshaft and Vibration Dampener removal, Main Bearing Removal, Installation and Line-Reaming data.* **Journal Diameters**—#1, 2 11/32"; #2, 2⅜"; #3, 2 13/32". **Bearing Type**—Bronze-backed, babbitt-lined. Furnished std., and unfinished (1/32" extra stock—ream to desired undersize). **Clearance**—.001".

Bearing Adjustment:—Shims. *See Hudson Shop Notes.*

End Thrust:—Taken by center bearing. Replace bearing to adjust. Endplay .006-.012".

CAMSHAFT:—Three bearing. Gear driven. **Journal Diameters**—#1, 2"; #2, 1 31/32"; #3, 1½". **Bearing Clearance**—.0025".

End Thrust:—Taken by thrust washer assembled between front face of crankcase and rear side of camshaft front flange, and by spring-loaded button in camshaft hub and thrust plate on gear cover. See that spring and button in place under cover.

Timing Gears:—Crankshaft gear cast-iron. Camshaft gear GE. or Continental Diamond Fibre Bakelite.

Camshaft Setting:—Gears marked. Mesh marked tooth of crankshaft gear between two marked teeth on camshaft gear.

VALVES:—Lighter valves (smaller stem diameter) used, than on previous models. New pilot size necessary for servicing tools. *See Hudson Shop Notes for data.*

	Head Diameter	Stem Diameter	Length
All valves	1⅜"	11/32"	5 11/32"

	Seat Angle	Lift	Stem Clearance
Intake	45°	11/32"	.0015-.003"
Exhaust	45°	11/32"	.003-.005"

Tappet Clearance—.006" Int., .008" Exh., engine hot.

Valve Guides:—2 9/16" long. Top 1 1/16" below top of block. Finish ream to size after installation.

Valve Springs:—Cadmium plated. Install spring seat and spring dampener on bottom of all springs. Spring check (out of engine)—34 lbs. (min.). at 2".

	Spring Pressure	Spring Length
Valve Closed	44 lbs.	2"
Valve Open	102 lbs.	1 21/32"

Valve Lifters:—Roller shoe type, fitted in removable guides. *See Hudson Shop Notes for lifter removal.*

Valve Timing:—See camshaft setting above. **Intake Valves**—Open 10°40' BTDC. Close 60° ALDC. **Exhaust Valves**—Open 50° BLDC. Close 18°44' ATDC. These figures correct with .010" tappet clearance. **To Check Timing**—Set tappet clearance #1 intake valve at .010". This valve should open with piston 10°40' or .0562" BTDC. when point on flywheel approximately 3.94 teeth before 'UDC.1-6/' mark lines up with pointer in hole in left front face of flywheel housing. Reset tappet clearance at .006" hot.

Motor Gauge—Weidenhoff Adapter #114, Rod #44.

LUBRICATION:—Duo-flow (pressure and positive splash) system.

Oil Pump:—Oscillating plunger type, gear driven by camshaft. Mounted on right side of crankcase. **Normal Oil Pressure**—3 lbs. (no gauge).

Oil Pressure Regulator:—Located on right side of crankcase at rear. Opens at 3 lbs. Not adjustable.

Oil Pressure Indicator:—Teleflash Oil Pressure indicator. *See article in Electrical Equipment Section.*

Checking Oiling System:—*See Hudson Shop Notes.*

Crankcase Capacity:—5 qts. (refill), 6 qts. (dry). NOTE—Capacity decreased ½ qt. after car #43845.

COOLING SYSTEM:—Water Pump. Centrifugal, belt-driven, packless type. *See article in Mechanical Equipment Section for data.* **Removal**—With water drained and fan belt removed, disconnect two inlet and one outlet hoses, remove mounting bolts and lift off fan and pump assembly.

Thermostat:—Mounted in cylinder head water outlet. **Setting**—Start to open 150-155°F. Fully open 185°F.

Water Capacity:—12½ quarts.

CLUTCH:—Own make. Single plate, cork insert type, operating in oil. *See article in Mechanical Equipment Section for data.* **Driven Member**—Thickness .203". Inside Diameter 6.375". Outside Diam. 9.75". Facing 108 cork inserts.

Automatic Clutch Control:—Optional equipment. *See article in Mechanical Equipment Section for data.*

Adjustment:—Pedal free movement must be 1½". To adjust, remove clevis pin at lower end of connecting link on throw-out shaft lever, loosen locknut, turn clevis. On cars with Automatic Clutch control, check setting whenever clutch adjusted.

Clutch Oil Servicing:—*See Hudson Shop Notes for data.*

Removal:—Remove transmission (see Transmission Removal following), take out 16 clutch cover capscrews and remove clutch assembly from below.

TRANSMISSION:—Own make. Constant-mesh, helical gears with synchronizing unit (second and high speed only). Sliding spur gears (low and reverse). **Electric Hand Transmission Control**—Optl. *See article in Mechanical Equipment Section for data.*

Removal:—Remove Electric Hand and Automatic Clutch Control units and wiring from transmission first, if car model so equipped. See separate articles in Mechanical Equipment Section for necessary adjustments on these units when reinstalling. Disconnect transmission side bumpers, interlock straps, speedometer cable, driveshaft at front universal. Support engine at rear and free rear engine mounting. Take out bell housing-to-engine mounting bolts, pull transmission straight back and remove.

UNIVERSAL JOINTS:—Spicer. 1271 (front), 1278 (rear). Needle bearing type. *See article in Mechanical Equipment Section for data.*

REAR AXLE:—Own make. Semi-floating, spiral bevel type. *See article in Mechanical Equipment Section.* **Ratios**—4 1/9-1 Std. 4 5/9-1, 3 5/9-1, 3 8/9-1 Optl. **Backlash**—.0005-.003". Screw adjustment.

Removal:—Remove rear wheel and hub assembly (use screw type hub puller only), take out four nuts on bearing cap bolts, push bolts out through backing plate (allows cap removal without disturbing hand brake operating link), remove shims, pull wheel bearing and axle shaft, disconnect drive shaft at rear universal joint, remove 8 nuts from axle housing stud bolts, withdraw differential carrier.

Wheel Bearing Adjustment:—Controlled by shims under bearing cap. To adjust, remove bearing caps (as directed above), add or remove shims equally at both wheels. **Endplay**—.004-.010".

SHOCK ABSORBERS:—Delco. Model 1164-S (front), 1163-T (rear). Direct acting, hydraulic type. *See article in Mechanical Equipment Section for data.*

STEERING:—Steering Gear—Gemmer Model 305. Worm-and-Roller type. *See article in Mechanical Equipment Section for data.*

Front Suspension:—Conventional 'I' beam section front axle with Elliott type ends and semi-elliptic springs. Axle alignment maintained by torque arm at each end (rubber-bushed bolt at frame). **Kingpin Inclination**—7° crosswise. *See Hudson Shop Notes for Kingpin Thrust Bearing data.* **Caster**—1-2° and equal within ½° for both wheels. To adjust, loosen capscrews at forward end of torque arm, insert shim between arm and axle at upper screw, or remove shim at lower screw to decrease caster, remove shim at upper screw or insert shim at lower screw to increase caster. Shims .020" thick, change caster ½°. **Camber**—1-1½°. No adjustment. Make minor corrections by bending axle cold. **Toe In**—0-⅛" measured 10" up from ground. Adjust by loosening clamp bolts and turning tie rod. **Steering Geometry**—Inner wheel 20°. Outer 17¾°.

BRAKES:—Service—Bendix hydraulic, Duo-Servo, Single anchor type. Mechanical follow-up (pedal linked to hand brake cables) provided. Hand lever applies rear service brakes. *See article in Mechanical Equipment Section for data.* **Drum**—Alloy-steel. Diameter—10 1/16". **Lining**—Moulded (primary), woven (secondary). Width 1¾".Thickness 3/16". Length 22⅛" per wheel. **Clearance**—.010" heel and toe of each shoe.

Hand Brake:—See Service Brakes above.

Hill-Holder:—Optional on all models. *See article in Mechanical Equipment Section for data.*

SERIAL NUMBER:—First number 84101 (84), 85101 (85), 87101 (87). Stamped on plate on right front door hinge pillar post.

ENGINE NUMBER:—First number same as serial number. Stamped on boss on left side of block near top front or on top of block between #1 and #2 exhaust manifold flanges.

ENGINE SPECIFICATIONS:—8 cylinder, 'L' head type.
Bore—3". **Stroke**—4½".
Displacement—254 cubic inches.
Rated Horsepower—28.8 A.M.A.
Developed Horsepower—122 HP. at 4200 R.P.M.
Compression Ratio—6.25-1 No Optl. Ratios.
Compression Pressure—103 lbs. at 170 R.P.M. cranking speed (plugs removed, throttle wide open).
Vacuum Reading—18-21" at 350 RPM. or 7 MPH.

PISTONS:—Own Lo-Ex aluminum alloy, 'T' slot, cam ground type. Use finished replacement pistons.
Weight—10.5 ozs. stripped. **Length**—3 3/16".
Removal—Pistons and rods may be removed from above or below.
Clearance—.016" top, .002" skirt (see below).
Original Bore Size: *See Hudson Shop Notes.*
Replacement Pistons:—*See Hudson Shop Notes.*
Fitting New Pistons:—3-4 lbs. tension should be required to withdraw .0015" feeler ½" wide from between piston and cylinder wall on side opposite slot at right angles to pin bosses.
Installing Pistons:—Slot away from camshaft side.

PISTON RINGS:—Two compression, one oil ring above pin, one oil ring below pin. Rings positioned by pin in groove.

Ring	Width	End Gap	Side Clearance
Compression	3/32"	.005-.010"	.001"
Oil (both)	3/16"	.005"	.001"

Replacement Rings:—*See Hudson Shop Notes.*

PISTON PIN:—Diameter—¾". **Length**—2 7/16".
Pin floats in piston and rod, held by locking rings. Pin hole in rod bronze-bushed. Pins furnished std., .002", .005", .010" oversize.
Pin Fit in Piston—.0003" clearance or hand push fit with piston heated to 200° F.
Pin Fit in Rod Bushing—.0003" clearance.

CONNECTING ROD:—Weight 30.3 oz. **Length** 8 3/16". **Crankpin Journal Diameter**—1 15/16".
See Hudson Shop Notes for Connecting Rod change.
Lower Bearing—Spun babbitt. Rods exchanged. Finished bearings furnished standard and undersize (special order).
Clearance—.001". **Sideplay**—.006-.010".
Bearing Adjustment:—None (no shims). Replace rods. *See Hudson Shop Notes for connecting rod palnut (locknut) installation instructions.*
Installing Rods:—Offset. Install rods with widest half of bearing toward rear (#1, 3, 5, 7), toward front (#2, 4, 6, 8). Oil scoop on all rods toward camshaft.

CRANKSHAFT:—5 bearing with integral counterweights *See Hudson Shop Notes for Crankshaft and Vibration Dampener removal, Main Bearing Removal, Installation and Line-Reaming data.*
Journal Diameters—#1, 2 9/32"; #2, 2 5/16"; #3, 2 11/32"; #4, 2⅜"; #5, 2 13/32".
Bearing Type—Bronze-backed, babbitt-lined. Furnished std. and unfinished (1/32" extra stock—ream to desired undersize). **Clearance**—.001".
Bearing Adjustment:—Shims. *See Hudson Shop Notes.*
End Thrust:—Taken by center bearing. Replace bearing to adjust. Endplay .006-.012".

CAMSHAFT:—Five bearing. Gear driven.
Journal Diameters—#1, 2 1/32"; #2, 2"; #3, 1 31/32"; #4, 1 15/16"; #5, 1½".
Bearing Clearance—.0025".
End Thrust:—Taken by thrust washer assembled between front face of crankcase and rear side of camshaft front flange, and by spring-loaded button in camshaft hub and thrust plate on gear cover. See that spring and button in place under cover.
Timing Gears:—Crankshaft gear cast-iron. Camshaft gear GE. or Continental Diamond Fibre Bakelite.
Camshaft Setting:—Gears are marked. Mesh marked tooth of crankshaft gear between two marked teeth on camshaft gear.

VALVES:—Lighter valves (smaller stem diameter) used, than on previous models. New pilot size necessary for servicing tools. *See Hudson Shop Notes for data.*

	Head Diameter	Stem Diameter	Length
Intake	1½"	11/32"	5 3/32"
Exhaust	1⅜"	11/32"	5 3/32"

	Seat Angle	Lift	Side Clearance
Intake	45°	11/32"	.0015-.003"
Exhaust	45°	11/32"	.003-.005"

Tappet Clearance—.006" Int., .008" Exh., engine hot.
Valve Guides:—2 9/16" long. Top 15/16" below top of block. Finish ream to size after installation.
Valve Springs:—Cadmium plated. Install spring seat and spring dampener on bottom of all springs.

	Spring Pressure	Spring Length
Valve Closed	44 lbs.	2"
Valve Open	102 lbs.	1 21/32"

Valve Lifters:—Roller shoe type, fitted in removable guides. *See Hudson Shop Notes for lifter removal.*
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 10°40' BTDC. Close 60° ALDC.
Exhaust Valves—Open 50° BLDC. Close 18°44' ATDC.
These figures correct with .010" tappet clearance.
To Check Timing—Set tappet clearance #1 intake valve at .010". This valve should open with piston 10°40' or .0494" BTDC. when point on flywheel approximately 3.97 teeth before 'UDC.1-8/' mark lines up with pointer in hole in left front face of flywheel housing. Reset tappet clearance at .006" hot.
Motor Gauge—Weidenhoff Adapter #114, Rod #44.

LUBRICATION:—Duo-flow (pressure and positive splash) system.
Oil Pump:—Oscillating plunger type, gear driven by camshaft. Mounted on right side of crankcase.
Normal Oil Pressure—3 lbs. (no gauge).
Oil Pressure Regulator:—Located on right side of crankcase at rear. Opens at 3 lbs. Not adjustable.
Oil Pressure Indicator:—Teleflash Oil Pressure indicator.
See article in Electrical Equipment Section.
Checking Oiling System:—*See Hudson Shop Notes.*
Crankcase Capacity:—7 qts. (refill), 9 qts. (dry).

COOLING SYSTEM:—Water Pump. Centrifugal, belt-driven, packless type.
See article in Mechanical Equipment Section for data.
Removal—With water drained and fan belt removed, disconnect pump hoses, remove mounting bolts and lift off fan and pump assembly.
Thermostat:—Mounted in cylinder head water outlet.
Setting—Start to open 150-155°F. Fully open 185°F.
Water Capacity:—17½ quarts.

CLUTCH:—Own make. Single plate, cork insert type operating in oil.
Automatic Clutch Control:—Optional equipment.
See article in Mechanical Equipment Section for data.
Driven Member—Thickness .203". Inside Diameter 6.375", Outside Diam. 9.75". Facing 108 Cork Inserts.
Adjustment:—Pedal free movement must be 1½". To adjust, remove clevis pin at lower end of connecting link on throw-out shaft lever, loosen locknut, turn clevis. On cars with Automatic Clutch control, check setting whenever clutch adjusted.
Clutch Oil Servicing:—*See Hudson Shop Notes.*
Removal:—Remove transmission (see Transmission Removal following), take out 16 clutch cover capscrews and remove clutch assembly from below.

TRANSMISSION:—Own Make. Constant-mesh, helical gears with synchronizing unit (second and high speeds), sliding spur gears (low and reverse).
Electric Hand Transmission Control—Optl.
See article in Mechanical Equipment Section for data.
Removal:—Remove Electric Hand and Automatic Clutch Control units and wiring from transmission first, if car model so equipped. See separate articles in Mechanical Equipment Section for necessary adjustments on these units when reinstalling. Disconnect transmission side bumpers, interlock straps, speedometer cable, drive shaft at front universal. Support engine at rear, free rear engine mounting. Take out bell housing-to-engine mounting bolts, pull transmission straight back and remove.

UNIVERSAL JOINTS:—Spicer. 1281 (front), 1288 (rear). Needle bearing type.
See article in Mechanical Equipment Section for data.

REAR AXLE:—Own make. Semi-floating, spiral bevel type. *See article in Mechanical Equipment Section.*
Ratios—4 1/9-1 Std. 4 5/9-1, 3 5/9-1, 3 8/9-1 Optl. **Backlash**—.0005-.003". Screw adjustment.
Removal:—Remove rear wheel and hub assembly (use screw type hub puller only), take out four nuts on bearing cap bolts, push bolts out through backing plate (allows cap removal without disturbing hand brake operating link), remove shims, pull wheel bearing and axle shaft, disconnect driveshaft at rear universal joint, remove 8 nuts from axle housing stud bolts, withdraw differential carrier.
Wheel Bearing Adjustment:—Controlled by shims under bearing cap. Measure endplay by dial indicator clamped to backing plate with plunger against end of axle shaft. To adjust, remove bearing caps (as directed above), add or remove shims equally at both wheels. **Endplay**—.004-.010".

SHOCK ABSORBERS:—Delco. Model 1164-S (front), 1163-T (rear). Direct acting hydraulic type.
See article in Mechanical Equipment Section for data.

STEERING:—Steering Gear—Gemmer Model 305. Worm-and-roller type.
See article in Mechanical Equipment Section for data.
Front Suspension:—Conventional 'I' beam section front axle with Elliott type ends and semi-elliptic springs. Axle alignment maintained by torque arm at each end (rubber-bushed bolt at frame).
Kingpin Inclination—7° crosswise. *See Hudson Shop Notes for Kingpin Thrust Bearing data.*
Caster—1-2° and equal within ½° for both wheels. To adjust, loosen capscrews at forward end of torque arm, insert shim between arm and axle at upper screw or remove shim at lower screw to decrease caster, remove shim at upper screw or insert shim at lower screw to increase caster. Shims .020" thick, change caster ½°.
Camber—1-1½°. Not adjustable.
Toe In:—0-⅛" measured 10" up from ground. Adjust by loosening clamp bolts and turning tie rod.
Steering Geometry—Inner wheel 20°. Outer 17¾°.

BRAKES:—Service—Bendix Hydraulic, Duo-servo, Single anchor type. Mechanical follow-up (pedal linked to hand brake cables) provided. Hand lever applies rear service brakes.
See article in Mechanical Equipment Section for data.
Drum—Alloy-steel. Diameter—11 1/16".
Lining—Moulded (primary), woven (secondary). Width 1¾". Thick 3/16". Length 23 15/16" per wheel.
Clearance—.010" at heel and toe of each shoe.
Hand Brake:—See Service Brakes above.
Hill-Holder:—Optional on all models.
See article in Mechanical Equipment Section for data.

CRANKSHAFT SIZE CODE:—*See Hudson Shop Notes.*

ENGINE BONNET LOCK, HOOD, SIDE PANEL AND DUST SHIELD REMOVAL:—*See Hudson Shop Notes*

BUSINESS CAR NOTE:—Model 90 (112" W.B.) and 98 (sedan only) use the 112 Engine (3"x4⅛"). Model 98 (119" W.B. except sedan) use the Six (3"x 5").

SERIAL NUMBER:—First number 90101 (90), 98101 (98). On plate on right front door hinge pillar post.

ENGINE NUMBER:—Same as Serial Number (above). Stamped on top of cylinder block between #1 and #2 exhaust manifold flanges.

ENGINE SPECIFICATIONS (90):—6 cylinder, 'L' head.
Bore—3". **Stroke**—4⅛".
Displacement—175 cu. ins. **Rated HP**—21.6.
Developed Horsepower—86 HP. at 4000 RPM.
Compression Ratio—6.50-1. Cast-iron head.
Compression Pressure—115 lbs. at 125 RPM.
Vacuum Reading—Steady 18-21" at 7 MPH.
See Hudson Shop Notes for Engine Assembly removal.

ENGINE SPECIFICATIONS (98):—See following page.

PISTONS:—Own Lo-Ex aluminum alloy, 'T' slot, Cam ground type. Use finished replacement pistons.
Weight—10.5 ozs. (stripped). **Length**—3 3/16".
Removal—Pistons and rods removed from above.
Clearance—Top .016". Skirt .001-.002".
Original Bore Sizes & Replacement Pistons:—*See Hudson Shop Notes for complete data.*
Fitting New Pistons:—Use .0015" feeler ½" wide inserted between piston and wall on side opposite slot at right angles to pin. Pull to withdraw feeler must be within 3-4 lbs.
Installing Pistons:—Slot away from camshaft.

PISTON RINGS:—2 compression, 2 oil rings (1 above pin, 1 below pin). Rings positioned by pin in groove. *See Hudson Shop Notes for Piston Ring change.*

Ring	Width	End Gap	Side Clearance
Compression	3/32"	.005-.010"	.001"
Oil	3/16"	.005"	.001"

Replacement Rings:—*See Hudson Shop Notes.*

PISTON PIN:—**Diameter**—¾". **Length**—2 7/16". Floating type. Pin hole in rod bronze bushed. Pins furnished std. and .002", .005", .010" oversize.
Pin Fit in Piston—.0003" clearance (hand push fit) with piston heated to 200°F.
Pin Fit in Rod Bushing:—.0003" clearance.

CONNECTING ROD:—**Weight** 30.75 ozs.(90), 30 ozs.(98).
Length—8⅝" (90), 8 3/16" (98).
Crankpin Journal Diameter—1 15/16".
Lower Bearing—Spun babbitt. Exchange rods furnished std. and undersize. *See Hudson Shop Notes for Connecting Rod change and Palnut data.*
Clearance—.001". **Sideplay**—.006-.010".
Bearing Adjustment:—None (no shims). Replace rods.
Installing Rods:—Offset. Install rods with widest half of bearing toward rear (#1, 2, 4), toward front (#3, 5, 6). Oil scoop on all rods toward camshaft.

CRANKSHAFT:—3 bearing, integral counterweights *See Hudson Shop Notes for Crankshaft and Vibration Dampener Removal, Main Bearing Removal, Installation, Replacement Bearings and Line-reaming data.*
Journal Diameters—#1, 2 11/32"; #2, 2⅜"; #3, 2 13/32".
Bearing Type—Bronze-backed, 'Bermax' alloy.
Clearance—.001".
Bearing Adjustment:—Shims. *See Hudson Shop Notes.*
End Thrust:—Taken by center bearing. Replace bearing only adjustment. **Endplay**—.006-.012".

CAMSHAFT:—3 bearing, gear driven. *See Hudson Shop Notes for Camshaft Removal and 'Granoseal' treatment.*
Journal Diameters—#1. 2"; #2, 1 1/32"; #3, 1½".
Bearing Clearance—.0025".
End Thrust:—Thrust washer between camshaft flange and crankcase and spring loaded button in camshaft hub bearing against thrust plate on cover.
Timing Gears:—Crankshaft gear cast-iron. Camshaft gear GE. or Continental Diamond Fibre Bakelite.
Camshaft Setting:—Gears marked. Mesh marked tooth of crankshaft gear between two marked teeth on camshaft gear.

VALVES:—

	Head Diameter	Stem Diameter	Length
All valves	1⅜"	11/32"	5 11/32"

	Seat Angle	Lift	Stem Clearance
Intake	45°	11/32"	.0025"
Exhaust	45°	11/32"	.004"

Tappet Clearance:—.006" Int., .008" Exh., hot. *See Hudson Shop Notes for Front Fender Dust Shield removal.*
Valve Guides:—2 9/16" long. Install with top 1 1/16" below top of block and finish ream to size.
Valve Springs:—Free length 2 17/64". See that dampener installed on bottom of spring with open side toward cylinder.

	Spring Pressure	Length
Valve Closed	40 lbs.	2"
Valve Open	80 lbs.	1 21/32"

Valve Lifters:—Roller shoe type, fitted in removable guides. *See Hudson Shop Notes for lifter removal.*
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 10°40' BTDC. Close 60° ALDC.
Exhaust Valves—Open 55° BLDC. Close 18°44'ATDC. These figures correct with .010" tappet clearance.
To Check Timing—Set tappet clearance #1 intake valve at .010". This valve should open with piston 10°40' or .0441" (90), .0562" (98) BTDC. when point on flywheel approximately 3.95 teeth before 'UDC.1-6/' mark lines up with indicator in inspection hole in left rear motor support. Reset tappets(see above).
Motor Gauge—Weidenhoff Adapter #114, Rod #44.

LUBRICATION:—Duo-flo (pressure & positive splash).
Oil Pump:—Oscillating plunger type, gear driven by camshaft. Mounted on right side of crankcase.
Normal Oil Pressure—3 lbs. (no gauge).
Oil Pressure Regulator:—Located on right side of crankcase at rear. Opens at 3 lbs. Not adjustable.
Oil Pressure Indicator:—Teleflash Oil Pressure indicator. *See article in Electrical Equipment Section.*
Checking Oiling System:—*See Hudson Shop Notes.*
Crankcase Capacity—4½ qts. (refill). NOTE—Install 1 qt. add'tl. oil in upper tray when pan installed.

COOLING SYSTEM:—**Capacity**—12½ quarts.
See Hudson Shop Notes for Radiator Core removal.
Water Pump:—Centrifugal, belt driven, packless type. *See article in Mechanical Equipment Section.*
Removal—Drain water, remove fan belt, disconnect pump hoses, remove mounting bolts and lift off
Thermostat:—Fulton. In cylinder head water outlet.
Setting—Start to open 150-155°F. Fully open 185°F.
Temperature Gauge:—King-Seeley Electric. K-S Nos. Dash Units—7170 (Pass. Cars), 7096 (Comm'l.), 7121 (Sta. Wagon). Engine Unit—No. 7000 (all models). *See article in Mechanical Equipment Section.*

CLUTCH:—**Own Make.** Single plate, cork insert type operating in oil. *See Mechanical Equipment Section.*
Driven Member—Thickness (cork) .244-.255".

	Inside Diam.	Outside Diam.	No. Corks
90, 98 Sedan	5⅜"	8 23/32"	90
98 (exc. Sedan)	6½"	9 27/32"	108

Adjustment:—Pedal free movement 1½". To adjust, remove clevis pin on link at throw-out shaft lever, loosen locknut, turn clevis. Check Automatic Clutch and Hill-holder. *See Mechanical Equipment Section.*
Clutch Oil Servicing:—*See Hudson Shop Notes.*
Removal:—Remove transmission (see Transmission Removal below), take out mounting screws in clutch cover rim, remove clutch assembly from below.
Automatic Clutch Control:—Electric type. Optl. *See article in Mechanical Equipment Section for data.*

TRANSMISSION:—**Own Make**—Constant-mesh, helical gears with synchronizing unit (second and high speeds), sliding spur gears (low and reverse).
Transmission Control:—Hudson 'Handy-Shift'. Optl. on Utility and Business cars. Std. on pass. cars. *See articles in Mechanical Equipment Section for data.*
Removal:—Disconnect 'Handy-Shift' controls at transmission and remove Automatic Clutch Control unit (if used)—see articles in Mechanical Equipment Section for adjustment of these units when re-installed. On cars with 'Handy-Shift' remove transmission cover (install temporary cover to keep transmission clean until removed from car). Disconnect speedometer cable and front universal. Remove transmission side bumpers. Raise front end of car, support engine at rear. Remove flywheel guard, rear engine mounting bolts, clutch cross shaft (2 screws in bracket), shift engine to right. Take out clutch housing-to-engine support bolts.

UNIVERSAL JOINTS:—**Spicer**—Front, 1271-01X (early 90), 1261-01X (late 90), 1281-01X (98). Rear, 1278-01X (early 90 ,all 98), 1268-01X (late 90). Needle bearing. *See Mechanical Equipment Section for data.*

REAR AXLE:—**Own Make**—Semi-floating, spiral bevel gear type with Hotchkiss drive.
See article in Mechanical Equipment Section for data.
Ratio—4 1/9-1 (Std. 90 pass. cars; Optl. 90, 98 Bus. Cars), 4 5/9-1 (Optl. 90 Pass.; Std. 90, 98 Bus. Cars).
Backlash—.0005-.003". Screw adjustment.
Removal:—Remove wheel and hub assembly (use screw type puller), remove nuts on 4 bearing cap bolts, push bolts back through backing plate, remove cap (without disturbing brake link), remove shims, pull axle shaft and wheel bearing. Disconnect drive shaft at rear universal, remove nuts on housing to carrier studs, withdraw carrier.
Wheel Bearing Adjustment:—Controlled by shims under bearing cap. To adjust, remove bearing cap (see Removal directions above), add or remove shims equally at both wheels. **Endplay**—.002-.004".

SHOCK ABSORBERS:—**Monroe**—156778 (front—all models), 157800 (rear—pass. cars). Direct acting, hydraulic type. NOTE—Rear shocks optl. on Business Cars. *See Mechanical Equipment Section.*

STEERING:—**Steering Gear**—Gemmer Model 305 Worm-and-Roller type with push-pull adjustment. *See article in Mechanical Equipment Section for data.*
Front Suspension:—Conventional 'I' beam section axle with Elliott type ends and semi-elliptic springs.
Autopoise Control—*See Hudson Shop Notes.*
Kingpin Inclination—7° crosswise. *See Hudson Shop Notes for Kingpin Thrust Bearing servicing data.*
Caster—1-2° (equal for both wheels within ½°). Adjust with wedge shims between axle and spring.
Camber—1-1½°. Bend axle cold for minor changes.
Toe-In—0-⅛". Measure on inside of rims 10" above ground. Adjust by turning tie rod.
Steering Geometry—Inner Wheel 20°. Outer 17¼°.

BRAKES:—**Service**—Bendix Hydraulic, duo-servo, Double Anchor (90 pass. cars, Utility Coach and Coupe), Single Anchor (90 others, 98) with mechanical follow-up (pedal linked to hand brake cables). Hand lever applies all four service brakes. *See articles in Mechanical Equipment Section for data.*
Drum—Alloy steel. Diameter 9 1/16"(90 pass. cars, Utility Coach & Coupe), 10 1/16" (90 others, 98).
Lining—Moulded (primary), woven (secondary). Thickness 7/32". Width 1¾". Length per wheel 19" (90 pass. cars, Utility Coach & Coupe), 22⅛" (90 others, 98).
See Hudson Shop Notes for Brake Lining change.
Clearance—.010" at heel and toe of each shoe.
Hand Brake:—See Service Brakes above.
Hill-Holder:—Optl. *See Mechanical Equipment Section.*

MODEL 98 NOTE:—Engine specifications listed below include Model 98. For all other Model 98 data see Models 90, 98 on preceding page.

CRANKSHAFT SIZE CODE:—*See Hudson Shop Notes.*

ENGINE BONNET LOCK, HOOD, SIDE PANEL AND DUST SHIELD REMOVAL:—*See Hudson Shop Notes*

SERIAL NUMBER:—First No. 9132576 (91), 92101 (92,) 93101 (93). Stamped on plate on right front door hinge pillar post.

ENGINE NUMBER:—Same as Serial Number (above). Stamped on top of cylinder block between #1 and #2 exhaust manifold flanges.

ENGINE SPECIFICATIONS (91, 92, 93, 98):—6 Cylinder, 'L' head. **Bore**—3". **Stroke**—5".
Displacement—212 cu. ins. **Rated HP**—21.6.
Developed Horsepower—96 HP, at 3900 RPM. (91, 92 single carb., 98), 101 @ 4000 RPM. (92 dual carb., 93).
Compression Ratio—6.25-1. Cast-iron head.
Compression Pressure—120 lbs. at 125 RPM.
Vacuum Reading—Steady 18-21" at 7 MPH.
See Hudson Shop Notes for Engine Assembly removal.

PISTONS:—Own Lo-Ex aluminum alloy, 'T' slot, Cam ground type. Use finished replacement pistons.
Weight—10.5 ozs. (stripped). **Length**—3 3/16".
Removal—Pistons and rods removed from above.
Clearance—Top .016". Skirt .001-.002".
Original Bore Sizes & Replacement Pistons:—*See Hudson Shop Notes for complete data.*
Fitting New Pistons:—Use .0015" feeler ½" wide inserted between piston and wall on side opposite slot at right angles to pin. Pull to withdraw feeler must be within 3-4 lbs.
Installing Pistons:—Slot away from camshaft.

PISTON RINGS:—2 compression, 2 oil rings (1 above pin, 1 below pin). Rings positioned by pin in groove.
See Hudson Shop Notes for Piston Ring change.

Ring	Width	End Gap	Side Clearance
Compression	3/32"	.005-.010"	.001"
Oil	3/16"	.005"	.001"

Replacement Rings:—*See Hudson Shop Notes.*

PISTON PIN:—**Diameter**—¾". **Length**—2 7/16". Pin floats in piston and rod, held by locking rings. Pin hole in rod bronze bushed. Pins furnished standard and .002", .005" and .010" oversize.
Pin Fit in Piston—.0003" clearance (hand push fit) with piston heated to 200°F.
Pin Fit in Rod Bushing—.0003" clearance.

CONNECTING ROD:—**Weight** 30 ozs. **Length** 8 3/16". **Crankpin Journal Diameter**— 1 15/16".
Lower Bearing—New 'Bermax' alloy spun type. Exchange rods furnished std. and undersize. *See Hudso Shop Notes for Connecting Rod change and Palnut installation instructions.*
Clearance—.001". **Sideplay**—.006-.010".
Bearing Adjustment:—None(no shims).Replace rods.
Installing Rods:—Offset. Install rods with widest half of bearing toward rear (#1, 2, 4), toward front (#3 5, 6). Oil scoop on all rods toward camshaft.

CRANKSHAFT:—3 bearing, integral counterweights *See Hudson Shop Notes for Crankshaft and Vibration Dampener Removal, Main Bearing Removal, Installation, Replacement Bearings and Line-reaming data.*
Journal Diameters—#1, 2 11/32"; #2, 2⅜"; #3, 2 13/32".
Bearing Type—Bronze-backed, 'Bermax' alloy.
Clearance—.001".
Bearing Adjustment:—Shims. *See Hudson Shop Notes.*
End Thrust:—Taken by center bearing. Replace bearing only adjustment. **Endplay**—.006-.012".

CAMSHAFT:—3 bearing, gear driven. *See Hudson Shop Notes for Camshaft Removal and 'Granoseal' treatment.*
Journal Diameters—#1, 2"; #2, 1 31/32"; #3, 1½".
Bearing Clearance—.0025".
End Thrust:—Thrust washer between camshaft flange and crankcase and spring loaded button in camshaft hub bearing against thrust plate on cover.
Timing Gears:—Crankshaft gear cast-iron. Camshaft gear GE. or Continental Diamond Fibre Bakelite.
Camshaft Setting:—Gears marked. Mesh marked tooth of crankshaft gear between two marked teeth on camshaft gear.

VALVES:

	Head Diameter	Stem Diameter	Length
All valves	1⅜"	11/32"	5 11/32"

	Seat Angle	Lift	Stem Clearance
Intake	45°	11/32"	.0025"
Exhaust	45°	11/32"	.004"

Tappet Clearance—.006" Int., .008" Exh., engine hot. NOTE—Remove right front fender dust shield for access to valves. *See Hudson Shop Notes for data.*
Valve Guides:—2 9/16" long. Install with top 1 1/16" below top of block and finish ream to size.
Valve Springs:—Free length 2 17/64". See that dampener installed on bottom of spring with open side toward cylinder.

	Spring Pressure	Length
Valve Closed	40 lbs.	2"
Valve Open	80 lbs.	1 21/32"

Valve Lifters:—Roller shoe type, fitted in removable guides. *See Hudson Shop Notes for lifter removal.*
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 10°40' BTDC. Close 60° ALDC.
Exhaust Valves—Open 55° BLDC. Close 18°44'ATDC.
These figures correct with .010" tappet clearance.
To Check Timing—Set tappet clearance #1 intake valve at .010". This valve should open with piston 10°40' or .0562" BTDC. when point on flywheel approximately 3.94 teeth before 'UDC.1-6/' mark lines up with indicator in inspection hole in front face of left rear motor support. Reset tappet cl. .006" hot.
Motor Gauge—Weidenhoff Adapter #114, Rod #44.

LUBRICATION:—Duo-flo (pressure & positive splash).
Oil Pump:—Oscillating plunger type, gear driven by camshaft. Mounted on right side of crankcase.
Normal Oil Pressure—3 lbs. (no gauge).
Oil Pressure Regulator:—Located on right side of crankcase at rear. Opens at 3 lbs. Not adjustable.
Oil Pressure Indicator:—Teleflash Oil Pressure indicator. *See article in Electrical Equipment Section.*
Checking Oiling System:—*See Hudson Shop Notes.*
Crankcase Capacity:—4½ qts. (refill). NOTE—Install 1 qt. add'tl. oil in upper tray when pan installed.

COOLING SYSTEM:—**Capacity**—12½ quarts.
See Hudson Shop Notes for Radiator Core removal.
Water Pump:—Centrifugal, belt driven, packless type.
See article in Mechanical Equipment Section.
Removal—Drain water, remove fan belt, disconnect pump hoses, remove mounting bolts and lift off
Thermostat:—Fulton. In cylinder head water outlet.
Setting—Start to open 150-155°F. Fully open 185°F.
Temperature Gauge:—King-Seeley Electric. K-S Nos: Dash Unit—7121 (91, 92), 7420 (93). Engine Unit—No. 7000 (all models).
See article in Mechanical Equipment Section for data.

CLUTCH:—**Own Make.** Single plate, cork insert type operating in oil. *See Mechanical Equipment Section.*
Driven Member—Thickness (cork) .244-.255".

	Inside Diam.	Outside Diam.	No. Corks
91, 92	5⅜"	8 23/32"	90
93	6½"	9 27/32"	108

Adjustment:—Pedal free movement 1½". To adjust, remove clevis pin on link at throw-out shaft lever, loosen locknut, turn clevis. Check Automatic Clutch Control and Hill-Holder Adjustment.
Clutch Oil Servicing:—*See Hudson Shop Notes.*
Removal:—Remove transmission (see Transmission Removal below), take out mounting screws in clutch cover rim, remove clutch assembly from below.
Automatic Clutch Control:—Electric type. Optl.
See article in Mechanical Equipment Section for data.

TRANSMISSION:—**Own Make**—Constant-mesh, helical gears with synchronizing unit (second and high speeds), sliding spur gears (low and reverse).
Transmission Controls:—Hudson 'Handy-Shift' std. Electric Hand Transmission Control optional.
See articles in Mechanical Equipment Section for data.
Removal: *See preceding Hudson '112' Model 90 page for instructions.* Before removing transmission on cars with Electric Hand, disconnect wires, vacuum and air hoses, and remove power unit.

UNIVERSAL JOINTS:—**Spicer—1271-01X (front), 1278-01X (rear).** Needle bearing type.
See article in Mechanical Equipment Section for data.

REAR AXLE:—**Own Make.** Semi-floating, Spiral bevel gear type with Hotchkiss drive.
See article in Mechanical Equipment Section for data.
Ratio—4 1/9-1 standard. 4 5/9-1 optional.
Backlash—.0005-.003". Screw adjustment.
Removal:—Remove wheel and hub assembly (use screw type puller), remove nuts on 4 bearing cap bolts, push bolts back through backing plate, remove cap (without disturbing brake link), remove shims, pull axle shaft and wheel bearing. Disconnect drive shaft at rear universal, remove nuts on housing to carrier studs, withdraw carrier.
Wheel Bearing Adjustment:—Controlled by shims under bearing cap. To adjust, remove bearing cap (see Removal directions above), add or remove shims equally at both wheels. **Endplay**—.002-.004".

SHOCK ABSORBERS:—Direct acting hydraulic types.

Car Model	Make	Front	Rear
91, 92	Monroe	157400	157801
93 (Dom. & Exp.)	Delco	1113-R	1120-S
91, 92, 93 (Exp.)	Delco	1132-S	1131-T

See articles in Mechanical Equipment Section for data.

STEERING:—**Steering Gear**—Gemmer Model No. 305 Worm-and-Roller type with push-pull adjustment.
See article in Mechanical Equipment Section for data.
Front Suspension:—Conventional 'I' beam section front axle with Elliott type ends and semi-elliptic springs. Axle alignment maintained by torque arm at side of each spring seat and held by rubber-bushed bolt at frame rail.
Autopoise Control—*See Hudson Shop Notes.*
Kingpin Inclination—7° crosswise. *See Hudson Shop Notes for Kingpin Thrust Bearing data.*
Caster—1-2° and equal within ½° for both wheels. To adjust, loosen capscrews at forward end of torque arm, insert shim between arm and axle at upper screw, or remove shim at lower screw to decrease caster, remove shim at upper screw or insert shim at lower screw to increase caster. Shims .020" thick, change caster ½°.
Camber—1-1½°. Bend axle cold for minor changes.
Toe In—0-⅛" measured 10" up from ground. Adjust by loosening clamp bolts and turning tie rod.
Steering Geometry—Inner wheel 20°. Outer 17¼°.

BRAKES:—**Service**—Bendix hydraulic, Duo-Servo, Single anchor type. Mechanical follow-up (pedal linked to hand brake cables) provided. Hand lever applies rear service brakes.
See article in Mechanical Equipment Section for data.
Drum—Alloy-steel. Diameter—10 1/16".
Lining—Moulded (primary), woven (secondary shoe). Width 1¾". Thickness 7/32". Length 22⅛" per wheel.
See Hudson Shop Notes for Brake Lining change.
Clearance—.010" heel and toe of each shoe.
Hand Brake:—See Service Brakes above.
Hill-Holder:—Optl. *See Mechanical Equipment Section.*

CRANKSHAFT SIZE CODE:—*See Hudson Shop Notes.*
ENGINE BONNET LOCK, HOOD, SIDE PANEL AND DUST SHIELD REMOVAL:—*See Hudson Shop Notes*
SERIAL NUMBER:—1st number 95101 (95), 97101 (97). On plate on right front door hinge pillar post.
ENGINE NUMBER:—1st number same as Serial Number (above). Stamped on top of cylinder block between #1 and #2 exhaust manifold flanges.
ENGINE SPECIFICATIONS:—8 cylinder, 'L' head type. **Bore**—3". **Stroke**—4½". **Displacement**—254 cu. ins. **Rated Horsepower**—28.8 A.M.A. **Developed Horsepower**—122 HP. at 4200 R.P.M. **Compression Ratio**—6.25-1 cast-iron head. **Compression Pressure**—103 lbs. at 170 R.P.M. cranking speed (plugs removed, throttle wide open). **Vacuum Reading**—18-21" at 350 RPM. or 7 MPH. *See Hudson Shop Notes for Engine Assembly removal.*
PISTONS:—Own Lo-Ex aluminum alloy, 'T' slot, Cam ground type. Use finished replacement pistons. **Weight**—10.5 ozs. (stripped). **Length**—3 3/16". **Removal**—Piston and rod assemblies may be removed from above or below. **Clearance**—Top .016". Skirt .001-.002".
Original Bore Sizes and Replacement Pistons:—*See Hudson Shop Notes for complete data.*
Fitting New Pistons:—Use .0015" feeler ½" wide inserted between piston and wall on side opposite slot at right angles to pin. Pull to withdraw feeler must be within 3-4 lbs.
Installing Pistons:—Slot away from camshaft.
PISTON RINGS:—2 compression, 2 oil rings, (1 above pin, 1 below pin). Rings positioned by pin in groove. *See Hudson Shop Notes for Piston Ring change.*

Ring	Width	End Gap	Side Clearance
Compression	3/32"	.005-.010"	.001"
Oil	3/16"	.005"	.001"

Replacement Rings:—*See Hudson Shop Notes.*
PISTON PIN:—**Diameter**—¾". **Length**—2 7/16". Pin floats in piston and rod, held by locking rings. Pin hole in rod bronze bushed. Pins furnished standard and .002", .005" and .010" oversize. **Pin Fit in Piston**—.0003" clearance (hand push fit) with piston heated to 200° F. **Pin Fit in Rod Bushing**—.0003" clearance.
CONNECTING ROD:—**Weight** 30 ozs. **Length** 8 3/16". *See Hudson Shop Notes for Connecting Rod change and Palnut installation instructions.* **Crankpin Journal Diameter**—1 15/16". **Lower Bearing**—New 'Bermax' (lead alloy) spun type with steel side-thrust faces. Rods with finished bearings furnished on exchange basis Std. and Undersize (special order). **Clearance**—.001". **Sideplay**—.006-.010".
Bearing Adjustment:—None (no shims). Replace rods.
Installing Rods:—Offset. Install rods with widest half of bearing toward rear (#1, 3, 5, 7), toward front (#2, 4, 6, 8). Oil scoop on all rods toward camshaft.
CRANKSHAFT:—5 bearing, integral counterweights *See Hudson Shop Notes for Crankshaft and Vibration Dampener Removal, Main Bearing Removal, Installation, Replacement Bearings and Line-reaming data.* **Journal Diameters**—#1, 2 9/32"; #2, 2 5/16"; #3, 2 11/32"; #4, 2⅜"; #5, 2 13/32". **Bearing Type**—Bronze-backed, 'Bohnolloy' type. **Clearance**—.001".
Bearing Adjustment:—Shims. *See Hudson Shop Notes.*
End Thrust:—Taken by center bearing. Replace bearing only adjustment. **Endplay**—.006-.012".
CAMSHAFT:—5 bearing, gear driven. *See Hudson Shop Notes for Camshaft Removal and 'Granoseal' treatment.* **Journal Diameters**—#1, 2 1/32"; #2, 2"; #3, 1 31/32"; #4, 1 15/16"; #5, 1½". **Bearing Clearance**—.0025".
End Thrust:—Thrust washer between camshaft flange and crankcase and spring loaded button in camshaft hub bearing against thrust plate on cover.
Timing Gears:—Crankshaft gear cast-iron. Camshaft gear GE. or Continental Diamond Fibre Bakelite.
Camshaft Setting:—Gears marked. Mesh marked tooth of crankshaft gear between two marked teeth on camshaft gear.
VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1½"	11/32"	5 3/32"
Exhaust	1⅜"	11/32"	5 3/32"

	Seat Angle	Lift	Stem Clearance
Intake	45°	11/32"	.0025"
Exhaust	45°	11/32"	.004"

Tappet Clearance—.006" Int., .008" Exh., engine hot. NOTE—Remove right front fender dust shield for access to valves *See Hudson Shop Notes for data.*
Valve Guides:—2 9/16" long. Install with top 1 1/16" below top of block and finish ream to size.
Valve Springs:—Free length 2 17/64". See that dampener installed on bottom of spring with open side toward cylinder.

	Spring Pressure	Length
Valve Closed	40 lbs.	2"
Valve Open	80 lbs.	1 21/32"

Valve Lifters:—Roller shoe type, fitted in removable guides. *See Hudson Shop Notes for lifter removal.*
Valve Timing:—See Camshaft Setting above. **Intake Valves**—Open 10°40' BTDC. Close 60° ALDC. **Exhaust Valves**—Open 55° BLDC. Close 18°44'ATDC. These figures correct with .010" tappet clearance. **To Check Timing**—Set tappet clearance #1 intake valve at .010". This valve should open with piston 10°40' or .0494" BTDC. when point on flywheel approximately 3.97 teeth before 'UDC.1-8/' mark lines up with indicator in inspection hole in front face of left rear motor support. Reset tappet cl. .006" hot. **Motor Gauge**—Weidenhoff Adapter #114, Rod #44.
LUBRICATION:—Duo-flo (pressure and positive splash) Automatic Lubrication System.
Oil Pump:—Oscillating plunger type, gear driven by camshaft. Mounted on right side of crankcase. **Normal Oil Pressure**—3 lbs. (no gauge).
Oil Pressure Regulator:—Located on right side of crankcase at rear. Opens at 3 lbs. Not adjustable.
Oil Pressure Indicator:—Teleflash Oil Pressure indicator. *See article in Electrical Equipment Section.*
Checking Oiling System:—*See Hudson Shop Notes.*
Crankcase Capacity:—7 quarts (refill). NOTE—Install 2 qts. additional oil in upper tray when installing pan.
COOLING SYSTEM:—**Capacity**—17½ quarts. *See Hudson Shop Notes for Radiator Core removal.*
Water Pump:—Centrifugal, belt driven, packless type. *See article in Mechanical Equipment Section.* **Removal**—Drain water, remove fan belt, disconnect pump hoses, remove mounting bolts and lift off fan and pump assembly.
Thermostat:—Fulton. In cylinder head water outlet. **Setting**—Start to open 150-155° F. Fully open 185° F.
Temperature Gauge:—King-Seeley Electric. K-S Nos. Dash Unit—7420, Engine Unit—7000. *See article in Mechanical Equipment Section for data.*
CLUTCH:—**Own Make.** Single plate, cork insert type operating in oil. *See Mechanical Equipment Section.* **Driven Member**—Thickness (cork) .245-.255". Inside Diam. 6½". Outside Diam. 9 27/32". 108 cork inserts.
Adjustment:—Pedal free movement 1½". To adjust, remove clevis pin on link at throw-out shaft lever, loosen locknut, turn clevis. Check Automatic Clutch Control & Hill Holder adjustment. *See Mechanical Equipment Section articles for data.*
Clutch Oil Servicing:—*See Hudson Shop Notes.*
Removal:—Remove transmission (see Transmission Removal below), take out mounting screws in clutch cover rim, remove clutch assembly from below.
Automatic Clutch Control:—Electric type. Optl. *See article in Mechanical Equipment Section for data.*
TRANSMISSION:—**Own Make.** Constant-mesh, helical gears with synchronizing unit (second and high speeds), sliding spur gears (low and reverse).
Transmission Controls:—Hudson 'Handy-Shift' std. Electric Hand Transmission Control optional. *See articles in Mechanical Equipment Section for data.*
Removal:—*See preceding Hudson '112' Model 90 page for instructions.* Before removing transmission on cars with Electric Hand, disconnect wires, vacuum and air hoses, and remove power unit.
UNIVERSAL JOINTS:—**Spicer—1281-01X (front), 1278-01X (rear).** Needle bearing type. *See article in Mechanical Equipment Section for data.*
REAR AXLE:—**Own Make.** Semi-floating, spiral bevel gear type with Hotchkiss drive. *See article in Mechanical Equipment Section for data.* **Ratio**—4 1/9-1 standard. 4 5/9-1 optional. **Backlash**—.0005-.003". Screw adjustment.
Removal:—Remove wheel and hub assembly (use screw type puller), remove nuts on 4 bearing cap bolts, push bolts back through backing plate, remove cap (without disturbing brake link), remove shims, pull axle shaft and wheel bearing. Disconnect drive shaft at rear universal, remove nuts on housing to carrier studs, withdraw carrier.
Wheel Bearing Adjustment:—Controlled by shims under bearing cap. To adjust, remove bearing cap (see Removal directions above), add or remove shims equally at both wheels. **Endplay**—.002-.004".
SHOCK ABSORBERS:—**Delco.** Front—1113-R, 1132-S (Export), Rear—1120-S, 1131-T (Export). Direct acting, hydraulic type. Export type adjustable. *See articles in Mechanical Equipment Section for data.*
STEERING:—**Steering Gear**—Gemmer Model No. 305 Worm-and-Roller type with push-pull adjustment. *See article in Mechanical Equipment Section for data.*
Front Suspension:—Conventional 'I' beam section front axle with Elliott type ends and semi-elliptic springs. Axle alignment maintained by torque arm at side of each spring seat and held by rubber-bushed bolt at frame rail. **Autopoise Control**—*See Hudson Shop Notes.* **Kingpin Inclination**—7° crosswise. *See Hudson Shop Notes for Kingpin Thrust Bearing data.* **Caster**—1-2° and equal within ½° for both wheels. To adjust, loosen capscrews at forward end of torque arm, insert shim between arm and axle at upper screw, or remove shim at lower screw to decrease caster, remove shim at upper screw or insert shim at lower screw to increase caster. Shims .020" thick, change caster ½°. **Camber**—1-1½°. Bend axle cold for minor changes. **Toe In**—0-⅛" measured 10" up from ground. Adjust by loosening clamp bolts and turning tie rod. **Steering Geometry**—Inner wheel 20°. Outer 17¾°.
BRAKES:—**Service**—Bendix hydraulic, Duo-Servo, Single anchor type. Mechanical follow-up (pedal linked to hand brake cables) provided. Hand lever applies rear service brakes. *See article in Mechanical Equipment Section for data.* **Drum**—Alloy-steel. Diameter—11 1/16". **Lining**—Moulded (primary shoe), woven (secondary). Width 1¾". Thickness 7/32". Length 23 15/16" per wheel. *See Hudson Shop Notes for Brake Lining change.* **Clearance**—.010" heel and toe of each shoe.
Hand Brake:—See Service Brakes above.
Hill-Holder:—Optional on all models. *See article in Mechanical Equipment Section for data.*

SERIAL NUMBER:—First number, W-5001. On right hand side of dash under hood.

ENGINE NUMBER:—Stamped on left hand side of crankcase.

ENGINE:—Six cylinder, 'L' head type. Cylinders cast enbloc.
Dimensions—Bore, 3½". Stroke, 3⅞". Displacement, 224 cu. ins.
Horsepower—Rated, 29.42. Developed, 80 H.P. at 3400 R.P.M.
Compression—Std. 5.32-1. No optional compression ratios.
Compression Pressure—Approximately 92-93 lbs. at cranking speed.
Vacuum Reading—Gauge should show steady reading of 18-20" with engine idling.

Pistons:—Bohn, aluminum alloy, Invar strut, split skirt type.
Removal—Piston and rod assembly removed through top of engine.
Clearance—Skirt, .002" (see Fitting New Pistons).
Fitting New Pistons—Use .002" feeler stock to check clearance. Pull required to withdraw feeler from between piston and cylinder wall should be 6-10 lbs.
NOTE:—Install pistons with slot to left.

Piston Rings:—Four rings per piston, all above pin. #1 and 2—compression rings, #3 and 4—oil control rings. Both oil control ring grooves drilled radially with oil drain holes.

Ring	Width	End Gap	Wall Thickness
Comp. (#1, 2)	⅛"	.007-.012"	.150"
Oil Cont. (#3, 4)	.1545-.1550"	.007-.015"	.150"

Piston Pin:—Diameter, ⅞". Length, 2 15/16". Pin floats in piston and rod.
NOTE:—Pin hole in piston is offset 1/16".

Connecting Rod:—Length, 8 7/16" (center-to-center).
Big End Bearing—Removable steel-backed, babbitt-lined type.
Clearance—.0015-.002". Sideplay .005-.010".
Adjustment—None (no shims). Replace removable bearings.
NOTE:—Connecting rod lower bearings are offset. Install rods with widest half of bearing away from nearest main bearing.

Crankshaft:—Four main bearing type with integral counterweights.
Journal Sizes—#1—2.580". #2—2.560". #3—2.540". #4—2.520".
Bearing Type—Bronze-backed, babbitt-lined type. No shims.
Clearance—.0017-.0022".
Adjustment—None (no shims). Replace bearings.
End Thrust—Taken by #2 main bearing. Endplay, .004-.005".

Camshaft:—Drive—Non-adjustable chain.
Chain—Morse. Width, 1". Length, 51 links. Pitch, .500".
Camshaft Setting—Sprockets are marked. Mesh chain with sprockets turned so that marks are adjacent and in line with a straightedge across the shaft centers.

Valves:—	Head Diameter	Stem Diameter	Seat Angle	Seat Width	Lift
Intake	1.651-1.661"	.3405-.3415"	45°	1/16-5/64"	11/32"
Exhaust	1.526-1.536"	.3405-.3415"	45°	3/32-7/64"	11/32"

Tappet Clearance—Running, .010" (intake), .013" (exhaust).

Valve Timing

Intake Valves Open—2° BTDC. Close—51° ALDC.
Exhaust Valves Open—44° BLDC. Close— 3° ATDC.

To Check Valve Timing:—Set tappet clearance #1 valves at .014" (intake), .021" (exhaust). With #6 piston on top dead center entering power stroke and flywheel mark 'DC/1-6' in line with finished bosses on right front face of clutch housing, #1 intake and exhaust valves should be closed. Reset tappet clearance at .010" (intake), .013" (exhaust).
Motor Gauge—Weidenhoff Adapter #104, Rod #5.

Lubrication:—Pressure type. Gear type oil pump located at front of engine.
Normal Oil Pressure—3-5 lbs. (idling), 30 lbs. at 30 M.P.H. with warm engine.
Oil Pressure Relief Valve—Adjustable type. Turn adjusting screw on relief valve cover in or clockwise to increase pressure and out or counter-clockwise to decrease pressure. Screw controls relief valve spring tension.
Capacity and Oil—6 qts. Use SAE. #30 (normal summer weather), #40 (extremely warm temperatures), #20 (winter).

CLUTCH:—**Borg & Beck Model 10A3.** Clutch Model No. 851 stamped on cover. Single plate, dry disc type. No adjustment required for wear. See article in Clutch Section for relining and assembling directions.
Adjustment—Free movement of clutch pedal should be ¾-1". Adjustment provided on connector link. Turn screw in or out for proper clearance.
Clutch Facings—Moulded type, 2 required. ID. 6⅛". OD. 9⅞". Thickness ⅛".

STEERING:—**Steering Gear**—Gemmer Model, Worm-and-Roller type. See article in Steering Section for adjustments.

Front Suspension:—Conventional tubular axle with Reverse-Elliott ends and semi-elliptic springs.
Kingpin Inclination—8½° crosswise.
Caster—1½°. Adjust by installing wedge shims between spring and spring pad on axle.
Camber—1¼°.
Toe In—1/16" plus or minus 1/16" measured at hub height.

BRAKES:—**Service**—Midland Steeldraulic, single shoe, self-energizing, internal expanding type with mechanical application. Hand lever applies all service brakes. See article in Brake Section for relining and complete adjustment procedure.
Drum Diameter—11".
Lining—Moulded type. Width 1¾". Thickness 3/16". Length per wheel 28⅝".
Clearance—1/16".

Hand Brake Adjustment:—See Service Brakes.

SERIAL NUMBER:—First number, J-12001. On plate on right hand side of dash under engine hood.

ENGINE NUMBER:—Stamped on left hand side of crankcase.

ENGINE:—Six cylinder, 'L' head type. Cylinders cast enbloc.

Dimensions—Bore, 3½". Stroke, 4¼". Displacement, 245.3 cu. ins.

Horsepower—Rated, 29.42. Developed, 93 H.P. at 3400 R.P.M.

Compression—Std. 5.75-1. No optional compression ratios.

Compression Pressure—Approximately 99-100 lbs. at cranking speed.

Vacuum Reading—Gauge should show steady reading of 18-20" with engine idling.

Pistons:—Bohn, aluminum alloy, Invar strut, split skirt type.
Removal—Piston and rod assembly removed through top of engine.
Clearance—Skirt, .002" (see Fitting New Pistons).
Fitting New Pistons—Use .002" feeler stock to check clearance. Pull required to withdraw feeler from between piston and cylinder wall should be 6-10 lbs.
NOTE:—Install pistons with slot to left.

Piston Rings:—Four rings per piston, all above pin. #1 and 2—compression rings, #3 and 4—oil control rings. Both oil control ring grooves drilled radially with oil drain holes.

Ring	Width	End Gap	Wall Thickness
Comp. (#1, 2)	⅛"	.007-.012"	.150"
Oil Cont. (#3, 4)	.1545-.1550"	.007-.015"	.150"

Piston Pin:—Diameter, ⅞". Length, 2 15/16". Pin floats in piston and rod.
NOTE:—Pin hole in piston is offset 1/16".

Connecting Rod:—Length, 8¼" (center-to-center).
Big End Bearing—Removable steel-backed, babbitt-lined type. No shims.
Clearance—.0015-.002". Sideplay .005-.010".
Adjustment—None (no shims). Replace removable bearings.
NOTE:—Connecting rod lower bearings are offset. Install rods with widest half of bearing away from nearest main bearing.

Crankshaft:—Four main bearing type with integral counterweights.
Journal Sizes—#1—2.580". #2—2.560". #3—2.540". #4—2.520".
Bearing Type—Removable bronze-backed, babbitt-lined type.
Clearance—.0017-.0022".
End Thrust—Taken by #2 main bearing. Endplay, .004-.005".

Camshaft:—Drive—Non-adjustable chain.
Chain—Morse. Width, 1". Length, 51 links. Pitch, .500".
Camshaft Setting—Sprockets are marked. Mesh chain with sprockets turned so that marks are adjacent and in line with a straightedge across the shaft centers.

Valves:—

	Head Diameter	Stem Diameter	Seat Angle	Seat Width	Lift
Intake	1.651-1.661"	.3405-.3415"	45°	1/16-5/64"	11/32"
Exhaust	1.526-1.536"	.3405-.3415"	45°	3/32-7/64"	11/32"

Tappet Clearance—Running, .010" (intake), .013" (exhaust).

Valve Timing

Intake Valves Open—2° BTDC. Close—51° ALDC.
Exhaust Valves Open—44° BLDC. Close— 3° ATDC.

To Check Valve Timing:—Set tappet clearance #1 valves at .014" (intake), .021" (exhaust). With #6 piston on top dead center entering power stroke and flywheel mark 'DC/1-6' in line with finished bosses on right hand front face of clutch housing, #1 intake and exhaust valves should be closed. Reset tappet clearance at .010" (intake), .013" (exhaust).
Motor Gauge—Weidenhoff Adapter #104, Rod #2.

Lubrication:—Pressure type. Gear type oil pump located at front of engine.
Normal Oil Pressure—3-5 lbs. (idling), 30 lbs. at 30 M.P.H. with warm engine.
Oil Pressure Relief Valve—Adjustable. Turn adjusting screw on relief valve cover in or clockwise to increase oil pressure and out or counter-clockwise to decrease pressure. Adjusting screw controls relief valve spring tension.
Capacity and Oil—6 qts. Use SAE. #30 (normal summer weather, #40 (extremely warm temperatures), #20 (winter).

CLUTCH:—**Borg & Beck Model 10A3.** Clutch Model No. 851 stamped on cover. Single plate, dry disc type. No adjustment required for wear. See article in Clutch Section for relining and assembling directions.
Adjustment—Free movement of clutch pedal should be ¾-1". Adjustment provided on connector link. Turn screw in or out for proper clearance.
Clutch Facings—Moulded type, 2 required. ID. 6⅛". OD. 9⅞". Thickness ⅛".

STEERING:—**Steering Gear**—Gemmer Model, Worm-and-Roller type. See article in Steering Section for adjustments.

Front Suspension:—Conventional tubular axle with Reverse-Elliott ends and semi-elliptic springs.
Kingpin Inclination—8½° crosswise.
Caster—1½°. Adjust by installing wedge shims between spring and spring pad on axle.
Camber—1¼°.
Toe In—1/16" plus or minus 1/16" measured at hub height.

BRAKES:—**Service**—Midland Steeldraulic, single shoe, self-energizing, internal expanding type with mechanical application. Hand lever applies all service brakes. See article in Brake Section for relining and complete adjustment procedure.
Drum Diameter—12".
Lining—Moulded type. Width 1 31/32". Thickness .210". Length per wheel 33 3/16".
Clearance—1/16".

Hand Brake Adjustment:—See Service Brakes.

SERIAL NUMBER:—First number, T-5001. On plate on right hand side of dash under engine hood.

ENGINE NUMBER:—Stamped on left hand side of crankcase.

ENGINE:—Eight cylinder, In Line, 'L' head type. Cylinders cast enbloc.
Dimensions—Bore, 3 3/16". Stroke, 4¾". Displacement, 303.2 cu. ins.
Horsepower—Rated, 32.51. Developed, 115 H.P. at 3500 R.P.M.
Compression—Std. 5.80-1. No optional compression ratios.
Compression Pressure—Approximately 100 lbs. at cranking speed.
Vacuum Reading—Gauge should show steady reading of 18-20" with engine idling.

Pistons:—Ray Day, aluminum alloy, split skirt type.
Removal—Piston and rod assembly removed through bottom of engine.
Clearance—.002" (skirt)—see Fitting New Pistons.
Fitting New Pistons—Use .002" feeler stock to check clearance. Pull required to withdraw feeler from between piston and cylinder wall should be 6-10 lbs.
NOTE:—Install pistons with slot to left.

Piston Rings:—Four rings per piston, all above pin. #1 and 2—compression rings, #3 and 4—oil control rings. Both oil ring grooves drilled radially with oil drain holes.

Ring	Width	End Gap	Maximum Wall Thickness
Comp. (#1, 2)	⅛"	.007-.012"	.140"
Oil Cont. (#3, 4)	5/32"	.007-.015"	.140"

Piston Pin:—Diameter, ⅞". Length, 2 23/32". Pin floats in piston and rod.
NOTE:—Pin hole in piston is offset 1/16".

Connecting Rod:—Length, 9½" (center-to-center).
Big End Bearing—Removable, steel-backed, babbitt-lined type.
Clearance—.0015-.002". Sideplay .005-.010".
Adjustment—None (no shims). Replace removable bearings.
NOTE:—Connecting rod lower bearings are offset. Install rods with widest half of bearing away from nearest main bearing.

Crankshaft:—Five main bearing type with integral counterweights.
Journal Sizes—#1—2.705". #2—2.685". #3—2.665". #4—2.645". #5—2.625".
Bearing Type—Removable, bronze-backed, babbitt-lined type.
Clearance—.0017-.0022".
Adjustment—Shims are used. Do not file bearing caps.
End Thrust—Taken by #3 (center) main bearing. Endplay, .003-.005".

Camshaft:—Drive—Two sprocket non-adjustable chain drive.
Chain—Morse #766 double slide guide type. Width, 1¼". Length, 66 links. Pitch, .375".
Camshaft Setting—Sprockets are marked. Mesh chain so there are exactly 15 open links between marks on sprockets. With correct setting, #1 intake and exhaust valves should be closed with #8 piston on top dead center entering power stroke when flywheel mark '1o8' lines up with indicator on edge of insptction hole in flywheel housing on right hand side. Tappet clearance for checking valve timing should be .020" (intake), .026" (exhaust).

Valves:—	Head Diameter	Stem Diameter	Seat Angle	Seat Width	Lift
Intake	1.526-1.536"	.3405-.3415"	45°	1/16-5/64"	11/32"
Exhaust	1.401-1.411"	.3405-.3415"	45°	3/32-7/64"	11/32"

Tappet Clearance—Running, .018" all valves.

Valve Timing

Intake Valves Open—3° ATDC. Close—49° ALDC.
Exhaust Valves Open—41° BLDC. Close— 5° ATDC.

To Check Valve Timing:—Set tappet clearance #1 valves at .020" (intake), .026" (exhaust). With #8 piston on top dead center entering power stroke and flywheel mark '1o8' lined up with indicator on edge of inspection hole in right hand side of flywheel housing, #1 intake and exhaust valves should be closed. Reset tappet clearance at .018".
Motor Gauge—Weidenhoff Adapter #104, Rod #2.

Lubrication:—Pressure type. Gear type oil pump located in crankcase.
Normal Oil Pressure—3-5 lbs. (idling), 30 lbs. at 50 M.P.H. with warm engine.
Oil Pressure Relief Valve—Adjustable. Turn adjusting screw on relief valve cover in or clockwise to increase oil pressure and out or counter-clockwise to decrease pressure. Adjusting screw controls relief valve spring tension.
Capacity and Oil—8 qts. Use SAE. #30 (normal summer weather), #40 (extreme warm weather), #20 (winter).

CLUTCH:—Long Model 9AB-6CI. Single plate, dry disc type. See article in Clutch Section for relining and assembling directions.
Adjustment—Free movement of clutch pedal should be ¾-1". Adjustment provided on connector link. Turn screw in or out for proper adjustment.
Clutch Facings—Moulded type, 2 required. ID. 5½". OD. 9¾". Thickness .137".

STEERING:—**Steering Gear**—Gemmer Model, Worm-and-Roller type. See article in Steering Section for adjustments.

Front Suspension:—Conventional tubular axle with Reverse-Elliott ends and semi-elliptic springs.
Kingpin Inclination—8½° crosswise.
Caster—1½°. Adjust by installing wedge shims between spring and spring pad on axle.
Camber—1¼°.
Toe In—1/16" plus or minus 1/16" measured at hub height.

BRAKES:—**Service**—Midland Steeldraulic, single shoe, self-energizing, internal expanding type with mechanical application. Hand lever applies all service brakes. See article in Brake Section for relining and complete adjustment procedure.
Drum Diameter—14".
Lining—Moulded type. Width 1 31/32". Thickness .210". Length per wheel 36 5/16".
Clearance—1/16".

Hand Brake Adjustment:—See Service Brakes.

SERIAL NUMBER:—First number (518-D) D-5001, (618-G) G-5001. On left hand frame side rail or on plate on right side of cowl under engine hood.

ENGINE NUMBER:—First number (518-D) D-5001, (618-G) G-5001. Stamped on left hand side of crankcase.

ENGINE SPECIFICATIONS:—6 cylinder, 'L' head.

Bore—3½". Stroke—4¼".

Displacement—245.3 cubic inches.

Rated Horsepower—29.42 (AMA).

Developed Horsepower—101 at 3600 R.P.M.

Compression Ratio—5.75-1 std. cast-iron head, 6.2-1 optl. aluminum head.

Compression Pressure—5.75 Std. head, 141 lbs. at 3000 R.P.M. or 107 lbs. at 160 R.P.M. (crank'g speed).

Vacuum Reading—Gauge should show stead reading of 18-20" at idling speed.

PISTONS:—Bohn, aluminum alloy, Invar strut, split skirt type. **Length—4 3/32".**

Weight—21.7 ozs. (stripped).

Removal—Pistons and rods removed from above.

Clearance—Top .020". Skirt .002". See Fitting New Pistons.

Replacement Pistons:—Finished replacement pistons furnished in standard and .001", .002", .003", .005", .010", .020", .022", .025", .032" oversizes.

NOTE—Second standard cylinder bore size .020" larger than above.

Fitting New Pistons:—With .002" feeler stock, pull required to withdraw feeler from between piston and cylinder wall on side opposite slot must be between 10-13 lbs.

Installing Pistons:—Slot should be toward left or away from camshaft side. Pin hole in piston offset 1/16" toward camshaft.

PISTON RINGS:—Two compression, two oil control rings per piston, all above pin. Both oil ring grooves drilled radially with oil drain holes.

Ring	Width	End Gap	Wall Thickness
Comp (all)	⅛"	.007-.012"	.150"
Oil Cont (all)	5/32"	.007-.015"	.150"

PISTON PIN:—**Diameter ⅞". Length 2 15/16".**

Pin floats in piston and rod. Held by retaining rings.

Pin Fit in Piston—Hand push fit with piston heated to 150° F.

Pin Fit in Rod Bushing—.0005" clearance.

CONNECTING ROD:—**Weight 35 ozs. Length 8¼".**

Crankpin Journal Diameter—2⅛".

Lower Bearing—Removable steel-backed, babbitt-lined type.

Clearance—.0015-.002". **Sideplay .005-.010".**

Bearing Adjustment:—**None (no shims). Replace bearings. Do not file rods or caps.**

Installing Rods:—Lower bearings are offset. Install rods with narrow half of bearing toward nearest main bearing or pointing toward front of engine for #1, 3, 5 and toward rear for #2, 4, 6.

CRANKSHAFT:—4 bearing. Integral counterweights.

Journal Diameters—#1, 2.580"; #2, 2.560"; #3, 2.540"; #4, 2.520" (first cars); 2.560"—all bearings (later cars).

Bearing Types—Bronze-backed, babbitt-lined (first cars), steel-backed, babbitt-lined (later cars).

Clearance—.0015"-.002".

Adjustment—Solid shims provided on first cars. No shims used on later cars. Replace bearings when necessary. Do not file bearing caps.

End Thrust:—Taken by #2 bearing. Endplay .004-.008". No adjustment. Replace bearing.

CAMSHAFT:—4 bearing. Non-adjustable chain drive.

Bearing Type—Bronze.

Clearance—.0015-.002".

End Thrust:—Taken by thrust plate at rear of sprocket hub. Replace plate if endplay excessive.

Timing Chain:—Morse #1886. Width 1". Pitch .500". Length 25½" or 51 links.

Camshaft Setting:—Sprockets are marked. Mesh chain with sprockets turned so that marks are adjacent and in line with a straightedge across the shaft centers.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1 21/32"	.3405-.3415"	4 7/16"
Exhaust	1 17/32"	.3405-.3415"	4 7/16"

	Seat Angle	Lift	Stem Clearance
Intake	45°	11/32"	.0015" max.
Exhaust	45°	11/32"	.0015" max.

Tappet Clearance—.010" Int., .013" Exh., running clearance with engine warm. Clearance for timing is .014" Int. opening, .018" Int. closing, .017" Exh. opening, .021" Exh. closing.

Valve Guides—Single piece, removable type.

Valve Springs:—	Spring Pressure	Length
Valve Closed	40 lbs.	1 13/16"
Valve Open	100 lbs.	1 15/32"

Valve Lifters:—Mushroom type, removable.

Valve Timing:—See Camshaft Setting above.

Intake Valves—Open 2° BTDC. Close 51° ALDC.

Exhaust Valves—Open 44° BLDC. Close 3° ATDC.

To Check Valve Timing—Set tappet clearance of #1 valves at .014" Int., .021" Exh. With #6 piston on top dead center entering power stroke and flywheel mark 'DC"1-6' lined up with finished bosses on right front face of flywheel housing, #1 intake and exhaust valves should be closed. Reset tappet clearance at .010" Int., .013" Exh.

Motor Gauge—Weidenhoff Adapter #104, Rod #2.

LUBRICATION:—Pressure. Gear type oil pump located on right hand side of crankcase.

NOTE—Whenever oil pump is removed, turn engine over until #1 piston is at firing position (see ignition timing), mesh oil pump drive gear so that tongue and slot connection meshes without disturbing position of distributor shaft, recheck ignition timing.

Normal Oil Pressure:—3-5 lbs. idling, 30 lbs. at 30 M.P.H.

Oil Pressure Relief Valve:—Located on oil pump cover. Operates at 35-45 lbs. Adjustable by turning screw on relief valve cover in or clockwise to increase pressure, and out or counter-clockwise to decrease pressure.

Crankcase Capacity:—6 quarts (refill).

CLUTCH:—**Borg & Beck Model 10A6.** Single plate, dry disc type. See article in Clutch Section for relining and assembling directions.

Facings—Moulded type, 2 required. Inside Diam. 6⅛". Outside Diam. 9⅞". Thickness ⅛".

Adjustment—Free movement of clutch pedal should be ¾-1". Adjustment provided on connector link. Turn screw in or out for proper clearance.

Removal—Disconnect clutch linkage, remove transmission, drop clutch housing pan, prick punch clutch cover and flywheel (install in same position to maintain balance), take out clutch mounting bolts turning all bolts out evenly to release spring tension. Remove clutch from below. Use pilot studs when removing and installing transmission to avoid springing clutch plate.

STEERING—Steering Gear—Ross Model S14. Cam-and-lever type. See article in Steering Section for adjustments.

Front Suspension:—Conventional 'I' beam section front axle with Reverse-Elliott ends and semi-elliptic springs.

Kingpin Inclination—7½° crosswise.

Caster—1½° plus or minus ½°. Adjust by installing wedge shims between spring and spring pad on axle.

Camber—1°. No adjustment provided.

Toe In—1/16" plus or minus 1/16" measured at hub height.

BRAKES:—**Service**—Lockheed Hydraulic, double anchor type. Hand lever applies rear service brakes.

See article in Mechanical Equipment Section for data.

Drum Diameter—10".

Lining—Moulded type. Width 2". Thickness 3/16". Length per wheel 20⅞".

Clearance—.010" toe, .005" heel, for each shoe.

Hand Brake Adjustment:—See Service Brake.

SERIAL NUMBER:—First number (521-O) O-5001, (621-N) N-5001. Stamped on plate on right side of cowl under engine hood.

ENGINE NUMBER:—First number (521-O) O-5001, (621-N) N-5001. Stamped on left hand side of crankcase.

ENGINE SPECIFICATIONS:—8 cylinder, 'L' head.

Bore—3 3/16". **Stroke** 4¾".

Displacement—303.2 cubic inches.

Rated Horsepower—32.51 (AMA).

Developed Horsepower—120 at 3500 R.P.M.

Compression Ratio—5.80-1 Std. cast-iron head. No optional ratios.

Compression Pressure—5.80-1 Std. head, 142 lbs. at 2000 R.P.M. or 113 lbs. at 160 R.P.M. (cranking speed).

Vacuum Reading—Gauge should show steady reading at 18-20" at idling speed.

PISTONS:—Bohn, aluminum alloy, Invar strut, split skirt type. **Length**—3⅞".

Weight—18.4 ounces (stripped).

Removal—Pistons and rods from below.

Clearance—Skirt .002". See Fitting New Pistons. NOTE—Second standard cylinder bore size .020" larger than above.

Fitting New Pistons:—Use .002" feeler stock to check clearance. Pull required to withdraw feeler from between piston and cylinder wall on side opposite slot must be between 6-8 lbs.

Installing Pistons:—Slot should be toward left or away from camshaft side. Pin hole in piston is offset 1/16" toward camshaft.

PISTON RINGS:—Two compression, two oil control rings per piston, all above pin. Both oil ring grooves drilled radially with oil drain holes.

Ring	Width	End Gap	Wall Thickness
Comp (all)	⅛"	.007-.012"	.140"
Oil Cont (all)	5/32"	.007-.015"	.140"

PISTON PIN:—**Diameter** ⅞". **Length** 2 23/32". Pin floats in piston and rod. Held by retaining rings.

Pin Fit in Piston—Hand push fit with piston heated to 150° F.

Pin Fit in Rod Bushing—.0005" clearance.

CONNECTING ROD:—**Weight** 39.4 ozs. **Length** 9½".

Crankpin Journal Diameter—2⅜".

Lower Bearing—Removable steel-backed, babbitt-lined type.

Clearance—.0015-.002". Sideplay .005-.010".

Bearing Adjustment:—None (no shims). Replace bearings. Do not file bearing caps.

Installing Rods:—Lower bearings are offset. Install rods with narrow half of bearing toward nearest main bearing or pointing toward front of engine for #1, 3, 5, 7 rods and toward rear for #2, 4, 6, 8.

CRANKSHAFT:—5 bearing. Integral counterweights.

Journal Diameters—2.665" (all bearings).

Bearing Type—Removable steel-backed, babbitt-lined type.

Clearance—.001-.003".

Bearing Adjustment:—None (no shims). Replace bearings. Do not file bearing caps.

End Thrust:—Taken by #3 bearing. Endplay .004-.008". No adjustment. Replace bearing.

CAMSHAFT:—6 bearing. Non-adjustable chain drive.

Bearing Type—Bronze.

Clearance—.0015-.002".

End Thrust:—Taken by thrust plate at rear of sprocket hub. Replace plate if endplay excessive.

Timing Chain:—Morse Type 766. Width 1¼". Pitch .375". Length 24¾" or 66 links.

Camshaft Setting:—Sprockets are marked. Mesh chain so there are exactly 15 links between marks on sprockets or 16 teeth inclusive of teeth meshed opposite marks.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1 17/32"	.3405-.3415"	5⅛"
Exhaust	1 13/32"	.3405-.3415"	5⅛"

	Seat Angle	Lift	Stem Clearance
Intake	45°	.325"	.0015" max.
Exhaust	45°	.325"	.0015" max.

Tappet Clearance—.006" Int., .013" Exh., running clearance with engine warm. Clearance for timing is .010" Int., .017" Exh.

Valve Guides:—Single piece, removable type.

Valve Springs:—	Spring Pressure	Length
Valve Closed	40 lbs.	1-13/16"
Valve Open	100 lbs.	1 15/32"

Valve Lifters:—Removable mushroom type.

Valve Timing:—See Camshaft Setting above.

Intake Valves—Open 1° ATDC. Close 49° ALDC.

Exhaust Valves—Open 45° BLDC. Close 3° ATDC.

To Check Valve Timing—Set tappet clearance of #1 valves at .010" Int., .017" Exh. With #8 piston on top dead center entering power stroke and flywheel mark '1°8' lined up with indicater in inspection hole in right hand top face of flywheel housing, #1 intake and exhaust valves should be closed. Reset tappet clearance at .006" intake, .013" exhaust, engine warm.

Motor Gauge—Weidenhoff Adapter #104, Rod #2.

LUBRICATION:—Pressure. Gear type oil pump located in crankcase.

NOTE—Whenever oil pump is removed, turn engine over until #1 piston is at firing position (see ignition timing), mesh oil pump drive gear so that tongue-and-slot connection meshes without disturbing position of distributor shaft, recheck ignition timing.

Normal Oil Pressure:—3-5 lbs. idling, 30 lbs. at 50 M.P.H. with engine warm.

Oil Pressure Relief Valve:—Operates at 35-45 lbs. Located on left side of engine approximately center of crankcase. Adjustable by turning screw in or clockwise to increase pressure and out or counter-clockwise to decrease pressure.

Crankcase Capacity:—8 quarts (refill).

CLUTCH:—**Long Model 10-CF-CI.** Single plate, dry disc type. See article in Clutch Section for relining and assembling directions.

Facings—Moulded type, 2 required. Inside Diam. 6". Outside Diam. 10". Thickness .137".

Adjustment—Free movement of clutch pedal should be 1¼-1½". Adjustment provided on connector link. Turn screw in or out for proper clearance.

Removal—Disconnect clutch linkage, remove transmission, take off clutch bell housing, prick punch clutch cover and flywheel (install in same position to maintain balance), take out clutch mounting bolts turning all bolts out evenly to release spring tension. Remove clutch. Use pilot studs when removing and installing transmission to avoid springing clutch plate.

STEERING:—**Steering Gear**—Gemmer Model Worm-and-Roller type. See article in Steering Section for adjustments.

Front Suspension:—Conventional 'I' beam section front axle with Reverse-Elliott ends and semi-elliptic springs.

Kingpin Inclination—8½° crosswise.

Caster—1½° plus or minus ½°. Adjust by installing wedge shims between spring and spring pad on axle.

Camber—1¼° plus or minus 1/16°. No adjustment.

Toe In—1/16" plus or minus 1/16". Adjust in usual manner by changing length of tie rod.

Kick Shackle—Clearance between spring eye and stopscrew on kick shackle should be .125" or 2½ turns. Check if steering is unsteady or car wanders.

BRAKES:—**Service**—Lockheed Hydraulic, double anchor type. Hand lever applies rear service brakes. See article in Brake Section for complete adjustment procedure.

Drum Diameter—12".

Lining—Moulded type. Width 2". Thickness 3/16". Length per wheel 24⅜".

Clearance—.010" heel, .005" toe, for each shoe.

Hand Brake Adjustment:—See Service Brake.

SERIAL NUMBER:—First number E-50001 (Deluxe & Custom '38), ES-35001 (Standard '38), E-72001 ('39). On plate on right side of dash under engine hood.

ENGINE NUMBER:—First number E-50001 ('38), E-72001 ('39). Stamped on boss on left side of crankcase in front of distributor.

ENGINE HOOD & SIDE PANELS:—To raise hood, turn lock handle to left as far as possible, raise hood slightly, reach under front edge and release safety catch.

Side Panels—To remove panels for work on engine, move locking handle (at top center inside panel) toward front of car, disengage rear end of panel, slide panel out toward rear.

ENGINE SPECIFICATIONS:—Six cylinder, 'L' head type.
Bore—3½". Stroke—4¼".
Displacement—245.3 cubic inches.
Rated Horsepower—29.4.
Developed Horsepower—101 at 3600 R.P.M.
Compression Ratio—5.75-1 Std. No optl. ratios.
Compression Pressure—141 lbs. at 3000 R.P.M. or 107 lbs. at 160 R.P.M. cranking speed.
Vacuum Reading—18-20" steady reading at idling speed.

PISTONS:—Bohn, aluminum alloy, Invar Strut, split skirt type. **Length—4 3/32".**
Weight—21 7 ozs. without rings or pin.
Removal—Pistons and rods removed from above
Clearance—See Fitting New Pistons.
Original Bore Sizes:—Mark opposite each bore indicate original bore size as follows:

	1st Standard Marking	Cyl. Size	2nd Standard Marking	Cyl. Size
.001" under.	'A'	3.4990"	'AA'	3 5190"
.0005" under.	'B'	3.4995"	'BB'	3 5195"
Standard	'C'	3.5000"	'CC'	3 5200"
.0005" over.	'D'	3 5005"	'DD'	3.5205"
.001" over.	'E'	3 5010"	'EE'	3.5210"

Replacement Pistons:—Finished pistons furnished standard (3 499") and .001", .002", .003", .005", .010", .020", .025", .032" oversize. Semi-finished in one size only (3 542").
Fitting New Pistons:—Use .002" feeler gauge inserted between piston and cylinder wall on side opposite slot. Pull required to remove feeler must be within 10-13 lbs.
Installing Pistons:—Slot on left side (away from valves).
NOTE—Piston pin offset in piston toward right or camshaft side of engine.

PISTON RINGS:—Two compression, two oil control rings per piston, all above pin.

Ring	Width	End Gap	Side Clearance
Comp.	⅛"	.007-.012"	.0005"
Oil Cont.	5/32"	.007-.015"	.0005"

Replacement Rings:—Furnished in standard and .005", 010", .020", .030" oversize.

PISTON PIN:—Diameter—⅞". Length—2 15/16". Pin floats in piston and rod. Held by locking ring at each end. Pin hole in connecting rod bronze bushed.
Pin Fit in Piston— 0005" clearance or hand push fit with piston heated to 212° F.
Pin Fit in Rod Bushing— 0005" clearance.
Replacement Pins:—Std. & .003", .006" oversize.

CONNECTING ROD:—Weight—35 ozs. Length—8¼".
Crankpin Journal Diameter—2⅛".
Lower Bearing—Steel-backed, babbitt-lined type.
Clearance—.001- 0025". **Sideplay**—.005-.010".
Bearing Adjustment:—None (no shims). Replace bearings. Do not file rods or bearing caps.
Replacement Bearings:—Std. and .001" undersize.
Installing Rods:—Lower bearings offset Install rods with narrow half of bearing toward nearest main bearing or pointing toward front of engine for #1, 3, 5 and toward rear for #2, 4, 6.

CRANKSHAFT:—Four bearing. Integral counterweights.
Journal Diameters—2.560" all bearings.
Bearing Type—Steel-backed, babbitt-lined.
Clearance—.001-.003".
Bearing Adjustment:—None (no shims). Replace bearings Do not file bearing caps.
NOTE—Bearings may be rotated out.
Replacement Bearings:—Std. and .001" undersize.
End Thrust:—Taken by #2 main bearing. Not adjustable (replace bearing). **Endplay**—.004-.008".

CAMSHAFT:—4 bearing. Non-adjustable chain drive.
Journal Diameters:—#1, 2.186"; #2, 2.076"; #3, 2 060", #4, 1.498".
Bearing Type—Leaded-bronze bushings.
Clearance—.001".
End Thrust—Taken by thrust plate at rear of camshaft sprocket. Adjustable by adding or removing shims. **Endplay**—.004".
Timing Chain:—Morse. Width 1". Pitch .500". Length 25½" or 51 links.
Camshaft Setting:—Sprockets are marked. Mesh chain with sprockets turned so that marks are adjacent & in line with straightedge across shafts.

VALVES:—	Head Diameter	Stem Diameter	Length
Intake	1 21/32"	.3405-.3415"	4 7/16"
Exhaust	1 17/32"	.3405-.3415"	4 7/16"

	Seat Angle	Lift	Stem Clearance
All Valves	45°	11/32"	.001-.0015"

Tappet Clearance—.010" Int., .013" Exh. running clearance with engine warm.
NOTE—Tappet clearance for timing is .014" (Intake—opening side), .018" (Intake—closing side), .017" (Exhaust—opening side), 021" (Exhaust—closing).
Valve Guides:—Pressed in block from above. To remove guides, work from lifter opening and press guides out from below.
Valve Springs:—Damper installed on all springs at top.

	Spring Pressure	Length
Valve Closed	40 lbs.	1 13/16"
Valve Open	100 lbs.	1 15/32"

Valve Lifters:—Mushroom type. Removable from below only Guides must be removed first. Lifters furnished .002", .004" oversize. Lifters must be free fit in guide at room temperature.
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 2° BTDC. Close 51° ALDC.
Exhaust Valves—Open 44° BLDC. Close 3° ATDC.
To Check Valve Timing—Set tappet clearance #1 intake valve at .014", #1 exhaust valve at .021". With this clearance, intake valve will open and exhaust valve will close with piston at top dead center when flywheel mark 'D-C/1-6' lines up with finished bosses on right front face of clutch housing. Reset tappets for correct running clearance (see above).

LUBRICATION:—Pressure system. Gear type oil pump located on right hand side of crankcase.
Oil Pump Installation—Whenever oil pump removed, turn engine over to firing position for #1 piston (see Ignition Timing), rotate oil pump shaft so that tongue-and-slot drive connection will mesh without disturbing distributor when pump replaced.
Normal Oil Pressure:—3-5 lb. idling, 30 lb. @ 30 MPH.
Oil Pressure Regulator:—Located on oil pump cover. Adjustable by turning screw which controls regulator valve spring tension (turn screw in to increase, or out to decrease pressure).
Crankcase Capacity—6½ qts. (dry), 6 qts. (refill).

COOLING SYSTEM:—Capacity—18 quarts.
Water Pump:—Belt-driven, adjustable packing type.
See article in Mechanical Equipment Section for data.
Removal—Drain cooling system, remove fan belt, take out pump mounting bolts. Lift off pump.
Thermostat:—Fulton. In water outlet on cyl. head.
Setting—Opening temperature 145-160°F.

CLUTCH:—Borg & Beck Model 10A7. Marked #898 on cover, single plate, dry disc type.
See article in Mechanical Equipment Section for data.
Facing—Molded type (flywheel side), Molded-Woven type (pressure plate side), one of each required. 6⅛" Inside Diam., 9⅞" Outside Diam., ⅛" thick (flywheel side), .133" thick (pressure plate side).
Adjustment—Pedal free movement should be ¾-1". Adjustment provided on connecting link. Turn screw in or out for proper clearance.
Removal—Remove transmission (see Transmission Removal below), take off clutch housing pan, punch mark clutch cover and flywheel (to insure replacing in same position to maintain balance), take out mounting screws in clutch cover flange turning all screws out evenly, remove clutch from below.

TRANSMISSION:—Warner Model T-86 Std. Special transmission with Superdrive (Overdrive) Optl. Both models have helical gears for all speeds, and synchro-mesh for second and high.
See article in Mechanical Equipment Section for data.
Transmission Control:—Remote steering column type. Optional equipment on 1939 models only.
See articles in Mechanical Equipment Section for data.
Removal—Disconnect clutch linkage and drive shaft at front universal joint. Install pilot studs in upper transmission mounting bolt holes, take out lower mounting bolts and pull transmission back.

UNIVERSAL JOINTS:—Spicer Model 1281-1288. Needle bearing type, 2 used.
See article in Mechanical Equipment Section.

REAR AXLE:—Spicer Model 42. Spiral gear, semi-floating type with Hotchkiss drive.
See article in Mechanical Equipment Section for data.
Ratio—4.545-1 Std., 4.27-1 and 4.09-1 Optl.
Backlash—.004-.007". Shim adjustment.
Removal:—Disconnect hand brake cables, brake line, and drive shaft at rear universal joint. Remove wheels, take off spring clips at axle housing, remove axle from beneath car.
Axle Shaft Removal:—Remove wheel, hub, drum and backing plate. Pull axle shaft & wheel bearing.
Wheel Bearing Adjustment—Shims provided between flanged end of axle housing and brake backing plate. To adjust, remove wheel, hub and drum assembly. Remove shims to decrease endplay, add shims to increase. **Endplay**—.003-.006".

SHOCK ABSORBERS:—Gabriel Model KT. Double acting, hydraulic type with thermostatic control.
See article in Mechanical Equipment Section.

STEERING:—Steering Gear—Gemmer Model 305. Worm-and-Roller type with 'push-pull' adjustment.
See article in Mechanical Equipment Section for data.
Front Suspension:—Conventionel 'I' beam section front axle with Reverse-Elliott ends and semi-elliptic springs.
Kingpin Inclination—7½° crosswise.
Caster—1½°. Adjust by installing wedge shims between spring and spring seat on axle.
Camber—1°. No adjustment provided.
Toe In—1/16-3/16". Adjust in usual manner by loosening clamp bolts and turning tie rod.

BRAKES:—Service—Hupp-Lockheed hydraulic type. Hand lever apples rear service brakes.
See article in Mechanical Equipment Section for data.
Brake Drums—Cast-iron. **Diameter**—10".
Lining—Moulded type. Width 2". Thickness 3/16". Length 20⅞" per wheel.
Clearance—.010" toe, .005" heel for each shoe.
Hand Brake:—See service brakes above.

ENGINE HOOD & SIDE PANELS:—To raise hood, turn lock handle to left as far as possible, raise hood slightly, reach under edge, release safety catch.

Side Panels—To remove panels for work on engine, move locking handle (at top center inside panel) toward front of car, disengage rear end of panel, slide panel out toward rear.

SERIAL NUMBER:—First number H-25001('38),H-30001 ('39). On plate on right side of dash under hood.

ENGINE NUMBER:—First number H-25001('38),H-30001 ('39). Stamped on boss on left side of crankcase.

ENGINE SPECIFICATIONS:—8 Cylinder, 'L' head type.

Bore—3 3/16". **Stroke**—4¾".

Displacement—303.2 cubic inches.

Rated Horsepower—32.51.

Developed Horsepower—120 at 3500 R.P.M.

Compression Ratio—5.8-1 Std. No Optl. heads.

Compression Pressure—142 lbs. at 2000 R.P.M. or 113 lbs. at cranking speed of 160 R.P.M.

Vacuum Reading—18-20" steady at idling speed.

PISTONS:—Bohn, aluminum alloy, Invar Strut, split skirt type. **Length**—3⅞".

Weight—18.4 ozs. without rings or pin.

Removal—Pistons and rods removed from below.

Clearance—See Fitting New Pistons.

Original Bore Sizes:—Mark opposite each bore indicates original bore size as follows:

	First Standard Marking	Cyl. Size	Second Standard Marking	Cyl. Size
.001" under.	'A'	3.1865"	'AA'	3.2065"
.0005" under.	'B'	3.1870"	'BB'	3.2070"
Standard	'C'	3.1875"	'CC'	3.2075"
.0005" over.	'D'	3.1880"	'DD'	3.2080"
.001" over.	'E'	3.1885"	'EE'	3.2085"

Replacement Pistons:—Finished pistons furnished standard (3.187"), and .001", .002", .003", .005", .010", .020", .022", .025", .032" oversize. Semi-finished pistons furnished in one size only (3.230").

Fitting New Pistons:—Use .002" feeler gauge inserted between piston and cylinder wall on side opposite slot. Pull required to remove feeler must be within 6-8 lbs.

Installing Pistons:—Slot to left (away from valves). NOTE—Piston pin offset in piston toward right or camshaft side of engine.

PISTON RINGS:—Two compression, two oil control rings per piston, all above pin. Both oil ring grooves drilled with oil drain holes.

Ring	Width	End Gap	Side Clearance
Comp.	⅛"	.007-.012"	.0005"
Oil Cont.	5/32"	.007-.015"	.0005"

Replacement Rings:—Furnished in standard and .005", .010", .020", .030" oversize.

PISTON PIN:—Diameter—⅞". **Length**—2 15/16". Pin floats in piston and rod. Held by locking ring at each end. Pin hole in connecting rod bronze bushed.

Pin Fit in Piston—.0005" clearance or hand push fit with piston heated to 212°F.

Pin Fit in Rod Bushing—.0005" clearance.

Replacement Pins:—Std. & .003", .006" oversize.

CONNECTING ROD:—Weight 39.4 ozs. **Length** 9½".

Crankpin Journal Diameter—2¼".

Lower Bearing—Steel-backed, babbitt-lined type.

Clearance—.0008-.0026". **Sideplay**—.005-.010".

Bearing Adjustment:—None (no shims). Replace bearings. Do not file rods or bearing caps.

Replacement Bearings:—Std. and .001" undersize.

Installing Rods:—Lower bearings offset. Install rods with narrow half of bearing toward nearest main bearing or pointing toward front of engine for #1, 3, 5, 7 and toward rear for #2, 4, 6, 8.

CRANKSHAFT:—Five bearing. Integral counterweights.

Journal Diameters—2.665" all bearings.

Bearing Type—Steel-backed, babbitt-lined.

Clearance—.001-.003".

Bearing Adjustment:—None (no shims). Replace bearings. Do not file bearing caps.

NOTE—Bearings can be 'rotated' out without removing crankshaft.

Replacement Bearings:—Std. and .001" undersize.

End Thrust:—Taken by #3 main bearing. Not adjustable (replace bearing). **Endplay**—.004-.008".

CAMSHAFT:—Six bearing. Non-adjustable chain drive.

Journal Diameters—#1, 2.186"; #2, 2.166"; #3, 2.146"; #4, 2.126"; #5, 2.106"; #6, 1.622".

Bearing Type—Leaded-bronze bushings.

Clearance—.001".

End Thrust—Taken by thrust plate at rear of camshaft sprocket. Adjustable by adding or removing shims. **Endplay**—.004".

Timing Chain:—Morse. Width 1¼". Pitch .375". Length 23¾" or 66 links.

Camshaft Setting:—Sprockets are marked. Turn crankshaft so that keyway is straight up, mesh chain so there are exactly 15 links (or 16 teeth inclusive of teeth meshed opposite marks) between marks on sprockets.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1 17/32"	.3405-.3415	5⅛"
Exhaust	1 13/32"	.3405-.3415	5⅛"

	Seat Angle	Lift	Stem Clearance
All Valves	45°	.325"	.0015" Max.

Tappet Clearance—.006" Int., .013" Exh. running clearance with engine warm.

NOTE—Tappet cl. for timing .010" Int., .017" Exh.

Valve Guides:—Pressed in block from above. To remove guides, work from lifter opening and press guides out from below.

Valve Springs:—Damper installed on all springs at top.

	Spring Pressure	Length
Valve Closed	40 lbs.	1 13/16"
Valve Open	100 lbs.	1 15/32"

Valve Lifters:—Mushroom type. Removable from below only. Guides must be removed first. Lifters furnished .002", .004" oversize.

Lifter Clearance in Guide—Free fit in guide at room temperature (move through guide of own weight without oil when cold).

Valve Timing:—See Camshaft Setting above.

Intake Valves—Open 1° ATDC. Close 49° ALDC.

Exhaust Valves—Open 45° BLDC. Close 3° ATDC.

To Check Valve Timing—Set tappet clearance #1 intake valve at .010", #1 exhaust valve at .017". With this clearance, intake valve will open and exhaust valve close at top dead center when flywheel mark '1°8' lines up with indicator in inspection hole in right top face of flywheel housing. Reset tappet clearance at .006" Int., .013" Exh. with engine warm.

LUBRICATION:—Pressure type. Gear type oil pump located in crankcase (driven by vertical shaft).

Oil Pump Installation—Whenever oil pump removed, turn engine over to firing position for #1 piston (see Ignition Timing), rotate oil pump shaft so that tongue-and-slot drive connection will mesh without disturbing distributor driveshaft.

Normal Oil Pressure:—3-5 lbs. idling, 30 lbs. at 30 MPH.

Oil Pressure Regulator:—Operates at 35-45 lbs. Located on left side of crankcase at approximate center of engine. Adjustable by turning screw in (clockwise) to increase pressure, or out to decrease.

Crankcase Capacity:—8½ qts. (dry), 8 qts. (refill).

COOLING SYSTEM:—Water Pump. Centrifugal, belt-driven, packless type.

See article in Mechanical Equipment Section for data.

Thermostat:—Bishop & Babcock. In water outlet.

Setting—Opening temperature 145-160°F.

Cooling System Capacity—21½ quarts.

CLUTCH:—Long Model 10CF-CI. Semi-centrifugal, single plate, dry disc type.

See article in Mechanical Equipment Section for data.

Facings—Woven, spiral wound type, 2 required. Inside Diam. 6". Outside Diam. 10". Thickness .125".

Adjustment—Pedal free movement should be 1¼-1½". Adjustment provided on connecting link. Turn screw in or out for proper clearance.

Removal—Remove transmission (see Transmission Removal below), take off clutch housing pan, punchmark clutch cover and flywheel (to insure replacing in same position to maintain balance), take out mounting screws in clutch cover flange turning all screws out evenly, remove clutch from below through pan opening.

TRANSMISSION:—Warner Model T-85. Superdrive (Overdrive) is standard equipment. Constant-mesh, synchro-mesh (second and high), sliding helical gear (low and reverse).

See article in Mechanical Equipment Section for data.

Transmission Control:—Own steering column type remote control. Optl. on 1939 models.

See article in Mechanical Equipment Section for data.

Removal—Disconnect clutch linkage and drive shaft at front universal joint. Install pilot studs in upper transmission mounting bolt holes, take out lower mounting bolts and pull transmission back to free clutch shaft from driven disc.

UNIVERSAL JOINTS:—Detroit (Universal Products) Series 5150. Roller bearing 'cross' type. 2 used.

See article in Mechanical Equipment Section for data.

REAR AXLE:—Spicer. Hypoid Gear, semi-floating type with Hotchkiss drive.

See article in Mechanical Equipment Section for data.

Ratio—4.545-1 Std., 4.27-1 and 4.09-1 Optl.

Backlash—.004-.007". Shim adjustment.

Removal:—Disconnect hand brake cables, brake line, and drive shaft at rear universal joint. Remove wheels, take off spring clips at axle housing, remove axle from beneath car.

Axle Shaft Removal:—Remove wheel, hub, drum and backing plate. Pull axle shaft and wheel bearing.

Wheel Bearing Adjustment—Shims provided between flanged end of axle housing and brake backing plate. To adjust, remove wheel, hub and drum assembly. Remove shims to decrease endplay, add shims to increase. **Endplay**—.003-.006".

SHOCK ABSORBERS:—Gabriel Model OT (front), KT (rear). Double acting, hydraulic type with thermostatic control.

See article in Mechanical Equipment Section for data.

STEERING:—Steering Gear—Gemmer Model 300. Worm-and-roller type.

See article in Mechanical Equipment Section for data.

Front Suspension:—Conventional 'I' beam section front axle with Reverse-Elliott ends and semi-elliptic springs.

Kingpin Inclination—8½° crosswise.

Caster—1½°. Adjust by installing wedge shims between spring and spring seat on axle.

Camber—1¼°. No adjustment provided.

Toe In—1/16-3/16". Adjust in usual manner by loosening clamp bolts and turning tie rod.

BRAKES:—Service—Hupp-Lockheed hydraulic type. Hand lever applies rear service brakes.

See article in Mechanical Equipment Section for data.

Braking Power—55% Front, 45% Rear.

Brake Drum—Cast-iron. Diameter—12".

Lining—Moulded type. Width 2". Thickness 3/16". Length per wheel 24⅜".

Clearance—.010" toe, .005" heel for each shoe.

Hand Brake:—See Service Brakes above.

SERIAL NUMBER:—First number R-100501. On plate on right side of dash under engine hood.
ENGINE NUMBER:—First number R-100501. Stamped on boss on left side of crankcase in front of distributor.
ENGINE SPECIFICATIONS:—6 cylinder, 'L' head type.
Bore—3½". **Stroke**—4¼".
Displacement—245.3 cu. ins. **Rated HP.**—29.4.
Developed Horsepower—101 at 3600 R.P.M.
Compression Ratio—5.75-1 Std. 6.2-1 Optl.
Compression Pressure—141 lbs. at 3000 RPM. or 107 lbs. at 160 RPM. cranking speed std. head. 110 lbs. at 350 RPM. optl. 6.2-1 head.
Vacuum Reading—18-20" steady at idling speed.
PISTONS:—Bohn, aluminum alloy, Invar strut, split skirt, cam ground type. **Length**—4 3/32".
Weight—21.7 ozs. (without rings or pin).
Removal—Pistons and rods removed from above.
Clearance—See Fitting New Pistons.
Original Bore Sizes:—Mark opposite each bore indicate original bore size as follows:

1st Standard		2nd Standard	
Marking	Cylinder Size	Marking	Cylinder Size
(A)	3.500"	(AA)	3.520"
(B)	3.5005"	(BB)	3.5205"
(C)	3.501"	(CC)	3.521"
(D)	3.5015"	(DD)	3.5215"
(E)	3.502"	(EE)	3.522"
(F)	3.5025"	(FF)	3.5225"

Replacement Pistons:—Finished pistons furnished standard (3.499") and .001", .002", .003", .005", .010", .020", .025", .032" oversize. Semi-finished in one size only (3.542").
Fitting New Pistons:—Use .002" feeler gauge inserted between piston and cylinder wall on side opposite slot. Pull required to remove feeler must be within 13-15 lbs.
Installing Pistons:—Slot to left (away from valves). NOTE—Piston pin offset in piston toward right or camshaft side of engine.
PISTON RINGS:—Two compression, two oil control rings per piston, all above pin.

Ring	Width	End Gap	Side Clearance
Comp.	⅛"	.007-.012"	.0005"
Oil Cont.	5/32"	.007-.015"	.0005"

Replacement Rings:—Furnished in standard and .005", .010", .020", .030" oversize.
PISTON PIN:—**Diameter**—⅞". **Length**—2 15/16". Pin floats in piston and rod. Held by locking ring at each end. Pin hole in connecting rod bronze bushed.
Pin Fit in Piston—.0005" clearance or easy slip fit with piston heated to 212° F.
Pin Fit in Rod Bushing—.0005" clearance.
Replacement Pins:—Std. & .003", .006" oversize.
CONNECTING ROD:—**Weight**—35 ozs. **Length**—8¼".
Crankpin Journal Diameter—2⅛".
Lower Bearing—Steel-backed, babbitt-lined type.
Clearance—.001-.0025". **Sideplay**—.005-.010".
Bearing Adjustment:—None (no shims). Replace bearings. Do not file rods or bearing caps.
Replacement Bearings:—Std. and .003" undersize.
Installing Rods:—Lower bearings offset. Install rods with narrow half of bearing toward nearest main bearing or pointing toward front of engine for #1, 3, 5 and toward rear for #2, 4, 6.
CRANKSHAFT:—Four bearing. Integral counterweights.
Journal Diameters—2.560" all bearings.
Bearing Type—Steel-backed, babbitt-lined.
Clearance—.001-.003".
Bearing Adjustment:—None (no shims). Replace bearings. Do not file bearing caps.
NOTE—Bearings may be 'rotated' out without removing crankshaft.
Replacement Bearings:—Std. and .003" undersize.
End Thrust:—Taken by #2 main bearing. Not adjustable (replace bearing). **Endplay**—.004-.008".
CAMSHAFT:—4 bearing. Non-adjustable chain drive.
Journal Diameters—#1, 2.186"; #2, 2.076"; #3, 2.060"; #4, 1.498".
Bearing Type—Leaded-bronze bushings.
Clearance—.0015".
End Thrust—Taken by thrust plate at rear of camshaft sprocket. Adjustable by adding or removing shims. **Endplay**—.004".
Timing Chain:—Morse Type 1866-N, No. 1115. Width 1". Pitch .500". Length 25½" or 51 links.
Camshaft Setting:—Sprockets are marked. Mesh chain with sprockets turned so that marks are adjacent and in line with straightedge across shaft centers.
VALVES:—

	Head Diameter	Stem Diameter
Intake	1 21/32"	.3405-.3415"
Exhaust	1 17/32"	.3405-.3415"

	Seat Angle	Lift	Stem Clearance
All Valves	45°	11/32"	.001-.0015"

Tappet Clearance—.010" Int., .013" Exh. running clearance with engine warm.
NOTE—Tappet clearance for timing is .014" (Intake—opening side), .018" (Intake—closing side), .017" (Exhaust—opening side), .021" (Exhaust—Closing side).
Valve Guides:—Pressed in block from above. To remove guides, work from lifter opening and press guides out from below.
Valve Springs:—Damper installed on all springs at top. Free length 2 3/64".

	Spring Pressure	Length
Valve Closed	40 lbs.	1 13/16"
Valve Open	100 lbs.	1 15/32"

Valve Lifters:—Mushroom type. Removable from below only. Guides must be removed first. Lifters furnished .002", .004" oversize. Lifters must be free fit in guide at room temperature.
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 2° BTDC. Close 51° ALDC.
Exhaust Valves—Open 44° BLDC. Close 3° ATDC.
To Check Valve Timing—Set tappet clearance #1 intake valve at .014", #1 exhaust valve at .021". With this clearance, intake valve will open and exhaust valve will close with piston at top dead center when flywheel mark 'D-C/1-6' lines up with finished bosses on right front face of clutch housing. Reset tappet clearance for correct running clearance (see above).
LUBRICATION:—Pressure system. Gear type oil pump located on right hand side of crankcase.
Oil Pump Installation—Whenever oil pump removed, turn engine over to firing position for #1 piston (see Ignition Timing), rotate oil pump shaft so that tongue-and-slot drive connection will mesh without disturbing distributor drive shaft when oil pump is replaced.
Normal Oil Pressure:—3-5 lb. idling, 30 lb. @ 30 MPH.
Oil Pressure Regulator:—Located on oil pump cover. Adjustable by turning screw which controls regulator valve spring tension (turn screw in to increase, or out to decrease pressure). Opens at 35-45 lbs.
Crankcase Capacity—6½ qts. (dry), 6 qts. (refill).
COOLING SYSTEM:—**Capacity**—18 quarts.
Water Pump:—Belt-driven, adjustable packing type.
See article in Mechanical Equipment Section for data.
Removal—Drain cooling system, remove fan belt, take out pump mounting bolts. Lift off pump assembly.
Thermostat:—Fulton. In water outlet on cyl. head.
Setting—Starts to open 140° F. Fully open 145° F.
CLUTCH:—**Borg & Beck Model 9A6.** Single plate, dry disc type.
See article in Mechanical Equipment Section for data.
Facings—Moulded type (flywheel side), woven type (pressure plate side). Inside Diam. 6⅛". Outside Diam. 9⅞". Thickness ⅛".
Adjustment—Pedal free movement should be ⅜-1". Adjustment provided on linkage.
Removal:—Remove transmission (see below), take off clutch housing pan, punch mark clutch cover and flywheel (to insure replacing in same position to maintain balance), take out mounting screws in clutch cover flange turning all screws out evenly, remove clutch from below.
TRANSMISSION:—**Warner Model T-86.** All helical gear type with synchro-mesh for second and high.
Transmission Control:—Remote steering column type.
See articles in Mechanical Equipment Section for data.
Removal:—Disconnect clutch linkage, shift linkage and drive shaft at front universal joint. Support rear of engine and free rear engine mountings. Install pilot studs in upper transmission mounting bolt holes, take out lower mounting bolts and pull transmission back.
UNIVERSAL JOINTS:—**Spicer.** Needle bearing type. 2 used.
See article in Mechanical Equipment Section for data.
REAR AXLE:—**Spicer.** Hypoid gear, semi-floating type with Hotchkiss drive.
See article in Mechanical Equipment Section for data.
Ratio—4.27-1.
Backlash—.004-.007". Shim adjustment.
Removal:—Disconnect hand brake cables, brake line, and drive shaft at rear universal joint. Remove wheels, take off spring clips at axle housing, remove axle from beneath car.
Axle Shaft Removal:—Remove wheel, hub, drum and backing plate. Pull axle shaft and wheel bearing.
Wheel Bearing Adjustment—Shims provided between flanged end of axle housing and brake backing plate. To adjust, remove wheel, hub and drum assembly. Remove shims to decrease endplay, add shims to increase. **Endplay**—.003-.010".
SHOCK ABSORBERS:—**Gabriel.**—Double acting, hydraulic type.
See article in Mechanical Equipment Section for data.
STEERING:—**Steering Gear.** Gemmer Model 305. Worm-and-Roller type with 'push-pull' adjustment.
See article in Mechanical Equipment Section for data.
Front Suspension:—Conventional 'I' beam section front axle with Reverse-Elliott ends and semi-elliptic springs.
Kingpin Inclination—7½° crosswise.
Caster—2° plus or minus ½°. Adjust by inserting wedge shims between spring and spring seat on axle.
Camber—1°. Minor corrections can be made by heating axle moderately.
Toe In—1/16" plus or minus 1/16". Adjust in usual manner by loosening clamp bolts and turning tie rod.
BRAKES:—**Service**—Hupp-Lockheed hydraulic type. Hand lever applies rear service brakes.
See article in Mechanical Equipment Section for data.
Wheel Cylinders—Stepped or two-stage bore type.
Front wheel—Front cylinder 1⅜". Rear 1".
Rear wheel—Front cylinder 1¼". Rear 1".
Drums—Cast-iron. Diameter—10".
Lining—Moulded type. Width 2". Thickness 3/16". Length per shoe 10½".
Clearance—.010" toe, .005" heel, for each shoe.
Braking Power—55% front, 45% rear.
Hand Brake:—See Service Brakes.

ENGINE NUMBER:—On plate on right side of crankcase at front of engine below valve cover plate.

SERIAL NUMBER:—First number (110) L-1001, (3510) L-13,701, (3610) L-23,101. On right frame side member under engine hood.

ENGINE SPECIFICATIONS:—Type—6 cyl., 'L' head.

Bore—3¼". **Stroke**—4⅜".

Displacement—217.7 cubic inches.

Rated Horsepower—25.35 (SAE).

Developed Horsepower—75(110), 80(3510), 83(3610) at 3200 R.P.M.

Compression Ratio and Pressure—5.54-1 std. cast-iron head. Pressure—125 lbs. at 350 R.P.M.

Vacuum Reading—Gauge should show steady reading of 18-20" with engine idling at 5-7 M.P.H.

PISTONS:—Nelson Bohnalite, aluminum alloy, Invar strut, split skirt type.

Length—3⅞".

Weight—18¼ ounces.

Removal—Pistons and rods removed from above.

Clearance—Skirt .002". See Fitting New Pistons.

Fitting New Pistons:—Use .002" feeler stock inserted between piston and cylinder wall on side opposite slot to check clearance.

Installing Pistons:—Slot should be toward left or away from camshaft.

PISTON RINGS:—Two compression rings, two oil control rings per piston, all above pin.

Ring	Width	End Gap
Comp. All	⅛"	.010-.025"
Oil Cont. (#3)	⅛"	.010-.025"
Oil Cont. (#4)	3/16"	.010-.025"

PISTON PIN:—Diameter—⅞". Pin floats in piston and rod. Pin hole in rod is bronze bushed. Pins furnished for service standard, .001", .003", .005" oversize.

Pin Fit in Piston—Light push fit with piston heated.

Pin Fit in Rod Bushing—.0001" or light push fit with both parts at normal temperature.

CONNECTING ROD:—Length—8¾".

Weight—36¼ ounces.

Upper Bearing (Piston Pin Bushing)—Bronze.

Crankpin Journal Diameter—2".

Lower Bearing—Interchangeable steel-backed, babbitt-lined (110, 3510), copper-lead lined (3610) type. Shim adjustment. One shim used on camshaft side on Models 110, 3510.

Clearance—.001-.003". Sideplay .008-.012".

Bearing Adjustment:—Shims. Do not file rods or caps. Replace bearings when necessary.

CRANKSHAFT:—7 bearing. Integral counterweights.

Journal Diameters—2 31/64" all bearings.

Bearing Type—Interchangeable steel-backed, babbitt lined (110, 3510), copper-lead lined (3610).

Clearance—.002-.0025".

Bearing Adjustment:—Shims. Do not file caps. Replace bearings when necessary. Bearing upper halves can be removed without removing crankshaft.

End Thrust:—Taken by center bearing. Endplay .004-.007".

CAMSHAFT:—6 bearing. Non-adjustable chain drive.

Bearing Type—Removable steel-backed, babbitt-lined type.

Timing Chain:—Diamond 'double strand' roller chain. Width 9/16". Pitch ⅜". Length 22½" or 60 links.

Camshaft Setting:—Sprockets are marked. Mesh chain with sprockets turned so that marks are adjacent and in line with a straightedge across the shaft centers. Remove and install chain 'endless.' Use special gear pullers and pushers, keep sprockets lined up so as to avoid sidestrain on chain or sprockets

VALVES:—	Head Diam.	Stem Diam.	Seat Width
Intake	1 21/32"	.341"	1/16"
Exhaust	1 17/32"	.341"	1/16"

	Seat Angle	Lift	Stem Clearance
Intake	45°	5/16"	.002"
Exhaust	45°	5/16"	.002"

Tappet Clearance—.015" all valves—engine hot or cold.

Valve Timing:—See Camshaft Setting Above.

LUBRICATION:—Pressure. Gear type oil pump located in crankcase.

Normal Oil Presure:—25 lbs., 10 lbs. idling.

Oil Pressure Relief Valve:—Located on oil pump. Operates at 25 lbs. Adjustable by turning screw.

Crankcase Capacity:—7 quarts (full).

CLUTCH:—**Borg & Beck Model 9A6.** Single plate, dry disc type. No adjustment required for wear.

Facings—Moulded type, 2 required. Inside Diam. 5¾" (110, 3510), 6⅛" (3610). Outside Diameter 9" (110, 3510), 9⅛" (3610). Thickness .133" (110, 3510), ⅛" (3610).

Adjustment—Free movement of clutch pedal must be ½-1". Adjust whenever free movement is less than ½". To adjust, loosen nut on lower end of clutch pedal. Setscrew on throwout shaft at right end of clutch housing should not contact stop on case.

Removal—Disconnect driveshaft at rear of transmission, remove transmission, drop clutch housing underpan, take out capscrews mounting clutch on flywheel turning all screws out evenly to release spring pressure. Clutch assembly can then be removed from below without removing flywheel housing.

STEERING:—Steering Gear—Gemmer Model. Worm- and Roller type. See article in Steering Section for complete adjustment procedure.

Front Suspension:—Conventional 'I' beam front axle with Reverse-Elliott ends (Std.), or articulated axle Optl. 110, 3510). Semi-elliptic springs used with both types.

Kingpin Inclination—7° crosswise.

Caster—1-2° (110, 3510). 2-4° (3610) according to car load. Adjust by inserting wedge shims between spring and spring pad on axle.

Camber—0-1½°. No adjustment.

Toe In—0-⅛". To adjust, loosen clamp at right end of tie rod, turn tie rod in or out of this end joint, tighten clamp.

BRAKES (110, 3510):—**Service**—Bendix duo-servo, single anchor type, mechanically operated. Hand lever applies all four service brakes.
See article in Mechanical Equipment Section for data.

Drum Diameter—11".

Lining—Moulded type. Width 1¾". Thickness 5/32". Length per wheel 23¾".

Clearance—.010" between lining and drum.

Hand Brake Adjustment:—See Service Brakes.

BRAKES (3610):—**Service**—Bendix hydraulic, duo-servo, single anchor type. Hand lever applies rear service brakes.
See article in Mechanical Equipment Section for data.

Drum Diameter—10".

Lining—Moulded type. Width 2". Thickness 3/16". Length 22 1/16" per wheel.

Clearance—.010" between drum and lining.

Hand Brake Adjustment:—Should be adjusted whenever service brakes adjusted. Turn adjusting screw in wheel so that shoes are tight in drum. Loosen 2 bracket bolts, pull hand brake lever 'on' three notches, pull bracket forward removing all slack in cables and tighten bolts. Then with lever in released position readjust shoes to give .010" clearance in drums by checking with feeler gauge through slot in drum.

SERIAL NUMBER:—Same as engine number.

ENGINE NUMBER:—Stamped on right side of crankcase below water inlet. First number (345-B) 1,100,001; (345-C) 2,100,001.

ENGINE SPECIFICATIONS:— 8 cylinder, 90 degree 'Vee' 'L' head type.

Bore—3⅜". Stroke—4 15"16".

Displacement—353 cubic inches.

Rated Horsepower—36.45 (AMA).

Developed Horsepower—115 at 3000 R.P.M.

Compression Ratio—5.4-1 std. head. 5.7-1 optional high compression head.

Compression Pressure—Approximately 94 lbs. (5.4-1 head), 98 lbs. (5.7-1 optl. head) at cranking speed.

Vacuum Reading—Gauge should show steady reading of 18-20" with engine idling.

PISTONS:—Cast-iron, light weight. 345-C pistons are tin-plated.

Length—3 21/32".

Weight—23.824 ozs. (stripped), 30.400 ozs. (with rings, pin, and locking screw).

Clearance—Top .0135-.0185". Bottom .002-.003".

Removal—Pistons and rods removed from below.

PISTON RINGS:—Four rings (345-B), five rings (345-C) per piston. Three compression (345-B), two compression (345-C), two oil control rings (all models). Lower ring groove drilled radially with oil drain holes.

345-B Piston Rings

Ring	Width	End Gap	Wall Thickness
Comp. (upper)	⅛"	.008"	.148"
Comp. (lower)	3/16"	.008"	.148"
Oil Control (upper)	3/16"	.008"	.148"
Oil Control (lower)	5/32"	.008"	.148"

345-C Piston Rings

Comp. (upper	⅛"	.005-.010"	.135"
Comp. (#2)	.0930"	.005-.010"	.135"
Comp. (#3)	.0930"	.005-.010"	.135"
Oil Control (upper)	3/16"	.003-.011"	.140"
Oil Control (lower)	5/32"	.003-.011"	.140"

PISTON PIN:—Diameter—⅞". Length—3 1/32". Pin is locked in piston by locking screw in one boss. Bushing is split type and must be installed loosely and then expanded with burnishing tool.

Pin Fit in Rod Bushing—.0003-.0007".

CONNECTING ROD:—Weight—32.875 ounces.

Length—10½" (center-to-center).

Crankpin Journal Diameter—2⅜".

Lower Bearing—Poured babbitt type. No shims.

Clearance—.003". Endplay .003-.006".

Bearing Adjustment:—None (no shims). Do not file caps. Replace rods.

CRANKSHAFT:—3 bearing type with four counterweights.

Journal Diameters—2⅜" all bearings.

Bearing Type—Bronze backed, babbitt lined.

Clearance—.0015".

Bearing Adjustment:—None (no shims). Replace bearings. Do not file caps.

End Thrust:—Taken by rear (#3) main bearing.

End Play—.001-.005".

CAMSHAFT:—Non-adjustable chain drive.

Timing Chain:—Morse #766. Width 1¾". Pitch .500". Length 27" or 54 links.

Camshaft Setting:—Sprockets are marked. Mesh chain with sprockets turned so that '0' marks are adjacent and in line with a straightedge across the shaft centers.

VALVES:—	**Head Diameter**	**Stem Diameter**	**Length**
Intake	1.660-1.666"	⅜"	6 17/32"
Exhaust	1.634-1.640"	⅜"	6½"
	Seat Angle	**Lift**	**Stem Clearance**
Intake	30°	23/64"	.0025"
Exhaust	45°	23/64"	.0025"

Tappet Clearance—.006" Int., .008" Exh., engine cold.

Valve Springs:—	**Spring Pressure**	**Length**
Valve Closed	79 lbs.	2.500"
Valve Open	160 lbs.	2.148"

Valve Timing:—See Camshaft Setting above.

Intake Valves—Open 6° BTDC. Close 42° ALDC.

Exhaust Valves—Open 38° BLDC. Close 2° ATDC.

To Check Valve Timing—Set tappet clearance at .006" for intake valve #1 cylinder (second valve from radiator on right hand bank). This valve should open with #1 piston 6° (.0165") before top dead center.

Motor Gauge—Weidenhoff Adapter #104, Rod #29.

LUBRICATION:—Pressure type.

Oil Pump:—Gear type located in crankcase.

Normal Oil Pressure:—30 lbs. at 30 M.P.H.

Oil Pressure Regulator:—Relief valve opens at 10 M.P.H. with pressure of 10 lbs.

Crankcase Capacity—8 quarts.

CLUTCH:—Own make. Double plate, dry disc type. See article in Clutch Section for complete data.

Clutch Facings—Woven asbestos, 5½" Inside Diameter, 10" Outside Diameter. .135-.145" thick. Four facings required.

NOTE—Mark clutch cover and flywheel before disassembling and reassemble in same position.

STEERING:—Steering Gear—Saginaw Model Worm-and-Sector type. See article in Steering Section for adjustments.

Front Suspension:—Conventional 'I' beam section front axle with Reverse-Elliott ends and semi-elliptic springs.

Kingpin Inclination—7°45' crosswise.

Caster—2½-3½°.

Camber—1½°.

Toe In—⅛-¼". Adjust in usual manner by changing length of tie rod.

BRAKES:—Service—Own Make. Internal expanding, self-energizing, mechanically operated, vacuum power type. Hand lever applies rear wheel service brakes. See article in Brake Section for relining and complete adjustment procedure.

Drum Diameter—15".

Lining—Semi-moulded Latex type. Width 2". Thickness 3/16". Length per wheel 29¾".

Clearance—.007" between lining and drum for each shoe.

Hand Brake Adjustment:—See Service Brakes.

Power Unit:—Bendix type. See article in Brake Section for complete data.

ENGINE NUMBER:—First number 2,100,001. On left top front corner of cylinder block (below head).

ENGINE:—Own Model 350. Eight cylinder, In Line, 'L' head type.

Bore—3". Stroke—4¼".

Piston Displacement—240 cubic inches.

Rated Horsepower—28.8.

Developed Horsepower—95 at 3600 R.P.M.

Compression Ratio—6.5-1 (std.), 5.75-1 (optl).

Compression Pressure—162 lbs. at 1000 R.P.M. or 183 lbs. at 2700 R.P.M. (std. head).

Vacuum Reading—Steady 18-20" at idling speed.

Pistons:—Lynite Lo-Ex, aluminum alloy, 'T' slot, cam ground type with Anodized finish (special hard oxide deposited on bearing surface). Pistons cannot be ground. Refinish cylinders to take replacement pistons furnished .003", .005", .015", .030" oversize. Piston length, 3 11/16".

Weight—12.128 ozs. (stripped), 18.192 ozs. (with rings, pin, and locking screw).

Removal—Pistons and rods removed from below.

Clearance—Top .016". Bottom .0018" (at 70°F.).

Fitting New Pistons—Check piston with micrometer at point just below and to the left of 'T' slot junction midway between pin bosses with piston at 70°F. Finish cylinder bore to size giving correct clearance. Feeler gauges can be used on side opposite slot. Piston should fall of own weight with .0015" feeler and should lock on .002" feeler.

Installing Pistons—Install pistons with slot to left (away from camshaft and valves).

Piston Rings:—Two notched or stepped compression rings, two oil control rings per piston, all above pin. Lower ring grooves drilled radially with oil drain holes. Compression rings installed with notch or step downward.

Ring	Width	End Gap	Wall Thickness
Comp. (all)	.1235-.1240"	.007-.012"	.130"
Oil Cont. (3)	.1235-.1240"	.007-.015"	.130"
Oil Cont. (4)	.1545-.1550"	.007-.015"	.130"

Piston Pin:—Diameter ⅞". Length 2 11/16". Pin is locked in piston. Heat piston in hot water to remove or install pins.

Pin Fit in Piston—Locking screw end .0005" press fit or light thumb push fit with piston at 200-210° F. Free end .0003" clearance or light thumb push fit with piston at 70°F.

Pin Clearance in Rod Bushing—.0002-.0009".

Connecting Rod:—Weight 30.448 ozs. Length 9".
Lower Bearing Type—Removable steel-backed, babbitt-lined type. No shims.
Clearance—.0015". Sideplay .005".
Adjustment—None. Replace bearings. Do not file rods or caps.
Installing Rods—See that oil hole in top of lower bearing is toward right (camshaft side) of engine on all rods.

Crankshaft:—Five bearings with eight counterweights.
Journal Diameters—#1—2⅜", #2—2 9/16", #3—2⅝", #4—2 11/16", #5—2¾".
Bearing Type—Removable bronze-backed, babbitt-lined type.
Clearance—.002".
Adjustment—None (no shims). Replace bearings. Do not file bearing caps.
End Thrust—Taken by #1 (front) bearing. Upper half of bearing flanged and steel thrust washer installed on shaft behind sprocket. Endplay .004".

Camshaft:—Non-adjustable chain drive.
Timing Chain—Whitney #CL-205. Width, 1¼". Pitch ½". Length, 23" or 46 links.
Camshaft Setting—Sprockets are marked. Install chain with sprockets turned so that marks are adjacent and in line with a straightedge across the shaft centers.

Valves:—

	Head Diameter	Stem Diameter	Length
Intake	1 9/16"	11/32"	5 9/32"
Exhaust	1 7/16"	11/32"	5 9/32"

	Seat Angle	Lift	Stem Clearance
Intake	30°	.291"	.002"
Exhaust	30°	.289"	.003"

Tappet Clearance—Running .006" Int., .008" Exh.
Timing—.015" all valves—engine cold.

Valve Springs—	Pressure	Length
Valve Closed	43 lbs.	2.25" Int., 2.248" Exh.
Valve Open	96 lbs.	1.906" Int., 1.904" Exh.

Spring cages installed on top of valve spring exert slight pressure on springs (pressure required to withdraw cages should be 3-6 lbs.). Use new cages with new valve springs.
Valve Timing—See Camshaft Setting above.
Intake Valves open 6° ATDC. Close 37° ALDC.
Exhaust Valves open 34° BTDC. Close 5° ATDC.
To Check Valve Timing—No. 1 intake valve should open with piston on top dead center with tappet clearance set at .0118".
Motor Gauge—Weidenhoff Adapter #104, Rod #40.

Lubrication:—Pressure type. Gear type pump located in oil pan.
Oil Pressure—30 lbs. at 60 M.P.H.
Oil Pressure Relief Valve—Operates at 30 lbs.
Capacity and Oil—7 qts. Use SAE. #30 (summer), 20-W or 10-W (winter).

CLUTCH:—Borg & Beck. Single plate, dry disc type. No adjustment of clutch necessary for wear.
See article in Mechanical Equipment Section for data.
Clutch Pedal Adjustment—Free movement of clutch pedal should be 1-1½". Adjust by loosening lock nut and turning stop screw on auxiliary cross shaft. Clearance between pedal and under side of toeboard should be ⅜-⅝" with clutch engaged. Adjust by changing length of clutch release rod (free rod at front end, turn rod in or out of clevis).
Clutch Facings—Moulded type, 2 required, 6⅛" I.D., 9⅞" O.D., .133" thick.

NOTE—Mark flywheel, cover and spring pressure plate before disassembling clutch and install in same relative position. Clutch can be removed from below after taking off clutch housing pan without disturbing clutch housing. Install driven plate with mark 'Flywheel Side' toward flywheel.

When removing transmission from car, keep transmission in high gear or install brace across face of case to hold clutch connection in position, preventing high-speed synchronizing drum from pulling out of splines in main shaft.

STEERING:—Front Suspension—Independent, linked parallelogram type with helical springs.
See article in Mechanical Equipment Section for data.
Caster—2° with car weight on wheels. To adjust, loosen retaining nuts fastening steering knuckle support yokes to upper and lower suspension arms, and clamp screw at upper end of support, remove lubrication fitting in front bushing of upper support yoke, insert Allen wrench and turn threaded pin clockwise to increase caster, or counter-clockwise to decrease caster angle, tighten yoke retaining nuts and clamp screw, replace lubrication fitting.

Camber—1° with car weight on wheels. No adjustment provided. Crosswise inclination of kingpin 4° 51'.

Toe In—⅛". To adjust, increase or decrease length of each tie rod equally. Turn tie rods in same direction that wheels revolve to increase toe-in, or in opposite direction to decrease toe-in.

Steering Gear:—Saginaw Worm-and-Double-Roller type with center steering. See article in Steering Section for adjustments.

BRAKES:—Service—Bendix Hydraulic, single anchor type. Hand lever applies rear wheel service brakes.
See article in Mechanical Equipment Section for data.
Wheel Cylinders—Diameters: front 1 1/16", rear 15/16". No part of assembly interchangeable between front and rear wheels.
Drum Diameter—11.995-12.005". Out-of-round .007" maximum. Run out (installed) .010" maximum.
Lining—Moulded type. Width 2". Thickness 3/16". Length per wheel 25⅞".
Clearance—.010" between lining and drum.
Hand Brake Adjustment:—See Service Brakes.

ENGINE NUMBER:—First number 2,200,001 (1935), 2,210,001 (1936). On left hand top front corner of cylinder block below head.

ENGINE SPECIFICATIONS:—8 cylinder, 'L' head.
Bore—3". **Stroke**—4⅜".
Displacement—248 cubic inches.
Rated Horsepower—28.8.
Developed Horsepower—105 at 3600 R.P.M. (Std. 6.25-1 head).
Compression Ratio—6.25-1 Std. cast-iron head.
NOTE—Shims for reducing compression ratio to 5.75-1 available for special operating conditions.
Compression Pressure—160 lbs. at 1000 R.P.M. or approximately 105-110 lbs. at cranking speed for std. 6.25-1 head.
Vacuum Reading—Gauge should show steady reading of 20-21" with engine idling at 6 M.P.H.

PISTONS:—Lynite, Lo-Ex aluminum alloy, 'T' slot, Cam ground type with anodized finish (special hard oxide formed on bearing surface). Pistons cannot be ground.
Length—3 11/16". **Weight**—12.128 ozs.
Removal—Pistons and rods removed from below.
Clearance—Top .015". Bottom of Skirt .0011-.0015". See Fitting New Pistons.
Replacement Pistons:—Finished anodized pistons furnished in standard (2.9982-3.0002") and .003" (3.0012-3.0032"), .005" (3.0032-3.0052"), .010" (3.0082-3.0102"), .015" (3.0142-3.0152") oversizes. Cylinder bores should be finished with a 500 grit wet stone.
NOTE—Cylinder bores held within .002" limits. Maximum cylinder bore out-of-round .0005".
Fitting New Pistons:—Check piston with micrometer gauge at vertical slot 1¼" below top of head and ½" above lower edge of skirt. Using ⅜-½" feeler gauges inserted between piston and cylinder wall on side opposite slot to check clearance, piston should drop of its own weight with .0015" feeler and should hold its own weight with .002" feeler.
Installing Pistons:—Slot should be toward left or away from camshaft

PISTON RINGS:—Two compression, two oil control rings per piston, all above pin. Lower ring grooves drilled radially with oil drain holes.
NOTE—A narow heat deflector groove located above top compression groove. No ring fitted in this groove.

Ring	Width	End Gap	Side Clear.
Comp. (all)	⅛"	.007-.012"	.0015-.0028"
Oil Cont (#3)	⅛"	.007-.015"	.0013-.0026"
Oil Cont. (#4)	5/32"	.007-.015"	.0013-.0026"

NOTE—Worn limits on all rings .025" (End gap) and .004" (Side Clearance).

PISTON PIN:—Diameter 55/64". Length 2 11/16". Pin is locked in one piston boss by locking screw. Split-type bushing used in pin hole in rod. See Note below.
Pin Fit in Piston—.0001" clearance or free fit (no play) at room temperature 70° F. (free end), .0003" press fit (locking pin end).
Pin Fit in Rod Bushing—.0002-.0008" (new), .0015" maximum (worn).
Removal:—Remove lockscrew, place piston in boiling water for one minute, then push pin out by hand from locking screw side (to install, proceed as mentioned, except that the pin is pushed in from the opposite direction).
NOTE—In removing and installing split-type bushing an arbor press and special tool kit (Tool No. HM-250) are necessary. Bushings must be pressed in, expanded, then burnished to give correct clearance.

CONNECTING ROD:—Weight 32.336 ozs. Length 9".
Crankpin Journal Diameter—2¼".
Lower Bearing—Removable steel-backed, babbitt-lined type. No shims.
Clearance—.001-.0025" (new), .006" max. (worn). Sideplay .003-.006".
Bearing Adjustment:—None (no shims). Replace bearings. Do not file rods or caps.
Installing Rods:—Oil hole in lower bearing upper half must be toward right or camshaft side on all rods.
NOTE—Crankpin out of round .002" maximum.

CRANKSHAFT—5 bearing. Integral counterweights.
Journal Diameters—#1, 2⅜"; #2, 2 9/16"; #3, 2⅝"; #4, 2 11/16"; #5, 2¾".
NOTE—Journal out-of-round .002" maximum.
Bearing Type—Removable steel-backed, babbitt-lined shells. New bearings need no line-reaming.
Clearance—.002" (new), .004" (worn).
Bearing Adjustment:—None (no shims). Replace bearings. Do not file bearing caps. Upper halves of bearings can be removed and installed by rotating crankshaft with 'T' shaped cotter pin installed in oil passage.
NOTE—When reinstalling rear main bearing cap use new wooden plugs in grooves.
End Thrust:—Taken by flange on front (#1) bearing and steel washer behind timing sprocket. Endplay .001-.004" (new), .010 max. (worn).

CAMSHAFT:—6 bearing. Non-adjustable chain drive.
Journal Diameters—#1, 2.3095-2.3100"; #2, 2.2470-2.2475"; #3, 2.1845-2.1850"; #4, 2.1220-2.1225"; #5, 2.0595-2.0600"; #6, 1.8095-1.8100".
Bearing Type—Removable bronze bushings.
Clearance—.002-.004" (new), .005" (worn limit).
End Thrust:—Taken by spring-loaded plunger or thrust button in forward end of camshaft. No end-play permissible.
Timing Chain:—Whitney #CL-205. Width 1¼". Pitch ½". Length 23" or 46 links.
Camshaft Setting:—Sprockets are marked. Mesh chain with sprockets turned so that 'O' marks are adjacent and in line with a straightedge across the shaft centers.

VALVES:—

	Head Diam.	Stem Diam.	Length
Intake	1.562"	.3415-.3425"	5 9/32"
Exhaust	1.421"	.3405-.3415"	5 9/32"

	Seat Angle	Lift	Stem Clearance
Intake	30°	5/16"	.006" (worn limit)
Exhaust	45°	5/16"	.005" (worn limit)

Tappet Clearance—.006" Int., .009" Exh. Hot.
Valve Guides:—Removable. Pressed in block with long stepped end down and finish reamed to provide clearance of .001-.002" Int., .001-.003" Exh.
Valve Springs:—Install springs with close coils below. Free spring length 2 9"16".

	Spring Pressure	Length
Valve Closed	40-46 lbs.	2¼"
Valve Open	112-120 lbs.	1 15/16"

Valve Lifters:—Mushroom type. Clearance in Lifter Guide .0003-.0008" (new), .005" (worn).
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 6° ATDC. Close 37° ALDC.
Exhaust Valves—Open 34° BLDC. Close 5° ATDC.
To Check Valve Timing—No. 1 intake valve opens with piston on top dead center with .0118" tappet clearance.
Motor Gauge—Weidenhoff Adapter #114, Rod #40.

LUBRICATION:—Pressure system from oil pump in crankcase through main oil channel in right hand crankcase wall.
Oil Pump:—Gear type located in crankcase. Ignition timing not disturbed by oil pump removal.
Oil Pump Drive Clearances—Drive gear endplay .003-010" (new), .015" (worn limit). Drive gear backlash must not exceed .018". Clearance between bushing and drive shaft .001-.0025" (new), .010" (worn limit).
Oil Pump Gear Clearances—Clearance between pump gears and pump housing .0025-.0085" (new), .010" (worn limit). Pump gear endplay .0025-.0055" (new), .015" (worn limit).
Normal Oil Pressure:—15 lbs. idling, 25 lbs. at 60 M.P.H.
Oil Pressure Regulator:—Operates at 25 lbs. Mounted on oil pump. Not adjustable.
Crankcase Capacity:—7 qts. (refill).

CLUTCH:—**Borg & Beck Model 10A4 with Long Driven Member (10CF-CI).** Single plate dry disc type.
See article in Mechanical Equipment Section for data.
Facings—Moulded type, 2 required. Inside Diam. 6". Outside Diam. 10". Thickness .137".
Adjustment—Free movement of clutch pedal should be ⅞-1⅛". Adjust by loosening locknut and turning stopscrew on auxiliary cross shaft. Clearance between pedal and underside of toeboard should be ⅜-⅝". Adjust by changing length of clutch release rod. Free rod at front end, turn rod in or out. Pedal should touch toeboard when clutch fully released. Adjust clutch release rod (as above) if necessary.
Removal—Disconnect front universal joint, remove transmission, drop clutch housing pan, remove clutch release yoke retaining screw, prick punch clutch cover, spring pressure plate and flywheel (install in same position to maintain balance), take out clutch mounting bolts, turning all bolts out evenly to release spring tension. Remove clutch from below.
NOTE—Keep transmission in high gear or install brace across face of case to hold clutch connection in position, preventing high-speed synchronizing drum from pulling out of splines in main shaft.

STEERING:—**Steering Gear:** Saginaw worm-and-double roller type with center steering. See article in Steering Section for adjustments.
Front Suspension:—Independent, linked parallelogram type with coil springs. See article in Steering Section for description and adjustment procedure.
Kingpin Inclination—4°51' crosswise.
Caster—1½-2°.
Camber—¼-1° with car weight on wheels.
Toe In—0-1/16".
Steering Geometry—Inner wheel turned 21¾-23¼°, outer wheel 20°. Check tie rod ends and kingpins for looseness.

BRAKES:—Bendix Hydraulic, single anchor type. Hand lever applies rear wheel service brakes. See article in Brake Section for complete data.
Wheel Cylinders—Diameters: front 1 1/16", rear 15/16". No part of assembly is interchangeable between front and rear wheels.
Drum Diameter—11.995-12.005". Out-of-round .007" maximum. Run out (installed) .010" maximum.
Lining—Primary (front) shoe moulded. Secondary (rear) shoe woven. Length front wheel (front shoe 10⅛", rear shoe 13"), rear wheel (each shoe 13"). Width 2". Thickness 3/16". Length per wheel 23⅛" (front), 26" (rear).
Clearance—.010" between lining and drum.
Hand Brake Adjustment:—See Service Brake.

SERIAL NUMBER:—Same as engine number below.

ENGINE NUMBER:—First number 2230001. Stamped on left side of crankcase at rear of left cylinder block.

ENGINE SPECIFICATIONS:—Own. 8 cylinder, 90° Vee, 'L' head type. Upper crankcase and cylinder blocks cast enbloc. **Bore**—3⅜". **Stroke**—4½".
Displacement—322 cu. ins. **Rated HP.**—36.45.
Developed Horsepower—125 at 3400 R.P.M.
Compression Ratio—6.25-1 Std. 5.75-1 Optl.
Compression Pressure—155 lbs. at 1000 R.P.M. or approx. 105-110 lbs. at cranking speed (std. head).
See Cadillac Special Shop Notes for cylinder head installation instructions, head gasket identification, and changing compression ratios.
Vacuum Reading—Steady 20-21" at idle speed.

PISTONS:—Lynite or Bohn Lo-Ex aluminum alloy, 'T' slot, Cam Ground type with Anodized finish (special hard oxide bearing surface). **Length**—4⅛".
Weight—18.30 oz. stripped. 25.13 oz. complete.
Removal—Pistons and rods removed from above.
Clearance—Skirt .0019". See Fitting New Pistons.

Replacement Pistons:—Finished anodized pistons furnished Std. (3.3726-3.3746"), .003" (3.3761-3.3776"), .005" (3.3781-3.3796"), .010" (3.3831-3.3846"), .015" (3.3881-3.3896").
NOTE—Hold all cylinders in same block within .002" size limits. Max. out-of-round .0005".

Fitting New Pistons:—Check piston diameter with micrometer gauge at right angles to pin hole just below lower ring groove and also ½" above lower edge. If feeler gauges (⅜-½" wide) used, insert feeler next to T-slot. Piston should fall of own weight with .002" feeler, hold tight on .0025" feeler.

Installing Pistons:—Slot to left, for all pistons.

PISTON RINGS:—Two compression, two oil control rings per piston, all above pin.

Ring	Width	End Gap	Side Clearance
Compression	1/8"	.007-.012"	.0015-.0028"
Oil Control	5/32"	.007-.015"	.0013-.0026"

NOTE—Worn limits .025" (gap), .004" (side clear.).
Replacement Rings: .003",.005",.010",.015",.030" oversize.

PISTON PIN:—Diameter ⅞". **Length** 2 15/16". Pin floats in piston and rod. Held by locking rings.
See Cadillac Shop Notes for special pin removal and installation instructions.
Pin Fit in Piston—.0004" press fit (ribbed end), .0001" clearance or free fit at 70° F. (plain end).
Pin Fit in Rod Bushing—.0002-.0008" clearance (new), .0015" (worn limit).

CONNECTING ROD:—Weight 37.472 oz. **Length** 8¾".
Crankpin Journal Diameter—2.460".
Lower Bearing—Steel-backed, babbitt-lined.
Clearance—.0015" (new), .006" Max. (worn).
Sideplay—.003-.006".

Bearing Adjustment:—None (no shims). Replace bearings. Do not file rods or caps.
See Cadillac Special Shop Notes for connecting rod data and bearing installation.

Installing Rods:—Numbers on rods and bearing caps on same side and installed in same numbered cylinders with marks down toward oil pan.

CRANKSHAFT:—3 bearing. 6 counterweights.
Journal Diameters—2½" all bearings.
Bearing—Steel or bronze backed, babbitt-lined.
Clearance—.0015" (new), .004" (worn limit).

Bearing Adjustment:—None (no shims). Replace bearings. Do not file bearing caps. Upper halves can be rotated out without removing shaft.
See Cadillac Special Shop Notes for main bearing removal instructions.

End Thrust:—Taken by center bearing. Endplay .001-.005" (new), .010" Max. (worn).

CAMSHAFT:—3 bearings. Non-adjustable chain drive.
Journal Diameters—#1 and 2, 2.4071-2.4078"; #3, 2.0009-2.0016".
Bearing Type—Steel-backed, babbitt-lined.
Clearance—.0027-.0037" (new), .005" (worn limit).
See Cadillac Special Shop Notes for Camshaft Bushing removal and installation instructions.

End Thrust:—Taken by thrust plate behind camshaft sprocket. No endplay should be permitted.

Timing Chain:—Morse Type C #3682-RX Side guide type. Width 1¼". Pitch ⅜". Length 23¼" or 62 links. NOTE—Install chain 'endless' as an assembly with sprockets. Use tool J-836 to pilot camshaft sprockets.

Camshaft Setting:—Sprockets marked. Mesh chain with sprockets turned so that '0' marks are adjacent and in line with straightedge across centers.

VALVES:—	Head Diameter	Stem Diameter	Length
Intake	1.876-1.886"	.3415-.3425"	5 33/64"
Exhaust	1.626-1.636"	.3405-.3415"	5 33/64"

	Seat Angle	Lift	Stem Clearance
Intake	45°	.335"	.001-.0023"
Exhaust	45°	.345"	.002-.0033"

NOTE—Worn limit for valve stem-to-guide clearance .006" Intake, .005" Exhaust.
See Cadillac Special Shop Notes for valve removal and installation instructions.

Tappet Clearance:—None (automatic take-up used).
See article in Mechanical Equipment Section.

Valve Guides:—Pressed in block with long stepped end down and reamed to correct size.

Valve Lifters:—Wilcox-Rich 'Zero-lash' type hydraulic lifters. Lifters are mushroom type operating in removable guide brackets.
See article in Mechanical Equipment Section.
Clearance—.001-.0025" (new), .005" (worn).

Valve Springs:—	Pressure	Length
Valve Closed	66 lbs.	1.926"
Valve Open	145 lbs.	1.581"

Valve Timing:—See Camshaft Setting above.
Intake Valves—Open at TDC. Close at 42° ALDC.
Exhaust Valves—Open 52° BLDC. Close 10° ATDC.
To Check Timing—Intake valve for #1 cylinder opens with piston on top dead center when 'C.1/6' on crankshaft pulley lines up with pointer.

LUBRICATION:—Pressure system with gear type oil pump located in crankcase.
See Cadillac Special Shop Notes for oil pump data and lubrication system servicing.
Normal Oil Pressure—30 lbs. at 60 MPH. 15 lbs. idle.
Oil Pressure Regulator—Located on oil pump. Operates at 30 lbs. Not adjustable.
Crankcase Capacity—7 qts. (refill).

COOLING SYSTEM:—Water Pump. Centrifugal type. Belt-driven in tandem with generator.
See article in Mechanical Equipment Section.

Thermostat:—Mounted in radiator top tank, linked to radiator shutters by rod on forward side.
Setting—(Std. Type) Starts to open 148-153°F., fully open at 170°F. (High Reading Type—use with heaters). Starts to open 163-168°F. Fully open 185°F.
Shutter Adjustment—Adjust clevis on threaded end of rod to secure 1/16" tension on thermostat with shutters closed.

CLUTCH:—Long Model 11CF-10½CI. Semi-centrifugal, single plate dry disc type.
See article in Mechanical Equipment Section for data.
Facings—Woven type, 2 required. Inside Diam. 6½". Outside Diam. 10½". Thickness .137".

Adjustment:—Free movement of pedal should be ⅞-1⅛". To adjust, turn nut on forward end of connector link in front of clutch fork.

Removal:—Remove transmission (see Transmission Section below), drop clutch housing pan, punch mark clutch cover, pressure plate, and flywheel to insure correct installation, take out 6 mounting bolts in cover flange, remove clutch from below.

TRANSMISSION:—Own Make. Constant-mesh helical gear (second), synchro-mesh (second and high), sliding helical gear (low and reverse).
See article in Mechanical Equipment Section for data.

Removal:—With car on blocks, remove floor boards, disconnect drive shaft at front universal joint, support engine with jack under oil oan (use wooden block to avoid damage to pan), free transmission extension at rear support cross-member, disconnect exhaust pipe brace, free cross-member carrying engine rear support (4 bolts at each end), disconnect speedometer cable. Take out transmission mounting capscrews, pull transmission straight back (plug clutch connection shaft bearing drain hole as soon as it is accessible to prevent lubricant loss). NOTE—When installing, shift transmission in reverse and remove plug.

UNIVERSAL JOINTS:—Mechanics Model 3-C. Needle bearing type, 2 used.
See article in Mechanical Equipment Section for data.

REAR AXLE:—Own make. Hypoid gear, semi-floating type with Hotchkiss drive.
See article in Mechanical Equipment Section for data.
NOTE—Manufacturer recommends Differential Carrier Assembly be returned to factory for servicing.
Ratio—3.92-1 Std. No optional ratios.
Backlash—.004-.008". Screw adjustment.

Removal:—Disconnect drive shaft at rear universal, remove axle shafts (see below), remove capscrews on differential carrier flange, pull carrier assembly out without disturbing axle housing.
Axle Shaft Removal—Jack up car, remove rear wheels, pull wheel hub and brake drum assembly, disconnect brake line and remove backing plates (bleed brake line when re-installed). Use tool J-838, pull shaft and bearing assembly out.
NOTE—Early axle shafts have no locating shoulder for wheel bearing. Install bearing with 5/32" clearance between inner edge of hub and bearing.

Wheel Bearing Adjustment:—None (sealed type).

SHOCK ABSORBERS:—Delco Model 1946C, D (front) 1751A, B (rear). Double acting, hydraulic type.
See article in Mechanical Equipment Section for data.

STEERING:—Steering Gear—Saginaw Worm-and-roller type.
See article in Mechanical Equipment Section for data.

Front Suspension:—Independent linked parallelogram type with coil springs.
See article in Mechanical Equipment Section for data.
Kingpin Inclination—4°51'.
Caster—¼-1° with car weight on wheels. Must be equal within ¼° at both wheels.
Camber—¼-1°. Equal within ¼° at both wheels.
Toe In—1/16-3/32" (at rest), 0-1/16" (in motion).
Steering Geometry—Inner wheel turned 21¾-23¼°. Outer wheel 20°.

BRAKES:—Service—Bendix hydraulic, Duo-servo, Single Anchor type. Hand lever applies rear wheel service brakes.
See article in Mechanical Equipment Section for data.
Drum Diameter—12". Centrifuse type. Drum out-of-round .007" max. Run-out (installed) .010" max. Drum turn down limit .030" cut.
Lining—Molded type. Width 2¼" (front wheels), 2" (rear wheels). Thickness 3/16". Length per shoe 12 15/16".
Clearance—.010" for all shoes.

Hand Brake:—See Service Brake above.

ENGINE HOOD & SIDE PANEL REMOVAL:—*See Cadillac Special Shop Notes for complete instructions.*

SERIAL NUMBER:—Same as Engine No. below.

ENGINE NUMBER:—First number 2,270,001. Stamped on left side of crankcase at rear of left cylinder block and on left frame side member at rear of front engine support.

ENGINE SPECIFICATIONS:—Own. 8 cylinder, 90° Vee, 'L' head type. Upper crankcase and cylinder blocks cast enbloc. **Bore**—3⅜". **Stroke**—4½".
Displacement 322 cu. ins. **Rated HP.**—36.45.
Developed Horsepower—125 at 3400 RPM.
Compression Ratio—6.25-1 Std., 5.75-1 Optl.
See Cadillac Special Shop Notes for cylinder head identification and interchangeability data.
Compression Pressure—155 lbs. at 1000 R.P.M. or approx. 105-110 lbs. at cranking speed (std. head).
Vacuum Reading—20-21" steady at 6 M.P.H.

PISTONS:—Lynite or Bohn Lo-Ex aluminum alloy, 'T' slot, Cam Ground type with Anodized finish (special hard oxide bearing surface). **Length**—4⅛".
Weight—16.88 oz. stripped. 25.13 oz. complete.
Removal—Pistons and rods removed from above
Clearance—Skirt .0019". See Fitting New Pistons.
Replacement Pistons:—Finished anodized pistons furnished Std. (3.3726-3.3746"), .003" (3.3761-3.3776"), .005" (3.3781-3.3796"), .010" (3.3831-3.3846"), .015" (3.3881-3.3896").
NOTE—Hold all cylinders in same block within .002" size limits. Max. allowable out-of-round .0005".
Fitting New Pistons:—Check piston diameter with micrometer gauge at right angles to pin hole just below lower ring groove and also ½" above lower edge. If feeler gauges (⅜-½" wide) used, insert feeler at high point of piston next to T slot. Piston should fall of own weight on .0015" feeler and hold tightly on .002" feeler.
Installing Pistons:—Slot toward left (viewed from drivers seat) for all pistons.

PISTON RINGS:—Two compression, two oil control rings per piston, all above pin (no ring in narrow top heat deflector groove).

Ring	Width	End Gap	Side Clearance
Compression	⅛"	.007-.012"	.0015-.0028"
Oil Control	5/32"	.007-.015"	.0013-.0026"

NOTE—Worn limits .025" (end gap), .004" (side cl.).
Replacement Rings:—Rings furnished .003", .005", .010", .015", .030" oversize.

PISTON PIN:—Diameter ⅞". **Length** 2 15/16". Pin floats in piston and rod. Held by locking rings.
See Cadillac Shop Notes for special pin removal and installation instructions.
Pin Fit in Piston—.0004" press fit (ribbed end), .000" clearance or free fit at 70° F. (plain end).
Pin Fit in Rod Bushing—.0002-.0008" clearance (new), .0015" (worn limit).

CONNECTING ROD:—Weight 37.472 ozs. **Length** 8¾".
Crankpin Journal Diameter—2.460".
Lower Bearing—Steel-backed, babbitt-lined.
Clearance—.0015" (new), .006" Max. (worn).
Sideplay—.003-.006".
Bearing Adjustment:—None (no shims). Replace bearings. Do not file rods or caps.
NOTE—Use new lockwashers under bearing cap bolts. Use only 12" wrench to tighten (Tool J-835).
Installing Rods:—Number on rods and bearing caps on same side and installed in same numbered cylinders with numbers down toward oil pan.

CRANKSHAFT:—3 bearing, 6 counterweights.
Journal Diameters—2½" all bearings.
Bearing—Bronze or steel-backed, babbitt-lined.
Clearance—.0015" (new), .004" (worn limit).
Bearing Adjustment:—None (no shims). Replace bearings. Do not file bearing caps. Upper halves can be rotated out without removing shaft.
See Cadillac Special Shop Notes for Rear Main Bearing oil seal renewal (new type).
End Thrust:—Taken by center bearing. Endplay .001-.005" (new), .010" Max. (worn).

CAMSHAFT:—3 bearing. Non-adjustable chain drive.
Journal Diameters—#1 and 2, 2.4071-2.4078"; #3, 2.0009-2.0016".
Bearing Type—Steel-backed, babbitt-lined.
Clearance—.0027-.0037" (new), .005" (worn limit).
See Cadillac Special Shop Notes for Camshaft Bushing removal and installation instructions.
End Thrust:—Taken by thrust plate behind camshaft sprocket. No endplay should be permitted.
Timing Chain:—Morse Type C #3682-R Side Guide type. Width 1⅛". Pitch ⅜". Length 23¼" or 62 links. NOTE—Install chain 'endless' as an assembly with sprockets. Use tool J-836 to pilot camshaft sprocket
Camshaft Setting:—Sprockets marked. Mesh chain with sprockets turned so that '0' marks are adjacent and in line with a straightedge across shaft centers.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1.876-1.886"	.3415-.3425"	5 33/64"
Exhaust	1.626-1.636"	.3405-.3415"	5 33/64"

	Seat Angle	Lift	Stem Clearance
Intake	45°	.335"	.001-.0023"
Exhaust	45°	.345"	.002-.0033"

NOTE—Worn limit for valve stem-to-guide clearance .006" Intake, 005" Exhaust.
See Cadillac Special Shop Notes for valve removal and installation instructions.
Tappet Clearance:—None (automatic take-up used).
See article in Mechanical Equipment Section for data.
Valve Guides:—Pressed in block with long stepped end down and reamed to correct size.
Valve Lifters:—Wilcox-Rich 'Zero-lash' type hydraulic lifters. Lifters are mushroom type operating in removable guide brackets.
See article in Mechanical Equipment Section.
Clearance—.001-.0025" (new), .005" (worn limit).

Valve Springs:—	Pressure	Length
Valve Closed	66 lbs.	1.926"
Valve Open	145 lbs.	1.581"

Valve Timing:—See Camshaft Setting above.
Intake Valves—Open at TDC. Close 42° ALDC.
Exhaust Valves—Open 52° BLDC. Close 10° ATDC.
To Check Timing—Intake valve for #1 cylinder opens with piston on top dead center when mark 'C.1/6' on crankshaft pulley lines up with pointer.
Motor Gauge—Weidenhoff Adapter #114, Rod #42.

LUBRICATION:—Pressure system with gear type oil pump located in crankcase.
See Cadillac Special Shop Notes for oil pump data.
Normal Oil Pressure—25 lbs. at 30 M.P.H.
Oil Pressure Regulator—Located on oil pump. Operates at 30 lbs. Not adjustable.
Crankcase Capacity—7 qts. (refill).

COOLING SYSTEM:—Water Pump. Centrifugal type. Belt-driven in tandem with generator.
See article in Mechanical Equipment Section for data.
Thermostat:—Mounted in radiator top tank, linked to radiator shutters by rod on forward side.
Setting—(Std. Type) Starts to open 148-153°F., fully open at 170°F. (High Reading Type—use with heaters). Starts 163-168°F. Fully open 185°F.
Shutter Adjustment—Adjust clevis on threaded end of rod to secure 1/16" tension on thermostat with shutters closed.

CLUTCH:—Long Model 11CF-10½CI. Semi-centrifugal, single plate dry disc type.
See article in Mechanical Equipment Section for data.
Facings—Woven joined type, 2 required. Inside Diam. 6½". Outside Diam. 10½". Thickness .125".
Adjustment:—Free movement of pedal should be ⅞-1⅛". To adjust, turn nut on forward end of connector link in front of clutch fork.
Removal:—Remove transmission (see Transmission Section below), drop clutch housing pan, punch mark clutch cover, pressure plate, and flywheel to insure correct installation, take out mounting bolts in cover flange, remove clutch from below.

TRANSMISSION:—Own make. Constant-mesh helical gear (second), synchro-mesh (second and high), sliding helical gear (low and reverse).
Transmission Control—Own make. Remote control, type with shift lever mounted on steering column.
See article in Mechanical Equipment Section for data.
Removal:—Disconnect shifter rods at levers on left hand side of case, disconnect drive shaft at front universal joint, support engine with jack under oil pan (use wooden block to avoid damage to pan), free transmission extension at rear support crossmember, disconnect engine support stabilizer on right hand (take out pin at forward end), disconnext exhaust pipe brace, disconnect speedometer cable. Take out transmission mounting capscrews, pull transmission straight back (plug clutch connection shaft bearing drain hole as soon as it is accessible to prevent lubricant loss).

UNIVERSAL JOINTS:—Mechanics Model 3-C. Needle bearing type, 2 used.
See article in Mechanical Equipment Section for data.

REAR AXLE:—Own make. Hypoid gear, semi-floating type with Hotchkiss drive.
See article in Mechanical Equipment Section for data.
NOTE—Manufacturer recommends Differential Carrier Assembly be returned to factory for servicing.
Ratio—3.92-1 Std. No optional ratios.
Backlash—.004-.008". Screw adjustment.
Removal:—Disconnect drive shaft at rear universal, remove axle shafts (see below), remove capscrews on carrier flange, pull carrier assembly out.
Axle Shaft Removal—Jack up car, remove rear wheels, pull wheel hub and brake drum assembly, disconnect brake line and remove backing plates. Use tool J-838, pull shaft and bearing assembly out.
Wheel Bearing Adjustment:—None (sealed type).

SHOCK ABSORBERS:—Delco Model 1946-E, F (front), 1751-E, F (rear). Double acting, hydraulic type.
See article in Mechanical Equipment Section for data.

STEERING:—Steering Gear—Saginaw Worm-and-roller type. *See data in Mechanical Equip. Section.*
Front Suspension:—Independent linked parallelogram type with coil springs.
See article in Mechanical Equipment Section for data.
Kingpin Inclination—4°51' crosswise.
Caster—Neg. ¼° to Neg. 1¼° at curb weight (gasoline tank full). Adjustable.
Camber—Neg. ¼° to Pos. ½°. Adjustable.
Toe In—1/32-3/32" (at rest), 0-1/16" (in motion).
Steering Geometry (Toe out on turns)—Inner wheel turned 23½°, outer wheel 20°.

BRAKES:—Service—Bendix hydraulic, Duo-Servo, Single Anchor type. Hand lever applies rear brakes.
See article in Mechanical Equipment Section for data.
Braking Power—54½% Front, 45½% Rear).
Drum Diameter—12". Centrifuse type. Drum out-of-round .007" max. Run-out (installed) .010" max.
Lining—Molded type. Width 2¼" (front wheels), 2" (rear wheels), Thickness 3/16". Length per shoe 12 15/16".
Clearance—.010" for all shoes.
Hand Brake:—See Service Brake above.

ENGINE HOOD & SIDE PANEL REMOVAL:—*See Cadillac Shop Notes for complete instructions.*

SERIAL & ENGINE NUMBER:—1st number 2290001. Stamped on left side of crankcase at rear of left cylinder block and left frame side member opposite steering gear.

ENGINE SPECIFICATIONS:—**Own.** 8 cylinder, 90° Vee, 'L' head type. Upper crankcase and cylinder blocks cast enbloc. **Bore**—3⅜". **Stroke**—4½".
Displacement—322 cu. ins. **Rated HP.**—36.45.
Developed Horsepower—125 at 3400 R.P.M.
Compression Ratio—6.25-1 Std., 5.75-1 Optl.
See Cadillac Shop Notes for Head installation, head gasket data, and for changing compression ratios.
Compression Pressure—155 lbs. at 1000 R.P.M. or approx. 105-110 lbs. at cranking speed (std. head).
Vacuum Reading—Steady 20-21" idling at 7-8 MPH.

PISTONS:—Lynite or Bohn Lo-Ex aluminum alloy, "T" slot, Cam Ground type with Anodized finish (special hard oxide bearing surface). **Length**—4⅛".
Weight—18.30 ozs. (stripped), 25.13 ozs. (complete).
Removal—Pistons and rods removed from above.
Clearance—Skirt .0019". See Fitting New Pistons.
Replacement Pistons:—*See Cadillac Shop Notes.*
Fitting New Pistons:—Check piston diameter with micrometer gauge at right angles to pin hole just below lower ring groove and also ½" above lower edge. If feeler gauges (⅜x½" wide, 7-10" long) used, insert feeler next to T-slot. Piston should fall through bore of own weight on .0015" feeler, and hold on .002" feeler. NOTE—Cylinder bore out-of-round .0005" max., taper .0003".
Installing Pistons:—Slot to left, for all pistons.

PISTON RINGS:—Two compression, two oil control rings per piston, all above pin.

Ring	Width	End Gap	Side Clearance
Comp. (Top)	3/32"	.007-.012"	.0023-.0041"
Comp. (#2)	⅛"	.007-.012"	.0013-.0026"
Oil Control	5/32"	.007-.015"	.0013-.0026"

Replacement Rings:—.003", .005", .010", .015", .030" O.S.

PISTON PIN:—**Diameter**—⅞". **Length**—2 15/16". Pin floats in piston and rod. Held by locking rings.
See Cadillac Shop Notes for special pin removal and installation instructions.
Pin Fit in Piston—.0004" press fit (ribbed end), .0000" clearance or free fit at 70° F. (plain end).
Pin Fit in Rod Bushing—.0002-.0008" clearance (new), .0018" (worn limit).

CONNECTING ROD:—**Weight** 37.472 ozs. **Length** 8¾".
Crankpin Journal Diameter—2.4590-2.4595".
Lower Bearing—Steel-backed, babbitt-lined type.
Clearance—.0015-.0025" (new), .0045" Max. (worn).
Sideplay—.008-.014".
Bearing Adjustment:—None (no shims). Replace bearings. Do not file rod or caps. *See Cadillac Shop Notes for connecting rod and bearing installation data.*
Installing Rods:—Numbers on rods and bearing caps on same side and installed in same numbered cylinders with marks down to oil pan.

CRANKSHAFT:—3 bearing. 6 counterweights.
See Cadillac Shop Notes for main bearing servicing and rear main bearing oil seal renewal.
Journal Diameters—2½" all bearings.
Bearings—Steel or bronze backed, babbitt-lined.
Clearance—.0015-.0025" (new), .005" (worn).
Bearing Adjustment:—None (no shims). Replace bearings. Do not file bearing caps. Upper halves can be rotated out without removing crankshaft.
End Thrust:—Taken by center (#2) bearing.
Endplay—.001-.005" (new), .010" Max. (worn).

CAMSHAFT:—3 bearing, non-adjustable chain drive.
See Cadillac Shop Notes for Camshaft Bushing data.
Journal Diameters—#1 and #2, 2.4071-2.4078"; #3, 2.0009-2.0016".
Bearing Type—Steel-backed, babbitt-lined.
Clearance .0015-.0033" (new), .0045" (worn).
End Thrust:—Taken by thrust plate behind camshaft sprocket. No endplay should be permitted.
Timing Chain:—Morse Type C #3682-R Side Guide type. Width 1¼". Pitch ⅜". Length 23¼" or 62 links. NOTE—Install chain 'endless' as an assembly with sprockets. Use Tool J-836 to pilot camshaft sprocket.
Camshaft Setting:—Sprockets marked. Mesh chain with sprockets turned so that '0' marks are adjacent and in line with a straightedge across shaft centers.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1.876-1.886"	.3415-.3425"	5 33/64"
Exhaust	1.626-1.636"	.3405-.3415"	5 33/64"

	Seat Angle	Lift	Stem Clearance
Intake	45°	.335"	.0012-.0032"
Exhaust	45°	.345"	.0022-.0042"

NOTE—Worn limit for stem clearance .005" (all valves). Valve heads not slotted.
See Cadillac Shop Notes for Valve Servicing data.
Tappet Clearance:—None (automatic take-up used).
Valve Guides:—Press in block (long stepped end down).
Valve Lifters:—Wilcox-Rich 'Zero-lash' type hydraulic lifters. Lifters are mushroom type operating in removable guide brackets.
See article in Mechanical Equipment Section for data.
Clearance—.0010-.0024" (new), .0035" (worn).
Valve Springs:—Free length 2.210".

	Spring Pressure	Length
Valve Closed	66 lbs.	1.926"
Valve Open	145 lbs.	1.581"

Valve Timing:—See Camshaft Setting above.
Intake Valves—Open at TDC. Close 42° ALDC.
Exhaust Valves—Open 52° BLDC. Close 10° ATDC.
To Check Timing—#1 cylinder (front—left bank) intake valve should open with piston at TDC and mark 'C.1/6' on crankshaft pulley aligned with chain case cover pointer.

LUBRICATION:—Pressure (gear type oil pump in crankcase). *See Cadillac Shop Notes for oil pump data.*
Normal Oil Pressure:—15 lbs. idling, 25 lbs. at 30 MPH.
Oil Pressure Regulator:—Opens at 30 lbs. On oil pump. Non-adjustable type.
Crankcase Capacity:—7 quarts.

COOLING SYSTEM:—**Capacity**—25 quarts.
See Cadillac Shop Notes for radiator core removal and fan pulley replacement instructions.
Water Pump:—Self-adjusting packing type.
See article in Mechanical Equipment Section for data.
Removal—Drain water, remove pump belt, hose and pump mounting screws. Lift pump out.
Thermostat:—Mounted in radiator top tank, linked to radiator shutters by rod on forward side.
Setting—(Std. Type) Starts to open 148-153°F., fully open at 170°F. (High Reading Type—use with Heaters) Starts to open 163-168°F. Fully open 185°F.
Shutter Adjustment—Adjust clevis on threaded end of rod to secure 1/16" tension on thermostat with shutters closed.
Temperature Gauge:—AC. Electric. #1510773 (dash unit), #1510774 (engine unit).
See article in Mechanical Equipment Section for data.

CLUTCH:—Long Model 11CF-10½CI (before engine unit 2-D-701), 10CF-CI (after engine unit 2-D-700). Semi-centrifugal, single plate, dry disc type.
See article in Mechanical Equipment Section for data.
Facings—Woven joined type, 2 required. Inside Diam. 6½" (early), 6" (late). Outside Diam. 10½" (early), 10" (late). Thickness .123-.127".
Adjustment:—Free movement f pedal should be ⅞-1⅛" (adjusting nut on connector link at fork).
Removal:—Remove transmission (see below), drop clutch housing pan, punch mark clutch cover, pressure plate, and flywheel (re-install to these marks), remove 6 cover screws (release tension evenly), remove assembly. *See Cadillac Shop Notes for clutch balancing.*

TRANSMISSION:—**Own Make.** Constant-mesh, synchro-mesh, all helical gear (sliding gear, low & reverse). *See article in Mechanical Equipment Section.*
Transmission Control:—Remote steering col. shift.
See articles in Mechanical Equipment Section for data.
Removal:—Support engine with jack under rear end of oil pan (use wooden block to avoid damage to pan), remove propeller shaft (disconnect front and rear universals), free transmission extension at engine rear support, remove crossmember with engine rear support, disconnect speedometer cable, remove shifter rods from levers at transmission, support transmission at rear, take out mounting screws, pull straight back (plug clutch connection shaft bearing drain hole as soon as accessible to prevent lubricant loss), lower front end of transmission and remove from car. *NOTE—See Mechanical Equipment Section for shifter linkage adjustment when re-installing.*

UNIVERSAL JOINTS:—**Mechanics Model 3C.** Needle bearing type. Two used.
See article in Mechanical Equipment Section for data.

REAR AXLE:—**Own Make.** Hypoid gear, semi-floating type with Hotchkiss drive.
See article in Mechanical Equipment Section for data.
NOTE—Manufacturer recommends Differential Carrier Assembly be returned to factory for servicing.
Ratio—3.92-1.
Backlash—.004-.010". Screw adjustment.
Removal:—Disconnect drive shaft at rear universal, remove axle shafts (see below), remove capscrews on carrier flange, pull carrier assembly out.
Axle Shaft Removal—Remove rear wheels, take off axle shaft nut, pull wheel hub and brake drum, disconnect brake line and remove backing plate. Pull shaft and bearing assembly out (use Tool J-838).
Wheel Bearing Adjustment:—None (sealed type).

SHOCK ABSORBERS:—**Delco.** Front 1946-G (right), H (left). Rear 1751-V (right), W (left). Double acting, hydraulic.
See article in Mechanical Equipment Section for data.

STEERING:—**Steering Gear**—Saginaw Worm-and-Double Roller type. *See Mechanical Equipment Section.*
NOTE—New type steering linkage with idler arm attached to right frame sidemember.
Front Suspension:—Independent linked parallelogram type with coil springs.
See article in Mechanical Equipment Section for data.
Kingpin Inclination—5°6' crosswise.
Caster—Neg. ¼° to Neg. 2¼°. Adjustable.
Camber—Neg. ¼° to Pos. ¾°. Adjustable.
Toe In—1/32-3/32" (at rest), 0-1/16" (in motion).
NOTE—Adjusting sleeve at wheel end of each tie rod provided for toe in adjustment.
Steering Geometry (Toe out on turns)—Inner wheel turned 22¼-23¾°. Outer wheel 20°.

BRAKES:—**Service**—Bendix hydraulic, duo-servo, single anchor type (no eccentric adjustment). Hand lever applies rear service brakes.
See article in Mechanical Equipment Section for data.
Drums—Centrifuse. Diameter—11.995-12.005". Drum out-of-round .007", turn down limit .030".
Lining—Moulded. Length per shoe—Front 11 17/32", Rear 12 31/32". Width 2". Thickness 3/16".
Clearance—.015" both ends of secondary shoe.
Braking Power—45½% rear, 54½% front.
Hand Brake:—See Service Brakes.

ENGINE NUMBER:—Stamped on left hand side of crankcase below #1 cylinder.

ENGINE:—Twelve cylinder, 65° Vee, 'L' head type. Cylinders for each bank cast Enbloc and separate from crankcase.
Dimensions—Bore 3¼". Sroke 4½". Displacement 448 cubic inches.
Horsepower—Rated 50.7. Developed 150 at 3400 R.P.M.
Compression—5.25-1. Pressure approximately 90-95 lbs. at cranking speed.
Vacuum Reading—Gauge should show steady reading of 18-20" at idling speed.

Pistons:—Lynite, aluminum alloy, split skirt type. Pistons have oxidized surface.
Weight—14 ozs. stripped (without rings, pin, or locking screw).
Length—4".
Removal—Piston and rod assembly removed through bottom of engine.
Clearance—(Top) .015-.018", (skirt) .002".

Installing Pistons—Slot should be toward left (viewed from drivers seat) for pistons in both banks.

Piston Rings:—Four rings per piston, #1 and 2—compression rings, #3 and 4—oil control rings.

Ring	Width	End Gap
Comp. (both)	⅛"	.007-.012"
Oil Cont. (both)	5/32"	.007-.012"

Piston Pin:—Diameter, ⅞". Pin is clamped in piston.
Pin Fit in Rod—Tight thumb push fit.

Connecting Rod:—Weight 34 ozs. Length 11⅞". Two type used—see note.
NOTE—Rod for pistons in left bank is 'forked' type and carries the crankpin bearing. Rod for pistons in right bank oscillates on bearing in forked rod.
Big End Bearing—Diameter, 2½". Length, 1".
Bearing Type—Removable bronze-backed, babbitt-lined type in forked rod.
Clearance—.0015". Endplay .006-.015".
Adjustment—Shims used in straight rod for right bank. This rod can be adjusted by removing shims. No adjustment possible for forked rod and bearings must be replaced. Do not file rods or caps (filing forked rod will increase clearance of straight rod).

Crankshaft:—Seven bearing type. Integral counterweights.
Journal Sizes—2½" all bearings.
Bearing Type—Bronze-backed, babbitt-lined type. Shims used.
Clearance—.0015".
Adjustment—Shims provided on all bearings. Do not file bearing caps.
End Thrust—Taken by #7 rear main bearing. Endplay .004-.008.

Camshaft:—Seven bearing type. Camshaft driven by chain with automatic idler take-up. See Equipment Section for data on Morse automatic take-up.
Chain—Morse. Width, 1½". Length, 104 links. Pitch, ⅜".
Camshaft Setting:—Sprockets are marked. Mesh chain with sprockets turned so that marks are adjacent and in line with a straightedge across the shaft centers. See Equipment Section for data on assembly and setting of automatic idler sprocket.

Valves:—	Head Diameter	Stem Diameter	Length	Seat Angle
All Valves	2"	⅜"	6⅝"	45°

Valve Lift—11/32" (1932), 5/16" (1933).
Tappet Clearance—.003" (intake), .005" (exhaust) cold.
Valve Springs—Pressure should be 75-80 lbs. at 2 15/16" with valves closed, and 175-180 lbs. at 2 19/32" with valves open.

Valve Timing

Intake Valves Open—21° Before TDC.	Close—47° after LDC.
Exhaust Valves Open—57° Before LDC.	Close—11° After TDC.

Lubrication:—Pressure type. Gear type oil pump located in crankcase.
Oil Pressure—40 lbs. with engine at normal temperature.
Oil Pressure Relief Valve—Operates at 40 lbs. Located under plug on right hand side of crankcase. Not adjustable.

NOTE—Oil Pressure Relief Valve on 1932 model consisted of a ball-check by-pass valve and an adjustable metering pin. Oil pressure for idling and ordinary driving speeds was adjustable by loosening the packing nut on the metering pin stem and turning the pin clockwise (to increase pressure) or counter-clockwise (to decrease pressure). This adjustment should only be made after engine warmed up to running temperature. Pressure should be 5-10 lbs. idling and 50 lbs. maximum. By-pass valve spring also adjustable.
Capacity & Oil—12 qts. Use SAE #40 (summer), #30 (winter).

CLUTCH:—**Long Model 29-A.** Double plate, dry disc type. See article in Clutch Section for relining and assembling directions.
Facings—Woven type, 4 required. Thickness .130". Inside Diameter 6¼". Outside Diameter 9¾".
Adjustment—Clutch pedal free movement should be 1". To adjust, loosen lock-scre and turn pedal adjusting screw on clutch throw-out fork at lower end of clutch pedal. Clearance between pedal and toeboard controlled by stopscrew on bracket above shaft.
NOTE—Center driving must be centered when clutch is installed on car and may require adjustment in service. To adjust, turn each of three slotted adjusting screws on rim of cover to right until they bottom on plate, then back each screw off exactly ½ turn or three 'clicks.'

STEERING:—**Steering Gear**—Gemmer special Worm-and-Roller type. See article in Steering Section for complete adjustment directions.

Front Suspension:—Conventional 'I' beam section front axle with Reverse Elliott type ends and semi-elliptic springs.
Kingpin Inclination—7½° crosswise.
Caster—2°. Adjusted by inserting wedge shims between spring and spring pad on axle.
Camber—1°. No adjustment provided. Manufacturer does not recommend bending of axle to correct camber.
Toe In—0-⅛". Adjust in usual manner by loosening clamp bolts and turning tie rod.

BRAKES:—**Service**—Bendix Mechanical, Duo-Servo, double anchor type with vacuum power operation. Hand lever applies all four service brakes. See article in Brake Section for complete adjustment directions.
Drum Diameter—16".
Lining—Woven type (primary shoe), moulded type (secondary shoe). Width 2½". Thickness ¼". Length 34" per wheel.
Clearance—.008" anchor pin end, .014" adjusting screw end for each shoe.

Hand Brake:—See Service Brake adjustment above.

Power Cylinder:—Bendix plain type vacuum cylinder linked to brake cross-shaft and controlled by valve linked in brake pedal rod. See article in Brake Section for complete data.

ENGINE NUMBER:—Stamped on left hand side of crankcase below center of block.

ENGINE:—Twelve cylinder, 67° Vee, 'L' head type. cylinder bank cast Enbloc and separate from crankcase.
Bore—3" (1933), 3⅛" (1934-35). **Stroke**—4½".
Displacement—381.7 cu. ins. ('33), 414 cu. ins. ('34-'35).
Rated Horsepower—43.2 ('33), 46.8 ('34-35).
Developed Horsepower—125 at 3400 R.P.M. ('33), 150 at 3400 R.P.M. ('34-35).
Compression Ratio—5.5-1 ('33), 6.38-1 ('34-35). Cylinder head on 1934-35 models is aluminum.
Compression Pressure—Approximately 95 lbs. ('33), 105-110 lbs. ('34-35) at cranking speed.
Vacuum Reading—Steady reading of 18-20" at idling speed.

Pistons:—Lynite, aluminum alloy, 'T' slot, elliptically (cam) ground, with oxidized bearing surface (special hard oxide deposited on skirt). Pistons cannot be ground. Refinish cylinders to take standard replacement pistons furnished .0025", .015", .030" oversize.
Weight—12½ ozs. (without rings, pin or locking screw).
Removal—Pistons and rods removed at bottom.
Clearance—Top Land .025". Bottom .002".
Fitting New Pistons—Use .002" feeler gauge to check clearance when fitting new pistons. Pull required to withdraw feeler from between piston and cylinder wall on side opposite slot must be between 3-4 lbs.
Installing Pistons—Install pistons with slot to left (viewed from drivers seat) in both banks.

Piston Rings:—Three compression rings ('33) two compression rings (all others), two oil control rings (all models) per piston.

Ring	Width	End Gap	Wall Thickness
Comp. (all)	⅛"	.008-.013"	.140"
Oil Cont. (all)	5/32"	.008-.013"	.140"

Piston Pin:—Diameter ⅞". Length 3". Pin is locked in piston.
Clearance in Rod Bushing—.0005".

Connecting Rod:—Weight 38 ozs. Length 10⅞".
Journal Diameter—2½".
Lower Bearing—Removable bronze- backed, babbitt-lined ('33), copper-lead type (1934-35).
Clearance—.002". Sideplay .006-.015" (both bearings).
Adjustment—Shims provided on 1933 model. No adjustment on 1934-35 model. Replace bearings. Do not file bearing caps.

Crankshaft:—Four bearing type with integral counterweights.
Journal Diameters—2⅝" (all bearings).
Bearing Type—Bohn Copper-lead type (except #4 which is bronze-backed, babbitt-lined type).
Clearance—.002".
Adjustment—Solid shims are used. Do not file caps.
End Thrust—Taken by #4 (rear) main bearing. Endplay .004-.007".

Camshaft:—Five bearing type. Duplex chain drive with automatic idler sprocket take-up. See Equipment Section for data on Morse automatic take-up idler.
Bearing Type—Babbitt-lined type.
Bearing Diameters—#1, 1½"; #2, 3, 4, 2¼"; #5, 1¼".
Timing Chain—Morse Duplex. Width 1½". Pitch ⅜". Length 104 links.
Camshaft Setting—Sprockets are marked. Mesh chain with sprockets turned so that marks are adjacent and in line with a straightedge across the shaft centers.

Valves:—	Head Diam.	Stem Diam.	Length
All valves ('33-34)	1 11/16"	5/16"	6¼"
All valves ('35)	1 11/16"	5/16"	6¾"

	Seat Angle	Lift	Stem Clearance
All valves ('33-34)	45°	5/16"	.003-.004"
All valves ('35)	45°	11/32"	.003-.004"

Tappet Clearance—.004" Int., .006" Exh. cold.
Valve Springs:—Spring pressure 70-75 lbs. with valve closed (1933). Pressures for 1934-35 as follows:

Valve Closed	60-66 lbs.	2 11/16"
Valve Open	187-199 lbs.	2 11/32"

Valve Timing—See Camshaft Setting above.
Intake Valves—Open 21° BTDC. Close 49° ALDC.
Exhaust Valves—Open 57° BLDC. Close 11° ATDC.
NOTE—Intake valve closing point is 47° ALDC. for 1933.
To Check Valve Timing—No flywheel marks provided. No. 2 intake valve opens when a point on the flywheel approximately 6.77 teeth before dead center mark 'D2/12C' lines up with indicator on housing.
Motor Gauge—Weidenhoff Adapter #104, Rod #40.

Lubrication:—Pressure. Gear type pump located in crankcase. Harrison oil temperature regulator located on right hand side of crankcase.
Normal Oil Pressure—40 lbs. at 50 M.P.H.
Oil Pressure Relief Valve—Located on outlet pipe from temperature regulator at right of crankcase. Operates at 40 lbs. Not adjustable. A second bypass valve is located in the crankcase on the oil header.
Capacity & Oil—11 qts. ('33), 13 qts. ('34), 12 qts. ('35). Use SAE #40 (summer), #20W (winter).

CLUTCH:—(1933)—**Long Model 29-A.** Double plate, dry disc type. (1934-35) **Long Model 12-CB.** Single plate dry disc type. See article in Clutch Section for relining and assembling directions.
Facings (29-A)—Woven type, 4 required. Thickness .130". Inside Diameter 6¼". Outside Diameter 9¾".
Facings (12-CB)—Woven type, 2 required. Thickness .137". Inside Diameter 7". Outside Diameter 12".
Clutch Pedal Adjustment—Free movement of clutch pedal should be 1". To adjust, loosen locknut and turn pedal adjusting screw on clutch arm below pedal shaft. Clearance between pedal and underside of toeboard is controlled by pedal stop screw on bracket above pedal shaft.
NOTE—On Model 29-A, center driving plate should be centered when clutch is installed and may require adjusting in service. To adjust, turn each of three slotted screws on rim of cover to right until they bottom on center plate, then back each screw off exactly ½ turn or 3 clicks.

STEERING:—**Steering Gear**—Gemmer Special Worm-and-Roller type. See article in Steering Section for complete adjustment directions.
Front Axle—Timken, 'I' beam section, reverse Elliot type ends.
Kingpin Inclination—7½° crosswise.
Caster—1½°. Use wedge shims inserted between spring and spring pad on axle to correct caster.
Camber—1°. Bending of axle to correct camber not recommended.
Toe In—1/16-⅛". To adjust, loosen clamps at each end of tie rod, turn rod (right and left hand threads).

BRAKES:—**Service**—Bendix Mechanical, Duo-Servo, Double-anchor type (1933), Single anchor type (1934-35) with vacuum power operation. Hand lever applies all four service brakes. See article in Brake Section on each type for complete adjustment instructions.
Drum Diameter—16".
Lining—Woven type (primary shoe), moulded type (secondary shoe). Width 2½". Thickness ¼". Length 34" per wheel.
Clearance—.008" anchor pin end, .014" adjusting screw end for each shoe.

Hand Brake:—See Service Brake adjustment above.

Power Cylinder:—Bendix plain type vacuum cylinder linked to cross-shaft and controlled by valve connected in pedal rod. See article in Brake Section for complete data.

ENGINE NUMBER—Stamped on left hand side of crank case below center of block. First number 5501.

ENGINE SPECIFICATIONS:—12 cylinder, 67° Vee, 'L' head type. Cylinder block for each bank cast enbloc and separate from crankcase.

Bore—3.125". **Stroke**—4.50".

Displacement—414 cubic inches.

Rated Horsepower—46.8 (SAE).

Developed Horsepower—150 at 3400 R.P.M.

Compression Ratio—6.38-1 Std. aluminum head.

Compression Pressure—138 lbs. at 1000 R.P.M. or 105-110 lbs. at 100 R.P.M.

Vacuum Reading—Gauge should show steady reading of 18-20" at idling speed.

PISTONS:—Lynite, aluminum alloy, 'T' slot, Cam ground with oxidized bearing surface (special hard oxide deposited on skirt). Pistons cannot be ground.

Weight—12½ ozs. (without rings, pin or locking screw).

Length—3.87".

Removal—Pistons and rods removed at bottom.

Clearance—Top land .025". Bottom .002". See Fitting New Pistons (below).

Replacement Pistons:—Finished replacement pistons furnished in standard and .0025", .015", .030" oversizes.

Fitting New Pistons:—Use .002" feeler gauge to check clearance when fitting new pistons. Pull required to withdraw feeler from between piston and cylinder wall on side opposite slot must be between 3-4 lbs.

Installing Pistons:—Install pistons with slot to left (viewed from driver's seat) in both banks.

PISTON RINGS:—Two compression rings, two oil control rings per piston, all above pin. Lower ring groove drilled with oil drain holes.

Ring	Width	End Gap	Wall Thick.
Comp. (all)	.1235-.1240"	.008-.015"	.125"
Oil Cont. (all)	.1545-.1550"	.007-.015"	.140"

PISTON PIN:—Diameter—.875". **Length**—3".

Pin is locked in piston.

Pin Fit in Rod Bushing—.0005" clearance.

CONNECTING ROD:—Weight—38 ounces.

Length—10.875" (center-to-center).

Crankpin Journal Diameter—2.500".

Lower Bearing—Removable copper-lead type.

Clearance—.0015-.003". Sideplay .006-.015". (Total for both rods).

Bearing Adjustment:—None (no shims). Replace bearings. Do not file rods or caps.

Installing Rods:—Number on rod and cap must correspond and should be installed in same numbered cylinder with marks pointing down toward pan.

CRANKSHAFT:—4 bearing. Integral counterweights.

Journal Diameters—2.625" (all bearings).

Bearing Type—Bohn copper-lead type.

Clearance—.001-.003".

Bearing Adjustment:—Solid shims are used. Do not file caps.

End Thrust:—Taken by rear (#4) main bearing. Endplay .004-.007". No adjustment. Replace bearing.

CAMSHAFT:—5 bearing. Duplex chain drive with automatic idler sprocket take up. See Equipment Section for data on Morse automatic take-up idler.

Journal Diameters—#1, 1.500"; #2, 3, 4, 2.250"; #5, 1.250".

Bearing Type—Babbitt-lined type.

Clearance—.002".

NOTE—Front bearing must be removed to remove camshaft.

End Thrust:—Taken by front bearing. Replace bearing.

Timing Chain:—Morse Duplex. Width 1½". Pitch ⅜". Length 104 links or 39".

Camshaft Setting:—Sprockets are marked. Mesh chain with sprockets turned so that marks are adjacent and in line with a straightedge across the shaft centers.

VALVES:—

	Head Diameter	Stem Diameter	Length
All Valves	1.687"	.3125"	6.750"

	Seat Angle	Lift	Stem Clearance
All Valves	45°	.343"	.003-.004"

Tappet Clearance—.004" Int., .006" Exh., cold.

NOTE—High tungsten chrome alloy steel inserts used in exhaust valve seats.

Valve Guides:—Press-fit. Finish ream to give correct stem clearance (above).

Valve Springs:—

	Spring Pressure	Length
Valve Closed	60-66 lbs.	2.687"
Valve Open	187-199 lbs.	2.343"

Valve Lifters:—Roller type, cylindrical. Diameter 1.122-1.1225". Lifter guides single piece, flanged top, removed from above.

Valve Timing:—See Camshaft Setting above.

Intake Valves—Open 21° BTDC. Close 49° ALDC.

Exhaust Valves—Open 57° BLDC. Close 11° ATDC.

To Check Valve Timing—No flywheel marks are provided. No. 2 intake valve opens when a point on the flywheel approximately 6.77 teeth before dead center mark 'D2/12C' lines up with indicator on housing.

Motor Gauge—Weidenhoff Adapter #113, Rod #37.

LUBRICATION:—Pressure. Gear type oil pump located in crankcase.

Normal Oil Pressure:—40 lbs. at 50 M.P.H.

Oil Pressure Relief Valve:—Located on outlet pipe from temperature regulator at right of crankcase. Operates at 40 lbs. Not adjustable. A second bypass valve is located in the crankcase on the oil header.

Oil Temperature Regulator:—Harrison. Located on right hand side of crankcase.

Oil Pressure Gauge:—King-Seeley Electric type, K-S Part No. 5760 (dash unit), 5460 (motor unit). Dash unit identified by letter 'O' stamepd on edge.

See article in Mechanical Equipment Section for data.

Crankcase Capacity:—12 quarts (refill).

CLUTCH:—Long Model 12 CB-CL. Single plate, dry disc type. See Clutch Section for relining and assembling directions.

Facings—Woven type, 2 required. Inside Diam. 7". Outside Diam. 12". Thickness .137".

Adjustment—Free movement of clutch pedal should be 1". To adjust, losen locknut and turn pedal adjusting screw on clutch throwout fork below pedal shaft. Clearance between pedal and underside of toeboard is controlled by pedal stopscrew on bracket above pedal shaft.

Removal—Slide rear end and transmission to rear as a unit (clutch housing unit with transmission case). Take out capscrews mounting clutch on flywheel, turning all screws out evenly to release clutch spring tension. Remove clutch assembly.

STEERING:—Steering Gear—Gemmer Worm-and-Double-Roller type. See article in Steering Section for complete adjustment directions.

Front Suspension:—Conventional 'I' beam section front axle with Reverse-Elliott ends. Left spring shackled both front and rear.

Kingpin Inclination—7½° crosswise.

Caster—1½° (normal load). Limits 1-2°. Use wedge shims inserted between spring and spring pad on axle to correct caster.

Camber—1°. Limits ½-1°. Bending of axle to correct camber not recommended.

Toe In—1/16-⅛". To adjust, loosen clamps at each end of tie rod, turn rod (right and left hand thrds.).

Steering Geometry—Inner wheel turned 22¾° (136"), 22⅛° (145"), outer wheel turned 20° both cars). Allowable variation ½°. Check tie rod ends and kingpins for looseness.

BRAKES:—Service—Bendix Mechanical, Duo-Servo, Single anchor type, mechanically operated, Vacuum power Brake. Hand lever applies all four service brakes. See article in Brake Section for complete adjustment procedure.

Drum Diameter—15.125". Forged steel type.

Lining—Moulded type. Width 2.50". Thickness .25". Length 33.50" per wheel.

Clearance—.010" at heel and toe of each shoe.

Hand Brake Adjustment:—See Service Brakes.

Power Unit:—Bendix plain type vacuum cylinder mounted on right front leg of 'X' member and linked to brake cross-shaft. Control valve connected in brake linkage between pedal and cross-shaft. Regulating valve located at base of steering column and controlled by lever on instrument board. See article in Brake Section for complete data.

SERIAL NUMBER:—On plate on front of dash.
ENGINE NUMBER:—Stamped on left side of crankcase at center. 1st number K-7500 ('37), K-9000 ('38).
ENGINE SPECIFICATIONS:—Own. 12 cylinder, 67° Vee, 'L' head type. Cylinder block for each bank cast enbloc and separate from crankcase.
Bore—3.125". **Stroke**—4.50".
Displacement—414 cubic inches.
Rated Horsepower—46.8 S.A.E.
Developed Horsepower—150 at 3400 R.P.M.
Compression Ratio—6.38-1 Std. aluminum head.
Compression Pressure—138 lbs. at 1000 R.P.M. or 105-110 lbs. at cranking speed of 100 R.P.M.
Vacuum Reading—18-20" steady reading with engine idling at 5-7 M.P.H.

PISTONS:—Lynite, aluminum alloy, T slot, Cam ground type with oxidized bearing surface (hard oxide formed on outer surface). Recondition engines to take finished replacement pistons. **Length**—3.87". **Weight**—12.5 ozs. (less rings, pin, locking screw).
Removal—Pistons and rods removed from below.
Clearance—.025" top, .002" bottom. See Fitting New Pistons.
Replacement Pistons:—Finished pistons furnished standard and .0025", .015", .030" oversize.
Fitting New Pistons:—Use .003" feeler inserted between piston and wall on side opposite slot at right angles to pin bosses to check clearance. Pull required to withdraw feeler must be within 2-4 lbs.
Installing Pistons:—Slot toward left (viewed from drivers seat) for all pistons.

PISTON RINGS:—Two compression, two oil control rings per piston, all above pin. Lower ring groove drilled with oil drain holes.

Ring	Width	End Gap	Side Clearance
Comp. Top	.1235-.1240"	.008-.015"	.0025"
Comp. #2	.1235-.1240"	.008-.015"	.0015"
Oil Cont.	.1545-.1550"	.007-.015"	.0015"

Replacement Rings:—Std. and .002", .015", .030" oversize.

PISTON PIN:—Diameter—.875". **Length**—3". Pin locked in piston by locking screw in one boss.
Pin Fit in Rod Bushing—.0005" clearance.

CONNECTING ROD:—Weight—38 ozs. **Length**—10.875".
Crankpin Journal Diameter—2.500".
Lower Bearing—Steel-backed, copper-lead lined.
Clearance—.0015-.003". Sideplay .006-.015" (total).
Bearing Adjustment:—None (no shims). Replace bearings. Do not file rods or caps. Bearings furnished .020" undersize.
Installing Rods:—Number on rod and cap must correspond. Install in same numbered cylinder with marks pointing down toward oil pan.

CRANKSHAFT:—4 Bearing. Integral counterweights.
Journal Diameters—2.625" (all bearings).
Bearing Type—Steel-backed, copper-lead lined.
Clearance—.001-.003".
Bearing Adjustment:—Shims. Do not file caps.
Replacement Bearings:—Furnished .020" undersize.
End Thrust:—Taken by rear main bearing. Endplay .004-.007". No adjustment (replace bearing).

CAMSHAFT:—Five bearing. Duplex chain drive with automatic idler sprocket take-up. See article in Mechanical Equipment Section for data.
Journal Diameters—#1, 1.500"; #2, 3, 4, 2.250"; #5, 1.250". Front bearing must be removed to take out camshaft.
Bearing Type—Steel-backed, babbitt bushings.
Clearance—.0015-.003".
End Thrust:—Taken by front bearing. Endplay .004-.006". No adjustment (replace bearing).
Timing Chain:—Morse Duplex. Width 1½". Pitch ⅜". Length 104 links or 39".
Camshaft Setting:—Sprockets marked. Mesh chain with sprockets turned so that marks are adjacent and in line with a straightedge across shaft centers. See article in Mechanical Equipment Section for instructions on assembling and setting automatic idler sprocket.

VALVES:—

	Head Diameter	Stem Diameter	Length
All valves	1.687"	.3125"	6.750"

	Seat Angle	Lift	Stem Clearance
All valves	45°	.343"	.003-.004"

Tappet Clearance:—None in service (hydraulic tappet take-up used).
Valve Guides:—Press fit in block. Finish ream to size for correct stem clearance.
Valve Lifters:—Mushroom type with hydraulic tappet take-up built in lifter body. Diameter .750".
See article in Mechanical Equipment Section for data.

Valve Springs:—	Pressure	Length
Valve Closed	55-60 lbs.	2.687"
Valve Open	130-140 lbs.	2.343"

Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 21° BTDC. Close 49° ALDC.
Exhaust Valves—Open 57° BLDC. Close 11° ATDC.
To Check Timing—No flywheel marks provided. No. 2 intake valve (front cylinder, right hand bank) opens when a point on the flywheel approximately 6.77 teeth before dead center mark 'D2/12C' lines up with indicator on housing.
NOTE—Hydraulic tappet clearance take-up makes it impossible to determine valve opening except by removing cylinder head and using dial indicator to check valve movement.

LUBRICATION:—Pressure system. Gear type oil pump mounted in crankcase at rear of engine. Harrison type oil temperature regulator mounted on right side of crankcase.
Normal Oil Pressure—40 lbs. at 50 M.P.H.
Oil Pressure Regulator—Located on outlet header near oil temperature regulator on right side of crankcase. Operates at 40 lbs. Not adjustable. Additional non-adjustable by-pass valve located at forward end of oil header in crankcase.
Crankcase Capacity—12 quarts.
Oil Pressure Gauge:—King-Seeley Electric. K-S No. 6255, Lincoln No. K-13116D (dash unit), K-S No. 5460, Lincoln No. 48-9278 (engine unit).
See article in Mechanical Equipment Section.

COOLING SYSTEM:—Water Pump:—Centrifugal type with adjustable packing. Mounted on rear of generator.
See article in Mechanical Equipment Section for data.
Removal—Drain radiator, disconnect hose couplings, oil temperature regulator lines, drive coupling, take out water pump mounting screws.
Radiator Shutter Thermostat:—In radiator top tank, connected to shutters by rod and levers. Should be practically closed at 145°F., open at 160°F.
Water Capacity—32 quarts.
Drain Valves:—One only, at lower inlet elbow of water pump.

CLUTCH:—Long Model 12CB-CL. Single plate, dry disc type. *See article in Mechanical Equipment Section.*
Facings—Woven type, 2 required. Inside Diam. 7", Outside Diam. 12". Thickness .137".
Adjustment:—Free movement of clutch pedal should be 1". To adjust, loosen locknut and turn adjusting screw on clutch throw-out fork below pedal shaft. Clearance between pedal and underside of toeboard controlled by stopscrew above pedal shaft.
Removal:—Disconnect speedometer cable, rear brake cables, shock absorber links, spring clips on axle housing. Take out clutch housing mounting screws (housing integral with transmission case), slide entire transmission and rear axle assembly to rear to expose clutch. Take out clutch mounting screws in cover flange on flywheel.

TRANSMISSION:—Own make. All helical gears. Constant mesh, synchro-mesh (second and high), sliding gears (low & reverse). NOTE—'Blocker' type synchronizer used on 1938-39 models.
See article in Mechanical Equipment Section for data.
Removal:—Remove rear axle or slide assembly back to free transmission (see Rear Axle Section below). Take out clutch housing mounting screws (integral with transmission case), pull transmission straight back and remove.

UNIVERSAL JOINT:—Spicer. One joint mounted within ball housing at rear of transmission case (torque tube drive).
See article in Mechanical Equipment Section for data.

REAR AXLE:—Own make. Full floating, spiral bevel gear type with straddle-mounted pinion and Torque Tube drive.
See article in Mechanical Equipment Section for data.
Ratio—4.58-1. **Backlash**—.010". Screw adjustment.
Removal:—Disconnect speedometer cable, rear brake cables, shock absorber links, spring clips on axle housing. Take out universal joint ball housing bolts, pull rear axle to rear to free drive shaft at splined joint at universal.
Axle Shaft Removal—Axle shaft flange bolted to wheel at outer end (under dustcap). To remove shaft, take out flange screws, pull shaft out (does not disturb wheel bearings).
Wheel Bearing Adjustment:—Remove axle shaft, unscrew locknut within wheel hub, take off lockwasher, turn up adjusting nut until bearing clearance is hardly perceptible, replace lockwasher, locknut and axle shaft.

SHOCK ABSORBERS:—Houde (Houdaille), Type 'ALG'. Double acting hydraulic, automatic thermostatic valve type.
See article in Mechanical Equipment Section for data.

STEERING:—Steering Gear—Own make, Gemmer Model 215 design. Worm-and-roller type.
See article in Mechanical Equipment Section for data.
Front Suspension:—Conventional 'I' beam section front axle with Reverse-Elliott ends and semi-elliptic springs.
Kingpin Inclination—7½° crosswise.
Caster—1½° (normal load). Limits 1-2°. Adjust by inserting wedge shims between spring and spring pad on axle.
Camber—1°. Limits ½-1°. Bending of axle to correct camber not recommended.
Toe In—1/16-⅛". Adjusted in usual manner by loosening clamp bolts and turning tie rod.
Steering Geometry—Inner wheel turned 22¾° (136" WB), 22 1/3° (145" WB), outer wheel 20° (all cars). Allowable variation ½°.

BRAKES:—Service—Bendix Mechanical, Duo-Servo, Single anchor type with Vacuum Power operation. Hand lever applies all four service brakes.
See article in Mechanical Equipment Section for data.
Drum Diameter—15.125". Cast-iron, steel-web type.
Lining—Molded (all '37, primary '38-39), woven (secondary '38-39). Width 2.5". Thickness .25". Length per wheel 33.50".
Clearance—.010" at heel and toe of each shoe.
Braking Power—50% Front, 50% Rear.
Hand Brake:—See Service Brakes above.
Power Unit:—Bendix plain type vacuum cylinder mounted on right front leg of 'X' member and linked to brake cross-shaft. Control valve connected in linkage between brake pedal and cross-shaft.
See article in Mechanical Equipment Section for data.

1936-39 MODELS

RECONDITIONED ENGINES & CYLINDER BLOCKS:—Reconditioned engines (complete with heads and oil pan) and cylinder blocks (with fitted pistons) are furnished as follows:

Reconditioned Engines
Model 901H ('36), HB ('37)

.015" Oversize	Part Number	.030" Oversize
HB-6012-A		HB-6012-B

Model 86H (1938)

86H-6012-A		86H-6012-B

Model 96H (1939)

96H-6012-A		96H-6012-B

Cylinder Block & Pistons
Part Numbers
Model 901H (1936)

Standard	.015" Oversize	.030" Oversize
H-6014-A	H-6014-B	

Model HB (1937)

HB-6014-A	HB-6014-B	HB-6014-C

Model 86H (1938)

86H-6014-A	86H-6014-B	86H-6014-C

Model 96H (1939)

96H-6014-A	96H-6014-B	96H-6014-C

1936-39 MODELS

REPLACEMENT PISTONS:—Finished pistons are furnished in Standard Size and Oversizes as listed below with each size graded in four steps as follows:

Standard Pistons
Model 901H ('36), HB ('37)

Part Number	Size
H-6110-C1	2.7470-2.7475"
H-6110-C2	2.7482-2.7485"
H-6110-C3	2.7487-2.7490"
H-6110-C4	2.7493-2.7496"

Model 86H ('38), 96H ('39)

86H-6110-A1	2.7477-2.7480"
86H-6110-A2	2.7482-2.7485"
86H-6110-A3	2.7487-2.7490"
86H-6110-A4	2.7493-2.7496"

.002" Oversize
Model 901H ('36), HB ('37)

H-6110-C5	2.7499-2.7502"
H-6110-C6	2.7505-2.7508"
H-6110-C7	2.7511-2.7514"
H-6110-C8	2.7517-2.7520"

Model 86H ('38), 96H ('39)

86H-6110-A5	2.7499-2.7502"
86H-6110-A6	2.7505-2.7508"
86H-6110-A7	2.7511-2.7514"
86H-6110-A8	2.7517-2.7520"

.015" Oversize
All Models

86H-6110-B1	2.7627-2.7630"
86H-6110-B2	2.7632-2.7635"
86H-6110-B3	2.7637-2.7640"
86H-6110-B4	2.7643-2.7646"

.030" Oversize
All Models

86H-6110-C1	2.7777-2.7780"
86H-6110-C2	2.7782-2.7785"
86H-6110-C3	2.7787-2.7790"
86H-6110-C4	2.7793-2.7796"

1939 MODELS

PISTON RINGS & EXPANDERS:—Sealed Power and Muskegon Piston Rings and Expanders (see note below) are furnished in Standard Size and Oversize as sets in cartons and singly as follows:

Sets in Cartons

Part Number	Size
86H-6149-D (3/16" oil ring)	Standard
86H-6149-E (3/16" oil ring)	.015" Oversize
86H-6149-F (3/16" oil ring)	.030" Oversize

Standard Size

Part Number	Type	Make
H-6150-B	Upper Compr.	
86H-6155-A	Lower Compr.	Muskegon
86H-6155-B	Lower Compr.	Sealed Power
86H-6156-A	Oil Control	Muskegon
86H-6156-B	Oil Control	Sealed Power

.015" Oversize

H-6150-C	Upper Compr.	
86H-6155-C	Lower Compr.	Muskegon
86H-6155-D	Lower Compr.	Sealed Power
86H-6156-C	Oil Control	Muskegon
86H-6156-D	Oil Control	Sealed Power

.030" Oversize

H-6150-D	Upper Compr.	
86H-6155-E	Lower Compr.	Muskegon
86H-6155-F	Lower Compr.	Sealed Power
86H-6156-E	Oil Control	Muskegon
86H-6156-F	Oil Control	Sealed Power

IDENTIFICATION NOTE—May be identified by differences in design as follows: **Lower Compression Ring**—Has word 'TOP' 42° above slot (Muskegon), 25° below slot (Sealed Power). **Oil Ring**—Has 9 slots (Muskegon), 8 slots (Sealed Power). Top compression ring is plain type.

Ring Expanders

Part Number	Make	Used With:
86H-6151-A	Muskegon	Lower Compr.
86H-6151-B	Sealed Power	Lower Compr.
86H-6154-A	Muskegon	3/16" Oil Ring
86H-6154-B	Sealed Power	3/16" Oil Ring

IDENTIFICATION NOTE—Expanders may be identified by differences in design as follows: **Muskegon**—6 Crimps (Lower Compression Ring), 6 Crimps & 5 Slots (Oil Ring). **Sealed Power**—7 Crimps (Lower Compression Ring), 7 Crimps and 6 Slots (Oil Ring).

1936-38 MODELS

PISTON RINGS (NEW TYPE) FOR EARLIER MODELS: New type piston rings (with expanders) can be installed on earlier Lincoln-Zephyr models as follows:

Model 86H (1938)—All rings same size as for 1939 models, and 1939 parts (as shown in tables above) can be used.

Models 901 (1936), HB (1937)—Upper & Lower Compression rings same size as for 1939 model, and 1939 parts (single rings & expanders—not sets) as shown in table above can be used. Oil Ring was narrower (5/32") and special Oil Ring, Expander, and Ring Sets available for these models as follows:

Sets in Cartons

Part Number	Size
H-6149-C (5/32" oil ring)	Standard
H-6149-D (5/32" oil ring)	.015" Oversize

5/32" Oil Rings

Part Number	Make	Size
H-6156-A	Muskegon	Standard
H-6156-B	Sealed Power	Standard
H-6156-C	Muskegon	.015" Oversize
H-6156-D	Sealed Power	.015" Oversize

IDENTIFICATION:—Same as 1939 rings (above).

1936-39 MODELS

PISTON PIN FITTING:—**Steel Pistons.** Pins can be removed and installed without heating pistons. Pins, pistons, and rod bushings held to close limits so that no fitting required. Clearances can be checked as follows:

Pin Fit in Piston—With piston and pin at same temperature and clean, pin should drop through pin hole in piston (total clearance not to exceed .0007").

Pin Fit in Rod Bushing—With pin installed, hold pin so that rod hangs vertically, then rotate pin. Lower end of rod should move upward through arc not greater than ½" before dropping back to vertical position.

1936-39 MODELS

VALVE SERVICING:—Complete valve assembly (valve, spring, guide) should be removed from the engine and dismantled on the bench as follows:

Valve Assembly Removal—Use special bar type lifter, VZ-185, inserting end of lifter through spring coils to engage flanged lower end of guide, pull guide down slightly to release retaining 'C' washer, pull 'C' washer out, lift valve assembly out through top of block.

Valve Assembly Dismantling—Use special bench fixture to compress valve spring so that spring retainer can be removed, then remove spring, separate guide halves and remove valve. Re-assemble valves in same manner.

Valve Installation Note—Intake valve guides have relief groove cut on one edge of each guide half. Install guides with this relief groove up.

Valve Seat Insert Grinding:—Manufacturer recommends use of eccentric grinding equipment to reface seat inserts (inserts are high-tungsten, chrome-alloy steel and are exceedingly hard).

1936-37 MODELS

Tappet Clearance Checking:—Use special two-step feeler to check clearance with valve lifter on heel of cam. First .0125" step of feeler should be 'go', second .0135" step of feeler should be 'no go'.

1938-39 MODELS

Hydraulic Valve Lifter Servicing:—When lifters removed they should be installed dry (will fill with oil and become quiet more rapidly than if installed with oil film between plunger and cylinder which will trap air in unit). Whenever lifters removed from engine, service as follows:

Lifter Installation—Remove plunger from lifter body, wash out all oil, dry with air, re-install plunger in lifter body and install in engine.

CAUTION—Plunger is selective fit in lifter body and must not be interchanged. Make certain that each plunger re-installed in same lifter from which removed.

Lifter Clearance—Clearance between plunger and valve stem must be .030-.070" with no oil in unit and plunger and spring fully compressed. To check this clearance, see that lifter is on heel of cam, use screwdriver to fully depress plunger in lifter body, check clearance with feeler gauge.

See article in Mechanical Equipment Section for complete Wilcox-Rich 'Zero-lash' hydraulic lifter servicing data.

NOTE:—Engine Hood—Hinged at cowl and lifts from forward end. Free hood latch by turning radiator ornament.

Engine Removal—All service work except on main bearings and crankshaft can be performed with engine in car. To remove engine, remove hood, radiator splash pan, grille and brace rods, remove radiator. Remove transmission cover in front compartment, disconnect transmission, lift engine out.

Oil Pan Removal—To remove pan for work on engine, disconnect radius rod rear connection, hoist car frame at front end.

ENGINE NUMBER:—First number H-1. Stamped on top of clutch housing and on left side of front frame cross-member.

ENGINE SPECIFICATIONS:—Own Model H. 12 cylinder, 75° Vee, 'L' head type. Both cylinder banks and crankcase cast Enbloc.
Bore—2.75". **Stroke**—3.75".
Displacement—267.28 cubic inches.
Rated Horsepower—36.39 S.A.E.
Developed Horsepower—110 at 3900 R.P.M.
Compression Ratio—6.7-1 Std. Aluminum head.
Compression Pressure—146 lbs. at 1000 R.P.M. or 105 lbs. at cranking speed of 100 R.P.M.
Vacuum Reading—18-20" steady reading with engine idling at 5 M.P.H.

PISTONS:—New type special heat-treated steel-alloy, Cam ground type. Length 3.245-3.305".
Weight—326 grams (without rings or pin).
Removal—Pistons and rods removed from above.
Clearance—See Fitting New Pistons.
Replacement Pistons:—*See Lincoln-Zephyr Shop Notes for complete data.*
Fitting New Pistons:—Use .002" feeler stock inserted between piston and wall at right angles to pin bosses. Tension required to withdraw feeler must be within 5-8 lbs.

PISTON RINGS:—Two compression, one oil ring per piston, all above pin. Oil ring groove drilled with oil drain holes.

Ring	Width	End Gap	Side Clearance
Comp.	.093-.0935"	.008-.013"	.003" (top)
Oil Cont.	.1545-.155"	.008-.013"	.0015"

Replacement Rings:—*See Lincoln-Zephyr Shop Notes for complete data and new expander type rings.*

PISTON PIN:—Diameter .7501-.7504". **Length** 2.482".
Pin floats in piston and rod. Held by locking ring at each end. Not furnished oversize.
Pin Fit in Piston—.0005" clearance.
Pin Fit in Rod Bushing—.0001" clearance.
See Lincoln-Zephyr Shop Notes for pin fitting.

CONNECTING ROD:—Weight 638 grams. **Length** 7.400".
Crankpin Journal Diameter—2.126".
Lower Bearing—Removable steel-backed, copper-lead lined bearing shells in each rod.
Bearing Dimensions—Thickness .0855". Length .787". Bearing bore in rod 2.298" diameter.
Clearance—.0015-.003" (total diametrical), .010-.022" (total sideplay).
Bearing Adjustment:—None (no shims). Replace bearings. Do not file rods or bearing caps.
Installing Rods:—Rods and caps marked 'R1', 'L1', etc. Assemble with marks together, install in same numbered cylinders with marks pointing down on all rods.

CRANKSHAFT:—4 bearing. Integral counterweights.
Journal Diameters—2.401" (all bearings).
Bearing Type—Steel-backed, copper-lead lined.
Clearance—.001-.003".
Bearing Adjustment:—None (no shims). Replace bearings. Do not file bearing caps.
End Thrust:—Taken by rear main bearing. Endplay .002-.006". Adjusted by replacing bearing cap.

CAMSHAFT:—Four bearing. Helical gear drive.
Journal Diameters—1.797" (all bearings).
Bearing Type—Steel-backed, babbitt-lined bushings pressed in block. **Clearance**—.002".
End Thrust:—Taken by front bearing and gear hub and by gear hub and cover plate. Endplay .004-.008". Adjusted by replacing bearing or front plate.
Timing Gears:—Crankshaft gear Cast-steel. Camshaft gear Bakelized Fabric.
Camshaft Setting:—Gears marked. Mesh crankshaft gear tooth marked '0' with space between teeth on camshaft gear marked '/' (this mark in line with mark on gear hub).

VALVES:—	Head Diam.	Stem Diam.	Length
All valves	1.537"	.3105-.3115"	4.750-4.751"

	Seat Angle	Lift	Stem Clearance
All valves	45°	.292"	.0015-.0035"

NOTE—Valve seat inserts used for exhaust valves.
See Lincoln-Zephyr Shop Notes for Valve Assembly Removal and valve servicing directions.
Tappet Clearance:—.0125-.0135" all valves. No adjustment. Use special two-step feeler gauge, .0125" step 'Go', .0135" step 'No Go'. Replace valves if clearance too great, grind off end of stem if insufficient.
Valve Guides:—Cast-iron split type. Held in place by 'C' washer and valve spring. *See Lincoln-Zephyr Shop Notes for Valve Assembly Removal.*
Valve Lifters:—Barrel type hollow-cast alloy iron. Operate in reamed holes in block.
Diameter—.999-.9995". **Clearance**—.0005-.001".
Valve Springs:—Free length 2 42".

	Spring Pressure	Length
Valve Closed	37-40 lbs.	2.13"
Valve Open	76-80 lbs.	1.84"

Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 19°30' BTDC. Close 54°30' ALDC.
Exh. Valves—Open 57°30' BLDC. Close 16°30'ATDC.
To Check Valve Timing—No flywheel marks or other means provided to check timing. If dead center point for any piston established on flywheel, intake valve opening for this cylinder should be approximately 6 2/3 teeth before this point with piston .1334" BTDC.
Motor Gauge—Weidenhoff Adapter #114, Rod #40.

LUBRICATION:—Pressure system. Gear type oil pump mounted in crankcase at rear of engine.
Normal Oil Pressure—40-45 lbs. at 2000 R.P.M.
Oil Pressure Regulator—Between cylinder banks at front of engine. Opens at 30 lbs. Not adjustable.
Crankcase Capacity—6 qts.
Oil Pressure Gauge:—King-Seeley Electric. Ford No. (1936) H-9273 dash unit, 48-9278 (motor unit). (1937) HB-9273 (dash unit—1st 5500 cars, black markings), HB-9273B (dash unit—next 10,000 cars, red-brown markings), HB-9273C (dash unit—later cars, brown-gray markings). No. 48-9278 (engine unit all). *See article in Mechanical Equipment Section.*

CLUTCH:—Long Model 10CF-CI. Semi-centrifugal, single plate, dry disc type.
See article in Mechanical Equipment Section for data.
Clutch Facings—Moulded type, 2 required. Inside Diam. 6.00". Outside Diam. 10.00". Thickness .140".
Pedal Adjustment:—Free movement should be 1½-2". To adjust, remove clevis pin on adjusting rod at clutch pedal lever, loosen locknut, turn clevis (lengthen rod to increase free movement).
Removal:—Remove transmission cover in front compartment, disconnect speedometer cable, remove shift lever. Disconnect rear brake cables and shock absorber links, disconnect rear spring at center mounting on body. Support engine, take out rear engine mounting bolts, take out clutch housing flange mounting screws (housing integral with transmission case), slide entire drive unit to rear exposing clutch. Take out clutch mounting screws on flywheel.

TRANSMISSION:—Own Make. 3 speed, helical gears (all speeds), Constant-mesh, Synchro-mesh (second and high).
See article in Mechanical Equipment Section for data.
Removal:—Disconnect rear spring at center mounting on body, disconnect speedometer cable, take out mounting bolts in front universal ball housing, slide rear end to rear. Remove transmission cover in front compartment, remove shift lever. Support engine, take out rear engine mounting bolts, take out clutch housing flange mounting screws, pull transmission to rear.

UNIVERSAL JOINT:—Spicer. 1 joint mounted at rear of transmission (within torque tube ball housing).
See article in Mechanical Equipment Section for data.

REAR AXLE:—Own make. ¾ floating, spiral bevel type with Torque Tube drive and straddle mounted pinion. *See Mechanical Equipment Section for data.*
Ratio—4.33-1 (1936), 4.44-1 (1937) Std.
Backlash—.006-.010".
Wheel Bearing Adjustment—None.
Removal:—Disconnect rear shock absorbers and brake cables, disconnect rear spring at center connection on body, disconnect speedometer cable, take out mounting bolts in universal joint ball housing, pull axle assembly back to free shaft at splined joint at universal.
Axle Shaft Removal:—Axle housing must be separated at pinion mounting and shafts removed from inner end (differential side gear integral with shaft).

SHOCK ABSORBERS:—Ford (Houde). Hydraulic type.
See article in Mechanical Equipment Section for data.

STEERING:—Steering Gear—Gemmer Worm-and-Roller Model 330.
See article in Mechanical Equipment Section for data.
Front Suspension:—Conventional 'I' beam section front axle with Reverse-Elliott type ends and transverse cantilever springs.
Kingpin Inclination—8° ('36), 4° ('37) crosswise.
Caster—9° Max., 4½° Min. ('36), 6° Max., 1½° Min. ('37). Must be alike within ½° for both wheels. Axle may be bent cold to correct caster if proper tools used (wedges and blocks to prevent crushing flange).
Camber—¾° (¾° Max., ¼° Min.). Both wheels must be alike within ¼°, right wheel must not exceed left. Correct in same manner as caster.
Toe In—1/16-⅛". Adjust in usual manner by loosening tie rod clamp bolts and turning rod.
Steering Geometry (Toe Out)—Inner wheel turned 23°, outer wheel 20°. Allowable variation ½°.

BRAKES:—Service—Bendix Duo-Servo, single anchor, mechanical type. Hand lever applies all four service brakes.
See article in Mechanical Equipment Section for data.
Drum Diameter—12" Cast alloy iron type.
Lining—Moulded (primary), Woven (secondary). Width 1.75". Thickness .21". Length per shoe 11.95".
Hand Brake:—See Service Brakes above.

ENGINE HOOD & ENGINE REMOVAL:—Turn radiator ornament counter-clockwise to free latch, lift hood up at front end. To remove hood, take out hood hinge capscrews.

Engine Removal:—Detach water hoses and heat indicator wire, take out radiator mounting screws, remove radiator (right and left grille sections can be removed if required). Disconnect all engine wires and controls, and fuel line. Disconnect exhaust pipe at manifolds. Disconnect transmission from engine, free engine mountings, lift engine out.

SERIAL & ENGINE NUMBER:—Stamped on top of clutch housing and on left side of front cross-member.

ENGINE SPECIFICATIONS:—Own Model 86H. 12 Cylinder, 75° Vee, L head type. Both blocks and crankcase cast together.

Bore—2.75". **Stroke**—3.75". **Displ'mt.** 267.28 cu. ins.
Rated Horsepower—36.39.
Developed Horsepower—110 at 3900 R.P.M.
Compression Ratio—6.7-1 Std. No Optl. ratios.
Compression Pressure—146 lbs. at 1000 R.P.M., 105 lbs. at cranking speed of 100 R.P.M.
Vacuum Reading—18-20" steady at 5 M.P.H.

PISTONS:—Special heat-treated steel alloy, cam-ground type. **Length** 3.245-3.305".
Weight—326 grams (without rings or pin).
Removal—Pistons and rods removed from above.
Clearance—See Fitting New Pistons.

Replacement Pistons:—*See Lincoln-Zephyr Shop Notes for complete data.*

Fitting New Pistons:—Use .002" feeler stock inserted between piston and wall at right angles to pin. Pull to withdraw feeler must be within 5-8 lbs.

PISTON RINGS:—Two compression, one oil control ring per piston, all above pin. Oil ring groove drilled with oil drain holes.

Ring	Width	End Gap	Side Clearance
Compr.	.093-.0935"	.008-.013"	.0025-.003"
Oil Cont.	.186-.1865"	.008-.013"	.0015-.002"

Replacement Rings:—*See Lincoln-Zephyr Shop Notes for complete data and new expander type rings.*

PISTON PIN:—Diameter .7501-.7504". **Length** 2.482". Pin floats in piston and rod, held by locking ring at each end. Pins not furnished oversize.
Pin Fit in Piston—.0005" clearance.
Pin Fit in Rod Bushing—.0001" clearance.
See Lincoln-Zephyr Shop Notes for Pin Fitting.

CONNECTING ROD:—Weight 638 grams. **Length** 7.400".
Crankpin Journal Diameter—2.126".
Lower Bearing—Removable steel-backed, copper-lead lined bearing shells in each rod.
Bearing Dimensions—Thickness .0855". Length .787". Bearing bore in rod 2.298" diameter.
Clearance—.0015-.003" (diam.), .006-.015" (endplay).

Bearing Adjustment:—None (no shims). Replace bearings. Do not file rods or bearing caps.

Replacement Bearings:—Furnished Std. and .0015" undersize. NOTE—Special bearings furnished for crankshafts .020" and .040" undersize.

Installing Rods:—Assemble rods with marks on rod and cap together. Install in same numbered cylinder with marks pointing toward pan.

CRANKSHAFT:—4 Bearing. Integral counterweights. NOTE—Crankshafts furnished Std. and .020", .040" undersize.
Journal Diameters—2.401" (all bearings).
Bearing Type—Steel-backed, copper-lead lined.
Clearance—.001-.003".

Bearing Adjustment:—None (no shims). Replace bearings.

End Thrust:—Taken by rear main bearing. Adjusted by replacing bearing cap. **Endplay**—.002-.006".

Replacement Bearings:—Furnished Std. and .0015" Undersize. NOTE—Special bearings furnished for .020" and .040" undersize crankshafts.

CAMSHAFT:—Four bearing. Helical Gear Drive.
Journal Diameters—1.797" (all bearings).
Bearing Type—Steel-backed, babbit-lined bushings pressed in block. **Clearance**—.002".

End thrust:—Taken by gear hub and coverplate. Adjusted by replacing coverplate. **Endplay** .004-.008"

Timing Gears:—Crankshaft gear cast-steel. Camshaft gear Bakelized Fabric.

Camshaft Setting:—Mesh marked crankshaft gear tooth with camshaft space between teeth marked by straight line (in line with mark on hub).

VALVES:—

	Head Diameter	Stem Diameter	Length
All Valves	1.537"	.3105-.3115"	4.750-4.751"

	Seat Angle	Lift	Stem Clearance
All Valves	45°	.292"	.0015-.0035"

NOTE—Special seat inserts for exhaust valves.
See Lincoln-Zephyr Shop Notes for Valve Assembly Removal and valve servicing directions.

Tappet Clearance:—None (Hydraulic type lifters).

Valve Guides:—Cast-iron split type retained by 'C' washer and valve spring. *See Lincoln-Zephyr Shop Notes for Valve Assembly Removal.*

Valve Lifters:—Barrel type with hydraulic tappet take-up (Wilcox-Rich Zero-lash type).
Diameter—.9995".
See article in Mechanical Equipment Section.

Valve Springs:—Free length 2.42".

	Spring Pressure	Length
Valve Closed	51-57 lbs.	2.13"
Valve Open	111-121 lbs.	1.84"

Valve Timing:—See Camshaft Setting aboye.
Int. Valves—Open 10.42° BTDC. Close 35.58° ALDC.
Exh. Valves—Open 50.92° BLDC. Close 8.08° ATDC.
To Check Valve Timing—No flywheel marks provided to check timing. If dead center position for any piston established on flywheel, intake valve for this cylinder should open approx. 3.24 flywheel teeth before this point with piston .0389" BTDC.
Motor Gauge—Weidenhoff Adapter #114. Rod #40.

LUBRICATION:—Pressure system. Gear type oil pump mounted in crankcase. System changed to include oil-relief valve on oil pump, and channel for each row of hydraulic valve lifters in block (fed through metering hole from oil channel at rear of engine, excess oil flows to pressure regulator at front end).
Normal Oil Pressure—40-45 lbs. at 2000 R.P.M.
Oil Pressure Regulator—Between cylinder banks at front of engine. Opens at 50 lbs. Non-adjustable.
Crankcase Capacity—5 quarts.

Oil Pressure Gauge:—King-Seeley Electric. Ford No. 86H-9273 (dash unit), 48-9278 (engine unit).
See article in Mechanical Equipment Section.

COOLING SYSTEM:—Water Pump—Centrifugal, packless type, 2 used (one pump for each bank, belt driven). *See article in Mechanical Equipment Section.*
Removal—Slack off drive belt, disconnect hose couplings, take out mounting screws in pump flange.

Thermostat:—In Upper radiator hose. NOTE—On first cars with thermostat at lower (engine) end of hose, reverse hose to provide additional clearance for drive belt **thermostat must be reversed in hose when this change made.** Later cars have thermostat at upper end.

Temperature Indicator:—King-Seeley Electric. Ford No. 86H-10833 (dash unit), H-8586 (radiator unit).
See article in Mechanical Equipment Section.

Water Capacity—30 quarts.
Drain Valves—One in left hand water outlet elbow, one at each front lower corner of engine block.

CLUTCH:—Long Model 10CF-CI. Single plate, semi-centrifugal, dry disc type.
See article in Mechanical Equipment Section for data.
Facings—Moulded type, chevron or spiral wound, 2 required. Inside Diam. 6". Outside Diam. 10". Thickness .125". NOTE—Before 11/30/37, facings were .137 or .140" thick, woven joined type.

Adjustment:—Pedal free movement 1½-2". To adjust, loosen locknut and turn clevis on connector link.

Removal:—Slide transmission and rear axle to rear as a unit (see Transmission Removal below), take out mounting screws in clutch cover flange.

TRANSMISSION:—Own Make. All helical gear, constant-mesh, synchro-mesh (second and high), sliding gear (Low and reverse) with new 'Blocker' type Synchronizer. *See Mechanical Equipment Section.*

Removal:—Disconnect rear spring at center mounting on body, disconnect speedometer cable, brake cables, shock absorber links, take out mounting bolts in universal joint ball housing, slide axle assembly to rear. Remove side panel on shift lever housing, remove pin at lower end of shift lever, free lever from transmission. Support engine, take out rear engine mounting bolts, remove clutch housing mounting screws, pull transmission to rear.
NOTE—On cars before Eng. No. 47980 (without plate over rear bearing) use extreme care to prevent transmission mainshaft and rear main bearing pulling out of case when removing transmission which will allow synchronizer balls to drop out. Cars after 11/24/37 have bearing retained by plate.

UNIVERSAL JOINT:—Spicer. 1 used (at rear of transmission). *See article in Mechanical Equipment Section*

REAR AXLE:—Own Make. New Hypoid Gear, 3/4 floating type with torque tube drive.
See article in Mechanical Equipment Section for data.
Ratio—4.44-1 Std. **Backlash**—.002-.004".

Removal:—Disconnect shock absorber links, brake cables, rear spring at center connection on body, speedometer cable. Take out mounting bolts in universal joint ball housing, pull axle assembly back to free drive shaft at splined joint.
Axle Shaft Removal—Axle housing must be separated at pinion mounting and shafts removed from inner end (diff. side gear integral with shaft).

SHOCK ABSORBERS:—Houde (Houdaille) No. BBLCE (front), BBCU (rear). Adjustable, hydraulic type.
See article in Mechanical Equipment Section.

STEERING:—Steering Gear—Gemmer Model 330. Worm and Roller type. *See Mechanical Equipment Section.*

Front Suspension:—Conventional 'I' beam section front axle with Reverse-Elliott ends and transverse spring. Axle positioned by radius rods.
Kingpin Inclination—4° crosswise.
Caster—4° (6° Max., 1½° Min.). Must be alike within ½° for both wheels. Axle may be bent cold to correct caster if correct tools used (wedges and blocks to prevent crushing axle flange).
Camber—¾° (¾° Max., ¼° Min.). Must be alike within ¼° for both wheels. Correct in same manner as caster.
Toe In—1/16-⅛". Adjust in usual manner by loosening tie rod clamp bolts and turning rod.
Steering Geometry (Toe out on turns)—Inner wheel turned 23°, outer 20°. Allowable variation ½°.

BRAKES:—Service—Bendix, Duo-servo, Single anchor, mechanical type. Hand lever applies all service brakes. *See Mechanical Equipment Section for data.*
Drums—Cast alloy iron. Diameter 12".
Braking Power—50% front, 50% rear.
Lining—Moulded (primary), Woven (secondary). Width 1.75". Thickness .21". Length per shoe 11.95".

Hand Brakes:—See Service Brake above.

ENGINE HOOD NOTE:—Turn radiator ornament counter-clockwise to free latch, lift hood up at forward end.

SERIAL & ENGINE NUMBER:—Stamped on top of clutch housing and on left side of front frame cross-member.

ENGINE SPECIFICATIONS:—**Own Model 96H.** 12 cylinder 75° Vee, L head type. Both blocks and crankcase cast enbloc.
Bore—2.75". **Stroke**—3.75".
Rated Horsepower—36.39. **Displ'mt.**—267.28 cu. in.
Developed Horsepower—110 at 3900 R.P.M.
Compression Ratio—6.7-1 Std. aluminum head.
Compression Pressure—146 lbs. at 1000 RPM. or 105 lbs. at cranking speed of 100 R.P.M.
Vacuum Reading—18-20" steady idling at 5 M.P.H.

PISTONS:—Steey alloy, light weight, cam-ground, with slipper type skirt. Recondition cylinders for finished replacement pistons.
Weight—360 grams (without rings or pin).
Removal—Pistons and rods removed from above.
Clearance—See Fitting New Pistons.
Replacement Pistons:—*See Lincoln-Zephyr Shop Notes for replacement piston and reconditioned block data.*
Fitting New Pistons:—Use .002" feeler, .50" wide, inserted between piston and cylinder wall at right angles to pin. Feeler should withdraw with 5-8 lbs. pull.

PISTON RINGS:—Two compression, one oil ring, all above pin. Oil ring groove drilled with drain holes. NOTE—Expander used with #2 Compr. and oil ring. Install this #2 Compr. ring with mark 'TOP' up.

Ring	Width	End Gap	Side Clearance
Compr.	.093-.0935"	.008-.013"	.0025-.003"
Oil Cont.	.1845-.185"	.008-.013"	.0015-.002"

Replacement Rings:—*See Lincoln-Zephyr Shop Notes for complete Ring and Expander size data.*

PISTON PIN:—**Diameter** .7501-.7504". **Length** 2.482". Floating type (locking ring in piston at each end). Pin hole in connecting rod bronze-bushed.
Pin Fit in Piston—.0005" clearance.
Pin Fit in Rod—.0001" clearance.
See Lincoln-Zephyr Shop Notes for pin fitting data.

CONNECTING ROD:—**Length** 7.40". **Weight** 638 grams.
Crankpin Journal Diameter—2.126".
Bearing Type—Steel-backed, copper-lead lined bearing halves clamped in each rod.
Clearance—.0015-.003". **Sideplay**—.006-.015".
Bearing Adjustment:—None (no shims). Replace bearings. Do not file rods or caps. NOTE—Engage tang on bearing in groove in rod and cap. See that long and short bearing cap bolts installed on correct side of rod (rod split at an angle, bolts are unequal length).
Replacement Bearings:—Furnished Std. and .0015", .020", .040" undersize.
Installing Rods:—Marks on rods and caps must be together and installed in same numbered cylinder with marks pointing down toward oil pan.

CRANKSHAFT:—Four bearing with integral counterweights. NOTE—Crankshafts furnished Std. and .020", .040" undersize.
Journal Diameters—2.401" (all bearings).
Bearing Type—Steel-backed, copper-lead lined.
Clearance—.001-.003".
Bearing Adjustment:—None (no shims). Replace bearings. Do not file bearing caps. NOTE—See that tang on bearing engages groove in block and bearing cap.
Replacement Bearings:—Furnished Std. and .0015", .020", .040" undersize.
End Thrust:—Taken by rear main bearing. To adjust, replace bearing. **Endplay**—.002-.006".

CAMSHAFT:—Four bearing. Helical gear drive.
Journal Diameters—1.797" (all bearings).
Bearing Type—Steel-backed, babbitt-lined bushings pressed in block. **Clearance**—.002".
End Thrust:—Taken by gear hub and coverplate. Adjusted by replacing coverplate. **Endplay**—.004-.008".
Timing Gears:—Cast alloy iron (crankshaft), Bakelized Fabric (camshaft). **Backlash**—.004" Max.
Camshaft Setting:—Mesh marked tooth of crankshaft gear with space marked by line on camshaft gear (this line must be in line with mark on hub).

VALVES:—

	Head Diameter	Stem Diameter	Length
All Valves	1.537"	.3115"	4.750-4.751"

	Seat Angle	Lift	Stem Clearance
All Valves	45°	.292"	.0015-.0035"

NOTE—Valve Seat Inserts used for exhaust valves.
See Lincoln-Zephyr Shop Notes for Valve Servicing data.
Tappet Clearance:—None (hydraulic type lifters).
Valve Guides:—Cast iron, split type. Retained by 'C' washer and valve spring. *See Lincoln-Zephyr Shop Notes.*
Valve Lifters:—Barrel type, hydraulic tappet take-up (Wilcox-Rich Zero-lash type). Diameter .9995".
See article in Mechanical Equipment Section for data.

Valve Springs:—	Pressure	Length
Valve Closed	51-57 lbs	2.13"
Valve Open	111-121 lbs	1.84"

Valve Timing:—See Camshaft Setting above.
Int. Valves—Open 10.42° BTDC. Close 35.58° ALDC.
Exh. Valves—Open 50.92° BLDC. Close 8.08° ATDC.
To Check Timing—No flywheel marks provided. If dead center position for any cylinder established on flywheel, intake valve for this cylinder should open approx. 3.24 teeth before this point with piston .0389" before top dead center.
Motor Gauge—Weidenhoff Adapter #114. Rod #40.

LUBRICATION:—Pressure type with gear type oil pump in crankcase at rear of engine.
Normal Oil Pressure—40-45 lbs. at 2000 R.P.M.
Oil Pressure Regulator:—Above crankshaft bearing between cylinder banks at front end of engine. Opens at 50 lbs. Not adjustable.
Oil Pressure Gauge:—King-Seeley Electric. Ford No. 96H-9273 (dash unit), No. 48-9278 (engine unit).
See article in Mechanical Equipment Section for data.
Crankcase Capacity:—5 qts.

COOLING SYSTEM:—**Capacity**—30 qts.
Water Pump:—Packless type, 2 used (1 for each bank).
See article in Mechanical Equipment Section for data.
Removal—Slack off drive belt, disconnect hose couplings, take out mounting screws on pump.
Thermostat:—In outlet hose for each bank (2 used).
Setting—Starts to open at 145°F. Fully open 180°F.
Temperature Gauge:—King-Seeley Electric. Ford No. 96H-10883 (dash unit), 99A-10884 (engine unit).
See article in Mechanical Equipment Section for data.
Drain Valves:—One at each front lower corner of engine block and at right front lower corner of radiator.

CLUTCH:—**Long Model 10CF-CI.** Semi-centrifugal, single plate, dry disc type.
See article in Mechanical Equipment Section for data.
Facings—Molded type, chevron or spiral wound, 2 required. Inside Diam. 6". Outside Diam. 10". Thickness .125".
Adjustment:—Pedal free movement must be 1.5-2.0". To adjust, loosen locknuts, turn clevis on connector link.
Removal:—Slide transmission and rear axle to rear as a unit to expose clutch (see Transmission Removal below), take out mounting screws in clutch cover.

TRANSMISSION:—**Own Model.** All helical gear, constant-mesh, synchro-mesh (second & high), sliding gear (low & reverse).
See article in Mechanical Equipment Section for data.
Removal:—Disconnect hand brake cable, hydraulic brake line at torque tube connection (bleed lines when re-connected), speedometer cable, shock absorber links. Disconnect rear spring at center frame connection. Take off universal joint ball housing nuts, slide axle assembly to rear. Remove side panel on shift lever housing in front compartment, remove pin at lower end of shift lever, free lever from transmission. Support engine at rear, take out rear engine mounting bolts, remove clutch housing mounting screws, pull transmission straight back.

UNIVERSAL JOINT:—**Spicer Model 8115-SF.** Needle-bearing type, one used (in ball housing at rear of transmission).
See article in Mechanical Equipment Section for data.

REAR AXLE:—**Own Model.** ¾ floating, Hypoid Gear type with Torque Tube drive.
See article in Mechanical Equipment Section for data.
Ratio—4.44-1. **Backlash**—.002-.004".
Optl. Axle:—Columbia Two-speed type.
See article in Mechanical Equipment Section for data.
Removal:—Disconnect hand brake cable, hydraulic brake line at torque tube connection (bleed lines when re-connected), speedometer cable, shock absorber links. Disconnect rear spring at center frame connection, take out universal joint ball housing bolts, pull axle assembly to free shaft at splined joint.
Axle Shaft Removal—Axle assembly must be dismantled and shafts removed at inner end.
See Rear Axle article in Mechanical Equipment Section for directions.

SHOCK ABSORBER:—**Houde (Houdaille) Model BBLCE (front), BBCU (rear).** Hydraulic, adjustable, double-acting.
See article in Mechanical Equipment Section for data.

STEERING:—**Steering Gear**—Gemmer Model 335. Worm-and-roller type with push-pull adjustments.
See article in Mechanical Equipment Section for data.
Front Suspension:—Conventional I-beam section axle with Reverse-Elliott ends and transverse spring. Axle positioned by radius rods and strut rod (anti-sway bar).
Kingpin Inclination—4° crosswise.
Caster—1½° Min., 6° Max. Must be equal for both wheels within ½°. No adjustment.
Camber—¼° Min., ¾° Max. Must be equal for both wheels within ½°, right wheel must not exceed left. No adjustment.
Toe In—1/16-⅛". Set at 10-1 ratio to camber. To adjust, loosen clamp bolts, turn tie rod.
Steering Geometry (Toe out on turns)—Inner wheel turned 23°, outer 20°. Allowable variation ½°.

BRAKES:—**Service**—Bendix Hydraulic, duo-servo, single anchor type without eccentric adjustment. Hand lever applies all four service brakes.
See article in Mechanical Equipment Section for data.
Wheel Cylinders—Diameter 1.125" (front), 1.00" (rear). Not interchangeable from one wheel to another.
Drums—Diameter 12".
Lining—Molded (primary or forward shoe), Woven (secondary shoe). Width 1.75". Thickness .21", Length per shoe 11.95".
Clearance—.010" at each end of each shoe.
Hand Brake:—See Service Brakes above.

ENGINE HOOD NOTE:—To raise hood, release lock by pulling up on latch handle at front of hood above grille, raise hood slightly, press down on safety latch handle (to right of latch under hood).

OIL PAN REMOVAL:—*See Ford Shop Notes for data.*

SERIAL & ENGINE NUMBER:—Stamped on top of clutch housing and on left frame member in front of dash bracket.

ENGINE SPECIFICATIONS:—Own 95. 8 Cylinder, 90° Vee, L head. Both banks & crankcase cast enbloc.
Bore—3.187". **Stroke**—3.75".
Rated Horsepower—32.5. Displacement—239 cu. ins.
Developed Horsepower—95 at 3600 R.P.M.
Compression Ratio—6.15-1 Std. cast-iron head.
Compression Pressure—145 lbs. at 2200 R.P.M. max., 100 lbs. at cranking speed of 100 R.P.M.
Vacuum Reading—Steady 18-20" at 5 M.P.H.

PISTONS:—Steel alloy, light wgt., cam ground type. Reconditioned engine for finished replacement pistons.
Weight—360 grams (without rings or pin).
Removal—Pistons and rods removed from above.
Clearance—See Fitting New Pistons.
Replacement Pistons:—*See Ford Shop Notes for data.*
Fitting New Pistons:—Use .0025" feeler, .50" wide, inserted between piston and cylinder wall at right angles to pin. Pull to withdraw feeler—7-12 lbs.

PISTON RINGS:—Two compression, one slotted oil ring, all above pin. Oil ring groove drilled with drain holes.
NOTE—Expander used with #2 Compr. and oil ring.

Ring	Width	End Gap	Side Clearance
Compr. 1#	.0915-.0920"	.012-.017"	.003"
Compr. #2	.0915-.0920"	.012-.017"	.0015"
Oil Cont.	.1535-.1540"	.012-.017"	.0015"

Replacement Rings:—Furnished (sets in carton only) Std. and .005", .015", .030", .045", .060" oversize.

PISTON PIN:—**Diameter** .7501-.7504". **Length** 2.985". Floating type (locking ring in piston at each end). Pin hole in connecting rod bronze-bushed.
Pin Fit in Piston—.0005" clearance.
Pin Fit in Rod Bushing—.0001" clearance. *See Ford Shop Notes for Pin Fitting directions.*

CONNECTING ROD:—**Length** 7.00". **Weight** 488 grams.
Crankpin Journal Diameter—2.139" (connecting rod diameter on crankpin—2.360").
Bearing Type—Steel-backed, special-alloy lined. Bearing floats in both rods (side-by-side mounting) with bearing surface on both inner and outer face.
Bearing Dimensions—Length 1.747". Thickness .1095". These bearings do not have end flanges.
Clearance—.0005-.0025" (total diametrical).
Bearing Adjustment:—None (no shims). Do not file.
Replacement Bearings:—*See Ford Shop Notes for special bearings for oversize rods and undersize crankpins.*
Installing Rods:—Marks on rods and caps must be together and installed in same numbered cylinder with marks pointing down toward oil pan.

CRANKSHAFT:—3 bearing. Integral counterweights.
Journal Diameters—2.499" (all bearings).
Bearing Type—Steel-backed, special-alloy lined.
Clearance—.0005-.0025".
Bearing Adjustment:—None (no shims). Do not file.
End Thrust:—Taken by rear main bearing. Adjust by replacing bearing. **Endplay**—.002-.006".
Replacement Bearings:—*See Ford Shop Notes for Undersizes and special long main bearings.*

CAMSHAFT:—Three bearing. Helical gear drive.
Bearing Diameters—1.797" (all bearings).
Bearings—Steel-backed, babbitt-lined bushings.
Clearance—.002".
End Thrust:—Taken by gear hub and cover plate. Adjust by replacing coverplate. Endplay—.004-.008".
Timing Gears:—Cast alloy iron (crankshaft), Bakelized Fabric (camshaft). **Backlash**—.004" max.
Camshaft Setting:—Mesh '0' marked tooth of crankshaft gear with '/' marked space on camshaft gear (this mark must be in line with mark on hub).

VALVES:—

	Head Diameter	Stem Diameter	Length
All Valves	1.537"	.3115"	4.750-4.751"

	Seat Angle	Lift	Stem Clearance
All Valves	45°	.292"	.0015-.0035"

See Ford Shop Notes for Valve Servicing data.
NOTE—Seat inserts used for all valves.
Tappet Clearance:—.0125-.0135". No adjustment.
Valve Guides:—Split type retained by 'C' washer and valve springs. *See Ford Shop Notes for servicing data.*
Valve Lifters:—Barrel type in reamed holes in block. **Diameter**—.9995". **Clearance**—.0005-.001".

Valve Springs:	Pressure	Length
Valve Closed	37-40 lbs.	2.13"
Valve Open	76-80 lbs.	1.84"

Valve Timing:—See Camshaft Setting above.
Intake Valves—Open at TDC. Close 44° ALDC.
Exhaust Valves—Open 48° BLDC. Close 6° ATDC.
To Check Valve Timing—No flywheel marks provided. Intake valve opens with piston on top dead center.

LUBRICATION:—Pressure. Gear type oil pump mounted in crankcase at rear of engine.
Normal Oil Pressure:—30 lbs. at 2000 R.P.M.
Oil Pressure Regulator:—Under plug above front camshaft bearing. Opens at 30 lbs. Not adjustable.
Oil Pressure Gauge:—King-Seeley Electric. Ford No. 99-A-9273 (dash unit), 48-9278 (engine unit).
See article in Mechanical Equipment Section for data.
Crankcase Capacity:—5 qts.

COOLING SYSTEM:—**Capacity** 22 qts.
Water Pump:—Packless type, 2 used (1 for each bank).
See article in Mechanical Equipment Section for data.
Removal—Slack off drive belt, support engine at forward end, remove front engine mounting bolts, take out mounting screws in pump body.
Thermostat:—In each cylinder head outlet (2 used).
Setting—Starts to open at 145°F. Fully open 180°.
Temperature Gauge:—King-Seeley Electric. Ford No. 99-A-10883 (dash unit), 99-A-10884 (engine unit).
See article in Mechanical Equipment Section for data.
NOTE—Gauge reads 212° (hot) when turned off.
Drain Valves:—One. At lower right front corner of radiator.

CLUTCH:—**Long Model 9CF-CS.** Single, plate, dry disc, semi-centrifugal type.
See article in Mechanical Equipment Section for data.
Facings—Moulded type, 2 required. Inside Diam. 5.76". Outside Diameter 9". Thickness .137".
Adjustment:—Pedal free movement must be 1.5-1.75". To adjust, remove pin at throw-out shaft lever end of connecting link, turn clevis on link rod.
Removal:—Slide rear axle and transmission to rear as a unit to expose clutch (See Transmission Removal below), take out mounting screws in clutch cover.

TRANSMISSION:—**Own Model 91-A.** Constant-mesh, synchro-mesh (second & high), sliding gear (low & reverse), all helical gear type.
See article in Mechanical Equipment Section for data.
Removal:—Disconnect rear shock absorbers, hand brake cables, hydraulic brake line (at torque tube connection—bleed lines when re-connected), speedometer cable, shock absorber links. Disconnect rear spring at center frame connection. Take out universal joint ball housing screws, slide rear axle assembly back to disengage drive shaft at splined joint. Support engine at rear, take out rear engine mounting bolts, remove clutch housing screws, pull transmission straight back.

UNIVERSAL JOINT:—**Spicer Model 6454-SF.** Steel bushing, 1 used (in ball housing at rear of transmission).
See article in Mechanical Equipment Section for data.

REAR AXLE—Own make. ¾ floating, Spiral Bevel gear type with Torque Tube drive.
See article in Mechanical Equipment Section for data.
Ratio—3.54-1 Std., 3.78-1 Optl.
Backlash—.010" max.
Optional Axle:—Columbia Two-speed type.
See article in Mechanical Equipment Section for data.
Removal:—Disconnect rear shock absorbers, hand brake cables, hydraulic brake line (at torque tube connection—bleed lines when re-connected), speedometer cable, shock absorber links. Disconnect rear spring at center frame connection. Take out universal joint ball housing screws, pull axle assembly to rear to disengage drive shaft at splined joint.
Axle Shaft Removal—Axle assembly must be dismantled as follows: Remove wheels and hubs, disconnect spring, remove mounting screws in differential housing, remove housing, dismantle differential assembly, pull axle shafts out at inner end (integral with differential side gear).

SHOCK ABSORBERS:—**Houde (Houdaille) Model BBDK (frt.), BBDW (rear).** Hydraulic, double-acting, adjustable. *See data in Mechanical Equipment Section.*

STEERING:—**Steering Gear**—Gemmer Model 305 Worm-and-Roller type with 'push-pull' adjustment.
See article in Mechanical Equipment Section for data.
Front Suspension:—Conventional 'I' beam section front axle with Reverse Elliott ends and transverse spring. Axle positioned by radius rods.
Kingpin Inclination—8° crosswise.
Caster—9° Max., 4½° Min. Must be equal within ½°. Axle may be bent cold to correct caster if proper tools (wedges and blocks to prevent crushing axle flange) are used.
Camber—1° Max., ¼° Min. Must be equal within ¼°, right wheel must not exceed left. Adjust in same manner as for caster (see caster data above).
Toe In—1/16". Set at 10-1 ratio to camber. Adjust by loosening clamp bolts and turning tie rod.
Steering Geometry (Toe Out on Turns)—Outer wheel turned 20°, Inner wheel 23⅓°. No adjustment.

BRAKES:—**Service**—Lockheed Hydraulic, double anchor non-energizing type. Hand lever applies rear wheel service brakes.
See article in Mechanical Equipment Section for data.
Drum—Cast iron. Diameter 12".
Wheel Cylinders—Stepped type with larger end of cylinder actuating forward shoe in each wheel as follows: Front Wheel—1.25" (front), 1.00" (rear). Rear Wheel—1.125" (front), 1.00" (rear).
Lining—Woven type (forward shoe, each wheel), Moulded type (rear shoe, each wheel). Width 1.75". Thickness .20". Length per shoe 13.18" (forward shoe, each wheel), 10.1" (rear shoe, each wheel).
Clearance—Least possible amount without drag.
Hand Brake:—See Service Brakes above.

SERIAL NUMBER:—First number R-274,300. On right hand frame side rail under engine hood.

ENGINE NUMBER:—On plate on right hand side of crankcase below valve cover plate at rear of engine.

ENGINE:—Six cylinder, 'L' head type. Cylinders cast Enbloc.
Dimensions—Bore, 3¼". Stroke, 4⅜". Displacement, 217.7 cu. ins.
Horsepower—Rated, 25.35. Developed, 75 (110), 80 (3510) at 3200 R.P.M.
Compression—Ratio 5.3-1. Pressure approximately 90-95 lbs. at cranking speed.
Vacuum Reading—Gauge should show steady reading of 18-20" at idling speed.

Pistons:—Nelson Bohnalite, aluminum alloy, Invar strut, split skirt type.
Weight—18¼ ounces.
Removal—Piston and rod assembly removed through top of engine.
Clearance—.002" (skirt). Use feeler stock to check clearance.
Installing Pistons—Slot should be toward left or away from valves.

Piston Rings:—Four rings per pistion, #1 and 2, compression rings; #3 and 4, oil control rings.

Ring	Width	End Gap
Comp. (1 and 2)	⅛"	.010-.025"
Oil Cont. (3)	⅛"	.010-.025"
Oil Cont. (4)	3/16"	.010-.025"

Piston Pin:—Diameter, ⅞". Pin floats in piston and rod. Piston pin hole in connecting rod is bronze-bushed.
Pin Fit in Piston—Light push fit with piston heated.
Pin Fit in Rod—Light push fit.

Connecting Rod:—Weight, 36½ ozs. Length, 8¾" (center-to-center).
Crankpin Journal Diameter—2".
Big End Bearing—Removable steel-backed, babbitt-lined type.
Clearance—.001-.003". Sideplay .008-.012".
Adjustment—One shim used on camshaft side of bearing only. Replace bearings. Do not file bearing caps.

Crankshaft:—Seven main bearing type with integral counterweights.
Journal Sizes—2 31/64" diameter (all bearings).
Bearing Type—Removable steel-backed, babbitt-lined type. No shims.
Clearance—.002".
Adjustment—None (no shims). Replace bearings. Do not file bearing caps.
End Thrust—Taken by #4 (center) main bearing. Endplay, .004-.007"

Camshaft:—Six bearing type. Camshaft drive, non-adjustable chain.
Bearing Type—Removable steel-backed, babbitt-lined type.
Timing Chain—Diamond 'double strand' Roller chain. Width 9/16". Pitch ⅜". Length 19½" or 52 links.
Camshaft Setting—Remove and install chain endless. Use gear pullers and pushers, keep sprockets lined up so as to avoid sidestrain on chain and sprockets. Sprockets are marked. Mesh chain with sprockets turned so that marks are adjacent and in line with straightedge across shaft centers.

Valves:—	Head Diam.	Seat Angles	Seat Width	Lift
Intake	1 21/32"	45°	1/16"	5/16"
Exhaust	1 17/32"	45°	1/16"	5/16"

Tappet Clearance—.008" all valves, engine hot or cold.
Valve Timing—See Camshaft Setting above.

Lubrication:—Pressure type. Gear type oil pump located in crankcase.
Normal Oil Pressure—20 lbs. at 20 M.P.H.
Oil Pressure Relief Valve—Opens at 20 lbs.
Capacity and Oil—7 qts. Use SAE. #30 (summer normal temperatures), #40 (summer—very hot weather), #20-W (winter).

CLUTCH:—**Borg & Beck Model 10A1**—Single plate, dry disc type. See article in Clutch Section for complete relining and assembling directions.
Facings—Moulded type, 2 required. Thickness ⅛". Inside Diameter 6¾". Outside Diameter 9⅞".
Adjustment—Free movement of pedal should be ½-1½". Adjust by lengthening connector link between pedal and clutch throw-out fork.

STEERING:—**Steering Gear**—Ross Cam-and-Lever type. See article in Steering Section for complete adjustment directions.

Front Suspension:—Conventional 'I' beam section front axle with Reverse Elliott type ends and semi-elliptic springs.
Kingpin Inclination—7° crosswise.
Caster—2½°. Adjust by inserting wedge shims between spring and spring pad on axle.
Camber—0-1½°. No adjustment provided.
Toe In—0-⅛". Adjust by loosening clamp bolt at right end of tie rod and turning end joint in or out of tie rod.

BRAKES:—**Service**—Midland Steeldraulic, four wheel,, internal expanding type. Hand lever applies all four service brakes. See article in Brake Section for complete adjustment instructions.
Drum Diameter—11".
Lining—Moulded type. Width 1¾". Thickness 3/16". Length 29" per wheel.
Clearance—1/16" at anchor and primary ends of shoe, .025" at eccentric.

Hand Brake:—See Service Brakes and Service Brake Adjustment.

SERIAL NUMBER:—First number (1180 '33) B-70,021, (1280 '34) B-70,801. On right hand frame side rail under engine hood.

ENGINE NUMBER:—On plate on right hand side of crankcase.

ENGINE:—Eight cylinder, 'In Line', valve-in-head, twin-ignition type.

Dimensions—Bore, 3⅛". Stroke, 4¼". Displacement, 260.8 cu. ins.

Horsepower—Rated, 31.25. Developed, 100 H.P. at 3400 R.P.M.

Compression—Std. 5.25-1. No optional compression ratios.

Compression Pressure—Approximately 90-95 lbs. at cranking speed.

Vacuum Reading—Gauge should show steady reading of 18-20" at idling speed.

Pistons:—Aluminum alloy, Invar strut, split skirt type.

Weight—16 ounces (stripped).

Removal—Piston and rod assembly removed through bottom of engine.

Clearance—.002" (skirt). See Fitting New Pistons.

Fitting New Pistons—Use .002" feeler stock to check clearance.

Installing Pistons—Slot away from valve side of engine.

Piston Rings:—Four rings per piston, all above pin. #1 and 2—compression rings, #3 and 4—oil control rings.

Ring	Width	End Gap
Comp. (#1, 2)	⅛"	.010-.025"
Oil Cont. (#3)	⅛"	.010-.025"
Oil Cont. (#4)	3/16"	.010-.025"

Piston Pin:—Diameter, ⅞". Pin floats in piston and rod.

Pin Fit in Piston—Light push fit with piston heated.

Pin Fit in Rod—Light push fit with both parts cold.

Connecting Rod:—Weight, 34 ozs. Length, 8¾" (center-to-center).

Crankpin Journal Diameter—2".

Lower Bearing Type—Spun babbitt integral with rod and cap (1933), removable steel-backed, babbitt-lined (1934).

Clearance—.002". Sideplay .006-.012".

Adjustment—None (no shims). Replace rods (1933), bearings (1934). Do not file rods or caps.

Crankshaft:—Nine main bearing type.

Journal Diameters—2¼" (1933), 2 31/64" (1934) all bearings.

Bearing Type—Bronze-backed (1933), steel-backed (1934), babbitt-lined.

Clearance—.002".

Adjustment—None (no shims). Replace bearings. Do not file bearing caps.

End Thrust—Taken by #5 (center) main bearing. Endplay, .004-.007".

Camshaft:—Drive—Double strand roller chain.

Timing Chain—Diamond 'double strand' Roller Chain. Width ⅞". Pitch ⅜". Length 23¼" or 62 links.

Camshaft Setting—Remove and install chain endless. Use special gear pullers and pushers, keep sprockets lined up to avoid sidestrain on chain and sprockets. Sprockets are marked. Mesh chain with sprockets turned so that marks are adjacent and in line with a straightedge across the shaft centers.

Valves:—	Head Diameter	Seat Angle	Seat Width	Lift
Intake	1 21/32"	45°	1/16"	11/32"
Exhaust	1 15/32"	45°	1/16"	11/32"

Tappet Clearance—.012" (1933), .015" (1934) all valves with engine hot and idling.

Valve Timing—See Camshaft Setting above.

Lubrication:—Pressure type. Gear type oil pump located in crankcase.

Normal Oil Pressure—25 pounds.

Oil Pressure Relief Valve—Operates at 25 lbs. Located on oil pump cover. Adjustable by turning screw.

Capacity and Oil—8 qts. Use SAE. #30 (summer), #20-W (winter).

CLUTCH:—**Borg & Beck Model 10A1 (1180), 10A3 (1280).** Single plate, dry disc type. See article in Clutch Section for complete relining and assembling directions. **Facings**—Moulded type, 2 required. Thickness ⅛". Inside Diameter 6¾" (10A1), 6⅛" (10A3). Outside Diameter 9⅞".

Adjustment—Clutch pedal free movement should be ½-1½". To adjust, take out clevis pin at forward end of connector link, turn clevis on rod (1933) or loosen transverse bolt at lower end of pedal (1934). On 1934 models, starter cable control must be adjusted when clutch adjusted.

STEERING:—**Steering Gear**—Gemmer Worm-and-Roller type. See article in Steering Section for complete adjustment directions.

Front Suspension:—Conventional 'I' beam section front axle with Reverse Elliott type ends and semi-elliptic springs.

NOTE—Independently sprung, articulated axle optional in 1934. All specifications for this type same as for standard axle.

Kingpin Inclination—7° crosswise.

Caster—0-1°. Adjust by inserting wedge shims between spring and spring pad on axle.

Camber—0-1½°. No adjustment provided.

Toe In—0-⅛". Adjust by loosening clamp bolt at right end of tie rod and turning end joint in or out of tie rod.

BRAKES:—**Service**—Bendix Mechanical, Duo-Servo, Single-anchor type. Hand lever applies all four service brakes. See article in Brake Section for complete adjustment directions.

Drum Diameter—13" (1933), 11" (1934).

Lining (1933)—Width 2". Thickness 3/16". Length 27½" per wheel.

Lining (1934)—Width 2¼". Thickness 5/32". Length 23⅛" per wheel.

Hand Brake:—See Service Brakes and Service Brake Adjustment.

SERIAL NUMBER:—First number (1190 '33) 521,191, (1290 '34) 521,801. On right hand frame side rail under engine hood.

ENGINE NUMBER:—On plate on right hand side of crankcase.

ENGINE:—Eight cylinder, 'In Line', valve-in-head, twin-ignition type.

Dimensions—Bore, 3⅜". Stroke, 4½". Displacement, 322 cu. ins.

Horsepower—Rated, 36.45. Developed, 125 H.P. at 3600 R.P.M.

Compression—Std. 5.25-1. No optional compression ratios.

Compression Pressure—Approximately 90-95 lbs. at cranking speed.

Vacuum Reading—Gauge should show steady reading of 18-20" at idling speed.

Pistons:—Nelson Bohnalite,.aluminum alloy, Invar strut, split skirt type.

Weight—19⅛ ounces (stripped).
Removal—Piston and rod assembly removed through bottom of engine.
Clearance—.002" (skirt). See Fitting New Pistons.
Fitting New Pistons—Use .002" feeler stock to check piston clearance.
Installing Pistons—Slot to left or opposite side of engine from valves.

Piston Rings:—Four rings per piston, all above pin. #1 and 2—compression rings, #3 and 4—oil control rings.

Ring	Width	End Gap
Comp. (#1, 2)	⅛"	.010-.025"
Oil Cont. (#3)	⅛"	.010-.025"
Oil Cont. (#4)	3/16"	.010-.025"

Piston Pin:—Diameter, ⅞". Pin floats in piston and rod.
Pin Fit in Piston—Light push fit with piston heated.
Pin Fit in Rod—Light push fit with both parts cold.

Connecting Rod:—Weight, 32 ozs. Length, 9 1/16" (center-to-center).
NOTE:—Connecting rod is aluminum alloy with steel bearing cap.
Crankpin Journal Diameter—2⅛".
Lower Bearing Type—Spun babbitt integral with rod and cap.
Clearance—.002". Sideplay .006-.012".
Adjustment—None (no shims). Replace bearings. Do not file rods or caps.

Crankshaft:—Nine main bearing type.
Journal Sizes—2⅜" diameter (all bearings).
Bearing Type—Removable bronze-backed, babbitt-lined type.
Clearance—.002".
Adjustment—None (no shims). Replace bearings. Do not file bearing caps.
End Thrust—Taken by #5 (center) main bearing. Endplay, .004-.007".

Camshaft:—Drive—Roller chain.
Timing Chain—Diamond 'Triple strand' Roller Chain. Width 1 3/16". Pitch ⅜". Length 24¾" or 66 links.
Camshaft Setting—Remove and install chain endless. Use special gear pullers and pushers, keep sprockets lined up to avoid sidestrain on chain and sprockets. Sprockets are marked. Mesh chain with sprockets turned so that marks are adjacent and in line with a straightedge across the shaft centers.

Valves:—	Head Diameter	Seat Angle	Seat Width	Lift
Intake	1 24/32"	45°	1/16"	11/32"
Exhaust	1 19/32"	45°	1/16"	11/32"

Tappet Clearance—.012" (1933), .015" (1934) all valves with engine hot and idling.
Valve Timing—See Camshaft Setting above.

Lubrication:—Pressure type. Gear type oil pump located in crankcase.
Normal Oil Pressure—25 pounds.
Oil Pressure Relief Valve—Operates at 25 lbs. Located in oil pump cover. Adjustable by turning screw.
Capacity and Oil—10 qts. Use SAE. #30 (summer), #20-W (winter).

CLUTCH:—**Borg & Beck Model 11N (1190 '33), 11A3 (1290 '34).** Single plate, dry disc type. See article in Clutch Section for complete relining and assembling directions.
Facings (11N)—Moulded type, 2 required. Thickness ⅛". Inside Diameter 6¾". Outside Diameter 10⅞".
Facings (11A3)—Moulded type, 2 required. Thickness ⅛". Inside Diameter 6⅛". Outside Diameter 11".
Adjustment (1933)—Adjust whenever free movement of clutch pedal decreases to ½". Remove clutch pan, loosen all clutch cover screws in rim of flywheel, depress clutch pedal about 2", use hammer to jar clutch cover about ½" to right, release clutch pedal, tighten cover screws, check distance from front edge of release bearing to clutch cover. Should be 9/16". Increase distance by turning clutch cover to right, decrease this distance by turning clutch cover to left. Loosen pedal hub adjusting bolt, shift pedal forward to limit of slot, adjust throw-out lever adjusting screw at right end of shaft on clutch housing until distance from front edge of throw-out lever pins to clutch cover is 1/16". Pull pedal back until pedal pad just touches toeboard, tighten adjusting bolt. These adjustments should provide ½" of pedal free movement.
Adjustment (1934)—Free movement of clutch pedal should be ½-1½". To adjust, loosen transverse bolt at lower end of pedal and shift position. Starting switch cable control must be adjusted whenever clutch pedal is adjusted.

STEERING:—**Steering Gear**—Gemmer Worm-and-Roller type. See article in Steering Section for complete adjustment directions.

Front Suspension:—Conventional 'I' beam section front axle with Reverse Elliott type ends and semi-elliptic springs.
NOTE—Independently sprung articulated type axle optional in 1934. All specifications same as for standard type.
Kingpin Inclination—6° crosswise.
Caster—0°. Adjust by inserting wedge shims between spring and spring pad on axle.
Camber—0-1½°. No adjustment provided.
Toe In—0-⅛". Adjust by loosening clamp bolt at right hand end of tie rod and turning end joint in or out of tie rod.

BRAKES:—**Service**—Bendix Mechanical, Duo-Servo, Single-anchor type. Hand lever applies all four service brakes. See article in Brake Section for complete adjustment directions.
Drum Diameter—16" (1933), 14" (1934).
Lining (1933)—Moulded type. Width 2". Thickness 3/16". Length 33¾" per wheel.
Lining (1934)—Moulded type. Width 2¼". Thickness ¼". Length 29 7/16" per wheel.

Hand Brake:—See Service Brakes and Service Brake Adjustment.

SERIAL NUMBER:—First number R-278,901 (1220), R-294,725 (3520). On right hand frame side rail under engine hood.

ENGINE NUMBER:—On plate on right side of crankcase.

ENGINE:—**Own.** Six cylinder, valve-in-head, twin-ignition type. Cylinders cast enbloc.

Bore—3⅜". **Stroke**—4⅜".

Piston Displacement—234 cubic inches.

Rated Horsepower—27.34 S.A.E.

Developed Horsepower—88 (1220), 90 3520) at 3200 R.P.M.

Compression Ratio—5.25-1. No optional ratios.

Compression Pressure—Approximately 92 lbs. at cranking speed.

Pistons:—Nelson Bohnalite, aluminum alloy, Invar strut, split skirt type. Length, 3⅞".

Weight—19⅛ ounces.

Removal—Pistons and rods removed from above.

Clearance—Skirt .002" (see Fitting Pistons).

Fitting New Pistons—Use .002" feeler stock to check clearance.

Installing Pistons—Slot should be toward left or opposite side from camshaft.

Piston Rings:—Two compression, two oil control rings per piston, all above pin.

Ring	Width	End Gap
Comp. All	⅛"	.010-.025"
Oil Cont. (3)	⅛"	.010-.025"
Oil Cont. (4)	3/16"	.010-.025"

Piston Pin:—Diameter ⅞". Pin floats in piston and rod. Pin hole in rod is bronze-bushed.

Pin Fit in Piston—Light push fit with piston heated.

Pin Clearance in Rod Bushing—.0001" or light push fit with both parts at normal temperature.

Connecting Rod:—Weight 35 ozs. Length 8¾".

Crankpin Journal Diameter—2".

Lower Bearing Type—Interchangeable steel-backed, babbitt-lined. One shim on camshaft side.

Clearance—.002". Sideplay .006-.012".

Adjustment—One shim. Replace bearings. Do not file rods or caps.

Crankshaft:—Seven bearing. Integral counterwts.

Journal Diameters—2 31/64" all bearings.

Bearing Type—Interchangeable steel-backed, babbitt-lined type. No shims.

Clearance—.002".

Adjustment—None (no shims). Replace bearings. Do not file bearing caps.

End Thrust—Taken by center bearing. Endplay .004-.007".

Camshaft:—Non-adjustable double roller chain drive.

Timing Chain—Diamond double roller chain. Pitch ⅜". Length 22½" or 60 links.

Camshaft Setting—Sprockets are marked. Mesh chain with sprockets turned so that marks are adjacent and in line with a straightedge across the shaft centers. Chain should be removed and installed endless. Use special pullers and pushers, keep sprockets lined up to avoid sidestrain on chain and sprockets.

Valves:—

	Head Diameter	Seat Angle	Seat Width
Intake	1¾"	45°	1/16"
Exhaust	1 19/32"	45°	1/16"

Tappet Clearance—.015" with engine hot. Set clearance with engine idling.

Valve Timing—See Camshaft Setting above.

Motor Gauge—Weidenhoff Adapter #113 (with #152 Adapter plus No. X4615 collar), Rod #37.

Lubrication:—Pressure type. Gear type oil pump located in crankshaft.

Normal Oil Pressure—25 pounds.

Oil Pressure Relief Valve—Located on oil pump cover. Operates at 25 lbs. Adjustable by turning screw.

Capacity & Oil—7 qts. Use SAE. #30 (warm and hot temperatures), #20W (cold temperatures).

CLUTCH:—**Borg & Beck Models 10A3 (Early 1220), 10A6 (Late 1220,** All 3520). Single plate dry disc type. No adjustment required for wear. See article in Clutch Section for relining and assembling directions.

Clutch Pedal Adjustment—Free movement of clutch pedal must be ½-1½". Adjust by loosening transverse bolt in link directly behind pedal and above clutch pedal shaft and shifting position of pedal. Setscrew on lever end of throw-out shaft at right of transmission must not contact stop on clutch housing. Check starting switch cable adjustment after adjusting clutch pedal.

Starting switch cable adjustment—Starting switch should make contact just after clutch is released. To check, engage transmission gears, depress clutch pedal, note when starter engages. If clutch is not completely released (car will tend to move) or if pedal travel is excessive, adjust by loosening two clamp bolts on clutch throw-out shaft lever to which switch cable is attached and move cable clamp in (for later engagement) or out (for earlier engagement) of starter.

Clutch Facings—Moulded type, 2 required, 6⅛" I.D., 9⅞" O.D., .133" thick.

NOTE—Mark clutch cover, flywheel and pressure plate before disassembling and replace in same position. Install driven plate assembly with mark 'Flywheel side' toward flywheel (hub is offset). Use special gauge plate and adaptor to set up release levers when reassembling clutch. Release lever heights must be equal within .005".

STEERING:—**Front Suspension**—Conventional 'I' beam section front axle with Reverse-Elliott ends, or 'Articulated' type independent springing. Semi-elliptic springs used with both type axles. Specifications for both types are same.

Kingpin Inclination—7° crosswise.

Caster—0-2½° (1220), 0-1½° (3520). Adjust by inserting wedge shims between spring and spring pad on axle.

Camber—0-1½°. No adjustment.

Toe In—0-⅛". Adjust in usual manner by changing length of tie rod.

Steering Gear:—Gemmer Model, Worm-and-Roller type. See article in Steering Section for adjustments.

BRAKES:—**Service**—Bendix Mechanical (1220), Hydraulic (3520). Duo-Servo, single anchor type. Hand lever applies rear service brakes. See separate articles on each type of brake in Brake Section for relining and complete adjustment procedure.

Lining—Moulded type. Width 1¾". Thickness 5/32". Length per wheel 23¾" (1220), 23 13/16" (3520).

Clearance—.010" between lining and drum.

Hand Brake Adjustment:—See Service Brakes.

SERIAL NUMBER:—First number, B-75010. On right frame siderail under engine hood.

ENGINE NUMBER:—On plate on right side of crankcase.

ENGINE:—Eight cylinder, Valve-in-head, Twin-Ignition type.

Bore—3⅛". **Stroke**—4¼".

Piston Displacement—260.8 cubic inches.

Rated Horsepower—31.25 S.A.E.

Developed Horsepower—102 at 3200 R.P.M.

Compression Ratio—5.25-1. No optional ratios.

Vacuum Reading—Gauge should show steady reading of 18-20" with engine idling.

Pistons:—Nelson Bohnalite, aluminum alloy, Invar strut, split skirt type. Length 3 11/16".

Weight—19 ounces.

Removal—Pistons and rods removed from below.
Clearance—Skirt .002". See Fitting Pistons.
Fitting New Pistons—Use .002" feeler gauge to check clearance.
Installing Pistons—Slot should be toward left or opposite side from camshaft.

Piston Rings:—Two compression, two oil control rings per piston, all above pin.

Ring	Width	End Gap
Comp. All	⅛"	.010-.025"
Oil Cont. (#3)	⅛"	.010-.025"
Oil Cont. (#4)	3/16"	.010-.025"

Piston Pin:—Diameter ⅞". Pin floats in piston and rod. Pin hole in rod is bronze-bushed.

Pin Fit in Piston—Light push fit with piston heated.

Pin Clearance in Rod Bushing—.0001" or light push fit with both parts at normal temperature.

Connecting Rod:—Weight 34 ozs. Length 8¾".

Crankpin Journal Diameter—2".
Lower Bearing Type—Interchangeable steel-backed, babbitt-lined. One shim on camshaft side.
Clearance—.002". Sideplay .006-.012".
Adjustment—One shim. Replace bearings. Do not file rods or caps.

Crankshaft:—9 bearing. Integral counterweights.
Journal Diameters—2 31/64" all bearings.
Bearing Type—Interchangeable steel-backed, babbitt-lined. No shims.
Clearance—.002".
Adjustment—None (no shims). Replace bearings. Do not file bearing caps.
End Thrust—Taken by center bearing. Endplay .004-.007".

Camshaft:—Non-adjustable roller chain drive.
Timing Chain—Diamond double roller chain. Pitch ⅜". Length 22½" or 60 links.

Camshaft Setting—Sprockets are marked. Mesh chain with sprockets turned so that marks are adjacent and in line with a straightedge across the shaft centers. Chain should be removed and installed endless. Use special pullers and pushers, keep sprockets lined up to avoid sidestrain on chain and sprockets.

Valves:—	Head Diameter	Seat Angle	Seat Width
Intake	1 21/32"	45°	1/16"
Exhaust	1 15/32"	45°	1/16"

Tappet Clearance—.015" with engine hot. Set clearance with engine idling.
Valve Timing—See Camshaft Setting above.
Motor Gauge—Weidenhoff Adapter #113 (with #152 Adapter and X4615 collar) Rod #37.

Lubrication:—Pressure type. Gear type oil pump located in crankcase.
Normal Oil Pressure—25 pounds.
Oil Pressure Relief Valve—Located on pump cover. Operates at 25 pounds. Adjustable by turning screw.

Capacity & Oil—7 qts. Use SAE. #30 (warm and hot temperatures), #20-W (cold temperatures).

CLUTCH:—**Borg & Beck Model 10A6.** Single plate, dry disc type. No adjustment required for wear. See article in Clutch Section for relining and assembling directions.

Clutch Pedal Adjustment—Free movement of clutch pedal must be ½-1½". Adjust by loosening transverse bolt directly behind pedal and above clutch pedal shaft and shifting position of pedal. Setscrew on lever on end of throw-out shaft at right of clutch housing must not contact stop on housing. Check starting switch cable adjustment after adjusting clutch pedal.

Starting Switch Cable Adjustment—Starting switch should make contact just after clutch is released. To check, engage transmission gears, depress clutch pedal, note when starter engages. If clutch is not entirely released (car will tend to move), or if pedal travel is excessive, adjust by loosening two clamp bolts on clutch throw-out shaft lever to which switch cable is attached and move cable clamp in (for later engagement) or out (for earlier engagement of starter).

Clutch Facings—Moulded type, 2 required, 6⅛" I.D., 9⅞" O.D., .133" thick.

NOTE—Mark clutch cover, flywheel, and pressure plate before disassembling clutch and replace in same position. Install driven plate assembly with mark 'Flywheel Side' toward flywheel (hub is offset). Use special gauge plate and adaptor to set up release levers when reassembling clutch. Release lever heights must be equal within .005".

STEERING:—**Front Suspension**—Conventional 'I' beam section front axle with Reverse-Elliott ends, or 'Articulated' type independent springing. Semi-elliptic springs are used with both axles. Specifications for both types are the same.

Kingpin Inclination—7° crosswise.
Caster—0-1½°. Adjust by inserting wedge shims between spring and spring pad on axle.
Camber—0-1½°. No adjustment.
Toe In—0-⅛". Adjust in usual manner by changing length of tie rod.

Steering Gear:—Gemmer Worm-and-Roller type. See article in Steering Section for adjustments.

BRAKES:—**Service**—Bendix Hydraulic, Duo-Servo, single anchor type. Hand lever applies rear service brakes. See article in Brake Section for relining and complete adjustment procedure.

Drum Diameter—11".
Lining—Moulded type. Width 2¼". Thickness 3/16". Length per wheel 23 13/16".
Clearance—.010" between drum and lining.

Hand Brake Adjustment:—See Service Brakes.

SERIAL NUMBER:—First number (3540) C-1001, (3640A) C-9501. On right frame side rail under engine hood and on Caution Plate on left front door corner plate.

ENGINE NUMBER:—Stamped on plate on right front of crankcase below valve cover plate.

ENGINE SPECIFICATIONS:—Own 'Monitor Sealed Motor.' Six cylinder, 'L' head type. Cylinders cast enbloc. No intake manifold is used and intake passage is formed within the head and block castings. NOTE—Some models equipped with engine hood and radiator grille in one unit which is hinged at the cowl. It is lifted up at the front end to expose the motor.

Bore—3⅜". **Stroke**—4⅜".

Displacement—234 cubic inches.

Rated Horsepower—27.34 (SAE).

Developed Horsepower—90 at 3400 R.P.M.

Compression Ratio and Pressure—5.58-1 std. cast-iron head. Presure—125 lbs. at 350 R.P.M.

Vacuum Reading—Gauge should show steady reading of 18-20" with engine idling at 5-7 M.P.H.

PISTONS:—Bohnalite, aluminum alloy, Invar strut, split skirt type.

Length—3⅞".

Weight—19⅛ ounces.

Removal—Pistons and rods removed from above.

Clearance—Skirt .002". See Fitting New Pistons.

Fitting New Pistons:—Use .002" feeler stock inserted between piston and cylinder wall on side opposite slot to check clearance.

Installing Pistons:—Slot should be toward left or away from camshaft.

PISTON RINGS:—Two compression rings, two oil control rings per piston, all above pin.

Ring	Width	End Gap
Comp. All	⅛"	.010-.025"
Oil Cont. (#3)	⅛"	.010-.025"
Oil Cont. (#4)	3/16"	.010-.025"

PISTON PIN:—**Diameter**—⅞". Pin floats in piston and rod. Pin hole in rod is bronze-bushed. Pins furnished for service standard, .001", .003", .005" oversize.

Pin Fit in Piston—Light push fit with piston heated.

Pin Fit in Rod Bushing—.0001" or light push fit with piston and rod cold.

CONNECTING ROD:—**Length**—8¾" (center-to-center).

Weight—36¼ ounces.

Upper Bearing (Piston Pin Bushing)—Bronze.

Crankpin Journal Diameter—2".

Lower Bearing—Interchangeable, steel-backed, babbitt or copper-lead lined type. Shims used.

Clearance—.002-.003". Sideplay .008-.012".

Bearing Adjustment:—Shims. Do not file rods or caps. Replace bearings when necessary.

CRANKSHAFT:—7 bearing. Integral counterweights.

Journal Diameters—2 31/64" all bearings.

Bearing Type—Interchangeable, steel-backed, babbitt or copper-lead lined. shims used.

Clearance—.002-.0025".

Bearing Adjustment:—Shims. Do not file caps. Replace bearings when necessary.

End Thrust:—Taken by center (#4) bearing. Endplay .004-.007".

CAMSHAFT:—6 bearing. Non-adjustable chain drive.

Journal Diameters—#1, 1⅞"; #2, 2 13/64"; #3, 2 11/64"; #4, 2 9/64"; #5 2 7/64; #6, 1¾".

End Thrust:—Taken by front bearing (shoulder formed on shaft behind bearing, and shoulder in front of bearing formed by sprocket hub when bolted on camshaft). Adjusted by replacing bearing.

Timing Chain:—Whitney. Double strand roller chain. Width 9/16". Pitch ⅜". Length 22½" or 60 links.

Camshaft Setting:—Sprockets are marked. Mesh chain with sprockets turned so that marks are adjacent and in line with a straightedge across the shaft centers. Install chain endless with camshaft sprocket off engine.

VALVES:—	Head Diam.	Stem Diam.	Seat Width
Intake	1 21/32"	.341"	1/16"
Exhaust	1 17/32"	.341"	1/16"

	Seat Angle	Lift	Stem Clearance
Intake	45°	5/16"	.002"
Exhaust	45°	5/16"	.002"

Tappet Clearance—.015" all valves with engine hot or cold.

Valve Timing:—See Camshaft Setting above.

LUBRICATION:—Pressure. Gear type oil pump located in crankcase.

Normal Oil Pressure:—25 lbs. (10 lbs. idling).

Oil Pressure Relief Valve:—Located on oil pump. Operates at 25 lbs. Adjustable by turning screw.

Crankcase Capacity:—7 qts. (refill).

CLUTCH:—**Borg & Beck Model 9A6.** Single plate, dry disc type. See article in Clutch Section for relining and assembling directions.

Facings—Woven (pressure plate side), molded (flywheel side), 2 required. Inside Diam 5⅝". Outside Diam. 9¼". Thickness .133".

Adjustment—Free movement of clutch pedal must be ½-1". Adjust whenever free movement is less than ½". To adjust, loosen transverse bolt at lower end of clutch pedal, shift pedal position, tighten bolt.

Removal—Disconnect driveshaft at rear of transmission, remove transmission, drop clutch housing underpan, take out capscrews mounting clutch on flywheel turning all screws out evenly to release spring pressure. Clutch assembly can then be removed from below without removing flywheel housing.

STEERING:—**Steering Gear**—Gemmer Model. Worm-and-Roller type. See article in Steering Section for adjustments.

Front Suspension:—Conventional 'I' beam section front axle with Reverse-Elliott ends and semi-elliptic springs.

Kingpin Inclination—7° crosswise.

Camber—0-1½°. No adjustment.

Caster—0-1°. Adjust by inserting wedge shims between spring and spring pad on axle.

Toe In—0-⅛". Adjust by loosening clamp bolt at right end of tie rod and screwing tie rod in or out of end joint. Tighten clamp bolt.

Tread—58" (front), 60¼" (rear).

BRAKES:—**Service**—Bendix Hydr., Duo-Servo, single anchor type. Hand lever applies rear service brakes. *See article in Mechanical Equipment Section for data.*

Drum Diameter—10".

Lining—Moulded type. Width 2". Thickness 3/16". Length 22 1/16" per wheel.

Clearance—.010" between drum and lining.

Hand Brake Adjustment:—Should be adjusted whenever service brakes adjusted. Turn adjusting screw in wheel so that shoes are tight in drum. Loosen two bracket bolts, pull hand brake lever on three notches, pull bracket forward removing all slack in cables and tighten bolts. Then with lever in released position readjust shoes to give .010" clearance in drums by checking with feeler gauge through slot in drum.

ENGINE NUMBER:—On plate on right hand side of crankcase. Serial number (R-303301 up) on right hand frame side rail under engine hood.

ENGINE SPECIFICATIONS:—Type—6 cylinder, valve-in head, twin-ignition type.

Bore—3⅜". Stroke—4⅜".

Displacement—234 cubic inches.

Rated Horsepower—27.34 (SAE).

Developed Horsepower—93 at 3400 R.P.M.

Compression Ratio and Pressure—5.25-1 std. cast-iron hd., no optl. **Pressure**—125 lbs at 350 R.P.M.

Vacuum Reading—Gauge should show steady reading of 18-20" with engine idling at 5-7 M.P.H.

PISTONS:—Nelson Bohnalite, aluminum alloy, Invar strut, split skirt type.

Length—3⅞".

Weight—19⅛ ounces.

Removal—Pistons and rods removed from above.

Clearance—Skirt .002". See Fitting Pistons.

Fitting New Pistons:—Use .002" feeler stock inserted between piston and cylinder wall on side opposite slot to check clearance.

Installing Pistons:—Slot should be toward left hand side of engine or away from camshaft.

PISTON RINGS:—Two compression rings, two oil control rings per piston, all above pin.

Ring	Width	End Gap
Comp. All	⅛"	.010-.025"
Oil Cont. (3)	⅛"	.010-.025"
Oil Cont. (4)	3/16"	.010-.025"

PISTON PIN:—Diameter—⅞". Length—2 51/64". Pin floats in piston and rod. Pin hole in rod is bronze-bushed. Pins furnished for service standard, .001" .003", .005" oversize.

Pin Fit in Piston—Light push fit with piston heated.

Pin Fit in Rod Bushing—.0001" or light push fit with both parts at normal temperature.

CONNECTING ROD:—Length—8¾". Weight—36¼ ozs.

Upper Bearing (Piston Pin Bushing)—Bronze.

Crankpin Journal Diameter—2".

Lower Bearing—Interchangeable steel-backed, copper-lead lined type. Shims used.

Clearance—.002-.0025". Sideplay .006-.012".

Bearing Adjustment:—Shims. Do not file rods or caps. Replace bearings when necessary.

CRANKSHAFT:—7 bearing. Integral counterweights.

Journal Diameters—2 31/64" all bearings.

Bearing Type—Interchangeable steel-backed, copper-lead lined. Shims used.

Clearance—.002-.0025".

Bearing Adjustment:—Shims. Do not file caps. Replace bearings when necessary.

End Thrust:—Taken by center (#4) bearing. Endplay .004-.007".

CAMSHAFT:—Non-adjustable double-roller chain drive.

End Thrust:—Taken by front bearing. Adjusted by replacing bearing.

Timing Chain:—Diamond double roller chain. Width ⅞". Pitch ⅜". Length 22½" or 60 links.

Camshaft Setting:—Sprockets are marked. Mesh chain with sprockets turned so that marks are adjacent and in line with a straightedge across the shaft centers. Chain should be removed and installed endless. Use special pullers and pushers, keep sprockets lined up to avoid sidestrain on chain and sprockets.

VALVES:—

	Head Diam.	Stem Diam.	Length
Intake	1¾"	.372"	5 17/32"
Exhaust	1 19/32"	.372"	5 17/32"

	Seat Angle	Lift	Stem Clearance
Intake	45°	11/32"	.002"
Exhaust	45°	11/32"	.002"

Tappet Clearance—.015" with engine hot. Set clearance with engine idling.

Valve Timing:—See Camshaft Setting above.

LUBRICATION:—Pressure. Gear type oil pump located in crankcase.

Normal Oil Pressure:—25 pounds.

Oil Pressure Relief Valve:—Located on oil pump cover. Operates at 25 lbs. Adjustable by turning screw.

Crankcase Capacity:—7 qts. (refill).

CLUTCH:—Borg & Beck Model 10A6. Single plate, dry disc type. See article in Clutch Section for relining and assembling directions.

Facings—Moulded type, 2 required. Inside Diam. 6⅛". Outside Diam. 9⅞". Thickness ⅛".

Adjustment—Free movement of clutch pedal must be ½-1½". Adjust by loosening transverse bolt in link directly behind pedal and above clutch pedal shaft and shifting position of pedal. Setscrew on lever end of throw-out shaft at right of transmission must not contact stop on clutch housing. Check starting switch cable adjustment after adjusting clutch pedal.

Starting Switch Cable Adjustment—Starting switch should make contact just after clutch is released. To check, engage transmission gears, depress clutch pedal, note when starter engages. If clutch is not completely released (car will tend to move) or if pedal travel is excessive, adjust by loosening two clamp bolts on clutch throw-out shaft lever to which switch cable is attached and move cable clamp in (for later engagement) or out (for earlier engagement) of starter.

Removal—Disconnect driveshaft at rear of transmission, remove transmission, drop clutch housing underpan, take out capscrews mounting clutch on flywheel turning all screws out evenly to release spring pressure. Clutch assembly can then be removed from below without removing flywheel housing.

STEERING:—Steering Gear—Gemmer Model. Worm-and-Roller type. See article in Steering Section for adjustments.

Front Suspension:—Conventional 'I' beam section front axle with Reverse-Elliott ends, or 'Articulated' type independent springing. Semi-elliptic springs used with both axles. Specifications for both types are the same.

Kingpin Inclination—7° crosswise.

Camber—0-1½°. No adjustment.

Caster—0-1½°. Adjusted by inserting wedge shims between spring and spring pad on axle.

Toe In—0-⅛". Adjust in usual manner by changing length of tie rod.

Tread—58" (front), 60" (rear).

BRAKES:—Service—Bendix Hydr., Duo-Servo, single anchor type. Hand lever applies rear service brakes. See article in Brake Section for complete adjustment procedure.

Drum Diameter—11".

Lining—Moulded type. Width 1¾". Thickness 3/16". Length 23 13/16" per wheel.

Clearance—.010" between drum and lining.

Hand Brake Adjustment: See Service Brakes.

ENGINE NUMBER:—On plate on right hand side of crankcase. Serial number (B-77325) on right hand frame side rail under engine hood.

ENGINE SPECIFICATIONS:—Type—8 cylinder, valve-in head, twin ignition type.

Bore—3⅛". Stroke—4¼".

Displacement—260.8 cubic inches.

Rated Horsepower—31.25 (SAE).

Developed Horsepower—102 at 3400 R.P.M.

Compression Ratio and Pressure—5.25-1 std. cast-iron hd., no optl. **Pressure**—110 lbs. at 350 R.P.M.

Vacuum Reading—Gauge should show steady reading of 18-20" with engine idling at 5-7 M.P.H.

PISTONS:—Nelson Bohnalite, aluminum alloy, Invar strut, split skirt type.

Length—3 11/16".

Weight—19 ounces.

Removal—Pistons and rods removed from below.

Clearance—Skirt .002". See Fitting New Pistons.

Fitting New Pistons:—Use .002" feeler stock inserted between piston and cylinder wall on side opposite slot to check clearance.

Installing Pistons:—Slot should be toward left or away from camshaft.

PISTON RINGS:—Two compression rings, two oil control rings per piston, all above pin.

Ring	Width	End Gap
Comp. All	⅛"	.010-.025"
Oil Cont. (#3)	⅛"	.010-.025"
Oil Cont. (#4)	3/16"	.010-.025"

PISTON PIN:—Diameter—⅞". Length—2 9/16".

Pin floats in piston and rod. Pin hole is bronze-bushed. Pins furnished for service standard, .001", .003", .005" oversize.

Pin Fit in Piston—Light push fit with piston heated.

Pin Fit in Rod Bushing—.0001" or light push fit with both parts at normal temperature.

CONNECTING ROD:—Length—8¾". Weight—34 ozs.

Upper Bearing (Piston Pin Bushing)—Bronze.

Crankpin Journal Diameter—2".

Lower Bearing—Interchangeable steel-backed, copper-lead lined type. Shims used.

Clearance—.002-.0025". Sideplay .006-.012".

Bearing Adjustment:—Shims. Do not file rods or caps. Replace bearings when necessary.

CRANKSHAFT:—9 bearing. Integral counterweights.

Journal Diameters—2 31/64" all bearings.

Bearing Type—Interchangeable steel-backed, copper-lead lined. Shims used.

Clearance—.002-.0025".

Bearing Adjustment:—Shims. Do not file caps. Replace bearing when necessary.

End Thrust:—Taken by center (#5) bearing. Endplay .004-.007".

CAMSHAFT:—Non-adjustable roller chain drive.

Timing Chain:—Diamond double roller chain. Width 9/16". Pitch ⅜". Length 62 links or 23¼".

Camshaft Setting:—Sprockets are marked. Mesh chain with sprockets turned so that marks are adjacent and in line with a straightedge across the shaft centers. Chain should be removed and installed endless. Use special pullers and pushers, keep sprockets lined up to avoid sidestrain on chain and sprockets.

VALVES:—

	Head Diam.	Stem Diam.	Seat Width
Intake	1 21/32"	.372"	1/16"
Exhaust	1 15/32"	.372"	1/16"

	Seat Angle	Lift	Stem Clearance
Intake	45°	11/32"	.002"
Exhaust	45°	11/32"	.002"

Tappet Clearance—.015" with engine hot. Set clearance with engine idling.

Valve Timing:—See Camshaft Setting above.

LUBRICATION:—Pressure. Gear type oil pump located in crankcase.

Normal Oil Pressure:—25 pounds.

Oil Pressure Relief Valve:—Located on oil pump cover. Operates at 25 lbs. Adjustable by turning screw.

Crankcase Capacity:—7 quarts (refill).

CLUTCH:—Borg & Beck Model 10A6. Single plate, dry disc type. See article in Clutch Section for relining and assembling directions.

Facings—Moulded type, 2 required. Inside Diam. 6⅛". Outside Diam. 9⅞". Thickness ⅛".

Adjustment—Free movement of clutch pedal must be ½-1½". Adjust by loosening transverse bolt directly behind pedal and above clutch pedal shaft and shifting position of pedal. Setscrew on lever end of throw-out shaft at right of clutch housing must not contact stop on housing. Check starting switch cable adjustment after adjusting clutch pedal.

Starting Switch Cable Adjustment—Starting switch should make contact just after clutch is released. To check, engage transmission gears, depress clutch pedal, note when starter engages. If clutch is not entirely released (car will tend to move), or if pedal travel is excessive, adjust by loosening two clamp bolts on clutch throw-out shaft lever to which switch cable is attached and move cable clamp in (for later engagement) or out (for earlier engagement of starter).

Removal—Disconnect driveshaft at rear of transmission, remove transmission, drop clutch housing underpan, take out capscrews mounting clutch on flywheel turning all screws out evenly to release spring pressure. Clutch assembly can then be removed from below without removing flywheel housing.

STEERING:—Steering Gear—Gemmer Model. Worm-and-Roller type. See article in Steering Section for adjustments.

Front Suspension:—Conventional 'I' beam section front axle with Reverse-Elliott ends, or 'Articulated' type independent springing. Semi-elliptic springs used on both axles. Specifications for both axles are the same.

Kingpin Inclination—7° crosswise.

Camber—0-1½°. No adjustment.

Caster—0-1½°. Adjust by inserting wedge shims between spring and spring pad on axle.

Toe In—0-⅛". Adjust in usual manner by changing length of tie rod.

Tread—58" (front), 60" (rear).

BRAKES:—Service—Bendix Hydr., Duo-Servo, single anchor type. Hand lever applies rear service brakes. *See article in Mechanical Equipment Section for data.*

Drum Diameter—11".

Lining—Moulded type. Width 2¼". Thickness 3/16". Length 23 13/16" per wheel.

Clearance—.010" between drum and lining.

Hand Brake Adjustment:—See Service Brakes.

ENGINE CODE NOTE:—Consists of three letters stamped on Engine Number Plate to indicate original size of Cylinder Bore (first letter), Main Bearings (second letter), Crankpin & connecting rod bearings (third letter) as follows: 'A'—Standard, 'B'—.010" Undersize, 'C'—.010" Oversize, 'D'—.015" Oversize, 'E' .020" Oversize.

SERIAL NUMBER:—First number—R-309311 (3720), R-324111 (3820). Stamped on plate on right frame side member under engine hood.

ENGINE NUMBER:—1st No.—RE-77104(3820). Stamped on plate on right hand side of engine block.

ENGINE SPECIFICATIONS:—Type—6 cylinder, valve-in head. Twin Ignition type.

NOTE—3820 models use the 'Iso-thermal' fuel intake system (intake manifold cast in cylinder head and surrounded by cooling water for temp. control).

Bore—3⅜". Stroke—4⅜".

Displacement—234 cu. ins. **Rated HP.**—27.34.

Developed Horsepower—93 ('37), 105 ('38) at 3400 R.P.M.

Compression Ratio—5.67-1 (3720), 6.0-1 (3820).

Compression Pressure—Approximately 100-105 lbs. at cranking speed. All cylinders equal within 10 lbs.

Vacuum Reading—Steady reading of approximately 18-20" with engine idling at 7-9 M.P.H.

PISTONS:—Nash, aluminum alloy, Invar strut, split skirt type. See Engine Code Note above for original bore and piston sizes. **Length**—3⅞".

Weight—19⅛ ounces.

Removal—Pistons and rods removed from above.

Clearance—.0015-.002". See Fitting New Pistons.

Replacement Pistons:—Finished pistons furnished Std. and .001", .002", .003", .005", .010", .012", .015", .020" oversize. Semi-finished pistons .050" oversize.

Fitting New Pistons:—Use .002" feeler stock inserted between piston and cylinder wall on side opposite slot to check clearance. Pull required to withdraw feeler should be 10 lbs.

Installing Pistons:—Piston pin offset toward camshaft side of engine and trademark (within piston) toward front.

PISTON RINGS:—Two compression rings, two oil control rings per piston, all above pin.

Ring	Width	End Gap
Compression (All)	1/8"	.010"
Oil Control (#3—1937)	1/8"	.010"
Oil Control (#4—1937)	3/16"	.010"
Oil Control (All—1938)	5/32"	.010"

Replacement Rings:—Furnished .010", .020" oversize.

PISTON PIN: —Diameter—⅞". Length—2 51/64". Pin floats in piston and rod, retained by locking rings. Pin hole in piston offset toward camshaft side of engine, pin hole in rod bronze-bushed.

Pin Fit in Piston—Light push fit with piston heated to 200°F.

Pin Fit in Rod Bushing—.0001" or light push fit with both parts at normal temperature.

Replacement Pins:—Furn. 001", .002", .005" oversize.

CONNECTING ROD:—Length—8¾". Weight—36¼ ozs.

Upper Bearing (Piston Pin Bushing)—Bronze.

Crankpin Journal Diameter—2".

Lower Bearing—Removable steel-backed, babbitt-lined type. No shims. See Engine Code Note (above) for original bearing sizes.

Clearance—.002". **Sideplay** .004" Max.

Bearing Adjustment:—None (no shims). Replace bearings. Do not file rods or caps.

Replacement Bearings:—Furnished .010" undersize.

CRANKSHAFT:—7 bearing, integral counterweights.

Journal Diameters—2 31/64" all bearings.

Bearing Type—Interchangeable steel-backed, babbitt-lined type. No shims. See Engine Code Note (above) for original bearing sizes.

Clearance—.002".

Bearing Adjustment:—None (no shims). Replace bearings. Do not file bearing caps. Bearing upper halves can be 'rotated' out without removing crankshaft by using pin installed in oil hole in shaft and rotating shaft.

Replacement Bearings:—Furnished .010" undersize.

End Thrust:—Taken by center (#4) bearing. End-play .004". No adjustment (replace bearing).

CAMSHAFT:—Non-adjustable double-roller chain drive.

End Thrust:—Taken by front bearing. Replace front bearing to take up excessive endplay.

Timing Chain:—Double-roller chain. Width 9/16". Pitch ⅜". Length (3720—22½" or 60 links 3820—23¼" or 62 links).

Camshaft Setting:—Sprockets are marked. Mesh chain with sprockets turned so that marks are adjacent and in line with a straightedge across the shaft centers. Chain should be removed and installed endless. Use special pullers and pushers, keep sprockets lined up to avoid sidestrain on chain and sprockets.

VALVES:—	**Head Diameter**	**Seat Angle**	**Stem Clear.**
Intake	1¾"	45°	.003"
Exhaust	1 19/32"	45°	.003"

Tappet Clearance:—.008" (Intake '37), .015" (Exhaust '37—All valves '38), engine hot and idling. NOTE—On 1938 cars driven consistently at less than 50 M.P.H., intake valves can be set at .008".

Valve Timing:—See Camshaft Setting above.

LUBRICATION:—Pressure. Gear type oil pump located in crankcase.

Normal Oil Pressure:—25-35 lbs. at normal temp.

Oil Pressure Gauge:—King-Seeley Electric. K-S No. 6730 (dash unit, firt cars—ball type pointer), 7070 (dash unit, later cars—bar type pointer), No. 6125 (motor unit, all cars). This data for 3820 only.

See article in Mechanical Equipment Section for data.

Oil Pressure Relief Valve:—Located on oil pump cover. Operates at 30 lbs. Screw adjustment.

Crankcase Capacity:—7 quarts (refill).

COOLING SYSTEM:—Water Pump. Centrifugal, adjustable packing. Driven by generator extension shaft.

See article in Mechanical Equipment Section for data.

Removal—Drain radiator, disconnect hose and drive coupling, take out mounting screws in pump flange.

Thermostat:—Dole. In water outlet on cyl. head.

Setting—Thermostat opens at 160°F.

Water Capacity:—17 qts. (3720), 16 qts. (3820).

Drain Valves:—One only—at bottom of radiator.

CLUTCH:—Borg & Beck Mod. 10A7. Mod. #902 stamped on cover. Single plate, dry disc type.

See article in Mechanical Equipment Section for data.

Facings (37)—Moulded type, 2 required. Inside Diam. 6⅛". Outside Diam. 9⅞". Thickness ⅛".

Facings (38)—Molded-woven, 2 required. Inside Diam. 6". Outside Diam. 10". Thickness ⅛".

Adjustment—Free movement of clutch pedal must be ½-1½". Adjust by loosening transverse bolt in link directly below clutch pedal shaft and positioning pedal in slot. Clearance between pedal and toeboard should be ⅜". On cars with 'NoRol,' check operation whenever clutch adjusted and, if necessary, adjust as follows:

NoRol Adjustment—Loosen locknut and turn adjusting nut at rear end of connecting rod (at NoRol lever) in for later brake release, out for earlier.

Removal:—Remove transmission (see Transmission Removal below), remove clutch housing underpan, take out clutch mounting bolts evenly, remove assembly from below.

TRANSMISSION:—Own Make. Constant-mesh, synchromesh, helical gear (second and high), sliding helical gear (low and reverse).

See article in Mechanical Equipment Section for data.

Cruising Gear (Overdrive):—Warner Model AS6-R6 optional. In separate case at rear of transmission.

See article in Mechanical Equipment Section for data.

Vacuum Gear Shift (Transmission Control):—Evans Nash Vacuum type. Optional on Model 3820.

See article in Mechanical Equipment Section for data.

Removal:—Disconnect driveshaft. Disconnect shift linkage (on cars with Vacuum Gear Shift). Take off nuts on transmission mounting bolts, pull transmission straight back.

UNIVERSAL JOINTS:—Mechanics—Model 2C. Roller bearing type. 2 used.

See article in Mechanical Equipment Section for data.

REAR AXLE:—Own—Semi-floating, spiral bevel gear type with Hotchkiss drive.

See article in Mechanical Equipment Section for data.

Ratio—4 1/9 to 1 Std.

Removal:—Block up rear of car, remove wheels and axle shafts, disconnect brake lines and cables, shock absorber links, drive shaft at rear universal joint. Free axle from springs by disconnecting spring bolts, remove axle assembly from under car.

Axle Shaft Removal—Remove wheel, take out mounting screws in retainer, remove retainer, oil seal, brake backing plate, bearing adjusting shims. Use puller to remove shaft and bearing assembly.

Wheel Bearing Adjustment—Controlled by shims at flanged end of housing. To adjust, remove brake backing plate and add or remove shims. **Endplay—**.003-.006".

SHOCK ABSORBERS:—Nash (Delco or Gabriel design), double acting (3720), direct acting (3820).

See article in Mechanical Equipment Section for data.

STEERING:—Steering Gear—Gemmer Mod. 305. Worm- and Roller type with 'push-pull' adjustment.

See article in Mechanical Equipment Section for data.

Front Suspension:—Conventional 'I' beam front axle with Reverse-Elliott ends and semi-elliptic springs.

Kingpin Inclination—7° crosswise.

Camber—½-1½°. No adjustment.

Caster—2½° ('37), 1½° ('38). Shim adjustment. Install shims between spring and spring pad on axle.

Toe In—0-1/16". Adjust by loosening clamp bolt at right hand end of tie rod and turning rod in or out of end fitting.

Steering Shock Eliminator—Consists of rubber bumper mounted on underside of left frame siderail just in front of left front spring rear shackle. Adjust to give 1/16" clearance between spring and bumper with normal load.

BRAKES:—Bendix Duo-Servo, Single Anchor type or Lockheed type hydraulic brakes. Hand lever applies rear wheel service brakes. NoRol optional (3820).

See article in Mechanical Equipment Section for data.

Drum Diameter—10" (3720). 10 1/16" (3820).

Lining—Woven (primary), moulded (secondary). Width 2" ('37), 2 1/16" ('38). Thickness 3/16". Length per wheel 22 1/16" ('37), 22" ('38).

Clearance (Bendix)—.010" at heel & toe (each shoe)

Clearance (Lockheed)—.005" heel, .010" toe (each shoe).

Braking Power—53% front, 47% rear.

NoRol:—Optional. Consists of a clutch pedal controlled valve in the brake line by which brakes held 'on' when car stopped on up-grade until clutch is engaged.

See article in Mechanical Equipment Section for data.

Hand Brake:—See Service Brakes above.

ENGINE CODE NOTE:—Consists of three letters stamped above Engine Number Plate to indicate original size of Cylinder Bore (first letter), Main Bearings (second letter), Crankpin & connecting rod bearings (third letter) as follows: 'A'—Standard, 'B'—.010" Undersize, 'C'—.010" Oversize, 'D'—.015" Oversize, 'E'—.020" Oversize.

SERIAL NUMBER:—1st No. B-80031 ('37), B-86031 ('38). On plate on right frame side member under hood.

ENGINE NUMBER:—1st No. B-100640 ('38). Stamped on plate on right hand side of engine block.

ENGINE SPECIFICATIONS:—8 cylinder, valve-in-head, Twin-ignition type.
NOTE—3880 models use 'Iso-thermal' fuel intake system (Intake manifold cast in cylinder head and surrounded by cooling water for temp. control).
Bore—3⅛". Stroke—4¼".
Displacement—260.8 cu. ins. **Rated HP.**—31.25.
Developed HP.—105 ('37), 115 ('38) @ 3400 RPM.
Compression Ratio—5.46-1 ('37). 6.0-1 ('38).
Compression Pressure—Approx. 90 lb. ('37), 100-105 lb.('38) at cranking speed. All cyl. equal within 10 lb.
Vacuum Reading—Steady 18-20" idling at 7-9 MPH.

PISTONS:—Nash, aluminum alloy, Invar strut, split skirt type. See Engine Code Note above for original bore and piston sizes.
Removal—Pistons and rods removed from below.
Clearance—.0015-.002". See Fitting New Pistons.
Replacement Pistons:—Finished pistons furnished Std. and .001", .002", .003", .005", .010", .012",. 015", .020" oversize. Semi-finished pistons .050" oversize.
Fitting New Pistons:—Use .002" feeler stock inserted between piston and cylinder wall on side opposite slot to check clearance. Pull required to withdraw feeler should be 10 lbs.
Installing Pistons:—Piston pins offset toward camshaft side of engine and trademark (within piston) toward front.

PISTON RINGS:—Two compression rings, two oil control rings per piston, all above pin.

Ring	Width	End Gap
Compression (All)	1/8"	.010"
Oil Control (#3—1937)	1/8"	.010"
Oil Control (#4—1937)	3/16"	.010"
Oil Control (All—1938)	5/32"	.010"

Replacement Rings:—Furnished .010",. 020" oversize.

PISTON PIN:—Diameter—⅞". Length—2 9/16".
Pin floats in piston and rod, retained by locking rings. Pin hole in piston offset toward camshaft side of engine, pin hole in rod bronze-bushed.
Pin Fit in Piston—Light push fit (piston @ 200°F).
Pin Fit in Rod Bushing—.0001" or light push fit with both parts at normal temperature.
Replacement Pins:—Furn. .001", .002", .005" oversize.

CONNECTING ROD:—Length—8¾". Weight—34 ozs.
Upper Bearing (Piston Pin Bushing)—Bronze.
Crankpin Journal Diameter—2".
Lower Bearing—Removable steel-backed, babbitt-lined type. No shims. See Engine Code Note (above) for original bearing sizes.
Clearance—.002". **Sideplay** .004" Max.
Bearing Adjustment:—None (no shims). Replace bearings. Do not file rods or caps.
Replacement Bearings:—Furnished .010" undersize.

CRANKSHAFT:—9 bearing. Integral counterweights.
Journal Diameters—2 31/64" all bearings.
Bearing Type:—Interchangeable steel-backed, babbitt-lined type. No shims.
Clearance—.002".
Bearing Adjustment:—None (no shims). Replace bearings. Do not file bearing caps. Bearing upper halves can be 'rotated' out without removing crankshaft by using pin installed in oil hole in shaft and rotating shaft.
Replacement Bearings:—Furnished .010" undersize.
End Thrust:—Taken by center (#5) bearing. Endplay .004". No adjustment (replace bearing).

CAMSHAFT:—Non-adjustable roller chain drive.
Timing Chain:—Double-roller chain. Width 9/16". Pitch ⅜". Length 23¼" or 62 links.
Camshaft Setting:—Sprockets are marked. Mesh chain with sprockets turned so that marks are adjacent and in line with a straightedge across the shaft centers. Chain should be removed and installed endless. Use special pullers and pushers, keep sprockets lined up to avoid sidestrain on chain and sprockets.

VALVES:

	Head Diam.	Seat Angle	Stem Clearance
Intake	1 21/32"	45°	.003"
Exhaust	1 15/32"	45°	.003"

Tappet Clearance:—.008" (Intake '37), .015" (Exhaust '37—All valves '38), engine hot and idling. NOTE—On 1938 cars driven consistently at less than 50 M.P.H., intake valves can be set at .008".
Valve Timing:—See Camshaft Setting above.

LUBRICATION:—Pressure. Gear type oil pump located in crankcase.
Normal Oil Pressure:—25-35 lbs. at normal temp.
Oil Pressure Relief Valve:—Located on oil pump cover. Operates at 30 lbs. Adjustable by turning screw.
Crankcase Capacity:—7 quarts (refill).
Oil Pressure Gauge:—King-Seeley Electric. K-S No. 6730 (dash unit, first cars—ball type pointer), 7070 (dash unit, later cars—bar type pointer), No. 6125 (motor unit, all cars). This data for 3880 only.
See article in Mechanical Equipment Section.

COOLING SYSTEM:—Water Pump:—Centrifugal type, driven through flexible coupling by extension of generator armature shaft.
See article in Mechanical Equipment Section.
Removal—Drain radiator, disconnect hose and drive coupling, take out mounting screws in pump flange.
Thermostat:—Dole. In water outlet on cyl. head.
Setting—Thermostat opens at 160°F.
Water Capacity:—18 qts (3780), 17 qts. (3880).
Drain Valves—At bottom of radiator. Drain plug also located at lower left rear corner of engine block.

CLUTCH:—Borg & Beck Mod. 10A6. Mod. #883 stamped on cover. Single plate, dry disc type.
See article in Mechanical Equipment Section for data.
Facings:—Moulded-woven type. 2 required. Inside Diam. 6". Outside Diam. 10". Thickness ⅛".
NOTE—Woven facings used on 3780.
Adjustment—Free movement of clutch pedal must be ½-1½". Adjust by loosening transverse bolt in link directly behind pedal and above clutch pedal shaft and positioning pedal in slot. Clearance between pedal and toeboard should be ⅜". Check Starting Switch adjustment and 'NoRol' setting whenever clutch adjusted and adjust if necessary.
NoRol Adjustment—Loosen locknut and turn adjusting nut at rear end of connecting rod (at NoRol lever) in for later brake release, out for earlier release. Brakes should release just as clutch engages.
Starting Switch Adjustment—Starting switch lever should have ⅛" free movement. Adjust by turning lever stopscrew on side of switch case. Switch should close just after clutch is completely disengaged. Adjust by loosening two clampscrews attaching switch cable to lever on right end of clutch throw-out shaft, move clamp toward shaft for later starter engagement, out for earlier.
Removal:—Remove transmission (see Transmission Removal below), remove clutch housing underpan, take out clutch mounting bolts evenly, remove assembly from below.

TRANSMISSION:—Own Make. Constant-mesh, synchro-mesh, helical gear (second and high), sliding helical gear (low and reverse).
See article in Mechanical Equipment Section for data.
Cruising Gear (Overdrive):—Warner Model AS7-R1 (3780), AS6-R6 (3880). Optional equipment.
See article in Mechanical Equipment Section for data.
Vacuum Gear Shift (Transmission Control):—Evans Nash vacuum type. Optl. on Model 3880 only.
See article in Mechanical Equipment Section for data.
Removal:—Disconnect driveshaft. Disconnect shift linkage (on cars with Vacuum Gear Shift). Take off nuts on transmission mounting bolts, pull transmission straight back.

UNIVERSAL JOINTS:—Mechanics Model 3C. Roller bearing type. Two used.
See Article in Mechanical Equipment Section.

REAR AXLE:—Own—Semi-floating, spiral bevel gear type with Hotchkiss drive.
See article in Mechanical Equipment Section for data.
Ratio—4.1-1 Std.
Removal:—With axle shafts removed, drop driveshaft, remove carrier mounting bolts and remove assembly from car without removing housing.
Axle Shaft Removal—Remove wheel, take out mounting screws in retainer, remove retainer, oil seal, brake backing plate, bearing adjusting shims. Use puller to remove shaft and bearing assembly.
Wheel Bearing Adjustment—Controlled by shims at flanged end of housing. To adjust, remove brake backing plate and add or remove shims.
Endplay—.003-.006".

SHOCK ABSORBERS:—Nash (Delco or Gabriel design), double acting (3780), direct acting (3880).
See articles in Mechanical Equipment Section.

STEERING:—Steering Gear—Gemmer Mod. 335. Worm-and Roller type with 'push-pull' adjustment.
See article in Mechanical Equipment Section for data.
Front Suspension:—Conventional 'I' beam front axle with Reverse-Elliott ends and semi-elliptic springs.
Kingpin Inclination—7° crosswise.
Camber—½-1½°. No adjustment.
Caster—2° ('37), 1½° ('38). Shim adjustment. Install shims between spring and spring pad on axle.
Toe In—0-1/16". Adjust by loosening clamp bolt at right hand end of tie rod and turning rod in or out of end fitting.
Steering Shock Eliminator—Consists of rubber bumper mounted on underside of left frame siderail just in front of left front spring rear shackle. Adjust to give 1/16" clearance between spring and bumper with normal load.

BRAKES:—Service. Bendix Duo-servo, Single Anchor type, or Lockheed type, Hydraulic brakes. Hand lever applies rear wheel service brakes. NoRol optional equipment on 3880 only.
See article in Mechanical Equipment Section for data.
Drum Diameter—11" ('37), 11 1/16" ('38).
Lining—Woven (prim. '38), Moulded (all '37—secondary '38). Width 2¼" ('37), 2 1/16" ('38). Thickness 3/16". Length per wheel 23 13/16" ('37).
Clearance (Bendix)—.010" at heel & toe (each shoe).
Clearance (Lockheed)—.005" heel, .010" toe (each shoe).
Braking Power—53% front, 47% rear.
NoRol:—Optional. Consists of a clutch pedal controlled valve in the brake line by which brakes held 'on' when car stopped on up-grade until clutch is engaged.
See article in Mechanical Equipment Section for data.
Hand Brake:—See Service Brakes above.

NOTE:—Engine hood hinged at cowl and lifts from forward end. Hood latch handle located at lower edge of radiator grille (safety catch at top of grille).

ENGINE CODE NOTE:—Consists of three letters stamped on Engine Number Plate to indicate original size of Cylinder Bore (first letter), Main Bearings (second letter), Crankpin & connecting rod bearings (third letter) as follows: 'A'—Standard, 'B'—.010" Undersize, 'C'—.010" Oversize, 'D'—.015" Oversize, 'E' .020" Oversize.

SERIAL NUMBER:—1st number R-331400. Stamped on plate on right frame side member under hood.

ENGINE NUMBER:—1st number E-33900 (See Note). On boss on right front upper corner of block.
Engine No. Change Note—Beginning with Serial No. R-331967, engine numbering changed so that number is 500 less than serial number on same car (Serial No. R-331967, Engine No. E-331467).

ENGINE SPECIFICATIONS:—6 cylinder, valve-in-head, Twin Ignition type. NOTE—'Iso-thermal' fuel intake system used (intake manifold cast in cylinder head—water cooled for temp. control).
Bore—3⅜". **Stroke**—4⅜".
Displacement—234.8 cu. ins. **Rated HP.**—27.34.
Developed Horsepower—105 HP. at 3400 R.P.M.
Compression Ratio—6.0-1 cast-iron head.
Compression Pressure—125 lbs. @ 350 RPM. or approx. 100-105 lbs. at cranking speed (160 RPM).
Vacuum Reading—18-20" steady idling at 7-8 MPH.

PISTONS:—Nelson-Bohnalite, aluminum alloy, Invar strut, tin plated, split skirt type. See Engine Code Note above for original bore and piston sizes.
Weight—19¼ ounces. **Length**—3⅞".
Removal—Pistons and rods removed from above.
Clearance—Top .027-.030". Skirt .001-.002".

Replacement Pistons:—Std. & .001", .002", .003", .005", .010", .012", .015", .020" O.S. Semi-finished .050" O.S.

Fitting New Pistons:—Insert .002" feeler between piston and cylinder wall on side opposite slot. Pull to withdraw feeler should be 10 lbs.

Installing Pistons:—Pin offset to camshaft side of engine. Trademark (within piston) to front.

PISTON RINGS:—Two compression rings, two oil control rings per piston, all above pin.

Ring	Width	End Gap	Wall Thickness
Compression	.123-.124"	.010-.020"	.150"
Oil Control	.1545-.1550"	.010-.018"	.150"

Replacement Rings:—Furnished .010", .020" oversize.

PISTON PIN:—**Diameter** .8745-.8748". **Length** 2.799-2.809". Floating type. Retained by locking rings. Pin hole in piston offset to camshaft.
Pin Fit in Piston—Light push fit (piston @ 200°F.)
Pin Fit in Rod Bushing—Select fit to .0001" or light push fit at normal temperature.

Replacement Pins:—Furn. .001", .002", .005" oversize.

CONNECTING ROD:—**Length**—8¾". **Weight**—36¼ ozs.
Upper Bearing (Piston Pin Bushing)—Bronze.
Crankpin Journal Diameter—2.0015-2.0025".
Lower Bearing—Removable steel-backed, babbitt-lined type. No shims. See Engine Code Note (above) for original bearing sizes.
Clearance—.0015-.0025". **Sideplay**—.008-.012".

Bearing Adjustment:—None (no shims). Replace bearings. Do not file rods or caps.

Replacement Bearings:—Furnished .010" undersize.

CRANKSHAFT:—7 bearing, 4 counterweights.
Journal Diameters—2 31/64" all bearings.
Bearing Type—Interchangeable steel-backed, babbitt-lined. No shims. See Engine Code Note (above) for original bearing sizes. **Clearance**—.002".
Bearing Adjustment:—None (no shims). Replace bearings. Do not file caps. Upper halves can be 'rotated' out without removing crankshaft by using pin in oil hole in shaft, turn shaft.
Replacement Bearings:—Furnished .010" undersize.
End Thrust:—At #4 bearing. **Endplay**—.004".

CAMSHAFT:—Non-adjustable double-roller chain drive.
End Thrust:—Taken by front bearing. Replace bearing to take up excessive endplay.
Timing Chain:—Whitney No. 49205. Width 9/16". Pitch ⅜". Length 60 links or 22½".
Camshaft Setting:—Sprockets marked. Mesh chain with sprocket marks adjacent and in line with a straightedge across the shaft centers.

VALVES:

	Head Diameter	Stem Diameter	Length
Intake	1 3/4"	.3715-.3725"	5 17/32"
Exhaust	1 19/32"	.3715-.3725"	5 17/32"

	Seat Angle	Lift	Stem Clearance
All Valves	45°	11/32"	.002-.004"

Tappet Clearance:—.008" Int., (.015" for high speed operation), .015" Exh. Set with engine warm and idling.
Valve Guides:—Press fit in head.
Valve Springs:—Double springs on all valves. Spring free length 1 21/32" (inner), 2" (outer).

	Inner Spring		Outer Spring	
	Pressure	Length	Pressure	Length
Closed	19-23 lbs.	1 3/8"	35½-40½ lbs.	1 11/16"
Open	48-54 lbs.	1 1/32"	92-98 lbs.	1 11/32"

Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 24½° BTDC. Close 70½°ALDC.
Exhaust Valves—Open 49½° BLDC. Close 5° ATDC.
Valve Timing Check—With regular running tappet clearance of .015", Exhaust valve should close with piston 5° or .0104" after top dead center.
Motor Gauge—Weidenhoff Adapter #113, Rod #37.

LUBRICATION:—Gear type pump in crankcase.
Normal Oil Pressure:—30 lbs. at 20 M.P.H.
Oil Pressure Relief Valve:—On oil pump cover. Opens at 30 lbs. Screw adjustment.
Oil Pressure Gauge:—King-Seeley Electric. K-S No. 7270 (dash unit), 6125 (engine unit).
See article in Mechanical Equipment Section for data.
Crankcase Capacity:—7 qts. (6 qts. refill).

COOLING SYSTEM:—**Capacity**—16 quarts.
Water Pump:—Centrifugal, adjustable packing type. Driven by generator extension shaft.
See article in Mechanical Equipment Section for data.
Removal—Drain radiator, disconnect hose and drive coupling, take out mounting screws in pump flange.
Thermostat:—Dole. In water outlet on cyl. head.
Setting—Starts to open at 160°F.
Temperature Gauge:—King-Seeley Electric. K-S No. 7275 (dash unit), 7000 (engine unit).
See article in Mechanical Equipment Section for data.
NOTE—Gauge reads '212' with ignition 'Off'.

CLUTCH:—**Borg & Beck Model 10A7.** #902 or #934 stamped on cover. Single plate, dry disc type.
See article in Mechanical Equipment Section for data.
Facings—Woven, 2 required. Inside Diam. 6". Outside Diam. 10". Thickness .125".
Adjustment:—Pedal free movement ½-1¼" (loosen transverse bolt in link below pedal shaft, position pedal in slot). Pedal toeboard clearance ⅜". Check 'No-Rol' operation (if car so equipped).
Removal:—Remove transmission (see below), clutch housing underpan, clutch cover mounting bolts (release tension evenly), lower assembly out.

TRANSMISSION:—**Own Make.** Constant-mesh (all speeds), synchro-mesh (second & high), all helical gear.
Cruising Gear (Overdrive):—Warner Model AS6-R6 optional. In separate case at rear of transmission.
Transmission Control:—Mechanical type steering column mounted gear shift, optional.
See articles in Mechanical Equipment Section for data.
Removal:—Disconnect driveshaft. Disconnect shift linkage (cars with steering column shift). Remove transmission mounting stud nuts and lift out.

UNIVERSAL JOINTS:—**Mechanics.** Type 2C. Roller bearing type. 2 used.
See article in Mechanical Equipment Section for data.

REAR AXLE:—**Own Make.** Semi-floating, hypoid gear type with Hotchkiss drive (spiral bevel on Coupe).
See article in Mechanical Equipment Section for data.
Ratio—4.1-1 Std. 4 4/9-1 Optl.
Backlash—.005-.007". Shim adjustment.
Removal:—Block up rear of car, remove wheel and drum assemblies, axle shafts, disconnect brake lines and cables, shock absorbers, drive shaft at rear universal. Free axle from springs by disconnecting spring bolts, withdraw axle.
Axle Shaft Removal—Remove wheel and drum, take out retainer mounting bolt nuts, remove retainer, oil seal, brake backing plate, bearing adjusting shims. Pull shaft and bearing out.
Wheel Bearing Adjustment—Shims at flanged end of housing. To adjust, remove brake backing plate, add or remove shims. **Endplay**—.004-.006".

SHOCK ABSORBERS:—**Delco.** Front 1112-P, Rear 1117-DD. Direct acting, hydraulic type. 1723-L, M, N, P (double acting) Export.
See articles in Mechanical Equipment Section for data.

STEERING:—**Steering Gear**—Gemmer Model 305. Worm-and-Roller type with 'push-pull' adjustment.
See article in Mechanical Equipment Section for data.
Front Suspension:—Conventional 'I' beam front axle with Reverse-Elliott end and semi-elliptic springs.
Kingpin Inclination—7° crosswise.
Camber—½-1½° and equal at both wheels.
Caster—1½°. Shim adjustment. Install shims (furnished in 1½° and 3° angles) between spring and spring pad on axle.
Toe In—0-1/16". Adjust by loosening clamp bolt at right end of tie rod and turning tie rod.
Steering Shock Eliminator—Consists of spring and rubber bumper bracket at rear of left front spring. Adjust lower nut to give ⅛" clearance between upper rubber cushion and frame. Adjust spring cushion (ahead of spring rear shackle) to 1/16" clearance between cushion and spring.

BRAKES:—**Service.** Bendix hydraulic, duo-servo, single anchor type with eccentric adjustment. Hand lever applies rear service brakes.
See article in Mechanical Equipment Section for data.
Drums—Cast-iron. Diameter 10 1/16".
Lining—Moulded. Width 2". Thickness 7/32". Length per wheel 22".
Clearance—.010" at heel and toe of each shoe.
Braking Power—53% front wheels, 47% rear.
Hand Brake:—See Service Brakes.
No-Rol:—Optl. *See Mechanical Equipment Section.*

NOTE:—Engine hood hinged at cowl and lifts from forward end. Hood latch handle located at lower edge of radiator grille (safety catch at top of grille).

ENGINE CODE NOTE:—Consists of three letters stamped on Engine Number Plate to indicate original size of Cylinder Bore (first letter), Main Bearings (second letter), Crankpin & connecting rod bearings (third letter) as follows: 'A'—Standard, 'B'—.010" Undersize, 'C'—.010" Oversize, 'D'—.015" Oversize, 'E' .020" Oversize.

SERIAL NUMBER:—1st number B-89000. Stamped on plate on right frame side member under hood.

ENGINE NUMBER:—Stamped on boss on right front upper corner of block.
Engine No. Change Note—Beginning with Serial No. B-103201, engine numbering changed so that number is 500 less than serial number on same car (Serial No. B-103201, Engine No. B-102701).

ENGINE SPECIFICATIONS:—8 cylinder, valve-in-head, Twin Ignition type. NOTE—'Iso-thermal' fuel intake system used (intake manifold cast in cylinder head—water cooled for temp. control).
Bore—3⅛". **Stroke**—4¼".
Displacement—260.8 cu. ins. **Rated HP**—31.25.
Developed Horsepower—115 HP. at 3400 R.P.M.
Compression Ratio—6.0-1 cast-iron head.
Compression Pressure—110 lbs. at 350 RPM. or approx. 110 lbs. at cranking speed (160 RPM.).
Vacuum Reading—Steady 18-20" idling at 7-8 MPH.

PISTONS:—Nelson-Bohnalite, aluminum alloy, Invar strut, tin plated, split skirt type. See Engine Code Note above for original bore and piston sizes.
Weight—16 ounces. **Length**—3 11/16".
Removal—Pistons and rods remove from below.
Clearance—Top .018-.022". Skirt .001-.002".
Replacement Pistons:—Std. & .001", .002", .003", .005", .010", .012", .015", .020" O.S. Semi-finished .050" O.S.
Fitting New Pistons:—Insert .002" feeler between piston and cylinder wall on side opposite slot. Pull to withdraw feeler should be 10 lbs.
Installing Pistons:—Pin offset to camshaft side of engine. Trademark (within piston) to front.

PISTON RINGS:—Two compression rings, two oil control rings per piston, all above pin.

Ring	Width	End Gap	Wall Thickness
Compression	.1235-.124"	.010-.015"	.130"
Oil Cont. (#3)	.1235-.1240"	.010-.018"	.140"
Oil Cont. (#4)	.1860-.1865"	.010-.018"	.140"

Replacement Rings:—Furnished .010", .020" oversize.

PISTON PIN:—**Diameter**—.8745-.8748". **Length**—2.564-2.576". Floating type. Retained by locking rings. Pin hole in piston offset toward camshaft.
Pin Fit in Piston—Light push fit (piston @ 200°F.)
Pin Fit in Rod Bushing—Select fit to .0001" or light push fit at normal temperature.
Replacement Pins:—Furn. .001", .002", .005" oversize.

CONNECTING ROD:—**Length**—8¾". **Weight**—34 ozs.
Upper Bearing (Piston Pin Bushing)—Bronze.
Crankpin Journal Diameter—2.0015-2.0025".
Lower Bearing—Removable steel-backed, babbitt-lined type. No shims. See Engine Code Note (above) for original bearing sizes.
Clearance—.0015-.0025". **Sideplay**—.008-.012".
Bearing Adjustment:—None (no shims). Replace bearings. Do not file rods or caps.
Replacement Bearings:—Furnished .010" undersize.

CRANKSHAFT:—Nine bearing type.
Journal Diameters—2 31/64" all bearings.
Bearing Type—Interchangeable steel-backed, babbitt-lined. No shims. See Engine Code Note (above) for original bearing sizes. **Clearance**—.002".
Bearing Adjustment:—None (no shims). Replace bearings. Do not file caps. Upper halves can be 'rotated' out without removing crankshaft by using pin in oil hole in shaft, turn shaft.
Replacement Bearings:—Furnished .010" undersize.
End Thrust:—At #5 bearing. **Endplay**—.004".

CAMSHAFT:—Non-adjustable double-roller chain drive.
Timing Chain:—Diamond. Width 9/16". Pitch ⅜". Length 62 links or 23¼".
Camshaft Setting:—Sprockets marked. Mesh chain with sprocket marks adjacent and in line with a straightedge across the shaft centers.

VALVES:

	Head Diameter	Stem Diameter	Length
Intake	1 21/32"	.3715-.3725"	5½"
Exhaust	1 15/32"	.3715-.3725"	5½"

	Seat Angle	Lift	Stem Clearance
All Valves	45°	11/32"	.002-.004"

Tappet Clearance:—.008" Int., (.015" for high speed operation), .015" Exh. Set with engine warm and idling.
Valve Guides:—Press fit in head.
Valve Springs:—Double springs on all valves. Spring free length 1 21/32" (inner), 2" (outer).

	Inner Spring		Outer Spring	
	Pressure	Length	Pressure	Length
Closed	19-23 lbs.	1 3/8"	35½-40½ lbs.	1 11/16"
Open	48-54 lbs.	1 1/32"	92-98 lbs.	1 11/32"

Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 20° BTDC. Close 74° ALDC.
Exhaust Valves—Open 45° BLDC. Close 10° ATDC.
Valve Timing Check—With regular running tappet clearance of .015", Exhaust valve should close with piston 10° or .0400" after top dead center.
Motor Gauge—Weidenhoff Adapter #113, Rod #37.

LUBRICATION:—Gear type pump in crankcase.
Normal Oil Pressure:—30 lbs. at 20 M.P.H.
Oil Pressure Relief Valve:—On oil pump cover. Opens at 30 lbs. Screw adjustment.
Oil Pressure Gauge:—King-Seeley Electric. K-S No. 7270 (dash unit), 6125 (engine unit).
See article in Mechanical Equipment Section for data.
Crankcase Capacity:—7 qts. (dry or refill).

COOLING SYSTEM:—**Capacity**—17 quarts.
Water Pump:—Centrifugal, adjustable packing type. Driven by generator extension shaft.
See article in Mechanical Equipment Section for data.
Removal—Drain radiator, disconnect hose and drive coupling, take out mounting screws in pump flange.
Thermostat:—Dole. In water outlet on cyl. head.
Setting—Starts to open at 160°F.
Temperature Gauge:—King-Seeley Electric. K-S No. 7275 (dash unit), 7000 (engine unit).
See article in Mechanical Equipment Section for data.
NOTE—Gauge reads '212' with ignition 'Off'.

CLUTCH:—**Borg & Beck Model 10A7.** #919 stamped on cover. Single plate, dry disc type.
See article in Mechanical Equipment Section for data.
Facings—Woven, 2 required. Inside Diam. 6". Outside Diam. 10". Thickness .125".
Adjustment:—Pedal free movement ½-1¼". (loosen transverse bolt in link below pedal shaft, position pedal in slot). Pedal toeboard clearance ⅜". Check Starting Switch adjustment (below) and 'No-Rol' (if car so equipped).
Starting Switch Adjustment—Starting switch lever should have ⅛" free movement. Adjust by turning lever stopscrew on side of switch case. Switch should close just after clutch is completely disengaged. Adjust by loosening two clampscrews attaching switch cable to lever on right end of clutch throw-out shaft, move clamp toward shaft for later starter engagement, out for earlier.
Removal:—Remove transmission (see below), clutch housing underpan, clutch cover mounting bolts (release tension evenly), lower assembly out.

TRANSMISSION:—**Own Make.** Constant-mesh (all speeds), synchro-mesh (second & high), all helical gear.
Cruising Gear (Overdrive):—Warner Model AS6-R6 standard. In separate case at rear of transmission.
Transmission Control:—Mechanical type steering column mounted gear shift, optional.
See articles in Mechanical Equipment Section for data.
Removal:—Disconnect driveshaft. Disconnect shift linkage (cars with steering column shift). Remove transmission mounting stud nuts and lift out.

UNIVERSAL JOINTS:—**Mechanics.** Type 3C. Roller bearing type. 2 used.
See article in Mechanical Equipment Section for data.

REAR AXLE:—**Own Make.** Semi-floating, hypoid gear type with Hotchkiss drive (spiral bevel on Coupe).
See article in Mechanical Equipment Section for data.
Ratio—4.1-1 standard
Backlash—.005-.007". Screw Adjustment.
Removal:—Block up rear of car, remove wheel and drum assemblies, axle shafts, disconnect brake lines and cables, shock absorbers, drive shaft at rear universal. Free axle from springs by disconnecting spring bolts, withdraw axle.
Axle Shaft Removal—Remove wheel and drum, take out retainer mounting bolt nuts, remove retainer, oil seal, brake backing plate, bearing adjusting shims. Pull shaft and bearing out.
Wheel Bearing Adjustment—Shims at flanged end of housing. To adjust, remove brake backing plate, add or remove shims. **Endplay**—.004-.006".

SHOCK ABSORBERS:—**Delco** 1112-M (front), 1117-DD (rear). Direct acting, hydraulic type.
Export Note—Double acting 1723-L, M, N, P used.
See article in Mechanical Equipment Section for data.

STEERING:—**Steering Gear**—Gemmer Model 335. Worm-and-Roller type with 'push-pull' adjustment.
See article in Mechanical Equipment Section for data.
Front Suspension:—Conventional 'I' beam front axle with Reverse-Elliott ends and semi-elliptic springs.
Kingpin Inclination—7° crosswise.
Camber—½-1½° and equal at both wheels.
Caster—1½°. Shim adjustment. Install shims (furnished in 1½° and 3° angles) between spring and spring pad on axle.
Toe In—0-1/16". Adjust by loosening clamp bolt at right end of tie rod and turning tie rod.
Steering Shock Eliminator—Consists of spring and rubber bumper bracket at rear of left front spring. Adjust lower nut to give ⅛" clearance between upper rubber cushion and frame. Adjust spring cushion (ahead of spring rear shackle) to 1/16" clearance between cushion and spring.

BRAKES:—**Service.** Bendix hydraulic, duo-servo, single anchor type with eccentric adjustment. Hand lever applies rear service brakes.
See article in Mechanical Equipment Section for data.
Drums—Cast-iron. Diameter 11 1/16".
Lining—Moulded. Width 2¼". Thickness 7/32". Length per wheel 24".
Clearance—.010" at heel and toe of each shoe.
Braking Power—53% front wheels, 47% rear.
Hand Brake:—See Service Brakes.
No-Rol:—Optl. *See Mechanical Equipment Section.*

ENGINE CODE NOTE:—Consists of three letters stamped on Engine Number Plate to indicate original size of Cylinder Bore (first letter), Main Bearings (second letter), Crankpin & Connecting Rod Bearings (third letter) as follows: 'A'—Standard, 'B'—.010" Undersize, 'C' .010" Oversize, 'D'—.015" Oversize, 'E'—.020" Oversize.

SERIAL NUMBER:—First number H-1001 & L-50781 ('37), H-10501 & L-106281 ('38). Stamped on plate on right frame side member under engine hood.

ENGINE NUMBER:—1st number—('38) HE-10510 & LE-107912. Stamped on plate on right hand side of engine block.

ENGINE SPECIFICATIONS:—Own 'Monitor Sealed' motor. Six cylinder, 'L' head. Cylinders cast enbloc. No intake manifold used, intake passage formed within head and block castings.

Bore—3⅜". Stroke—4⅜".

Displacement—234.8 cubic inches.

Rated Horsepower—27.34 (SAE).

Developed HP.—90 ('37), 95 ('38) @ 3400 RPM.

Compression Ratio—5.61-1 ('37). 5.83-1 ('38).

Compression Pressure—Approximately 100 lbs. at cranking speed. Cylinders must be equal within 10 lbs.

Vacuum Reading—Steady reading of approximately 18-20" with engine idling at 7-9 M.P.H.

PISTONS:—Nash, aluminum alloy, Invar strut, split skirt type. See Engine Code Note above for original bore and piston sizes.

Removal—Pistons and rods removed from above.

Clearance—.0015-.002". See Fitting New Pistons.

Replacement Pistons:—Finished pistons furnished Std. and .001", .002", .003", .005", .010", .012", .015", .020" oversize. Semi-finished pistons .050" oversize.

Fitting New Pistons:—Use .002" feeler stock inserted between piston and cylinder wall on side opposite slot to check clearance. Pull required to withdraw feeler should be 10 lbs.

Installing Pistons:—Piston pin offset toward camshaft side of engine and trademark (within piston) toward front.

PISTON RINGS:—Two compression rings, two oil control rings per piston, all above pin.

Ring	Width	End Gap
Compression (All)	1/8"	.010"
Oil Control (#3—3710)	3/16"	.010"
Oil Control (#4—3710)	5/32"	.010"
Oil Control (All—3810)	5/32"	.010"

Replacement Rings:—Rings furnished .010", .020" oversize.

PISTON PIN:—Diameter—⅞". Pin floats in piston and rod, retained by locking rings. Pin hole in piston offset toward camshaft side of engine, pin hole in rod bronze-bushed.

Pin Fit in Piston—Light push fit with piston heated to 200°F.

Pin Fit in Rod Bushing—.0001" or light push fit with piston and rod cold.

Replacement Pins:—Furnished .001", .002", .005" oversize.

CONNECTING ROD:—Length—8¾" (center-to-center).

Upper Bearing (Piston Pin Bushing)—Bronze.

Crankpin Journal Diameter—2".

Lower Bearing—Removable, steel-backed, babbitt-lined type. No shims. See Engine Code Note (above) for original bearing sizes.

Clearance—.002". **Sideplay**—.004" max.

Bearing Adjustment:—None (no shims). Replace bearings. Do not file rods or caps.

Replacement Bearings:—Furnished .010" undersize.

CRANKSHAFT:—7 bearing. Integral counterweights.

Journal Diameters—2 31/64" all bearings.

Bearing Type—Interchangeable steel-backed, babbitt-lined type. No shims.

Clearance—.002".

Bearing Adjustment:—None (no shims). Replace bearings. Do not file bearing caps. Bearing upper halves can be 'rotated' out without removing crankshaft by using pin installed in oil hole in shaft and rotating shaft.

Replacement Bearings:—Furnished .010" undersize.

End Thrust:—Taken by center (#4) bearing. Endplay .004". No adjustment (replace bearing).

CAMSHAFT:—6 bearing. Non-adjustable chain drive.

End Thrust:—Taken by front bearing (shoulder formed on shaft behind bearing, and shoulder in front of bearing formed by sprocket hub when bolted on camshaft). Adjusted by replacing bearing.

Timing Chain:—Double-roller chain. Width 9/16". Pitch ¼". Length (3710—22½" or 60 links, 3810—23¼" or 62 links).

Camshaft Setting:—Sprockets are marked. Mesh chain with sprockets turned so that marks are adjacent and in line with a straightedge across the shaft centers. Install chain endless with camshaft sprocket off engine.

VALVES:—

	Head Diameter	Seat Angle	Stem Clear.
Intake	1 21/32"	45°	.003"
Exhaust	1 17/32"	45°	.003"

Tappet Clearance—.015" all valves with engine hot or cold.

Valve Timing:—See Camshaft Setting above.

LUBRICATION:—Pressure. Gear type oil pump located in crankcase.

Normal Oil Pressure:—25-35 lbs. at normal temp.

Oil Pressure Relief Valve:—Located on oil pump. Operates at 30 lbs. Adjustable by turning screw.

Crankcase Capacity—6 qts. (refill).

Oil Pressure Gauge:—King-Seeley Electric. K-S No. 6730 (dash unit, first cars—ball type pointer), 7070 (dash unit, later cars—bar type pointer), No. 6125 (motor unit, all cars).

See article in Mechanical Equipment Section for data.

COOLING SYSTEM:—Water Pump. Centrifugal type with adjustable packing. Impeller driven through flexible coupling by extension of generator shaft.

See article in Mechanical Equipment Section for data.

Removal—Drain radiator, disconnect hose and drive coupling, take out mounting screws in pump flange.

Thermostat:—Dole. Located in water outlet elbow on cylinder head.

Setting—Thermostat opens at 160°F.

Water Capacity:—20 quarts.

Drain Valves:—One only—at bottom of radiator.

CLUTCH:—Borg & Beck Model 9A6. Model No. 906 stamped on cover. Single plate, dry disc type.

See article in Mechanical Equipment Section for data.

Facings—Moulded-Woven type, 2 required. Inside Diam. 5⅝". Outside Diam. 9¼". Thickness ⅛".

NOTE—Woven facings used on Model 3710.

Adjustment—Free movement of clutch pedal must be ½-1½". Adjust by loosening transverse bolt in slot below clutch pedal shaft and positioning pedal in slot. Clearance between pedal and toeboard should be ⅜". Check 'NoRol' setting whenever clutch adjusted and adjust if necessary.

NoRol Adjustment—Loosen locknut and turn adjusting nut at rear end of connecting rod (at NoRol lever) in for later brake release, out for earlier release. Brakes should release just as clutch engages.

Removal:—Remove transmission (see Transmission Removal below), remove clutch housing underpan, take out clutch mounting bolts evenly, remove assembly from below.

TRANSMISSION:—Own Make. Constant-mesh, synchro-mesh, helical gear (second and high), sliding helical gear (low and reverse).

See article in Mechanical Equipment Section for data.

Cruising Gear (Overdrive):—Warner Model AS2-R6 (3710), AS6-R6 (3810) optional.

See article in Mechanical Equipment Section for data.

Vacuum Gear Shift (Transmission Control):—Evans Nash vacuum type. Optional on Model 3810.

See article in Mechanical Equipment Section for data.

Removal:—Disconnect drive shaft. Disconnect shift linkage (on cars with Vacuum Gear Shift). Take off nuts on transmission mounting bolts, pull transmission straight back.

UNIVERSAL JOINTS:—Mechanics—Model 2C. Roller bearing type. 2 used.

See article in Mechanical Equipment Section for data.

REAR AXLE:—Own—Semi-floating, spiral bevel gear type with Hotchkiss drive.

See article in Mechanical Equipment Section for data.

Ratio—4 1/9-1 Standard.

Removal:—Block up rear of car, remove wheels and axle shafts, disconnect brake lines and cables, shock absorber links, drive shaft at rear universal joint. Free axle from springs by disconnecting spring bolts, remove axle assembly from under car.

Axle Shaft Removal—Remove wheels, take out mounting screws in retainer, remove retainer, oil seal, brake backing plate, bearing adjusting shims. Use puller to remove shaft and bearing assembly.

Wheel Bearing Adjustment—Controlled by shims at flanged end of housing. To adjust, remove brake backing plate and add or remove shims.

Endplay—.003-.006".

SHOCK ABSORBERS:—Nash (Delco or Gabriel design), double acting (3710), direct acting (3810).

See article in Mechanical Equipment Section for data.

STEERING:—Steering Gear—Gemmer Model 305. Worm-and-Roller type with 'push-pull' adjustment.

See article in Mechanical Equipment Section for data.

Front Suspension:—Conventional 'I' beam front axle with Reverse-Elliott ends and semi-elliptic springs.

Kingpin Inclination—7° crosswise.

Camber—½-1½°. No adjustment.

Caster—2½° ('37), 1½° ('38). Shim adjustment. Install shims between spring and spring pad on axle.

Toe In—0-1/16". Adjust by loosening clamp bolt at right hand end of tie rod and turning rod in or out of end fitting.

Steering Shock Eliminator—Consists of rubber bumper mounted on underside of left frame siderail just in front of left front spring shackle. Adjust to give 1/16" clearance between spring and bumper with normal load.

BRAKES:—Service. Bendix Duo-Servo, Single Anchor type, or Lockheed type, Hydraulic brakes. Hand lever applies rear wheel service brakes. NoRol optional equipment.

See article in Mechanical Equipment Section for data.

Drum Diameter—10" ('37), 10 1/16" ('38).

Lining—Woven (primary '38), Moulded (all '37—secondary '38). Width 2". Thickness 3/16". Length per wheel 22 1/16" ('37).

Clearance (Bendix)—.010" at heel & toe (each shoe).

Clearance (Lockheed)—.005" heel, .010" toe (each shoe).

Braking Power—53% front, 47% rear.

NoRol:—Optional. Consists of a clutch pedal controlled valve in the brake line by which brakes held 'on' when car stopped on up-grade until clutch is engaged.

See article in Mechanical Equipment Section for data.

Hand Brake:—See Service Brakes above.

NOTE:—Engine hood hinged at cowl and lifts from forward end. Hood latch handle located at lower edge of radiator grille (safety catch at top of grille).

ENGINE CODE NOTE:—Consists of three letters stamped on Engine Number Plate to indicate original size of Cylinder Bore (first letter), Main Bearings (second letter), Crankpin & Connecting rod bearings (third letter) as follows: 'A'—Standard, 'B'—.010" Undersize, 'C'—.010" Oversize, 'D'—.015" Oversize, 'E' .020" Oversize.

SERIAL NUMBER:—1st number H-19450. Stamped on plate on right frame side member under hood.

ENGINE NUMBER:—1st number HE-18950. Stamped on boss on upper left hand side of engine block above front water jacket cover plate. NOTE—Engine No. for each car is 500 less than serial number.

ENGINE SPECIFICATIONS:—Own Make. 6 cylinder, 'L' head type. Cylinders cast enbloc. No intake manifold used, intake passage formed within head and block castings.
Bore—3⅜". **Stroke**—4⅜".
Displacement—234.8 cu ins. **Rated HP.**—27.34.
Developed Horsepower—99 HP. at 3400 R.P.M.
Compression Ratio—6.3-1 cast-iron head.
Compression Pressure—110 lbs. at cranking speed (160 R.P.M.).
Vacuum Reading—18-20" steady idling at 7-8 MPH.

PISTONS:—Nelson-Bohnalite, aluminum alloy, Invar strut, tin plated, split skirt type. See Engine Code Note above for original bore and piston sizes.
Weight—19¼ ounces. **Length**—3⅞".
Removal—Pistons and rods removed from above.
Clearance—Top .027-.030". Skirt .001-.002".

Replacement Pistons:—Std. & .001", .002", .003", .005", .010", .012", .015", .020" O.S. Semi-finished .050" O.S.

Fitting New Pistons:—Insert .002" feeler between piston and cylinder wall on side opposite slot. Pull to withdraw feeler should be 10 lbs.

Installing Pistons:—Pin offset to camshaft side of engine. Trademark (within piston) to front.

PISTON RINGS:—Two compression rings, two oil control rings per piston, all above pin.

Ring	Width	End Gap	Wall Thickness
Compression	.123-.124"	.010-.020"	.150"
Oil Control	.1545-.1550"	.010-.018"	.150"

Replacement Rings:—Furnished .010", .020" oversize.

PISTON PIN:—Diameter .8745-.8748". **Length** 2.799-2.809". Floating type. Retained by locking rings. Pin hole in piston offset to camshaft.
Pin Fit in Piston—Light push fit (piston at 200°F).
Pin Fit in Rod Bushing—Select fit to .0001" or light push fit at normal temperature.

Replacement Pins:—Furn. 001", .002", .005" oversize.

CONNECTING ROD:—Length—8¾". **Weight**—36¼ ozs.
Upper Bearing (Piston Pin Bushing)—Bronze.
Crankpin Journal Diameter—2.0015-2.0025".
Lower Bearing—Removable steel-backed, babbitt-lined type. No shims. See Engine Code Note (above) for original bearing sizes.
Clearance—.0015-.0025". **Sideplay**—.008-.012".

Bearing Adjustment:—None (no shims). Replace bearings. Do not file rods or caps.

Replacement Bearings:—Furnished .010" undersize.

CRANKSHAFT:—7 bearing, 4 counterweights.
Journal Diameters—2 31/64" all bearings.
Bearing Type—Interchangeable steel-backed, babbitt-lined. No shims. See Engine Code Note (above) for original bearing sizes. **Clearance**—.002".

Bearing Adjustment:—None (no shims). Replace bearings. Do not file caps. Upper halves can be 'rotated' out without removing crankshaft by using pin in oil hole in shaft, turn shaft.

Replacement Bearings:—Furnished .010" undersize.

End Thrust:—At #4 bearing. **Endplay**—.004".

CAMSHAFT:—6 bearing. Non-adjustable chain drive.
End Thrust:—Taken by front bearing. Replace bearing to take up excessive endplay.

Timing Chain:—Whitney No. 49205. Width 9/16". Pitch ⅜". Length 60 links or 22½".

Camshaft Setting:—Sprockets marked. Mesh chain with sprocket marks adjacent and in line with a straightedge across the shaft centers.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1 21/32"	.3402-.3412"	5 55/64"
Exhaust	1 17/32"	.3402-.4312"	5 55/64"

	Seat Angle	Lift	Stem Clearance
All Valves	45°	5/16"	.002-.004"

Tappet Clearance:—.015" all valves, hot or cold.

Valve Guides:—Press fit in block.

Valve Springs:—Free length 2½".

	Spring Pressure	Spring Length
Valve Closed	65-70 lbs	2"
Valve Open	111-118 lbs	1 11/16"

Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 21½° BTDC. Close 71° ALDC.
Exhaust Valves—Open 71° BLDC. Close 36½° ATDC.
Valve Timing Check—With regular running tappet clearance of .015", Intake valve should open with piston 21½° or .1891" BTDC., and Exhaust valve close with piston 36½° or .5118" ATDC.
Motor Gauge—Weidenhoff Adapter #104, Rod #40.

LUBRICATION:—Gear type pump in crankcase.
Normal Oil Pressure:—30 lbs. at 20 M.P.H.
Oil Pressure Gauge:—King-Seeley Electric. K-S No. 7270 (dash—Deluxe), 7070 (dash—Special), 6125 (engine unit—all models).
See article in Mechanical Equipment Section for data.
Oil Pressure Relief Valve:—On oil pump cover. Opens at 30 lbs. Screw adjustment.
Crankcase Capacity:—6 qts.

COOLING SYSTEM:—Capacity—20 quarts.
Water Pump:—Centrifugal, adjustable packing type. Driven by generator extension shaft.
See article in Mechanical Equipment Section for data.
Removal—Drain radiator, disconnect hose and drive coupling, take out mounting screws in pump flange.
Thermostat:—Dole. In water outlet on cyl. head.
Setting—Starts to open at 160°F.
Temperature Gauge:—King-Seeley Electric. K-S No. 7275 (dash—Deluxe), 7295 (dash—Special), 7000 (engine unit—all models).
See article in Mechanical Equipment Section for data.
NOTE—Gauge reads '212' with ignition 'Off'.

CLUTCH:—Borg & Beck Model 9A6. #932 stamped on cover. Single plate, dry disc type.
See article in Mechanical Equipment Section for data.
Facings—Woven. 2 required. Inside Diam. 5⅝". Outside Diam. 9¼". Thickness .125".
Adjustment:—Pedal free movement ½-1¼" (loosen transverse bolt in link below pedal shaft, position pedal in slot). Pedal toeboard clearance ⅜". Check 'No-Rol' operation (if car so equipped.)
Removal:—Remove transmission (see below), clutch housing underpan, clutch cover mounting bolts (release tension evenly), lower assembly out.

TRANSMISSION:—Own Make. Constant-mesh (all speeds), syncro-mesh (second & high), all helical gear.
Cruising Gear (Overdrive):—Warner Model AS6-R6 optional. In separate case at rear of transmission.
Transmission Control:—Mechanical type steering column mounted gear shift, optional.
See articles in Mechanical Equipment Section for data.
Removal:—Disconnect driveshaft. Disconnect shift linkage (cars with steering column shift). Remove transmission mounting stud nuts and lift out.

UNIVERSAL JOINTS:—Mechanics. Type 2C. Roller bearing type. 2 used.
See article in Mechanical Equipment Section for data.

REAR AXLE:—Own Make. Semi-floating, hypoid gear type with Hotchkiss drive (spiral bevel on Coupe).
See article in Mechanical Equipment Section for data.
Ratio—4.1-1 Std. 4 4/9-1 Optl.
Backlash—.005-.007". Shim adjustment.
Removal:—Block up rear of car, remove wheel and drum assemblies, axle shafts, disconnect brake lines and cables, shock absorbers, drive shaft at rear universal. Free axle from springs by disconnecting spring bolts, withdraw axle.
Axle Shaft Removal—Remove wheel and drum, take out retainer mounting bolt nuts, remove retainer, oil seal, brake backing plate, bearing adjusting shims. Pull shaft and bearing out.
Wheel Bearing Adjustment—Shims at flanged end of housing. To adjust, remove brake backing plate, add or remove shims. **Endplay**—.004-.006".

SHOCK ABSORBERS:—Delco. Front 1112-N (Special), Q (Deluxe). Rear 1117-DD. Direct acting, hydraulic type, 1723-L, M, N, P (double acting) Export.
See articles in Mechanical Equipment Section for data.

STEERING:—Steering Gear—Gemmer Model 305. Worm-and-Roller type with 'push-pull' adjustment.
See article in Mechanical Equipment Section for data.
Front Suspension:—Conventional 'I' beam front axle with Reverse-Elliott ends and semi-elliptic springs.
Kingpin Inclination—7° crosswise.
Camber—½-1½° and equal for both wheels.
Caster—1½°. Shim adjustment. Install shims (furnished in 1½° and 3° angles) between spring and spring pad on axle.
Toe In—0-1/16". Adjust by loosening clamp bolt at right end of tie rod and turning tie rod.
Steering Shock Eliminator—Consists of spring and rubber bumper bracket at rear of left front spring. Adjust lower nut to give ⅛" clearance between upper rubber cushion and frame. Adjust spring cushion (ahead of spring rear shackle) to 1/16" clearance between cushion and spring.

BRAKES:—**Service**—Lockheed hydraulic, double anchor type. Hand lever applies rear service brakes.
See article in Mechanical Equipment Section for data.
Drums—Cast-iron. Diameter 10 1/16".
Lining—Moulded. Width 2". Thickness 7/32". Length per wheel 21".
Clearance—.010" at heel and toe of each shoe.
Braking Power—53% front wheels, 47% rear.
Hand Brake:—See Service Brakes.
No-Rol:—Optl. *See Mechanical Equipment Section.*

1939 MODELS

F-39 '60' & G-39 '70' ENGINE NOTE:—Some parts on these engines are not identical and must not be interchanged (though similar in appearance), other parts are identical for both engines as follows:

Identical Parts:—Following parts same for F and G engines: Cylinder Blocks, Flywheel, Main Bearings, Pistons, Timing Chain and Sprockets, Valve Springs, Valve Guides, Valve Lifters, Oil Pump, Water Pump, Water Thermostat, and Carburetor.

Dissimilar Parts:—Following parts are not identical and must not be interchanged:

Cylinder Head—Marked by numeral cast in head: '216'—F-39, '230'—G-39 (early G-39 heads unmarked). Heads must not be interchanged.

Crankshaft—Marked by letter cast on largest counterweight: 'F'—F-39, 'G'—G-39. Throw greater on G-39.

Camshaft—Letter 'F' cast in shaft near GM trademark for F-39 camshaft only. G-39 shaft longer and unmarked.

Connecting Rod—Round Boss in center of rod I-beam section on F-39 rod only. G-39 connecting rod ⅛" shorter and unmarked (serviced by 'L' rods).

1937 MODELS

HOOD SIDE PANEL REMOVAL:—Disconnect 3 headlamp wires from junction block on hood side panel bracket to rear of radiator. Remove three cap screws on top side of panel (two at rear on cowl, one at radiator harness), one nut from through bolt at rear of headlamp.

1938 MODELS

RIGHT FRONT FENDER FILLER PLATE REMOVAL:—Remove headlamp wiring junction block, six (on Six), eight (on Eight) bolts along upper edge of plate, capscrews (one at rear, two at front) at ends of plate, lift off.

1937-38 MODELS

FRONT END DISMANTLING FOR TIMING CHAIN REMOVAL:—**1937.** To dismantle front end proceed as follows: Drain cooling system, remove Hood Side Panels (see directions above), remove one bolt at each end of hood center hinge and bolt for each hood holder on rear of hood, lift hood off. Remove 4 bolts on underside of fender at rear, remove 2 bolts body-to-fender brace (in line with front of dash), remove radiator center anchor bolt nut (under car), remove front bumper. Disconnect radiator hoses. Slide entire assembly to front and remove. Then remove 2 nuts from top of front engine mounting and remove oil pan. Jack up front end of engine until timing chain cover clears frame

1938. To dismantle front end assembly proceed as follows: Remove Front End Sheet Metal Assembly by removing hood, draining cooling system, removing 5 capscrews at rear of fender (1 to filler plate, 4 to body), disconnect wiring harness from junction block and free from 4 clips (on each filler plate), disconnect radiator hoses, remove center radiator anchor bolt nut (under car), radiator brace rods at cowl, slide entire assembly to front and remove. Then remove 2 nuts from top of front engine mounting and remove oil pan. Jack up front end of engine until chain cover clears frame member.

1939 MODELS

FRONT END SHEET METAL ASSEMBLY REMOVAL:—May be removed to facilitate work on front of engine as follows: Drain radiator, disconnect radiator hose, disconnect wires at headlamp junction block, free wiring harness from clips on radiator core and along side panel. Take out capscrew in hood ledge filler plate on top of frame (each side), hood ledge filler plate-to-body capscrews (4—Sixes, 5—Eight, on each side), disconnect fender to frame brace at fender, remove nut from center radiator support, bumper, sheet metal and radiator core assembly.

1938-39 MODELS

CYLINDER HEAD SERVICING:—Steel-asbestos cylinder head gasket used. **This gasket cannot be reused.** When installing new gasket, coat both sides with thin coat of P.O.B. Perfect Gasket Seal with room temperature of approximately 70° F. (edges at cylinder bore holes must be wiped clean). Plain washers used under cylinder head bolts to prevent leakage at front end. Car manufacturer recommends use of torque wrench (if J-1264 torque wrench used, reading should be 65-70 lbs. ft.).

L-39 Note—Install new neoprene grommet in pump by-pass hole in head, when head removed.

1939 MODELS

OIL PAN REMOVAL:—Steering linkage must be lowered to allow pan removal. Disconnect Pitman arm from Pitman arm shaft and steering idler arm support (on right side) from frame. Then lower steering relay rod. Holes provided for removal of pan screws at front cross member. Car manufacturer recommends that 5 capscrews at front of pan be removed from above with box socket wrench.

1936-39 MODELS

PISTON PINS:—Servicing—Standard size pins only furnished for service. Pin bosses in pistons electrolited and must not be reamed. Replacement pistons (standard and oversize) furnished with pins fitted.

Removal:—To remove pin, take out lockscrew, place assembly in boiling water for one minute. With Tool HM-535 push pin out through plain boss end. NOTE—Piston Heater and Pin Assembly Fixture No. J-849 consisting of piston and pin heater compartments and piston holder available.

Fitting:—Pin fit in piston .0001" loose to .0002" tight (plain boss), .0002-.0005" tight (lock screw boss). Pin fit in rod bushing .0003-.0006". If rod bushing worn, press new bushing place, burnish with Tool HM-587E and line ream with Reamer HM-586 to .8558-.8562".

Installing:—To install pin, heat piston and pin (as for Removal above), dip pin in hot light engine oil, start pin through plain boss end of piston and through rod (make sure lock screw hole in pin and boss will be aligned), then with Tool HM-535 lightly push pin in place until hole in pin and boss aligned (use punch in hole to correct slight mis-alignment). IMPORTANT—Pin must not be forced (if heavy push required, indicates piston has cooled, disassemble and reheat piston and pin). After pin in place, coat screw with graphite and tighten.

1935-39 MODELS

MAIN BEARING UPPER HALVES:—Removal—May be removed without removing crankshaft by removing bearing cap and inserting pin (Tool HM-J-173) in oil hole in shaft. With tang on pin engaging plain end of bearing shell, rotate shaft, turn shell out.

L-39 Note—Front of engine must be raised to remove upper half of front bearing.

Installation—Remove sharp edge from plain end of bearing, insert this end at indented side of support and rotate in place, using pin in oil hole.

1939 MODELS

CRANKSHAFT END THRUST:—Taken by front (#1) bearing. A bronze or steel-backed bronze thrust washer plate (.1205-.1245" thick) is doweled to each face of bearing cap. A steel thrust collar is assembled between front thrust plate and crankshaft gear. IMPORTANT—If steel-backed thrust plates used (use 2 plates of same type), assemble with steel side against bearing cap face.

1937-38-39 MODELS

REAR MAIN BEARING OIL SEAL:—Consists of oil slinger on crankshaft to rear of bearing with asbestos covered wiper seal held by retainer fitted in groove (forms channel for oil slinger). Wiper seal must be renewed whenever crankshaft removed.

1939 Six—Seal held in separate groove at rear.

Installation—With crankshaft out of engine and bearing cap off, crowd seal in bearing support in rear groove (F,G-39), to rear of retainer (others) by hand. Then using seal compressor tool J-955 over seal, tap tool 3 or 4 times to seat seal. With tool resting on seal, cut ends flush at each end. Repeat operation for bearing cap. Seal must entirely fill groove and be trimmed flush to prevent oil leaks.

1939 MODELS

OIL PUMP:—Gear type pump. Six and Eight pump identical except for gear faces which are ¼" wider on Eight. When assembling pump gear on shaft, press shaft on gear flush with outer end of gear (Six), with gear extending ¼" beyond end of shaft (Eight—Use Tool J954 which properly positions gear on shaft). Pump drive gear must be assembled with Feeler Gauge J-954-1 between inner face of gear hub and pump body to give proper end clearance for pump shaft. Use new gasket between pump body and cylinder block.

Installation—Set engine in firing position for #1 cylinder on Six, #6 cylinder on Eight, with rotor opposite #1 segment in distributor cap on Six, opposite #6 segment on Eight. Note position of distributor shaft tongue for proper oil pump drive gear mesh, then raise distributor and mesh pump drive gear with camshaft gear. Replace distributor in position and reset ignition timing.

1939 MODELS

CLUTCH REINFORCING PLATE:—Used on 'G' and 'L' models instead of gasket (3/16" steel plate which is bolted between clutch housing and underpan). 2 capscrews hold plate on housing while 12 used to bolt pan on housing (through plate).

NOTE—F-39 housing has 12 screw holes, (only 8 used with regular gasket). No reinforcing plate used.

Installation—Whenever clutch underpan removed, take off reinforcing plate and coat both sides of plate with Permatex (no gasket used).

1937-38-39 MODELS

PROPELLER SHAFT CENTER BEARING:—Removal—Split both propeller shafts at front companion flanges, remove 4 bolts (at frame) freeing intermediate bearing support and remove front propeller shaft. Place shaft in vise and remove cap screw from rear of shaft. Remove companion flange from shaft with arbor press. Take off slinger, pull bearing support housing and bearing assembly from rear of shaft, slide rubber retainer from bearing support. Wash all parts (except bearing and rubber retainer) in kerosene, wipe bearing and retainer clean (shielded type bearing used).

NOTE—Used on 'G' and 'L' models only with Self-Shifting Transmission.

Installation—With rubber retainer on bearing, install bearing on shaft (lip of retainer to rear), install bearing support over retainer (coat with soap to allow support sliding in place) with flat portion of housing to front, put slinger in place with flange over lip of retainer, press companion flange on shaft with slinger clamped tight against bearing inner race, install cap screw (use both plain washer and lock washer in place under screw). Bolt intermediate bearing support to frame and attach shafts in place at front companion flanges.

ENGINE NUMBER:—First number (F-32) F-302,001, (F-33) F-316,568. On car serial number plate on right hand side of front compartment floor.

ENGINE SPECIFICATIONS:—Six cylinder, 'L' head type.

Bore—3 5/16" (F-32), 3⅜" (F-33), **Stroke**—4⅛".

Displacement—213.3 cubic inches (F-32), 221.4 cubic inches (F-33).

Horsepower (F-32)—Rated 26.35. Developed 71 at 3200 R.P.M.

Horsepower (F-33)—Rated 27.34. Developed 80 at 3200 R.P.M.

Compression Ratio—5.8-1 (F-32), 5.3-1 (F-33).

Compression Pressure—Approximately 100 lbs. (F-32), 90-95 lbs. (F-33) at cranking speed.

Vacuum Reading—Gauge should show steady reading of 18" at idling speed.

Pistons:—Electro-plated cast-iron. Pistons are tin-plated after being finished and cannot be ground. Replacement pistons furnished in standard oversizes of .003", .005", .0075", .010", .015", .020", .025", .030". Cylinders must be reconditioned to standard oversize. Piston length, 3⅞".

Weight—28 ozs. (stripped), 34 ozs. (with bushings, pin and rings).

Removal—Piston and rod assembly removed from top of engine.

Clearance—.0085" top, .0015-.0025" skirt. See Fitting New Pistons.

Fitting New Pistons—Use .002" feeler stock ½" wide to check piston clearance. Pull required to withdraw feeler stock from between piston and cylinder wall should be 4-15 lbs.

NOTE:—Piston pin hole in piston is offset 3/32". Install pistons with this offset away from valves with mark 'VS' on piston head toward valve side.

Piston Rings:—Three rings per piston, #1 and 2—compression rings, #3— oil control ring. Lower ring groove is drilled radially with oil drain holes.

Ring	Width	End Gap	Wall Thickness
Compression (#1, 2)	.125"	.007-.012"	.170"
Oil Control (#3)	.1865"	.007-.012"	.190"

Piston Pin:—Diameter .8559-.8562". Length 3 1/16". Pin is locked in piston by locking screw in one boss. Pin hole in rod is bronze-bushed.

Pin Fit in Piston—Press fit.

Pin Fit in Rod—.0001-.0008" clearance.

Connecting Rod:—Weight 30½ ounces. Length 9" (center-to-center).

Crankpin Journal Diameter—1⅞".

Lower Bearing Type—Spun-babbitt lined integral with rod and cap (F-32), Removable steel-backed, babbitt-lined (F-33). No shims.

Clearance—.0015-.003". Sideplay .006-.010".

Adjustment—None (no shims). Replace rods (F-32), bearings (F-33). Do not file rods or caps.

Crankshaft:—Four bearing. Bolted-on type counterweights.

Journal Diameters (F-32)—#1, 2¼"; #2, 2 5/16"; #3, 2 7/16"; #4, 2½".

Journal Diameters (F-33)—#1, 2 31/64"; #2, 2 35/64"; #3, 2 43/64"; #4, 2 47/64".

Bearing Type—Removable bronze-backed (F-32), steel-backed (F-33), babbitt-lined type. No shims.

Clearance—.001-.003".

Adjustment—No shims used. Replace bearings.

End Thrust—Taken by #1 front main bearing. Endplay .003-.006".

Camshaft:—Camshaft drive—Non-adjustable chain.

Chain—Whitney. Width, 1¼". Length, 23½" or 47 links. Pitch, .500".

Camshaft Setting—Sprockets are marked. Mesh chain with sprockets turned so that marks are adjacent and in line with a straightedge across the shaft centers.

Valves:—	Head Diameter	Stem Diameter	Length	Seat Angle	Lift
Intake	1⅝"	11/32"	5⅜"	30°	.320"
Exhaust	1½"	⅜"	5⅜"	30°	.320"

Stem-to-Guide Clearance—.00125-.00325" (intake), .00225-.00425" (exhaust).

Tappet Clearance—.008" (intake), .010" (exhaust) cold, running clearance.

Valve Springs—	Pressure	Length
Valve Closed	43 lbs.	2¼"
Valve Open	96 lbs.	1 29/32"

Valve Timing

Intake Valves Open—At TDC. Close—50° ALDC.
Exhaust Valves Open—40° BLDC. Close—10° ATDC.

NOTE:—Timing figures correct with .010" tappet clearance.

To Check Valve Timing:—Set tappet clearance #1 intake valve at .012". This valve should open with piston on top dead center when mark (TDC. Line) on vibration dampener at front of engine lines up with pointer on chain case. Reset tappet clearance at .008".

Motor Gauge—Weidenhoff Adapter #104, Rod #2.

Lubrication:—Pressure type. Gear type oil pump located on lower end of inclined accessory shaft (right of crankcase).

Oil Pressure—30-35 lbs. (normal driving speeds).

Oil Pressure Relief Valve—Operates at 33 lbs. Not adjustable.

Capacity and Oil—6 qts. (refill). Use SAE. #30 (summer—normal driving 32°-80°F.), #40 (summer—high speed driving—above 80°F.), #20-W (winter 32° to 0°F.), #10-W (winter 0° to —15°F.).

CLUTCH:—**Borg & Beck. Model 9A1 (F-32), 10A1 (F-33).** Clutch marked 555 (9A1), 618 (10A1) on cover. Single plate dry disc type. See article in Clutch Section for complete relining and assembling directions.

Facings—Moulded type, 2 required. Thickness ⅛". Inside diameter 6⅛". Outside diameter 8⅞" (F-32), 9⅞" (F-33).

Adjustment—Free movement of clutch pedal should be 1-1½". To adjust, loosen locknut, turn adjusting nut at lower end of clutch pedal.

STEERING:—**Steering Gear**—Jacox (Saginaw) Worm-and-Sector type. See article in Steering Section for complete adjustment directions.

Front Suspension:—Conventional 'I' beam section front axle with Reverse Elliott type ends and semi-elliptic springs.

Kingpin Inclination—9½° crosswise.

Caster—2¾-3°. Adjust by inserting wedge shims between spring and spring pad on axle.

Camber—1¾°. No adjustment provided.

Toe In—⅛". Adjust in usual manner by loosening clamp bolts and turning tie rod.

BRAKES:—**Service**—Bendix Mechanical, Duo-Servo, Single anchor type. Hand lever applies all four service brakes. See article in Brake Section for complete adjustment directions.

Drum Diameter—12".

Lining—Moulded type. Width 1¾". Thickness 3/16". Length 25 5/16" (F-32), 25 25/32" (F-33) per wheel.

Clearance—.005" anchor pin end, .015" adjusting screw end of each shoe.

Hand Brake:—See Service Brakes above.

ENGINE NUMBER:—First number (L-32) 1001, (L-33) 6557. On car serial number plate on right hand side front compartment floor or on door sill under mat.

ENGINE:—Eight cylinder, 'L' head type. Cylinders cast enbloc.

Dimensions—Bore, 3". Stroke, 4¼". Displacement, 240.3 cu. ins.

Horsepower (L-32)—Rated 28.8. Developed 82 H.P. at 3200 R.P.M.

Horsepower (L-33)—Rated 28.8. Developed 90 H.P. at 3350 R.P.M.

Compression Ratio—5.90-1 (L-32), 5.50-1 (L-33).

Compression Pressure—Approximately 102 lbs. (L-32), 95 lbs. (L-33) at cranking speed.

Vacuum Reading—Gauge should show steady reading of 18" at idling speed.

Pistons:—Electro-plated cast-iron. Piston are tin plated after being finished and cannot be ground. Replacement pistons furnished in standard oversizes of .003", .005", .0075", .010", .015", .020", .025", .030". Recondition cylinders to standard oversize. Piston length, 3 11/16".

Weight—24½ ozs. (stripped), 30 ozs. (with bushings, rings and pin).

Removal—Piston and rod assembly removed at bottom of engine.

Clearance—.0085" top, .0015-.0025" skirt. See Fitting New Pistons.

Fitting New Pistons—Use .002" feeler stock ½" wide to check clearance. Pull required to withdraw feeler from between piston and cylinder wall should be 4-15 lbs.

NOTE:—Piston pin hole in piston is offset 3/32". Install pistons with this offset toward left side of engine and mark 'VS' on head toward valve side.

Piston Rings:—Four rings per piston, #1 and 2—compression rings, #3 and 4—oil control rings. Lower ring groove drilled radially with oil drain holes.

Ring	Width	End Gap	Wall Thickness	Groove Depth in Piston
Comp. (#1, 2)	.124"	.007-.012"	.135"	.155"
Oil Cont. (#3)	.124"	.007-.015"	.135"	.170"
Oil Cont. (#4)	.1865"	.007-.015"	.135"	.170"

NOTE—Groove depth for 1932 pistons was .130" (compression rings), .120" (oil rings) and maximum wall thickness of rings was .120".

Piston Pin:—Diameter, .8558-.8554". Length, 2 11/16". Pin is locked in piston and oscillates in connecting rod.

Pin Fit in Piston—Press fit.

Pin Fit in Connecting Rod—.0003-.0007" clearance.

Connecting Rod:—Weight, 32 ozs. Length, 9" (center-to-center).

Crankpin Journal Diameter—2¼".

Lower Bearing Type—Spun babbitt integral with rod and cap. (L-32), removable steel-backed, babbitt-lined (L-33). No shims.

Clearance—.0015-.003". Sideplay .006-.010".

Adjustment—None (no shims). Replace rods (L-32), bearings (L-33). Do not file rods or caps.

Crankshaft:—Five main bearing type with integral counterweights.

Journal Diameters—#1, 2¼"; #2, 2 7/16"; #3, 2½"; #4, 2 9/16"; #5, 2⅝".

Bearing Type—Bronze-backed (L-32), steel-backed (L-33), babbitt-lined.

Clearance—.001-.003".

Adjustment—None (no shims used). Replace removable bearings.

End Thrust—Taken by #1 (front) main bearing. Endplay, .003-.006".

Camshaft:—Camshaft drive—Non-adjustable chain.

Chain—Whitney. Width, 1¼". Length, 23" or 46 links. Pitch, .500".

Camshaft Setting—Sprockets are marked. Mesh chain with sprockets turned so that marks are adjacent and in line with a straightedge across the shaft centers.

Valves:—	Head Diameter	Stem Diameter	Length	Seat Angles	Lift
Intake	1 9/16"	11/32"	5 9/32"	30°	.300"
Exhaust	1 7/16"	⅜"	5 9/32"	30°	.300"

Stem-to-Guide Clearance—.00125-.00325" (intake), .00225-.00425" (exhaust).

Tappet Clearance—.008" (intake), .010" (exhaust) cold running clearance.

Valve Springs—	Spring Pressure	Spring Length
Valve Closed	43 lbs.	2¼"
Valve Open	96 lbs.	1 29/32"

Valve Timing

Intake Valves Open—At TDC. Close—42° ALDC.
Exhaust Valves Open—40° BLDC. Close—10° ATDC.

NOTE:—Timing figures correct with .010" tappet clearance.

To Check Valve Timing:—Set tappet clearance #1 intake valve at .012". This valve should open with piston on top dead center when second mark (TDC. line) on vibration dampener at front of engine lines up with pointer on chain case. Reset tappet clearance at .008".

Motor Gauge—Weidenhoff Adapter #104, Rod #2.

Lubrication:—Pressure type. Gear type oil pump located in crankcase.

Normal Oil Pressure—30-35 lbs.

Oil Pressure Relief Valve—Opens at 35 lbs. Not adjustable.

Capacity and Oil—7 qts (refill). Use SAE. #30 (summer—normal driving—32°-80°F.), #40 (summer—high speed driving above 80°F.), #20-W (winter 32° to 0°F.), #10-W (winter 0° to —15°F.).

CLUTCH:—Borg & Beck Model 10A1. Marked 618 on cover. Single plate, dry disc type. See article in Clutch Section for relining and assembling directions.

Facings—Moulded type. Thickness ⅛". Inside Diameter 6⅛". Outside Diameter 9⅞".

Adjustment—Free movement of clutch pedal should be 1-1½". To adjust, loosen locknut and turn adjusting nuts at lower end of clutch pedal.

STEERING:—Steering Gear—Jacox (Saginaw) Worm-and-Sector type. See article in Steering Section for complete adjustment directions.

Front Suspension—Conventional 'I' beam section front axle with Reverse Elliott type ends and semi-elliptic springs.

Kingpin Inclination—9½° crosswise.

Caster—2¾-3°. Adjust by inserting wedge shims between spring and spring pad on axle.

Camber—1¾°. No adjustment provided.

Toe In—⅛". Adjust in usual manner by loosening clamp bolts and turning tie rod.

BRAKES:—Service—Bendix Mechanical, Duo-Servo, Single-anchor type. Hand lever applies all four service brakes. See article in Brake Section for complete adjustment directions.

Drum Diameter—12".

Lining—Moulded type. Width 1¾". Thickness 3/16". Length 25 5/16" (L-32), 25 29/32" (L-33) per wheel.

Clearance—.005" anchor pin end, .015" adjusting screw end for each shoe.

Hand Brakes:—See Service Brakes above.

SERIAL NUMBER:—First number (F-34) 51,001. On plate on right hand side front compartment floor in front seat (sedans), or under seat (coupes). (F-35) F103001. On frame siderail.

ENGINE NUMBER:—F-35 first number F405001. F-34 on car serial plate.

ENGINE:—Own make. 6 cylinder, 'L' head type.
Bore—3 5/16". **Stroke**—4⅛".
Piston Displacement—213.3 cu. ins.
Rated Horsepower—26.3 (SAE).
Developed Horsepower—F-34, 84 at 3200 R.P.M. F-35, 90 at 3400 R.P.M.
Compression Ratio—5.7-1 (F-34), 6.2-1 (F-35). No optional ratios.
Compression Pressure—Approximately 98 lbs. (5.7-1 hd.) or 106 lbs. (6.2-1 hd.) at cranking speed.
Vacuum Reading—Gauge should show steady reading of 18-20" with engine idling.

Pistons:—Electro-plated cast-iron. Pistons are tin-plated after finishing and cannot be ground. Refinish cylinders to take replacement pistons furnished .003", .005", .0075", .010", .015", .020", .025", .030" oversize. Oversize pistons held to same weight as standard. Piston length 3⅞" (F-34), 3 15/16" (F-35).
Weight—28 ozs. (F-34), 26.84 ozs. (F-35), stripped; 34 ozs. (F-34), 33.19 ozs. (F-35), with rings, pin, and lockscrew.
Removal—Pistons and rods removed from above.
Clearance—Top .013-.020" F-34, .0235-.0305" F-35. Bottom .0015-.0025" (all).
Fitting New Pistons—Pistons and bore should be round within .0005". Use .002" feeler stock ½" wide inserted between piston and wall, spring tension required to withdraw feeler must be 4-15 lbs.
Installing Pistons—Pin hole in piston offset 3/32". Install pistons with mark 'V.S.' toward valve side.

Piston Rings:—Two compression, one oil control ring per piston, all above pin. Lower ring groove drilled with oil return holes. Compression rings installed with groove toward bottom.

Ring	Width	End Gap	Side Clearance	Wall Thickness
Comp. (all)	⅛"	.007-.012"	.0015-.003"	.148"
Oil Cont.	3/16"	.007-.012"	.001-.0025"	.145"

NOTE—1934 rings have end gap of .009-.014" and wall thickness of .145".

Piston Pin:—Diameter, .8554-.8558". Length, 3 1/32". Pin length for 1934 model (F-34) is 3 1/16". Pin is locked in piston (opposite end slotted to allow boss to slide freely on pin).
Pin Fit in Piston—Press fit (see below).
Pin Fit in Rod Bushing—.0003-.0007" clearance.
Fitting Pins—Use special tool HM-412 to install pins (tool checks pressure required to press pin into place). Insert pin from lockpin side (slotted end first). Pressure should be 200-250 lbs. (first boss), 300-350 lbs (second boss). Check piston for out-of-round after pin is installed (maximum allowable, .0005").

Connecting Rod:—Weight 29 ozs. (F-34), 30.7 ozs. (F-35). Length 7 13/16".
Upper Bearing—Split bushed type. New bushings should be burnished and then line-reamed to inside diameter of .8559-.8564". Oil hole in bushing must line up with rifle-drilled oil passage in rod.
Lower Bearing—Steel-backed, babbitt-lined type.
Clearance—.001-.003". Sideplay .0055-.0105".
Adjustment—No shims used. Replace bearings. Do not file rod or cap faces. Bearings assembled with slight projection above faces to insure contact.

Crankshaft:—Four bearings. Integral counterweights.
Journal Diameters—#1—2.478-2.479". #2—2.5405-2.5415", #3—2.6655-2.6665", #4—2.728-2.729".
Bearing Type—Interchangeable steel-backed, babbitt-lined type. Bearings halves are interchangeable (upper and lower) except rear (#4).
Clearance—.001-.003".
Adjustment—No shims used. Replace bearings. Do not file bearing caps. Bearing upper halves can be removed without removing crankshaft by using tool HM-J-173. This is a flat headed plug which is slipped into oil hole in crankshaft. The head engages the edge of the bearing and turns bearing out as crankshaft is rotated. Install new bearings in same manner (insert plain edge of bearing on indented side of upper bearing support).
End Thrust F-34—Taken by second main bearing. Endplay .0035-.0075".
End Thrust F-35—Taken by #1 front bearing. Endplay .004-.007". A bronze thrust plate .1205-.1235" thick (selective) is assembled at each end of front main bearing and is dowelled to bearing cap. There is a steel thrust collar on the crankshaft behind the crankshaft gear.

Camshaft:—4 bearing. Non-adjustable chain drive.
Journal Diameters—#1—1.9975-1.9970", #2—1.9350 1.9345", #3—1.8725-1.8720", #4—1.8100-1.8095".
Bearing Type—Metal-backed, babbitt-lined.
Clearance—.002-.004".
End Thrust—Taken by spring loaded plunger in front end of camshaft and thrust plate on cover.
Timing Chain—Whitney. Width, 1¼". Pitch, .500". Length, 23½" or 47 links.
Camshaft Setting—Sprockets are marked. Mesh chain with sprockets turned so that marks are adjacent and in line with a straightedge across the shaft centers. Use Sprocket Gauge HM-408-O.

Valves:—

	Head Diameter	Stem Diameter	Length
Intake	1 9/16"	11/32" (.3425-.3415")	5 51/64"
Exhaust	1 7/16"	11/32" (.3415-.3405")	5 55/64"

	Seat Angle	Lift	Stem Clearance
Intake	30°	.300"	.00125-.00325"
Exhaust	30°	.300"	.00225-.00425"

NOTE—F-34 valve length 5 27/32" (all valves).
Tappet Clearance—.008" Int., .010" Exh., warm.
Installing New Guides—Install guides with turned portion toward bottom and finish ream to .34375-.34475" (inside diameter) after assembly. Top of guide must be 15/16" below top of block.
Valve Springs—F-35 are new type with three close coils at top (No spring cages—see Note below).

	Pressure	Length F-34	Length F-35
Valve Closed	43 lbs.	2¼"	2 9/32"
Valve Open	116 lbs.	1 29/32"	1 15/16"

NOTE—1935 springs interchangeable (intake and exhaust) and may be used for service on 1933 and 1934 models by discarding cages used previously.
Valve Timing—See Camshaft Setting above.

1934—Model F-34

Intake Valves—Open 5° BTDC. Close 45° ALDC.
Exhaust Valves—Open 45° BLDC. Close 5° ATDC.

1935—Model F-35

Intake Valves—Open at TDC. Close 50° ALDC.
Exhaust Valves—Open 40° BLDC. Close 10° ATDC.
To Check Valve Timing, F-34—Set tappet clearance #1 intake valve at .010". This valve should open with piston on top dead center when flywheel mark "TDC/' lines up with indicator. Reset tappet clearance at .008" with engine hot.
F-35—#1 intake valve should open with #1 piston .0163" before top dead center when a point on the flywheel approximately 2 teeth before dead center mark 'TDC/' lines up with indicator.
Motor Gauge—Weidenhoff Adapter #104, Rod #40.

Lubrication:—Pressure. Gear type oil pump on right hand side of crankcase. Use new gasket whenever pump is taken off engine.
Normal Oil Pressure—30-35 lbs. (F-34), 25-30 lbs. (F-35) at all speeds.
Oil Pressure Relief Valve—Operates at 33 lbs. (F-34), 27 lbs. (F-35). Not adjustable. Located on oil pump Cover plate.
Capacity and Oil—6 qts. (refill). Use SAE. #30 (summer—32 to 80°F—average driving), #40 (summer—above 80°—high speed driving), #20-W (winter 32° to 0°F.), #10-W (winter 0° to —15°F.).

CLUTCH:—Borg & Beck Models 9A3 (F-34), 9A6 (F-35). Model No. stamped on cover 9A3 (857), 9A6 (873). Single plate, dry disc type. No adjustment for wear required See article in Clutch Section for relining and assembling directions.
Clutch Pedal Adjustment—Loosen locknut on lower end of clutch pedal pullrod, turn adjusting nut until lash or free movement of pedal is 1-1½", tighten locknut.
Clutch Facing—Woven type, 2 required. 5⅝" I. D., 9" O. D., .133" thick.
Clutch Assembly—Clutch can be removed from bottom without taking off flywheel housing. Cover and pressure plate should be punchmarked and installed in same position. In installing clutch assembly, place cover cap screws with longer shank in second hole on each side from locating dowel (these holes have deeper counterbore).

STEERING:—Steering Gear—Saginaw Model, Worm-and-Roller type. See article in Steering Section for adjustments.

Front Suspension:—Independent, linked parallelogram type with coil springs. See article in Steering Section for adjustments.
Kingpin Inclination—6° (F-34), 5° (F-35) crosswise.
Caster—1½—2¼°. To adjust, loosen nuts holding yokes to upper and lower support arms, remove lubrication fitting on front bushing of upper support arm yoke, insert Allen wrench, turn clockwise to increase or counter-clockwise to decrease caster, tighten nuts holding support arm yokes, replace fittings.
Camber—⅛-1°. Camber is affected by caster adjustment and must be checked when caster angle is changed. To adjust, place shims between upper control arm yoke and upper control arm to increase camber, or between lower control arm yoke and lower control arm to decrease camber. A 1/16" shim will change camber approximately 1/3°.
Toe-in—⅛-3/16". To adjust, increase or decrease length of each tie rod equally.
NOTE—Before checking caster, camber, or toe-in, see that tires are properly inflated, check front wheel run-out (allowable maximum ⅛"), check front tire run-out (allowable maximum ⅛"), check front wheel balance, set front wheels in straight-ahead position, raise and lower front of car several times to allow frame to assume normal level.

BRAKES:—Service—Bendix hydraulic, Duo-Servo, single anchor type. Hand lever applies rear service brakes. *See article in Mechanical Equipment Section for data.*
Drum Diameter—11" F-34, 11 1/16" F-35.
Lining—Front primary shoe—woven. All other shoes moulded. F-34—Lining width 1¾", thickness 5/32", length per wheel 23.7". F-35—Lining width 2", thickness 3/16", length per wheel 23.7".
Clearance—.008" toe, .010" heel, for each shoe.
Hand Brake Adjustment:—See Service Brakes.

SERIAL NUMBER:—First number (L-34) 18,001. On plate on right hand side front compartment floor in front of seat (sedans), or under seat (coupes). (L-35) On frame siderail.

ENGINE NUMBER:—L-34 on car serial plate. L-35 first number L-45001.

ENGINE:—Own Make. 8 cylinder, 'L' head type.
Bore—3". **Stroke**, 4¼".
Piston Displacement—240.3 cubic inches.
Rated Horsepower—28.8 (SAE).
Developed Horsepower—90 at 3200 R.P.M. L-34, 100 at 3400 L-35.
Compression Ratio—L-34, 5.7-1 std. head. L-35, 6.2-1 std head. No optional ratios.
Compression Presure—Approximately 98 lbs. (5.7-1 hd.) or 106 lbs. (6.2-1 hd.) at cranking speed.
Vacuum Reading—Gauge should show steady reading of 18-20" with engine idling.

Pistons:—Electro-plated cast-iron. Pistons are tin-plated after finishing and cannot be ground. Refinish cylinders to take replacement pistons furnished .003", .005", .0075", .010", .015", .020", .025", .030" oversize. Oversize pistons held to same weight as standard. Piston length 3 11/16" (L-34), 3¾" (L-35).
Weight—24.5 ozs. (L-34), 24.18 ozs. (L-35), stripped; 30 ozs. (L-34), 30.08 ozs. (L-35), with rings, pin, and lockscrew.
Removal—Pistons and rods removed from below. Rotate crankshaft so that counterweights are crosswise and opposite to camshaft.
Clearance—Top .012-.019" (L-34), .022-.029" (L-35). Bottom .0013-.0025".
Fitting New Pistons—Pistons and bore should be round within .0005". Use .002" feeler stock inserted between piston and wall, pull required to withdraw feeler must be within 4-15 lbs.
Installing Pistons—Pin hole in piston offset 3/32". Install pistons with mark 'V.S.' toward valve side.

Piston Rings:—Two compression, two oil control rings per piston, all above pin. Both oil ring grooves drilled with oil return holes. Compression rings installed with groove toward bottom.

Ring	Width	Side End Gap Clearance	Wall Thickness
Comp. (all)	⅛"	.007-.012"	.0015-.003"	.135"
Oil Cont. (3)	⅛"	.007-.015"	.0015-.003"	.138"
Oil Cont. (4)	3/16"	.007-.015"	.001-.0025"	.138"

NOTE—L-34 oil rings have wall thickness of .135".

Piston Pin:—Diameter .8554-.8558". Length 2 11/16". Pin is locked in piston (opposite end slotted to allow boss to slide freely on pin).
Pin Fit in Piston—Press fit (see below).
Pin Fit in Rod Bushing—.0003-.0007" clearance.
Fitting Pins—Use special tool HM-412 to install pins. See Model F-34, 35 for complete instructions.

Connecting Rod:—Weight 32 ozs. (L-34), 34.5 ozs. (L-35). Length 9".
Upper Bearing—Split bushed type. New bearings should be burnished and then line reamed to inside diameter of .8559-.8564". Oil hole in bushing must line up with rifle-drilled oil passage in rod.
Lower Bearing—Steel-backed, babbitt-lined type.
Clearance—.0015-.003" (L-34), .001-.003" (L-35). Sideplay .006-.010" (L-34), .0055-.0015" (L-35).
Adjustment—No shims used. Replace bearings. Do not file rod or cap faces. Bearings assembled with slight projection to insure contact.

Crankshaft:—Five bearing. Integral counterweights.
Journal Diameters—#1—2.373-2.374", #2—2.5605-2.5615", #3—2.623-2.624", #4—2.6855-2.6865", #5—2.748-2.749".
Bearing Type—Interchangeable steel-backed, babbitt-lined type. Upper and lower bearing halves not interchangeable.
Clearance—.001-.003".

Adjustment—No shims used. Replace bearings. Do not file bearing caps. See Models F-34, 35 for bearing removal.
End Thrust—#1 front bearing. Endplay .003-.006" L-34. .004-.007" L-35. Bronze thrust plate .1205-.1235" thick (selective) is assembled at each end of front bearing and dowelled to bearing cap. There is a steel thrust washer on the crankshaft behind the crankshaft gear.

Camshaft:—Six bearing. Non-adjustable chain drive.
Bearing Type—Metal-backed, babbitt-lined type.
Clearance—.002-.004".
End Thrust—Taken by spring-loaded plunger in forward end of camshaft and thrust plate on chain case cover.
Timing Chain—Whitney. Width, 1¼". Pitch, .500". Length, 23" or 46 links.
Camshaft Setting—Sprockets are marked. Mesh chain with sprockets turned so that marks are adjacent and in line with a straightedge across the shaft centers. Use Sprocket Gauge HM-408-0.

Valves:—

	Head Diameter	Stem Diameter	Length
Intake	1 9/16"	11/32" (.3425-.3415")	5 9/32"
Exhaust	1 7/16"	11/32" (.3415-.3405")	5 11/32"

NOTE—L-34 exhaust valve length 5 9/32".

	Seat Angle	Lift	Stem-to-Guide Clearance
Intake	30°	.300"	.00125-.00325"
Exhaust	30°	.300"	.00225-.00425"

Tappet Clearance—.008" Int., .010" Exh., warm.
Installing New Guides—Install guides with longer turned portion toward bottom and finish ream to .34375-.34475" inside diameter after assembly. Top of guide must be 15/16" below top of block.
Valve Springs—L-35 are new type with three close coils at top. No valve cages used (see Note below).

	Pressure	Length L-34	Length L-35
Valve Closed	43 lbs.	2¼"	2 9/32"
Open	96('34) 116('35) lbs.	1 29/32"	1 15/16"

NOTE—1935 springs interchangeable for both intake and exhaust valves. May be used on 1933-34 models if old spring cages discarded.
Valve Timing—See Camshaft Setting above.
Intake Valves—Open at TDC. Close 42° ALDC.
Exhaust Valves—Open 40° BLDC. Close 10° ATDC.
To Check Valve Timing—Set .010" tappet clearance #1 intake valve. This valve should open with #1 piston on top dead center when flywheel mark 'TDC.#1' lines up with pointed end of inspection hole cover screw (left front face of housing. Reset tappet clearance at .008" with engine warm.
Motor Gauge—Weidenhoff Adapter #104, Rod #2.

Lubrication:—Pressure. Gear type oil pump located in oil pan.
Normal Oil Pressure—30-35 lbs. (L-34), 25-30 lbs. (L-35) at all speeds.
Oil Pressure Relief Valve—Operates at 35 lbs.(L-34), 27 lbs. (L-35). Not adjustable. Located in oil pump body.
Capacity and Oil—7 qts. (refill). Use SAE. #30 (summer 32 to 80°F.—average driving), #40 (summer above 80°F.—high speed driving), #20-W (winter 45° to 10°F), #10-W (10° to —15°F).

CLUTCH:—**Borg & Beck Model 10A4.** Single plate, dry disc type. See article in Clutch Section for relining and assembling directions.
Clutch Pedal Adjustment—Loosen lock nut on lower end of clutch pedal pullrod, turn adjusting nut until lash or free movement of pedal is 1½", tighten lock nut.
Clutch Facing—Woven type, 2 required, 6⅛" I.D., 9⅞" O.D., .133" thick.
NOTE—New driven plates are recommended rather than relining. Facings are riveted individually (rivet goes through plate and one facing only). Each facing is riveted at outer row of holes (six) on convex side of plate segments, and at inner row of holes (six) to horseshoe tongues. Insert rivets with heads on plate side (if split) or on facing side (if rolled). Drill out old rivets (punching out rivets may damage tongues).
Clutch Assembly—Clutch can be removed from bottom without removing flywheel housing. Cover and pressure plate should be punchmarked and installed in same position. In installing clutch assembly, place cover cap screws with longer shank in second hole on each side from locating dowel

STEERING:—**Steering Gear**—Saginaw Model. Worm- and Roller type. See article in Steering Section for complete adjustments.

Front Suspension:—Independent, linked parallelogram type with coil springs. See article in Steering Section for adjustments.
Kingpin Inclination—6° (L-34), 5° (L-35) crosswise.
Caster—1½-2¼°. To adjust, loosen nuts holding yokes to upper and lower support arms, remove lubrication fitting on front bushing of upper support arm yoke, insert Allen wrench, turn clockwise to increase, or counter-clockwise to decrease caster angle, tighten nuts holding support arm yokes, replace fittings.
Camber—¼-1°. Camber is affected by caster adjustment and must be checked when caster angle is changed. To adjust, place shims between upper control arm yoke and upper control arm to increase camber, or between lower control arm yoke and lower control arm to decrease camber. A 1/16" shim will change camber approximately 1/3°.
Toe-in—⅛-3/16". To adjust, increase or decrease length of each tie rod equally.
NOTE—Before checking caster, camber, or toe-in, see that tires are properly inflated, check front wheel run-out and front tire run-out (allowable maximum ⅛" in each case), check front wheel balance, set front wheels in straight-ahead position, raise and lower front end of car several times to allow frame to assume normal level.

BRAKES:—**Service**—Bendix hydraulic, Duo-Servo, single anchor type. Hand lever applies rear service brakes. *See article in Mechanical Equipment Section for data.*
Drum Diameter—12".
Lining—Front wheel (primary shoe) woven, all others moulded. Width 1¾" (L-34), 2" (L-35). Thickness 3/16". Length per wheel 25.90".
Clearance—.008" toe, .010" heel, for each shoe.

Hand Brake Adjustment:—See Service Brakes.

ENGINE NUMBER:—First number—F506,001. Stamped on ledge on top of block beside head at left front corner.

ENGINE SPECIFICATIONS:—**Type**—6 cyl. 'L' Head.
Bore—3 5/16". **Stroke**—4⅛".
Displacement—213.3 cubic inches.
Rated Horsepower—26.3 (SAE).
Developed Horsepower—90 at 3400 R.P.M.
Compression Ratio & Pressure—6.0-1 Std. cast-iron head. No optl. ratios. Pressure 106-116 lbs. at cranking speed of 100 R.P.M.
Vacuum Reading—Gauge should show steady reading of 17" of HG. minimum with engine idling at 350 R.P.M. or 6 M.P.H.

PISTONS:—Aluminum alloy, 'T' slot, Cam Ground type with Electrolite (hard oxide) bearing surface. Skirt is elliptical with .007-009" greater diameter at right angles to pin bosses. Pistons cannot be ground. Use finished replacement pistons.
Weight—15.4 ozs. (stripped). **Length**—3 5/16".
Removal—Pistons and rods removed from above.
Clearance—.0013-.0018" measured ⅜" up on skirt and ⅜" below lower ring groove at right angles to pin holes for new pistons. See Fitting new Pistons.
Replacement Pistons:—Finished pistons with pins fitted furnished in .003", .005", 010", .015" and .030" over size. Oversize pistons held to same weight as standard.
Fitting New Pistons:—With pin removed, check clearance by inserting .002" feeler ½" wide between piston and cylinder wall on pressure or camshaft side at right angles to pin hole. Piston should be inverted with slot away from camshaft. Pressure to withdraw feeler must be 4-11 lbs. with piston and block at 70° F.
Installing Pistons:—Mark 'V-S' on piston head must be toward valves (slot on side away from valves). Pin hole in piston offset 3/32" toward left (slotted side).

PISTON RINGS:—Two compression, two oil control rings per piston, all above pin. Both oil ring grooves drilled radially with oil drain holes. Piston rings furnished in .010", .020", .030" oversizes.

Ring	Width	End Gap	Side Clearance
Comp.	⅛"	.007-.012"	.0015-.003"
Oil Cont.	3/16"	.007-.015"	.001 -.0025"

NOTE—Install compression rings with groove or step downward.

PISTON PIN:—**Diameter**—.8554-.8557". **Length**—3 1/32". Pin is locked in piston by lock screw in one boss. Opposite end slotted to allow boss to slide freely on pin.
Pin Fit in Piston—.0001" loose to .0002" tight in plain boss end, .0002-.0005" tight in lock boss end.
Pin Fit in Rod Bushing—Clearance .0002"-.0005". Pins selected to give this clearance. New rod bushings are burnished and reamed to inside diameter of .8557-.8561".
NOTE—Replacement pistons furnished with pins fitted. Pin bosses in piston are Electrolited and cannot be reamed. Pins not furnished oversize.
Fitting Pins—Place piston and pin in boiling water for one minute. With special tool HM-535 insert pin in plain boss end and push lightly until lockscrew hole in pin and boss are aligned. Install lockscrew. Skirt taper with pin installed must not exceed. 0005".

CONNECTING ROD:—**Weight**—29½ozs.
Length—7 13/16".
Crankpin Journal Diameter—2".
Lower Bearing—Steel-backed, babbitt-lined, interchangeable type.
Clearance—.001-.003". Sideplay .0055-.0105".
Bearing Adjustment:—None (no shims). Replace bearing shells. Do not file rod or cap faces. Bearings assembled with slight projection above faces to insure contact.
Installing Rods:—Oil spit hole in lower bearing upper half must be toward camshaft. Grooves in rod and cap bolt boss must be on same side as part number.
NOTE—Ground bolts used for cap and rod assembly. Common bolts must not be used.

CRANKSHAFT:—Four bearings. Integral count'rw'ghts.
Journal Diameters—#1, 2.478-2.479"; #2, 2.5405-2.5415"; #3, 2.6655-2.6665"; #4, 2.728-2.729".
Bearing Type—Interchangeable steel-backed, babbitt-lined. Bearing halves interchangeable (upper and lower) except #4 (rear).
Clearance—.001-.003".
Bearing Adjustment:—None (no shims). Replace bearings. Do not file bearing caps. Bearing upper halves can be removed without removing crankshaft by using tool HM-J-173. This is a flat headed plug which is slipped into oil hole in crankshaft. The head engages the edge of the bearing and turns it out as crankshaft is rotated. Install bearings in same manner (insert plain edge of bearing on indented side of upper bearing support).
End Thrust:—Taken by #1 (front) bearing. Endplay .004-.008". A bronze thrust plate .1205-.1235" thick is assembled at each end of front main bearing and is dowelled to bearing cap. There is a steel thrust collar on the crankshaft behind the crankshaft gear.

CAMSHAFT:—Four bearing. Non-adjust'ble chain drive.
Journal Diameters—#1, 1.9970-1.9975"; #2, 1.9345-1.9350; #3, 1.8720-1.8725"; #4, 1.8095-1.8100".
Bearing Type—Metal-backed, babbitt-lined.
Clearance—.002-.004".
End Thrust:—Taken by spring-loaded plunger in forward end of camshaft and thrust plate on chain case cover.
Timing Chain:—Whitney. Width—1¼". Pitch—.500". Length 47 links or 23½".
Camshaft Setting:—Sprockets are marked. Mesh chain with sprockets turned so that marks are adjacent and in line with a straightedge across the shaft centers. Use Sprocket Guage HM-408-0.

VALVES:

—Head Diameter	Stem Diameter	Length
Intake 1 9/16"	.3415-.3425"	5 51/64"
Exhaust 1 27/64"	.3405-.3415"	5 51/64"

	Seat Angle	Lift	Stem Clearance
Intake	30°	.300"	.00125-.00325"
Exhaust	45°	.300"	.00225-.00425"

Tappet Clearance—.008" Int., .010" Exh., warm.
Valve Guides:—Cast-iron. Install with turned portion below and finish ream to .34375-.34475" (inside diameter) after assembly. Guide must be 15/16" below top of block.
Valve Springs:—Free length 2 9/16". Install springs with three close-coils at top. No spring cages used.

	Spring Pressure	Spring Length
Valve Closed	43 lbs.	2 9/32"
Valve Open	116 lbs.	1 15/16"

NOTE—Springs are interchangeable (intake and exhaust, and for 6 and 8 engines) and can be used on '33-'35 engines. Discard spring cages on '33-'34 engines.
Valve Lifters:—Single piece cast-iron with core openings in side wall. Operate directly in reamed holes in block. Clearance .0008". Serviced by reaming out holes and installing new lifters furnished standard, .002", .005" oversize.
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 5° BTDC. Close 45° ALDC.
Exhaust Valves—Open 45° BLDC. Close 5° ATDC.
To Check Valve Timing—Check tappet clearance #1 intake valve. This valve should open with piston 5° or .0163" before top dead center when point on flywheel approximately 2 teeth before top dead center mark (steel ball insert) on flywheel lines up with pointed end of inspection hole cover screw in left front face of housing.
Motor Gauge—Weidenhoff #104 Adapter, #40 Rod.

LUBRICATION:—Pressure type. Gear type oil pump located on right side of crankcase.
NOTE—Use new gasket whenever oil pump taken off engine. See that holes in gasket line up with oil leads in block.
Normal Oil Pressure:—25-30 lbs.
Oil Pressure Regulator:—On oil pump cover. Operates at 27 lbs. Not adjustable.
Crankcase Capacity:—6 qts. refill.

CLUTCH:—**Borg & Beck Model 9A6.** Single plate, dry disc type. See article in Clutch Section for relining and assembling directions.
Facings—Woven type, 2 required. Inside Diam. 5⅝". Outside Diam. 9". Thickness .133".
Adjustment—Free movement of clutch pedal must be 1-1½". To adjust, loosen locknut and turn adjusting screw at lower end of inner lever on clutch throwout auxiliary shaft in front of clutch pedal.
Removal—Disconnect propeller shaft, remove transmission, take off clutch housing pan, take out six capscrews mounting clutch on flywheel turning all screws out evenly to release spring pressure. Clutch can be removed from below without removing flywheel housing.
NOTE—A locating dowel is mounted on the flywheel and the second clutch mounting screw hole on each side is counterbored deeper than the remaining holes. When mounting clutch, use the two screws with short thread and longer shank in these holes.

STEERING:—**Steering Gear**—Saginaw Worm-and-Roller type with center steering. See article in Steering Section for adjustments.
Front Suspension:—Independent, linked parallelogram type with coil springs. See article in Steering Section for description and adjustment procedure.
NOTE—Before checking front end, check tire inflation, front wheel balance, front wheel and tire runout (not to exceed ⅛"), bounce car up and down several times to allow frame to assume normal height.
King Pin Inclination—5°51' crosswise.
Caster—1½-2¼°. Adjustable. Caster affected by camber adjustment but not outside limits as given.
Camber—⅛-1°. Adjustable.
Toe In—⅛-3/16". Adjustable. Both tie rods must be turned equally.
Steering Geometry—Inner wheel turned 23° 10', outer wheel 20°.

BRAKES:—**Service**—Bendix Hydraulic, Duo-Servo, Single anchor type. Hand lever applies rear brakes. *See article in Mechanical Equipment Section for data.*
Brake Drum Diameter—11 1/16".
Brake Lining—Moulded and woven type. Width 2". Thickness 3/16". Length 23.7" per wheel.
Brake Clearance—.008" toe, .010" heel on each shoe.
Hand Brake Adjustment:—See Service Brakes.

ENGINE NUMBER—First number—L202,001. Stamped on ledge on top of block beside head at left front corner.

ENGINE SPECIFICATIONS:—Type—8 cyl., 'L' head.
Bore—3". **Stroke**—4¼".
Displacement—240.3 cubic inches.
Rated Horsepower—28.8 (SAE).
Developed Horsepower—100 at 3400 R.P.M.
Compression Ratio & Pressure—6.2-1 Std. cast-iron head. Pressure 116-126 lbs. at cranking speed of 100 R.P.M.
Vacuum Reading—Gauge should show steady reading of 17" of HG. minimum with engine idling at 300 R.P.M. or 6 M.P.H.

PISTONS:—Aluminum alloy, 'T' slot, Cam Ground type with Electrolite (hard oxide) bearing surface. Skirt is elliptical with .006-.008" greater diameter at right angles to pin bosses. Pistons cannot be ground. Use finished replacement pistons.
Weight—12.8 ozs. (stripped). **Length**—3¾".
Removal—Pistons and rods removed from below. Rotate crankshaft so that counterweights are crosswise and on opposite side from camshaft.
Clearance—.0013-.0018" measured ⅜" up on skirt and ⅜" below lower ring groove at right angles to pin hole for new pistons. See Fitting New Pistons.
Replacement Pistons:—Finished pistons with pins fitted furnished in .003", .005", .010", .015", .030" oversizes. Oversize pistons held to same weight as standard.
Fitting New Pistons:—With pin removed, check clearance by inserting .002" feeler ½" wide between piston and cylinder wall on pressure or camshaft side at right angles to pin hole. Piston should be inverted with slot away from camshaft. Pressure to withdraw feeler must be 4-11 lbs. with piston and block at 70° F.
Installing Pistons:—Mark 'V-S' on piston head must be toward valves (slot away from valves). Pin hole in piston offset 3/32" toward left (slotted side).

PISTON RINGS:—Two compression, two oil control rings per piston, all above the pin. Both oil ring grooves drilled radially with oil drain holes. Piston rings furnished in .010", .020", .030" oversizes.

Ring	Width	End Gap	Side Clearance
Comp.	⅛"	.007-.012"	.0015-.003"
Oil Cont.	3/16"	.007-.015"	.001-.0025"

NOTE—Install compression rings with groove or step downward.

PISTON PIN:—Diameter .8554-.8557". **Length** 2 23/32". Pin is locked in piston by lockscrew in one boss. Opposite end slotted to allow boss to slide freely on pin.
Pin Fit in Piston—.0001" loose to .0002" tight in plain boss end, .0002-.0005" tight in lock boss end.
Pin Fit in Rod Bushing—Clearance .0002-.0005". Pins selected to give this clearance. New rod bushings burnished and reamed to inside diameter of .8557-.8561."
Fitting Pins—Place piston and pin in boiling water for 1 minute. With special tool HM-535 insert pin in plain boss end and push lightly until lockscrew hole in pin and boss are aligned. Install lockscrew. Skirt taper with pin installed must not exceed .0005".
NOTE—Replacement pistons furnished with pins fitted. Pin bosses in piston are Electrolited and cannot be reamed. Pins not furnished oversize.

CONNECTING ROD:—Weight 33 ozs. **Length** 9".
Crankpin Journal Diameter—2¼".
Lower Bearing—Steel-backed, babbitt-lined, interchangeable type.
Clearance—.001-.003". Sideplay—.0055-.0105".
Bearing Adjustment:—None (no shims). Replace bearing shells. Do not file rod or cap faces. Bearings assembled with slight projection above faces to insure contact.
Installing Rods:—Oil spit hole in lower bearing upper half must be toward camshaft. Grooves in rod and cap bolt boss must be on same side as part number NOTE—Ground bolts used for cap and rod assembly. Common bolts must not be used.

CRANKSHAFT:—Five bearing. Integral counterweights.
Journal Diameters—#1, 2.373-2.374"; #2, 2.5605-2.5615"; #3, 2.623-2.624; #4, 2.6855-2.6865; #5, 2.748-2.749".
Bearing Type—Interchangeable steel-backed, babbitt-lined. Upper and lower halves not interchangeable.
Clearance—.001-.003".
Bearing Adjustment:—None (no shims). Replace bearings. Do not file bearing caps. Bearing upper halves can be removed without removing crankshaft by using tool HM-J-173. This is a flat headed plug which is slipped into oil hole in crankshaft. The head engages the edge of the bearing and turns it out as crankshaft is rotated. Install bearings in same manner (insert plain edge of bearing on indented side of upper bearing support).
End Thrust:—Taken by #1 (front) bearing. Endplay .004-.008". A bronze thrust plate .1205-.1235" thick is assembled at each end of front main bearing and is dowelled to bearing cap. There is a steel thrust collar on the crankshaft behind the crankshaft gear.
NOTE—In removing fan drive pulley sheet metal rim on hub must not be damaged.

CAMSHAFT:—Six bearings. Non-adjustable chain drive.
Journal Diameters—#1, 2.3095-2.3100"; #2, 2.2470-2.2475"; #3, 2.1845-2.1850"; #4, 2.1220-2.1225; #5, 2.0595-2.0600"; #6, 1.8095-1.8100".
Bearing Type—Metal-backed, babbitt-lined.
Clearance—.002-.004".
End Thrust:—Taken by spring-loaded plunger in forward end of camshaft and thrust plate on chain case cover.
Timing Chain:—Whitney. Width 1¼". Pitch .500". Length 46 links or 23".
Camshaft Setting:—Sprockets are marked. Mesh chain with sprockets turned so that marks are adjacent and in line with a straigtedge across the shaft centers. Use Sprocket Gauge HM-408-0.

VALVES:—Head Diameter Stem Diameter Length

Intake	1 9/16"	.3415-.3425"	5 9/32"
Exhaust	1 27/64"	.3405-.3415"	5 9/32"

	Seat Angle	Lift	Stem Clearance
Intake	30°	.300"	.00125-.00325"
Exhaust	45°	.300"	.00225-.00425"

Tappet Clearance—.008" Int., .010" Exh., warm.
Valve Guides:—Cast-iron. Install with turned portion below and finish ream to .34375-.34475" (inside diameter) after assembly. Guide must be 15/16" below top of block.
Valve Springs:—Free length 2 9/16". Install springs with three close-coils at top. No spring cages used.

	Spring Pressure	Spring Length
Valve Closed	43 lbs.	2 9/32"
Valve Open	116 lbs.	1 15/16"

NOTE—Springs are interchangeable (intake and exhaust, and 6 and 8 engines). Can be used on '33-35 engines. On '33 and '34 engines discard spring cages.
Valve Lifters:—Single piece cast-iron with core openings in sidewalls. Operate in removable guides in block. Clearance .0008". Serviced by renewing guides and installing standard lifters.
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open at TDC. Close 42° ALDC.
Exhaust Valves—Open 40° BLDC. Close 10° ATDC.
To Check Valve Timing—Check tappet clearance #6 intake valve. This valve should open with piston on top dead center when flywheel mark 'TDC/' lines up with pointed end of inspection hole cover screw in left front face of housing.
Motor Gauge—Weidenhoff #104 Adapter, #2 Rod.
NOTE—Steel ball insert in flywheel does not indicate top dead center point as on the six cylinder engine.

LUBRICATION:—Pressure. Gear type oil pump located in crankcase. Ignition timing not disturbed by removal of oil pump.
Normal Oil Pressure—25-30 lbs.
Oil Pressure Regulator—Mounted on oil pump. Operates at 27 lbs. Not adjustable.
Crankcase Capacity—7 qts. refill.

CLUTCH:—Borg & Beck Model 10A4. Single plate, dry disc type. See article in Clutch Section for relining and assembling directions.
Facings—Woven type, 2 required. Inside Diam. 6⅛". Outside Diam. 9⅞". Thickness .125".
Adjustment—Free movement of clutch pedal must be 1-1½". To adjust, loosen locknut and turn adjusting screw at lower end of inner lever on clutch throwout auxiliary shaft in front of clutch pedal.
Removal—Disconnect propeller shaft, remove transmission, take off clutch housing pan, take out six capscrews mounting clutch on flywheel turning all screws out evenly to release spring pressure. Clutch can be removed from below without removing flywheel housing.
NOTE—A locating dowel is mounted on the flywheel and the second clutch mounting screw hole on each side is counterbored deeper than the remaining holes. When mounting clutch, use the two screws with short thread and longer shank in these holes.

STEERING:—Steering Gear—Saginaw Worm-and-Roller type with center steering. See article in Steering Section for adjustments.
Front Suspension:—Independent, linked parallelogram type with coil springs. See article in Steering Section for complete data.
NOTE—Before checking front end, check tire inflation, front wheel balance, front wheel and tire runout (not to exceed ⅛"), bounce car up and down several times to allow frame to assume normal height.
King Pin Inclination—5°51' crosswise.
Caster—1½-2¼°. Adjustable. Caster affected by camber adjustment but not outside limits as given.
Camber—⅛-1°. Adjustable.
Toe In—⅛-3/16". Adjustable. Both tie rods must be turned equally.
Steering Geometry—Inner wheel turned 23°, outer wheel 20°.

BRAKES:—**Service**—Bendix Hydraulic, Duo-Servo, Single anchor type. Hand lever applies rear wheel brakes. See article in Brake Section for complete data.
Brake Drum Diameter—12".
Brake Lining—Molded & woven type. Width 2". Thickness 3/16". Length 25.9" per wheel.
Brake Clearance—.008" toe, 010" heel, each shoe.
Hand Brake Adjustment:—See Service Brake Adjustment.

SERIAL NUMBER:—On left frame side member under hood. First number F-372,001 (1937) and numbers for each plant for 1938 models as follows:
Lansing, Michigan .....F-600,001 and up
South Gate, California.....CF-504,001 to CF-540,000
Linden, New Jersey .....LF-545,001 to LF-600,000

ENGINE NUMBER:—First number F-670,001 ('37), F-828,001 ('38). On boss on left side of engine behind water pump. '38 motors with Auto. Transmission carry prefix 'FA'.

ENGINE SPECIFICATIONS:—6 cylinder, 'L' head.
Bore—3 7/16". **Stroke**—4⅛".
Displacement—229.7 cu. ins. **Rated HP.**—28.4.
Developed Horsepower—95 at 3400 R.P.M.
Compression Ratio—6.1-1 Std. cast-iron head.
Compression Pressure—146 lbs. at 1000 RPM. or 102-112 lbs. at 320 RPM. (cranking speed).
NOTE—New steel-asbestos cyl. head gasket used. Cannot be re-used. Use new gasket.
Vacuum Reading—17" min. @ 400 RPM. or 6 MPH.

PISTONS:—Aluminum alloy, 'T' slot, Cam Ground type with Electrolite (hard oxide) bearing surface.
Weight—17.35 ozs. (stripped). **Length**—4 1/32".
Removal—Pistons and rods removed from above.
Clearance—Skirt .0013-.0018".
Replacement Pistons:—Finished pistons with pins fitted furnished in .003", .005", .010", .015" and .030" oversize. Held to same weight as standard.
Fitting New Pistons:—With pin removed, check clearance by inserting .002" feeler ½" wide between piston and cylinder wall on camshaft side at right angles to pin hole. Invert piston with slot away from camshaft 4-11 lbs. pull required to withdraw feeler with piston and block at 70° F.
Installing Pistons:—Mark 'V-S' on piston head must be toward valves. Pin hole in piston offset 3/32" toward left (slotted side).

PISTON RINGS:—Two compression, two oil control rings per piston above pin. Oil ring grooves drilled with eighteen 5/32" oil drain holes. Ring oversizes—.010", .020", .030".

Ring	Width	End Gap	Side Clearance
Comp.	.1235-.1240"	.009-.014"	.002-.0035"
Oil	.1860-.1865"	.009-.014"	.0025"

NOTE—Install comp. rings with groove down.

PISTON PIN:—Diameter—.8554-.8557". **Length**—3 5/32". Pin locked in piston boss by lockscrew. Free end slotted to allow boss to slide freely in pin.
Pin Fit in Piston—.0001" loose to .0002" tight in plain boss end, .0002-.0005" tight in lock boss end.
Pin Fit in Rod Bushing—Clearance .0003-.0006". New rod bushings burnished and reamed to inside diameter of .8558-.8562".
Fitting Pins—*See Oldsmobile Shop Notes.*

CONNECTING ROD:—Weight 26.17 oz. **Length** 7 13/16". NOTE—8 cylinder rods furnished in service for six. Select rod to weight within ¼ oz. of other rods.
Crankpin Journal Diameter—2.123-2.124".
Lower Bearing—Removable steel-backed, babbitt.
Clearance—.001-.003" ('37), .0005-.002" ('38).
Sideplay—.0055-.0105".
Bearing Adjustment:—None. Replace bearings. Do not file rods or cap faces.
Installing Rods:—Oil spit hole in lower bearing upper half must be toward camshaft. Grooves in rod and cap bolt boss must be on same side as part number. NOTE—Ground bolts used for rod and cap assembly.

CRANKSHAFT:—4 bearing, integral counterweights.
Journal Diameters—#1, 2.478-2.479"; #2, 2.5405-2.5415"; #3, 2.6655-2.6665"; #4, 2.6855-2.6865.
Bearing Type—Interchangeable steel-backed, babbitt-lined. Bearing halves interchangeable (upper and lower) except #1 (front).
Clearance—.001-.003" ('37), .0005-.002" ('38).
Bearing Adjustment:—None (no shims). Replace bearings. Do not file caps. *See Oldsmobile Shop Notes for main bearing and oil seal data.*
End Thrust:—Taken by #1 (front) bearing. A bronze thrust plate .1205-.1245" thick is assembled at each end of bearing and is dowelled to bearing cap. Steel thrust collar between front bronze thrust plate and crankshaft gear. **Endplay**—.004-.008".

CAMSHAFT:—4 bearing, non-adjustable chain drive.
Journal Diameters—#1, 1.9975-1.9970"; #2, 1.9350-1.9345"; #3, 1.8725-1.8720"; #4, 1.8100-1.8095".
Bearing Type—Bronze bushings.
Clearance—.002-.004".
End Thrust:—Spring and plunger in front end of camshaft and steel plate on chain case cover.
Timing Chain:—Whitney. Width 1". Pitch .500". Length 23½" or 47 links.
See Oldsmobile Shop Notes for front end assembly dismantling for timing chain removal.
Camshaft Setting:—Sprockets are marked. Mesh chain with sprockets turned so that marks are adjacent and in line with a straightedge across the shaft centers. Use Sprocket Gauge HM-408-0.

VALVES:—	Head Diameter	Stem Diameter	Length
Intake	1 9/16"	.3415-.3425"	5 51/64"
Exhaust	1 27/64"	.3410-.3418"	5 51/64"

	Seat Angle	Lift	Stem Clearance
Intake	30°	.300"	.0012-.0032"
Exhaust	45°	.300"	.00245-.00425"

See Oldsmobile Shop Notes for Hood Side Panel Removal (1937), Fender Plate Removal (1938).
Tappet Clearance—.008" Int., .011" Exh., warm.
Valve Guides:—Cast-iron. Exhaust guide taper counterbored on inside diameter for ⅜" at top. Install ⅝" below top of block. Ream inside diam. to .34375-.34475" ('37), .34425-.34525" ('38). Lgth. 3 15/32".
Valve Springs:—Free length 2⅝". Interchangeable for either valve and on 6 & 8. Spring dampers used inside of spring at top. **Pressure & Length as follows:**

	Valve Closed	Valve Open
1937	46 lbs. at 2 9/32"	94 lbs. at 1 31/32"
1938	50½ lbs. at 2 1/4 "	95½ lbs. at 1 15/16"

Valve Lifters:—Mushroom type. Length 2½". Head Diam. 1¼". Body Diam. .6235-.6240". Clearance .0003-.0007". Furnished std., .002", .005" oversize.

VALVE TIMING:—See Camshaft Setting above.
Intake Valves—Open 5° BTDC. Close 45° ALDC.
Exhaust Valves—Open 45° BLDC. Close 5° ATDC.
To Check Valve Timing:—Check tappet clearance #1 intake valve. This valve should open with piston 5° or .0163" before top dead center when a point on the flywheel approximately 2 teeth before top dead center mark (steel ball insert) lines up with pointer in inspection hole in left front face of housing.
Motor Gauge—Weidenhoff Adapter #114, Rod #40.

LUBRICATION:—Pressure type. Gear type oil pump located on right side of crankcase.
NOTE—New gasket aligned with oil holes in block must be used when oil pump assembled to engine.
Normal Oil Pressure:—25-30 lbs. ('37), 28-33 lbs. ('38).
Oil Pressure Regulator:—On oil pump cover. Operates at 27 lbs. Not adjustable.
Crankcase Capacity:—6 quarts, refill.

COOLING SYSTEM:—Water Pump. Centrifugal, belt-driven, packless type.
See article in Mechanical Equipment Section for data.
Removal—Remove fan belt, three pump mounting capscrews, lift fan and pump assembly off.
Thermostat:—Harrison. In cyl. hd. water outlet.
Setting—Start to open 145°F. ('37), 152°F. ('38).
Water Capacity:—16 qts. ('37), 17 qts. ('38).

CLUTCH:—Borg & Beck Model 9A6. Single plate, dry disc type. Model No. 895 stamped on clutch cover.
See article in Mechanical Equipment Section for data.
Facings—Molded-woven, 2 required. Inside Diam. 5⅝". Outside Diam. 9¼". Thickness ⅛".
NOTE—Special spiral-grooved facings used with Self-Shifting Transmission (not interchangeable).
Pedal Adjustment—Free travel ¾-1". Free adjustable link at release lever end. Loosen locknut, adjust lever length.
Removal—Remove transmission (see Transmission Removal below), take off clutch underpan, take out six clutch cover mounting screws evenly, remove assembly from below.
NOTE—When mounting clutch, use two screws with short thread and longer shanks in second hole on either side of locating dowel.

TRANSMISSION:—Own—Helical gear type with Synchro Mesh on second and high gears.
See article in Mechanical Equipment Section for data.
Removal:—Disconnect front propeller shaft at transmission, remove 4 bolts at bearing support, slide bearing assembly to left, remove mounting bolts and withdraw transmission.

SELF-SHIFTING TRANSMISSION:—Optl. on F-38.
See article in Mechanical Equipment Section for complete Removal and Adjustment instructions.

UNIVERSAL JOINTS:—Mechanics—Model 2C, roller bearing type, three used.
See article in Mechanical Equipment Section for data.
Propeller Shaft Center Bearing:—See Oldsmobile Shop Notes for servicing data.

REAR AXLE:—Own make. Semi-floating, spiral bevel gear type with Hotchkiss drive.
See article in Mechanical Equipment Section for data.
Ratio—4.37-1 or 4.33-1 Std. '37. 4.37-1 Std. '38. 3.55-1 Auto. Transmission. 4.62-1 Optional (all).
Backlash—.004-.008". Screw adjustment.
Removal:—Remove wheel, drum, free backing plate (4 nuts), static collector, pull bearing retainer away from backing plate without disturbing plate, pull shaft and bearing (Tool J-942), secure plate with one nut. Disconnect rear universal joint remove ten capscrews freeing carrier from housing, lift carrier out. NOTE—Left wheel nuts front and rear have left hand threads.
Wheel Bearing Adjustment—None (shielded type).

SHOCK ABSORBERS:—Delco. Model 1947A, B (front), 1713-E-F (rear). Double acting, piston type.
See article in Mechanical Equipment Section for data.

STEERING:—Steering Gear—Saginaw Worm-and-Roller type with center steering.
See article in Mechanical Equipment Section for data.
Front Suspension:—Independent, linked parallelogram type with coil springs.
See article in Mechanical Equipment Section for data.
NOTE—Level frame by inserting 2" blocks between upper support arm and frame. Check following:
Kingpin Inclination—4° 51' 10" crosswise.
Caster—¼-1° pos. ('37). 0-¾° reverse ('38).
Camber—⅛-1°. Adjustable. Set Caster first.
Toe In—⅛-3/16". Adjust length of tie rods.
Steering Geometry—Inner w. 22½-23½°. Outer 20°

BRAKES:—Service—Bendix Hydraulic, Duo-Servo, single anchor type. Hand lever applies rear brakes.
See article in Mechanical Equipment Section for data.
Drum—Cast-iron. Diameter—11".
NOTE—Drum turn down limit .030" cut.
Lining—Prim.-molded.Sec.-woven&compressed.Width 1¾". Thick 3/16". Length (P) 9 11/32", (S) 11 31/32"
Clearance—.010" at heel and toe of each shoe.
Hand Brake Adjustment:—See Service Brake above.

SERIAL NUMBER:—On left frame side member under hood. First number L-146,001 (1937) and numbers for each plant for 1938 models as follows:
Lansing, Michigan .....L-212,001 and up
South Gate, California.....CL-187,001 to CL-195,000
Linden, New Jersey.....LL-197,001 to LL-212,000

ENGINE NUMBER:—First number L-250,001 ('37), L-296,001 ('38). On boss on left side of engine behind water pump. '38 motors built with Auto. Transmission carry prefix 'LA'.

ENGINE SPECIFICATIONS:—8 cylinder, 'L' head.
Bore—3¼". **Stroke**—3⅞".
Displacement—257.1 cubic inches.
Rated Horsepower—33.8 (S.A.E.)
Developed Horsepower—110 HP. at 3600 RPM.
Compression Ratio—6.2-1 Std. cast-iron head.
Compression Pressure—152 lbs. at 1000 RPM. or 104-114 lbs. at 310 RPM. (cranking speed).
NOTE—New steel-asbestos cyl. head gasket used. Cannot be re-used. Use new gasket.
Vacuum Reading—17" min. at 6 MPH.

PISTONS:—Aluminum alloy, 'T' slot, Cam Ground type with Electrolite (hard oxide) bearing surface.
Weight—15.75 ozs. (stripped). **Length**—3 15/16".
Removal—Pistons and rods removed from above.
Clearance—.0013-.0018" at skirt.

Replacement Pistons:—Finished pistons with pins fitted furnished in .003", .005", .010", .015" and .030" oversize. Held to same weight as standard.

Fitting New Pistons:—With pin removed, check clearance by inserting .002" feeler ½" wide between piston and cylinder wall on camshaft side at right angles to pin hole. Invert piston with slot away from camshaft. 4-11 lbs. pull required to withdraw feeler with piston and block at 70° F.

Installing Pistons:—Mark 'V-S' on piston head must be toward valves. Pin hole in piston offset 3/32" toward left (slotted side).

PISTON RINGS:—Two compression, two oil control rings per piston above pin. Oil ring grooves drilled with eighteen 5/32" oil drain holes. Ring oversizes —.010", .020", .030".

Ring	Width	End Gap	Side Clearance
Comp. ('37)	...1235-.1240"	.....009-.014"	.....002-.0035"
Comp. ('38)	...0930-.0935"	.....009-.014"	.....002-.0035"
Oil (all)	.....1860-.1865"	.....009-.014"	.....001-.0025"

NOTE—Install '37 comp. ring with groove down. '38 comp. ring taper faced (greater diameter at bottom). Install '38 comp. ring with side marked TOP to top.

PISTON PIN:—Diameter—.8554-.8557". **Lgth**—2 31/32". Pin locked in piston boss by lockscrew. Free end slotted to allow boss to slide freely on pin.
Pin Fit in Piston—.0001" loose to .0002" tight in plain boss end, .0002-.0005" tight in lock boss end.
Pin Fit in Rod Bushing—Clearance .0003-.0006". New rod bushings burnished and reamed to inside diameter of .8558-.8562".
Fitting Pins—*See Oldsmobile Shop Notes.*

CONNECTING ROD:—Weight 26.17 oz. **Length** 7 13/16".
Crankpin Journal Diameter—2.123-2.124".
Lower Bearing—Removable steel-backed, babbitt.
Clearance—.001-.003" ('37), .0005-.002" ('38).
Sideplay—.0055-.0105".

Bearing Adjustment:—None. Replace bearings.

Installing Rods:—Oil spit hole in lower bearing upper half must be toward camshaft. Grooves in rod and cap bolt boss must be on same side as part number.
NOTE—Ground bolts used for rod & cap assembly.

CRANKSHAFT:—5 bearing, integral counterweights.
Journal Diameters—#1, 2.478-2.479"; #2, 2.5405-2.5415"; #3, 2.603-2.604"; #4, 2.6655-2.6665"; #5, 2.6855-2.6865".
Bearing Type—Interchangeable steel-backed, babbitt-lined. Bearing halves interchangeable (upper and lower).
Clearance—.001-.003" ('37), .0005-.002" ('38).

Bearing Adjustment:—None (no shims). Replace bearings. Do not file caps. *See Oldsmobile Shop Notes for main bearing and oil seal data.*

End Thrust:—Taken by #1 (front) bearing. A bronze thrust plate .1205-.1245" thick is assembled at each end of bearing and is dowelled to bearing cap. Steel thrust collar between front bronze thrust plate and crankshaft gear. **Endplay**—.004-.008".

CAMSHAFT:—5 bearing, non-adjustable chain drive.
Journal Diameters—#1, 2.0600-2.0595"; #2, 1.9975-1.9970"; #3, 1.9350-1.9345"; #4, 1.8725-1.8720"; #5, 1.8100-1.8095".
Bearing—Bronze bushings. **Clearance**—.002-.004".

End Thrust:—Spring and plunger in front end of camshaft and steel plate on chain case cover.

Timing Chain:—Link-Belt. Width 1". Pitch .500" Length 23½" or 47 links.
See Oldsmobile Shop Notes for front end assembly dismantling for timing chain removal.

Camshaft Setting:—Sprockets are marked. Mesh chain with sprockets turned so that marks are adjacent and in line with a straightedge across the shaft centers. Use Sprocket Gauge HM-408-0.

VALVES:—	Head Diameter	Stem Diameter	Length
Intake	1 9/16"	.3415-.3425"	5 51/64"
Exhaust	1 27/64"	.3410-.3418"	5 51/64"

	Seat Angle	Lift	Stem Clearance
Intake	30°	.300"	.0012-.0032"
Exhaust	45°	.300"	.00225-.00425"

See Oldsmobile Shop Notes for Hood Side Panel Removal (1937), Fender Plate Removal (1938).

Tappet Clearance—.008" Int., .011" Exh., warm.

Valve Guides:—Cast-iron. Exhaust guide taper counterbored on inside diameter for ⅜" at top. Install ⅝" below top of block. Ream inside diam. to .34375-.34475" ('37), .34425-.34525" ('38). Lgth. 3 15/32".

Valve Springs:—Free length 2⅝". Interchangeable for either valve and on 6 and 8. Spring dampers used inside of spring at top.

	Valve Closed	Valve Open
1937	.....46 lbs. at 2 9/32"	.....94 lbs. at 1 31/32"
1938	.....50½ lbs. at 2 1/4 "	.....95½ lbs. at 1 15/16"

Valve Lifters:—Mushroom type. Length 2½". Head diam. 1¼". Body diam. .6235-.6240". Clearance .0003-.0007". Furnished std., .002", .005" oversize.

VALVE TIMING:—See Camshaft Setting above.
Intake Valves—Open TDC. Close 35° ALDC.
Exhaust Valves—Open 45° BLDC. Close 10° ATDC.

To Check Timing:—Check tappet clearance #1 intake valve. This valve should open with piston on top dead center (.000"), when flywheel mark 'TDC/' (NOT steel ball insert) lines up with pointed end of the inspection hole cover screw (left side).
Motor Gauge—Weidenhoff Adapter #114, Rod #40.

LUBRICATION:—Pressure type. Gear type oil pump located on right side of crankcase.
NOTE—New gasket aligned with oil holes in block must be used when oil pump assembled to engine.

Normal Oil Pressure:—25-30 lbs. ('37), 28-33 lbs. ('38).

Oil Pressure Regulator:—On oil pump cover. Operates at 27 lbs. Not adjustable.

Crankcase Capacity:—7 quarts, refill.

COOLING SYSTEM:—Water Pump. Centrifugal, belt-driven, packless type.
See article in Mechanical Equipment Section for data.
Removal—Remove fan belt, three pump mounting capscrews, lift fan and pump assembly off.

Thermostat:—Harrison. In cyl. hd. water outlet.
Setting—Start to open 145°F. ('37), 152°F. ('38).
Water Capacity:—20 qts. ('37), 21 qts. ('38).

CLUTCH:—Borg & Beck Model 10A7. Single plate, dry disc type. Model No. 897 stamped on Clutch Cover.
See article in Mechanical Equipment Section for data.
Facings—Molded-woven, 2 required. Inside Diam. 6". Outside Diam. 10". Thickness ⅛".
NOTE—Special spiral-grooved facings used with Self-Shifting Transmission (not interchangeable).
Pedal Adjustment—Free travel ¾-1". Free adjustable link at release lever end. Loosen locknut, adjust lever length.
Removal—Remove transmission (see Transmission Removal below), take off clutch underpan, take out clutch cover mounting screws evenly, remove assembly from below.
NOTE—When mounting clutch, use two screws with short thread and longer shanks in second hole on either side of locating dowel.

TRANSMISSION:—Own—Helical gear type with Synchro Mesh on second and high gears.
See article in Mechanical Equipment Section for data.

Removal:—Disconnect front propeller shaft at transmission, remove 4 bolts at bearing support, slide bearing assembly to left, remove mounting bolts and withdraw transmission.

SELF-SHIFTING TRANSMISSION:—Optl. (all models).
See article in Mechanical Equipment Section for complete Removal and Adjustment instructions.

UNIVERSAL JOINTS:—Mechanics—Model 2C, roller bearing type, three used.
See article in Mechanical Equipment Section for data.

Propeller Shaft Center Bearing:—See Oldsmobile Shop Notes for servicing data.

REAR AXLE:—Own make. Semi-floating, spiral bevel gear type with Hotchkiss drive.
See article in Mechanical Equipment Section for data.
Ratio—4.37-1 or 4.33-1 Std. '37. 4.37-1 Std. '38. 3.55-1 Auto. Transmission. 4.62-1 Optional (all).
Backlash—.004-.008". Screw adjustment.

Removal:—Remove wheel, drum, free backing plate (4 nuts), static collector, pull bearing retainer away from backing plate without disturbing plate, pull shaft and bearing (Tool J-942), secure plate with one nut. Disconnect rear universal joint, remove ten capscrews freeing carrier from housing, lift carrier out. NOTE—Left wheel studs have reverse threads.
Wheel Bearing Adjustment—None (shielded type).

SHOCK ABSORBERS:—Delco—Model 1947-A, B (front) 1713-E, F (rear). Double acting, piston type.
See article in Mechanical Equipment Section for data.

STEERING:—Steering Gear—Saginaw Worm-and-Roller type with center steering.
See article in Mechanical Equipment Section for data.

Front Suspension:—Independent, linked parallelogram type with coil springs.
See article in Mechanical Equipment Section for data.
NOTE—Level frame by inserting 2" blocks between upper support arm and frame. Check following:
Kingpin Inclination—4° 51' 10" crosswise.
Caster—¼-1° pos. ('37). 0-¾° reverse ('38).
Camber—⅛-1°. Adjustable. Set Caster first.
Toe In—⅛-3/16". Adjust length of tie rods.
Steering Geometry—Inner w. 22½-23½°. Outer 20°.

BRAKES:—Service—Bendix Hydraulic, Duo-Servo, single anchor type. Hand lever applies rear brakes.
See article in Mechanical Equipment Section for data.
Wheel Cylinders—Diam. Front 1 3/32", Rear 1".
Drum—Cast-iron. Diameter—12".
NOTE—Drum turn down limit .030" cut.
Lining—Prim.-molded.Sec.-woven&compressed.Width 1¾. Thick 3/16". Length (P) 10 3/32". (S) 12 61/64"
Clearance—.010" at heel and toe of each shoe.

Hand Brake Adjustment:—See Service Brakes.

F-60 & G-70 ENGINES:—*See Shop Notes for differences.*

ENGINE HOOD NOTE:—To raise hood, turn latch handle at bottom of grille, raise hood slightly and release safety catch.

FRONT END SHEET METAL ASSEMBLY AND OIL PAN REMOVAL:—*See Oldsmobile Shop Notes.*

SERIAL NUMBER:—On left frame side member under hood. 1st No. as follows:

	F-60	G-70
Lansing, Mich.	F-663001	G-300001
South Gate, Calif.	CF-511001	CG-10001
Linden, N. J.	LF-551301	LG-100001

ENGINE NUMBER:—First number (F-60) F-905501, (G-70) G-10001. On left front side of engine.
Self-Shifting Transmission Cars—Engine number prefix is FA (F-60), GA (G-70) instead of F or G.

ENGINE SPECIFICATIONS:—6 cylinder, 'L' head.
Bore—3 7/16". **Stroke**—3⅞" (F-60). 4⅛" (G-70).
Displacement—216 cu. ins. (F-60), 229.7 (G-70).
Rated Horsepower—28.4
Developed Horsepower—90 (F-60 Std. Hd), 85 (F-60 LC), 95 (G-70 Std.), 90 (G-70 LC) at 3400 RPM.
Compression Ratio—6.2-1 (Std. F-60), 6.1-1 (Std. G-70), 5.67-1 (Optl. F-60), 5.61-1 (Optl. G-70).
Compression Pressure—151 lbs. (F-60 Std. Hd.), 146 lbs. (G-70 Std. Hd.), 120 lbs. (All—Optl. LC. Hd.) at 1000 RPM. or approx. 102-112 lbs. at cranking speed. *See Oldsmobile Shop Notes for Cylinder Head Servicing.*
Vacuum Reading—Steady 17" min. at 6 MPH.

PISTONS:—Aluminum alloy, 'T' slot, cam ground type with hard oxide bearing surface.
Weight—17.75 ozs. (stripped). **Length**—4 1/32".
Removal—Pistons and rods removed from above.
Clearance—Top .026". Skirt .0013-.0018".
Replacement Pistons:—Finished pistons (pins fitted) .003", .005", .010", .015", .030" oversize (Std. Weight).
Fitting New Pistons:—Insert .002"x½" feeler between piston and cylinder wall on valve side with piston (pin out) inverted and 'T' slot on opposite side from feeler. Pull to withdraw feeler must be 4-11 lbs. (at 70° F., low lbs. pull below 70°, high above 70°).
Installing Pistons:—Mark 'V-S' on head toward valves (slot away from valves). Pin hole offset 3/32" to left.

PISTON RINGS:—2 compression (tapered, O.D. .001" larger at bottom), 2 oil control rings per piston, all above pin. All rings are coated.

Ring	Width	End Gap	Side Clearance
Compr.	.0925-.0935"	.007-.012"	.001-.003"
Oil	.1860-.1865"	.007-.015"	.001-.0025"

Replacement Rings:—.010", .020", .030" oversize.

PISTON PIN:—**Diameter**—.8554-.8557". **Length**—3 5/32". Pin locked in one piston boss by lockscrew (opposite end slotted). Pin bosses are plated.
Pin Fit in Piston—.0001" loose to .0002" tight (plain boss end), .0002-.0005" tight (lock boss end).
Pin Fit in Rod Bushing—.0003-.0006" clearance. *See Oldsmobile Shop Notes for Pin Fitting directions.*

CONNECTING ROD:—**Weight**—27.9 ozs. (F-60), 28.0 ozs. (G-70) complete except for bearing insert.
Length—7 15/16" (F-60), 7 13/16" (G-70).
Crankpin Journal Diameter—2.123-2.124".
Lower Bearing—Removable, steel-backed, babbitt.
Clearance—.0005-.0025". **Sideplay**—.0055-.0105".
Bearing Adjustment:—None. Replace bearings.
Installing Rods:—Oil spit hole at lower end toward valves and grooves on rod and cap bolt bosses (part number side) matched. Special ground bolts used.

CRANKSHAFT:—4 bearing. 7 integral counterweights.
Journal Diameters—#1, 2.478-2.479"; #2, 2.5405-2.5415"; #3, 2.6655-2.6665"; #4, 2.6855-2.6865".
Bearings—Removable, steel-backed, babbitt. Upper and lower halves interchangeable except #1 (front).
Clearance—.0005-.002" (rear), .001-.003" (all others).
Bearing Adjustment:—None (no shims). Replace bearings. Do not file caps. Tighten bolts to 135-145 ft.lbs. with J-1264 torque wrench. **Endplay** .004-.008". *See Oldsmobile Shop Notes for main bearing removal, end thrust and oil seal data.*

CAMSHAFT:—4 bearing. Non-adjustable chain drive.
Journal Diameters—#1, 1.9970-1.9975"; #2, 1.9345-1.9350"; #3, 1.8720-1.8725"; #4, 1.8095-1.8100". *See Oldsmobile Shop Notes for finished bushing sizes.*
Bearings—Bronze bushings. **Clearance** .0015-.0035".
End Thrust:—Spring-loaded steel plunger in front of camshaft bearing against steel plate on chain cover.
Timing Chain:—Whitney #4112239. Width 1". Pitch .500". Length 47 links or 23½". *See Oldsmobile Shop Notes for Front End Sheet Metal Assembly Removal.*
Camshaft Setting:—Mesh chain with sprocket marks adjacent and in line with a straightedge across the shaft centers (Gauge J-1248, F-60; HM-408-0, G-70).

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1 9/16"	.3415-.3425"	5 51/64"
Exhaust	1 27/64"	.3410-.3418"	5 51/64"

Seat Angle	Lift: (F-60)	(G-70)	Stem Clearance
Intake	30°	.286"	.303"	.00175-.00375"
Exhaust	45°	.313"	.298"	.00245-.00425"

Tappet Clearance:—.008" Intake, .011" Exh. hot.
Valve Guides:—Length 3 7/32" (¼" shorter at top over '38. May be used on '37 and '38 models). Press guides in so top end ⅞" below top of block (Tool J-1042). Ream to .34425-.34525".
Valve Springs:—Free Length 2⅝". Damper used in top of each spring.

	Spring Pressure	Length
Valve Closed	50½ lbs.	2¼"
Valve Open	95½ lbs.	1 15/16"

Valve Lifters:—Mushroom type. Body Diam. .6235-.6240". Serviced by installing lifters furnished .001", .0015", .002", .005", .010" oversize.
Clearance—.0005-.0008".
NOTE—Lifter holes have bearing-ized finish. Fit lifters without reaming holes wherever possible.
Valve Timing:—See Camshaft Setting above.

F-60
Intake Valves—Open 5° BTDC. Close 30° ALDC.
Exhaust Valves—Open 50° BLDC. Close 5° ATDC.
G-70
Intake Valves—Open 5° BTDC. Close 45° ALDC.
Exhaust Valves—Open 45° BLDC. Close 5° ATDC.
Valve Timing Check—Set tappet clearance #1 intake valve at .0124". This valve should open with piston 5° or .0074" (F-60), .0163" (G-70) before top dead center when a point on the flywheel approximately 2 teeth before TDC mark (steel ball insert) lines up with pointer (inspection hole left front face of housing). Reset tappet clearance at .008" hot.

LUBRICATION:—Pressure. Gear type oil pump on right side of crankcase. *See Oldsmobile Shop Notes for data.*
Normal Oil Pressure—28-33 lbs. **Regulator** On pump cover. Opens at 27 lbs. Not adjustable.
Crankcase Capacity—5 quarts.

COOLING SYSTEM:—**Capacity**—17 quarts.
Water Pump:—Packless, sealed bearing type. *See article in Mechanical Equipment Section for data.*
Removal—Remove fan belt, 3 pump mounting capscrews, and lower radiator hose. Lift pump out.
Thermostat:—Harrison. In cylinder head outlet.
Setting—Starts to open at 152° F. Fully open 173° F.
Temperature Gauge:—AC#1510796 Std.#1510830 RHD. *See article in Mechanical Equipment Section for data.*

CLUTCH:—**Borg & Beck Model 9A6 (First G-70), 9A7 (Later G-70, All F-60).** Cover marked #895 (9A6), #924 (9A7). Single plate, dry disc type. *See article in Mechanical Equipment Section for data.*
Facings—Molded-woven, 2 required. Inside Diam. 5⅝" (First G-70), 6" (Later G-70, F-60 with S-S Trans.), 6¼" (F-60 Std. Trans.). Outside Diam. 9" (F-60 Std. Trans.), 9¼" (all others). Thickness .125"
Adjustment:—Pedal free movement 1-1½" (adjusting clevis and locknut on link at clutch fork).
NOTE—Arm on auxiliary shaft has 2 holes for pedal pushrod link. Use rear hole only.
Removal:—Remove transmission (see below), take off clutch underpan and re-inforcing plate (G-70 only), mark clutch and flywheel, take out six mounting screws in clutch cover flange. NOTE—Install two mounting screws with long shank in second hole on each side of locating dowel when installing clutch. *See Oldsmobile Shop Notes for re-inforcing plate data.*

TRANSMISSION:—**Own Make.** All helical gear, constant-mesh, synchro-mesh (second & high), sliding gear (low & reverse) with new remote shift control.
Transmission Control:—Oldsmobile 'Handi-shift' type. *See articles in Mechanical Equipment Section for data.*
Removal:—Disconnect lower control rod at transmission, disconnect selector cable from cable anchor bracket, unscrew cable from shaft, remove selector shaft lever (with helper springs) and speedometer cable. Remove propeller shaft (disconnect rear U-joint and pull shaft out), remove mounting bolts, pull transmission straight back and remove.

SELF-SHIFTING TRANSMISSION:—Optl. (all models). *See article in Mechanical Equipment Section for data.*

UNIVERSAL JOINTS:—**Mechanics Type 2C.** Roller bearing type, 2 used (3 on G-70 with Optl. S-S Trans.). *See article in Mechanical Equipment Section for data.*
Propeller Shaft Center Bearing:—On G-70 with Optl. S-S Trans. only. *See Oldsmobile Shop Notes.*

REAR AXLE:—**Own Make.** Semi-floating, hypoid gear type with torque taken through 2 support arms. *See article in Mechanical Equipment Section for data.*
Ratio—4.3-1 Std. 3.636-1 Self-Shift Tr. 4.55-1 Mt.
Backlash—.004-.008". Screw adjustment.
Removal:—Disconnect drive shaft at rear universal, remove axle shafts (see below), remove capscrews on carrier flange, pull carrier assembly out.
Axle Shaft Removal—Hoist rear end, remove wheel, brake drum, backing plate mounting nuts, static collector, bearing retainer (do not allow backing plate to shift or damage brake line). Pull shaft and bearing with puller J-942 (do not allow shaft to drag on oil seal), replace one backing plate nut.
Rear Suspension:—Quadri-coil type (support arms). *See article in Mechanical Equipment Section for data.*

SHOCK ABSORBERS:—**Delco.** Front—Model 1947-C (right), 1947-D (left). Rear—1751-U (right), 1751-T (left). Double acting hydraulic type. Rear shocks are new parallel cylinder type. *See article in Mechanical Equipment Section for data.*

STEERING:—**Steering Gear**—Saginaw Worm-and-Roller type with new steering linkage. *See article in Mechanical Equipment Section for data.*
Front Suspension:—Independent, linked parallelogram type with coil springs. *See article in Mechanical Equipment Section for data.*
Kingpin Inclination—4°51'10".
Caster—0-¾° reverse.
Camber—⅛° to 1°. Adjustable.
Toe In—⅛-3/16". Adjust each end tie rod.
Steering Geometry (Toe out on turns)—Inner wheel turned 23° plus or minus ½°. Outer wheel 20°.

BRAKES:—**Service.** Bendix hydraulic, duo-servo, single anchor type without eccentric adjustment. Hand lever applies rear service brakes. *See article in Mechanical Equipment Section for data.*
Drums—Cast-iron. Diameter 11".
Lining—Molded. Width 1¾". Thickness 3/16". Length—Primary Shoe 9 11/32". Secondary 11 31/32".
Clearance—.015" both ends of secondary shoe.
Hand Brake:—See Service Brakes above.

FRONT END SHEET METAL ASSEMBLY AND OIL PAN REMOVAL:—*See Oldsmobile Shop Notes.*

ENGINE HOOD NOTE:—To raise hood, turn handle at bottom of grille, raise hood slightly and release safety catch.

SERIAL NUMBER:—On left frame side member under hood. First number L-228201 (Lansing, Mich.), CL-189001 (California), LL-199001 (Linden).

ENGINE NUMBER:—1st number L-316001. On left side of engine behind water pump. **Self-Shifting Transmission Cars**—Carry prefix 'LA'.

ENGINE SPECIFICATIONS:—8 cylinder, 'L' head.
Bore—3¼". **Stroke**—3⅞".
Displacement—257.1 cu. ins. **Rated HP**—33.8.
Developed Horsepower—110 HP. (Std. Hd.), 105 HP. (Optl. LC. Hd.) at 3600 R.P.M.
Compression Ratio—6.2-1 Std., 5.8-1 Optl.
Compression Pressure—152 lbs (Std. Hd.), 145 lbs. (Optl. Hd) at 1000 R.P.M. or approximately 104-114 lbs. at cranking speed for Std. head.
See Oldsmobile Shop Notes for cylinder head servicing.
Vacuum Reading—Steady 17" min. at 6 MPH.

PISTONS:—Aluminum alloy, 'T' slot, cam ground type with hard oxide bearing surface.
Weight—15.75 ozs. (stripped). **Length**—3 15/16".
Removal—Pistons and rods removed from above.
Clearance—Top .026". Skirt .0013-.0018".
Replacement Pistons:—Finished pistons (pins fitted) .003", .005", .010", .015", .030" oversize. Same wt. as std.
Fitting New Pistons:—Insert .002" x ½" x 12" feeler between piston and cylinder wall on valve side with piston (pin out) inverted and 'T' slot on opposite side from feeler. Pull to withdraw feeler must be 4-11 lbs. (piston and block at 70°F.—low lbs. pull below 70°, high lbs. above 70°).
Installing Pistons:—Mark 'V-S' on head to valves (slot away from valves). Pin hole offset 3/32" to left.

PISTON RINGS:—2 compression (tapered. O.D. .001" larger at bottom), 2 oil control rings per piston, all above pin.
NOTE—Install comp. rings with mark TOP to top.

Ring	Width	End Gap	Side Clearance
Compr.	.0925-.0935"	.009-.014"	.001-.003"
Oil	.1860-.1865"	.009-.014"	.001-.0025"

Replacement Rings:—.010", .020", .030" oversize.

PISTON PIN:—**Diameter**—.8554-.8557". **Length** 2 31/32". Pin locked in 1 piston boss by lockscrew. Free end slotted (allows boss to slide on pin). Bosses plated.
Pin Fit in Piston—.0001" loose to .0002" tight in plain boss end, .0002-.0005" tight in lock boss end.
Pin Fit in Rod Bushing—Clearance .0003-.0006".
Fitting Pins—*See Oldsmobile Shop Notes.*

CONNECTING ROD:—**Length** 7 13/16". **Weight** 28.0 ozs. (complete except less bearing inserts).
Crankpin Journal Diameter—2.123-2.124".
Lower Bearing—Removable steel-backed, babbitt.
Clearance—.0005-.0025". **Sideplay**—.0055-.0105".
Bearing Adjustment:—None. Replace bearings.
Installing Rods:—Oil spit hole in lower bearing upper half to valves. Grooves in rod and cap bolt boss on part number side must be matched. Ground bolts used (tighten to 30-35 ft. lbs. with J-1264 torque wrench).

CRANKSHAFT:—5 bearing. 8 integral counterweights.
Journal Diameters—#1, 2.478-2.479"; #2, 2.5405-2.5415"; #3, 2.603-2.604"; #4, 2.6655-2.6665"; #5, 2.6855-2.6865".
Bearings—Removable steel-backed, babbitt-lined. Upper and lower halves interchangeable.
Clearance—.001-.003" (#1, 2, 3, 4), .0005-.002" (#5).
Bearing Adjustment:—None (no shims). Replace bearings. Do not file caps. Tighten bolts to 135-145 ft. lbs. with J-1264 torque wrench. **Endplay**—.004-.008". *See Oldsmobile Shop Notes for main bearing removal, end thrust and oil seal data.*

CAMSHAFT:—5 bearing. Non-adjustable chain drive.
Journal Diameters—#1, 2.0600-2.0595"; #2, 1.9975-1.9970"; #3, 1.9350-1.9345"; #4, 1.8725-1.8720"; #5, 1.8100-1.8095". *See Oldsmobile Shop Notes for reamed bushing sizes.*
Bearings—Bronze bushings. **Clearance** .0015-.0035".
End Thrust:—Spring-loaded steel plunger in front of camshaft bearing against steel plate on chain cover.
Timing Chain:—Link-Belt #365. Width 1". Pitch .500". Length 47 links or 23½". *See Oldsmobile Shop Notes for front end sheet metal assembly removal.*
Camshaft Setting:—Mesh chain with sprocket marks adjacent and in line with a straightedge across the shaft centers (or use Gauge HM-408-0).

VALVES:—	Head Diameter	Stem Diameter	Length
Intake	1 9/16"	.3415-.3425"	5 51/64"
Exhaust	1 27/64"	.3410-.3418"	5 51/64"

	Seat Angle	Lift	Stem Clearance
Intake	30°	.286"	.00175-.00375"
Exhaust	45°	.313"	.00245-.00425"

Tappet Clearance:—.008" Intake, .011" Exh. hot.
Valve Guides:—Length 3 7/32" (¼" shorter at top over '38. May be used on '37 and '38 models). Press guides in so top end ⅞" below top of block (Tool J-1042). Ream to .34425-.34525".

Valve Springs:—Free length 2⅝". Damper used in top of each spring.	Spring Pressure	Length
Valve Closed	50½ lbs.	2 1/4"
Valve Open	95½ lbs.	1 15/16"

Valve Lifters:—Mushroom type. Body Diam. .6235-.6240". Serviced by installing lifters furnished .001", .0015", .002", .005", .010" oversize.
Clearance—.0005-.0008".
NOTE—Lifter holes have bearing-ized finish. Fit lifters without reaming hole wherever possible.
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open at TDC. Close 35° ALDC.
Exhaust Valves—Open 45° BLDC. Close 10° ATDC. These figures correct with tappet clearance of .0124" Intake and .0155" Exhaust.
Valve Timing Check—Set tappet clearance #1 intake valve at .0124". This valve should open with piston on top dead center (.000") when flywheel mark 'TDC/' (NOT steel ball insert) lines up with pointed end of the inspection hole cover screw in left front face of flywheel housing.
Motor Gauge—Weidenhoff Adapter #114, Rod #40.

LUBRICATION:—Pressure (gear type oil pump on right of engine). *See Oldsmobile Shop Notes for pump data.*
Normal Oil Pressure:—28-33 lbs.
Oil Pressure Regulator:—On pump. Opens at 27 lbs. Non-adjustable type.
Crankcase Capacity:—6 quarts.

COOLING SYSTEM:—**Capacity**—24 quarts.
Water Pump:—Packless, sealed bearing type.
See article in Mechanical Equipment Section for data.
Removal—Remove fan belt, 3 pump mounting capscrews, and lower radiator hose. Lift pump out.
Thermostat:—Harrison. In cylinder head outlet.
Setting—Starts to open 152° F. Fully open 173° F.
Temperature Gauge:—AC #1510796, 1510830 RHD.
See article in Mechanical Equipment Section for data.

CLUTCH:—**Borg & Beck Model 10A7.** Marked 897 (first cars), 927 (later cars). Single plate, dry disc type.
See article in Mechanical Equipment Section for data.
Facings—Moulded-woven, 2 required. Inside Diameter 6" (897), 7" (927), Outside Diameter 10" (all), Thickness .125" (all).
Adjustment:—Pedal free movement 1-1½" (adjusting clevis and locknut on link at clutch fork).
NOTE—Arm on auxiliary shaft has 2 holes for pedal push rod link. Use front hole only.
Removal:—Remove transmission (see below), take off clutch underpan and reinforcing plate, mark clutch and flywheel take out 6 mounting screws in cover NOTE—Use 2 mounting screws with long shank in second hole on each side of locating dowel.
See Oldsmobile Shop Notes for re-inforcing plate data.

TRANSMISSION:—**Own make.** All helical gear, constant-mesh, synchro-mesh (second & high), sliding gear (low & reverse) with new remote shift control.
Transmission Control:—Oldsmobile 'Handi-shift' type.
See articles in Mechanical Equipment Section for data.
Removal:—Disconnect lower control rod at transmission and selector cable from cable anchor bracket, unscrew cable from shaft, remove selector shaft lever (with helper springs) and speedometer cable. Remove propeller shaft (disconnect rear U-joint and pull shaft out), and take out 4 transmission mounting bolts, pull transmission straight back.

SELF-SHIFTING TRANSMISSION:—Optional.
See article in Mechanical Equipment Section for data.

UNIVERSAL JOINTS:—**Mechanics Type 2C.** Roller bearing type. 2 used (3 with Self-Shift Trans.).
See article in Mechanical Equipment Section for data.
Propeller Shaft Center Bearing:—Used on cars with Self-Shifting Transmission.
See Oldsmobile Shop Notes for servicing data.

REAR AXLE:—**Own make.** Semi-floating, hypoid gear type with torque taken through 2 support arms.
See article in Mechanical Equipment Section for data.
Ratio—4.3-1 Std. 3.636-1 Self-Shift Tr. 4.55-1 Mt.
Backlash—.004-.008". Screw adjustment.
Removal:—Disconnect drive shaft at rear universal, remove axle shafts (see below), remove capscrews on carrier flange, pull carrier assembly out.
Axle Shaft Removal—Hoist rear of car, remove wheel, brake drum and 4 nuts securing backing plate to housing, remove static collector and bearing retainer (avoid shifting backing plate so as not to damage brake line). Pull shaft (Puller J-942). Do not drag shaft on seal. Secure backing plate with one nut. **Wheel Bearing Adjustment**—None.
Rear Suspension:—Coil springs with 2 support arms.
See article in Mechanical Equipment Section for data.

SHOCK ABSORBERS:—**Delco.** Front—Model 1947-C (right), 1947-D (left). Rear—1751-U (right), 1751-T (left). Double acting, hydraulic type. Rear shocks are new parellel cylinder type.
See articles in Mechanical Equipment Section for data.

STEERING:—**Steering Gear.** Saginaw Worm-and-Double Roller type with new Relay Arm and Rod linkage.
See article in Mechanical Equipment Section for data.
Front Suspension:—Independent, linked parallelogram type with coil springs.
See article in Mechanical Equipment Section for data.
Kingpin Inclination—4°51'10".
Caster—0-¾° reverse.
Camber—⅛-1°. Adjustable.
Toe In—⅛-3/16". Adjust each tie rod.
Steering Geometry (Toe-out on Turns)—Inner wheel turned 23° plus or minus ½°. Outer wheel 20°.

BRAKES:—**Service.** Bendix hydraulic, duo-servo, single anchor type with eccentric adjustment. Hand lever applies rear service brakes.
See article in Mechanical Equipment Section for data.
Drums—Cast-iron. Diameter 12".
NOTE—Drum turn down limit .030" cut.
Lining—Primary—molded. Secondary—woven and compressed. Width 1¾". Thickness 3/16". Length—Primary 8 27/32" (front), 10 3/32" (rear); Secondary 12 61/64" (all).
Clearance—.010. at heel and toe of each shoe.
Hand Brake:—See Service Brakes above.

1937-38-39 MODELS

FRONT END REMOVAL:—For work on front of engine, remove radiator and fender assembly as a unit as follows: drain cooling system, remove fender-to-body bolts, fender-to-running board bolts, fender to brace bolts, disconnect radiator hoses, free radiator tie rods, free radiator anchor bolt on frame remove running board molding from fender and lift entire assembly off.

1938-39 MODELS

ORIGINAL BORE & PISTON SIZES:—Piston size indicated by mark stamped on head of each piston. Cylinder bore size indicated by mark stamped on top left face of cylinder block at Cylinder #4 (Six), #8 ('120' Eight), #1 (Super Eight), #1 of Right Hand Bank (Twelve). Piston and cylinder marks should correspond (AA piston in AA bore, etc) as shown in following tables:

SIX

Mark	Piston Size	Cylinder Size
AA	3.49825-3.49850"	3.49950-3.49975"
A	3.49850-3.49875"	3.49975-3.50000"
BB	3.49875-3.49900"	3.50000-3.50025"
B	3.49900-3.49925"	3.50025-3.50050"
CC	3.49925-3.49950"	3.50050-3.50075"
C	3.49950-3.49975"	3.50075-3.50100"
DD	3.49975-3.50000"	3.50100-3.50125"
D	3.50000-3.50025"	3.50125-3.50150"

'120' EIGHT

Mark	Piston Size	Cylinder Size
AA	3.24825-3.24850"	3.24950-3.24975"
A	3.24850-3.24875"	3.24975-3.25000"
BB	3.24875-3.24900"	3.25000-3.25025"
B	3.24900-3.24925"	3.25025-3.25050"
CC	3.24925-3.24950"	3.25050-3.25075"
C	3.24950-3.24975"	3.25075-3.25100"
DD	3.24975-3.25000"	3.25100-3.25125"
D	3.25000-3.25025"	3.25125-3.25150"

SUPER EIGHT

Mark	Piston Size	Cylinder Size
AA	3.18575-3.18600"	3.18700-3.18725"
A	3.18600-3.18625"	3.18725-3.18750"
BB	3.18625-3.18650"	3.18750-3.18775"
B	3.18650-3.18675"	3.18775-3.18800"
CC	3.18675-3.18700"	3.18800-3.18825"
C	3.18700-3.18725"	3.18825-3.18850"
DD	3.18725-3.18750"	3.18850-3.18875"
D	3.18750-3.18775"	3.18875-3.18900"

TWELVE

Mark	Piston Size	Cylinder Size
AA	3.43575-3.43600"	3.43700-3.43725"
A	3.43600-3.43625"	3.43725-3.43750"
BB	3.43625-3.43650"	3.43750-3.43775"
B	3.43650-3.43675"	3.43775-3.43800"
CC	3.43675-3.43700"	3.43800-3.43825"
C	3.43700-3.43725"	3.43825-3.43850"
DD	3.43725-3.43750"	3.43850-3.43875"
D	3.43750-3.43775"	3.43875-3.43900"

1937-38-39 MODELS

CYLINDER BLOCK REMOVAL (SUPER EIGHT):—Remove head, remove valves 1, 8, 9, 16 (for access to crankcase stud nuts), remove nuts on all crankcase studs. NOTE—Block may be re-installed with pistons and rods installed in cylinder bores by pulling pistons up until pins exposed and passing a length of rod or wire through all pins.

1938-39 MODELS

CYLINDER HEADS (SIX, '120' EIGHT, SUPER 8):—Cast iron heads used in 1939 and on 1938 Six (std. head). Aluminum heads used on all other 1938 cars. Each head marked by part number on front end (and letters 'HC' for optl. high compression heads).

Car	Standard	High Compression
Six (1938)	324285	335664
Six (1939)	324285	317725
Eight (1938)	327564	317737
Eight (1939)	330812	341344
Super 8 ('38)	221400 or 237994	239001
**Super 8 ('39)	242511	335618

**—Low compression iron head marked 338960.

Replacement Note—Cast iron heads only available for replacement. Use copper ferruled gaskets with cast iron hds., terne ferruled gaskets with alumin'm.

Head Installation—Coat machined face of cylinder head and lower face of gasket with Perfect Seal (Grade A). Coat studs with grease. Tighten head cold to 740-760 in. lbs. (Six, Eight), 700-720 in. lbs. (Super 8). Recheck to these figures when warm.

1937-38-39 MODELS

CYLINDER HEADS (TWELVE):—Heads are aluminum. Standard compression head unmarked, Low Compression head marked 'L.C.', High Compression head marked 'H.C.' on top of head at rear end.

Head Installation—Coat machined face of head and lower face of gasket with Perfect Seal (Grade A), coat studs with grease. Tighten head cold to 740-760 in. lbs. and recheck when warm.

1937-38-39 MODELS ('120' 1935-39)

REPLACEMENT PISTONS:—Finished Autothermic, Cam-ground, Tin-plated type pistons (as furnished for installation on 1939 and previous car models) are stamped on head with decimal figure (.005, .010, etc.) indicating nominal oversize and one or two letters (AA, A, BB, B, CC, C, DD, D) which indicates the actual variation of the piston (in .00025" steps) from the indicated nominal oversize. See tables below for oversizes and size variations for each letter. This system of marking makes it possible to order a finished piston (using number and letter) for any particular finished bore size within these limits.

Piston Oversizes
(Figure Stamped on Piston Head)

Six & Eight	Super Eight	Twelve
Standard	Standard	Standard
.005" Oversize	.003" Oversize	.003" Oversize
.010" "	.005" "	.005" "
.020" "	.010" "	.010" "
.030" "	.015" "	.015" "
.040" "	.020" "	.020" "
	.025" "	.030" "
	.030" "	.045" "
	.035" "	
	.045" "	

Piston Variation
(Letters Stamped on Piston Head)
For All Models and Piston Oversizes

AA—.00025" Under marked size.
A—Same as marked size.
BB—.00025" Over marked size.
B—.0005" Over marked size.
CC—.00075" Over marked size.
C—.001" Over marked size.
DD—.00125" Over marked size.
D—.0015" Over marked size.

Super Eight Note—Factory reground cylinder blocks (with Pistons, Pins, and Rings fitted) are furnished on an 'exchange' basis. See Cylinder Block Removal

1937-38-39 MODELS

SPECIAL RING INSTALLATIONS:—To correct piston slap and excessive oil consumption on engines with some service, manufacturer recommends that special Perfect Circle piston ring combination be installed as follows (piston ring grooves numbered from head toward skirt):

Six & Eight

#1—P.C. #200 (when piston expanders used) or
#1—P.C. #70 (when piston expanders not used).
#2—P.C. #X-90 Compression Ring.
#3—P.C. #X-90 Oil Ring.

NOTE—#200 ring must be installed with groove on inner edge toward top of piston.

Super Eight

#1—P.C. #70.
#2—P.C. #X-90 Compression Ring.
#3 & 4—P.C. #X-90 Oil Rings.

1937-38-39 MODELS

PISTON PIN BUSHING (SIX & EIGHT):—Formed by two split type bushings pressed in rod eye from opposite sides so as to form oil groove in center. Rifle-drilled oil passage in rod must open into this groove. New bushings should be burnished (Packard Tool ST-5008 (grind pilot end of tool to diameter of .861" so that it will enter 1939 type bushings) and then ream bushing to size for correct fit.

1939 MODELS

CONNECTING ROD 'PALNUTS' (SIX & EIGHT):—Special patented self-locking locknuts are used on connecting rod bolt nuts in place of cotter pins. To install, turn regular connecting rod bolt up to desired point, turn 'Palnut' on bolt (smooth side toward regular nut) until it contacts nut, then tighten Palnut ¼-⅓ additional turn to lock it in place.

1938 MODELS

CAMSHAFT & OIL PUMP GEAR CHANGE (SIX & EIGHT):—Late cars with suffix letter 'B' following engine number have forged steel camshaft (first cars with suffix letter 'A' had cast alloy iron type camshaft same as 1937 cars). **Oil pump drive gear must be same material as Camshaft.** Both type gears furnished for service. Note engine suffix letter when replacing oil pump drive gear.

1938 MODELS

EXHAUST VALVE GUIDE CHANGE TO PREVENT STICKING (SIX & EIGHT):—Late 1938 cars have shorter exhaust valve guide (top of guide 31/32" below top of valve seat with top of guide counterbored ¼" deep to diameter of ⅜"). All cars with longer first type guide (top of guide 23/32" below valve seat) should be re-worked with special Counterbore-and-Cutoff Tool SE-5123 to the same dimensions as the later type guide. If this tool not available, counterbore exhaust valve guides adjacent to dash to depth of ½" without cutting off top of guide.

1938 MODELS

VALVE LIFTERS (SIX & EIGHT):—Early cars with suffix letter 'A' following engine number have cast alloy iron camshaft and use steel valve lifters. Late cars with suffix letter 'B' have forged steel camshaft and chilled iron lifters. **Never use steel lifters with steel camshaft.** Either type lifter can be used on cast alloy iron camshafts. Note engine suffix letter when replacing valve lifters.

1937-38-39 MODELS

OIL PUMP INSTALLATION (SIX & EIGHT):—Install pump with driving slot parallel to center-line of camshaft with distributor rotor in line with #1 segment in cap. Recheck ignition timing.

ENGINE NUMBER:—First number 340,001 (901, 2 '32), 370,001 (1001, 2 '33), 374,001 (1100, 1, 2 '34). Stamped on left hand front engine support arm.

ENGINE:—Eight cylinder In Line, 'L' head type. Cylinders cast enbloc.

Dimensions—Bore, 3 3/16". Stroke, 5". Displacement, 320 cu. ins.

Horsepower—Rated 32.5. Developed 110 ('32), 120 ('33-34) at 3200 R.P.M.

Compression—Std. 6.0-1. Compression pressure, 95-100 lbs. at 125 R.P.M.
Optl. 6.36-1. Compression pressure, 123 lbs. at 125 R.P.M.

Pistons:—Permite aluminum alloy, steel strut, split skirt type.

Removal—Pistons removed from above, rods from below. Push piston up until pin exposed, remove locking ring, push pin out, remove piston from above, lower rod and remove from below.

Clearance—.0015" (skirt).

NOTE:—Istall pistons with slot toward valve side of engine.

Piston Rings:—Four rings per piston, all above pin. #1 to 3, compression rings. #4, oil control ring. Lower ring groove drilled radially with twelve ⅛" oil drain holes.

Ring	Width	End Gap	Groove Depth
Comp. (all)	⅛"	.007" min.	.1575"
Oil Cont. (#4)	5/32"	.007" min.	.1575"

Piston Pin:—Diameter, ⅞". Length, 2 47/64". Pin floats in piston and rod.

Pin Fit in Piston—Push fit.

Pin Fit in Rod—Hand push fit. End play, ⅛".

Connecting Rod:—Weight, 2 lbs., 6¾ ozs. Length, 10⅞".

Crankpin Journal Diameter—2 3/16".

Lower Bearing Type—Poured babbitt integral with rod and cap.

Clearance—.0015". Sideplay .003".

Adjustment—None (no shims). Replace rods. Do not file rod or cap.

NOTE:—Rods now installed with oil bleed holes (upper half lower bearing) toward valve side of engine.

Crankshaft:—Nine main bearing type.

Journal Sizes—2⅝" diameter (all bearings).

Bearing Type—Bronze-backed ('32), steel-backed ('33-34), babbitt-lined.

Clearance—.001".

Adjustment—None (no shims). Replace bearings. Do not file bearing caps.

End Thrust—Taken by #7 main bearing. Endplay, .003"

Camshaft:—Drive, adjustable chain. Eight bearing type.

Chain—Morse #1866. Width, 1½". Length, 32" or 64 links. Pitch, .500".

Camshaft Setting—Sprokets are marked. Mesh chain with sprockets turned so that marks are adjacent and in line with a straightedge across the shaft centers.

Chain Adjustment—Remove inspection plug on top surface of chain case at right of engine. Adjust chain whenever sideplay at this point exceeds ½". To adjust, loosen generator flange mounting screws, pull generator away from engine until chain sideplay is ¼", tighten mounting screws. With correct adjustment chain will operate noiselessly (if chain hums, back adjustment off slightly).

Valves:—	Head Dia.	Stem Dia.	Length	Seat Angle	Lift
Intake	1 21/32"	.3405"	7⅜"	45°	.358"
Exhaust	1 15/32"	.3405"	7⅜"	45°	.358"

Stem-to-Guide Clearance—.0025" (intake), .004" (exhaust).

Tappet Clearance—.004" (all valves '32), .004" Intake, .006" Exhaust (1933-34) with engine warm.

Valve Springs—73 lbs. at 3 1/16" (valve closed).

Valve Timing—901, 2 1932.

Intake Valve Open—20° Before TDC. Close—65° After LDC.
Exhaust Valves Open—65° Before LDC. Close—20° After TDC.

Valve Timing—1001, 2 ('33), 1100, 1, 2 ('34).

Intake Valves Open—30° Before TDC. Close—65° After LDC.
Exhaust Valves Open—65° Before LDC. Close—30° After TDC.

To Check Valve Timing—Check tappet clearance #1 intake valve. This valve should open with the piston 20° or .1844" (1932), 30° or .4070" (1933-34) before top dead center when a point on the flywheel approximately 6.55 teeth (1932), 9.83 teeth (1933), 12 teeth (1934) before the dead center mark lines up with indicator on housing. Remove starter and sight flywheel through starter mounting hole when making this check.

Lubrication:—Full pressure type. Gear type oil pump located in crankcase.

Normal Oil Pressure—35 lbs.

Oil Pressure Relief Valve—Operates at 35 lbs. Located on left hand side of crankcase. Adjustable by turning screw.

Capacity and Oil—8 qts. Use SAE #30 (normal temperatures—30° to 100°F) #40 (above 100°F), #20-W (0° to 60°F), #10-W (—15° to 40°F).

CLUTCH:—Long Model 11-A (901, 2 '32), 11-CB (1001, 2 '33), 12-CB (1100, 1, 2 '34). Single plate, dry disc type. See article in Clutch Section for complete relining and assembling directions.

Facings—Moulded type. Thickness .137" (all models). Inside Diameter 6½" (11-A, 11-CB), 7" (12-CB). Outside Diameter 11" (11-A, 11-CB), 12" (12-CB).

Adjustment—Clearance between pedal and underside of toeboard should be ½-1". Free movement of pedal should be 1½". To adjust, loosen locknut and turn turnbuckle on connector link between pedal and throw-out shaft lever.

STEERING:—Steering Gear—(1932-33) Gemmer Worm-and-Sector type, 1934) Gemmer Worm-and-Roller type. See article in Steering Section for complete adjustment directions.

Front Suspension:—Conventional 'I' beam section front axle with Reverse Elliott type ends and semi-elliptic springs.

Kingpin Inclination—8½° croswise.

Caster—1° (1932), 3¼° (1933), 1½° (1934). Adjust by inserting wedge shims between spring and spring pad on axle.

Camber—1½° all models. No adjustment provided.

Toe In—0-1/16". Adjust in usual manner by loosening clamp bolt and turning tie rod.

BRAKES:—Service—(1932) Bendix Mechanical, three shoe type with Perrot control (1933-34). Bendix Mechanical, Duo-Servo, Single-anchor type with vacuum power operation. See article in Brake Section for complete adjustment directions. Hand lever applies all four service brakes.

Drum Diameter—16" (1932), 14" (1933-34).

Lining (1932)—Moulded type. Width 1¾". Thickness 3/16". Length 45 7/32" per wheel.

Lining (1933-34)—Moulded and semi-moulded type (Raybestos—primary, Hyco—secondary). Width 1¾" (left front wheel), 2¼" (all others). Thickness ¼". Length 30¼". per wheel.

Clearance—.010". between drum and lining for each shoe.

Hand Brake:—See Service Brakes and Service Brake Adjustment.

Power Unit:—Bendix plain type vacuum cylinder controlled by valve in brake pedal linkage. See article in Brake Section for complete data.

ENGINE NUMBER:—First number 193,001 (903, 4 '32), 750,001 (1003, 4 '33), 752,001 (1003, 4, 5 '34). Stamped on top of left hand front engine support arm.

ENGINE:—Eight cylinder, In Line, 'L' head type. Cylinders cast Enbloc.
Dimensions—Bore, 3½". Stroke, 5". Displacement, 384.8 cu. ins.
Horsepower—Rated 39.2. Developed 135 ('32), 145 ('33-34) at 3200 R.P.M.
Compression—Std. 6.0-1. Compression pressure, 95-100 lbs. at 125 R.P.M.
Optl. H.C. 6.38-1. Compression pressure, 123 lbs. at 125 R. P. M.

Pistons:—Permite aluminum alloy, steel strut, split skirt type.
Removal—Pistons and rods removed through top of engine.
Clearance—.0015" (skirt).
NOTE—Install pistons with slot toward valve side of engine.

Piston Rings:—Four rings per piston, all above pin, #1 to 3—compression rings, #4—oil control ring. Lower ring groove drilled radially with twelve ⅛" oil drain holes.

Ring	Width	End Gap	Groove Depth
Comp. (all)	⅛"	.007" min.	.1585"
Oil Cont. (#4)	5/32"	.007" min.	.1585"

Piston Pin:—Diameter, ⅞". Length, 3 3/64". Pin floats in piston and rod.
Pin Fit in Piston—Push fit.
Pin Fit in Rod—Hand push fit. Endplay, ⅛".

Connecting Rod:—Weight, 2 lbs., 13¾ ozs. Length, 10⅞".
Crankpin Journal Diameter—2 3/16".
Lower Bearing Type—Poured babbitt integral with rod and cap.
Clearance—.0015". Sideplay .003".
Adjustment—None (no shims). Replace rods. Do not file rod or cap.
NOTE:—Rods now installed with oil bleed holes (upper half lower bearing) toward valve side of engine.

Crankshaft:—Nine main bearing type.
Journal Sizes—2⅝" diameter (all bearings).
Bearing Type—Bronze-backed ('32), steel-backed ('33-34), babbitt-lined.
Clearance—.001".
Adjustment—None (no shims). Replace bearings. Do not file bearing caps.
End Thrust—Taken by #7 main bearing. Endplay, .003".

Camshaft:—Eight bearing type. Camshaft drive—Adjustable chain.
Chain—Morse #1866. Width, 1½". Length, 32" or 64 links. Pitch, .500".
Camshaft Setting—Sprockets are marked. Mesh chain with sprockets turned so that marks are adjacent and in line with straightedge across the shaft centers.
Chain Adjustment—Remove inspection plug on top surface of chain case at right of engine. Adjust chain whenever sideplay at this point exceeds ½". To adjust, loosen generator flange mounting screws, pull generator away from engine until chain sideplay is ¼", tighten mounting screws. With correct adjustment chain will operate noiselessly (if chain hums, back adjustment off slightly).

Valves:—	Head Dia.	Stem Dia.	Length	Seat Angle	Lift
Intake	1 13/16"	.3405"	7⅜"	45°	.358"
Exhaust	1 11/16"	.3405"	7⅜"	45°	.358"

Stem-to-Guide Clearance—.0025" (intake), .004" (exhaust).
Tappet Clearance—.004" (all valves '32), .004" Intake, .006" Exhaust (1933-34) with engine warm.
Valves Springs—73 pounds at 3 1/16" (valve closed).

Valve Timing—903, 4 1932.
Intake Valve Open—20° Before TDC. Close—65° After LDC.
Exhaust Valves Open—65° Before LDC. Close—20° After TDC.

Valve Timing—1003, 4 ('33), 1003, 4, 5 ('34).
Intake Valves Open—30° BTDC. Close—65° ALDC.
Exhaust Valves Open—65° BLDC. Close—30° ATDC.

To Check Valve Timing—Check tappet clearance #1 intake valve. This valve should open with the piston 20° or .1844" (1932), 30° or .4070" (1933-34) before top dead center when a point on the flywheel approximately 6.55 teeth (1932), 9.83 teeth (1933), 12 teeth (1934) before the dead center mark lines up with indicator on housing. Remove starter and sight flywheel through starter mounting hole when making this check.

Lubrication:—Full pressure type. Gear type oil pump located in crankcase.
Normal Oil Pressure—35 lbs.
Oil Pressure Relief Valve—Operates at 35 lbs. Located on left hand side of crankcase. Adjustable by turning screw.
Capacity and Oil—10 qts. Use SAE. #30 (normal temperatures—30° to 100°F), #40 (above 100°F), #20-W (0° to 60°F), #10-W (-15° to 40°F).

CLUTCH:—**(1932) Long Model 29-A.** Double plate, dry disc type. **(1933-34) Long Model 12-CB.** See articles in Clutch Section for complete relining and assembling directions.
Facings (29-A)—Moulded type, 4 required. Thickness .130". Inside Diameter 6¼". Outside Diameter 9⅞".
Facings (12-CB)—Moulded type, 2 required. Thickness .137". Inside Diameter 7". Outside Diameter 12".
Adjustment—Clearance between pedal and underside of toeboard should be ½-1". Free movement of pedal should be 1½". To adjust, loosen locknut and turn turnbuckle on connector link between pedal and throw-out shaft lever.

STEERING:—**Steering Gear**—(1932-33) Gemmer Worm-and-Sector type. (1934) Gemmer Worm-and-Roller type. See article in Steering Section for complete adjustment directions.
Front Suspension:—Conventional 'I' beam section front axle with Reverse Elliott type ends and semi-elliptic springs.
Kingpin Inclination—8½° croswise.
Caster—1° (1932), 3¼° (1933), 1½° (1934). Adjust by inserting wedge shims between spring and spring pad on axle.
Camber—1½° all models. No adjustment provided.
Toe In—0-1/16". Adjust in usual manner by loosening clamp bolt and turning tie rod.

BRAKES:—**Service**—(1932) Bendix Mechanical, three shoe type with Perrot control (1933-34). Bendix Mechanical, Duo-Servo, Single-anchor type with vacuum power operation. Hand lever applies all four service brakes. See article in Brake Section for complete adjustment directions.
Drum Diamter—16" (1932), 14" (1933-34).
Lining (1932)—Moulded type. Width 2". Thickness 3/16". Length 45 7/32" per wheel.
Lining (1933-34)—Moulded and semi-moulded (Raybestos—primary, Hyco—Secondary). Width 1¾" (left front wheel), 2¼" (all others). Thickness ¼". Length 30¼" per wheel.
Clearance—.010". between drum and lining for each shoe.
Hand Brake:—See Service Brakes and Service Brake Adjustment.
Power Unit:—Bendix plain type vacuum cylinder controlled by valve in brake pedal linkage. See article in Brake Section for complete data.

ENGINE NUMBER:—First number 900,001 (905, 6 '32), 901,001 (1005, 6 '33), 901,601 (1107, 8 '34). Stamped on left hand cylinder block below head.

ENGINE:—Twelve cylinder, 67 degree, Modified 'L' head type. Both cylinder banks and crankcase cast enbloc.

Dimensions (1932)—Bore 3 7/16". Stroke 3½". Displacement 390 cubic inches.

Dimensions (1933-34)—Bore 3 7/16". Stroke 4". Displacement 445.5 cubic inches.

Rated Horsepower—54.68 (1932), 56.7 (1933-34).

Developed Horsepower—150 at 3600 R.P.M. (1932), 160 at 3600 R.P.M. (1933-34).

Compression—Std. 6.0-1. Compression pressure, 95-100 lbs. at 125 R.P.M.
Optl. H.C. 6.33-1. Compression pressure, 123 lbs. at 125 R.P.M.

Vacuum Reading—Gauge should show steady reading of 18-20" at idling speed.

Pistons:—Permite (1932), Nelson Bohnalite (1933-34) aluminum alloy, Invar strut, split skirt type.

Weight—1½ pounds (with rings and pin).

Removal—Pistons removed through top; rods through bottom of engine.

Clearance—.0015" (skirt).

NOTE:—Install pistons with slot toward valve side of engine.

Piston Rings:—Four rings per piston, all above pin. #1 to 3, compression rings; #4, oil control ring. Lower ring groove drilled radially with twelve ⅛" oil drain holes.

Ring	Width	End Gap	Groove Depth
Comp. (all)	⅛"	.007" min.	.1582"
Oil Cont. (#4)	5/32"	.007" min.	.1582"

Piston Pin:—Diameter, ⅞". Length, 2 63/64". Pin floats in piston and rod.

Pin Fit in Piston—Push fit.

Pin Fit in Rod—Hand push fit. Endplay, ⅛".

Connecting Rod:—Weight, 2 lbs. 5 ozs. Length, 9⅛" (center-to-center).

Big End Bearing—Poured babbitt type.

Clearance:—.0015". Sideplay .003".

Adjustment—None (no shims). Replace rods. Do not file rods or caps.

NOTE:—Rods now installed with oil bleed hole (upper half lower bearing) toward valve side of engine.

Crankshaft:—Four main bearing type.

Journal Sizes—2¾" diameter (all bearings).

Bearing Type—Bronze backed (1932-33), steel-backed (1934), babbitt-lined.

Clearance—.001".

Adjustment—None (no shims). Replace removable bearings.

End Thrust—Taken by #1 (front) main bearing. Endplay, .003":

Camshaft:—Four bearing type. Camshaft drive, non-adjustable chain.

Chain—Whitney Type 595-X. Width, 1½". Length, 28" or 56 links. Pitch, .500".

Camshaft Setting—Sprockets are marked. Mesh chain with sprockets turned so that marks are adjacent and in line with a straight edge across the shaft centers.

Valves:—Valves are mounted at 20° angle to horizontal and are operated directly by rocker arms which bear on cam face. Camshaft is mounted between cylinder banks directly above crankshaft. Hydraulic valve tappet take-up is built in rocker arm shaft.

Valve	Head Diam.	Stem Diam.	Length	Seat Angle	Lift
Intake	1 21/32"	.3405"	6 35/64"	45°	5/16"
Exhaust	1 21/32"	.338"	6 35/64"	45°	5/16"

Stem-to-Guide Clearance—.0025" (intake), .005" (exhaust).

Tappet Clearance—None in service (hydraulic take-up). See article in Equipment Section for complete data.

Valve Springs—70 lbs. at 2 7/32" (valves closed).

Valve Timing

Intake Valves Open—At TDC. Intake Valves Close—45° ATDC.

Exhaust Valves Open—35° BLDC. Exhaust Valves Close—10° ATDC.

To Check Valve Timing—Turn engine over until piston No. 6R is on top dead center entering power stroke with mark 'IR-UDC' on vibration dampener at front of engine in line with pointer on chain case. No 1R intake valve should open at this point.

Lubrication:—Full Pressure type. Gear type oil pump located in crankcase.

Normal Oil Pressure—50 pounds.

Oil Pressure Relief Valve—Under plug on left hand side of crankcase below oil filler. Adjustable by turning screw.

Capacity and Oil—10 qts. Use SAE #30 (normal temperature ranges, 30° to 100° F), #40 (above 100° F), #20-W (0° to 60° F), #10-W (—15° to 40° F).

CLUTCH:—**(1932) Long Model 29-A.** Double plate, dry disc type. **(1933-34) Long Model 12-CB.** Single plate, dry disc type. See articles in Clutch Section for complete relining and assembling directions for each type.

Facings (29-A)—Moulded type, 4 required. Thickness .130". Inside Diameter 6¼". Outside Diameter 9¾".

Facings (12-CB)—Moulded type, 2 required. Thickness .137". Inside Diameter 7". Outside Diameter 12".

Adjustment—Clearance between pedal and underside of toeboard should be ½-1". Free movement of clutch pedal should be 1½". Adjust by loosening locknut and turning turnbuckle on connector link between pedal and throw-out shaft lever.

STEERING:—**Steering Gear (1932)**—Gemmer Worm-and-Sector type. **(1933-34)**—Gemmer Worm-and-Roller type. See article in Steering Section for complete adjustment directions.

Front Suspension:—Conventional 'I' beam section front axle with Reverse Elliott type ends and semi-elliptic springs.

Kingpin Inclination—8½° crosswise.

Caster—1½°. Adjust be inserting wedge shims between spring and spring pad on axle.

Camber—1½°. No adjustment provided.

Toe In—1/16". Adjust in usual manner by loosening clamp bolts and turning tie rod.

BRAKES:—**Service (1932)**—Bendix Mechanical, three-shoe type with Perrot control. **1933-34)**—Bendix Mechanical, Duo-Servo, Single-anchor type with vacuum power operation. Hand lever applies all four service brakes. See article in Brake Section for complete adjustment directions.

Drum Diameter—16" (1932), 15" (1933-34).

Lining (1932)—Moulded type. Width 2¼". Thickness ¼". Length 34" per wheel.

Lining (1933-34)—Moulded and semi-moulded type (Raybestos—primary, Hyco—secondary). Width 1⅞" (left front wheel), 2½" (all others). Thickness ¼". Length 32¼" per wheel.

Clearance—.010" between lining and drum for each shoe.

Hand Brake:—See Service Brakes and Service Brake adjustment.

Power Unit:—Bendix plain type vacuum cylinder controlled by valve in brake pedal linkage. See article in Brake Section for complete data.

ENGINE NUMBER:—First number, 1516. Stamped on boss on upper left hand corner of cylinder block.

ENGINE:—**Own.** 8 cylinder, In Line, 'L' head type.
Bore—3¼ . **Stroke**—3⅞".
Piston Displacement—257.16 cubic inches.
Rated Horsepower—33.8 A.M.A.
Developed Horsepower—110 at 3850 R.P.M.
Compression Ratio—6.5-1 Std., 7.0-1 Optl.
Compression Pressure—120 lbs. at 300 R.P.M. Std. 6.5-1 head.
Vacuum Reading—Gauge should show stead reading of 18-20" with engine idling.
NOTE:—Cylinder head is aluminum and special service tools must be used in tightening head bolts to avoid distortion and warping.

Pistons:—Nelson Bohnalite, Invar Strut, Split skirt type.
Replacement Pistons—*See Packard Shop Notes.*
Weight—17¼ ozs. stripped, 23 ozs. with rings and pin.
Removal—Pistons and rods removed from above.
Clearance—Skirt .0015" (see Fitting Pistons).
Fitting New Pistons—Use .0015" feeler ½" wide to check clearance. Pull required to withdraw feeler from between piston and cylinder wall on side opposite slot must be within 3-5 lbs.
Installing Pistons—Slots should be toward left or opposite side from valves.

Piston Rings:—Two compression, one oil control ring per piston, all above pin. Lower groove drilled radially with oil drain holes.

Ring	Width	End Gap	Side Clearance
Comp	⅛"	.007-.012"	.002"
Oil Cont.	5/32"	.007-.015"	.0015"

Piston Pin:—Diameter ⅞". Length 2 51/64". Pin floats in piston and rod. Held by retaining rings at each end. Pin hole in connecting rod is bronze bushed. Pins furnished .003", .006" oversize.
Pin Fit in Piston—Palm push fit with piston at 160°F.
Pin Fit in Rod Bushing—Thumb push fit with both parts at room temperature (70°F).
NOTE—Finish ream bushings to .87515-.87485".

Connecting Rod:—Weight 29½ ozs. Length 7⅞".
Upper Bearing—Formed by two bronze bushings pressed in from opposite sides so as to form oil groove in center. Rifle-drilled piston pin oil passage in rod must open into this groove.
See Packard Shop Notes for Bushing Installation.
Crankpin Journal Diameter—2 3/32".
Lower Bearing—Interchangeable steel-backed, babbitt-lined type. No shims.
Clearance—.0005-.0015". Sideplay .004-.010".
Adjustment—None (no shims). Replace bearings. Do not file rods or caps.
Installing Rods—Identification mark on side of rod should be toward front of engine with oil bleed hole in lower bearing toward camshaft side.

Crankshaft:—Five bearing. Integral counterwights.
Journal Diameters—2¾" all bearings.
Bearing Type—Interchangeable steel-backed, babbitt-lined type. No shims.
Clearance—.001-.003".
Adjustment—None (no shims). Replace bearings. Do not file bearing caps.
End Thrust—Taken by center bearing. Endplay .003-.008".

Camshaft:—5 bearing. Non-adjustable chain drive.
Bearing Type—Steel-backed, babbitt-lined.
Clearance—.001-.003".
End Thrust—Taken by thrust plate in back of camshaft sprocket. Endplay .002-.004".
Timing Chain—Morse #1866RX. Width 1". Pitch .375". Length 21" or 58 links.
Camshaft Setting—With #1 piston on top dead center and #1 exhaust valve just closing, mesh chain with sprockets turned so that '0' marks are adjacent and in line with a straightedge across the shaft centers.

Valves:—

	Head Diameter	Stem Diameter	Lgth.
Intake	1 17/32"	11/32"	5⅝"
Exhaust	1 15/32"	11/32"	5⅝"

	Seat Angle	Lift	Stem Clearance
Intake	30°	.300"	.0005-.0010"
Exhaust	45°	.300"	.0005-.0010"

Note on Stem Clearance—Stem clearance in guides should be measured at the bottom. New guides are finish reamed with a taper reamer after installation with .0035" greater clearance at top. Exhaust valve guides are counterbored ⅜" deep at top to provide .015" greater clearance.
Tappet Clearance—.007" Int., .009" Exh., Engine hot.
NOTE—Splasher in right front fender should be removed when valve adjustments are made.

Valve Springs—Intake and exhaust springs are

Interchangeable	Spring Pressure	Length
Valve Closed	40 lbs.	1⅝"
Valve Open	110 lbs.	1 5/16" approx.

Valve Timing—See camshaft setting above.
Intake Valves—Open 5° BTDC. Close 39° ALDC.
Exhaust Valves—Open 45° BLDC. Close 5° ATDC.
To Check Valve Timing—Set tappet clearance #1 exhaust valve at .013". This valve should close with piston 5° or .0092" past top dead center when point on flywheel 2½ graduations past #1 UP.DC. mark (top dead center mark) lines up with pointer in inspection hole in left front face of flywheel housing under starter. Reset tappet clearance at .009" with engine warm.
Motor Gauge—Weidenhoff Adapter #114, Rod #5.

Lubrication:—Pressure. Gear type oil pump mounted on right side of crankcase.
Normal Oil Pressure—35 lbs.
Oil Pressure Relief Valve—Located on pump cover. Not adjustable. Replace relief valve spring if defective. Tension 6 lbs. compressed to 2".
Capacity and Oil—7 qts. Use SAE. #30 (60°F. and above), #20-W(32° to 75°F), #10-W(32° to —15°F).

CLUTCH:—**Long Model 10CF.** Semi-centrifugal, single plate, dry disc type. No adjustment for wear required. Weights formed on outer ends of clutch release levers increase pressure on pressure plate approximately 137% at 4000 R.P.M. See article in Clutch Section for relining and assembling directions.
Clutch Pedal Adjustment—Clearance between clutch pedal and toeboard must be ½" with clutch engaged. Free movement of clutch pedal must be 1½". To adjust, loosen locknut and turn nut on clutch pedal-to-lever connecting rod.
Clutch Facings—Woven asbestos, 2 required, 6" I.D., 10" O.D., .137" thick.
NOTE—Six crimped clock spring steel segments located bet. rear clutch facing and driven disc.

STEERING:—**Front Suspension**—Packard SafeTflex design, independent, linked parallelogram type with coil springs. Unlike other designs in that angle between two lower support arms is 90° with rear (torque) arm anchored to frame side rail at point slightly forward from dash. Upper support arms (shock absorber arms) are rubber bushed at outer ends and are positioned approximately midway between lower support arms.
See article in Mechanical Equipment Section for data.
Steering Knuckle Inclination—1°30' crosswise.
Caster—2°. No adjustment provided.
Camber—1°. No adjustment should be required. Adjustable by changing bushing in outer end of upper support arm (three interchangeable parts available providing five settings).
Toe In—0-⅛". Adjustable by changing length of tie rods. Each tie rod should be changed an equal amount and tie rods should be measured to make certain that lengths are equal.

Steering Gear:—Gemmer Model Worm-and-Roller type. See article in Steering Section for adjustments.

BRAKES:—**Service**—Bendix Hydraulic, Duo-Servo, single anchor type. Hand lever applies rear wheel service brakes. See article in Brake Section for relining and complete adjustment procedure.
Drum Diameter—12".
Lining—**Primary Multibestos**—DR, Secondary Multibestos—PRX. Width 1¾". Thickness 3/16". Length per wheel 26".
Clearance—.010" at heel and toe of each shoe.

Hand Brake Adjustment:—See Service Brakes.

ENGINE NUMBER:—First number, 385,501 (1200, 1, 2), 1,755,101 (1203, 4, 5). Stamped on left side of crankcase at front end.

ENGINE:—Eight cylinder, In Line, 'L' head type.

Bore—3 3/16" (1200, 1, 2), 3½" (1203, 4, 5).

Stroke—5" (all models).

Piston Displacement—320 cu. ins. (1200, 1, 2), 384.8 cu. ins. (1203, 4, 5).

Rated Horsepower—32.5 (1200, 1, 2), 39.2 (1203, 4, 5).

Developed Horsepower—130 at 3200 R.P.M. (1200, 1, 2), 150 at 3200 R.P.M. (1203, 4, 5).

Compression Ratio—Standard and optional cylinder heads of aluminum used as follows:

Model	Std. Head	Low Comp.	High Comp.
1200, 1, 2	6.5-1	6.0-1	7.0-1
1203, 4, 5	6.3-1	6.0-1	7.0-1

Compression Pressure—110 lbs. at cranking speed for standard heads.

Vacuum Reading—Gauge should show stead reading of 18-20" with engine idling.

Pistons:—Nelson Bohnalite, aluminum alloy, Invar Strut, split skirt type. Replacement pistons furnished in standard size and .003", .005", .010", .015", .020", .025", .030", .035", .045" oversize.

Weight—18.7 ozs. (1200, 1, 2), 21.9 ozs. (1203, 4, 5).

Removal—Pistons removed from top, rods from bottom on Model 1200, 1, 2 (push piston up until piston pin is exposed, remove locking ring and push out pin, remove piston, lower rod and remove from below. Use new locking rings when replacing pistons). Pistons and rods removed from above on Model 1203, 4, 5.

Clearance—Skirt .0015" See Fitting Pistons.

Fitting New Pistons—Use .0015" feeler stock ½" wide to check clearance. Pull required to withdraw feeler from between piston and cylinder wall on side opposite slot should be 6-8 lbs.

Installing Pistons—Slot should be on valve side of engine.

Piston Rings:—Three compression, one oil control ring per piston, all above pin. Lower ring groove drilled radially with twelve ⅛" oil drain holes.

Ring	Width	End Gap	Wall Thickness
Comp. All	⅛"	.007" min.	.145"
Oil Cont.	5/32"	.007" min.	.145"

Piston Pin:—Diameter ⅞". Length 2 47/64" (1200, 1, 2), 3 3/64" (1203, 4, 5). Pin floats in piston and rod. Held by locking rings at each end. Pins furnished for service .003", .006" oversize.

Pin Fit in Piston—Palm push fit with piston at 160°F.

Pin Fit in Rod Bushing—Thumb push fit with both parts at room temperature (70°F).

Connecting Rod:—Weight 41¼ ozs. (1200, 1, 2), 47½ ozs. (1203, 4, 5). Length 10⅞".

Crankpin Journal Diameters—2.1875".

Lower Bearing—Removable steel-backed, copper-lead alloy lined type. No shims.

Clearance—.0017-.0022". Sideplay .003" minimum.

Adjustment—None (no shims). Replace bearings. Do not file rods or bearing caps.

Crankshaft:—Nine bearing. Integral counterweights.

Journal Diameters—2.625" all bearings.

Bearing Type—Removable steel-backed, babbitt-lined type. No shims.

Clearance—.001" minimum.

Adjustment—None (no shims). Replace bearings. Do not file bearing caps.

End Thrust—Taken by #7 bearing. Endplay .003" minimum.

Camshaft:—Chain driven with manual adjustment.

Timing Chain—Morse #1866. Width 1½". Pitch .500". Length 32" or 64 links.

Chain Adjustment—Loosen generator flange mounting screw, pull generator out or away from engine until sideplay as measured at chain inspection plug hole in top face of chain case is ¼", tighten mounting screws. Adjust chain whenever sideplay exceeds ½".

Camshaft Setting—Sprockets are marked. Mesh chain with sprockets turned so that '00' marks are adjacent and are centered on a straightedge across the shaft centers.

Valves:—	Head Diam.	Stem Diam.	Lgth.
Intake (1200, 1, 2)	1 21/32"	.3405"	7⅜"
Exhaust " "	1 15/32"	.3405"	7⅜"
Intake (1203, 4, 5)	1 13/16"	.3405"	7⅜"
Exhaust " "	1 11/16"	.3405"	7⅜"

	Seat Angle	Lift	Stem Clearance
Intake	45°	.358"	.0025" min.
Exhaust	45°	.358"	.0045" min.

Tappet Clearance—.004" Int., .006" Exh. engine warm.

Valve Springs—	Spring Pressure	Length
Valve Closed	73 lbs.	3 1/16"

Valve Timing—See Camshaft Setting above.
Intake Valves—Open 30° BTDC. Close 65° ALDC.
Exhaust Valves—Open 65° BLDC. Close 30° ATDC.

Motor Gauge—Weidenhoff Adapter #114, Rod #5.

Lubrication:—Pressure. Gear type oil pump located in crankcase.

Normal Oil Pressure—35 lbs. min. at 1000 R.P.M.

Oil Pressure Relief Valve—Located on left side of crankcase. Operates at 35 lbs. Adjustable by turning screw.

Capacity and Oil—8 qts. (1200, 1, 2), 9½ qts. 1203, 4, 5). Use SAE. #30 (30° to 100°F—use #40 for temperatures above 100°F)), #20-W (0° to 60°F), #10-W (—15° to 40°F).

CLUTCH:—**Long, Model 12CB.** Single plate, dry disc type. No adjustment required for wear. See article in Clutch Section for relining and assembling directions.

Clutch Pedal Adjustment—Clearance between pedal and toeboard should be ½-1". Free movement of pedal should be 1½". Adjust by turning turnbuckle on connecting rod at lower end of pedal.

Clutch Facings—Moulded type, 2 required, 7" I.D., 12" O.D., .137" thick.

STEERING:—**Front Suspension**—Conventional 'I' beam section front axle with Reverse-Elliott ends and semi-elliptic springs.

Kingpin Inclination—9° crosswise.

Caster—1°. Adjustable by installing wedge shims between spring and spring pad on axle.

Camber—1°.

Toe In—0-1/16". Adjustable in usual manner by changing length of tie rod.

Steering Gear:—Gemmer Model Worm-and-Roller type. See article in Steering Section for adjustments.

BRAKES:—**Service**—Bendix, Duo-Servo, Single Anchor, mechanically operated, vacuum power brakes. Hand lever applies all four service brakes. *See article in Mechanical Equipment Section for data.*

Drum Diameter—14".

Lining—Primary (Raybestos), Secondary (Hyco). Width 2¼" (except left front which is 1¾"). Thickness ¼". Length 30¼" per wheel.

Clearance—Free—at heel and toe of each shoe.

Hand Brake Adjustment:—With hand brake lever fully released and cross shaft against stop, remove all slack in cable by adjusting clevis position at cross shaft end of cable until clevis pin can just be inserted in cross lever. Check brakes making sure they are fully released with hand brake in off position. Adjustment for each wheel equalization should be made after drum lining has been worn in.

Power Unit:—Bendix plain tube type vacuum cylinder mounted on frame and linked to cross shaft lever. Controlled by valve built in brake pedal mechanism. *See article in Mechanical Equipment Section for data.*

ENGINE NUMBER:—First number, 903,101. Stamped on left cylinder block below head.

ENGINE:—Twelve cylinder, 67° Vee, modified 'L' head type. Both cylinder blocks and upper crankcase cast enbloc.

Bore—3 7/16". **Stroke**—4¼".

Piston Displacement—473 cubic inches.

Rated Horsepower—56.7 A.M.A.

Developed Horsepower—175 at 3200 R.P.M.

Compression Ratio—6.4-1 Std., 6.0-1 Low Comp., 7.0-1 High Comp. Optl. Cylinder heads are aluminum.

Compression Pressure—110 lbs. at cranking speed (125 R.P.M.) for Std. 6.4-1 head.

Vacuum Reading—Gauge should show steady reading of 18-20" with engine idling.

Pistons:—Nelson Bohnalite, aluminum alloy, Invar Strut, split skirt type. Replacement pistons furnished in standard size and .003", .005", .010", .015", .020", .030", .045" oversize.

Weight—21.7 ounces.

Removal—Pistons removed through top, rods through bottom of engine (push pistons up until piston pin is exposed, take out locking rings, push out pin, lift out piston, lower rod and remove from below). Use new locking rings when installing pistons.

Clearance—Skirt .0015". See fitting pistons.

Fitting New Pistons—Use .0015" feeler stock ½" wide to check clearance. Pull required to withdraw feeler from between piston and cylinder wall on side opposite slot should be 6-8 lbs.

Installing Pistons—Slot should be toward left side (viewed from driver's seat) on all pistons.

Piston Rings:—Three compression, one oil control ring per piston, all above pin. Lower ring groove drilled radially with twelve ⅛" oil drain holes.

Ring	Width	End Gap	Groove Depth
Comp. All	⅛"	.007" min.	.158"
Oil Cont.	5/32"	.007" min.	.158"

Piston Pin:—Diameter ⅞". Length 2 63/64". Pin floats in piston and rod. Held by retaining ring at each end. Pins furnished for service .003", .006" oversize.

Pin Fit in Piston—Palm push fit with piston at 160°F.

Pin Fit in Rod Bushing—Thumb push fit with both parts at room temperature (70°F).

Connecting Rod:—Weight 40⅝ ozs. Length 9".

Crankpin Journal Diameter—2½".

Lower Bearing—Removable steel-backed, copper-lead alloy lined type. No shims.

Clearance—.0017-.0022". Sideplay .008" minimum.

Adjustment—None (no shims). Replace bearings. Do not file rods or caps.

Crankshaft:—Four bearing. Integral counterweights.

Journal Diameters—2¾" all bearings.

Bearing Type—Removable steel-backed, babbitt-lined type. No shims.

Clearance—.001" minimum.

Adjustment—None (no shims). Replace bearings. Do not file bearing caps.

End Thrust—Taken by front bearing. Endplay .003" minimum.

Camshaft:—Four bearing. Mounted between cylinder banks directly above crankshaft. Non-adjustable chain drive.

Timing Chain—Morse #1866. Width 1½". Pitch .500". Length 28" or 56 links.

Camshaft Setting—Sprockets are marked. Mesh chain with sprockets turned so that '00' marks are adjacent and centered on straightedge across the shaft centers.

Valves:—

	Head Diameter	Stem Diameter	Length
Intake	1 21/32"	.3405"	6 35/64"
Exhaust	1 21/32"	.338"	6 35/64"

	Seat Angle	Lift	Stem Clearance
Intake	45°	5/16"	.0025"
Exhaust	45°	5/16"	.005"

Tappet Clearance—None in service (automatic take-up).

See article in Mechanical Equipment Section for data.

Automatic Tappet Takeup (Valve Silencer)—See Mechanical Equipment Section for data on bleeding the automatic takeup (necessary in order to grind valves) and initial clearance when installing valves (new or after grinding). Automatic takeup should not require attention at other times.

Valve Springs:—

	Spring Pressure	Length
Valve Closed	70 lbs.	2 7/32"

Valve Timing—See Camshaft Setting above.

Intake Valves—Open at TDC. Close 45° ALDC.

Exhaust Valves—Open 35° BLDC. Close 10° ATDC.

To Check Valve Timing—Intake valve in #1 cylinder of right hand bank (1R) should begin to open with piston 6R on top dead center entering power stroke when mark '1R-UDC' on vibration dampener at front of engine lines up with pointer on chain case cover.

Motor Gauge—Weidenhoff Adapter #114, Rod #2.

Lubrication:—Pressure. Gear type oil pump located in crankcase.

Normal Oil Pressure—35 lbs. minimum at 1000 R.P.M.

Oil Pressure Relief Valve—Under plug on left hand side of crankcase below oil filler. Adjustable by turning adjustment screw.

Capacity and Oil—10 qts. Use SAE. #30 (normal temperatures of 30° to 100°F), #40 (above 100°F), #20-W (0° to 60°F), #10-W (—15° to 40°F).

CLUTCH:—**Long, Model 12CB.** Single plate, dry disc type. No adjustment required for wear. See article in Clutch Section for relining and assembling directions.

Clutch Pedal Adjustment—Clearance between pedal and toeboard should be ½-1". Free movement of pedal should be 1½". To adjust, turn turnbuckle on connecting rod at lower end of clutch pedal.

Clutch Facings—Moulded type, 2 required, 7" I.D., 12" O.D., .137" thick.

STEERING:—**Front Suspension**—Conventional 'I' beam section front axle with Reverse-Elliott ends and semi-elliptic springs.

Kingpin Inclination—9° crosswise.

Caster—1°. Adjustable by installing wedge shims between spring and spring pad on axle.

Camber—1°.

Toe In—0-1/16". Adjustable by changing length of tie rod in usual manner.

Steering Gear:—Gemmer Worm-and-Roller type.

See article in Mechanical Equipment Section for data.

BRAKES:—**Service**—Bendix, Duo-Servo, Single anchor, mechanically operated, vacuum power brakes. Hand lever applies all four service brakes. See article in Brake Section for complete adjustment procedure.

Drum Diameter—15".

Lining—Primary (Raybestos), Secondary (Hyco). Width 2½" (except left front brake which is 1⅞"). Thickness ¼". Length 32¼" per wheel.

Clearance—Free—at heel and toe of each shoe.

Hand Brake Adjustment:—See Packard 8 Model 1200 (previous article) for complete data.

Power Unit:—Bendix plain type vacuum cylinder mounted on frame and linked to cross shaft lever. Controlled by valve in brake rod between brake pedal and cross shaft.

See article in Mechanical Equipment Section for data.

ENGINE NUMBER:—First number—X-27900. Stamped on boss on upper left hand corner of cylinder block (obscured by oil filter when filter installed).

ENGINE SPECIFICATIONS:—8 cylinder, 'L' head.

Bore—3¼". Stroke—4¼".

Displacement—282.04 cubic inches.

Rated Horsepower—33.8 (AMA).

Developed Horsepower—120 at 3800 R.P.M.

Compression Ratio and Pressure—6.5-1 Aluminum head, 110 lbs. at cranking speed (125 R.P.M.).

Vacuum Reading—Gauge should show steady reading of 18-19" with engine idling at 300 R.P.M. or 6 M.P.H.

PISTONS:—Nelson Bohnalite, aluminum alloy, Invar Strut, split skirt type. Recondition cylinders to take finished replacement pistons.

Weight—17.5 ozs. (stripped), 23 ozs. (with rings and pin).

Removal—Pistons and rods removed from above.

Clearance—Skirt .0015". See Fitting New Pistons.

Replacement Pistons—*See Packard Shop Notes.*

Fitting New Pistons:—Use feeler gauge .0015" thick ½" wide to check clearance. Pull required to withdraw feeler from between piston and cylinder wall on side opposite slot must be within 5-7 lbs.

Installing Pistons:—Slot toward left or away from valves.

PISTON RINGS:—Two compression, one oil ring per piston above pin. Lower ring groove drilled with twelve 5/32" oil drain holes.

Ring	Width	End Gap	Side Clearance
Comp. (top)	⅛"	.007-.012"	.002"
Comp. (2nd)	⅛"	.007-.012"	.0015"
Oil	3/16"	.007-.015"	.0015"

NOTE—Ring tension when compressed to cylinder size with .007" minimum gap must be 6¼ lbs. (compression), 4½-7½ lbs. (oil ring).

PISTON PIN:—Diameter—⅞". Length—2 51/64". Pin floats in piston and rod. Held by retaining ring at each end. Pin hole in connecting rod is bronze-bushed. Pins furnished .003", .006" oversize.

Pin Fit in Piston—Palm push fit with piston at 160°

Pin Fit in Rod Bushing—.00025" clearance or thumb push fit with both parts at room temperature (70° F.). See Connecting Rod Upper Bearing.
NOTE—Finish ream bushings to .87515-.87485".

CONNECTING ROD:—Weight 32½ ozs. Length 7 11/16".

Upper Bearing (Piston Pin Bushing)—Formed by two bushings pressed in rod from opposite sides so as to form oil groove in center. Rifle-drilled oil passage in rod must open into this groove.
See Packard Shop Notes for Bushing Installation.

Crankpin Journal Diameter—2 3/32".

Lower Bearing—Interchangeable steel-backed, babbitt-lined type. No shims.

Clearance—.0005-.0025". Sideplay .003-.006".

Bearing Adjustment:—None (no shims). Replace bearings. Do not file rods or caps.

Installing Rods:—Identification mark on side of rod should be toward front of engine with oil bleed hole in lower bearing toward camshaft side.

CRANKSHAFT:—Five bearing Integral counterweights.
Journal Diameter—2.746" all bearings.
Bearing Type—Interchangeable steel-backed, babbitt-lined type. No shims.
Clearance—.001-.003".

Bearing Adjustment:—None (no shims). Replace bearings. Do not file bearing caps.

End Thrust—Taken by center (#3) bearing. Endplay .003-.008". Adjusted by replacing or building up bearing.

CAMSHAFT:—5 bearing. Non-adjustable chain drive.

Journal Diameters—#1, 2"; #2, 1 31/32"; #3, 1 15/16"; #4, 1 29/32"; #5, 1⅞".
Bearing Type—Steel-backed, babbitt-lined.
Clearance—.001-.003".

End Thrust:—Taken by thrust plate in back of camshaft sprocket. Endplay .002-.004".

Timing Chain:—Morse #1866 RX. Width 1¼". Pitch .375". Length 58 links.

Camshaft Setting:—With #1 piston on top dead center (when center line above mark '#1 UP D.C.' lines up with indicator in inspection hole in left front face of flywheel housing under starter) and #1 exhaust valve just closing, mesh chain with sprockets turned so that 'O' marks are adjacent and in line with a straightedge across the shaft centers.
NOTE—Radiator and front assembly must be removed as a unit when work is done on front of engine and engine must be supported at front end and front engine support removed for work on timing chain, camshaft or sprockets. To remove front assembly, take out bolts to body (3 each side), bolts to running board (3 each side), fender brace bolts (1 each side), radiator tie rod nuts, center bolt in front cross-member, and running board moulding clips (4 each side).

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1 17/32"	11/32"	5⅝"
Exhaust	1 13/32"	11/32"	5⅝"

	Seat Angle	Lift	Stem Clearance
Intake	30°	.300"	.0005-.00175"
Exhaust	45°	.300"	.0005-.00175"

NOTE—Stem clear'ce in guides measured at bottom.
Tappet Clearance—.007" Int., .010 Exh. Engine hot.
NOTE—Splasher in right front fender should be removed when valve adjustments are made.

Valve Guides:—Cast-iron, one piece, removable with exhaust longer than intake. New guides are finish reamed with a taper reamer after installation with .0035" greater clearance at top. Exhaust valve guides are counterbored ⅜" deep at top to provide .015" greater clearance.

Valve Springs:—Intake and exhaust springs are interchangeable.

	Spring Pressure	Length
Valve Closed	40 lbs.	1⅝"
Valve Open	110 lbs.	1 5/16" approx.

Valve Lifters—Single piece barrel-type with openings in side walls.

Valve Timing:—See Camshaft Setting above.

Intake Valves—Open 5° BTDC. Close 39° ALDC.

Exhaust Valves—Open 45° BLDC. Close 5° ATDC.

To Check Valve Timing—Set tappet clearance #1 exhaust valve at .013". This valve should close with piston 5° or .0103" past top dead center when point on flywheel 2½ graduations past #1 UP.DC. mark (top dead center mark) lines up with pointer in inspection hole in left front face of flywheel housing under starter. Reset tappet clearance at .010" with engine warm.

LUBRICATION:—Pressure. Gear type oil pump mounted on right side of crankcase.
NOTE—Whenever oil pump is to be removed turn engine over until distributor rotor in #1 position (#1 piston 7° BTDC.). When installing pump turn oil pump shaft so that tongue-and-groove connection to distributor shaft meshes. Recheck ignition timing.

Normal Oil Pressure:—35 lbs. at 1000 R.P.M.

Oil Pressure Relief Valve:—Located on pump cover. Not adjustable. Replace relief valve spring if defective. Tension 6 lbs. compressed to 2".

Crankcase Capacity:—7 qts. (full).

CLUTCH:—Long Mod. 10CF-CI. Semi-centrifugal, single plate, dry disc type. See article in Clutch Section for relining and assembling directions.

Facings—Woven type, 2 required. Inside Diam. 6". Outside Diam. 10". Thickness .140".

Adjustment—Clearance between clutch pedal and toeboard must be ½" with clutch engaged. Free movement of clutch pedal must be 1½". To adjust, loosen locknut and turn adjusting nut on clutch pedal-to-lever connecting rod.

Removal—Remove floor boards and front seat, disconnect front universal joint, support engine at rear and remove rear engine mountings, remove transmission, remove clutch housing bottom cover, and clutch pedal linkage. Loosen capscrews mounting clutch cover on flywheel turning all screws out evenly to release springs. Remove clutch from below without removing housing.

STEERING:—Steering Gear—Gemmer Model Worm-and-Roller type. See article in Steering Section for adjustments.

Front Suspension:—Independent 'Safe-T-Flex' type with Coil springs. All specifications below apply with car weight on wheels. See article in Steering Section for adjustments.

King Pin Inclination—1°30' crosswise.

Camber—1° plus or minus ¼°. Adjustable.

Caster—2° plus or minus ½°. Adjustable.

Toe In—1/16-⅛". Adjustable by turning tie rods equally (check for equal lengths after adjustment).

Steering Geometry—Inner wheel turned 23°, outer wheel turned 20°. Check tie rod ends and kingpin for looseness.

BRAKES:—Service—Bendix Hydr'lic, Duo-Servo, Single anchor type. Hand lever applies rear wheel brakes. *See article in Mechanical Equipment Section for data.*

Wheel Cylinders—1 1/16" (front—painted white), 15/16" (rear—painted brown).

Drum Diameter—12".

Lining—Primary U.S. Asbestos 714, Secondary U.S. Asbestos 589. Width 1¾". Thickness 3/16". Length per wheel 26".

Clearance—.010" at heel and toe of each shoe.

Spring Pressure—63 lbs. on primary return spring (No. 303837-red), 70 lbs. on secondary return spring (No. 303836-yellow).

Hand Brake Adjustment:—See Service Brakes.

ENGINE NUMBER:—First number 390000 (1400, 1, 2), 757000 (1403, 4, 5). Stamped on left side of block at front of engine near oil filler.

ENGINE SPECIFICATIONS:—**Type**—8 cylinder In Line, 'L' head type.

Bore—3 3/16" (1400, 1, 2), 3½" (1403, 4, 5).

Stroke—5" (all models).

Displacement—320 cubic inches (1400, 1, 2), 384.4 cubic inches (1403, 4, 5).

Rated Horsepower—32.5 (1400, 1, 2), 39.2 (1403, 4, 5).

Developed Horsepower—130 at 3200 (1400,1,2), 150 at 3200 (1403, 4, 5).

Compression Ratio—6.5-1 Std. head (1400, 1, 2), 6.3-1 Std. head (1403,4, 5), 6.0-1 Optl. low comp. head, 7.0-1 Optl. high comp. head (both models).

Compression pressure—110 lbs. at cranking speed of 125 R.P.M. (std. head—both models).

Vacuum Readng—Gauge should show steady reading of 18-19" with engine idling at 350 R.P.M. or 7 M.P.H.

PISTONS:—Nelson Bohnalite, aluminaum alloy, Invar Strut, split skirt type. Recondition cylinders to take finished replacement pistons.

Weight—18.7 ozs. (1400, 1, 2), 21.9 ozs. (1403, 4, 5).

Removal—Pistons removed from top, rods from bottom on Model 1400, 1, 2 (push piston up until piston pin is exposed, remove locking ring and push out pin, remove piston, lower rod and remove from below. Use new locking rings when replacing pistons). Pistons and rods removed from above on Model 1403, 4, 5.

Clearance—Skirt .0015". See Fitting New Pistons.

Replacement Pistons:—Finished replacement pistons furnished in standard size and .003", .005", .010", .015", .020", .025", .030", .035", .045" oversize

Fitting New Pistons:—Use .0015" feeler stock ½" wide to check clearance. Pull required to withdraw feeler from between piston and cylinder wall on side opposite slot should be 3-5 lbs.

Installing Pistons:—Slot should be on valve side of engine.

PISTON RINGS:—Three compression, one oil control ring per piston, all above pin. Lower ring groove drilled with twelve ⅛" oil drain holes.

Ring	Width	End Gap	Side Clearance
Comp (Top)	⅛"	.007-.012"	.002"
Comp (2nd)	⅛"	.007-.012"	.0015"
Oil	5/32"	.007-.015"	.0015"

NOTE—Ring tension when compressed to cylinder size with .007" minimum gap should be 6¼ lbs. (1400, 1, 2 comp. ring), 6¾ lbs. (1403, 4 5 comp. ring), 4½-7½ lbs. (oil ring—all models).

PISTON PIN:—**Diameter ⅞". Length 2 47/64"** (1400, 1, 2) 3 3/64" (1403, 4, 5). Pin floats in piston and rod. Held by locking ring at each end. Pin hole in rod is bronze-bushed. Pins furnished for service .003", .006" oversize.

Pin Fit in Piston—Palm push fit with piston heated to 160° F. Pin holes in piston finished to inside diameter of .87515-.87485".

Pin Fit in Rod Bushing—.0002" clearance or thumb push fit with both parts at room temperature (70°F)

CONNECTING ROD:—**Weight** 40 1/16 ozs. (1400, 1, 2), 47¾ ozs. (1403, 4, 5). **Length 10⅞".**

Crankpin Journal Diameter—2.1875".

Lower Bearing—Removable steel-backed, babbitt-lined type. No shims. Bearings furnished for service .001", .002", .003", .015" undersize.

Clearance—.0005-.002". Sideplay .003-.006".

Bearing Adjustment:—None (no shims). Replace bearings. Do not file rods or bearing caps.

Installing Rods:—Install with oil hole toward camshaft.

CRANKSHAFT:—9 bearing. Integral counterweights.

Journal Diameter—2.625".

Bearing Type—Removable steel-backed, babbitt-lined type. No shims.

Clearance—.001-.002".

Bearing Adjustment:—None (no shims). Replace bearings. Do not file bearing caps.

End Thrust:—Taken by #7 bearing. Endplay .003-.005"

CAMSHAFT:—8 bearing. Adjustable chain drive.

Bearing Type—Steel-backed, babbitt-lined.

Clearance—.001-.003".

Endplay—.001-.004".

Timing Chain:—Morse #1866. Width 1½". Pitch .500". Length 32" or 64 links.

Chain Adjustment—Loosen generator flange mounting screws, pull generator out or away from engine until sideplay as measured at chain inspection plug hole in top face of chain case is ¼", tighten mounting screws. Adjust chain whenever sideplay exceeds ½".

Camshaft Setting:—Sprockets are marked Mesh chain with sprockets turned so that 'OO' marks are adjacent and are centered on a straitedge across the shaft centers.

VALVES:—

	Head Diam.	Stem. Diam.	Length
Intake (1400, 1, 2)	1 21/32"	.3405"	7 13/32"
Exhaust " "	1 15/32"	.3405"	7 13/32"
Intake (1403, 4, 5)	1 13/16"	.3405"	7 13/32"
Exhaust " "	1 11/16"	.3405"	7 13/32"

	Seat Angle	Lift	Stem Clear.
Intake	45°	.358"	.0025" min.
Exhaust	45°	.358"	.004" min.

Tappet Clearance—.004" Int., .006" Exh., eng. warm.

Valve Guides:—Pressed in block. Reamed to size for correct stem clearance (see table above).

Valve Rocker Arms:—Consist of pivoted arms mounted on bracket on crankcase which transmit motion from cam to valve pushrod (valve lifter).

Removal—Remove screws in bracket on right side of crankcase, withdraw bracket and pushrod assembly.

Valve Springs:—Double springs used on all valves.

	Spring Pressure	Spring Length
Valve Closed	73 lbs.	3 1/16"

Valve Timing:—See Camshaft Setting above.

Intake Valves—Open 30° BTDC. Close 65° ALDC.

Exhaust Valves—Open 65° BLDC. Close 30° ATDC.

To Check Valve Timing—Check tappet clearance #1 intake valve. This valve should open with piston 30° or .4070" before top dead center when flywheel mark 'INT' (visible through starter mounting hole in flywheel housing with starter removed) lines up with indicator on housing within case.

Motor Gauge—Weidenhoff #114 Adapter, #5 Rod.

LUBRICATION:—Pressure type. Gear type oil pump mounted in crankcase. Oil temperature regulator mounted on left side of engine.

Normal Oil Pressure—35 lbs. at 1000 R.P.M.

Oil Pressure Regulator—Located under plug on left side of crankcase. Operates at 35 lbs. Adjustable by turning adjusting screw.

Crankcase Capacity—8 qts. (1400, 1, 2), 9½ qts. (1403, 4, 5).

CLUTCH:—**Long Model 12 CB-CL.** Single plate, dry disc type. See article in Clutch Section for relining and assembling directions. No adjustment for wear required.

Facings—Moulded type, 2 required. Inside Diam 7". Outside Diam. 12". Thickness .140".

Adjustment—Clearance between pedal and toeboard should be ½-1". Free movement of pedal should be 1½". Adjust by turning turnbuckle on connecting rod at lower end of pedal.

Removal—Disconnect drive shaft at front universal, remove transmission and bell housing, take out screws mounting clutch on flywheel turning all screws out evenly to release clutch spring pressure.

STEERING:—**Steering Gear**—Gemmer Worm-and-Roller type. See article in Steering Section for adjustments.

Front Suspension:—Conventional 'I' beam section front axle with Reverse-Elliott ends and semi-elliptic springs.

King Pin Inclination—9° crosswise.

Camber—1°.

Caster—2½°. Adjustable by installing wedge shims between spring and spring pad on axle.

Toe In—1/16-⅛" at rim. Adjustable in usual manner by changing length of tie rod.

Tread—60".

Steering Geometry—Inner wheel turned 22½°-23°, outer wheel turned 20°. Check tie rod ends and king pins for looseness.

BRAKES:—Bendix Duo-Servo, Single Anchor, mechanically operated, vacuum power brakes. Hand lever applies all four brakes. See article in Brake Section for complete adjustment procedure.

Drum Diameter—14".

Lining—Primary (Raybestos 451), Secondary (Hyco DV 1391). Width 2¼" (except left front which is 1¾"). Thickness ¼". Length 30¼".

Clearance—Free—at heel and toe of each shoe.

Hand Brake Adjustment:—With hand brake lever fully released and cross shaft against stop, remove all slack in cable by adjusting clevis position at cross shaft end of cable until clevis pin can just be inserted in cross lever. Check brakes making sure they are fully released with hand brake in off position. Adjustment for wheel equalization should be made after drum lining has been worn in.

NOTE—By removing glove compartment and changing brake latch piece (#228705) operating position of hand brake lever may be moved 2" to the rear.

Power Unit:—Bendix plain type vacuum cylinder mounted on frame and linked to cross shaft lever. Controlled by valve built in brake pedal mechanism. *See article in Mechanical Equipment Section for data.*

ENGINE NUMBER:—First number—904000. Stamped on front of left cylinder block below head.

ENGINE SPECIFICATIONS:—**Type**—12 cyl. 67° Vee, modified 'L' head. Both blocks and upper crankcase cast enbloc.

Bore—3 7/16". **Stroke**—4¼".

Displacement—473 cubic inches.

Rated Horsepower—56.7 (AMA).

Developed Horsepower—175 at 3200 R.P.M. Std. 6.4-1 head.

Compression Ratio & Pressure—6.4-1 Std. head, 6.0-1 Optl. low comp. head, 7.0-1 Optl. high comp. head. Pressure 110 lbs. at cranking speed of 125 R.P.M. Std. 6.4-1 head.

Vacuum Reading—Gauge should show steady reading of 18-19" with engine idling at 375 R.P.M. or 8 M.P.H.

PISTONS:—Nelson Bohnalite, aluminum alloy, Invar Strut, split skirt type. Recondition cylinders to take finished replacement pistons.

Weight—21.7 ounces.

Removal—Pistons removed through top, rods thru bottom of engine (push pistons up until piston pin is exposed, take out locking rings, push out pin, lift out piston, lower rod and remove from below). Use new locking rings when installing pistons.

Clearance—Skirt .0015". See Fitting New Pistons.

Replacement Pistons:—Furnished in standard size and .003", .005", .010", .015", .020", .030", .045" oversize.

Fitting New Pistons:—Use .0015" feeler stock ½" wide to check clearance. Pull required to withdraw feeler from between piston and cylinder wall on side opposite slot should be 3-5 lbs.

Installing Pistons:—Slot should be toward camshaft on all pistons.

PISTON RINGS:—Three compression, one oil control ring per piston, all above pin. Lower ring groove drilled radially with twelve ⅛ oil drain holes.

Ring	Width	End Gap	Side Clear.
Comp. (Top)	⅛"	.007-.012"	.002"
Comp. (2nd)	⅛"	.007-.012"	.0015"
Oil	5/32"	.007-.015"	.0015"

NOTE—Ring tension when compressed to cylinder size with .007" minimum gap should be 6½ lbs. (compression), 4½-7½ lbs. (oil ring).

PISTON PIN:—**Diameter ⅞". Length 2 63/64".** Pin floats in piston and rod. Held by locking ring at each end. Pin hole in rod is bronze-bushed. Pins furnished for service .003", .006" oversize.

Pin Fit in Piston—Palm bush fit with piston heated to 160° F. Pin holes in piston finished to inside diameter of .87515-.87485".

Pin Fit in Rod Bushing—.0002" clearance or thumb push fit with both parts at room temp. (70° F.).

CONNECTING ROD:—**Weight 40⅝ ozs. Length 9".**

Crankpin Journal Diameter—2½".

Lower Bearing—Removable, steel-backed, babbitt-lined type. Bearings furnished for service .001", .002", .003", .015" undersize.

Clearance—.0005-.002". **Sideplay .005-.013".**

Bearing Adjustment:—None (no shims). Replace bearings. Do not file rod or caps.

Installing Rods:—Install all rods with oil bleed hole in lower bearing toward right or starter side of engine.

CRANKSHAFT: 4 bearing. Integral counterweights.

Journal Diameters—2¾" all bearings.

Bearing Type—Removable, steel-backed babbitt-lined. No shims.

Clearance—.001-.002".

Bearing Adjustment:—None (no shims). Replace bearings. Do not file bearing caps.

End Thrust:—Taken by #1 front bearing. Endplay .003-.005".

CAMSHAFT:—Four bearing. Mounted between cylinder banks directly above crankshaft. Non-adjustable chain drive.

Bearing Type—Steel-backed, babbitt-lined.

Clearance—.001-.003".

Endplay—.002-.006".

Timing Chain:—Morse #1866. Width 1¾". Pitch .500". Length 28" or 56 links.

NOTE—Engine must be supported at front end and engine front casting (engine support, timing chain cover, generator and water pump mounting) removed for work on timing chain, sprockets, or camshaft.

Camshaft Setting:—Sprockets are marked. Mesh chain with sprockets turned so that '00' marks are adjacent and in line with a straightedge across the shaft centers (vertical).

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1 21/32"	.3405"	6 35/64"
Exhaust	1 21/32"	.338"	6 35/64"

	Seat Angle	Lift	Stem Clearance
Intake	45°	5/16"	.0025"
Exhaust	45°	5/16"	.005"

Tappet Clearance—None (automatic take up).

Automatic Tappet Take-up (Valve Silencer):—Consists of eccentric take-up on rocker arm shaft. Rocker arms contact valve stem ends and cams directly and are mounted on roller bearings.
See article in Mechanical Equipment Section for data.
NOTE—Initial clearance of take-up mechanism must be checked when valves are installed and take-up must be bled when valves are ground.
See article in Mechanical Equipment Section for data.

Valve Springs:—Install springs with japanned end down and close-spaced first coil up.

	Spring Pressure	Length
Valve Closed	70 lbs.	2 7/32"

Valve Timing:—See Camshaft Setting above.

Intake Valves—Open at TDC. Close 45° ALDC.

Exhaust Valves—Open 35° BLDC. Close 10° ATDC.

To Check Valve Timing—Intake valve in #1 cylinder of right hand bank (1R) should begin to open with piston No. 6R on top dead center entering power stroke when mark '1R-UDC' on vibration dampener at front of engine lines up with pointer on chain case cover.

Motor Gauge—Weidenhoff #114 Adapter, #2 Rod.

LUBRICATION:—Pressure system. Gear type oil pump located in crankcase. Oil temperature regulator mounted on right side of crankcase.

Normal Oil Pressure—35 lbs. at 1000 R.P.M.

Oil Pressure Regulator—Under plug on right hand side of crankcase. Adjustable by turning adjusting screw.

Crankcase Capacity—10 qts.

CLUTCH:—**Long Model 12 CB-CL.** Single plate, dry disc type. See article in Clutch Section for relining and assembling directions. No adjustment for wear required.

Facings—Moulded type, 2 required. Inside Diam. 7". Outside Diam. 12". Thickness .137".

Adjustment—Clearance between pedal and toeboard should be ½-1". Free movement of pedal should be 1½". To adjust, turn turnbuckle on connecting rod at lower end of clutch pedal.

Removal—Disconnect drive shaft at front universal, remove transmission and bell housing, take out screws mounting clutch cover on flywheel, turning all screws out evenly to release clutch spring tension.

STEERING:—**Steering Gear**—Gemmer Worm-and-Roller type. See article in Steering Section for adjustments.

Front Suspension:—Conventional 'I' beam section front axle with Reverse-Elliot ends and semi-elliptic springs.

King Pin Inclination—9° crosswise.

Camber—1°.

Caster—1½°. Adjustable by installing wedge shims between spring and spring pad on axle.

Toe In—1/16-⅛" at rim. Adjustable in usual manner by changing length of tie rod.

Tread—60".

Steering Geometry—Inner wheel turned 22½°, outer wheel turned 20°. Check tie rod ends and king pins for looseness.

BRAKES:—**Service**—Bendix Duo-Servo, Single anchor, mechanically operated, vacuum power brakes. Hand lever applies all four brakes. See article in Brake Section for complete adjustment procedure.

Drum Diameter—15".

Lining—Primary (Raybestos 451), Secondary (Hyco DV 1391). Width 2½" (except left front which is 1⅞"). Thickness ¼". Length 32¼".

Clearance—Free—at heel and toe of each shoe.

Hand Brake Adjustment:—With hand brake lever fully released and cross shaft against stop, remove all slack in cable by adjusting clevis position at cross shaft end of cable until clevis pin can just be inserted in cross lever. Check brakes making sure they are fully released with hand brake in off position. Adjustment for wheel equalization should be made after lining has been worn in.

NOTE—By removing glove compartment and changing brake latch piece (#228705) operating position of hand brake lever may be moved 2" to the rear.

Power Unit:—Bendix plain type vacuum cylinder mounted on frame and linked to cross shaft lever. Controlled by valve in brake rod between brake pedal and cross shaft. See Brake Section for complete data.

ENGINE NUMBER:—First number T-1526. Stamped on boss on left side of block near distributor.

ENGINE SPECIFICATIONS:—6 cylinder, 'L' head.
Bore—3 7/16". **Stroke**—4¼".
Displacement—237 cubic inches.
Rated Horsepower—28.4 (AMA).
Developed Horsepower—100 HP. (Std. 6.3-1 head), 103 HP, (Optl. 6.75-1 head) at 3600 R.P.M.
Compression Ratio & Pressure—As follows:
6.3-1 Std. cast-iron hd. 105 lbs. at 125 R.P.M.
6.75-1 Optl. aluminum hd. 115 lbs. at 125 R.P.M.
Vacuum Reading—Gauge should show steady reading of 18-20" with engine idling at 6 M.P.H.

PISTONS:—Nelson Bohnalite, aluminum alloy, autothermic strut type, tin plated, cam ground.
Weight—19.0 ozs. (stripped), 25.4 ozs. (with rings and pin). **Length**—3⅞".
Removal—Pistons and rods removed from above.
Clearance—Skirt .0015". See Fitting New Pistons.

Replacement Pistons:—*See Packard Shop Notes for data.*

Fitting New Pistons:—.0015" x ½" feeler inserted between piston and cylinder wall on side opposite slot should require 12-18 lbs. pressure to withdraw.

Installing Pistons:—Slot toward valves.

PISTON RINGS:—Two compression, one oil control ring per piston, above pin. Lower ring groove drilled with twelve 5/32" oil drain holes. Rings furnished .005", .010", .020", .030", .040" oversize.

Ring	Width	End Gap	Side Clearance
Compr.	⅛"	.007-.012"	.0025-.003"
Oil Cont.	3/16"	.007-.015"	.0015-.002"

NOTE—Install #1 and #3 ring with gap away from valves, #2 compression ring gap toward valves.

PISTON PIN:—Diameter—⅞". **Length**—2 63/64".
Floating type. Furnished .003" and .006" oversize. See Connecting Rod Upper Bearing below.
Pin Fit in Piston—Finger push fit with piston heated to 160° F.
Pin Fit in Rod Bushing—Finger push fit at 70° F.
NOTE—Finish ream bushings to .87515-.87485".

CONNECTING ROD:—Weight 33⅝ ozs. **Length** 7 11/16".
Upper Bearing (Piston Pin Bushing)—Split type bushings used. Expand to tight fit and ream. Oil passage in rod must open to groove between bushings.
See Packard Shop Notes for Bushing installation.
Crankpin Journal Diameter—2 3/32".
Lower Bearing—Interchangeable steel-backed, babbitt-lined type. No shims. Bearings furnished .001", .002", .003", .015" undersize.
Clearance—.0005-.0025". **Sideplay**—.004-.010".
Bearing Adjustment:—None. Replace bearings.
Installing Rods:—Oil squirt hole to camshaft.

CRANKSHAFT:—4 bearing. Integral counterweights.
Journal Diameters—2¾" all bearings.
Bearing Type—Interchangeable steel-backed, babbitt-lined type. No. shims. Bearings furnished .001", .002" undersize.
Clearance—.001-.003".
Bearing Adjustment:—None. Replace bearings. Upper halves may be rotated in place.
End Thrust:—Taken by #1 bearing. Adjust by adding or removing shims. **Endplay**—.003-.008".

CAMSHAFT:—4 bearing. Non-adjustable chain drive.
Bearing Type—Steel-backed, babbitt-lined.
Clearance—.001-.003".
End Thrust:—Taken by thrust plate in back of camshaft sprocket. **Endplay**—.002-.004".
Timing Chain:—Morse 1866 RX. Width 1¼". Pitch .375". Length 58 links or 20¾".
Camshaft Setting:—Install chain and sprockets together with marks on sprockets adjacent and in line with a straightedge across the shaft centers with #1 piston at top dead center.
See Packard Shop Notes for Front Assembly and Radiator removal.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1.575"	.340"	5⅝"
Exhaust	1.406"	.340"	5⅝"

	Seat Angle	Lift	Stem Clearance
Intake	30°	.300"	.0005-.00175"
Exhaust	45°	.300"	.0005-.00175"

NOTE—.0005" min. clearance at bottom of guide.
Tappet Clearance—.007" Int., .010" Exh., hot.
NOTE—Remove plate in right fender for valve adj.

Valve Guides:—Guides taper reamed. Install from above with smallest diameter at bottom.

Valve Springs:—Int. & Exh. springs interchangeable. 1938 springs only furnished for replacement.

	Spring Pressure	Spring Length
Valve Closed	36-44 lbs.	1⅝"
Valve Open	105-113 lbs.	1 5/16"

Valve Lifters:—Single piece, barrel type. Remove from above. Ream lifter holes from above working thru stem guide with Packard Tool #S.T.-5065. Camshaft need not be removed. Oversize lifters furnished .001", .002", .005".

VALVE TIMING:—See Camshaft Setting above.
Intake Valves—Open 5° BTDC. Close 39° ALDC.
Exhaust Valves—Open 45° BLDC. Close 5° ATDC.

To Check Timing:—Set tappet clearance #1 exhaust valve at .013". This valve should close with piston 5° or .0103" past top dead center when point on flywheel 2½ graduations past #1 UP.DC (top dead center mark) lines up with pointer in inspection hole in left front face of flywheel housing under starter. Reset tappet clearance at .010" with engine hot.

LUBRICATION:—Pressure. Gear type pump on right side of engine.
NOTE—Install oil pump with driving slot parallel with center line of camshaft with distributor rotor opposite #1 terminal in cap.

Normal Oil Pressure:—35 lbs. at 30 M.P.H. Warm oil.

Oil Pressure Relief Valve:—On pump cover. Not adjustable. Replace spring if pressure less than 5-8 lbs. at 2".

Crankcase Capacity:—7 quarts (dry).

CLUTCH:—Long Model 9½ CF-CS. Semi-centrifugal, single plate, dry disc type.
See article in Mechanical Equipment Section for data.
Facings—Woven, 2 required. I.D. 6". O.D. 9½". Thickness .125".
Adjustment:—Pedal free travel 1½-2". Adjusting nut on connector link at clutch fork.

Removal:—With clutch pedal depressed, insert wedge (ST-879) between each throwout finger and cover (assembly can only be removed from below when in partially released position). Remove transmission (see Transmision Removal below), clutch shifter bearing, pedal rod, and cover capscrews evenly, then remove assembly from below.

TRANSMISSION:—Own—Helical gear type with synchronizing shift on second and high gears.
See article in Mechanical Equipment Section for data.
Removal:—Remove floorboards, speed. cable, ground strap, propeller shaft, housing lower cover, shifter bearing spring, engine stabilizer (frame to trans.). Remove 2 bolts at trans. end of left support, remove frame bolts in right support with jack supporting rear of engine, 4 trans.-to-housing bolts, and withdraw transmission.
NOTE—Keep engine to right when installing.

UNIVERSAL JOINTS:—Mechanics—Model 2-C. Roller bearing. 2 used.
See article in Mechanical Equipment Section for data.

REAR AXLE:—Own—Semi-floating, hypoid gear type with Hotchkiss drive. Welded cover used.
See article in Mechanical Equipment Section for data.
Ratio—4.36-1 (std.). 4.54-1, 4.09-1 (optl.).
Backlash—.003-.005". Screw adjustment for ring gear mesh in pinion. Pinion stationary.
Removal:—With wheel, hub and brake assembly removed, axle shafts can be withdrawn from housing. Differential carrier can then be removed from housing (on car) by disconnecting rear universal joint at flange, removing housing bolt nuts (below) and screw with locknut (at top). Assembly can then be removed from below.
Wheel Bearing Adjustment—None.
NOTE—Whenever wheel bearing replaced be sure that spring washer between inner bearing race and hub installed.

SHOCK ABSORBERS:—Delco—Mod. 1960-C, D (front), 1717-A, B (rear). Double acting, piston type.
See article in Mechanical Equipment Section for data.

STEERING:—Steering Gear—Packard (Gemmer design) Worm-and-Roller type with center-steering.
See article in Mechanical Equipment Section for data.
Front Suspension:—Independent 'Safe-T-Flex' type with coil springs.
See article in Mechanical Equipment Section for data.
NOTE—Data below applies with car on level floor, tires properly inflated and car weighted as follows: 5 pass. (375 lbs. rear seat, 300 lbs. front), 2-4 pass. (150 lbs. frt. seat, 225 lbs. rear comp't.).
Front Suspension Height—Distance from floor to top of frame side rail at spring should be 17⅝".
Kingpin Inclination—1½° crosswise.
Camber—1° plus or minus ¼°. Adjustable.
Caster—2½° plus or minus ½°. Shim adjustment.
Toe In—1/32-1/16". Adjust by turning tie rods equally (check for equal lengths after adjustment).

BRAKES:—Service—Bendix hydraul., duo-servo, single anchor type. Hand lever applies rear service brakes.
See article in Mechanical Equipment Section for data.
Wheel Cylinders—Diameter 1 1/16" front wheel, 15/16" rear wheel.
Drum Diameter—11".
Lining—Marshall #1915 (primary), S.R.-600 (secondary). Width 1¾". Thickness 3/16". Length per shoe 12".
Clearance—.010" at heel and toe of each shoe.
Hand Brake Adjustment—See Service Brakes.

ENGINE NUMBER:—First number X-100,001. Stamped on boss on left side of block near distributor.

ENGINE SPECIFICATIONS:—8 cylinder, 'L' head.
Bore—3¼". **Stroke**—4¼".
Displacement—282.04 cubic inches.
Rated Horsepower—33.8 (AMA).
Developed Horsepower—120 HP. at 3800 with std. 6.43-1 aluminum head.
Compression Ratio & Pressure—As follows:
6.43-1 Std. aluminum hd. 110 lbs. at 125 R.P.M.
7.0-1 Optl. aluminum hd. 118 lbs. at 125 R.P.M.
Vacuum Reading—Gauge should show steady reading of 18-20" with engine idling at 6 M.P.H.

PISTONS:—Nelson Bohnalite, aluminum alloy, strut type (split skirt), tin plated (early cars not plated). **Weight**—17.6 ozs. (stripped), 23 ozs. (with rings and pin). **Length**—3⅞".
Removal—Pistons and rods removed from above.
Clearance—Skirt .0015". See Fitting New Pistons.
Replacement Pistons:—*See Packard Shop Notes for data.*
Fitting New Pistons:—.0015"x½" feeler inserted between piston and cylinder wall on side opposite slot should require 12-18 lbs. to withdraw.
Installing Pistons:—Slot toward valves.

PISTON RINGS:—Two compression, one oil control ring per piston, all above pin. Lower ring groove drilled with twelve 5/32" oil drain holes. Rings furnished .005", .010", .020", .030", .040" oversize.

Ring	Width	End Gap	Side Clearance
Comp.	⅛"	.007-.012"	.0025-.003"
Oil Cont.	3/16"	.007-.015"	.0015-.002"

NOTE—Install #1 and #3 ring with gap away from valves, #2 compression ring gap toward valves.

PISTON PIN:—Diameter—⅞". **Length**—2 51/64". Floating pin type. Furnished .003" and .006" oversize. See Connecting Rod Upper Bearing below.
Pin Fit in Piston—Finger push fit with piston heated to 160° F.
Pin Fit in Rod Bushing—Finger push fit at 70° F.
NOTE—Finish ream bushings to .87515-.87485".

CONNECTING ROD:—Weight 33⅝ ozs. **Length** 7 11/16".
Upper Bearing (Piston Pin Bushing)—Split type bushings used. Expand to tight fit and ream. Oil passage in rod must be open to groove bet. bushings.
See Packard Shop Notes for bushing installation.
Crankpin Journal Diameter—2 3/32".
Lower Bearing—Interchangeable steel-backed, babbitt-lined type. No shims. Bearings furnished .001", .002", .003", .015" undersize.
Clearance—.0005-.0025". **Sideplay**—.004-.010".
Bearing Adjustment:—None. Replace bearings.
Installing Rods:—Oil squirt hole to camshaft.

CRANKSHAFT:—5 bearing. Integral counterweights.
Journal Diameters—2¾" all bearings.
Bearing Type—Interchangeable steel-backed, babbitt-lined type. No shims. Bearings furnished .001", .002" undersize.
Clearance—.001-.003".
Bearing Adjustment:—None. Replace bearings. Upper halves may be rotated in place.
End Thrust:—Taken by #3 bearing. Adjust by adding or removing shims. **Endplay**—.003-.008".

CAMSHAFT:—5 bearing. Non-adjustable chain drive.
Bearing Type—Steel-backed, babbitt-lined.
Clearance—.001-.003".
End Thrust:—Taken by thrust plate in back of camshaft sprocket. **Endplay**—.002-.004".

Timing Chain:—Morse 1866 RX. Width 1¼". Pitch .375". Length 58 links or 20¾".

Camshaft Setting:—Install chain and sprockets together with marks on sprockets adjacent and in line with a straightedge across the shaft centers with #1 piston at top dead center.
See Packard Shop Notes for Front Assembly and Radiator Removal.

VALVES—

	Head Diameter	Stem Diameter	Length
Intake	1 17/32"	.340"	.5⅝"
Exhaust	1 13/32"	.340"	.5⅝"

	Seat Angle	Lift	Stem Clearance
Intake	30°	.300"	.0005-.00175"
Exhaust	45°	.300"	.0005-.00175"

NOTE—.0005" min. clearance at bottom of guide.
Tappet Clearance—.007" Int., .010" Exh., hot.
NOTE—Remove plate in right fender for valve adj.

Valve Guides:—Guides taper reamed. Install from above with smallest diameter at bottom.

Valve Springs:—Int. & Exh. springs interchangeable. 1938 springs only furnished for replacement.

	Spring Pressure	Spring Length
Valve Closed	36-44 lbs.	1⅝"
Valve Open	105-113 lbs.	1 5/16"

Valve Lifters:—Single piece, barrel type. Remove from above. Ream lifter holes from above working through stem guide with Packard Tool #S.T.-5065. Camshaft need not be removed. Oversize lifters furnished .001", .002", .005".

VALVE TIMING:—See Camshaft Setting above.
Intake Valves—Open 5° BTDC. Close 39° ALDC.
Exhaust Valves—Open 45° BLDC. Close 5° ATDC.

To Check Timing:—Set tappet clearance #1 exhaust valve at .013". This valve should close with piston 5° or .0103" past top dead center when point on flywheel 2½ graduations past #1 UP.DC (top dead center mark) lines up with pointer in inspection hole in left front face of flywheel housing under starter. Reset tappet clearance at .010" with engine hot.

LUBRICATION:—Pressure. Gear type pump on right side of engine.
NOTE—Install oil pump with driving slot parallel with center line of camshaft with distributor rotor opposite #1 terminal in cap.

Normal Oil Pressure:—35 lbs. at 30 M.P.H. Warm oil.

Oil Pressure Relief Valve:—On pump cover. Not adjustable. Replace spring if pressure less than 5-8 lbs. at 2".

Crankcase Capacity:—7 quarts (dry).

CLUTCH:—Long Model 10CF-CI. Semi-centrifugal, single plate, dry disc type.
See article in Mechanical Equipment Section for data.
Facings—Woven, 2 required. I.D. 6". O.D. 10". Thickness .137".
Adjustment:—Pedal free travel 1½-2". Adjusting nut on connector link at clutch fork.
Removal:—With clutch pedal depressed, insert wedge (ST-879) between each throwout finger and cover (assembly can only be removed from below when in partially released position). Remove transmission (see Transmission Removal below), clutch shifter bearing, pedal rod, and cover capscrews evenly, then remove assembly from below.

TRANSMISSION:—Own—Helical gear type with synchronizing shift on second and high gears.
See article in Mechanical Equipment Section for data.
Removal:—Remove floorboards, speedometer cable, ground strap, propeller shaft, housing lower cover, shifter bearing spring, engine stabilizer (frame to transmission). Remove 2 bolts at transmission end of left support, remove frame bolts in right support with jack supporting rear of engine, 4 transmission-to-housing bolts, and withdraw transmission.
NOTE—Keep engine to right when installing.

UNIVERSAL JOINTS:—Mechanics—Model 3-C. Roller bearing. 2 used.
See article in Mechanical Equipment Section for data.

REAR AXLE:—Own—Semi-floating, 'Angle Set', hypoid gear type with Hotchkiss drive. Welded cover used.
See article in Mechanical Equipment Section for data.
Ratio—4.09-1 (std. pass., optl. hearse), 4.54-1 (std. hearse, optl pass.), 4.36-1 (optl), 4.7-1 (optl hearse).
Backlash—.003-.005". Screw adjustment for ring gear mesh in pinion. Pinion stationary.
Removal:—With wheel, hub and brake assembly removed, axle shafts can be withdrawn from housing. Differential carrier can then be removed from housing (on car) by disconnecting rear universal joint at flange, removing housing bolt nuts (below) and screw with locknut (at top). Assembly can then be removed from below.
Wheel Bearing Adjustment—None.
NOTE—Whenever wheel bearing replaced be sure that spring washed between inner bearing race and hub installed.

SHOCK ABSORBERS:—Delco—Mod. 1960-C, D (front), 1717-A, B (rear). Double acting, piston type.
See article in Mechanical Equipment Section for data.

STEERING:—Steering Gear—Packard (Gemmer design) Worm-and-Roller type with center-steering.
See article in Mechanical Equipment Section for data.
Front Suspension:—Independent 'Safe-T-Flex' type with coil springs.
See article in Mechanical Equipment Section for data.
NOTE—Data below applies with car on level floor, tires properly inflated and car weighted as follows: 5 pass (375 lbs. rear seat, 300 lbs. front), 2-4 pass. (300 lbs. frt. seat, 225 lbs. rear comp't.).
Front Suspension Height—Distance from floor to top of frame side rail at spring should be 18".
Kingpin Inclination—1½° crosswise.
Camber—1° plus or minus ¼°. Adjustable.
Caster—2½° plus or minus ½°. Shim adjustment.
Toe In—1/32-1/16". Adjust by turning tie rods equally (check for equal lengths after adjustment).

BRAKES:—Service—Bendix hydraul., duo-servo, single anchor type. Hand lever applies rear service brakes.
See article in Mechanical Equipment Section for data.
Wheel Cylinders—Diameter 1 1/16" front wheel, 15/16" rear wheel.
Drum Diameter—12".
Lining—Primary: Raybestos #451. Secondary: U.S. #589. Width 1¾". 3/16" thick. Length per shoe 13".
Clearance—.010" at heel and toe of each shoe.
Hand Brake Adjustment—See Service Brakes.

ENGINE NUMBER:—First number 395,501. Stamped on left side of engine near starter.

ENGINE SPECIFICATIONS:—8 cylinder, 'L' head.
Bore—3 3/16". **Stroke**—5".
Displacement—320 cubic inches.
Rated Horsepower—32.5 (AMA).
Developed Horsepower—130 HP. (std. 6.4-1 head), 135 HP. (optl. 7.0-1 head) at 3200 R.P.M.
Compression Ratio and Pressure—As follows:
6.4-1 Std. aluminum head. 108 lbs. at 125 R.P.M.
7.0-1 Optl. aluminum head. 119 lbs. at 125 R.P.M.
Vacuum Reading—Gauge should show steady reading of 18-19", engine idling at 350 R.P.M. or 7 M.P.H.
See Packard Shop Notes for Cylinder Block Removal instructions.

PISTONS:—Nelson Bohnalite, aluminum alloy, strut type, tin-plated (early cars not plated).
Weight—18.7 ozs. (stripped), 24.1 ozs. (with rings and pin). **Length**—4¼".
Removal—Pistons removed from above, rods from below (push assembly up to expose pin, remove pin, lift piston out, remove rod from below with engine warm).
Clearance—Skirt .0015". See Fitting New Pistons.

Replacement Pistons:—*See Packard Shop Notes for data.*

Fitting New Pistons:—.0015" x ½" feeler inserted between piston and cylinder wall on side opposite slot should require 12-14 lbs. to withdraw.

Installing Pistons:—Slot toward valves.

PISTON RINGS:—Two compression, two oil control rings per piston, all above pin. Each oil ring groove drilled with ten ⅛" oil drain holes. Rings furnished .005", .010", .020", .030", .040" oversize.

Ring	Width	End Gap	Side Clearance
Comp. (top)	⅛"	.007-.012"	.002-.0025"
Comp. (#70)	⅛"	.007-.012"	.0025"
Oil (top #85)	5/32"	.007-.015"	.0015"
Oil (X90-85)	5/32"	.007-.015"	.0015"

NOTE—Install #1 and 3 rings with gap toward valves, #2 & 4 with gap away from valves.

PISTON PIN:—Diameter—⅞". **Length**—2 47/64".
Floating type. Furnished .003" and .006" oversize. Pin hole in rod bronze-bushed.
Pin Fit in Piston—Finger push fit with piston heated to 160° F.
Pin Fit in Rod Bushing—Finger push fit at 70° F.
NOTE—Finish ream bushings to .87515-.87485".

CONNECTING ROD:—Weight—40⅜ ozs. **Length**—10⅞".
Crankpin Journal Diameter—2 3/16".
Lower Bearing—Copper lead alloy, interchangeable type. Furnished .001", .002", .003", .015" undersize.
Clearance—.001-.0015". **Sideplay**—.006". Limits—.005-.008".

Bearing Adjustment:—None (no shims). Replace bearings. Do not file rods or caps.

Installing Rods:—Oil squirt hole to camshaft.

CRANKSHAFT:—9 bearing. Bolted-on counterweights.
Journal Diameters—2⅝".
Bearing Type—Removable steel-backed, babbitt-lined type. No shims.
Clearance—.001-.002".

Bearing Adjustment:—None (no shims). Replace halves may be rotated in place.

End Thrust:—Taken by #7 bear. **Endplay**—.003-.005".

CAMSHAFT:—8 bearing. Non-adjustable chain drive.
Bearing Type—Steel-backed, babbitt-lined.
Clearance—.0015-.0035".

End Thrust:—Taken by thrust plate in back of camshaft sprocket. **Endplay**—.001-.004".

Timing Chain:—Morse 3682-KX. Width 1½". Pitch .375". Length 70 links or 26¼".

Camshaft Setting:—Install chain and sprockets together with marks adjacent and in line with a straightedge across the shaft centers.
NOTE—Front end disassembly as follows: remove bumper, center bolt at bottom of radiator, trim strips on running board, fender-to-board and frame bolts. Fender and radiator can then be removed as an assembly.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1 21/32"	.3405"	7 13/32"
Exhaust	1 15/32"	.3405"	7 13/32"

	Seat Angle	Lift	Stem Clearance
Intake	45°	.358"	.0025" min.
Exhaust	45°	.358"	.004" min.

Tappet Clearance:—.006" Int., .008" Exh. hot.

Valve Guides:—Pressed in block from above. Reamed to size for correct stem clearance (see table above).

Valve Rocker Arms:—Consist of pivoted arms mounted on bracket on crankcase which transmit motion from cam to valve pushrod (valve lifter).
Removal—Remove screws in bracket on right side of crankcase, withdraw bracket and pushrod assembly.

Pushrods (Valve Lifters):—Mounted on guides seated in crankcase and held down by block which engages guide flange.

Valve Springs:—	Spring Pressure	Length
Valve Closed	68-78 lbs.	3 1/16"
Valve Open	154-164 lbs.	2 45/64"

VALVE TIMING:—See Camshaft Setting above.
Intake Valves—Open 30° BTDC. Close 65° ALDC.
Exhaust Valves—Open 65° BLDC. Close 30° ATDC.

To Check Timing:—Set tappet clearance #1 exhaust valve at .005" (or .010", then insert .005" feeler). Turn engine over until pointer over damper (at front of engine) lines up with a point 1 1/16" (plus or minus 11/32") past '1-UPDC' mark (feeler should withdraw with finger pull). Valve closes 30° or .4070" ATDC. Reset tappet clearance at .008" hot.

LUBRICATION:—Pressure type. Gear type oil pump mounted in crankcase.
Normal Oil Pressure:—55 lbs. max., 5 lbs. min. with SAE #20 oil.
Oil Pressure Relief Valve:—Located under plug on left side of crankcase. Remove acorn nut and adjust by turning screw.
Crankcase Capacity—8 quarts (dry).

CLUTCH:—Long Model 12CB-CL. Single plate, dry disc type.
See article in Mechanical Equipment Section for data.
Facings—Woven (Raybestos #250). 2 required. I.D. 7". O.D. 12". Thickness .137".
Adjustment—Adjust nut on pedal rod to give 1½" of free travel.
Removal:—Remove transmission (see Transmission Removal below), take out cover mounting screws evenly. Align '0' marks on flywheel and cover at reassembling.

TRANSMISSION:—Own—Helical gear type with synchronizing shift on second and high gears.
See article in Mechanical Equipment Section for data.
Removal:—Remove ground strap, propeller shaft, light switch, hand brake cable (at equalizer), two stud nuts (case bracket to rubber support) on either side, stabilizer link (left side), clutch pedal pull rod and spring, place jack under rear of engine. Remove pedal shaft inner bracket, loosen brace rod on right at rear end only, lower cross member, take out bell housing nuts and capscrews, raise rear of engine, remove 2 frame-to-vertical support members on either side and remove. Transmission can now be removed.

UNIVERSAL JOINTS:—'Detroit Universal'. Series 5350. Cross type with roller bearings. 2 used.
See article in Mechanical Equipment Section for data.

REAR AXLE:—Own—Semi-floating, hypoid gear type with Hotchkiss drive.
See article in Mechanical Equipment Section for data.
Ratio—4.69-1 (std.), 4.36-1, 4.9-1 (optl.).
Backlash—.003-.005". Screw adjustment (back off one nut, tighten other nut equal amount with bearings correctly adjusted). Pinion setting controlled by shims furnished .005", .008", .015" thick.
Removal:—With wheel, hub and brake assembly removed, axle shafts may be withdrawn from housing. Differential carrier can then be removed from housing (on car) by disconnecting rear universal joint at flange, removing housing bolt nuts (below) and locknut on screw (at top). Assembly can then be removed from below.
Wheel Bearing Adjustment—Controlled by shims between outer race of inner bearing and shoulder in housing. Remove hub asembly, backing plate, axle shaft, and inner bearing outer race. Add or remove shims to give proper clearance.
Endplay—.003" (at each wheel).

SHOCK ABSORBERS:—Delco—Model 1960 C, D (front), 1717 C and D (rear). Double acting, piston type.
See article in Mechanical Equipment Section for data.

STEERING:—Steering Gear—Packard (Gemmer design). Worm-and-Roller type with center steering.
See article in Mechanical Equipment Section for data.

Front Suspension:—Packard Safe-T-Flex, independent type.
See article in Mechanical Equipment Section for data.
NOTE—Data below applies with car on level floor and car loaded with 300 lbs. (frt.—all), 225 lbs. (rear—Coupe), 375 lbs. (rear—5 Pass.), 675 lbs. (rear—7 & 8 Pass.).
Front Suspension Height—Distance from floor to top of frame side rail at spring should be 20⅛".
Kingpin Inclination—1½° crosswise.
Camber—1° plus or minus ¼°. Adjustable.
Caster—2½° plus or minus ½°. Shim adjustment.
Toe In—1/32-⅛". Adjusted by turning tie rods equally (check for equal lengths after adjustment).

BRAKES:—Service—Bendix hydraul., duo-servo, single anchor type. Hand lever applies rear service brakes.
See article in Mechanical Equipment Section for data.
Wheel Cylinders—Diameters—Front wheel 1¼", rear 1⅛".
Drum Diameter—13".
Lining—Primary: Marshall Asb. #1035, Secondary: #600. Width 2½". 3/16" thick. Length per shoe 13".
Clearance—.010" at heel and toe of each shoe.

Hand Brake Adjustment:—See Service Brakes.

ENGINE NUMBER:—First number 905,501. Stamped left side of block below cylinder head.

ENGINE SPECIFICATIONS:—**Type**—Own make. 12 cylinder, 67° Vee, modified 'L' head. Both blocks and upper crankcase cast Enbloc.
Bore—3 7/16". **Stroke**—4¼".
Displacement—473 cu. ins. **Rated HP.**—56.7.
Developed Horsepower—175 HP. (Std. 6.4 head), 180 HP. (Optl. 7.0-1 head) at 3200 R.P.M.
Compression Ratio & Pressure—All cylinder heads aluminum. Ratios and pressure at 125 RPM. (cranking speed) as follows:

	Ratio	Pressure
Standard	6.4-1	110 lbs.
Optional	7.0-1	119 lbs.

See Packard Shop Notes for Cylinder Head data.
Vacuum Reading—18-20" at 375 R.P.M. or 8 M.P.H.

PISTONS:—Nelson Bohnlite, aluminum alloy, Invar strut, split skirt type, tin-plated. Recondition cylinders to take finished replacement pistons.
Weight—22 ozs. (stripped), 28.7 ozs. (with rings and pin). **Length**—4.318" (2.336" pin center-line to top.)
Removal—Pistons removed through top of engine, rods from below (push pistons up until pin is exposed, remove locking ring, push out pin, lift pistons out, lower rods and remove from below. Removal will be easier if engine is warm.
Clearance—Skirt .0015". See Fitting New Pistons.
Replacement Pistons:—*See Packard Shop Notes for data.*
Fitting New Pistons:—Use .0015" feeler, ½" wide, inserted between piston and cylinder wall on side opposite slot. Pull to withdraw feeler 12-18 lbs.
Installing Pistons:—Slot toward valves (all pistons).

PISTON RINGS:—Three compression, one oil control ring per piston, all above pin. Oil ring groove drilled with twelve ⅛" oil drain holes.

Ring	Width	End Gap	Side Clearance
Comp. (1 & 2)	⅛"	.007-.012"	.0025-.003"
Comp. (#3)	⅛"	.007-.012"	.0015-.002"
Oil (X90-85)	5/32"	.007-.015"	.0015-.002"

NOTE—On right bank, install #1 and 3 rings with gap toward camshaft, #2 and 4 away from camshaft. Reverse order on left hand bank.

PISTON PIN:—Diameter ⅞". Length—2 63/64".
Pin floats in piston and rod. Held by locking ring at each end. Pin hole in rod bronze-bushed.
Pin Fit in Piston—Finger push fit with piston heated to 160°F.
Pin Fit in Rod Bushing—.0002" clearance or thumb push fit with both parts at room temp. (70°F).

CONNECTING ROD:—Weight 38¼ ozs. **Length** 9".
Crankpin Journal Diameter—2½".
Lower Bearing—Removable steel-backed, copper-lead alloy lined type. No shims. Bearings furnished std., and .001", .002", .003", .005" undersize.
Clearance—.001-.0015". **Sideplay**—.008-.010".
Bearing Adjustment:—None (no shims). Replace bearings. Do not file rods or caps.
Installing Rods:—Install all rods with oil squirt hole toward right or starter side of engine.

CRANKSHAFT:—Four bearing. Bolted counterweights.
Journal Diameters—2¾" all bearings.
Bearing Type—Removable steel-backed, babbitt-lined. No shims.
Clearance—.001-.002".
Bearing Adjustment:—None (no shims). Replace bearings (upper halves can be rotated in place). Do not file bearing caps.
End Thrust:—Taken by #1 front bearing. Endplay .003-.005".

CAMSHAFT:—Four bearing. Between banks directly above crankshaft. Non-adjustable chain drive.
Bearing Type—Steel-backed, babbitt-lined.
Clearance—.001-.0015". (#1, 4), .002-.0025" (#2, 3).
Endplay—.002-.006".
Timing Chain:—Morse, No. 1866. Width 1¾". Pitch .500". Length 28" or 56 links.
NOTE—Engine must be supported at front end and front casting (engine support, chain case cover, generator and water pump mounting) removed for work on chain or sprockets. Remove fenders and radiator as an assmbly.
Camshaft Setting—Sprockets marked. Mesh chain with sprockets turned so that marks are adjacent and in line with straightedge across shaft centers. Install chain endless with both sprockets off engine.

VALVES:—

	Head Diam.	Stem. Diam.	Length
Intake	1 41/64"	.3405"	6.550"
Exhaust	1 21/32"	.338"	6.550"

	Seat Angle	Lift	Stem Clearance
Intake	45°	.3125"	.0025"
Exhaust	45°	.3125"	.005"

Tappet Clearance—None (automatic take-up).
Automatic Tappet Take-up:—Must be bled and blocked open when valves are ground and initial clearance must be checked afterward. Clearance must be .030-.045".
See article in Mechanical Equipment Section for data.
Valve Springs—Install springs with painted end down and close-spaced first coil toward valve head. Special 1/32" higher stem keeper furnished to compensate for loss of pressure caused by valve reseat'g.

	Spring Pressure	Length
Valve Closed	70 lbs.	2 7/32"
Valve Open	140 lbs.	1 29/32"

Valve Timing:—See camshaft setting above.
Intake Valves—Open at TDC. Close 45° ALDC.
Exhause Valves—Open 35° BLDC. Close 10° ATDC.
To Check Valve Timing—Intake valve for #1 (front cylinder, right bank) begins to open with piston on top dead center when '#1R-UDC' mark on dampener lines up with pointer on chain case cover. Removal of right cylinder head and dial indicator mounted over valve recommended to check opening.

LUBRICATION:—Pressure type. Gear type oil pump mounted in crankcase. Oil filter and temperature regulator mounted at right of engine.
Normal Oil Pressure—5 lbs. idling, 55 lbs. max.
Oil Pressure Regulator—Under acorn nut on right side of crankcase below filter.
Adjustment—Remove acorn nut, turn slotted screw in to increase pressure.
Crankcase Capacity—10 quarts.

CLUTCH:—**Long Model 12CB-CL.** Single plate, dry disc type with Bendix Vacuum Power operation.
See article in Mechanical Equipment Section for data.
Facings—Hyco DV-3903PDX, 2 required. Inside Diameter 7". Outside Diameter 12". Thickness .137".
Pedal & Vacuum Booster Adjustment—Free movement of pedal should be 1-1½". To adjust, remove floor boards, operate clutch 10 times, see that pedal is against toeboard spring when engaged. Loosen lockscrew at lower end of pedal in front of shaft, pull forward on front lever and rearward on middle lever until all clearance is at front of connecting pin at lower end of levers, tighten lockscrew. Depress clutch pedal exactly 1 13/16" and hold in this position, loosen locknut on clutch rod at clutch fork end, turn adjusting nut until throw-out bearing just contacts clutch release levers, tighten locknut.
Removal:—Remove transmission (see Transmission Removal below), take out clutch cover mounting screws.

TRANSMISSION:—**Own**—Constant mesh helical gears (all forward speeds), Synchronized shift (second and high).
See article in Mechanical Equipment Section for data.
Removal:—Remove ground cable, speedometer cable, propeller shaft, light switch, two stud nuts (case bracket to rubber support) at each side, hand brake cable at equalizer, left stabilizer link, clutch pedal pull-rod, and pedal spring. Support engine at rear. Remove right brace rod (rear only), lower crossmember, and bell housing nuts and capscrews. Jack up rear of engine, remove two bolts on each side (holding vertical support members to frame), remove support members, pull transmission back and remove.

UNIVERSAL JOINTS:—**Spicer.** Roller bearing type. 2 used.
See article in Mechanical Equipment Section for data.
REAR AXLE:—**Own make.** Semi-floating, 'Angle-set' hypoid gear type with Hotchkiss drive.
See article in Mechanical Equipment Section for data.
Ratio—4.41-1 Std., 4.06-1 and 4.69-1 Optl.
Backlash—.003-.005". Screw adjustment (back off one nut, tighten other nut equal amount with bearings correctly adjusted). Pinion setting controlled by shims furnished .005", .008", .015" thick.
Removal:—Disconnect drive shaft at rear universal, remove wheels and hubs, backing plate (disconnect brake line), axle shafts. Take off differential carrier bolt nuts on flange and stud nuts at top (at rear of housing), remove differential carrier without disturbing housing.
Wheel Bearing Adjustment:—Remove wheel and hub asembly, backing plate (disconnect brake line), pull axle and bearing assembly, add or remove shims behind inner bearing race, use gasket paste on inner face of bearing cap when replacing.
Endplay—.003" plus or minus .001" and equal for both wheels.

SHOCK ABSORBERS:—Delco, Model 1952-A, B (front), 2006-G, H (rear). Double acting, hydraulic type.
See article in Mechanical Equipment Section for data.
STEERING:—**Steering Gear**—Packard (Gemmer) design. Worm-and-roller type with center steering.
See article in Mechanical Equipment Section for data.
Front Suspension:—Packard Safe-T-Flex, independent type.
See article in Mechanical Equipment Section for data.
NOTE—Data below applies with car loaded same as for Super Eight model (preceding page).
Front Suspension Height—20 7/16" plus or minus ¼" from top of cross-member to floor at spring.
Kingpin Inclination—1°30' crosswise.
Camber—1° plus or minus ¼°. Adjustable
Caster—0° plus 0 or minus ½°. Adjustable.
Toe In—1/16" plus or minus 1/16". Adjustable.

BRAKES:—**Service**—Bendix hydraulic duo-servo, single anchor type with Vacuum Power operation. Hand lever applies rear service brakes.
See article in Mechanical Equipment Section for data.
Wheel Cylinders—1¼" Diam. (front), 1⅛" (rear).
Drum Diameter—14". Centrifuse drums.
Lining—U. S. Asbestos #714 or Raybestos #451 (primary), U. S. Asbestos #589 (secondary). Width 2¾". Thickness ¼". Length 15" per shoe.
Clearance—.010" at heel and toe of each shoe.
NOTE—Heavier (yellow) retracting spring must be attached to primary, lighter (blue) spring to secondary shoe.
Hand Brake:—See Service Brakes above.
Vacuum Power Unit:—Bendix internal valve type Vacuum Cylinder linked to brake pedal lever.
See article in Mechanical Equipment Section for data.

SERIAL NUMBER:—On front of dash (use engine number).

ENGINE NUMBER:—First number A-1336. Stamped on boss on left side of engine block at upper end.

ENGINE SPECIFICATIONS:—6 cylinder, 'L' head.
Bore—3½". Stroke—4¼".
Displacement—245.3 cu. ins. **Rated HP.**—29.4.
Developed Horsepower—100 HP. (Std. 6.52-1 head), 103-105 HP. (Optl. 7.05-1 head) at 3600 R.P.M.
Compression Ratio and Pressure—As follows:
6.52-1 Std. cast-iron hd. 110 lbs. at 125 R.P.M.
7.05-1 Optl. aluminum hd. 120 lbs. at 125 R.P.M.
Vacuum Reading—18-20" idling at 6 M.P.H.
See Packard Shop Notes for Cylinder Head data.

PISTONS:—Nelson Bohnalite, aluminum alloy, autothermic, strut type, tin plated, cam ground.
Weight—19.5 ozs. (stripped), 26 ozs. (with rings and pin). **Length**—3⅞".
Removal—Pistons and rods removed from above.
Clearance—Skirt .0015". See Fitting New Pistons.
Original Bore & Piston Size, Replacement Pistons:—*See Packard Shop Notes for complete data.*
Fitting New Pistons:—Insert .0015" feeler ½" wide between piston and cylinder wall on side opposite slot. Pull to withdraw feeler 12-18 lbs.
Installing Pistons:—Slot toward valves.

PISTON RINGS:—Two compression (Perfect Circle #70), one oil control (#X-90-85) per piston, above pin. Lower ring groove drilled with twelve 5/32" oil drain holes. Rings furnished standard and .005", .010", .020", .030" and .040" oversize.

Ring	Width	End Gap	Side Clearance
Compr.	.1235-.1240"	.007-.015"	.0025-.003"
Oil Cont.	.1860-.1865"	.007-.015"	.0015"

NOTE—Install #1 and #3 ring with gap away from valves, #2 compression ring gap toward valves.

PISTON PIN:—Diameter—⅞". Length—3 1/64".
Pin floats in piston and rod, held by locking rings. Furnished std. and .003", .006" oversize. See Connecting Rod Upper Bearing below.
Pin Fit in Piston—Finger push fit with piston heated to 160°F.
Pin Fit in Rod Bushing—Finger push fit at 70°F. Finish ream pin hole to .87485-.87515".

CONNECTING ROD:—Weight 31.6 oz. **Length** 7 11/16".
Upper Bearing (Piston Pin Bushing)—Split type.
See Packard Shop Notes for bushing installation.
Crankpin Journal Diameter—2 3/32".
Lower Bearing—Interchangeable steel-backed, babbitt-lined type. Bearings furnished std. and .001", .002", .003", .015" undersize (marked with size).
Clearance—.0005-.0015". **Sideplay**—.004-.010".
Bearing Adjustment:—None. Replace bearings.
Installing Rods:—Oil squirt hole to camshaft.

CRANKSHAFT:—4 bearing, integral counterweights with rubber friction disc vibration damper mounted on forward end.
Journal Diameters—2¾".
Bearing Type—Interchangeable babbitt-lined steel shell type. Bearings furnished standard and .001" and .002" undersize.
Clearance—.001-.003".
Bearing Adjustment:—None (no shims). Replace bearings. Upper halves may be rotated in place.
End Thrust:—Taken by #1 bearing. Adjust by adding or removing shims. **Endplay**—.003-.008".

CAMSHAFT:—4 bearing. Non-adjustable chain drive.
See Packard Shop Notes for Oil Pump Gear Change to be made when replacing camshaft.
Bearing Type—Steel-backed, babbitt-lined.
Clearance—.001-.003".
End Thrust:—Taken by thrust plate in back of camshaft sprocket. **Endplay**—.002-.004".
Timing Chain:—Morse 1866 RX. Width 1¼". Pitch .375". Length 58 links or 20¾".
Camshaft Setting:—Install chain and sprockets together with '0' marks on sprockets adjacent and in line with a straightedge across shaft centers with #1 piston on top dead center.
See Packard Shop Notes for Fender & Radiator Assembly removal for work on front of engine.

VALVES:—Head Diameter Stem Diameter Length
Intake ..... 1.575" ..... .34025" ..... 5⅝"
Exhaust ..... 1 13/32" ..... .34025" ..... 5⅝"

	Seat Angle	Lift	Stem Clearance
Intake	30°	.3175"	.002"
Exhaust	45°	.318"	.004"

Tappet Clearance—.007" Int., .010" Exh. (hot).
NOTE—Remove plate in right front fender for valve adjustment.
Valve Guides:—*See Packard Shop Notes for guide change on first cars to correct valve sticking.*
Valve Springs:—Intake and exhaust springs interchangeable. 1937 type springs used on first cars (1938 type only for replacement).

	Spring Pressure	Spring Length
Valve Closed	47-52 lbs.	1⅝"
Valve Open	114-124 lbs.	1 5/16"

NOTE—Serrated washer on top of each spring.
Valve Lifters:—New mushroom type. Remove from below with camshaft out. Ream lifter holes through stem guide. Lifters furnished standard and .001", .002", .005" oversize. *See Packard Shop Notes for lifter type used with each type camshaft.*
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 1° BTDC. Close 39° ALDC.
Exhaust Valves—Open 45° BLDC. Close 5° ATDC.
To Check Timing—Set tappet clearance #1 exhaust valve at .015". This valve should close with piston 5° or .0103" past top dead center when 5° point on flywheel (midpoint between second and third graduations after top dead center mark '#1 UP DC.') lines up with pointer on housing in inspection hole in left front face of flywheel housing below starter. Reset tappet clearance at .010" hot.

LUBRICATION:—Pressure system with gear type oil pump mounted on right side of engine.
See Packard Shop Notes for Oil Pump installation and gear change when replacing camshaft on first cars.
Normal Oil Pressure:—35 lbs. at 30 M.P.H. (warm oil).
Oil Pressure Relief Valve:—Mounted on pump cover. Not adjustable. Replace spring if pressure less than 5 to 8 lbs at 2".
Crankcase Capacity:—6 quarts (refill).

COOLING SYSTEM:—Water Pump. Centrifugal, belt-driven, packless type.
See article in Mechanical Equipment Section for data.
Removal—Remove fan belt, disconnect pump hose, remove pump mounting capscrews, lift off pump assembly.
Thermostat:—Located in top radiator tank. Operates radiator shutters. Two used in production (Early—marked 165°. Later—marked 150°).
Setting—Start to open—150°F (early), 135°F (later). Fully open 165°F (early), 150°F (later).
Water Capacity:—15 quarts.

CLUTCH:—Long Model 9½ CF-CS. Semi-centrifugal, single plate, dry disc type.
See article in Mechanical Equipment Section for data.
Facings—Woven (U. S. Asbestos No. 733), 2 required. I.D. 6". O.D. 9½". Thickness .125".
Adjustment—Adjust nut on inner pedal rod to give 1½" free travel (pedal pad to floor board).
Removal:—Remove transmission (see Transmission Removal following). With clutch pedal depressed, insert wedge (ST-879) between each throwout finger and cover (assembly can only be removed when in partially released position). Remove clutch shifter bearing, pedal rod, and cover capscrews (release evenly), then remove assembly from below.

TRANSMISSION:—Own make. Helical gear type with synchronizer for second and high speeds.
See article in Mechanical Equipment Section for data.
Removal:—Remove floorboards, speedometer cable, ground strap and accelerator pedal. Disconnect propeller shaft at front universal, block shaft up against floor board. Support rear end of engine with jack, unbolt cross-member from frame, disconnect hand brake cable at equalizer, remove flywheel housing lower cover and clutch retracting spring, take out 4 capscrews in transmission mounting flange, pull transmission back and remove.

UNIVERSAL JOINTS:—Mechanics. Model 2C. Needle bearing type. Two used.
See article in Mechanical Equipment Section for data.

REAR AXLE:—Own make. Semi-floating, hypoid gear type with Hotchkiss drive. Rear face of differential carrier now vertical (supersedes angular type used previously).
See article in Mechanical Equipment Section for data.
Ratios—4.54-1 Std. 4.36-1, 4.7-1 Optional.
Backlash—.003-.005". Screw adjustment.
Removal:—Remove wheel, hub, and brake backing plate assembly. Withdraw axle shafts. Disconnect rear universal joint and drop drive shaft. Remove nuts on carrier-to-housing bolts and withdraw carrier assembly from housing.
Wheel Bearing Adjustment—Endplay controlled by shims between flanged end of housing and brake backing plate. Adjust by removing backing plate disconnect brake tube clips on housing. Add shims at one wheel only if endplay .050" or below, at both wheels equally if above. Measure with dial indicator against end of shaft. **Endplay**—.002-.005".

SHOCK ABSORBERS:—Delco. Model 1966-A, B (front), 1751-L, M (rear). Hydraulic, double acting type.
See article in Mechanical Equipment Section for data.

STEERING:—Steering Gear—Packard (Gemmer design) Worm-and-Roller type with center steering.
See article in Mechanical Equipment Section for data.
Front Suspension:—Independent 'Safe-T-fleX' type with coil springs.
See article in Mechanical Equipment Section for data.
NOTE—Data below applies with car on level floor, tires properly inflated and car weighted as follows: 300 lbs. front seat, 375 lbs. (rear—5 pass. bodies), 225 lbs (rear—auxiliary seat coupes).
Front Suspension Height—Distance from floor to top side of frame siderail at spring should be 18¾" plus or minus ¼".
Kingpin Inclination—1°54' crosswise.
Camber—½° plus or minus ½°. Adjustable.
Caster—1½° plus or minus ½°. Shim adjustment.
Toe In—1/32-1/16" measured at hub height. Adjust tie rods equally (rod lengths must be equal after adjustment).

BRAKES:—Service—Bendix, hydraulic, duo-servo, single anchor type. Hand lever applies rear service brakes.
See article in Mechanical Equipment Section for data.
Drum—Centrifuse. Diameter—11".
Lining—Marshall #1915 (primary, SR-600 (secondary) or Marshall #2201 (all). Width 1¾". Thickness 3/16". Length per shoe 12".
Clearance—.010" at heel and toe of each shoe.
Hand Brak Adjustment:—See Service Brakes.

SERIAL NUMBER:—Stamped on plate on front of dash (use engine number).

ENGINE NUMBER:—First number A-300001. Stamped on left side of crankcase near distributor.

ENGINE SPECIFICATIONS:—8 cylinder, 'L' head.
Bore—3¼". **Stroke**—4¼".
Displacement—282.4 cu. ins. **Rated HP.**—33.8.
Developed Horsepower—120 HP. (std. 6.6-1 al. hd.), 123-125 HP. (optl. 7.05-1 al. hd.) at 3800 R.P.M.
Compression Ratio and Pressure—As follows: 6.6-1 Std. aluminum head (110 lbs. at 125 R.P.M.). 7.05-1 Optional aluminum head.
Vacuum Reading—18-21" idling at 6 M.P.H.
See Packard Shop Notes for Cylinder Head data.

PISTONS:—Nelson Bohnalite, aluminum alloy, autothermic, strut type, tin plated, cam ground.
Weight—16⅞ ozs. (stripped), 22¾ ozs. (with rings and pin). **Length**—3⅞".
Removal—Pistons and rods removed from above.
Clearance—Skirt .0015". See Fitting New Pistons.
Original Bore & Piston Size, Replacement Pistons:—*See Packard Shop Notes for complete data.*
Fitting New Pistons:—Insert .0015" feeler ½" wide between piston and cylinder wall on side opposite slot. Pull to withdraw feeler should be 12-18 lbs.
Installing Pistons:—Slot toward valves.

PISTON RINGS:—Two compression (Perfect Circle #70), one oil control (#X-90-85) per piston, above pin. Lower ring groove drilled with twelve 5/32" oil drain holes. Rings furnished standard and .005", .010", .020", .030" and .040" oversize.

Ring	Width	End Gap	Side Clearance
Compr.	.1235-.1240"	.007-.015"	.0025-.003"
Oil Cont.	.1860-.1865"	.007-.015"	.0015"

NOTE—Install #1 and #3 ring with gap away from valves, #2 compression ring gap toward valves.

PISTON PIN:—Diameter—⅞". **Length**—2 51/64".
Pin floats in piston and rod, held by locking rings. Furnished standard and .003", .006" oversize.
Pin Fit in Piston—Finger push fit with piston heated to 160°F.
Pin Fit in Rod Bushing—Finger push fit at 70°F. Finish ream pin hole to .87485-.87515".

CONNECTING ROD:—Weight 31.6 ozs. **Length** 7 11/16".
Upper Bearing (Piston Pin Bushing)—Split type.
See Packard Shop Notes for bushing installation.
Crankpin Journal Diameter—2 3/32".
Lower Bearing—Interchangeable steel-backed, babbit-lined type. Bearings furnished std. and .001", .002", .003", .015" undersize (marked with size).
Clearance—.0005-.0015". **Sideplay**—.004-.010".
Bearing Adjustment:—None. Replace bearings.
Installing Rods:—Oil squirt hole to camshaft.

CRANKSHAFT:—5 bearing, integral counterweights with rubber friction disc vibration damper mounted on forward end.
Journal Diameters—2¾".
Bearing Type—Interchangeable babbitt-lined steel shell type. Bearings furnished standard and .001" and .002" undersize.
Clearance—.001-.003".
Bearing Adjustment:—None (no shims). Replace bearings. Upper halves may be rotated in place.
End Thrust:—Taken by #3 bearing. Adjust by adding or removing shims. **Endplay**—.003-.008".

CAMSHAFT:—5 bearing. Non-adjustable chain drive.
See Packard Shop Notes for Oil Pump Gear Change to be made when replacing camshaft.
Bearing Type—Steel-backed, babbitt-lined.
Clearance—.001-.003".
End Thrust:—Taken by thrust plate in back of camshaft sprocket. **Endplay**—.002-.004".

Timing Chain:—Morse 1866 RX. Width 1¼". Pitch .375". Length 58 links or 20¾".
Camshaft Setting:—Install chain and sprockets together with '0' marks on sprockets adjacent and in line with a straightedge across the shaft centers with #1 piston on top dead center.
See Packard Shop Notes for Fender & Radiator Assembly removal for work on front of engine.

VALVES:—Exhaust valves interchangeable with Six.

	Head Diameter	Stem Diameter	Length
Intake	1 17/32"	.34025"	5⅝"
Exhaust	1 13/32"	.34025"	5⅝"

	Seat Angle	Lift	Stem Clearance
Intake	30°	.3175"	.002"
Exhaust	45°	.318"	.004"

Tappet Clearance—.007" Intake, .010" Exh. (hot). NOTE—Remove plate in right front fender for valve adjustment.
Valve Guides:—*See Packard Shop Notes for guide change on first cars to correct valve sticking.*
Valve Springs:—Intake and exhaust springs interchangeable. 1937 type springs used on first cars (1938 type only for replacement).

	Spring Pressure	Spring Length
Valve Closed	47-52 lbs.	1⅝"
Valve Open	114-124 lbs.	1 5/16"

NOTE—Serrated washer on top of each spring.
Valve Lifters:—New mushroom type. Remove from below with camshaft removed. Ream lifter holes through stem guide. Lifters furnished std. and .001", .002", .005" oversize. *See Packard Shop Notes for lifter type used with each type camshaft.*
Valve Timing:—See Camshaft Setting.
Intake Valves—Open 1° BTDC. Close 39° ALDC.
Exhaust Valves—Open 45° BLDC. Close 5° ATDC.
To Check Timing—Set tappet clearance #1 exhaust valve at .015". This valve should close with piston 5° or .0103" past top dead center when 5° point on flywheel (midway between second and third graduations after dead center mark #1 UP.DC.) lines up with pointer in inspection hole in left front face of housing. Reset tappet clearance at .010" (hot).

LUBRICATION:—Pressure system with gear type oil pump mounted on right side of engine.
See Packard Shop Notes for Oil Pump installation and gear change when replacing camshaft on first cars.
Normal Oil Pressure:—35 lbs. at 30 M.P.H.
Oil Pressure Relief Valve:—Mounted on pump cover. Not adjustable. Replace spring if pressure less than 5 to 8 lbs. at 2".
Crankcase Capacity:—6 quarts (refill).

COOLING SYSTEM:—Water Pump. Centrifugal, belt-driven, packless type.
See article in Mechanical Equipment Section for data.
Removal—With water drained and fan belt removed, disconnect pump hose, remove pump mounting capscrews, and lift pump assembly off.
Thermostat:—Located in top radiator tank. Operates radiator shutters. Two used in production (Early—marked 165°. Later—marked 150°).
Setting—Start to open—150°F (early), 135°F (later). Fully open 165°F (early), 150°F (later).
Water Capacity:—16 quarts.

CLUTCH:—Long Model 10 CF-CI. Semi-centrifugal, single plate, dry disc type.
See article in Mechanical Equipment Section for data.
Facings—Woven-joined, 2 required. Inside Diam. 6". Outside Diam. 10". Thickness .137".
Adjustment—Adjust nut on inner pedal rod to give 1½" free travel (pedal to toeboard), secure locknut.
Removal:—Remove transmission (see Transmission Removal following). With clutch pedal depressed, insert wedge (ST-879) between each throwout finger and cover (assembly can only be removed when in partially released position). Remove clutch shifter bearing, pedal rod and cover capscrews (remove assembly from below).

TRANSMISSION:—Own make. Helical gear type with synchronizer for second and high speeds.
See article in Mechanical Equipment Section for data.
Removal:—Remove floorboards, speedometer cable, ground strap and accelerator pedal. Disconnect propeller shaft at front universal, block shaft up against floor board. Support rear end of engine with jack, unbolt cross-member from frame, disconnect hand brake cable at equalizer, remove flywheel housing lower cover and clutch retracting spring, take out 4 capscrews in transmission mounting flange, pull transmission back and remove.

UNIVERSAL JOINTS:—Detroit. Series 5150. Cross type with roller bearings. Two used.
See article in Mechanical Equipment Section for data.
NOTE—On 1602, Intermediate self-aligning bearing used on drive shaft.

REAR AXLE:—Own make. Semi-floating, hypoid gear type with Hotchkiss drive. Rear face of differential carrier now vertical.
See article in Mechanical Equipment Section for data.
Ratios—4.36-1 (1601), 4.7-1 (1601A, 2), 4.09-1, 4.54-1 optional.
Backlash—.003-.005". Screw adjustment.
Removal:—Remove wheel, hub, and brake backing plate assembly. Withdraw axle shafts. Disconnect rear universal joint and drop drive shaft. Remove nuts on carrier-to-housing bolts and withdraw carrier assembly from housing.
Wheel Bearing Adjustment—Endplay controlled by shims between flanged end of housing and brake backing plate. Adjust by removing backing plate and disconnect brake tube clips on housing. Add shims at one wheel only if endplay .050" or below, at both wheels equally if above. Measure with dial indicator against end of shaft. **Endplay**—.002-.005".

SHOCK ABSORBERS:—Houdaille. Model OBBDI (front), OBBCP (rear). Double acting, hydr. type.
See article in Mechanical Equipment Section for data.

STEERING:—Steering Gear—Packard (Gemmer design) Worm-and-Roller type with center steering.
See article in Mechanical Equipment Section for data.
Front Suspension:—Independent 'Safe-T-flex' type with coil springs.
See article in Mechanical Equipment Section for data.
NOTE—Data below applies with car on level floor, tires properly inflated and car weighted as follows: 300 lbs. front seat, 375 lbs. (rear—5 pass. bodies), 225 lbs. (rear—Coupe), 675 lbs. (rear—7 Pass.).
Front Suspension Height—Distance from floor to top side of frame siderail at spring should be 19¼" plus or minus ¼".
Kingpin Inclination—1°54' crosswise.
Camber—½° plus or minus ½°. Adjustable.
Caster—1½° plus or minus ½°. Shim adjustment.
Toe In—1/32-1/16" measured at hub height. Adjust tie rods equally (rod lengths must be equal after adjustment).

BRAKES:—Service—Bendix hydraulic, duo-servo, single anchor type. Hand lever applies rear service brakes.
See article in Mechanical Equipment Section for data.
Drum—Centrifuse. Diameter—12".
Lining—Primary (Raybestos No. 451). Secondary (U. S. Asbestos No. 589-F). Width 1¾" (1601), 2¼" (1601A, 2). Thickness 3/16". Length 13" per shoe.
Clearance—.010" at heel and toe of each shoe.
Hand Brake Adjustment:—See Service Brakes above.

SERIAL NUMBER:—Stamped on plate on front of dash (use engine number).

ENGINE NUMBER:—First number A-500001. Stamped on upper center left side of crankcase.

ENGINE SPECIFICATIONS:—8 cylinder, 'L' head.
Bore—3 3/16". **Stroke**—5".
Displacement—320 cubic inches.
Rated Horsepower—32.5 (A.M.A.)
Developed Horsepower—130 HP. (Std. 6.5-1 hd.), 133-135 HP. (optl. 7.05-1 hd.) at 3200 RPM.
Compression Ratio and Pressure—As follows: 6.5-1 std. aluminum head, 110 lbs. at 125 R.P.M. 7.05-1 optl. aluminum head, 119 lbs. at 125 R.P.M.
Vacuum Reading—18-19" idling at 7 M.P.H.
See Packard Shop Notes for Cylinder Head data and Block Removal directions.

PISTONS:—Nelson Bohnalite, aluminum alloy, autothermic, strut type, tin plated, cam ground.
Weight—17¾ oz. (stripped), 24 oz. (with rings and pin). **Length**—4¼".
Removal—Pistons above, rods below (push piston up to expose pin, remove locking rings, push pin out, lift piston out, lower rod and remove from below). Remove with engine warm.
Clearance—Skirt .0015". See Fitting New Pistons.
Original Bore & Piston Sizes, Replacement Pistons:—*See Packard Shop Notes for complete data.*
Fitting New Pistons:—Insert .0015" feeler ½" wide between piston and cylinder wall on side opposite slot. Pull to withdraw feeler should be 12-14 lbs.
Installing Pistons:—Slot toward valves.

PISTON RINGS:—#1 compression (plain), #2 compression (#70 Perfect Circle), #3 oil (P-C #85), #4 oil (P-C #X90-85) rings per piston, all above pin. Each oil ring groove drilled with ten ⅛" oil drain holes. Rings furnished standard and .003", .005", .010", .015", .020", .025", .030", .035" and .045" oversize. NOTE—P-C#200 ring used in #1 groove on early production.

Ring	Width	End Gap	Side Clearance
Compr.	1225-1230"	.007-.015"	.003"
Oil Cont.	.1545-.1550"	.007-.015"	.0015"

NOTE—Install #1 & 3 rings with slot toward camshaft, #2 & 4 with slot away from camshaft.

PISTON PIN:—Diameter—⅞. **Length**—2 47/64". Pin floats in piston and rod, held by locking rings. Furnished std. and .003", .006" oversize.
Pin Fit in Piston—Finger push fit with piston heated to 160°F.
Pin Fit in Rod Bushing—Finger push fit at 70°F. Finish ream pin hole to .87485-.87515".

CONNECTING ROD:—Weight—40.3 oz. **Length**—10⅞".
Crankpin Journal Diameter—2 3/16".
Lower Bearing—Copper lead alloy, interchangeable type. Furnished .001", .002", .003", .015" undersize. NOTE—Babbitt type for replacement furnished std. and .002", .005", and .015", undersize.
Clearance—.001-.0015". **Sideplay**—.005-.008".
Bearing Adjustment:—None (no shims). Replace bearings. Do not file rods or caps.
Installing Rods:—Oil hole toward camshaft.

CRANKSHAFT:—9 bearing, 8 bolted counterweights with rubber friction disc vibration damper mounted on forward end.
Journal Diameters—2⅝".
Bearing Type—Interchangeable babbitt-lined, steel shell type.
Clearance—.001-.002".
Bearing Adjustment:—None (no shims). Replace bearings. Upper halves may be rotated in place.
End Thrust:—Taken by #7 bearing.
Endplay—.003-.005".

CAMSHAFT:—8 bearing. Non-adjustable chain drive.
Bearing Type—Steel-backed, babbitt-lined.
Clearance—.0015-.0035".
End Thrust:—Taken by thrust plate assembled in back of camshaft sprocket. **Endplay**—.001-.004".
Timing Chain:—Morse 3682-RX. Width 1½". Pitch .375". Length 70 links or 26¼".
Camshaft Setting:—Install chain and sprockets together with marks adjacent and in line with a straightedge across the shaft centers.
See Packard Shop Notes for Fender and Radiator Assembly removal for work on front of engine.

VALVES:	Head Diameter	Stem Diameter	Length
Intake	1 21/32"	.3405"	7 13/32"
Exhaust	1 15/32"	.3405"	7 13/32"

	Seat Angle	Lift	Stem Clearance
Intake	45°	.354"	.003"
Exhaust	45°	.354"	.0045"

Tappet Clearance—.006" Intake, .008" Exhaust, (hot).
Valve Guides:—Pressed in block from above. Ream to size for correct stem clearance (see above).
Valve Rocker Arms:—Consist of pivoted arms mounted on bracket on crankcase which transmit motion from cam to valve pushrod (valve lifter).
Removal—Take out screws in bracket on right side of crankcase, withdraw bracket and pushrod assembly.
Pushrods (Valve Lifters):—Mounted on guides seated in crankcase and held down by engine block which engages guide flange.

Valve Springs:	Spring Pressure	Spring Length
Valve Closed	68-78 lbs.	3 1/16"
Valve Open	154-164 lbs.	2 45/64"

NOTE—Serrated washer on top of each spring.

Valve Timing:—See Camshaft Setting (above).
Intake Valves—Open 30° BTDC. Close 65° ALDC.
Exhaust Valves—Open 65° BLDC. Close 30° ATDC.
To Check Timing—Set tappet clearance #1 exhaust valve at .005" (or .010", then insert .005" feeler). Turn engine over until pointer over damper (at front of engine) lines up with a point 1 1/16" (plus or minus 11/32") past '1-UPDC' mark (feeler should withdraw with finger pull). Valve closes 30° or .4070" ATDC. Reset tappet clearance at .008" (hot).
Motor Gauge—Weidenhoff Adapter #104 (with 10 MM. adapter). Rod #5.

LUBRICATION:—Pressure system with gear type oil pump mounted in crankcase.
Normal Oil Pressure:—55 lbs. (max.), 5 lbs. (min.).
Oil Pressure Relief Valve:—Located under plug on left side of crankcase. Remove acorn nut and adjust by turning slotted screw.
Crankcase Capacity:—8 quarts.

COOLING SYSTEM:—Water Pump. Centrifugal, belt-driven, with adjustable type packing.
See article in Mechanical Equipment Section for data.
Removal—With water drained and fan belt removed, disconnect pump hose, remove nuts on pump mounting studs and lift off fan and pump assembly.
Thermostat:—Located in top radiator tank. Operates radiator shutters. Two used in production (Early—marked 165°. Later—marked 150°).
Setting—Start to open—150°F. (early), 135°F. (later). Fully open—165°F. (early), 150°F. (later).
Water Capacity:—20 quarts.

CLUTCH:—Long Model 12CB-CL. Single plate, dry disc type.
See article in Mechanical Equipment Section for data.
Facings—Moulded (Raybestos No. 250), 2 required. Inside Diam. 7". Outside Diam. 12". Thickness .137".
Adjustment—Adjust nut on pedal rod to give 1-1½" free travel (pedal pad to toe board).
Removal:—Remove transmission (see Transmission Removal following), take out cover mounting screws (release pressure evenly), lift assembly out. Align '0' marks on flywheel and cover when reassembling.

TRANSMISSION:—Own make. Helical gear type with synchronizer for second and high speeds.
See article in Mechanical Equipment Section for data.
Removal:—Remove floor boards, speedometer cable, ground strap, drop drive shaft at front universal joint. Remove light switch, two stud nuts (case bracket to rubber support) on each side, hand brake cable (at equalizer), stabilizer link (left side), clutch pedal pull rod and spring, place jack under rear of engine. Remove pedal shaft inner bracket, loosen brace rod on right side at rear only, lower cross member, take out bell housing nuts and cap-screws, jack up rear of engine, remove 2 frame-to-vertical support member bolts on each side, remove support members. Remove transmission.

UNIVERSAL JOINTS:—Detroit. Series 5350. Cross type with roller bearings. Two used.
See article in Mechanical Equipment Section for data.

REAR AXLE:—Own make. 'Angle-Set', semi-floating, hypoid gear type with Hotchkiss drive.
See article in Mechanical Equipment Section for data.
Ratio—4.69-1 (std.), 4.36-1, 4.09-1 (optl.).
Backlash—.003-.005". Screw adjustment.
Removal:—Remove wheel, hub, brake assembly, wheel bearing and axle shaft. Disconnect rear universal joint at flange, drop drive shaft, remove differential housing by removing housing bolt nuts (below), and locknut on stud (at top). Remove carrier.
Wheel Bearing Adjustment—Controlled by shims between outer race of inner bearing and shoulder in housing. Remove wheel, hub, brake assembly, wheel bearing and axle shaft. Add or remove shims Adjust each wheel independently.
Endplay .003" (plus or minus .001") at each wheel.

SHOCK ABSORBERS:—Delco. Model 1966-A, B (front), 1751-J, K (rear). Hydraulic, double acting type.
See article in Mechanical Equipment Section for data.

STEERING:—Steering Gear—Packard (Gemmer design). Worm-and-Roller type with center steering.
See article in Mechanical Equipment Section for data.
Front Suspension:—Packard Safe-T-fleX type with coil springs.
See article in Mechanical Equipment Section for data.
NOTE—Data below applies with car on level floor tires properly inflated and car loaded with 300 lbs. (frt.—all), 375 lbs. (rear—5 Pass.), 225 lbs. (rear—Coupe), 675 lbs. (rear—7 & 8 Pass.).
Front Suspension Height—Distance from floor to top of frame siderail at spring should be 20⅛" plus or minus ¼".
Kingpin Inclination—1½° crosswise.
Camber—½° (plus ¾°). Adjustable.
Caster—2½° plus or minus ½°. Shim adjustment.
Toe In—1/32-⅛". Adjust by turning tie rods equally (check for equal lengths after adjustment).

BRAKES:—Service—Bendix hydraulic, duo-servo, single anchor type. Hand lever applies rear service brakes.
See article in Mechanical Equipment Section for data.
Drum—Centrifuse. Diameter—12".
Lining—Primary (Marshall #1035), Secondary (#600). Width 2½". Thickness 3/16". Length 13".
Clearance—.010" at heel and toe of each shoe.
Hand Brake Adjustment:—See Service Brakes.

SERIAL NUMBER:—Stamped on plate on front of dash. Use engine number (below).

ENGINE NUMBER:—First number A-600001. Stamped on left side of block below distributor.

ENGINE SPECIFICATIONS:—12 cyl., modified 'L' head, 67° Vee. Blocks and upper crankcase cast Enbloc. **Bore**—3 7/16". **Stroke**—4¼".
Displacement—473 cubic inches.
Rated Horsepower—56.7 (A.M.A.)
Developed Horsepower—175 HP (std. 6.4-1 hd.), 178-180 HP. (optl. 7.0-1 hd.) at 3200 R.P.M.
Compression Ratio and Pressure—As follows:
6.4-1 std. aluminum head (110 lbs. at 125 RPM.).
7.0-1 optl. aluminum head (119 lbs. at 125 RPM.).
NOTE—6.0-1 low compression head available.
Vacuum Reading—18-20" at 375 R.P.M. or 8 MPH.
See Packard Shop Notes for Cylinder Head data.

PISTONS:—Nelson Bohnalite, aluminum alloy, autothermic strut type, tin plated, cam ground.
Weight—20 oz. (stripped), 26¾ oz. (with rings and pin). **Length**—4.318".
Removal—Pistons above, rods below (push piston up to expose pin, remove locking rings, push pin out, lift piston out, lower rod and remove from below). Remove with engine warm.
Clearance—.0015". See Fitting New Pistons.
Original Bore & Piston Sizes, Replacement Pistons:—*See Packard Shop Notes for complete data.*
Fitting New Pistons:—Insert .0015" feeler ½" wide between piston and cylinder wall on side opposite slot. Pull to withdraw feeler 12-18 lbs.
Installing Pistons:—Slot toward valves (all pistons).

PISTON RINGS:—2 compression (Perfect Circle #70), #3 oil (#85), #4 oil (#X90-85) rings per piston, above pin. Oil ring grooves drilled with twelve 5/32" oil drain holes. Rings furnished standard and .003", .005", .010", .015", .020", .030", .045" oversize.

Ring	Width	End Gap	Side Clearance
Compr.	.1225-.1230"	.007-.015"	.0025-.003"
Oil Contr.	.1545-.1550"	.007-.015"	.0015-.002"

NOTE—On left bank, ring gap #1 and #3 away from camshaft, #2 and #4 toward camshaft. The reverse for right bank.

PISTON PIN:—Diameter—⅞". **Length**—2 63/64".
Pin floats in piston and rod, held by locking rings. Furnished std. and .003", .006" oversize.
Pin Fit in Piston—Finger push fit with piston heated to 160°F.
Pin Fit in Rod Bushing—Finger push fit at 70°F. Finish ream pin hole to .87485-.87515".

CONNECTING ROD:—Weight—36 ozs. **Length**—9".
Crankpin Journal Diameter—2½".
Lower Bearing—Copper lead alloy, interchangeable type. Furnished std. and .001", .002", .003", and .015" undersize.
Clearance—.001-.0015". **Sideplay**—.008-.010".
Bearing Adjustment:—None (no shims). Replace bearings. Do not file rods or caps.
Installing Rods:—Oil hole toward starter.

CRANKSHAFT:—4 bearing, 6 bolted counterweights with rubber friction disc vibration damper mounted on forward end.
Journal Diameters—2¾".
Bearing Type—Interchangeable babbitt-lined steel shell type.
Clearance—.001-.002".
Bearing Adjustment:—None (no shims). Replace bearings. Upper halve may be rotated in place.
End Thrust:—Taken by #1 front bearing.
Endplay—.003-.005".

CAMSHAFT:—Four bearing. Between banks directly above crankshaft. Non-adjustable chain drive.
Bearing Type—Steel backed, babbitt lined.
Clearance—.001-.0015" (#1, 4). .002-.0025" (#2, 3).
End Thrust:—Taken at front bearing.
Endplay—.002-.006".
Timing Chain:—Morse No. 1866-N. Width 1¾". Pitch .500". Length 28" or 56 links.
Camshaft Setting:—Install chain and sprockets together with marks adjacent and in line with a straightedge across the shaft centers.
See Packard Shop Notes for Fender and Radiator Assembly removal for work on front of engine.

VALVES:—	Head Diameter	Stem Diameter	Length
Intake	1 41/64"	.3405"	6 35/64"
Exhaust	1 21/32"	.338"	6 35/64"

	Seat Angle	Lift	Stem Clearance
Intake	45°	.3125"	.0025"
Exhaust	45°	.3125"	.005"

Tappet Clearance—None (automatic take-up).
Automatic Tappet Take-up:—Hydraulic type (using engine oil pressure). Check whenever valves ground.
See article in Mechanical Equipment Section for data.
Valve Springs:—Install springs with painted end down and close-spaced first coil toward valve head. Special 1/32" higher stem keeper furnished (compensating for loss of pressure due to valve reseating).

	Spring Pressure	Spring Length
Valve Closed	65-75 lbs.	2 7/32"
Valve Open	140-150 lbs.	1 29/32"

NOTE—Serrated washer on top of each spring.
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open at TDC. Close 45° ALDC.
Exhaust Valves—Open 35° BLDC. Close 10° ATDC.
To Check Timing—Intake valve for #1 (front cylinder, right bank) begins to open with piston on top dead center when '#1R-UDC' mark on dampener lines up with pointer on chain case cover. Removal of right cylinder head and dial indicator mounted over valve recommended to check opening.
Motor Gauge—Weidenhoff Adapter #104 (with 10 MM. adapter), Rod #2.

LUBRICATION:—Pressure system with gear type oil pump mounted in crankcase. Oil filter and temperature regulator mounted on right side of engine.
Normal Oil Pressure:—55 lbs. (max.), 5 lbs. (min.).
Oil Pressure Relief Valve:—Located under plug on right side of crankcase below filter. Remove acorn nut and adjust by turning slotted screw.
Crankcase Capacity:—10 quarts.

COOLING SYSTEM:—Water Pump. Centrifugal, twin belt driven, with adjustable type packing.
See article in Mechanical Equipment Section for data.
Removal—With water drained and fan belts removed, disconnect pump hose, remove pump mounting bolts, lift fan and pump assembly off.
Thermostat:—Located in radiator tank. Operates radiator shutters. Two used in production (Early—marked 165°. Later—marked 150°).
Setting—Start to open—150°F (early), 135°F (later). Fully open—165°F (early), 150°F (later).
Water Capacity:—40 quarts.

CLUTCH:—Long Model 12CB-CL. Single plate, dry disc type with Bendix Vacuum Power operation.
See article in Mechanical Equipment Section for data.
Facings—Endless-compressed (Hyco DV 3903 PDX), 2 required. I.D. 7". O.D. 12". Thickness .137".
Pedal Adjustment:—Vacuum Power unit must be adjusted whenever pedal free travel insufficient. See article in Clutch Section for complete directions.
Removal:—Remove transmission (see Transmission Removal following), take out cover mounting screws (release pressure evenly), lift assembly out. Align '0' marks on flywheel and cover when reassembling.

TRANSMISSION:—Own make. Helical gear type with synchronizer for second and high speeds.
See article in Mechanical Equipment Section for data.
Removal:—Remove ground cable, speedometer cable, propeller shaft, light switch, two stud nuts (case bracket to rubber support) at each side, hand brake cable at equalizer, left stabilizer link, clutch pedal pull-rod ,and pedal spring. Support engine at rear. Remove right brace rod (rear only), lower crossmember, and bell housing nuts and capscrews. Jack up rear of engine, remove two bolts on each side (holding vertical support members to frame), remove support members, pull transmission back and remove.

UNIVERSAL JOINTS:—Spicer. Roller bearing type. Two used.
See article in Mechanical Equipment Section for data.

REAR AXLE:—Own make. 'Angle-Set', semi-floating, hypoid gear type with Hotchkiss drive.
See article in Mechanical Equipment Section for data.
Ratio—4.41-1 (std.), 4.69-1, 4.06-1 (optl.).
Backlash—.003-.005". Screw adjustment.
Removal:—Remove wheel, hub, brake assembly, wheel bearing and axle shaft. Disconnect rear universal joint at flange, drop drive shaft, remove differential from housing by removing housing bolt nuts (below), and locknut on stud (at top). Remove carrier
Wheel Bearing Adjustment—Controlled by shims between outer race of inner bearing and shoulder in housing. Remove wheel, hub and brake assembly, wheel bearing and axle shaft. Add or remove shims adjust each wheel independently.
Endplay—.003" (plus or minus .001") at each wheel.

SHOCK ABSORBERS:—Delco. Model 1952-A, B (front), 2006-G, H (rear). Hydraulic, double acting type.
See article in Mechanical Equipment Section for data.

STEERING:—Steering Gear—Packard (Gemmer design). Worm-and-Roller type with center steering.
See article in Mechanical Equipment Section for data.
Front Suspension:—Packard Safe-T-fleX type with coil springs.
See article in Mechanical Equipment Section for data.
NOTE—Data below applies with car on level floor tires properly inflated and car loaded with 300 lbs. (frt.—all), 375 lbs. (rear—5 Pass.), 225 lbs. (rear—Coupe), 675 lbs. (rear—7 & 8 Pass.).
Front Suspension Height—Distance from floor to top of frame siderail at spring should be 20½" plus or minus ¼".
Kingpin Inclination—1½° crosswise.
Camber—1° plus or minus ¼°. Adjustable.
Caster—0° (½° reverse max.). Shim adjustment.
Toe In—1/32-⅛". Adjust by turning tie rods equally (check for equal lengths after adjustment).

BRAKES:—Service—Bendix hydraulic, duo-servo, single anchor type with Vacuum Power operation. Hand lever applies rear service brakes.
See article in Mechanical Equipment Section for data.
Drum—Centrifuse. Diameter—14".
Lining—Primary (Raybestos No. 451). Secondary (U. S. Asbestos No. 589). Width 2¾". Thickness ¼". Length 15" per shoe.
Clearance—.010" at heel and toe of each shoe.
Hand Brake:—See Service Brakes.
Vacuum Power Unit:—Bendix internal valve type. Vacuum cylinder linked to brake pedal lever.
See article in Mechanical Equipment Section for data.

SERIAL NUMBER:—On front of dash (Use Engine No.).
ENGINE NUMBER:—First number B-1501. Stamped on front upper left hand side of cylinder block.
ENGINE SPECIFICATIONS:—6 cylinder, 'L' head.
Bore—3½". **Stroke**—4¼".
Displacement—245.3 cu. ins. **Rated HP.**—29.4.
Developed Horsepower—100 HP. (Std. 6.52-1 head), 103-105 HP. (Optl. 6.85-1 head) at 3600 R.P.M.
Compression Ratio and Pressure—As follows:
6.52-1 Std. cast-iron hd.—110 lbs. at 125 R.P.M.
6.85-1 Optl. H.C. head—118 lbs at 125 RP.M.
NOTE—On later cars with .070" thick head gasket, these ratios reduced to 6.39-1 Std., 6.71-1 Optl.
Vacuum Reading—Steady 18-20" idling at 6 M.P.H.
See Packard Shop Notes for Cylinder Head data.

PISTONS:—Nelson Bohnalite, aluminum alloy, autothermic, strut type, tin plated, cam ground.
Weight—19.5 ozs. (stripped), 26 ozs. (with rings and pin) and equal within 4 grams. **Length**—3⅞".
Removal—Piston and rods removed from above.
Clearance—.0005-.001" skirt. See Fitting Pistons.
Original Bore & Piston Sizes, Replacement Pistons:—*See Packard Shop Notes for complete data.*
Fitting New Pistons:—Insert .0015" feeler ½" wide between piston and cylinder wall on side opposite slot. Pull to withdraw feeler should be 12-18 lbs.
Installing Pistons:—Slot toward valves.

PISTON RINGS:—2 compression (Perfect Circle #70), one oil control (X-90) per piston, all above pin.

Ring	Width	End Gap	Side Clearance
Comp. #1	.123-.1240"	.007-.017"	.0025-.003"
Comp. #2	.123-.1240"	.007-.017"	.0025-.003"
Oil Contr.	.186-.1865"	.007-.015"	.0015"

Replacement Rings:—Furnished standard and .005", .010", .020", .030", and .040" oversize.

PISTON PIN:—**Diameter**—⅞". **Length**—3 1/64"
Pin floats in piston and rod, held by locking rings. Furnished Std. and .003", .006" oversize.
Pin Fit in Piston—Finger push fit with piston heated to 160° F.
Pin Fit in Rod Bushing—Finger push fit at 70° F.

CONNECTING ROD:—**Length**—7 11/16". **Weight**—33 ozs.
IMPORTANT CHANGE—After No. B-4607, bearings are .010" thicker and rod holes .020" larger diameter. Rods with large hole marked '330613' on web at lower end. Use only thicker bearing shells (marked by inked star) in these rods.
Upper Bearing (Piston Pin Bushing)—Split type. *See Packard Shop Notes for complete data.*
Crankpin Journal Diameter—2 3/32".
Lower Bearing—Interchangeable steel-backed, babbitt-lined type. Bearings furnished std. and .001", .002", .003", .015" undersize. NOTE—Bearing shells marked with inked star, must be used with new rods marked '330613' on web at lower end.
Clearance—.0005-.0015". **Sideplay**—.004-.010".
Bearing Adjustment:—None (no shims). Replace bearings. Do not file rods or caps. Tighten bolt nuts to 715-725 in. lbs. *See Packard Shop Notes for 'Palnut' installation data.*
Installing Rods:—Oil squirt hole to camshaft.

CRANKSHAFT:—4 bearing, integral counterweights with rubber friction disc vibration damper
Journal Diameters—2¾".
Bearing Type—Interchangeable babbitt-lined steel shell type. Bearings furnished standard and .001" and .002" undersize.
Clearance—.001-.003".
Bearing Adjustment:—None (no shims). Replace bearings (upper half can be 'rotated' in place). Do not file caps. Tighten bolt nuts to 980-1020 in. lbs.
End Thrust:—Taken by front (#1) bearing. Adjust by adding or removing shims. **Endplay**—.003-.008".

CAMSHAFT:—4 bearing. Non-adjustable chain drive.
Bearing Type—Steel-backed, babbitt-lined.
Clearance—.001-.003".
End Thrust:—Taken by thrust plate in back of camshaft sprocket. **Endplay**—.002-.004".
Timing Chain:—Morse No. 3682-R. Width 1¼". Pitch .375". Length 20¾" or 58 links.
Camshaft Setting:—Install chain and sprockets together with '0' marks on sprockets adjacent and in line with a straightedge across the shaft centers.
See Packard Shop Notes for Radiator & Fender (unit) removal for work on front end of engine.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1.575"	.34025"	5⅝"
Exhaust	1 13/32"	.34025"	5⅝"

	Seat Angle	Lift	Stem Clearance
Intake	30°	.317-.319"	.001-.003"
Exhaust	45°	.3165-.3185"	.003-.005"

Tappet Clearance:—.007" Intake, .010" Exh. (hot).
NOTE—Remove right front fender plate for adj.
Valve Guides:—New type. Press in block so upper end 31/32" below valve seat and finish-ream to size.
Valve Springs:—Intake and exhaust springs interchangeable.

	Spring Pressure	Length
Valve Closed	47-52 lbs.	1⅝"
Valve Open	114-124 lbs.	1 5/16"

NOTE—Serrated washer installed on top of spring.
Valve Lifters:—Mushroom type. Remove from below with camshaft out. Service by reaming (work through valve guide) and installing oversize lifter. Furnished .001", .002", .005" oversize.
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 1° BTDC. Close 39° ALDC.
Exhaust Valves—Open 45° BLDC. Close 5° ATDC.
To Check Timing—Set tappet clearance #1 exhaust valve at .015". This valve should close with piston 5° or .0103" past top dead center when 5° point on flywheel (midpoint between second and third graduations after top dead center mark '#1 UP DC.') lines up with pointer on housing in inspection hole in left front face of flywheel housing below starter. Permissable variation 3 graduations either side of mark. Reset tappet clearance at .010" warm.

LUBRICATION:—Gear type pump (right of engine). *See Packard Shop Notes for Oil Pump Installation.*
Normal Oil Pressure:—35 lbs. at 30 M.P.H. (warm oil).
Oil Pressure Regulator:—Mounted on pump cover. Not adjustable. Replace spring if pressure less than 5 to 8 lbs. at 2".
Crankcase Capacity—6 qts. (dry), 5 qts. (refill).

COOLING SYSTEM:—**Capacity**—15.2 quarts.
Water Pump:—Packless type with ball-bearing shaft. *See article in Mechanical Equipment Section for data.*
Removal—Remove fan belt, disconnect pump hose, take out pump mounting screws, lift out pump.
Thermostat:—In top radiator tank. Operates shutters.
Setting—Starts to open 135° F. Fully open 150°.
Install 162° thermostat in cylinder head for use with heaters (remove in summer).
Adjustment—Pull back on shutter pullrod to close shutters, tighten nut on rod to remove all slack, then tighten 1 turn additional for pre-load.

CLUTCH:—**Long Model 9½ CF-CS.** Semi-centrifugal, single plate, dry disc type.
See article in Mechanical Equipment Section for data.
Facings—Woven (US Asbestos 1133G), 2 required. Inside Diam. 6". Outside Diam. 9½". Thickness .125".
Adjustment—Adjust nut on pedal rod (at clutch fork) for 1½-2" pedal free movement.
Removal:—Remove Transmission (see Transmission Removal following). Disconnect and remove pedal rod, clutch throw-out bearing. Remove clutch cover capscrews, remove clutch from below.

TRANSMISSION:—**Own Make.** New type with constant-mesh, helical, ball-bearing mounted low speed gear (sliding spur gear for reverse). Synchromesh (second and high).
See article in Mechanical Equipment Section for data.
Econo-Drive Transmission:—Warner Model AS9-R6 overdrive unit with electrical control optl.
See article in Mechanical Equipment Section for data.
Transmission Control:—Own Remote Control type.
See article in Mechanical Equipment Section for data and recommended control changes on first cars.
Removal:—Disconnect shifter rods, speedometer cable, ground strap at transmission case. Disconnect drive shaft at front universal and block shaft up against floorpan. Support rear end of engine, unbolt cross-member from frame (on cars with Econo-Drive remove cross-member at rear with stabilizer, disconnect wires at solenoid). Disconnect hand brake cable at equalizer, remove flywheel housing lower cover, clutch throwout retracting spring. Take out transmission-to-bell housing mounting screws and remove assembly.

UNIVERSAL JOINT:—**Mechanics.** Model 2C (Std.), 3C (With Econo-Drive). Needle bearing type. 2 used.
See article in Mechanical Equipment Section for data.
CAUTION—Do not loosen universal flange nut on first cars (this nut controls overdrive rear bearing pre-load). In later cars (with 'M' stamped on flange), bearing pre-load controlled by spring washer and nut should be kept tight.

REAR AXLE:—**Own Make.** Semi-floating, hypoid gear type with Hotchkiss drive.
See article in Mechanical Equipment Section for data.
Ratio—4.54-1 Std., 4.7-1 with Econo-Drive trans'm. Optl. ratios 4.36-1, 4.54-1, 4.7-1.
Backlash—.003-.005". Screw adjustment.
Removal:—Remove wheel, hub, and brake backing plate assembly. Withdraw axle shafts. Disconnect rear universal joint and drop drive shaft. Remove carrier-to-housing bolt nuts, withdraw carrier.
Wheel Bearing Adjustment—Endplay controlled by shims between flanged end of housing and brake backing plate. **Endplay**—.004-.007".

SHOCK ABSORBERS:—**Delco.** Model 1966-D (right frt.), 1966-C (left frt.), 1751-Z (right rear), 1751-M (left rear). Double acting, hydraulic type.
Fifth Shock Absorber (Stabilizer):—Houdaille Model NFT. Double acting, hydraulic, adjustable type.
See articles in Mechanical Equipment Section for data.

STEERING:—**Steering Gear**—Packard (Gemmer design) Worm-and-Roller type with center steering.
See article in Mechanical Equipment Section for data.
Front Suspension:—Independent 'Safe-T-fleX' type
See article in Mechanical Equipment Section for data.
NOTE—Frame height must be set first before checking Caster and Camber.
Frame Height—With car on level floor, distance from floor to top of frame side rail at front wheel center-line 18¾" (load car until figure correct).
Kingpin Inclination—1°54' crosswise.
Camber—½° (plus ¾°, minus 0°). Adjustable.
Caster—1½° plus or minus ½°. Shim adjustment.
Toe In—1/32-1/16" at hub height. Adjust both tie rods equally (must be equal after adjustment).

BRAKES:—**Service.** Bendix hydraulic, duo-servo, single anchor type with eccentric adjustment. Hand lever applies rear service brakes.
See article in Mechanical Equipment Section for data.
Drums—Centrifuse. Diameter—11".
Lining—Marshall #2201 (all shoes). Width 1¾". Thickness 3/16". Length 12" per shoe.
Clearance—.010" at heel and toe of each shoe.
Hand Brake:—See Service Brakes (above).

SERIAL NUMBER:—On front of dash (use Engine No.).
ENGINE NUMBER:—First number B-300001. Stamped on front upper left hand side of cylinder block.
ENGINE SPECIFICATIONS:—8 cylinder, 'L' head.
Bore—3¼". **Stroke**—4¼".
Displacement—282.04 cu. ins. **Rated HP.**—33.8.
Developed Horsepower—120 HP. (Std. 6.41-1 hd) at 3800 R.P.M.
Compression Ratio—6.41-1 Std., 6.85-1 Optl.
Compression Pressure—110 lbs. (Std. 6.41-1 hd.), 118 lbs. (Optl. 6.85-1 hd) at 125 R.P.M.
Vacuum Reading—Steady 18-21" idling at 6 M.P.H.
See Packard Shop Notes for Cylinder Head data.

PISTONS:—Nelson Bohnalite, aluminum alloy, autothermic, strut type, tin plated, cam ground.
Weight—16⅞ ozs. (stripped), 22¾ ozs. (with rings and pin) and equal within 4 grams. **Length**—3⅞".
Removal—Pistons and rods removed from above.
Clearance—.0005-.001" skirt. See Fitting Pistons.
Original Bore & Pistons Sizes, Replacement Pistons:—*See Packard Shop Notes for complete data.*
Fitting New Pistons:—Insert .0015" feeler ½" wide between piston and cylinder wall on side opposite slot. Pull to withdraw feeler should be 12-18 lbs.
Installing Pistons:—Slot toward valves.

PISTON RINGS:—2 compression (Perfect Circle #70), one oil control (#X90-85) per piston, above pin.

Ring	Width	End Gap	Side Clearance
Comp. #1	.123-.1240"	.007-.017"	.0025-.003"
Comp. #2	.123-.1240"	.007-.017"	.0025-.003"
Oil Contr.	.186-.1865"	.007-.015"	.0015-.002"

Replacement Rings:—Furnished standard and .005", .010", .020", .030", and .040" oversize.

PISTON PIN:—**Diameter**—⅞". **Length**—2 51/64".
Pin floats in piston and rod, held by locking rings. Furnished std. and .003", .006" oversize.
Pin Fit in Piston—Finger push fit with piston heated to 160°F.
Pin Fit in Rod Bushing—Finger push fit at 70°F.

CONNECTING ROD:—**Length**—7 11/16". **Weight** 33 ozs.
IMPORTANT CHANGE—After No. B-303053, bearings are .010" thicker and rod hole .020" larger diameter. Rods with large hole marked '330613' on web at lower end. Use only thicker bearing shells (marked by inked star) in these rods.
Upper Bearing (Piston Pin Bushing)—Split type.
See Packard Shop Notes for complete data.
Crankpin Journal Diameter—2 3/32".
Lower Bearing—Interchangeable steel-backed, babbitt-lined type. Bearings furnshed std. and .001", .002", .003", .015" undersize. NOTE—.010" thicker bearing shells (marked by inked star) should be used on rods marked '330613' on web at lower end.
Clearance—.0005-.0015". **Sideplay**—.004-.010".
Bearing Adjustment:—None (no shims). Replace bearings. Do not file rods or caps. Tighten bolt nuts to 715-725 in. lbs. *See Packard Shop Notes for 'Palnut' installation data.*
Installing Rods:—Oil squirt hole to camshaft.

CRANKSHAFT:—5 bearing, integral counterweights with rubber friction disc vibration dampener.
Journal Diameters—2¾".
Bearing Type—Interchangeable babbitt-lined steel shell type. Bearings furnished standard and .001" and .002" undersize. **Clearance**—.001-.003".
Bearing Adjustment:—None (no shims). Replace bearings (upper half can be 'rotated' in place). Do not file caps. Tighten bolt nuts to 980-1020 in. lbs.
End Thrust:—Taken by #3 bearing. Adjust by adding or removing shims. **Endplay**—.003-.008".

CAMSHAFT:—5 bearing. Non-adjustable chain drive.
Bearing Type—Steel-backed, babbitt-lined.
Clearance—.001-.003".
End Thrust:—Taken by thrust plate in back of camshaft sprocket. **Endplay**—.002-.004".
Timing Chain:—Morse No. 3682-R. Width 1¼". Pitch .375". Length 20¾" or 58 links.
Camshaft Setting:—Install chain and sprockets together with '0' marks on sprockets adjacent and in line with a straightedge across shaft centers with #1 piston on top dead center.
See Packard Shop Notes for Radiator & Fender (unit) removal for work on front end of engine.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1 17/32"	.34025"	5⅝"
Exhaust	1 13/32"	.34025"	5⅝"

	Seat Angle	Lift	Stem Clearance
Intake	30°	.317-.319"	.001-.003"
Exhaust	45°	.3165-.3185"	.003-.005"

Tappet Clearance:—.007" Intake, .010" Exh. (hot).
NOTE—Remove right front fender plate for adj.
Valve Guides:—New type. Press in block so that upper end 31/32" below valve seat and finish-ream to size.
Valve Springs:—Intake and exhaust springs interchangeable.

	Spring Pressure	Length
Valve Closed	47-52 lbs.	1 5/8"
Valve Open	114-124 lbs.	1 5/16"

NOTE—Serrated washer on top of each spring.
Valve Lifters:—Mushroom type. Remove from below with camshaft out. Service by reaming (work through valve guide) and installing oversize lifter. Furnished .001", .002", .005" oversize.
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 1° BTDC. Close 39° ALDC.
Exhaust Valves—Open 45° BLDC. Close 5° ATDC.
To Check Timing—Set tappet clearance #1 exhaust valve at .015". This valve should close with piston 5° or .0103" past top dead center when 5° point on flywheel (midpoint between second and third graduations after top dead center mark '#1 UP DC.') lines up with pointer on housing in inspection hole in left front face of flywheel housing below starter. Permissible variation 3 graduations either side of mark. Reset tappet clearance at .010" warm.

LUBRICATION:—Pressure system with gear type oil pump mounted on right side of engine.
See Packard Shop Notes for Oil Pump installation.
Normal Oil Pressure:—35 lbs. at 30 M.P.H. (warm oil).
Oil Pressure Regulator:—Mounted on pump cover. Not adjustable. Replace spring if pressure less than 5 to 8 lbs. at 2".
Crankcase Capacity:—6 quarts (refill).

COOLING SYSTEM:—**Capacity**—15 quarts.
Water Pump:—Packless type with ball-bearing shaft.
See article in Mechanical Equipment Section for data.
Removal—Remove fan belt, disconnect pump hose, take out pump mounting screws, lift out pump.
Thermostat:—In top radiator tank. Operates shutters. Use 162° thermostat in cylinder head outlet for heaters. Remove this thermostat in summer.
Setting—Starts to open 135°F. Fully open 150°.
Adjustment—At room temperature with thermostat sylphon closed, pull back on shutter pullrod to close shutters, tighten nut on rod to remove all slack, then tighten 1 turn additional for pre-load.

CLUTCH:—**Long Model 10 CF-CI.** Semi-centrifugal, single plate, dry disc type.
See article in Mechanical Equipment Section for data.
Facings—Woven (US Asbestos 1133G), 2 required. Inside Diam. 6". Outside Diam. 10". Thickness .125".
Adjustment—Adjust nut on pedal rod (at clutch fork) for 1½-1¾" pedal free movement.
Removal:—Remove transmission (see Transmission Removal following). Remove clutch throwout bearing, pedal rod, and mounting screws in clutch cover flange, remove clutch from below.

TRANSMISSION:—**Own Make.** New type with constant-mesh, helical, ball-bearing mounted low speed gear (sliding spur gear for reverse). Synchro-mesh (second and high).
See article in Mechanical Equipment Section for data.
Econo-Drive Transmission:—Warner Model AS9-R6 overdrive unit with electrical control optl.
See article in Mechanical Equipment Section for data and recommended control changes on first cars.
Transmission Control:—Own remote control type.
See article in Mechanical Equipment Section for data.
Removal:—Disconnect shifter rods, speedometer cable, ground strap at transmission case. Disconnect drive shaft at front universal and block shaft up against floorpan. Support rear end of engine, unbolt cross-member from frame (on cars with Econo-Drive remove cross-member at rear with stabilizer, disconnect wires at solenoid). Disconnect hand brake cable at equalizer, remove flywheel housing lower cover, clutch throwout retracting spring. Take out transmission-to-bell housing mounting screws and remove assembly.

UNIVERSAL JOINT:—**Mechanics Model 3C.** Needle bearing type. Two used.
See article in Mechanical Equipment Section for data.

REAR AXLE:—**Own Make.** Semi-floating hypoid gear type with Hotchkiss drive.
See article in Mechanical Equipment Section for data.
Ratio—1701—4.36-1 std., 4.54-1 with Econo-Drive. 1701A, 2—4.7-1 Std., 4.9-1 with Econo-Drive. Optional Ratios—4.54-1, 4.36-1, 5.22-1.
Backlash—.003-.005". Screw adjustment.
Removal:—Remove wheel, hub, and brake backing plate assembly. Withdraw axle shafts. Disconnect rear universal joint and drop drive shaft. Remove carrier-to-housing bolt nuts, withdraw carrier.
Wheel Bearing Adjustment—Endplay controlled by shims between flanged end of housing and brake backing plate. **Endplay**—.004-.007".

SHOCK ABSORBERS:—**Delco.** Model 1966-D (right frt.), 1966-C (left frt.), 1751-Z (right rear), 1751-M (left rear). Double acting, hydraulic type.
Fifth Shock Absorber (Stabilizer):—Houdaille Model NFT. Double acting, hydraulic, adjustable type.
See articles in Mechanical Equipment Section for data.

STEERING:—**Steering Gear**—Packard (Gemmer design) Worm-and-Roller type with center steering.
See article in Mechanical Equipment Section for data.
Front Suspension:—Independent 'Safe-T-fleX' type
See article in Mechanical Equipment Section for data.
NOTE—Frame Height must be set first before checking Caster and Camber.
Frame Height—With car on level floor, distance from floor to top of frame side rail at front wheel center-line 19¼" (load car for correct figure).
Kingpin Inclination—1°54' crosswise.
Camber—½° (plus ¾°, minus 0°). Adjustable.
Caster—1½° (1701), 0° (1702) plus or minus ½°.
Toe In—0" (plus 1/16", minus 0") at hub height. Adjust tie rods equally (lengths must be equal after adjustment).

BRAKES:—**Service.** Bendix hydraulic, duo-servo, single anchor type with eccentric adjustment. Hand lever applies rear service brakes.
See article in Mechanical Equipment Section for data.
Drums—Centrifuse. Diameter—12".
Lining—Marshall #2201 (1701). US Asbestos #714—primary, #589—secondary (1701A,2). Width 1¾" (1701), 2¼" (1701A,2), Thickness 3/16". Length 13" per shoe.
Clearance—.010" at heel and toe of each shoe.
Hand Brake:—See Service Brakes (above).

SERIAL NUMBER:—On front of dash (Use Engine No.).
ENGINE NUMBER:—First number B-500001. Stamped on boss on left hand side of cylinder block.
ENGINE SPECIFICATIONS:—8 cylinder, 'L' head.
Bore—3 3/16". **Stroke**—5".
Displacement—320 cu. ins. **Rated HP.**—32.5.
Developed Horsepower—130 HP. (Std. Hd.), 135 HP. (Optl. HC. Hd.) at 3200 R.P.M.
Compression Ratio—6.45-1 Standard, 6.85-1 Optl. H.C., 6.20-1 Optl. L.C.
Compression Pressure—110 lbs. (Std. 6.45-1 hd.), 118 lbs. (Optl. 6.85-1 hd.) at 125 R.P.M.
Vacuum Reading—Steady 18-19" idling at 5 M.P.H.
See Packard Shop Notes for Cylinder Head data and Block Removal instructions.

PISTONS:—Nelson Bohnalite, aluminum alloy, autothermic, strut type, tin plated, cam ground.
Weight—17¾ ozs. (stripped), 24 ozs. (with rings and pin) and equal within 4 grams. **Length**—4¼".
Removal—Pistons from above, rods from below.
Clearance—.0005-.001" skirt. See Fitting Pistons.
Original Bore & Pistons Sizes, Replacement Pistons:—*See Packard Shop Notes for complete data.*
Fitting New Pistons:—Insert .0015" feeler ½" wide between piston and cylinder wall on side opposite slot. Pull to withdraw feeler must be 12-14 lbs.
Installing Pistons:—Slot toward valves.

PISTON RINGS:—#1 compression (plain), #2 compression (#70 Perfect Circle), #3 oil (P-C #85), #4 oil (P.C. #X-90) rings per piston, all above pin.

Ring	Width	End Gap	Side Clearance
Comp. #1 & 2	.123-.1240"	.007-.017"	.003"
Comp. #3	.123-.1240"	.007-.015"	.003"
Oil Contr	.186-.1865"	.007-.015"	.0015"

Replacement Rings:—Standard and .003", .005", .010", .015", .020", .025", .030", .035" & .045" oversize.

PISTON PIN:—**Diameter**—⅞". **Length**—2 47/64". Pin floats in piston and rod, held by locking rings.
Pin Fit in Piston—Finger push fit with piston heated to 160° F.
Pin Fit in Rod Bushing—Finger push fit at 70° F.
Replacement Pins:—Std. and .003", .006" oversize.

CONNECTING ROD:—**Length** 10⅞". **Weight** 40-40.125 ozs. (with bearings).
Crankpin Journal Diameter—2 3/16".
Lower Bearing—Copper lead alloy, interchangeable type. Furnished .001", .002", .003", .015" undersize. **Clearance**—.0007-.00125". **Sideplay**—.005-.008".
Bearing Adjustment:—None (no shims). Replace bearings. Do not file rods or bearing caps. Tighten rod bolt nuts to 550-570 in. lbs.
Installing Rods:—Oil hole toward camshaft.

CRANKSHAFT:—9 bearing, 8 bolted counterweights with rubber friction disc vibration dampener.
Journal Diameters—2⅝" (all bearings).
Bearing Type—Interchangeable steel-backed, babbitt-lined type. **Clearance**—.001-.002".
Bearing Adjustment:—None (no shims). Replace bearings (upper half can be 'rotated' in place). Do not file caps. Tighten bolt nuts to 800-830 in. lbs.
End Thrust:—Taken by #7 bearing. **Endplay**.003-.005".

CAMSHAFT:—8 bearing. Non-adjustable chain drive.
Bearing Type—Steel-backed, babbitt-lined.
Clearance—.0015-.0035".
End Thrust:—Taken by thrust plate assembled in back of camshaft sprocket. **Endplay**—.003-.006".
Timing Chain:—Morse No. 3682-KX. Width 1½". Pitch .375". Length 26¼" or 70 links.
Camshaft Setting:—Install chain and sprockets together with marks adjacent and in line with a straightedge across the shaft centers.
See Packard Shop Notes for Radiator & Fender (unit) removal for work on front of engine.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1 21/32"	.3405"	7 13/32"
Exhaust	1 15/32"	.3405"	7 13/32"

	Seat Angle	Lift	Stem Clearance
Intake	45°	.358"	.0025-.004"
Exhaust	45°	.358"	.004-.006"

Tappet Clearance:—.006" Int., .008" Exh. (warm).
NOTE—Remove right front fender plate for adj.
Valve Guides:—New type. Press guides in block so top is 1 1/32" below valve seat and finish-ream.
Valve Rocker Arms:—Consist of pivoted arms mounted on bracket on crankcase which transmit motion from cam to valve pushrod (valve lifter).
Removal—Take out screws in bracket on right side of crankcase, withdraw bracket assembly.
Valve Lifters (Tappets):—Removable from above with valve springs removed. Operate in individual guides held in place by bottom face of cylinder block (remove block to remove guides).

Valve Springs:	Spring Pressure	Spring Length
Valve Closed	68-78 lbs.	3 1/16"
Valve Open	154-164 lbs.	2 45/64"

NOTE—Serrated washer on top of each spring.
Valve Timing.:—See Camshaft Setting (above).
Intake Valves—Open 26° BTDC. Close 69° ALDC.
Exhaust Valves—Open 61° BLDC. Close 34° ATDC.
To Check Timing—Set tappet clearance #1 exhaust valve at .005" (or .010", then insert .005" feeler). Turn engine over until pointer over damper (at front of engine) lines up with a point 1 1/16" (plus or minus 11/32") past '1-UPDC' mark (feeler should withdraw with finger pull). Valve closes 34° or .5176" ATDC. Reset tappet clearance at .008" warm.

LUBRICATION:—Gear type oil pump in crankcase.
Normal Oil Pressure:—55-60 lbs. max., 5 lbs. min. idling (SAE #20 oil, engine warm or 150° F.).
Oil Pressure Regulator:—Located under plug on left side of crankcase. To adjust, remove acorn nut, turn slotted screw.
Relief Valves—Non-adjustable relief valve located in regulator housing opens at 17 lbs. back-pressure in filter and cooler to by-pass oil to manifold. By-pass valve in oil filter opens at 7-8 lbs.
Crankcase Capacity:—7½ quarts.

COOLING SYSTEM:—**Water Capacity**—22 quarts.
Water Pump:—New ball-bearing, packless type.
See article in Mechanical Equipment Section for data.
Removal—Drain water and remove fan belt, take out pump mounting screws, lift fan and pump out.
Thermostat:—In top radiator tank. Operates shutters.
Setting—Starts to open 135° F. Fully open 150° F. NOTE—Install 162° cylinder head thermostat for use with heaters. Remove in summer.
Adjustment—Pull back on the shutter pullrod to close shutters, tighten nut to remove all slack in rod, then tighten one turn additional for pre-load.

CLUTCH:—**Long Model 11CFS-CI.** Semi-centrifugal, single plate, dry disc type (riveted assembly).
See article in Mechanical Equipment Section for data.
Facings—Woven (US Asbestos #1133G), 2 required. Inside Diam. 6½". Outside Diam. 11". Thickness .125".
Adjustment—Adjust nut on pedal rod (at clutch fork) for 1½-2" pedal free movement.
Removal:—Remove transmission (see Transmission Removal below), remove flywheel bell housing by taking out 4 screws and removing nuts on 4 studs. Remove mounting screws in clutch cover flange

TRANSMISSION:—**Own Make.** New type with constant-mesh, helical, ball-bearing mounted low-speed gear (sliding gear for reverse). Synchro-mesh
See article in Mechanical Equipment Section for data.
Econo-Drive Transmission:—Warner Model AS9-R6 overdrive unit with electrical control optl.
See article in Mechanical Equipment Section for data and recommended control changes on first cars.
Transmission Control:—Own remote control type.
See article in Mechanical Equipment Section for data.
Removal:—Disconnect shifter rods, speedometer cable, ground strap at transmission case. Disconnect drive shaft at front universal joint and block shaft up against floorpan. Support rear end of engine, unbolt cross-member from frame (on cars with Econo-Drive remove cross-member at rear with stabilizer, disconnect wires at solenoid). Disconnect hand brake cable at equalizer, remove flywheel housing lower cover, clutch throwout retracting spring. Take out transmission-to-bell housing mounting screws and remove assembly.

UNIVERSAL JOINT:—**Mechanics Model 3C.** Needle bearing type. Two used.
See article in Mechanical Equipment Section for data.
CAUTION—Do not disturb universal flange nut on first cars (this nut controls overdrive rear bearing pre-load). On later cars (with 'M' stamped on flange), bearing pre-load controlled by spring washer and nut should be kept tight.

REAR AXLE:—**Own Make.** New type, semi-floating, hypoid gear type with Hotchkiss drive. NOTE—Axle has special Ring Gear Support Roller, differential case is straight (not Angle-set), cover welded on.
See article in Mechanical Equipment Section for data.
Ratio—4.36-1 Std., 4.54-1 With Overdrive (1703), 4.54-1 Std., 4.7-1 With Overdrive (1705).
Backlash—.003-.005". Screw adjustment.
Removal:—Remove wheel, hub, brake assembly, wheel bearing and axle shaft. Disconnect rear universal joint at flange, drop drive shaft, remove differential housing mounting nuts, withdraw carrier.
Wheel Bearing Adjustment—Controlled by shims between flanged end of housing and backing plate.
Endplay—.004-.007".

SHOCK ABSORBERS:—**Delco.** Model 1966-D, C (front), 1751-Z, M (rear). Double acting, hydraulic type.
Fifth Shock Absorber (Stabilizer):—Houdaille Model NFT. Double acting, hydraulic, adjustable type.
See articles in Mechanical Equipment Section for data.

STEERING:—**Steering Gear**—Packard (Gemmer design). Worm-and-Roller type with center steering.
See article in Mechanical Equipment Section for data.
Front Suspension:—Independent Safe-T-fleX type.
See article in Mechanical Equipment Section for data.
NOTE—Frame Height must be set first before checking Caster and Camber.
Frame Height—With car on level floor, distance from floor to top of frame side rail at front wheel center-line 19¼" (load car for correct figure).
Kingpin Inclination—1°54' crosswise.
Camber—½° plus ¾° minus 0°. Adjustable.
Caster—½° (1703, 5), 2½° (1703A) plus or minus ½°. Adjustable.
Toe In—1/32-⅛" at hub height. Adjust by turning both tie rods equally (lengths must be equal after adjustment).

BRAKES:—**Service**—Bendix hydraulic, duo-servo, single anchor type. Hand lever applies rear service brakes. *See article in Mechanical Equipment Section.*
Drum—Centrifuse. Diameter—12".
Lining—Primary Shoe—US Asbestos #714 (1703, 5), Marshall #1035 (1703A). Secondary Shoe—US Asbestos #589 (1703, 5), Marshall #600 (1703A). Width 2¼" (1703, 5), 2½" (1703A). Thickness 3/16". Length 13" per shoe.
Clearance—.010" at heel and toe of each shoe.
Hand Brake Adjustment:—See Service Brakes.

SERIAL NUMBER:—On front of dash (Use Engine No.).
ENGINE NUMBER:—First number B-600001. Stamped on left side of cylinder block below distributor.
ENGINE SPECIFICATIONS:—12 cyl., modified 'L' head, 67° Vee. Blocks and upper crankcase cast Enbloc. **Bore**—3 7/16". **Stroke**—4¼".
Displacement—473 cu. ins. **Rated HP.**—56.7.
Developed Horsepower—175 HP. (Std. 6.3-1 hd.), 180 HP. (Optl. 7.03-1 HC. head) at 3200 R.P.M.
Compression Ratio—6.3-1 Std., 6.0-1 Optl. LC., 7.03-1 Optl. HC. Cylinder heads are Aluminum.
Compression Pressure—110 lbs. (Std. 6.3-1 hd.), 118 lbs. (Optl. 7.03-1 HC. hd.) at 125 R.P.M.
Vacuum Reading—18-20" at 375 R.P.M. or 8 M.P.H.
See Packard Shop Notes for Cylinder Head data.
PISTONS:—Nelson Bohnalite, aluminum alloy, autothermic strut type, tin plated, cam ground.
Weight—20 ozs. (stripped), 26¾ ozs. (with rings and pin). **Length**—4.318".
Removal—Pistons removed from above, rods from below. Warm engine facilitates removal.
Clearance—.0005-.001". See Fitting Pistons.
Original Bore & Pistons Sizes, Replacement Pistons:—*See Packard Shop Notes for complete data.*
Fitting New Pistons:—Insert .0015" feeler ½" wide between piston and cylinder wall on side opposite slot. Pull to withdraw feeler should be 12-18 lbs.
Installing Pistons:—Slot toward valves (all pistons).
PISTON RINGS:—Four rings per piston, #1 Comp. (plain), #2 & 3 Comp. (Perfect Circle #70), #4 Oil Contr. (#X-90), all above pin. Oil ring groove drilled with twelve #30 oil drain holes.

Ring	Width	End Gap	Side Clearance
Comp. (#1, 2)	.123-.1240"	.007-.017"	.0025-.003"
Comp. (#3)	.123-.1240"	.007-.015"	.0015-.002"
Oil Contr.	.186-.1865"	.007-.015"	.0015-.002"

NOTE—On left bank, ring gap #1 and #3 away from camshaft, #2 and #4 toward camshaft. Reverse procedure for right hand bank.
Replacement Rings:—Std. and .003", .005", .010", .015", .020", .030", .045" oversize.
PISTON PIN:—Diameter—⅞". **Length**—2 63/64".
Pin floats in piston and rod, held by locking rings. Furnished std. and .003", .006" oversize.
Pin Fit in Piston—Finger push fit with piston heated to 160° F.
Pin Fit in Rod Bushing—Finger push fit at 70° F. Finish ream pin hole to .87485-.87515".
CONNECTING ROD:—Weight—36 ozs. **Length**—9".
Crankpin Journal Diameter—2½".
Lower Bearing—Copper lead alloy, interchangeable type. Furnished std. and .001", .002", .003", and .015" undersize.
Clearance—.001-.0015". **Sideplay**—.008-.010".
Bearing Adjustment:—None (no shims). Replace bearings. Do not file rods or caps.
Installing Rods:—Oil hole toward starter.
CRANKSHAFT:—4 bearing, 6 bolted counterweights with rubber friction disc vibration damper mounted on forward end. **Journal Diameters**—2¾".
Bearing Type—Interchangeable steel-backed, babbitt-lined type. **Clearance**—.001-.002".
Bearing Adjustment:—None (no shims). Replace bearings. Upper halve may be rotated in place.
End Thrust:—By #1 bearing. **Endplay**—.003-.005".
CAMSHAFT:—Four bearing. Between banks directly above crankshaft. Non-adjustable chain drive.
Bearing Type—Steel backed, babbitt-lined.
Clearance—.001-.0015" (#1, 4). .002-.0025" (#2, 3).
End Thrust:—Taken at front bearing.
Endplay—.002-.006".
Timing Chain:—Morse No. 1866-N. Width 1¾". Pitch .500". Length 28" or 56 links.
Camshaft Setting:—Install chain and sprockets together with marks adjacent and in line with a straightedge across the shaft centers.
See Packard Shop Notes for Radiator & Fender (unit) removal for work on front end of engine.

VALVES:—	Head Diameter	Stem Diameter	Length
Intake	1 41/64"	.3405"	6 35/64"
Exhaust	1 21/32"	.338"	6 35/64"

	Seat Angle	Lift	Stem Clearance
Intake	45°	.3125"	.002-.0025"
Exhaust	45°	.3125"	.0045-.005"

Tappet Clearance—None (automatic take-up).
Automatic Tappet Take-up:—Hydraulic type (using engine oil pressure). Must be checked when valves ground.
See article in Mechanical Equipment Section for data.
Valve Springs:—Install springs with painted end down and close-spaced first coil toward valve head. Special 1/32" higher stem keeper furnished (compensating for low pressure due to reseating valves).

	Spring Pressure	Spring Length
Valve Closed	65-75 lbs.	2 7/32"
Valve Open	140-150 lbs.	1 29/32"

NOTE—Serrated washer on top of spring to prevent rotation.
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open at TDC. Close 45° ALDC.
Exhaust Valves—Open 35° BLDC. Close 10° ATDC.
To Check Timing—Intake valve for #1 (front cylinder, right bank) begins to open with piston on top dead center when '#1R-UDC' mark on dampener lines up with pointer on chain case cover. (permissable variation 9/16" either side of mark). Removal of right cylinder head and dial indicator mounted over valve recommended to check opening.
Motor Gauge—Weidenhoff Adapter #104 (with 10 MM. adapter), Rod #2.
LUBRICATION:—Pressure system with gear type oil pump mounted in crankcase. Oil filter and temperature regulator mounted on right side of engine.
Normal Oil Pressure:—55-60 lbs. max., 5 lbs. min. idling (SAE #20 oil, engine warm or 150° F.).
Oil Pressure Regulator:—Located under plug on right side of crankcase below filter. Remove acorn nut and adjust by turning slotted screw.
Pressure Relief Valves—Non-adjustable relief valve in regulator housing opens at 17 lbs. back-pressure in filter and cooler and by-passes oil directly to manifold. By-pass valve in filter opens at 7-8 lbs.
Valve Silencer Metering Valve—Spring loaded type in pump body, exposed by removing pump cover.
Crankcase Capacity:—10 quarts.
COOLING SYSTEM:—Water Capacity—40 quarts.
Water Pump:—Adjustable packing type, mounted on ball bearings, driven by twin Vee belts.
See article in Mechanical Equipment Section for data.
Removal—With water drained and fan belts removed, disconnect pump hose, remove pump mounting bolts, lift fan and pump assembly off.
Thermostat:—In top radiator tank. Operates shutters.
Setting—Starts 135° F. Fully open 150° (no load). Cover stamped 150°. NOTE—Special thermostat (for heater use with permanent anti-freeze) starts to open at 160°, fully open 170-175°. Marked 175°.
Adjustment—At room temperature with thermostat sylphon closed, pull back on shutter pullrod to close shutters, tighten nut to remove all slack in rod, then tighten one turn additional for pre-load.
CLUTCH:—Long Model 12CB-CL. Single plate, dry disc type with Bendix Vacuum Power operation.
See article in Mechanical Equipment Section for data.
Facings—Endless-compressed (Hyco DV 3903 PDX), 2 required. I.D. 7". O.D. 12". Thickness .137".
Pedal Adjustment:—Vacuum Power unit must be adjusted whenever pedal free travel insufficient (should be 1-1 13/16"). *See article in Mechanical Equipment Section for complete directions.*
Removal:—Remove transmission (see Transmission Removal following), take out cover mounting screws (release pressure evenly), lift assembly out. Align '0' marks on flywheel and cover when reassembling.
TRANSMISSION:—Own Make. Helical gear type with synchronizer for second and high speeds.
See article in Mechanical Equipment Section for data.
Transmission Control:—Own remote control type.
See article in Mechanical Equipment Section for data.
Removal:—Remove ground cable, speedometer cable, propeller shaft, light switch, two stud nuts (case bracket to rubber support) at each side, hand brake cable at equalizer, left stabilizer link, clutch pedal pull-rod, and pedal spring. Support engine at rear. Remove right brace rod (rear only), lower crossmember, and bell housing nuts and capscrews. Jack up rear of engine, remove two bolts on each side (holding vertical support members to frame), remove support members, pull transmission back.
UNIVERSAL JOINTS:—Spicer Model 1351-10X (front), 1358-18X (rear). Needle bearing type, 2 used.
See article in Mechanical Equipment Section for data.
REAR AXLE:—Own Make. 'Angle-Set', semi-floating, hypoid gear type with Hotchkiss drive.
See article in Mechanical Equipment Section for data.
Ratio—4.41-1 (std.), 4.69-1, 4.06-1 (optl.).
Backlash—.003-.005". Screw adjustment.
Removal:—Remove wheel, hub, brake assembly, wheel bearing and axle shaft. Disconnect rear universal joint at flange, drop drive shaft, remove differential from housing by removing housing bolt nuts (below), and locknut on stud (at top). Remove carrier.
Wheel Bearing Adjustment—Controlled by shims between outer race of inner bearing and shoulder in housing. Remove wheel, hub and brake assembly, wheel bearing and axle shaft. Add or remove shims adjust each wheel independently.
Endplay—.003" (plus or minus .001") at each wheel.
SHOCK ABSORBERS:—Delco. Model 1952-B, C (front), 2006-G, H (rear). Double acting, hydraulic type.
See article in Mechanical Equipment Section for data.
STEERING:—Steering Gear—Packard (Gemmer design) Worm-and-Roller type with push-pull adjustment. *See article in Mechanical Equipment Section.*
Front Suspension:—Packard Safe-T-fleX type with coil springs.
See article in Mechanical Equipment Section for data.
NOTE—Frame Height must be set first before checking Caster and Camber.
Frame Height—With car on level floor, distance from floor to top of frame side rail at front wheel center-line 20½" (load car for correct figure).
Kingpin Inclination—1½° crosswise.
Camber—1° plus or minus ¼°. Adjustable.
Caster—0° (½° reverse max.). Shim adjustment.
Toe In—1/32-⅛". Adjust by turning tie rods equally (check for equal lengths after adjustment).
BRAKES:—Service—Bendix hydraulic, duo-servo, single anchor type with Vacuum Power operation. Hand lever applies rear service brakes.
See article in Mechanical Equipment Section for data.
Drum—Centrifuse. Diameter—14".
Lining—Primary (Raybestos No. 451). Secondary (U.S. Asbestos No. 589). Width 2¾". Thickness ¼". Length 15" per shoe.
Clearance—.010" at heel and toe of each shoe.
Hand Brake:—See Service Brakes.
Vacuum Power Unit:—Bendix internal valve type.
See article in Mechanical Equipment Section for data.

SERIAL NUMBER:—First number (54 137" WB) 1,050,001, (54 142" WB) 1,525,001, (836, 9 136" WB) 1,070,001, (836, 9 139" WB) 1,550,001. On plate on right hand frame side member behind right front spring rear shackle.

ENGINE NUMBER:—Stamped on left hand side cylinder block below head at center.

ENGINE:—Eight cylinder In line, 'L' head type. Cylinders cast enbloc.
Dimensions—Bore 3½". Stroke 4¾". Displacement 366 cubic inches.
Horsepower—Rated 39.2. Developed (54 '32) 125 at 3000 R.P.M. (836, 9 '33) 135 at 3400 R.P.M.
Compression Ratio—5.05-1 (54 '32), 5.5-1 (836, 9 '33). No optional ratios.
Compression Pressure—Approximately 88 lbs. (5.05-1 head), 95 lbs. (5.5-1 head) at cranking speed.
Vacuum Reading—Steady reading of 18-20" at idling speed.

Pistons:—Bohn Aluminum Bohnalite, Invar Strut type. Pistons furnished in standard oversizes of .002", .004", .010", .020".
Weight—No variation allowed in complete set.
Length—4¼".
Removal—Piston and rod assembly removed from top of engine.
Clearance—Top, .019-.026", bottom, .001-.007" (across bosses), .000-.005" (at right angles to bosses).
Fitting New Pistons—Pistons should be snug on .0015" feeler and locked on .002" feeler.

Piston Rings:—Four rings per piston, #1 and 2—compression rings, #3—oil scraper ring, #4—oil control ring. Lower ring groove drilled radially with oil drain holes.

Ring	Width	End Gap	Wall Thickness	Side Clearance in Groove
Comp. (#1 & 2)	.1235"	.015-.020"	.145"	.001-.002"
Scraper (#3)	.1235"	.015-.020"	.145"	.001-.002"
Oil Cont. (#4)	.186"	.028"	.145"	.001-.002"

Piston Pin:—Diameter, .937". Length, 3 1/16". Pin is locked in rod.
Piston Pin Fit in Piston—Thumb push fit. Clearance, .0005-.0008".

Connecting Rod:—Length 9.029". Weight 37.89 ozs. ¼ oz. maximum variation allowed in entire set.
Crankpin Journal Diameter—2¼".
Big End Bearing—Centrifugally cast babbitt-lined type. No shims.
Clearance—.001-.002". Sideplay .006-.009".
Adjustment—None (no shims used). Bearings .010" and .020" undersize furnished for service.
NOTE:—Oil spray holes are drilled in both sides of connecting rod lower bearing upper half.

Crankshaft:—Nine main bearing type with integral counterweights.
Journal Sizes—2⅝" diameter (all bearings).
Bearing Type—Bronze-backed, babbitt-lined. No shims.
Clearance—.0015-.003".
Adjustment—None (no shims used).
End Thrust—Taken by #1 (front) main bearing. Endplay, .002-.004". Adjustable by adding or removing shims.

Camshaft:—Six bearing type. Camshaft drive—Non-adjustable chain.
Bearing Type—Steel-backed, babbitt-lined type.
Clearance—.002". Endplay .003-.009".
Chain—Whitney No. E-206. Width, 1½". Length, 50 links. Pitch, ½".
Camshaft Setting:—Sprockets are marked. Mesh chain with sprockets turned so that marks are adjacent and in line with a straightedge across the shaft centers (center the two '0' marks on camshaft sprocket on straightedge).

Valves—	Head Diameter	Stem Diameter	Length	Seat Angle	Lift
Intake	1 21/32"	.3725"	4¾"	45°	.359"
Exhaust	1 9/16"	.3715"	4¾"	45°	.359"

Stem-to-Guide Clearance—.002-.003" (intake and exhaust valves).
Tappet Clearance (54 '32)—.004" Intake, .006" Exhaust with engine hot.
Tappet Clearance (836, 9 '33)—None in service (Hydraulic valve tappet take-up used). See data below.

Valve Springs—Install springs with small end up. Flat coil spring type dampener assembled on outside of all springs at top.

Spring Specifications—Model 54 (1932)

	Spring Pressure	Spring Length
Valve Closed	50-55 lbs.	2 1/16"

Spring Specifications—Model 836, 9 (1933)

	Spring Pressure	Spring Length
Valve Closed	60-64 lbs.	2 1/16"
Valve Open	120-125 lbs.	1¾"

Valve Timing

Intake Valves Open—5° ATDC. Close—45° ALDC.
Exhaust Valves Open—40° BLDC. Close—12° ATDC.
To Check Valve Timing (54 '32)—Check tappet clearance #1 intake valve. This valve should open with piston 5° or .0115" after top dead center when flywheel mark 'IN.OP./1-8' lines up with indicator in inspection hole in flywheel housing.
Motor Gauge—Weidenhoff Adapter #102, Rod #2.
To Check Valve Timing (836, 9 '33)—Remove #1 intake hydraulic valve lifter, pull out plunger, remove spring, wash lifter assembly in gasoline, replace plunger, install lifter assembly in bracket. Check clearance between end of plunger and valve stem (clearance will be about .070" with valve closed), insert sufficient feeler stock to take up all except .010" clearance. This valve should open with piston 5° or .0115" past top dead center when flywheel mark 'IN.OP./1-8' lines up with indicator in inspection hole in flywheel housing. Remove feeler stock, reassemble hydraulic valve lifter in engine (install dry and run engine until lifter is quiet).
Hydraulic Valve Lifters—See article in Mechanical Equipment Section for complete servicing and installation directions.

LUBRICATION:—Pressure type. Gear type oil pump located in crankcase.
Normal Oil Pressure—40 lbs. at 40 M.P.H.
Oil Pressure Relief Valve—Operates at 40 lbs. Located at pump. Adjustable by adding or removing spacer washers.
Capacity and Oil—9 qts. Use SAE. #30 (summer), #20 (winter).

CLUTCH:—**Long Model 29-A.** Double plate, dry disc type. See article in Clutch Section for complete relining and assembling directions.
Facings—Moulded type, 4 required. Thickness .130". Inside Diameter 6¼". Outside Diameter 9¾".
Adjustment—Clutch pedal free movement should be ¾-1¼".

STEERING:—**Steering Gear**—Ross Cam-and Roller type. See article in Steering Section for complete adjustment directions.
Front Suspension:—Conventional 'I' beam section front axle with Reverse-Elliott ends and semi-elliptic springs.
Kingpin Inclination—8° crosswise.
Caster—1¾°. Adjust by inserting wedge shims between spring and spring pad on axle.
Camber—1°. No adjustment provided.
Toe In—⅛-3/16". Adjust in usual manner by loosening clamp bolts and turning tie rod.

BRAKES (1932):—**Service**—Bendix Mechanical, Duo-Servo, Single-anchor type. Hand lever applies all four service brakes. See article in Brake Section for complete adjustment directions.
Drum Diameter—16".
Lining—Moulded type. Width 2¼". Thickness ¼". Length 32⅜" per wheel
Clearance—.010" at heel and toe for each shoe.
Hand Brake:—See Service Brake and Service Brake Adjustment above.

BRAKES (1933):—**Service**—Stewart-Warner mechanical four wheel type with transmission power unit application. Hand lever applies all four service brakes. See article in Brake Section for complete adjustment directions.
Drum Diameter—16".
Lining—Moulded type. Width 2¼". Thickness .270". Length 38" per wheel.
Clearance—.012" for heel and toe of each shoe (rear brakes), .009" for heel and toe of each shoe (front brakes).
Hand Brake:—See Service Brake and Service Brake Adjustment.
Power Unit:—Stewart-Warner Transmission type mechanical power unit. See article in Brake Section for complete data.

SERIAL NUMBER:—On plate on right hand frame side rail directly behind right front spring rear shackle. First numbers as follows:

Model	136" WB	137" WB	139" WB	142" WB	147" WB
51					
52				3,075,001	3,500,001
53		2,050,001		2,550,001	
1236	2,075,001		2,575,001		
1242		3,100,001		3,525,001	
1247				3,525,001	3,550,001

ENGINE NUMBER:—Stamped on left side of engine below cylinder head at center.

ENGINE:—Twelve cylinder, 80° V, 'L' head type. Cylinders cast enbloc for each bank.

Bore—3¼" (53 '32), 3⅜" (51, 52 '32; 1236 '33), 3½" (1242, 47 '33).

Stroke—4" all models.

Displacement—398 cu. ins. (3¼" bore), 429 cu. ins. (3⅜" bore), 462 cu. ins. (3½" bore).

Horsepower—For each engine as follows:

Model	Rated Horsepower	Developed Horsepower
51, 52 '32	54.60	150 at 3100 R.P.M.
53 '32	50.80	140 at 3100 R.P.M.
1236 '33	54.60	160 at 3400 R.P.M.
1242, 47 '33	58.80	175 at 3400 R.P.M.

Compression Ratio—5.05-1 (all models '32), 6-1 (all models '33).

Compression Pressure—Approximately 85-90 lbs. (5.05-1 head), 100-105 lbs. (6-1 head) at cranking speed.

Vacuum Reading—Steady reading of 18-20" at idling speed.

Pistons:—Bohn Aluminum, Bohnalite, Invar Strut type. Pistons furnished in standard oversizes of .002", .004", .010", .020".

Weight—No variation allowed in complete set.

Removal—Piston and rod assembly removed from top of engine.

Clearance—Top, .019-.026". Bottom, .001-.007" (across bosses), .000-.005" (at right angles to bosses).

Fitting New Pistons—New pistons should be snug on .0015" feeler and locked on .002" feeler.

Piston Rings:—Four rings per piston, #1 and 2—compression rings, #3—oil scraper ring, #4—oil control ring. Lower ring groove drilled radially with oil drain holes.

Ring	Width	End Gap	Side Clearance
Compression (all)	.1235"	.015-.020"	.001-.002"
Oil Control (#4)	.186"	.028"	.001-.002"

Piston Pin:—Diameter, .875". Length, 2.750". Pin floats in rod and piston and is held in place by two locking rings. Pin hole in upper end of connecting rod is bronze bushed.

Pin Fit in Piston—Thumb push fit at 160°F.

Pin Fit in Rod—Bushing reamed to provide clearance of .0004-.0006".

Connecting Rod:—Length, 9.936". Weight, ⅛ oz. variation allowed in entire set.

Crankpin Journal Diameter—2.1265".

Big End Bearing—Centrifugally cast babbit-lined type. No shims.

Clearance—.001-.002". Sideplay .006-.009".

Adjustment—None (no shims used). Bearings .010" and .020" undersize furnished for service.

NOTE:—Oil spray holes are drilled in both sides of connecting rod lower bearing upper half.

Crankshaft:—Seven main bearing type with integral counterweights.

Journal Sizes—2.49" diameter (all bearings).

Bearing Type—Bronze-backed, babbitt-lined. No shims.

Clearance—.0015-.003".

Adjustment—None (no shims used).

End Thrust—Taken by #1 (front) main bearing. Endplay, .002-.004". Adjustable by adding or removing shims.

Camshaft:—Four bearing type. Camshaft drive, non-adjustable chain.

Bearing Type—Steel-backed, babbitt-lined type.

Clearance—.002". End play .003-.009".

Chain—Whitney, Type CL-206-G. Width, 1½". Length, 53 links. Pitch, .500".

Camshaft Setting—Sprockets are marked. Mesh chain with sprockets turned so that marks are adjacent and in line with a straightedge across the shaft centers.

Valves—	Head Diameter	Stem Diameter	Length	Seat Angle	Lift
Intake	1 21/32"	.3725"	4¾"	45°	.312"
Exhaust	1 9/16"	.3715"	4¾"	45°	.312"

Stem-to-Guide Clearance—.002-.003" (all valves).

Tappet Clearance (1932)—.004" Intake, .006" Exhaust with engine hot.

Tappet Clearance (1933)—None in service. Hydraulic valve tappet take-up used. See data below.

Valve Springs—Install springs with small end up. Flat coil type dampener assembled on outside of all springs at top.

Spring Specifications—1932 Models

	Spring Pressure	Spring Length
Valve Closed	50-55 lbs.	2 1/16"

Spring Specifications—1933 Models

	Spring Pressure	Spring Length
Valve Closed	60-64 lbs.	2 1/16"
Valve Open	120-125 lbs.	1¾"

Valve Timing—See Camshaft Setting above.

All 1932 Models and First 68 Cars Model 1236 (1933)

Intake Valves—Open 4° Before TDC. Close 52° After LDC.

Exhaust Valves—Open 40° Before LDC. Close 16° After TDC.

All 1933 Models Except First 68 Cars Model 1236

Intake Valves—Open 19° Before TDC. Close 69° After LDC.

Exhaust Valves—Open 56° Before LDC. Close 28° After TDC.

To Check Valve Timing (1932 Models)—Check tappet clearance #1 intake valve (front cylinder left bank). This valve should open with piston 4° or .0059" before top dead center when flywheel mark 'IN.OP.NO.1' lines up with indicator in inspection hole in flywheel housing.

To Check Valve Timing (1933 Models)—Remove #1 intake hydraulic valve lifter, pull out plunger, remove spring, wash lifter assembly in gasoline, replace plunger, install lifter assembly in bracket. Check clearance between end of plunger and valve stem (clearance will be about .070" with valve closed), insert sufficient feeler stock to take up all except .004" clearance. This valve should open with piston 4° or .0059" (First 68 cars Model 1236), 19° or .1303" (all others) before top dead center when flywheel mark 'IN.OP.NO.1' lines up with indicator in inspection hole in flywheel housing. Remove feeler stock, reassemble hydraulic valve lifter in engine (install dry and run engine until quiet).

Hydraulic Valve Lifters—See article in Mechanical Equipment Section for complete servicing and installation directions.

LUBRICATION:—Pressure type. Gear type oil pump located in crankcase.

Normal Oil Pressure—40 lbs. at 40 M.P.H.

Oil Pressure Relief Valve—Located at oil pump. Adjustable by adding or removing spacing washers.

Crankcase Capacity—14 qts. (dry), 12 qts. (refill). Use SAE. #30 (summer), #20 (winter).

CLUTCH:—**Long Model 29-A.** Double plate, dry disc type. See article in Clutch Section for complete relining and assembling directions.

Facings—Moulded type, 4 required. Thickness .130". Inside Diameter 6¼". Outside Diameter 9¾".

Adjustment—Clutch pedal free movement should be ¾-1¼".

STEERING:—**Steering Gear**—Ross Cam-and Roller type. See article in Steering Section for complete adjustment directions.

Front Suspension:—Conventional 'I' beam section front axle with Reverse-Elliott ends and semi-elliptic springs.

Kingpin Inclination—8° crosswise.

Caster—1¾°. Adjust by inserting wedge shims between spring and spring pad on axle.

Camber—1°. No adjustment provided.

Toe In—⅛-3/16". Adjust in usual manner by loosening clamp bolts and turning tie rod.

BRAKES (1932):—**Service**—Bendix Mechanical, Duo-Servo, Single-anchor type. Hand lever applies all four service brakes. See article in Brake Section for complete adjustment directions.

Drum Diameter—16".

Lining—Moulded type. Width 2¼". Thickness ¼". Length 32⅜" per wheel

Clearance—.010" at heel and toe for each shoe.

Hand Brake:—See Service Brake and Service Brake Adjustment above.

BRAKES (1933):—**Service**—Stewart-Warner mechanical four wheel type with transmission power unit application. Hand lever applies all four service brakes. See article in Brake Section for complete adjustment directions.

Drum Diameter—16".

Lining—Moulded type. Width 2¼". Thickness .270". Length 38" per wheel.

Clearance—.012" for heel and toe of each shoe (rear brakes), .009" for heel and toe of each shoe (front brakes).

Hand Brake:—See Service Brake and Service Brake Adjustment.

Power Unit:—Stewart-Warner Transmission type mechanical power unit. See article in Brake Section for complete data.

SERIAL NUMBER:—On plate on right side of frame at rear of right front spring rear shackle under fender. First number as follows:

	136" WB	138" WB	144" WB
836A	1,080,001		1,560,001
840A		2,080,001	2,580,001
840A		2,090,001	2,590,001

ENGINE NUMBER:—Stamped on left side of cylinder block below head at center.

ENGINE:—Own. Eight Cylinder, In line, 'L' head type.
Bore—3½". **Stroke**—4¾" (836A), 5" (840A, 845).
Displacement—366 cu. ins. (836A), 385 (others).
Rated Horsepower—39.2.
Developed Horsepower—135 (836A), 140 (840A, 845) at 3400 R.P.M.
Compression Ratio—5.5-1. No optional ratios.
Compression Pressure—100 lbs. at 350 R.P.M. or 80-85 lbs. at cranking speed.
Vacuum Reading—Gauge should show stead reading of 18-20" with engine idling.

Pistons:—Bohn, Bohnalite aluminum alloy, Invar Strut, split skirt type. Replacement pistons furnished in standard oversizes of .002", .004", .010", .020". Piston length, 4¼".
Weight—22.61 ozs. minimum, 22.73 ozs. maximum without rings or pin.
Removal—Pistons and rods removed from above.
Clearance—Top .019-.026". Bottom .000-.005" at right angles to bosses, .001-.007" across bosses. See Fitting New Pistons.
Fitting New Pistons—Pistons should be snug on .0015" feeler and locked on .002" feeler.
Installing Pistons—Slot should be toward left viewed from driver's seat).

Piston Rings:—Four rings per piston, three compression rings, one oil control ring, all above pin. Oil ring groove drilled radially with oil drain holes.

Ring	Width	End Gap	Side Clearance
Comp. All	.1235-.1240"	.013-.018"	.001-.002"
Oil Cont.	.1860-.1865"	.013-.018"	.001-.002"

Piston Pin:—Diameter—.937" ('34), .9355-.9359" ('35). Length 3 1/16". Pin is locked in rod.
Clearance In Piston—.0005-.0008" or thumb push fit.

Connecting Rod:—Length 9.029" (836A), 8.904-8.905" (840A, 845). Weight 21.89 ozs. (836A). ⅛ oz. variation allowed in entire set.
Crankpin Journal Diameter—2.251-2.2515".
Lower Bearing—Centrifugally cast, babbitt-lined type. No shims used.
Clearance—.001-.0025". Sideplay, .004-.007".
Adjustment—None. Replace rods. Do not file caps.

NOTE—Oil spray holes drilled in both sides of connecting rod lower bearing upper half. Rods are installed at factory with piston pin clamp on same side as piston slot (left side).

Crankshaft:—Nine bearings. Integral counterweights.
Journal Diameters—2⅝" all bearings.
Bearing Type—Steel or bronze backed, babbitt-lined type. No shims used.
Clearance—.0015-.003".
Adjustment—None. Replace the bearings. Do not file caps.
End Thrust—Taken by front bearing. Endplay, .002-.004". Adjustable by adding or removing shims.

Camshaft:—Six bearings. Non-adjustable chain drive.
Bearing Type—Steel-backed, babbitt-lined.
Clearance—.002". Endplay, .003-.009".
Timing Chain—Whitney #CL-206. Width 1½", Pitch ½", Length 25" or 50 links.
Camshaft Setting—Sprockets are marked. Mesh chain with sprockets turned so that a straight-edge across the shaft centers splits the 'O' mark on the crankshaft sprocket and is midway between the two 'O' marks on the camshaft sprocket.

Valves:—

	Head Diameter	Stem Diameter	Length
Intake	1 21/32"	.3725-.3735"	4¾"
Exhaust	1 9/16"	.3715-.3725"	4¾"

	Seat Angle	Lift '34	Lift '35	Stem Clearance
Intake	45°	.359"	.355"	.0015-.0025"
Exhaust	45°	.359"	.355"	.0025-.0035"

Tappet Clearance (836A)—.004" Intake, .006" Exhaust, with engine hot.
Tappet Clearance (840A, 845)—None in service. See data below on hydraulic valve lifters.
Valve Springs—Install springs with small end up. Flat coil spring type dampener assembled on outside of all springs at top.

	Spring Pressure	Length '34	Length '35
Valve Closed	60-65 lbs.	2 1/16"	2 3/32"
Valve Open	120-128 lbs.	1¾"	1 25/32"

Valve Timing—See Camshaft Setting above.
Intake Valves—Open 5° ATDC. Close 45° ALDC.
Exhaust Valves—Open 40° BLDC. Close 12° ATDC.

To Check Valve Timing (836A)—Set tappet clearance #1 intake valve at .006". This valve should open with piston .0115" past top dead center when flywheel mark 'IN.OP/1-8' registers with indicator on flywheel housing. This mark is 5° after top dead center mark 'UDC/1-8'. Reset tappet clearance at .004" with engine hot.

To Check Timing (840A, 845)—Remove #1 intake hydraulic valve lifter, pull out plunger, remove spring, wash lifter assembly in gasoline, replace plunger, install lifter in bracket. Check clearance between end of plunger and valve stem (valve closed—clearance will be about .070"). Insert sufficient feeler stock to take up all except .010" clearance. Turn engine over until piston #1 slightly past top dead center, stop when flywheel mark 'IN.OP./1-8' lines up with indicator on housing. #1 intake valve should begin to open at this point. Remove feeler stock, reassemble hydraulic valve lifter as directed below.
Motor Gauge—Weidenhoff Adapter #114, Rod #29.
Installing Hydraulic Valve Lifters — Hydraulic valve lifters should always be installed without oil. Oil in lifter will retard escape of air and delay quieting of lifter when engine is operated. Remove plunger from lifter body, wash out all oil with gasoline. Do not interchange plungers—they are selective fit in lifter bodies—this is important. When lifters are installed (new or after grinding valves), check mechanical clearance with lifter dry (all oil removed from assembly). To check clearance, compress plunger spring by prying between plunger cap and valve stem, use feeler to check clearance. Clearance at this point must be .015". If clearance is insufficient, remove lifter from bracket, grind end of plunger slightly. Do not grind into check ball retaining pin.
Servicing Hydraulic Valve Lifters—*See article in Mechanical Equipment Section for complete data.*

Lubrication:—Pressure. Gear type oil pump located in crankcase.
Normal Oil Pressure—35 lbs. at 40 M.P.H.
Oil Pressure Relief Valve—Located at pump. Adjustable by adding or removing spacer washers.
Capacity & Oil—10 qts. (dry), 9 qts. (refill). Use SAE #30 (above 30°F), #20-W (30° to 0°F), #10-W (temperatures below 0°F).

CLUTCH:—Long Model 29-A. Double plate dry disc type. No adjustment required for wear. See article in Clutch Section for relining and assembling directions.
Clutch Pedal Adjustment — Free movement of clutch pedal must be ¾-1¼".
Clutch Facings—Moulded type, 4 required, 6¼" I.D., 9¾" O.D., .130" thick.

STEERING: — Front Suspension — Conventional axle with Reverse-Elliott ends and semi-elliptic springs.
Kingpin Inclination—8° crosswise.
Caster—¾° **Camber**—1°
Toe In—¼" (⅛-3/16").

Steering Gear:—Ross Cam-and-Roller type.
See article in Mechanical Equipment Section for data.

BRAKES:—Service—Stewart-Warner mechanical four wheel type with transmission power unit application. Hand lever applies all four service brakes. See article in Brake Section for complete data.
Drum Diameter—16".
Lining—Moulded type. Width 2¼". Thickness .270" ('34), ¼" ('35). Length per wheel 38".
Clearance—.012" at heel and toe of each shoe in rear brakes, .009" at heel and toe of each shoe in front brakes.

Hand Brake Adjustment:—See Service Brakes.

Power Unit:—Stewart-Warner Transmission type mechanical power unit used. See article in Brake Section for complete data.

SERIAL NUMBER:—On plate on right side of frame at rear of right front spring rear shackle under fender. **First number (1934)**—(1240-A, 138" WB.) 3,110,001, (1240-A, 144" WB.) 3,530,001, (1248-A, 147" WB.) 3,560,001. **First number (1935)**—(1245, 138" WB.) 3,120,001, (1245, 144" WB.) 3,540,001, (1255, 147" WB.) 3,570,001.

ENGINE NUMBER:—Stamped on left side of left cylinder block below head at center.

ENGINE:—Twelve cylinder, 80° included angle Vee, 'L' head type. Cylinders cast Enbloc for each bank.
Bore—3½". **Stroke**—4".
Piston Displacement—462 cubic inches.
Rated Horsepower—58.8.
Developed Horsepower—175 at 3400 R.P.M.
Compression Ratio—6.0-1 (std.), 6.5-1 and 7.0-1 (optional). High compression heads are formed by milling off face of standard head to reduce combustion chamber.
Compression Pressure—115 lbs. at 350 R.P.M. or 80-85 lbs. at cranking speed (std. 6.0-1 head).
Vacuum Reading—Gauge should show steady reading of 18-20" with engine idling.

Pistons:—Bohn, Bohnalite aluminum alloy, Invar Strut, split skirt type. Replacement pistons furnished .002", .004", .010", .020" oversize. Piston length 4¼".
Weight—22.70 ozs. minimum, 22.82 ozs, maximum.
Removal—Pistons and rods removed from above.
Clearance—Top .019-.026", Bottom .000-.005" at right angles to bosses, .001-.007" across bosses. See Fitting new pistons.
Fitting New Pistons—Pistons should be snug on .0015" feeler and locked on .002" feeler.
Installing Pistons—Slot should be toward left on both banks (viewed from driver's seat).

Piston Rings:—Four rings per piston, three compression rings, one oil control ring, all above pin. Oil ring groove drilled radially with oil drain holes.

Ring	Width	End Gap	Side Clearance
Comp. All	.1235-1240"	.013-.018"	.001-.002"
Oil Cont.	.1860-.1865"	.013-.018"	.001-.002"

Piston Pin:—Diameter .8749-.8751". Length 2.750" ('34), 3.031-3.041" ('35). Pin floats in piston and rod. Pin hole in rod is bronze bushed.
Pin Fit in Piston—Thumb push fit with piston at 160°F.
Clearance in Rod Bushing—.0004-.0006".

Connecting Rod:—Weight, ⅛ oz. variation allowed in entire set. Length 9.936-9.939".
Crankpin Journal Diameter—2.2160-2.2165".
Lower Bearing—Centrifugally-cast, babbitt-lined type. No shims used.
Clearance—.001-.0025".. Sdieplay, .006-.010".
Adjustment—None. Replace rods. Do not file caps. Bearings .010" and .020" undersize furnished for service.

NOTE—Oil spray holes are drilled in both sides of connecting rod lower bearing upper half. Rods are installed at factory with chamfer in crank pin bore next to crankshaft cheek (rods mounted side by side).

Crankshaft:—Seven bearings. Integral counterweights.
Journal Diameters—2.49" ('34), 2½" ('35), all bearings.
Bearing Type—Steel or bronze backed, babbitt-lined type. No shims used.
Clearance—.0015-.003".
Adjustment—None. Replace bearings. Do not file caps.
End Thrust—Taken by front bearing. Endplay, .002-.004". Adjustable by adding or removing shims.

Camshaft:—Four bearings. Non-adjustable chain drive.
Bearing Type—Steel-backed, babbitt-lined.
Clearance—.002". Endplay, .003-.009".
Timing Chain—Whitney #CLG-206. Width 1½", Pitch ½", Length 26½" or 53 links.
Camshaft Setting—Sprockets are marked. Mesh chain with sprockets turned so that marks are adjacent and in line with a straightedge across the shaft centers.

Valves:—

	Head Diameter	Stem Diameter	Length
Intake	1 21/32	.3725-.3735"	4¾"
Exhaust	1 9/16	.3715-.3725"	4¾"

	Seat Angle	Lift '34	Lift '35	Stem Clearance
Intake	45°	.312"	.324"	.0015-.0025"
Exhaust	45°	.324"	.324"	.0025-.0035"

	Seat Angle	Lift	Stem Clearance
Intake	45°	.324"	.0015-.0025"
Exhaust	45°	.324"	.0025-.0035"

Tappet Clearance—None in service. See data below on hydraulic valve lifters.
Valve Springs—Install springs with small end up. Flat coil spring type dampener installed on all springs at top.

	Spring Pressure	Length '34	Length '35
Valve Closed	60-65 lbs.	2 1/16"	2 3/32"
Valve Open	120-128 lbs.	1¾"	1 25/32"

Valve Timing—See Camshaft Setting above.
Intake Valves—Open 19° BTDC. Close 69° ALDC.
Exhaust Valves—Open 56° BLDC. Close 28° ATDC.
To Check Valve Timing—Remove #1 intake hydraulic valve lifter, pull out plunger, remove spring, wash lifter assembly in gasoline to remove all oil, replace plunger, install lifter in bracket, check clearance between end of plunger and valve stem (valve closed—clearance will be about .070"). Insert sufficient feeler stock to take up all except .004" clearance, turn engine over with #11 piston on compression, stop when flywheel mark 'IN.OP.#1/' lines up with indicator on housing, #1 intake valve should begin to open at this point. Remove feeler stock, reassemble hydraulic valve lifter.
Motor Gauge—Weidenhoff Adapter #114, Rod #42.
Installing and Servicing Hydraulic Valve Lifters—See article in Equipment Section for complete data. Hydraulic valve lifters are interchangeable between 8 and 12 cylinder models except for plunger cap or plug. Short or thin caps are used on 12 cylinder models and a longer or thick cap on 8 cylinder models.

Lubrication:—Pressure. Gear type oil pump located in crankcase.
Normal Oil Pressure—40 lbs. at 40 M. P. H.
Oil Pressure Relief Valve—Located at oil pump. Adjustable by adding or removing spacing washers.
Capacity & Oil—14 qts. (dry), 12 qts. (refill). Use SAE #30 (above 30°F), #20-W (30° to 0°F), #10-W (temperatures below 0°F).

CLUTCH:—**Long Model 29-A.** Double plate dry disc type. No adjustment required for wear. See article in Clutch Section for relining and assembling directions.
Clutch Pedal Adjustment—Free movement of clutch pedal must be ¾-1¼".
Clutch Facings—Moulded type, 4 required, 6¼" I.D., 9¾" O.D., .130" thick.

STEERING:—**Front Suspension** — Conventional axle with Reverse-Elliott ends and semi-elliptic springs.
Kingpin Inclination—8° crosswise.
Caster—¾°. **Camber** 1°.
Toe In—¼" (⅛-3/16").
Steering Gear:—Ross Cam-and-Lever type. See article in Steering Section for adjustments.

BRAKES:—**Service**—Stewart-Warner mechanical four wheel type with transmission power unit application. Hand lever applies all four service brakes. See article in Brake Section for complete data.
Drum Diameter—16".
Lining—Moulded type. Width 2¼". Thickness .270" ('34), ¼" ('35). Length per wheel 38".
Clearance—.012" at heel and toe of each shoe in rear brakes, .009" at heel and toe of each shoe in front brakes.
Hand Brake Adjustment:—See Service Brakes.
Power Unit:—Stewart-Warner Transmission type mechanical power unit used. See article in Brake Section for complete data.

ENGINE NUMBER:—Stamped on left side of cylinder block below head at center of engine.

ENGINE SPECIFICATIONS:—8 cylinder, In Line, 'L' hd.
Bore—3½". **Stroke**—5".
Displacement—385 cubic inches.
Rated Horsepower—39.2 (AMA).
Developed Horsepower—150 at 3400 R.P.M.
Compression Ratio—6.4-1 Std. aluminum head, no optional ratios.
Compression Pressure—148 lbs. at 2500 R.P.M. or 75-80 lbs. at cranking speed.
Vacuum Reading—Gauge should show steady reading of 19-20" with engine idling.

PISTONS:—Bohn, Bohnalite aluminum alloy, Invar strut, split skirt type or Lynite aluminum alloy, "T" slot type with Anodic finish (special hard oxide bearing surface). **Length**—4¼".
Weight—22.71 ozs. (stripped).
Removal—Pistons and rods removed from above.
Clearance—Top .025" (Bohn), .035" (Lynite), Bottom .002". See Fitting New Pistons.

Replacement Pistons:—Pistons furnished in standard oversizes of .002", .004", .010", .020".

Fitting New Pistons:—Pistons should be snug on .0015" feeler and locked on .002" feeler.

Installing Pistons:—Slot should be toward left viewed from driver's seat.

PISTON RINGS:—Before Eng. No. 314480. Four rings per piston, one plain compression ring (top), two Perfect Circle #70 scraper rings (# 2 & 3), one Perfect Circle #85 oil control ring, all above pin. Oil ring groove drilled for oil drainage.

Ring	Width	End Gap	Side Clearance
Comp. (all)	.1235-.1240"	.013-.018"	.001-.002"
Oil Cont.	.1860-.1865"	.013-.018"	.001-.002"

PISTON RINGS:—After Eng. No. 314480. Four rings per piston, two compression (Perfect Circle #70), two oil control (Perfect Circle #85). Both oil ring grooves drilled for oil drainage.

Ring	Width	End Gap	Side Clearance
Compression	.1235"	.020-.025"	.001-.002"
Oil Control	.1545"	.013-.021"	.001-.002"

Pin hole in connecting rod is bronze bushed.

PISTON PIN:—Diameter .8749". Length 3.031".
Pin floats in piston and rod. Held by retaining rings.
Pin Fit in Piston—Thumb push fit at 70° F.
Pin Fit in Rod Bushing—.0004-.0006" clearance.

CONNECTING ROD:—Weight 34.82 ozs. **Length** 8.999".
Crankpin Journal Diameter—2.251-2.2515".
Lower Bearing—Centrifugally cast, babbitt-lined type. No shims used.
Clearance—.001-.0025". Sideplay .004-.006".

Bearing Adjustment:—None (no shims). Replace rods. Do not file caps.
NOTE—Oil spray holes in both sides of connecting rod lower bearing upper half.

CRANKSHAFT:—9 bearing. Integral counterweights.
Journal Diameters—2⅝" all bearings.
Bearing Type—Removable bronze-backed, babbitt-lined. No shims.
Clearance—.0015-.003".

Bearing Adjustment:—None (no shims). Replace bearings. Do not file caps.

End Thrust:—Taken by front bearing. Endplay .002-.004". Adjustable by adding or removing shims.

CAMSHAFT:—6 bearing. Non-adjustable chain drive.
Bearing Type—Steel-backed, babbitt-lined.
Clearance—.002". Endplay .003-.009".

Timing Chain:—Whitney #CL-206. Width 1½". Pitch ½". Length 25" or 50 links.

Camshaft Setting:—Sprockets are marked. Mesh chain with sprockets turned so that a straightedge across shaft centers splits the 'O' mark on the crankshaft sprocket and is midway between the two 'O' marks on the camshaft sprocket.
NOTE—Special puller tool necessary to install timing chain. Timing chain must be installed 'endless.'

VALVES:—	Head Diameter	Stem Diameter	Length
Intake	1 9/16"	.3725-.3735"	4¾"
Exhaust	1 9/16"	.3715-.3725"	4¾"

	Seat Angle	Lift	Stem Clear.
Intake	45°	.355"	.0015-.0025"
Exhaust	45°	.355"	.0025-.0035"

NOTE—Exhaust valve lift .343" on 1936 model.

Tappet Clearance—None in service. See data below on Hydraulic Valve Lifters.
See article in Mechanical Equipment Section for data.

Valve Springs:—	Spring Pressure	Spring Length
Valve Closed	60-65 lbs.	2 3/32"
Valve Open	120-128 lbs.	1 25/32"

Valve Lifters:—Hydraulic type providing automatic tappet take-up. See article in Equipment Section for complete data on servicing these units.
NOTE—Hydraulic lifters have been redesigned. Service instructions as given for previous types apply to the new type but new type lifters are not interchangeable in part or as a unit with previous lifters. Lifters used on eight and twelve cylinder engines not interchangeable (longer body used on eight). Cannot be adapted to twelve engine as previously (by changing plunger cap).
Installing Hydraulic Valve Lifters—Install this type lifter without oil. Oil in lifter will retard escape of air and delay quieting of lifter when engine is operated. Remove plunger from lifter body, wash out all oil with gasoline. Do not interchange plungers—they are selective fit in lifter bodies—this is important.

Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 5° ATDC. Close 45° ALDC.
Exhaust Valves—Open 40° BLDC. Close 12° ATDC.
To Check Valve Timing—Remove #1 intake hydraulic valve lifter, pull out plunger, remove spring, wash lifter assembly in gasoline, replace plunger, install lifter in bracket. Check clearance between end of plunger and valve stem (valve closed—clearance will be about .070"). Insert sufficient feeler stock to take up all except .010" clearance. Turn engine over until piston #1 is .0123" past top dead center, stop when flywheel mark 'IN.OP./1-8' lines up with indicator on housing. #1 intake valve should begin to open at this point. Remove feeler stock, re-assemble hydraulic valve lifter as directed above.
Motor Gauge—Weidenhoff #114 Adapter, #29 Rod.

LUBRICATION:—Pressure. Gear type oil pump located in crankcase.
Normal Oil Pressure—40 lbs. at 40 M.P.H. (1936), 53 M.P.H. (1937).

Oil Pressure Regulator:—Located at pump. Opens at 50 lbs. Adjustable by adding or removing spacer washers.

Oil temperature Regulator:—Harrison Radiator Co. type.

Crankcase Capacity:—9 qts. (refill). 10 qts. (dry).

CLUTCH:—Long Model 12CB-CL. Single plate, dry disc type. See article in Clutch Section for relining and assembling directions. **No adjustment for wear** required.
Facings—Moulded type, 2 required. Inside diameter 7". Outside diameter 12". Thickness .137".
Adjustment—Free movement of clutch pedal must be ¾-1¼". Screw adjustment provided at bell housing. Pedal should have free clearance at underside of toeboard.

Removal:—Remove transmission (see Transmission Section below), remove clutch housing, take out mounting screws in clutch cover mounting flange on flywheel.

TRANSMISSION:—Warner with Overdrive. Model AS1-T82A (1937-38). Constant mesh, synchro-mesh (second and high), sliding helical gear (low and reverse).
See article in Mechanical Equipment Section for data.

Removal:—Disconnect drive shaft at front universal, take out transmission mounting bolts, pull transmission straight back.

UNIVERSAL JOINTS:—Detroit Series 5350. Roller bearing type, 2 used.
See article in Mechanical Equipment Section for data.

REAR AXLE:—Own Make. Semi-floating, hypoid gear type with Hotchkiss drive.
Ratio—4.58-1.
Backlash—.002-.003". Shim adjustment.

STEERING:—Steering Gear—Ross Model 660. Cam-and-lever type. See article in Steering Section for adjustments.

Front Suspension:—Conventional 'I' beam section axle with Reverse-Elliott ends and semi-elliptic springs.
Kingpin Inclination—8° crosswise.
Caster (1936)—¾° plus or minus ¼° for axles with plain bearings, 1° plus or minus ¼° for axles with needle bearings. Spring seat on axle should tilt down at rear 4° 15' (axles with plain bearings), 4° (axles with needle bearings). Correct caster by inserting wedge shims between spring and spring pad on axle.
Caster (1937)—1° for all cars. Adjust in same manner.
Camber—1° (plus or minus ½°). Wheel felloe at top of wheel should be not more than 15/32" or less than 5/32" outside felloe at bottom. No adjustment provided.
Toe In—3/16" plus 0" or minus 1/16" (1936), ¼" (1937). Adjust in usual manner by loosening clamp bolts and turning tie rod.
Steering Geometry—Inner wheel turned 40°, outer wheel 30°.

BRAKES:—Service—Stewart-Warner mechanical four wheel type with vacuum power operation. Hand lever applies all four service brakes.
See article in Mechanical Equipment Section for data.
Drum Diameter—16".
Lining—Moulded type. Width 2¼". Thickness ¼". Length per wheel 38".
Clearance—.009" (front wheels), .012" (rear wheels), at heel and toe of each shoe.
Hand Brake Adjustment:—See Service Brakes.
Power Unit:—Bendix vacuum power unit.
See article in Mechanical Equipment Section for data

ENGINE NUMBER:—Stamped on left cylinder block below head at center of engine.

ENGINE SPECIFICATIONS:—12 cylinder, 80° included angle Vee, 'L' head type. Cylinders cast en bloc for each bank.
Bore—3½". **Stroke**—4".
Displacement—462 cubic inches.
Rated Horsepower—58.8 (AMA).
Developed Horsepower—185 at 3400 R.P.M.
Compression Ratio—6.4-1 Std. aluminum head. No. optional ratios.
Compression Pressure—140 lbs. at 2500 R.P.M. or 80-85 lbs. at cranking speed.
Vacuum Reading—Gauge should show steady reading of 19-20" with engine idling.

PISTONS:—Bohn, Bohnalite aluminum alloy, Invar strut, split skirt type or Lynite aluminum alloy, 'T' slot type with Anodic finish (special hard oxide bearing surface). **Length**—4¼".
Weight—22.70-22.82 ozs. (stripped).
Removal—Pistons and rods removed from above.
Clearance—Top .025" (Bohn), .035" (Lynite), Bottom .002". See Fitting New Pistons.

Replacement Pistons:—Pistons furnished in standard oversizes of .002", .004", .010", .020".

Fitting New Pistons:—Pistons should be snug on .0015" feeler and locked on .002" feeler.

Installing Pistons:—Slot should be toward left on both banks (viewed from driver's seat).

PISTON RINGS (1936):—Four rings per piston, three compression, one oil control, all above pin. Oil Ring groove drilled radially with oil drain holes.

Ring	Width	End Gap	Side Clearance
Comp. (all)	.1235-.1240"	.013-.018"	.001-.002"
Oil Cont.	.1860-.1865"	.013-.018"	.001-.002"

PISTON RINGS (1937-38):—Four rings per piston, two compression (one stepped ring, one plain), two oil control, all above pin. Both oil ring grooves drilled radially with oil drain holes.

Ring	Width	End Gap	Side Clearance
Compression	.1235"	.020-.025"	.001-.002"
Oil Control	.1545"	.013-.021"	.001-.002"

PISTON PIN:—Diameter—.8749-.8751".
Length—3.031-3.041".
Pin floats in piston and rod. Held by retaining rings. Pin hole in rod is bronze-bushed.

Pin Fit in Piston:—Thumb push fit at 70° F.

Pin Fit in Rod Bushing:—.0004-.0006" clearance.

CONNECTING ROD:—Weight—35.62 ounces.
Length—9.936-9.939" (center-to-center).
Crankpin Journal Diameter—2.126-2.1265".
Lower Bearing—Centrifugally-cast, babbitt-lined type. No shims used.
Clearance—.001-.0025". Sideplay .006-.009".

Bearing Adjustment:—None (no shims). Replace rods. Do not file caps. Bearings .010" and .020" undersize furnished for service.

NOTE—Oil spray holes are drilled in both sides of connecting rod lower bearing upper half. Rods are installed at factory with chamfer in crankpin bore next to crankshaft cheek (rods mounted side by side).

CRANKSHAFT:—7 bearing. Integral counterweights.
Journal Diameters—2½" all bearings.
Bearing Type—Removable bronze-backed, babbitt-lined. No shims used.
Clearance—.0015-.003".

Bearing Adjustment:—None (no shims). Replace bearings. Do not file caps.

End Thrust:—Taken by front bearing. Endplay .002-.004" Adjustable by adding or removing shims.

CAMSHAFT:—4 bearing. Non-adjustable chain drive.
Bearing Type—Steel-backed, babbitt-lined.
Clearance—.002". Endplay .003-.009".

Timing Chain:—Whitney CLG-206. Width 1½". Pitch ½". Length 26½" or 53 links.

Camshaft Setting:—Sprockets are marked. Mesh chain with sprockets turned so that marks are adjacent and in line with a straightedge across the shaft centers.

NOTE—Special puller tool necessary to install timing chain. Install timing chain 'endless.'

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1 21/32"	.3725-.3735"	4¾"
Exhaust	1 9/16"	.3715-.3725"	4¾"

	Seat Angle	Lift	Stem Clear.
Intake	45°	.324"	.0015-.0025"
Exhaust	45°	.324"	.0025-.0035"

Tappet Clearance—None in service. See data below on hydraulic valve lifters.

Valve Springs:—Install springs with small end up. Flat coil spring type dampener installed on all springs at top.

	Spring Pressure	Length
Valve Closed	60-65 lbs.	2 3/32"
Valve Open	120-128 lbs.	1 25/32"

Valve Lifters:—Hydraulic type, providing automatic tappet take-up. See article in Equipment Section for complete data on servicing these units.

NOTE—Hydraulic lifters have been redesigned. Service instructions as given for previous types apply to the new type but new type lifters are not interchangeable in part or as a unit with previous lifters. Lifters used on eight and twelve cylinder engines not interchangeable (longer body used on eight). Cannot be adapted to twelve engine as previously

Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 19° BTDC. Close 69° ALDC.
Exhaust Valves—Open 56° BLDC. Close 28° ATDC.
To Check Valve Timing—Remove #1 intake hydraulic valve lifter, pull out plunger, remove spring, wash lifter assembly in gasoline to remove all oil, replace plunger, install lifter in bracket, check clearance between end of plunger and valve stem (valve closed—clearance will be about .070"). Insert sufficient filler stock to take up all except .004" clearance, turn engine over with #11 piston on compression, stop when flywheel mark 'IN.OP.#1/' lines up with indicator on housing, #1 intake valve should begin to open at this point. Remove feeler stock, reassemble hydraulic valve lifter.
Motor Gauge—Weidenhoff #114 Adapter, #42 Rod. Piston position should be .1303" BTDC.

LUBRICATION:—Pressure. Gear type oil pump located in crankcase.

Normal Oil Pressure:—45 lbs. at 53 M.P.H.

Oil Pressure Relief Valve:—Located at oil pump. Operates at 50 lbs. Adjustable by adding or removing spacing washers.

Oil Temperature Regulator:—Harrison Radiator Co. type.

Crankcase Capacity:—11 qts. (refill).

CLUTCH:—Long Model 12CB-CL. Single plate, dry disc type. See article in Clutch Section for relining and assembling directions. No adjustment for wear required.
Facings—Moulded type, 2 required. Inside diameter 7". Outside diameter 12". Thickness .137".
Adjustment—Free movement of clutch pedal must be ¾-1¼". Screw adjustment provided at bell housing. Pedal must have free clearance at underside of toeboard.

Removal:—Remove transmission (see Transmission Section below), remove clutch housing, take out mounting screws in clutch cover mounting flange on flywheel.

TRANSMISSION:—Warner with Overdrive. Model AS1-T82A (1937-38). Constant mesh, synchro-mesh (second and high), sliding helical gear (low and reverse).
See article in Mechanical Equipment Section for data.

Removal:—Disconnect drive shaft at front universal, take out transmission mounting bolts, pull transmission straight back.

UNIVERSAL JOINTS:—Detroit Series 5350. Roller bearing type. 2 used.
See article in Mechanical Equipment Section for data.

REAR AXLE:—Own Make. Semi-floating, hypoid gear type with Hotchkiss drive.
Ratio—4.58-1.
Backlash—.002-.003". Shim adjustment.

STEERING:—Steering Gear—Ross Model 660. Cam-and-lever type. See article in Steering Section for adjustments.

Front Suspension:—Conventional axle with Reverse-Elliott ends and semi-elliptic springs.
Kingpin Inclination—8° crosswise.
Caster—¾° (1936), 1° (1937). Adjust by inserting wedge shims between spring and spring pad on axle.
Camber—1° (plus or minus ½°). Wheel felloe at top of wheel should be not more than 15/32" or less than 5/32" outside felloe at bottom. No adjustment provided.
Toe In—¼". Adjusted in usual manner by loosening clamp bolts and turning tie rod.
Steering Geometry—Inner wheel turned 40°, outer wheel 30°.

BRAKES:—Service—Stewart-Warner mechanical four wheel type with vacuum power operation. Hand lever applies all four service brakes.
See article in Mechanical Equipment Section for data.
Drum Diameter—16".
Lining—Moulded type. Width 2¼". Thickness ¼". Length per wheel 38".
Clearance—.009" (front wheels), .012" (rear wheels), at heel and toe of each shoe.

Hand Brake Adjustment:—See Service Brakes.

Power Unit:—Bendix vacuum power unit.
See article in Mechanical Equipment Section for data.

SERIAL NUMBER:—On right front door hinge pillar post.
First number each model as follows:

Six Model PC (1933)	1,759,001.
Deluxe Six Model PF (1934)	2,000,001.
Std. Six Model PF (1934)	1,859,001.
Spec. Six Model PG (1934)	1,020,001.
Deluxe Six Model PE (1934)	2,188,001.

ENGINE NUMBER:—Stamped on boss on left side of cylinder block between #1 and #2 cylinders.
NOTE—Letter 'A' following engine number indicates bore .020" larger than standard. Letter 'B' indicates main and connecting rod bearings .010" smaller than standard. Letters 'AB' indicate that bore and bearing sizes are as above. Letter 'C' indicates that connecting rod bearings outside diameter .005" larger than standard (bearings standard).

ENGINE SPECIFICATIONS:—Six cylinder, 'L' head type. Floating power engine mountings.
Bore—3⅛". Stroke—4⅛" (PC, PD), 4⅜" (PF, G, E).
Displacement—189.8 cu. ins. (PC, PD), 201.31 cu. ins. (PF, G, E).
Rated Horsepower—23.43.
Developed Horsepower—For each model as follows:
Models PC, PD—Std. 5.5-1 head—70 at 3600 R.P.M.
Models PC, PD—Opt. 6.5-1 head—76 at 3600 R.P.M.
Models PF, PG, PE—Std. 5.8-1 head—77 at 3600 R.P.M.
Models PF, PG, PE—Optl. 6.5-1 head—82 at 3600 R.P.M.
Compression Ratio—See above for std. and optl. ratios.
Compression Pressure—Approximately 95 lbs. 5.5-1 head), 100 lbs. (5.8-1 head), 110 lbs. 6.5-1 head) at cranking speed.
Vacuum Reading—Gauge should show steady reading of 16-18" at idling speed.

PISTONS:—Aluminum alloy, 'T' slot, Cam ground type. Pistons cannot be ground. Refinish cylinders to take standard oversize piston. Piston Length—3 11/16".
Weight—Held to ¼ oz. maximum variation.
Removal—Pistons and rods removed from above.
Clearance—.022" top. 0015" skirt. See Fitting Pistons.

Replacement Pistons:—Finished pistons furnished .003", .005", .010", .015", .020", .023", .025", .030", .040", .050", .060" oversize. Install same size piston in all cylinders to maintain balance.

Fitting New Pistons:—Use micrometer gauge to check piston diameter and cylinder bore or .0015" feeler between piston and cylinder wall on side opposite slot.

Installing Pistons:—Slot should be toward left or away from valves.

PISTON RINGS:—Two compression, one undercut oil wiper ring, one oil control ring per piston, all above pin. Lower ring grooves drilled radially with oil drain holes.

Ring	Width	End Gap	Side Clearance
Comp.	⅛"	.005-.010"	.003" Max.
Oil Wiper (#3)	⅛"	.007-.015"	.003" Max.
Oil Control	5/32"	.007-.015"	.003" Max.

PISTON PIN:—Diameter 55/64". **Length—2⅝".** Pin floats in piston and rod. Pin hole in rod is bronze-bushed. Pistons should be heated in boiling water to remove or install pins.
Pin Fit in Piston—Tight thumb push fit with piston heated to temperature of boiling water (212°F.).
Pin Fit in Rod Bushing—Tight thumb push fit at normal room temperature (70°F.).

CONNECTING ROD:—Length—8 1/16" (PC, PD '33), 7 15/16" (PF, G. E '34).
Weight—Held to ¼ oz. maximum variation.
Crankpin Journal Diameter—1 15/16".
Lower Bearing Type—Removable steel-backed, babbit-lined.
Clearance—.001-.00275". Sideplay .003-.009".
Adjustment:—None (no shims). Replace bearings. Do not file rods or caps. Install new bearings with small boss on bearing registering with groove in rod and cap.
Installing Rods:—Lower bearings offset. Install rods with widest half of bearing toward rear (cylinders #1, 3, 5) or toward front (cylinders #2, 4, 6). Oil hole in upper half of lower bearing must be toward camshaft on all rods.

CRANKSHAFT:—4 bearing. Integral counterweights.
Journal Diameters—2¼" all bearings.
Bearing Type—Removable, steel-backed, babbitt-lined.
Clearance—.001-.002".
Adjustment:—None (no shims). Replace bearings. Do not file bearing caps. *See Chrysler Shop Notes for Front Main Bearing Cap removal, and installation and adjustment of replacement bearings and bearing caps.*
End Thrust:—Taken by #4 rear main bearing. Endplay .003-.007".

CAMSHAFT:—4 bearing. Non-adjustable chain drive.
Bearing Type (PC, PD '33)—#1 steel-backed. babbitt-lined removable type. #2 3, 4 machined in crankcase.
Bearing Type (PF, G, E '34)—Steel-backed, babbitt-lined removable type except #4 which is machined in crankcase.
Clearance—.0015-.0025". Endplay .003-.005".
End Thrust—Taken by thrust plate at front bearing.
Timing Chain:—Morse. Width 1". Pitch .500". Length 24" or 48 links.
Camshaft Setting:—Sprockets are marked. Mesh chain with sprockets turned so that marks are adjacent and in line with a straightedge across the shaft centers. Install chain endless with camshaft sprocket off hub.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1 15/32"	11/32"	4 25/32"
Exhause	1 15/32"	11/32"	4 25/32"

NOTE—Valve length 4 11/16" for PC model.

	Seat Angle	Lift	Stem Clearance
Intake	45°	5/16"	.001-.003"
Exhaust	45°	5/16"	.003-.005"

See Chrysler Special Shop Notes for Exhaust valve seat insert removal and installation instructions.
Guide Inside Diameter (new)—.342-.343" (intake), .344-.345" (exhaust).
Tappet Clearance—.005" (intake—hot), .007" (exhaust—hot).

Valve Springs—	Pressure	Length
Valve Closed	34-38 lbs.	1¾"
Valve Open	77-85 lbs.	

Do not compress springs below 1 7/16".

Valve Timing

Intake Valves—Open 6° ATDC. Close 46° ALDC.
Exhaust Valves—Open 42° BLDC. Close 8° ATDC.
To Check Valve Timing—Set tappet clearance #6 intake valve at .011". Use regular timing gauge. This valve should open with piston .015" past top dead center. Reset tappet clearance at .005" (hot).
Motor Gauge—Weidenh ff Adapter #103, Rod #12.

LUBRICATION:—Pressure type. Oil pump located at
Oil Pressure—30-60 lbs. at normal driving speeds.
Oil Pressure Relief Valve—Models PC, PD '33—Located under plug on oil pump cover at right of engine. Not adjustable.
Oil Pressure Relief Valve—Models PF, G, E '34—Located under plug on left hand side of crankcase. Adjustable by replacing spring. Standard springs unpainted. Heavy spring (to increase oil pressure) painted green. Lighter spring (to decrease oil pressure) painted red.
Capacity and Oil—5 qts. Use SAE. #30 (summer), #20-W or 10-W (winter).

CLUTCH:—Borg and Beck Model 9A1 ('33), 9A3 ('34). Single plate, dry disc type. See article in Clutch Section for relining and assembling instructions.
Facings—Moulded type, 2 required. Thickness .133". Inside diameter 5¾". Outside diameter 9".
Adjustment—Adjust clutch pedal stopscrew at lower end of pedal at rear of shaft for highest possible position of the pedal without interference with the floor board. Pedal free movement must be 1¼" ('33), 1⅛" ('34). To adjust, loosen locknut and turn clutch release fork adjusting screw at side of clutch housing.

STEERING:—Steering Gear—Gemmer Worm-and-Sector type (PC, PD '33), Worm-and-Roller type (PF, PG, PE '34). See article in Steering Section for complete adjustment instructions.
Front Suspension (PC, PD '33; PG '34)—Conventional tubular section (PC, PD), 'I' beam section (PG) with Reverse Elliott ends and semi-elliptic springs.
Kingpin Inclination—9° crosswise.
Caster—1-3°. Adjusted by inserting wedge shims between spring and spring pad on axle.
Camber—¼-¾° No adjustment. Camber must be equal for both wheels.
Toe In—1/16". Adjusted in usual manner by loosening clamp bolts and rotating tie rod.
Front Suspension (PF, PE '34)—Independent linked parallelogram type with coil springs. See article in Steering Section for complete description and adjustment.
Kingpin Inclination—10° plus or minus ½° crosswise.
Caster—1½° (½-2½°).
Camber—½° (¼-1°).
Toe In—1/16"-⅛". Adjusted by changing length of each tie rod equally. Intermediate steering arm must point straight back with wheels turned straight ahead.

BRAKES:—Service—Lockheed Hydraulic, double anchor type. See article in Brake Section for complete adjustment instructions.
Drum Diameter—10".
Lining—Width 1½" (PC, PD '33; PF, PG '34), 2" (PE). Thickness 3/16". Length 15 25/32" per wheel.
Clearance—.012" toe, .006" heel for each shoe.

Hand Brake:—External type on drum at rear of transmission.
Adjustment—Place hand lever in released position. Remove locking wire and turn anchor adjusting screw so that clearance between lining and drum at this point is 1/16", replace locking wire. Turn adjusting nut at top of adjusting bolt so that clearance around drum is 1/16". Loosen locknut and turn nut on guide bolt, if necessary, to secure uniform clearance around drum.
Drum Diameter—6" (all models).
Lining—Width 2". Thickness 5/32". Length 18 13/32".

NOTE—Series PJ(E) do not have separate serial numbers. This series may be distinguished by letter 'E' inserted in engine number, thus: PJ-E-1001. This letter 'E' should not be confused with letters 'A', 'B', etc., following engine number.

ENGINE NUMBER:—First number PJ-1001 or PJ-E-1001 (see note above). Stamped on left side of cylinder block between #1 and 2 cylinders. Letter 'A' following engine number indicates that bore is .020" larger than standard. Letter 'B' indicates main and connecting rod bearings .010" smaller than standard. Letters 'AB' indicate bore and bearings as above and also that outside diameters of connecting rod bearings are .005" larger than standard. Letter 'C' indicates that connecting rod outside diameters are .005" larger than standard.

ENGINE:—Own. Six cylinder, 'L' head type. Floating Power engine mounting.
Bore—3⅛". Stroke—4⅜".
Piston Displacement—201.31 cubic inches.
Rated Horsepower—23.44.
Developed Horsepower—82 at 3600 R.P.M. (Series PJ), 65 at 3000 R.P.M. (Series PJE).
Compression Ratio—6.7-1. No optional ratios.
Compression Pressure—140-150 lbs. at 1000 R.P.M. or approximately 110-115 lbs. at cranking speed.
Vacuum Reading—Gauge should show steady reading of 16-18" with engine idling.

Pistons:—Aluminum alloy, 'T' slot, Cam ground type. Semi-finished pistons (head and ring grooves completely finished, skirt semi-finished) furnished for service where 'Cam' grinding equipment is available in two sizes: (1) standard to .023" oversize, (2) .025 to .050" oversize. If cam grinding equipment not available, use finished replacement pistons furnished .003", .005", .010", .015", .020", .023", .025", .030", .040", .050", .060" oversize and finish cylinder bores to provide correct clearance. Piston length — 3 11/16".
Weight—Maximum allowable variation ¼ oz.
Removal—Pistons and rods removed from above.
Clearance—.0015" at bottom.
Fitting New Pistons—Use micrometer to check piston diameter and cylinder bore. Measurement on piston made at bottom of skirt at right angles to piston pin (pin must be removed).
Installing Pistons—Slot to left (away from valves).

Piston Rngs:—Two undercut compression rings, two oil control rings per piston, all above pin, lower ring grooves drilled radially with oil drain holes. Rings furnished in same oversizes as pistons (except .023").

Ring	Width	End Gap	Side Clear.
Comp. (all)	⅛"	.007-.015"	.002"
Oil Cont. (all)	5/32"	.007-.015"	.002"

Piston Pin:—Diameter 55/64". Length 2⅝". Pin floats in piston and rod. Held by retaining rings. Piston can be heated in boiling water to remove or install pin. Pins furnished .003", .005, .008" oversize.
Pin Fit in Piston—Tight thumb push fit with piston at 120°F.
Pin Fit in Rod Bushing—Tight thumb push fit with piston at room temperature (70°F).

Connecting Rod:—Weight Maximum variation held to ¼ oz. Length 7 15/16".
Crankpin Journal Diameters—1 15/16".
Lower Bearing—Removable steel-backed, babbitt-lined type. No shims.
Clearance—.001-.00275". Sideplay .003-.009".
Adjustment—None. Replace bearings. Do not file rods or caps. Install new bearings with small boss registering with groove (both halves). Bearings furnished .010" undersize and standard size.
Installing Rods—Lower bearings are offset. Install rods with widest half of bearings toward rear of engine (#1, 3, 5) or toward front (#2, 4, 6). Oil hole in upper half of bearing must be toward camshaft side of engine on all rods.

Crankshaft:—4 bearing. Integral counterweights.
Journal Diameters—2¼" (all bearings).
Bearing Type—Removable steel-backed, babbitt-lined type.
Clearance—.001-.002".
Adjustment—None. Replace bearings. Do not file bearing caps. ***See Chrysler Shop Notes for Front Main Bearing Cap removal, Replacement Bearings, and installation and fitting of Replacement Bearing Caps.***
End Thrust—Taken by #4 (rear) bearing. Endplay .003-.007".

Camshaft:—4 bearing. Non-adjustable chain drive.
Bearing Type—Removable steel-backed, babbitt-lined type, except #4, which is machined in crankcase.
Clearance—.0015-.0025". Endplay .003-.005".
End Thrust—Taken by thrust plate at rear of the sprocket hub.
Timing Chain—Morse. Width 1". Pitch .500". Length 24" or 48 links.
Camshaft Setting—Sprockets are marked. Mesh chain with sprockets turned so that marks are adjacent and in line with a straightedge across the shaft centers. Install chain endless with camshaft sprocket off.

Valves:—

	Head Diameter	Steam Diam.	Length
All Valves	1 15/32"	.3405"	4 27/32"

	Seat Angle	Lift	Stem-to-Guide-Clr.
Intake	45°	5/16"	.001-.003"
Exhaust	45°	5/16"	.003-.005"

See Chrysler Special Shop Notes for Exhaust valve seat insert removal and installation instructions.
Installing New Guides—Use special tool to remove and install guides. Intake guides installed with tapered end up, exhaust guides with taper end down. Top of guide must be ⅞" below top of block. Finish ream new guides to inside diameter of .342-.343" (intake), .344-345" (exhaust) after installing.
Tappet Clearance—.006" Int., .008" Exh. with engine hot. Set exhaust clearance at .010" for sustained high speed driving. Adjustment accessible by removing housing cover under right front fender.
Valve Springs—Variable pitch type. Install springs with closer spaced coils at top. Do not compress spring to length of less than 1 7/16".

	Spring Pressure	Length
Valve Closed	34-38 lbs.	1¾"
Valve Open	77-83 lbs.	1 7/16"

Valve Timing—See Camshaft Setting (above).
Intake Valves—Open 6° ATDC. Close 46° ALDC.
Exhaust Valves—Open 42° BLDC. Close 8° ATDC.
To Check Valve Timing—Install regular timing gauge in timing plug hole over #6 piston, set tappet clearance #6 valves at .011" (intake), .012" (exhaust). Intake valve should open with piston .015" past top dead center, and exhaust valve close with piston .027" past top dead center. Reset tappet clearance at .006" (intake), .008" (exhaust) with engine hot.

Lubrication:—Pressure. Gear type oil pump located on right hand side of crankcase.
Normal Oil Pressure—30-60 lbs. at driving speeds.
Oil Pressure Relief Valve—Under plug on left hand side of crankcase. Operates at 40-45 lbs. Adjustable by changing spring. Standard springs unpainted. Heavy spring (to increase pressure) painted green. Lighter spring (to reduce pressure) painted red.
Capacity & Oil—5 qts. Use SAE. #30 (summer or #40 for sustained high speed or above 100°F), #20-W (winter 32° to 0°F), #10-W (0° to —15°F).

CLUTCH:—Borg & Beck. Single plate, dry disc type. No adjustment required for wear.
See article in Mechanical Equipment Section for data.
Clutch Pedal Adjustment—Clutch pedal should just clear underside of toeboard. Adjust by turning stopscrew located just above clutch pedal shaft. Free movement of clutch pedal must be 1 1/16". Adjust by loosening locknut and turning release fork rod adjusting nut (at clutch release fork).
Clutch Facings—Moulded Asbestos (flywheel side), Woven Asbestos (pressure plate side), one of each type required, 5⅝" I.D., 9¼" O.D., .133" thick.
NOTE—Mark clutch cover and flywheel before disassembling and reassemble in same position. Install driven plate assembly with mark 'Flywheel Side' toward flywheel (hub is offset). Use special gauge plate and adaptor to set up release levers when reassembling clutch. Release lever heights must be equal within .005".

STEERING:—Front Suspension—Conventional tubular front axle with Reverse-Elliott ends and semi-elliptic springs.
Kingpin Inclination—8½° crosswise.
Caster—2° (1½—2½°). Adjust by inserting wedge plates between springs and axle pads. Wedges available in ½, 1, 2° angles.
Camber—½° (¼—¾°). No adjustment provided. Axle may be bent cold not more than ½° to correct camber. Replace axle if out more than ½°.
Toe In—1/16". Adjust in usual manner by loosening tie rod end clamps and rotating tie rod.
Steering Gear:—Gemmer Model Worm-and-Roller type. See article in Steering Section for adjustmts.

BRAKES:—Service—Lockheed hydraulic, double anchar type. Hand lever applies brake at rear of transmission. See article in Brake Section for relining and complete adjustment procedure.
Wheel Cylinders—Diameters—Front wheel (front shoe 1¼", rear shoe 1⅜"), Rear wheel (front shoe 1⅛", rear shoe 1¼").
NOTE—Wheel cylinders marked 'R' for right brakes, 'L' for left brakes, and are not interchangeable.
Drum Diameter—10".
Lining—Moulded type. Width 2". Thickness 3/16". Length per wheel 19 13/16".
Clearance—.012" toe, .006" heel ,for each shoe.

Hand Brake:—External type on drum at rear of transmission.
Adjustment—With lever in released position, remove anchor screw locking wire, turn anchor screw so that clearance between lining and drum is 1/16", lock anchor screw with wire. Turn adjusting nut at top of adjusting bolt so that clearance around drum is 1/16". Loosen locknut and turn guide bolt, if necessary, to secure uniform clearance around drum.
Drum Diameter—6".
Lining—Width 2". Thickness 5/32". Length 18 13/32".

NOTE—The letter 'E' inserted in engine number, thus: P2-E-1001 indicates that engine is equipped with smaller carburetor and intake manifold and 3.7-1 ratio rear axle.

ENGINE NUMBER:—First number—P2-1001 (see note above). Stamped on left side of cylinder block between #1 and 2 cylinders. Letter 'A' following number indicates bore .020" larger than standard. 'B' indicates main and connecting rod bearings .010" smaller than standard. 'AB' indicates that bore and bearing sizes are as above. 'C' indicates main and connecting rod bearings standard, but outside diameter of connecting rod bearings .005" larger than standard.

ENGINE SPECIFICATIONS:—6 cylinder, 'L' head.
Bore—3⅛". **Stroke**—4⅜".
Displacement—201.31 cubic inches.
Rated Horsepower—23.44 (AMA).
Developed Horsepower—82 at 3600 R.P.M.
Compression Ratio—6.7-1 Std. cast-iron head. No optional ratios.
Compression Pressure—140-150 lbs. at 1000 R.P.M. or approximately 113 lbs. at cranking speed.
Vacuum Reading—Gauge should show steady reading of 16-18" with engine idling at 6 M.P.H.

PISTONS:—Aluminum alloy, 'T' slot, Cam ground type with anodized finish (special hard oxide formed on bearing surface). **Length**—3 11/16".
Weight—Held to two gram max. variation.
Removal—Pistons and rods removed from above.
Clearance—Top .022". Skirt .0005". Limits .0005-.001". See Fitting New Pistons.
Replacement Pistons:—Finished anodized pistons furnished in standard and .003", .005", .010", .015", .020", .023", .025", .030", .040", .050", .060" oversizes. Semi-finished pistons furnished: (1) standard to .023" oversize. (2) .025-.050" oversize, not interchangeable. Pistons should be slotted and then finished on cam grinding equipment.
Fitting New Pistons:—Micrometer gauge recommended. Check cylinder bore and piston diameter. Measurement on piston made at bottom of skirt at right angles to piston pin (pin must be removed).
Installing Pistons:—Slot should be at left or away from valves.

PISTON RINGS:—Two undercut compression rings, two oil control rings per piston, all above pin. Lower ring groove drilled with oil drain holes.

Ring	Width	End Gap	Side Clearance
Comp (all)	⅛"	.007-.015"	.002-.003"
Oil (both)	5/32"	.007-.015"	.002-.003"

Replacement Rings:—Furnished in standard and .003" .010", .020", .030", .040", .050", .060" oversizes.
NOTE—Install compression rings with step down.

PISTON PIN:—**Diameter** 55/64". **Length** 2⅝". Pin floats in piston and rod. Held by retaining rings. Pin hole in rod is bronze-bushed.
NOTE—Heat piston in boiling water to remove or install pins.
Pin Fit in Piston—Tight thumb push fit with piston heated to 130° F.
Pin Fit in Rod Bushing—Tight thumb push fit with piston and rod at 70° F.
Replacement Pins:—Pins furnished in standard and .003", .005", .008" oversizes. Ream rod bushing and pin holes in piston bosses for correct fit.

CONNECTING ROD:—**Weight**—All rods held to ¼ oz. maximum variation. **Length**—7 15/16".
Crankpin Journal Diameter—1 15/16".
Lower Bearing—Steel-backed, copper-lead lined, interchangeable. Furnished standard and .010" undersize.
Clearance—.001-.003". Sideplay .0055-0115".
Bearing Adjustment—None (no shims). Replace bearings. Do not file rods or caps. Install new bearings so small bosses engage grooves in rod and cap.
Installing Rods:—Lower bearings are offset. Install rods with widest half of bearing toward rear (#1, 3, 5) and toward front (#2, 4, 6). Oil hole in lower bearing upper half toward camshaft on all rods.

CRANKSHAFT—4 bearing. Integral counterweights.
Journal Diameters—2¼" (all bearings).
Bearing Type—Removable steel-backed, babbitt-lined (#1 and 4), copper-lined or cadmium-nickel (#2 and 3). Furnished standard & .010" undersize.
Clearance—(#1 & 4) .001-.002". (#2 & 3) .0015-.0025"
Bearing Adjustment:—None (no shims). Replace bearings. Do not file caps. *See Chrysler Shop Notes for Front Main Bearing Cap removal, and installation and fitting of replacement bearing caps.*
End Thrust:—Taken by flange faces on rear (#4) bearing. Endplay .003-.007".

CAMSHAFT:—4 bearing. Non-adjustable chain drive.
Journal Diameters—#1, 2"; #2, 1 31/32"; #3, 1 15/16"; #4, 1¼".
Bearing Type—Removable steel-backed, babbitt-lined (except #4 machined in crankcase).
Clearance—.001-.003" (#1), .0015-.0035" (all others).
NOTE—New bearings require no line-reaming.
End Thrust:—Taken by thrust plate at rear of sprocket hub. Endplay .002-.006".
Timing Chain:—Morse. Width 1". Pitch .500". Length 24" or 48 links.
Camshaft Setting:—Sprockets are marked. Mesh chain with sprockets turned so that 'O' marks are adjacent and in line with a straightedge across shaft centers. Install chain endless.
NOTE—Engine must be supported under front end of oil pan and front engine support removed for work on timing chain and camshaft.

VALVES:—

	Head Diameter	Stem Diameter	Length
All valves	1 15/32"	.340-.341"	4 25/32"

	Seat Angle	Lift	Stem Clearance
Intake	45°	5/16"	.001-.003"
Exhaust	45°	5/16"	.003-.005"

See Chrysler Special Shop Notes for Exhaust valve seat insert removal and installation instructions.
Tappet Clearance—.006" Int., .008" Exh. (hot). .010" Exh. recommended for sustained high speed.
Valve Guides:—Use special tool to remove and install guides. Insert guides with taper end up (intake) and down (exhaust). Top of guide must be ⅞" below top of block. After installing finish ream new guides to give correct stem clearance.
Valve Springs:—Variable pitch type. Install springs with close coil at top. Do not compress springs to over all length of less than 1⅜".

	Spring Pressure	Spring Length
Valve Closed	34-38 lbs.	1¾"
Valve Open	77-83 lbs.	1 7/16"

Valve Lifters:—Mushroom type. Ream guides to take following oversizes: .001", .008", .030", .060".
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 6° ATDC. Close 46° ALDC.
Exhaust Valves—Open 42° BLDC. Close 8° ATDC.
To Check Valve Timing—Install regular timing gauge in timing plug hole over #6 piston, set tappet clearance #6 valves at .011" (intake), .012" (exhaust). Intake valve should open with piston .015" past top dead center, and exhaust valve close with piston .027" past top dead center. Reset tappet clearance at .006 (intake), .008" (exhaust) with eng. hot.
Motor Gauge—Weidenhoff Adapter #103, Rod #12.

LUBRICATION:—Pressure. Gear type oil pump located at right of crankcase.
NOTE—Ignition timing should be checked whenever oil pump is installed in engine.
Normal Oil Pressure:—30-40 lbs. at 30 M.P.H.
Oil Pressure Relief Valve:—Under plug on left hand side of crankcase. Operates at 40 lbs. Adjustable by changing spring. Standard spring unpainted. Heavy spring (to increase pressure) painted green. Lighter spring (to decrease pressure) painted red.
Crankcase Capacity:—5 qts. (refill).

CLUTCH:—**Borg & Beck Model 9A6.** Single plate, dry disc type. See article in Clutch Section for data.
Facings—Woven (pressure plate side), molded (flywheel side), 2 required. Inside Diam. 5⅝". Outside Diam. 9¼". Thickness .133".
Adjustment—Clutch pedal should just clear under side of toe board with clutch engaged. To adjust, turn stopscrew located just above clutch pedal shaft. Free movement of pedal should be 1 1/16". To adjust, loosen locknut and turn adjusting nut (clevis) on clutch fork adjusting rod.
Removal—Disconnect clutch pedal linkage, remove fork pivot screw, take out clutch fork. Remove transmission (release bearing and spring are withdrawn with transmission), remove clutch housing pan, prick punch clutch cover and flywheel (install in same position to maintain balance), take out clutch mounting bolts, turning all bolts out evenly to release spring tension and avoid distortion of clutch cover. Remove clutch from below. Use pilot studs when removing and installing transmission to avoid springing clutch plate.
Automatic Clutch:—See article in Clutch Section.

STEERING:—**Steering Gear:** Gemmer Model Worm-and-Roller type. See article in Steering Section.
Front Suspension:—Conventional tubular section front axle with Reverse-Elliott ends and semi-elliptic springs.
Kingpin Inclination—9½° crosswise. Limits 9-10°.
Caster—2° (1½-2½°). Adjust by inserting wedge plates between springs and axle pads. Wedges available in ½, 1, 2° angles.
Camber—½° (¼-¾°). No adjustment, Replace tubular axle if camber is out more than ½°.
Toe In—0-⅛". Adjust in usual manner by loosening tie rod end clamps and rotating tie rod.

BRAKES:—**Service**—Lockheed Hydraulic, double anchor type. Hand lever applies brake at rear of transmission or rear wheel service brakes (special equipment). See article in Brake Section.
Wheel Cylinders—Diameters, Front Wheel (Front end 1¼", Rear end 1⅜"). Rear Wheel (Front end 1⅛", Rear end 1¼").
NOTE—Wheel cylinders marked 'R' right side of car, 'L' left side of car. Not interchangeable.
Drum Diameter—10".
Lining—Moulded type. Width 2". Thickness 13/64". Length per wheel 19 13/16".
Clearance—.012" toe, .006" heel for each shoe.
Hand Brake:—External type on drum at rear of transmission. See Service Brake (above) for cars with rear wheel hand brake.
Adjustment—With lever in released position, remove anchor screw locking wire, turn anchor screw so that clearance between lining and drum is 1/16", lock anchor screw with wire. Adjust brake band guide bolt nut to give 1/16" clearance (as above) for lower portion of band, secure with locknut. Finally, adjust brake adjusting bolt nut to give 1/16" clearance (as above), making sure that groove in bolt nut is lined up with ridge lockwasher.
Drum Diameter—6".
Lining—Width 2". Thickness 5/32". Length 18 13/32".
NOTE—Clearance at anchor and saddle .005" max.

NOTE—The letter 'E' inserted in engine number, thus: P4-E-1001 indicates that engine is equipped with smaller carburetor and intake manifold and 3.7-1 ratio rear axle.

ENGINE NUMBER:—First number—P-4-1001. Stamped on left side of block between #1 and #2 cylinders. *See Chrysler Shop Notes for engine number lettering data (denoting special bore and bearing sizes).*

ENGINE SPECIFICATIONS:—6 cylinder, 'L' head.
Bore—3⅛". **Stroke**—4⅜".
Displacement—201.31 cubic inches.
Rated Horsepower—23.44 (AMA).
Developed Horsepower—82 at 3600 R.P.M.
Compression Ratio—6.7-1 Std. cast-iron head.
Compression Pressure—140-150 lbs. at 1000 R.P.M. or approximately 113 lbs. at cranking speed.
Vacuum Reading—Steady reading of 18-21" with engine idling at 6 M.P.H.

PISTONS:—Aluminum alloy, U-slot, cam ground type with anodized finish. **Length**—3 11/16".
Weight—14.43 ozs. (plus or minus 2 grams).
Removal—Pistons and rods removed from above.
Clearance—Top .022". Skirt .0005". Limits .0005-.001".
Replacement Pistons:—Finished pistons furnished standard and .003", .005", .010", .015", .023" .025", .030", .040", .050", .060" oversizes. Semi-finished pistons furnished (1) standard to .023" oversize, (2) .025-.050" oversize, not interchangeable. Pistons should be slotted, then cam ground.
Fitting New Pistons:—Check piston (across pin support ribs at bottom of skirt) and cylinder bore with micrometer gauge. Piston should pass through bore with slight drag (70° F), with pin removed.
Installing Pistons:—Slot to left, away from valves.

PISTON RINGS:—2 undercut compression, 2 oil control rings per piston, all above pin. Ten ⅛" oil drain holes #3 groove, five in #4 groove.

Ring	Width	End Gap	Side Clearance
Compression	⅛"	.007-.015"	.0015-.003"
Oil Control	5/32"	.007-.015"	.0015-.003"

Replacement Rings:—Furnished standard and .003", .005", .010", .015", .020", .025", .030", .040", .050", .060" oversizes.
NOTE—Install compression rings with step down.

PISTON PIN:—**Diameter** 55/64". **Length**—2⅝". Floating type. Pin hole in rod bronze bushed.
Pin Fit in Piston—Thumb push fit at 130° F.
Pin Fit in Rod Bushing—Thumb push fit at 70° F.
Replacement Pins:—Furnished standard and .003", .005", .008" oversize. Ream bushing and pin hole to size.

CONNECTING ROD:—**Weight**—31.0 ounces.
Length—7 15/16".
Crankpin Journal Diameter—1 15/16".
Lower Bearing—Steel-backed, babbitt-lined, interchangeable. Furnished standard and .0015", .010" undersize.
Clearance—.0005-.0025". **Sideplay**—.0055-.0115".
Bearing Adjustment:—None. Install new bearings with bosses engaging grooves in rod and cap.
Installing Rods:—Lower bearings offset. Install wide portion to rear on #1, 3, 5, to front on #2, 4, 6. Oil hole in lower bearing upper half toward valves.

CRANKSHAFT:—4 bearing. Integral counterweights.
Journal Diameters—2¼" (all bearings).
Bearing Type—Removable steel-backed, babbitt-lined. Furnished stand. and .0015", .010" undersize.
Clearance—.001-.002".
Bearing Adjustment:—*See Chrysler Shop Notes for Front Main Bearing Cap removed, adjustment directions, and Replacement Bearing Cap data.*
End Thrust:—Taken by flange faces on rear (#4) bearing. **Endplay**—.003-.007".

CAMSHAFT:—4 bearing. Non-adjustable chain drive.
Journal Diameters—#1, 2"; #2, 1 31/32"; #3, 1 15/16"; #4, 1¼".
Bearing Type—Removable steel-backed, babbitt-lined (except #4 machined in crankcase).
Clearance—.0015-.0035".
End Thrust:—Taken by thrust plate at rear of camshaft sprocket hub. **Endplay**—.002-.006".
Timing Chain:—Morse. Width 1". Pitch .500". Length 24" or 48 links.
Camshaft Setting:—Mesh chain with sprockets turned so that '0' marks are adjacent and in line with a straightedge across shaft centers.

VALVES:—

	Head Diameter	Stem Diameter	Length
All valves	1 15/32"	.340-.341"	4 25/32"

	Seat Angle	Lift	Stem Clearance
Intake	45°	5/16"	.001-.003"
Exhaust	45°	5/16"	.003-.005"

See Chrysler Special Shop Notes for Exhaust valve seat insert removal and installation instructions.
Tappet Clearance—.006" Int., .008" Exh. (hot). Remove front wheel and wheel housing to adjust.
Valve Guides:—Guides must be ⅞" below top of block. Ream guides after installing (.342-.343" Int., .344-.345" Exh.).
Valve Springs:—1⅜" limit of compression.

	Spring Pressure	Spring Length
Valve Closed	34-38 lbs.	1¾"
Valve Open	77-83 lbs.	1 7/16"

Valve Lifters:—Mushroom type. Ream guides to take following oversizes: .001", .008", .030", .060".

VALVE TIMING:—See Camshaft Setting above.
Intake Valves—Open 6° ATDC. Close 46° ALDC.
Exhaust Valves—Open 42° BLDC. Close 8° ATDC.
To Check Valve Timing:—Install timing gauge in hole over #6 piston, set intake valve at .011" (cold). Valve should open with piston .015" past top dead center. Reset tappet clearance .006" (hot).
Motor Gauge—Weidenhoff Adapter #103. Rod #12.

LUBRICATION:—Gear type oil pump on rt. of engine.
NOTE—Check ignition timing whenever oil pump installed on engine.
Normal Oil Pressure:—30-45 lbs. at 30 M.P.H.
Oil Pressure Relief Valve:—Under plug on left side of crankcase. Operates at 40-50 lbs. Adjustable. Heavy (green) spring to increase pressure, lighter (red) spring to decrease pressure.
Crankcase Capacity:—5 quarts (refill).

CLUTCH:—**Borg & Beck Mod. 9A6.** Mod. #869 stamped on cover. Single plate, dry disc type.
See article in Mechanical Equipment Section for data.
Facings—Moulded (flywheel side), woven (pressure plate side). 2 required. I.D. 5⅝". O.D. 9¼". Thickness .133".
Adjustment—Adjust stopscrew (just above clutch pedal shaft) so that pedal arm just clears floor board. Free movement of pedal should be 1 1/16" (adjust by turning release fork rod adjusting nut).
Removal:—Remove floor board, remove transmission (see Transmission Removal below), remove housing under-pan, mark cover and flywheel, remove cover bolts evenly, remove assembly from below.

TRANSMISSION:—**Own**—All helical gear type with synchronizing shift on second and high gears.
See article in Mechanical Equipment Section for data.
Removal:—Disconnect front and rear U-joints, disconnect hand brake, remove nuts from studs at clutch housing, disconnect release fork pull-back spring, pull release fork out of clutch housing, remove transmission cover assembly, remove unit with two pilot studs in upper stud holes.
NOTE—Run-out of clutch housing .003" maximum.

UNIVERSAL JOINTS:—**Detroit Universal** Series 4200. Ball and trunnion type with roller bearings. 2 used.
NOTE—Three U-joints used on 7 pass. sedan.
See article in Mechanical Equipment Section for data.
Propeller Shaft Center Bearing:—Used on 7 Pass. models. *See Chrysler Shop Notes for data.*

REAR AXLE:—**Own**—Semi-floating, hypoid gear type with Hotchkiss drive.
See article in Mechanical Equipment Section for data.
Ratio—P-3 std. 3.9-1, optl. 3.73-1.
P-3, 4 (5.25x20" tires), P-4 (7 pass.) 4.3-1.
P-4 (5 pass.) 4.1-1, (coupe) 3.9-1.
Backlash—.006-.010". Shim adjustment.
Removal:—Remove axle shaft nut, hub and drum assembly (use hub puller, do not hammer out or bearing damage may result), disconnect brake line at wheel cylinder, remove backing plate (with oil seal). Use shaft puller to remove axle shaft and bearing. With axle shafts removed, differential carrier may be removed by disconnecting rear U-joint at flange and removing housing capscrews.
Wheel Bearing Adjustment—Controlled by shims between brake backing plates and flanged ends of housing. Remove brake backing plates (see above) and add or remove shims to give proper clearance.
Endplay—.003-.008".
NOTE—Shims supplied .010", .0125", .030" thick.

SHOCK ABSORBERS:—**Delco**—Model 1162-U (front), 1163-U (rear). Direct acting, hydraulic type.
See article in Mechanical Equipment Section for data.

STEERING:—**Steering Gear**—Chrysler (Gemmer design Model 300). Worm-and-Roller type.
See article in Mechanical Equipment Section for data.
Front Suspension:—Conventional tubular section axle, Reverse-Elliott ends, semi-elliptic springs.
Kingpin Inclination—4½-5½° crosswise.
Caster—2° (1-3°). Adjust by inserting wedge shims between spring & axle pad. ½° & 2° wedges supplied.
Camber—½° (¼-¾°). No adjustment.
Toe In—1/16" (0-⅛"). Adjust by turning tie rod.
Steering Geometry—Outer wheel turned 20°. Inner wheel turned 22°50'. 22°20' (7 pass.).

BRAKES:—**Service**—Lockheed hydraulic, double anchor type. Hand brake at rear of transmission.
See article in Mechanical Equipment Section for data.
Wheel Cylinders—Stepped or two-stage bore type:
Front Wheel—Front cyl. 1¼", Rear 1⅜".
Rear Wheel—Front cyl. 1⅛", Rear 1¼".
Drum Diameter:—10".
Lining—Moulded. Width 2". Thickness .200". Length (Rear wh. rear shoe) 7 25/64", (all others) 9 29/32".
Clearance—.012" toe, .006" heel for each shoe.
Braking Power—55% front wheels, 45% rear.
Hand Brake:—On drum at rear of transmission.
Adjustment—Fully release hand brake lever. Remove anchor screw locking wire (left side), adjust anchor screw for .025" clearance between band and drum, set anchor screw with lock wire. Free large adjusting bolt nut (upper end of band), loosen locknut, adjust guide bolt nut to .025" clearance between band and drum, set with locknut. Tighten adjusting bolt nut until tension on either end of guide bolt is just relieved (groove in nut must align with ridge in lockwasher).
Drum Diameter—6".
Lining—Width 2". Thickness 5/32". Length 16 15/16".
NOTE—Clearance at anchor and saddle .005" max.

SERIAL NUMBER:—On right front door hinge pillar post. First number as follows:

	Detroit	Los Angeles	Evansville	Canada
P-5	1,240,001	3,105,000	9,097,601	9,381,161
P-6	10,470,001	3,206,001	20,001,001	9,349,566

ENGINE NUMBER:—First number P-6-1001. Stamped on left side of block between #1 and #2 cylinders. *See Chrysler Special Shop Notes for engine number lettering data (for special bore and bearing sizes).*

ENGINE SPECIFICATIONS:—6 cylinder, 'L' head.
Bore—3⅛". **Stroke**—4⅜".
Displacement—201.3 cubic inches.
Rated Horsepower—23.44 (A.M.A.).
Developed Horsepower—82 HP. (std. 6.7-1 head), 86 HP. (optl. 7.0-1 head) at 3600 R.P.M.
Compression Ratio & Pressure—As follows:

Ratio	Pressure at 1000 RPM.	At 100 RPM.
6.7-1 Std. C.I. head	140-150 lbs.	Approx. 113 lbs.
7.0-1 Optl. Al. head	150-160 lbs.	Approx. 117 lbs.

Vacuum Reading—Steady 18-21" idling at 6 MPH.

PISTONS:—Aluminum alloy, U-slot, cam ground type anodized finish. **Length** 3 11/16". **Weight** 14.56 oz.
Removal—Pistons and rods removed from above.
Clearance—Top .022". See Fitting New Pistons.
Replacement Pistons:—*See Chrysler Shop Notes.*
Fitting New Pistons:—Check piston size with micrometer at right angles to pin bosses at bottom of skirt. Fit piston with slight drag using .0005-.001" feeler between piston and cylinder wall. Piston should float through cylinder with feeler removed.
Installing Pistons:—Slot away from camshaft.

PISTON RINGS:—2 undercut compression, 2 slotted oil rings per piston, above pin.

Ring	Width	End Gap	Side Clearance
Compression	⅛"	.007-.015"	.0015-.003"
Oil Control	5/32"	.007-.015"	.0015-.003"

Replacement Rings:—Furnished Std. and .005", .010", .015", .020", .025", .030", .040", .050", .060" oversize.

PISTON PIN:—**Diameter**—55/64". **Length**—2⅝". Floating type. Pin hole in rod bronze bushed.
Pin Fit in Piston—Thumb push fit with piston heated to 100°F.
Pin Fit in Rod Bushing—Thumb push fit at 70°F.
Replacement Pins:—Furnished std. & .003", .005",. 008" oversize. Ream bushing and pin hole to size.

CONNECTING ROD:—**Weight** 29.13 oz. **Length** 7 15/16".
Crankpin Journal Diameter—1 15/16".
Lower Bearing—Removable steel-backed, babbitt-lined. Furnished std. & .002", .010", .012" undersize. **Clearance**—.0005-.0025". **Sideplay**—.0055-.0115".
Bearing Adjustment:—None. Install new bearings with bosses engaging grooves in rod and cap.
Installing Rods:—Install rods with wide portion of bearing to rear on #1, 3, 5, to front on #2, 4, 6. Oil spit hole to camshaft (all rods).

CRANKSHAFT:—4 bearing type, 7 counterweights.
Journal Diameters—2¼" all bearings.
Bearing Type—Steel-backed, babbitt-lined.
Clearance—.001-.002".
Bearing Adjustment:—*See Chrysler Shop Notes for Front Main Bearing Cap Removal, replacement bearings and bearing caps, adjustment directions, and Crankshaft Oil Seals.*
End Thrust:—Taken by flange faces on rear (#4) bearing. **Endplay**—.003-.007".

CAMSHAFT:—4 bearing. Non-adjustable chain drive.
Journal Diameters—#1, 2"; #2, 1 31/32"; #3, 1 15/16"; #4, 1¼".
Bearing Type—Removable steel-backed babbitt-lined bushings (except #4 machined in block).
Clearance—.001-.003" (#1), .0015-.0035" (all others).
NOTE—Replacement bushings finish reamed.
End Thrust:—Taken by thrust plate behind camshaft sprocket hub. **Endplay**—.002-.006".
Timing Chain:—Morse #1866 (restricted bend). Width 1". Pitch .500". Length 24" or 48 links.
See Chrysler Special Shop Notes for front end removal for work on timing chain.
Camshaft Setting:—Mesh chain with sprockets turned so that '0' marks are adjacent and in line with a straightedge across the shaft centers.

VALVES:—

	Head Diameter	Stem Diameter	Length
All valves	1 15/32"	.340-.341"	4 25/32"

	Seat Angle	Lift	Stem Clearance
Intake	45°	5/16"	.001-.003"
Exhaust	45°	5/16"	.003-.005"

See Chrysler Special Shop Notes for Exhaust valve seat insert removal and installation instructions.
Tappet Clearance—.006" Int., .008" Exh. (hot). .010" Exh. setting recommended for sustained high speed driving. Valves accessible by removing right front wheel and wheel housing panel.
Valve Guides:—Install with round end up to ⅞" below top of block. Finish ream guides after installing to .342-.343" Int., .344-.345 Exh.
Valve Springs:—Free length approx. 2 3/32". Limit of compression 1 9/32".

Spring Pressure	Length
Valve Closed 34-38 lbs.	1 3/4"
Valve Open 77-83 lbs.	1 7/16"

Valve Lifters:—Mushroom type. Ream guides from above for following oversizes: .001", .008", .030", .060".
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 6° ATDC. Close 46° ALDC.
Exhaust Valves—Open 42° BLDC. Close 8° ATDC.
To Check Timing—Set tappet clearance #6 intake valve at .011". This valve should open with piston 6° (.0153") past top dead center when 6° ATDC. mark on crankshaft pulley at front of engine lines with pointer. Reset tappet cl. at .006" (hot).
Motor Gauge—Weidenhoff Adapter #103, Rod #12.

LUBRICATION:—Gear type oil pump on right of engine.
Normal Oil Pressure:—30-45 lbs. at 30 M.P.H.
Oil Pressure Relief Valve:—Under plug on left side of engine. Operates at 40 lbs. Adjustable. Change to heavy (green) spring to increase pressure, light (red) spring to decrease.
Crankcase Capacity:—5 quarts (refill).

COOLING SYSTEM:—**Water Pump**—Centrifugal, belt-driven, packless type.
See article in Mechanical Equipment Section.
Removal—With water drained and fan belt removed, remove fan blades and pulley (attached by 4 capscrews), disconnect pump hoses, remove nuts from pump mounting studs and lift out.
Thermostat:—Bishop & Babcock. In outlet on hd.
Setting—Start to open 150-155°F. Fully open 176°F.
Water Capacity:—14 quarts.
Drain Valves:—At lower left corner of radiator and on left side of block in front of distributor.

CLUTCH:—**Borg & Beck Model 9A6, 11A6 (P-5 Taxi).** Model #918, 917 (Taxi) stamped on cover. Single plate, dry disc type. New pressure plate oil baffle used. Spiral grooved type facings used on 11A6
See article in Mechanical Equipment Section for data.
Facings—Molded-woven (spiral grooved—Taxi only), 2 required. .133", ⅛" (Taxi) thick. I.D. 5⅝", 6½" (Taxi). O.D. 9¼", 11" (Taxi).
Adjustment—Adjust stopscrew (to rear of pedal) so that pedal arm just clears floor board. Pedal free movement must be 1 1/16". Adjusting nut provided on fork rod next to release fork.
Removal:—Remove transmission (see following), remove clutch housing underpan, mark cover and flywheel, remove cover bolts evenly, take out assembly from below.

TRANSMISSION:—**Own Make.** All helical gear type with synchro-mesh on second and high speeds.
See article in Mechanical Equipment Section for data.
Removal:—Remove floor boards, battery cable, disconnect front and rear universals (see Propeller Shaft Center Bearing below for 7 pass. sedan), free hand brake cable at clevis. Take off nuts on mounting studs, disconnect clutch release fork pull-back spring, free clevis pin on release fork rod, remove transmission cover with gear-shifter assembly and mounting stud nuts. Install two pilot studs and withdraw transmission.

UNIVERSAL JOINTS:—**Detroit-Universal.** Series 4200. Ball and trunnion type with roller bearings. 2 used. NOTE—Three universals used on 7 pass. sedan.
See article in Mechanical Equipment Section.
Propeller Shaft Center Bearing:—Used on 7 Pass. models. *See Chrysler Shop Notes for data.*

REAR AXLE:—**Own make.** Semi-floating, hypoid gear type with Hotchkiss drive.
See article in Mechanical Equipment Section for data.
Ratio—3.54-1 (P-5 Econ.). 3.73-1 (P-5 optl., P-6 Econ.). 3.9-1 (P-5 std., P-6 Coupe). 4.1-1 (P-6 Sedan). 4.3-1 (P-5,6 with 18" or 20" tires; P-6 7 pass.).
Backlash—.006-.010". Screw adjustment.
Removal:—Remove wheel, hub, and drum assembly (using screw type hub puller). Place block under brake pedal, disconnect brake line, remove backing plate and oil seal, pull axle shaft and bearing (Tool C-158). With shafts removed, carrier may be removed by disconnecting rear universal at flange, and removing housing capscrews.
Wheel Bearing Adjustment—Controlled by shims at flanged ends of axle housing. With wheel and hub removed measure endplay with dial indicator. To adjust remove backing plate (see above) and add or remove shims (equally at both sides) to proper clearance. **Endplay**—.003-.008".

SHOCK ABSORBERS:—**Delco**—Model 1162-U (front), 1163-U (rear). Direct acting, hydraulic type.
See article in Mechanical Equipment Section.

STEERING:—**Steering Gear**—Chrysler (Gemmer design Model 300). Worm-and-Roller type.
NOTE—RHD cars equipped with Gemmer Model 305.
See article in Mechanical Equipment Section for data.
Front Suspension:—Conventional tubular section axle, Reverse-Elliott ends, semi-elliptic springs.
Kingpin Inclination—4½-5½° crosswise.
Caster—2° (1-3°). Adjust by inserting wedge plates between springs and axle center.
Camber—½° (¼-¾°). Not adjustable.
Toe In—1/16" (0-⅛"). Turn tie rod to adjust.
Steering Geometry—Outer wheel 20°. Inner 22°50'.

BRAKES:—**Service**—Lockheed hydraulic, double anchor type. Hand brakes at rear of transmission.
See article in Mechanical Equipment Section for data.
Wheel Cylinders—Stepped or two-stage bore type.
Front Wheel—Front cylinder 1¼". Rear 1⅜".
Rear Wheel—Front cylinder 1⅛". Rear 1¼".
Drum—Centrifuse. Diameter 10" (11" on 7 Pass.).
Lining—Moulded. Width 2". Thickness 13/64". Length (frt. shoe) 10 9/32", 11 5/32"—7 Pass., (rear shoe) 7 11/16", 7 31/32"—7 Pass.
Clearance—.012" toe, .006" heel for each shoe.
Braking Power—55% front, 45% rear.
Hand Brake:—External at rear of transmission.
Adjustment—*See Chrysler Shop Notes.*
Drum—Cast-iron. Diameter—6".
Lining—Width 2". Thick. 5/32". Length 17 1/16".

FRONT END ASSEMBLY (UNIT) REMOVAL:—Should be removed as a unit for work on front of engine. *See Chrysler Shop Notes for directions.*

SERIAL NUMBER:—On plate on right front door hinge pillar post. First number as follows:

	Detroit	Los Angeles	Evansville	Canada
P-7	1,298,001	3,110,001	9,150,401	9,603,586
P-8	10,630,001	3,222,001	20,027,001	9,358,626

ENGINE NUMBER:—First number P-8-1001. Stamped on left side of block between #1 and #2 cylinders. *See Chrysler Shop Notes for Engine Number Lettering ('Special Standard' bore and bearing sizes).*

ENGINE SPECIFICATIONS:—6 cylinder, 'L' head type. **Bore**—3⅛". **Stroke**—4¾". **Displacement**—201.3 cu.ins. **Rated Horsepower**—23.44 (A.M.A.). **Developed Horsepower**—82 @ 3600 RPM. (Std. 6.7-1 hd.). 86 @ 3600 RPM. (Optl. 7.0-1 Al. hd.). **Compression Ratio & Pressure**—As follows:

Ratio	Pressure at 1000 RPM.	At 100 RPM.
6.7-1 Std. C.I. head	140-150 lbs.	Approx. 113 lbs.
7.0-1 Optl. Al. head	150-160 lbs.	Approx. 117 lbs.

Vacuum Reading—Steady 18-21" idling at 6 M.P.H.

PISTONS:—Aluminum alloy, U-slot, Cam-ground, with Anodic finish. **Length** 3 11/16". **Weight** 14.56 ozs. **Removal**—Pistons and rods removed from above. **Clearance**—Top .021". Skirt .0001-.0011".

Original Bore & Piston Sizes, Replacement Pistons:—*See Chrysler Shop Notes for sizes and markings.*

Fitting New Pistons:—Use micrometers. Check piston at bottom of skirt at right angles to pin bosses. With piston and wall dry, piston should pass through bore of own weight with slight drag (pin removed).

Installing Pistons:—Slot away from camshaft.

PISTON RINGS:—Four rings, all above pin—#1 Compression (upper inner edge beveled), #2 Comp. (lower edge stepped), #3 & 4 (slotted oil rings).

Ring	Width	End Gap	Side Clearance
Comp. (Top)	⅛"	.007-.015"	.002 -.004"
Comp. (#2)	⅛"	.007-.015"	.0015-.0035"
Oil Control	5/32"	.007-.015"	.0015-.003"

Replacement Rings:—Furnished Std. and .005", .010", .015", .020", .025", .030", .040", .050", .060" oversize.

PISTON PIN:—**Diameter**—55/64". **Length**—2⅝". Floating type. Pin hole in rod bronze bushed. **Pin Fit in Piston**—Tight thumb push fit with piston heated to 100°F. **Pin Fit in Rod Bushing**—Tight thumb push fit at normal room temperature.

Replacement Pins:—Std. & .003", .005", .008" oversize.

CONNECTING ROD:—**Weight** 29.13 oz. **Length** 7 15/16". **Crankpin Journal Diameter**—1 15/16". **Lower Bearing**—Removable steel-backed, babbitt-lined. Furnished Std. & .002", .010", .012" undersize. **Clearance**—.0005-.0025". **Sideplay**—.0055-.0115".

Bearing Adjustment:—None (no shims). Install bearings with boss engaging groove in rod and cap.

Installing Rods:—Wide portion of bearing to rear (#1, 3, 5), to front (#2, 4, 6). Oil hole to camshaft.

CRANKSHAFT:—4 bearing type with 7 counterweights. *See Chrysler Shop Notes for Replacement Main Bearing Caps and Crankshaft Front and Rear Oil Seals.* **Journal Diameters**—2¼" all bearings. **Bearing Type**—Removable, precision type steel-backed, babbitt-lined. **Clearance**—.001-.002".

Bearing Adjustment:—*See Chrysler Shop Notes for Front Main Bearing Cap removal, Replacement Bearings and Crankshaft Oil Seals.*

End Thrust:—Taken by flange faces on rear (#4) bearing. **Endplay**—.003-.007".

CAMSHAFT:—4 bearing. Non-adjustable chain drive. **Journal Diameters**—#1, 2"; #2, 1 31/32"; #3, 1 15/16"; #4, 1¼". **Bearing Type**—Removable, Steel-backed, babbitt-lined bushings (except #4 machined in block). **Clearance**—.001-.003" (#1), .0015-.0035" (all others).

End Thrust:—Taken by thrust plate behind camshaft sprocket hub. **Endplay**—.002-.006".

Timing Chain:—Morse Type 1866-N, No. 2661. Width 1". Pitch .500". Length 24" or 48 links.

Camshaft Setting:—Mesh chain with sprockets turned so that '0' marks are adjacent and in line with a straightedge across the shaft centers.

VALVES:—

	Head Diameter	Stem Diameter	Length
All valves	1 15/32"	.340-.341"	4 25/32"

	Seat Angle	Lift	Stem Clearance
Intake	45°	5/16"	.001-.003"
Exhaust	45°	5/16"	.003-.005"

See Chrysler Shop Notes for Exh. Valve Seat Insert data.

Tappet Clearance:—.006" Int., .008" Exh. (hot). .002" additional exhaust clearance recommended for sustained high speed driving. NOTE—Tappet screws self-locking type. Remove right front wheel and housing panel for access to valves.

Valve Guides:—Remove from above. Press new guides in (tapered end up) so top ⅞" below top of block, then finish ream to .342-.343" Int., .344-.345" Exh.

Valve Springs:—Free length 2 3/32". Limit of compression 1 9/32".

	Spring Pressure	Length
Valve Closed	34-38 lbs.	1 3/4"
Valve Open	77-83 lbs.	1 7/16"

Valve Lifters:—Mushroom type. Ream holes from above (pilot in valve stem guide) for new lifters .001", .008", .030", .060" oversize. Stem Diam. ⅝".

Valve Timing:—See Camshaft Setting above. **Intake Valves**—Open 6° ATDC. Close 46° ALDC. **Exhaust Valves**—Open 42° BLDC. Close 8° ATDC. **To Check Timing**—Set tappet clearance #6 intake valve at .011". This valve should open with piston 6° (.0153") past top dead center when 6° ATDC. mark on crankshaft pulley at front of engine lines up with pointer. Reset tappet cl. .006" (hot).

LUBRICATION:—Gear type pump (right of engine). **Normal Oil Pressure:**—30-45 lbs. at 30 M.P.H.

Oil Pressure Relief Valve:—Under cap below starter. Opens at 40-45 lbs. To increase pressure use heavy (green) spring, to decrease use light (red) spring.

Crankcase Capacity:—5 quarts (refill).

COOLING SYSTEM:—**Capacity**—14 quarts. **Radiator Core Removal**—*See Chrysler Shop Notes.*

Water Pump:—Packless type. *See article in Mechanical Equipment Section for data.* **Removal**—Drain water, remove fan blades and pulley, by-pass elbow and hose, loosen radiator outlet hose, remove nuts from pump mounting studs, take off fan belt adjusting strap at generator.

Thermostat:—Bishop & Babcock. In head outlet. **Setting**—Start to open 157-162°F. Fully open 183°.

Temperature Gauge:—Motometer (Auto-Lite) No. H-9008. *See article in Mechanical Equipment Section.*

CLUTCH:—**Borg & Beck Model 9A6, 11A6 (P-7 Taxi).** Single plate, dry disc type. Marked #918 (9A6), 931 (11A6) on cover. Pressure plate oil-baffle and new Over-center return spring (hooked to pedal) *See article in Mechanical Equipment Section for data.* **Facings**—Woven & compressed, 2 required. Inside Diam. 5⅝" (9A6), 6½" (11A6). Outside Diam. 9¼" (9A6), 11" (11A6). Thick. .133" (9A6), .125" (11A6). NOTE—Spiral grooved type facings used on 11A6.

Adjustment:—Pedal should just clear toeboard (adjust stopscrew on lower end) and have 1" free movement (adjust nut on link rod at clutch fork).

Removal:—Remove floor board, unhook clutch fork pull-back spring and take out clevis pin in connecting link. Remove transmission (see Transmission Removal below), remove housing underpan, mark cover & flywheel, remove clutch cover bolts evenly.

TRANSMISSION:—**Own Make.** All helical gear, constant-mesh, synchro-mesh (second & high), sliding gear (low & reverse) with steering column gear shift (P-8). *See Mechanical Equipment Section.*

Transmission Control (P-8):—Remote control type. *See article in Mechanical Equipment Section for data.*

Removal:—Remove floor boards, disconnect battery ground cable, speedometer cable, front and rear universal joints (see Chrysler Shop Notes for Propeller Shaft Center Bearing on 7 Pass. models), free hand brake cable at clevis, disconnect gear shifter rod and selector cable at transmission case (P-8 only). Remove mounting stud nuts, take out cover capscrews and lift off cover assembly (with shift lever on P-7), install two pilot studs in upper mounting stud holes, withdraw transmission.

UNIVERSAL JOINTS:—**Detroit-Universal Series 4200.** Ball and trunnion type with roller bearings. *See article in Mechanical Equipment Section for data.*

Propeller Shaft Center Bearing:—On 7 pass. sedans. *See Chrysler Shop Notes for Propeller Shaft Center Bearing Removal and Installation instructions.*

REAR AXLE:—**Own Make.** Semi-floating, hypoid gear type with Hotchkiss drive. *See article in Mechanical Equipment Section for data.* **Ratio**—3.54-1 (P-7 Econ.). 3.73-1 (P-7 Spec., P-8 Econ.). 3.9-1 (P-7 Std., P-8 Coupe). 4.1-1 (P-8 Sedan). 4.3-1 (P-7, 8 with 18" or 20" tires, P-8 7 pass.). **Backlash**—.006-.010". Screw adjustment.

Removal:—Disconnect drive shaft at rear universal, remove axle shafts (see below), remove capscrews on carrier flange, pull carrier assembly out. **Axle Shaft Removal**—Remove wheel, hub and drum assembly (use screw type hub puller), block brake pedal, disconnect brake line at wheel cylinder, take off backing plate & oil seal, pull shaft & bearing.

Wheel Bearing Adjustment:—Shims between backing plate and axle housing. With wheel and hub removed check endplay with dial indicator. To adjust, remove backing plate (see above), add or remove shims equally (at both sides). **Endplay**—.003-.008".

SHOCK ABSORBERS:—**Delco.** Direct acting type. Domestic—Front 1110-C. Rear 1111-T, W (20" wh.). Exp.—Front 1114-C. Rear 1115-T, W (20" wh.). Adj. Exp.—Front 1134-E. Rear 1130-W, Y (20" wh.). Adj. *See article in Mechanical Equipment Section for data.*

STEERING:—**Steering Gear**—Chrysler (Gemmer Model 300 Std., 305 'push-pull' adj. Export). Worm & Roller. *See article in Mechanical Equipment Section for data.*

Front Suspension:—Independent, linked parallelogram type with coil springs. *See article in Mechanical Equipment Section for data.* **Kingpin Inclination**—5¼-6½° (4¾-6°—7 pass.). **Caster**—Minus ¼° to Plus 1½° (plus ½-2½° 7 pass). **Camber**—0° preferred. Limits minus ¼° to plus ½°. Minus ¼° to Plus ¾° (7 passenger). **Toe In**—1/16" (0-⅛"). Set long tie rod to 31 11/16" (between ball centers). Adjust short rod only.

Steering Geometry:—Inner wheel turned 22°30', outer wheel 20°.

BRAKES:—**Service.** Lockheed hydraulic, double anchor type. Hand lever applies independent shaft brake. *See article in Mechanical Equipment Section for data.* **Wheel Cylinders**—Stepped or two-stage bore type. **Drum**—Centrifuse. Diameter 10", 11" (7 pass.). **Lining**—Moulded type. Width 2". Thickness 13/64". Length per shoe, Front 10 9/32", 11 5/32" (7 Pass.), Rear 7 11/16", 7 31/32" (7 Pass.). **Clearance**—.012" toe, .006" heel, for each shoe.

Hand Brake:—On drum at rear of transmission. **Adjustment**—*See Chrysler Shop Notes for data.* **Drum**—Cast-iron. Diameter—6". **Lining**—Width 2". Thick. 5/32". Length 17 1/16".

1935-38 MODELS

FRONT FENDER AND RADIATOR REMOVAL:—Work on front of engine can be facilitated by removing radiator and front fenders as an assembly. Removal as follows:—Remove hood, side panels, front bumper, drain cooling system and free radiator tie rods at dash. Disconnect headlamp wires at lamps and withdraw from radiator shell. Free fenders from running boards and body, disconnect radiator and front fender support from frame cross member by removing two nuts under center of cross member. Lift off radiator and fenders as an assembly.

1939 MODELS

FRONT FENDER AND RADIATOR REMOVAL:—To facilitate work on front of engine remove front end assembly as follows: Remove hood side panels, front bumper assembly, fender-to-body and fender-to-frame brace hex head bolts, drain cooling system. Remove 6 stove bolts at top of fender side apron releasing headlamp wiring clips. Disconnect lamp wires at body side of terminal on apron, free wires from apron. Free radiator support by removing nuts on 2 support bolts under center of radiator. Lift off front end assembly as a unit.

1939 MODELS

RADIATOR CORE REMOVAL:—Drain cooling system, disconnect radiator hoses, take out 3 capscrews at each side of radiator and lift core out (rotate fan to clear radiator water outlet).

1937-38-39 MODELS

ORIGINAL BORE & PISTON SIZES:—Original bore sizes, and size of pistons installed in each cylinder bore, may be determined by letter stamped on piston head and on top face of cylinder block. Piston sizes graduated in .0005" steps as follows:

Piston & Engine Mark	Six	Eight
'A'	3.4355"	3.247"
'B'	3.436"	3.2475"
'C'	4.4365"	3.248"
'D'	3.437"	3.2485"
'E'	3.4375"	3.249"

1937-38-39 MODELS

REPLACEMENT PISTONS:—Standard. Pistons furnished in following sizes for replacement of Standard Production Pistons listed above. Sizes and part numbers for each model as follows:

1937-38

Part No. (6)	Size	Part No. (8)	Size
496949	3.4355"	549628	3.247"
496950	3.4365"	549629	3.248"
496951	3.4375"	549630	3.249"

1939

Part No.	Size	Part No.	Size
503045	3.4355"	503048	3.247"
503046	3.4365"	503049	3.248"
503047	3.4375"	503050	3.249"

First size covers 'A' and low limit 'B', Second size covers high limit 'B', 'C' and low limit 'D'. Third size covers high limit 'D' and 'E' pistons.

Oversize Replacement Pistons:—Finished pistons furnished in following oversizes: .005", .010", .020", .030". NOTE—Factory replacement pistons up to .030" oversize held to 1/16 oz. max. weight variation.

1938-39 MODELS

COMPRESSION RINGS:—Taper face ring used to lessen ring-to-cylinder wall 'break in' time. Face tapers out from top to bottom.
NOTE—Available for 1933-37 car models.

Installation—Side marked TOP toward top.

1934-39 MODELS

PISTON PIN FITTING:—Check piston pin for out-of-round. Maximum out-of-round .0002". Factory pins held within this limit. To install pins coat inside of piston bosses with graphite grease Insert pin with slotted end in lockscrew boss and press in place. Manufacturer recommends use of Piston Pin Removal and Replacing Fixture (HM-412). This fixture consists of screw press with pressure gauge attachment to prevent skirt distortion. Using this fixture, pressure to install pin should be 150-263 lbs. ('34), 200-350 lbs. ('35-36), 200-300 lbs. ('37-38-39).

1934-39 MODELS

PISTON PIN BUSHING:—To install split type bushing proceed as follows:—Press bushings in place being sure that 3/32" groove between bushings is aligned with oil hole in connecting rod. Then burnish bushings securely in rod with burnishing bar. Finally ream bushings to give .0003-.0005" clearance on piston pin. Manufacturer recommends use of following tools for servicing pin bushings:—HMJ-171—Bushing Remover. HMJ-172—Bushing Replacer (this tool fitted with shoulder which prevents bushings from being pressed through too far in rod boss). HMJ-516 ('39), HMJ-149 ('34-38) Burnishing Bar. NOTE—Tools HMJ-171, 172 used with arbor press.

1937-38-39 MODELS

CONNECTING ROD LOWER BEARING:—Removable type. No adjustment. Shims should not be used or bearing caps filed. When replacing bearings check crankpins. If scored or out-of-round and taper exceeds .001" crankshaft should be replaced.

Fitting—Use .0015" brass shim ½" wide and ⅞" long. Remove cap and lay shim across bearing. Tighten cap (with shim in place). Check bearing fit as follows:—Rod should be locked when testing end movement by hand but should slide on crankpin when tapped lightly with hammer. With shim removed rod should move freely on pin. If rod can be moved by hand with shim in place install .001" undersize bearing.

Installing Bearings—Bearing halves fitted with tangs (one on each edge of bearing). When installing bearings make sure that tangs on rod are on opposite ends of crankpin from tangs in cap.

1934-39 MODELS

HARMONIC BALANCER:—Replace for service.
Removal and Installation—Remove front assembly (see Front Fender and Radiator Removal 1st col.). Retaining screw which secures balancer in place, can be removed by using 13/16" (6), 1" (8) socket wrench and turning off. Pull balancer with suitable puller. Manufacturer recommends use of special puller (J-496). This tool consists of a bar with threaded bolt through center (engaging end of shaft) and turned ends (which engage in fan belt groove). NOTE—On 1934-38 models, balancer secured by crank nut. This nut can be removed by inserting ¾" hexagonal bar in nut and turning off.

1935-39 MODELS

MAIN BEARINGS:—Removal. Bearings can be removed with caps removed and crankshaft in place by inserting suitable tool (see NOTE following) in oil hole in shaft and rotating shaft in usual direction. NOTE—Bearing Removal Tool can be made from ⅛"x1½" cotter key. Bend each end of key up 5/16" to make ⅝" long base. With this as a base, bend key to form 59° angle. With this tool inserted in place end will just protrude far enough to engage bearing.

Installation—Insert plain edge of bearing in indented side of bearing support, slowly rotate crankshaft until bearing seated.

1937-38-39 MODELS

FITTING MAIN BEARINGS:—If the crankshaft is badly scored manufacturer recommends that it be replaced. To check bearing fit, use .002" brass shim ½" wide and 1" long. With cap removed place shim across bearing. Tighten cap (with shim in place). Test bearing fit by rocking flywheel by hand. **Do not rock flywheel more than 1" in either direction** or bearing may be damaged by shim. If crankshaft locks with shim in place and rotates freely with shim removed bearing size correct. If shaft moves with shim in place use .001" undersize bearing.

1939 MODELS

REAR MAIN BEARING OIL SEAL (Six only):—Consists of asbestos covered wiper seal fitted in groove at rear of bearing and held by retainer fitted in forward part of groove (forms trough around oil throw ring on crankshaft).

Installation—With crankshaft out and bearing shells removed, press upper half of packing and plain half of retainer in block, using Tool J-1045 placed with large diameter in front, seat packing in place by tapping tool with rawhide or lead hammer. Then cut each end of seal flush with bearing cap seat. Repeat operation for bearing cap using packing retainer with locating tangs.

1934-39 MODELS

CAMSHAFT:—Removal—Remove front assembly (see Front Fender and Radiator Removal 1st Col.), fan, harmonic balancer (see Harmonic Balancer paragraph above). Support engine at front with jack and remove front support, timing chain assembly, cylinder head, valve assembly, fuel pump, oil pump and distributor. Camshaft can then be removed from front. Center chain cover with Tool J-546 when reassembling. NOTE—On '34-36 models, valves and lifters may be blocked up by using J-527 holders.

Bearing Removal and Installation on Eight Models—All bearings except rear can be removed and installed with a driver. Rear bearing cannot be driven out due to plug at rear. Puller must be used on this bearing. Manufacturer recommends use of tool set J-550 consisting of special puller and driver. Rear bearing installed with driver.

Camshaft Bearing Finished Sizes—After installing line ream (Tool J-539) bearings to following sizes:

	Six	Eight
#1	1.9950-1.9955"	1.9950-1.9955"
#2	1.9637-1.9642"	1.9637-1.9642"
#3	1.9325-1.9330"	1.9325-1.9330"
#4	1.9012-1.9017"	1.9012-1.9017"
#5		1.8700-1.8705"

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1939 MODELS

TIMING CHAIN COVER OIL SEAL:—Squeak Correction. If seal becomes dry forming glazed surface, squeal may develop due to seal rubbing on chain cover. This may be corrected by squirting oil and graphite fluid on seal. If seal must be replaced, rub graphite into seal thoroughly. Also, seal may be drilled with four or five ⅛" holes 3/16" deep. These holes should then be packed with graphite.

1935-39 MODELS

OIL PUMP:—Removal and Installation—Remove right hand engine side pan. Turn engine over to place #1 piston on top dead center on compression stroke with distributor rotor opposite #1 terminal, remove pump. Install pump with #1 piston as above, place prick punch mark on pump down and mesh gears. Reset ignition timing. NOTE—On '35-36 cars with conventional front axle, hoist car by frame to allow shifting of spring for pump removal. On '39 sixes, Steering Idler Arm must also be removed for pump removal.

1937-38-39 MODELS

OIL PUMP CLEARANCES:—Shaft b'ing .0005-.002". Idler gear bearing .0005-.002". Driving gear backlash .003-.004". Backlash between pump gears .006-.008". Pump Gear end clearance .002-.006".

1939 MODELS

OIL PAN REMOVAL (Eight only):—To facilitate removal and installation of front oil pan bolts, car manufacturer recommends removal of front engine insulator support assembly and replacing with a steel block (5¼" long, 1½" wide, 15/16" high). By using this block front end need not be jacked up.

Front Engine Insulator Removal—Remove hood side panels, disconnect exhaust pipe, take out 2 front engine to mounting bolts, raise engine with jack until insulator accessible, remove excess dirt from mounting, take out 2 mounting-to-frame screws, lift off mounting together with 'U' shaped shield. When reinstalling, tighten mounting bolts securely.

1938 MODELS

CLUTCH HELPER SPRING:—Removal and Installation—To remove assembly, disconnect pedal-to-cross shaft rod (allowing pedal to rest on floorboard with spring extended) and remove strut from pedal. Disconnect opposite end and remove from car. To assemble unit off car, oil lubrication felt and place in spring, install cup on pedal side of spring, insert strut with lubrication felt on top side, install cup on opposite end, compress cup and spring until cotter pin can be inserted through hole in strut holding assembly together. Lubricate pedal end of strut with lubriplate and install assembly on car. Remove cotter pin from strut and assemble connector link to pedal.

1937-38 MODELS

FRONT PROPELLER SHAFT BEARING:—Front shaft supported by bearing in rear end of shaft housing.

Checking—Overhaul assembly if oil leakage excessive or when shaft play exceeds .008" (measure by dial indicator mounted on housing, use 20-30 lbs. lifting force on shaft). With assembly dismantled, check for worn teeth on shaft and coupling, leaky oil seals. Replace worn parts.

Disassembly—Wire front universal joint trunnions together, disconnect rear propeller shaft at front universal joint, take out mounting screws in housing flange at rear of transmission case, pull shaft and housing assembly back to disengage coupling, remove from below at front. Take out universal joint flange capscrew, press shaft out of flange, remove snap ring on shaft, pull shaft out toward front. Press bearing and oil seals out toward rear (use tool made of 13/16" diameter pipe 18" long).

Assembly—Press new bearing in at rear end against shoulder in housing, install leather oil seal (lip toward bearing), offset washer (raised center portion to rear), and retainer (soak retainer felt in oil first) so that distance from retainer to end of housing is 1 9/16". Complete assembly by reversing disassembling directions above. NOTE—Manufacturer recommends use of tool J-693 to install bearing and oil seals, and J-1086 cap on end of shaft to prevent damage to oil seals when shaft installed.

Installation—When installing assembly on car, place oil filler plug on left side and slightly below center line, fill with trans. lubricant to plug level.

1937-38-39 MODELS

BRAKE BACKING PLATE ALIGNMENT:—If brake drum flange extends over edge of backing plate when installed, install sufficient gaskets (part 499930 or 499776) between axle flange and plate so that it is flush with edge of drum.

ENGINE NUMBER:—First number (1934) 987,401. On top left hand corner of engine block.

ENGINE SPECIFICATIONS:—Eight cylinder, 'L' head type.
Bore—3 3/16". **Stroke**—3½".
Displacement—223.4 cubic inches.
Rated Horsepower—32.52.
Developed Horsepower (1933)—75 at 3600 R.P.M.
Developed Horsepower (1934)—84 at 3600 R.P.M.
Compression Ratio—5.7-1 (1933), 6.2-1 (1934).
Compression Pressure—Approximately 98 lbs. (5.7-1 head), 106 lbs. (6.2-1 head) at cranking speed.
Vacuum Reading—Gauge should show steady reading of 18-20" at idling speed.

PISTONS:—Electro-plated cast-iron. Pistons are tin-plated after being finished and cannot be ground. Cylinders should be reconditioned to size for standard replacement pistons. Piston length 3.880".
Weight—26¾ ozs. Held to ⅛ oz. maximum variation.
Removal—Pistons and rods removed from above.
Clearance—Top .022". Skirt .0015-.002". See Fitting New Pistons.

Replacement Pistons:—Oversize pistons up to .030" held to same weight as standard and can be installed in one cylinder without destroying balance.

Fitting New Pistons:—Check clearance with ½" feeler stock inserted betwen piston and wall at right angles to pin bosses. Piston should fall through cylinder of own weight on .0015" feeler and hold own weight on .002" feeler. Pull required to withdraw .002" feeler should be 10-20 lbs.

PISTON RINGS:—Three compression rings above pin, one oil control ring below pin. Oil ring groove drilled radially with ten ⅛" oil drain holes.

Ring	Width	End Gap	Side Clearance
Comp	⅛"	.007-.017"	.0010-.0025"
Oil control	3/16"	.007-.017"	.0010-.0025"

PISTON PIN:—Diameter 15/16". Length 2⅞". Pin is locked in piston by locking screw in one boss. Pin hole in rod is bronze bushed. Free end of pin is slotted and is light press fit in piston to permit free expansion.
Pin Fit in Rod Bushing—.0003-.0005" clearance. Bushings should be finish-reamed to provide this clearance (bushings are split type and must be expanded with burnishing bar before being reamed).

Fitting New Pins:—Coat plain boss in piston with graphite. Insert pin in lock-boss side (slotted end first). Use special tool HM-412. Gauge reading on tool should be 150-263 for pressure required to force pin in both bosses.

CONNECTING ROD:—Length 7 11/16". Weight 32½ ozs. Held to ⅛ oz. maximum variation.
Crankpin Journal Diameter—2".
Lower Bearing Type—Spun babbitt lined. No shims.
Clearance—.0005-.002". Sideplay .005-.010".

Adjustment:—None (no shims). Replace rods. Do not file rods or caps.

Installing Rods:—Lower bearings offset. Install rods with offset (larger half of bearing) toward front of engine in cylinders #2, 4, 6, 8 and toward rear in #1, 3, 5, 7. Narrow half of bearing should be toward nearest main bearing.

CRANKSHAFT:—5 bearing. Integral counterweights.
Journal Diameters—#1, 2¼"; #2, 2 9/32"; #3, 2 5/16"; #4, 2 1/32"; #5, 2⅜".
Bearing Type—Removable steel-backed, babbitt-lined.
Clearance—.001-.003".

Adjustment:—None (no shims). Replace bearings. Do not file bearing caps. New bearings should be line-reamed.

End Thrust:—Taken by #3 center main bearing. End-play .003-.008".

CAMSHAFT:—5 bearing. Non-adjustable chain drive.
Bearing Diameters—#1, 2"; #2, 1 31/32"; #3, 1 15/16"; #4, 1 29/32"; #5, 1⅞".
Bearing Type—Steel-backed, babbitt-lined bushings.
Clearance—.0015-.0025".
NOTE—New camshaft bearings should be line-reamed after installation. See that oil hole in bushing and block line up.
End Thrust—Taken by thrust plate at front bearing. Endplay .002-.005".

Timing Chain:—Morse No. 766. Width 27/32". Pitch ⅜". Length 21" or 56 links.

Camshaft Setting:—Sprockets are marked. Mesh chain with sprockets turned so that marks are adjacent and in line with a straightegde across the shaft centers.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1 13/32"	.310-.311"	3.880"
Exhaust	1 11/32"	.310-.311"	3.880"

	Seat Angle	Lift	Stem Clearance
Intake	30°	19/64"	Free to .0006"
Exhaust	45°	19/64"	Free to .0006"

Tappet Clearance—.009-.011" (all valves with engine hot).

Valve Springs—	Pressure	Length
Valve Closed	45-51 lbs.	1 29/32"
Valve Open	74-82 lbs.	1 19/32"

NOTE:—Springs are installed with two closed coils at top and single closed coil at bottom. Valve spring dampeners installed on top of each valve spring. Install new dampeners whenever dampener is removed from spring.

Valve Timing

Intake Valves open 5° BTDC. Close 39° ALDC.
Exhaust Valves open 45° BLDC. Close 5° ATDC.
NOTE:—Valve timing figures are correct with .0125" tappet clearance.
To Check Timing—Set tappet clearance #1 intake valve at .0125". This valve should open with piston 5° or .0082" before top dead center with the second straight line of the ignition mark '/IGN..1&8/' slightly before the pointer in the inspection hole in the left front face of the flywheel housing. Reset tappet clearance at .010" with engine hot.
Motor Gauge—Weidenhoff Adapter #114, Rod #42.

LUBRICATION:—Pressure type. Gear type oil pump located at right of crankcase on lower end of inclined accessory shaft.
Oil Pressure—20-30 lbs. at normal driving speeds.
Oil Pressure Relief Valve—Built in oil pump cover. Not adjustable. Relief valve ball clearance should be .0145-.0165".
Pump Clearances—.006-.008" (backlash between gears), .002-.006" (end clearance between gears and housing).
Crankcase Capacity—7 quarts.

CLUTCH:—**Own make.** Single plate, dry disc type.
See article in Mechanical Equipment Section for data.
Facings—Moulded type, 2 required. Thickness .125". Inside Diameter 6¼". Outside Diameter 10".
Adjustment—Clearance between pedal and underside of toeboard should be ⅝". To adjust, loosen locknut and turn stopscrew at rear of pedal shaft. Free movement of pedal must be 1". To adjust, loosen one nut and turn up second nut on clutch pedal link at throw-out shaft lever.

STEERING:—**Steering Gear**—Saginaw Worm-and-Sector type (1933), Worm-and-Roller type (1934).
See article in Mechanical Equipment Section for data.

Front Suspension (603 '33):—Conventional 'I' beam section front axle with Reverse Elliott ends and semi-elliptic springs.
Kingpin Inclination—9½° crosswise.
Caster—1½-2½°. Adjust by inserting wedge shims between spring and spring pad on axle.
Camber—1½°. No adjustment provided.
Toe In—0-⅛". Adjust in usual manner by loosening clamp bolts and rotating tie rod.

Front Suspension (605 '34):—'Knee Action' type independent front suspension. Entire suspension unit pivoted on kingpin and turns with wheel.
See article in Mechanical Equipment Section for data.
Kingpin Inclination—7° crosswise.
Caster—0° Caster effect secured by trailing wheel center behind kingpin center-line.
Camber—1-2°.
Toe In—1/32-⅛". Adjust in usual manner by loosening clamp bolts and turning tie rod.
Steering Geometry—Inner wheel turned 23-24°, outer wheel 20°.

BRAKES:—**Service (603 '33):**—Houck (own make). Two shoe, mechanically operated, internal expanding, four wheel type. Hand lever applies all four service brakes.
Drum Diameter—12".
Lining—Moulded type. Width 1¾". Thickness 3/16". Length per wheel—one piece 12 5/32" long, one piece 6 3/32" long.

Service Brakes (605 '34):—Bendix Mechanical, Duo-Servo, Single-anchor type. Hand lever applies all four service brakes. See article in Brake Section for complete adjstment directions.
Drum Diameter—12".
Lining—Moulded type. Width 1¾". Thickness 3/16" and 13/64" (one piece each thicknes). Length per wheel—2 pieces 12 31/32".

Hand Brake (all models):—See Service Brakes.

ENGINE NUMBER: — First number 6-10001. On boss on left hand top corner of cylinder block.

ENGINE:—Six cylinder, 'L' head type.
Bore—3⅜". **Stroke**—3⅞".
Piston Displacement—208 cubic inches.
Rated Horsepower—27.4 (SAE.).
Developed Horsepower—80 at 3600 R.P.M.
Compression Ratio—6.2-1. No optional ratios.
Compression Pressure—148-150 lbs. at 1000 R.P.M. or approx. 106 lbs. at cranking speed.
Vacuum Reading—Gauge should show steady reading of 18-20" with engine idling.
See Pontiac Shop Notes for Radiator & Fender Removal.

Pistons:—Electro-plated cast-iron. Pistons are tin-plated to thickness of .00075-.00125" after finishing and cannot be ground. Standard pistons furnished in following sizes: 3.3720", 3.3730", 3.3740". Oversize pistons furnished 005", 010", 015", 020", 030" oversize and are held to same weight as standard (can be used in one cylinder without destroying balance).
Piston Length—3 25/32".
Weight—Held to 1/16 oz. variation. Not necessary to select pistons for service.
Removal—Pistons and rods removed at top.
Clearance—Top .022". Bottom .0015".
Fitting New Pistons—Use .002" feeler stock ½" wide inserted between piston and cylinder wall to check clearance. Pull required to withdraw feeler should be 10-20 lbs. Piston must not be out-of round or tapered more than .0005".

Piston Rings:—Four rings per piston, 3 compression rings above pin, one oil control ring below pin. Oil ring groove drilled radially with ten ⅛" oil drain holes.

Ring	Width	End Gap	Side Clearance
Comp. (all)	⅛"	.007-.017"	.001-.0025"
Oil Cont.	3/16"	.007-.017"	.001-.0025"

Piston Pin:—Diameter 15/16". Length 3 25/32". Pin is locked in piston (opposite end slotted to allow free movement of boss on pin).
Pin Fit in Piston—*See Pontiac Shop Notes.*
Pin Fit in Rod Bushing—.0003-.0005" clearance. See Connecting Rod upper bearing.
Fitting Pins—Use special tool HM-412 to install pins (tool checks pressure required to press pin into place). Coat bosses with graphite grease, insert slotted end of pin in lockpin boss. Pressure should be 200-350 lbs.

Connecting Rod:—Weight held to 1/16 oz. maximum variation. Length, 7 11/16".
Upper Bearing—Split bushed type 15/16" diameter. Two bushings used with 3/32" gap at center forming oil groove. Use special tool to install bushings (shoulder on tool prevents closing up gap). Drilled oil passage in rod must open into this groove. New bushings should be burnished and then reamed to size giving correct clearance.
Lower Bearing—Interchangeable steel-backed, cadmium-silver alloy lined type. Bearings furnished .0005" undersize for service.
Clearance—.0005-.0015". Sideplay .005-.010".
Adjustment—None (no shims). Replace bearings. Do not file bearing caps. Clearance must be kept below .0015".
Installing Rods—Connecting rods not offset. Install rods in same cylinders from which removed.

Crankshaft:—Four bearing type with integral counterweights.
See Pontiac Shop Notes for Harmonic Balancer data.
Journal Diameters—#1 2¼", #2 2 9/32", #3 2 5/16", #4 2⅜".
Bearing Type—Interchangeable steel-backed, cadmium-silver lined type. Upper and lower bearing halves interchangeable.
Clearance—.001-.003".
Adjustment—None (no shims). Replace bearings. Do not file bearing caps. Bearing upper halves can be removed without removing crankshaft by using special tool. Tool consists of a flat headed plug which is inserted in oil hole in crankshaft and turns out bearing as crankshaft is rotated. Install new bearings in same manner, inserting plain edge of bearing on indented side of upper bearing support. Tool furnished with bearings.

Camshaft: — Four bearing type. Non-adjustable chain drive.
See Pontiac Shop Notes for Camshaft Removal and Camshaft Bearing finished sizes.
Bearing Type—Steel-backed, babbitt-lined type.
Clearance—.0015-.0025". Endplay .002-.005".
Timing Chain—Morse Side-Guide type. Width 1". Pitch ⅜". Length 56 links.
Camshaft Setting—Sprockets are marked. Mesh chain with sprockets turned so that '0' marks are adjacent and in line with a straightedge across the shaft centers.

Valves:—

	Head Diameter	Stem Diameter	Seat Angle
Intake	1 17/32"	.310"	30°
Exhaust	1 15/32"	.310"	45°

Valve Lift—19/64" (all valves).
Stem-to-Guide Clearance—Free fit to .0006" clearance (for new guides).
Valve Guides—Removable, tapered guides (.001" taper to the inch, with greatest clearance at top). IMPORTANT—Measure clearance at bottom end. Valve should just fall through of own weight when started in guide. NOTE—When valves serviced, guides should be cleaned with wire brush or taper reamer (Tool P.R. 131).
Tappet Clearance—.009-.011" all valves, engine hot. Use .009" and .011" feelers as 'go' and 'no go' gauges. Hood sill must be removed to adjust clearance of valves in front cluster.
Valve Springs—Install springs with one closed coil at bottom two closed coils at top. Valve spring dampener installed on top of each spring. Use new dampener whenever dampener is removed.

	Spring Pressure	Spring Length
Valve Closed	52 lbs.	1 29/32"
Valve Open	82 lbs.	1 39/64"

Valve Timing—See Camshaft Setting (above). Intake Valves—Open 5° BTDC. Close 39° ALDC. Exhaust Valves—Open 45° BLDC. Close 5° ATDC. These figures correct with .0125" tappet clearance.
To Check Valve Timing—Set tappet clearance #1 intake valve at .0125". This valve should open with piston 5° before top dead center and first straight line of ignition mark '/IGN.1&6/' slightly past indicator. Reset tappet clearance at .010".
Motor Gauge—Weidenhoff Adapter #114, Rod #42.

Lubrication:—Pressure. Gear type oil pump on right hand side of crankcase. Dip pump gears in oil before installing (pump does not require priming).
See Pontiac Shop Notes for Pump removal & installation.
Normal Oil Pressure—5 to 40 lbs.
Oil Pressure Relief Valve—Built in pump cover. Not adjustable. Relief valve ball clearance should be .0145-.0165".
Oil Pump Clearances—Shaft bearing .0005-.002". Idle gear bearing .0005-.002". Driving gear backlash .003-.004". Backlash between pump gears .006-.008". Pump gear end clearance .002-.006".
Capacity and Oil—6 qts. Use SAE. #10-W for first 500 miles in new cars. After 500 miles use SAE. #30 (above 95°F.), #20 (32° to 95°F.), #10-W (0° to 32°F.).

CLUTCH:—Own make, single plate, dry disc type. No release lever adjustment necessary for wear.
See article in Mechanical Equipment Section for data.
Clutch Pedal Adjustment—Clearance between clutch pedal and pedal felt retainer board (on under side of toeboard) should be ⅝". Adjust by loosening lock nut and turning pedal stop screw. Lash or free movement of clutch pedal should be 1". Adjust by changing length of clutch pedal link (adjusting screw on outer end of link).
Clutch Facings—Moulded type, 2 required. 6¼" I.D., 9⅞" O.D., ⅛" thick.
NOTE—Cap screws used to hold clutch cover on flywheel are sufficiently long to relieve clutch spring tension. To disassemble clutch, back off cap screws equally, one turn at a time. Clutch springs should force cover free of flywheel flange. If cover sticks, strike sharply on radius outside spring cups before screws are completely removed.

STEERING:—**Front Suspension** — Independent type used on De Luxe Models. All data same as for Eight Cylinder Model 605 (see next page).
Standard Six Model 701-B—Conventional "I" beam section front axle with Reverse-Elliott ends and semi-elliptic springs.
Kingpin Inclination—7°10' (crosswise).
Camber—1½° plus 0° minus 1° (car empty). Bending of axle to correct camber not recommended.
Caster—1¼° plus or minus ¼° (car empty). Adjust by using wedge shims between spring and axle pad.
Toe In—0-⅛" (measured 9" above floor). Adjust in usual manner by changing length of tie rod.
Steering Gear:—Saginaw Model, Worm-and-Roller type. See article in Steering Section for adjustmts.

BRAKES:—**Service**—Bendix hydraulic, Duo-Servo, single anchor type. Hand lever applies rear wheel service brakes.
See article in Mechanical Equipment Section for data.
Wheel Cylinders—Diameter (front wheels, 1"), (rear wheels—15/16"). Late 701-B (15/16"—all wheels).
Drum Diameter—12".
Lining—Width 1¾". Thickness 3/16". Length per wheel 23 3/16" (10 3/16" Primary or front shoe, 13" Secondary or rear shoe).
Clearance—.010" at heel and toe of each shoe.
Hand Brake Adjustment:—See Service Brakes.

ENGINE NUMBER:—First number, 8-1001. On boss on left hand top corner of cylinder block.

ENGINE:—Eight cylinder In line, 'L' head type.
Bore—3 3/16". **Stroke**—3½".
Piston Displacement—223.4 cubic inches.
Rated Horsepower—32.6 (SAE).
Developed Horsepower—84 at 3600 R.P.M.
Compression Ratio—6.2-1. No optional ratios.
Compression Pressure—137-139 lbs. at 1000 R.P.M. or approx. 106 lbs. at cranking speed.
Vacuum Reading—Gauge should show steady reading of 18-20" with engine idling.
See Pontiac Shop Notes for Radiator & Fender Removal.

Pistons:—Electro-plated cast-iron. Pistons are tin-plated to thickness of .00075-.00125" after finishing and cannot be ground. Standard pistons furnished in following sizes: 3.1845", 3.1855", 3.1865". Oversize pistons furnished .005", .010", .015", .020", .030" oversize and are held to same weight as standard (can be used in one cylinder without destroying balance. Piston length 3⅞".
Weight—Held to 1/16 oz. variation. Not necessary to select pistons for service.
Removal—Pistons and rods removed at top.
Clearance—Top .022". Bottom .0015". See below.
Fitting New Pistons—Use .002" feeler stock ½" wide inserted between piston and cylinder wall to check clearance. Pull required to withdraw feeler should be 10-20 lbs.

Piston Rings:—Four rings per piston, 3 compression rings above pin, one oil control ring below pin. Oil ring groove drilled radially with ten ⅛" oil drain holes.

Ring	Width	End Gap	Side Clearance
Comp. (all)	⅛"	.007-.017"	.001-.0025"
Oil Cont.	3/16"	.007-.017"	.001-.0025"

Piston Pin:—Diameter 15/16". Length 2⅞". Pin is locked in piston (opposite end slotted to allow free movement of boss on pin).
Pin Fit in Piston—*See Pontiac Shop Notes.*
Pin Fit in Rod Bushing—.0003-.0005" clearance.
Fitting Pins—Use special tool HM-412. See Pontiac Six for instructions.

Connecting Rod:—Weight held to 1/16 oz. maximum variation. Length, 7 11/16".
Piston Pin Bushing (Upper Bearing)—Split bushed type. *See Pontiac Shop Notes for complete data.*
Lower Bearing—Interchangeable steel-backed, cadmium-silver alloy lined type. Bearings furnished .0005" undersize for service.
Clearance—.0005-.0015". Sideplay .005-.010".
Adjustment—None (no shims). Replace bearings. Do not file bearing caps. Clearance must be kept below .0015".
Installing Rods—Connecting rod lower bearings are offset. Install rods with narrow half of bearing toward nearest main bearing (widest half of bearing toward front on #2, 4, 6, 8 or toward rear on #1, 3, 5, 7).

Crankshaft:—Five bearing type with integral counterweights.
See Pontiac Shop Notes for Harmonic Balancer data.
Journal Diameters—#1 2¼", #2 2 9/32", #3 2 5/16", #4 2 11/32", #5 2⅜".
Bearing Type—Interchangeable steel-backed, babbitt-lined type. Upper and lower bearing halves are interchangeable.
Clearance—.001-.003".
Adjustment—None (no shims). Replace bearings. Do not file bearing caps. See Pontiac Six for directions on bearing removal.
End Thrust—Taken by #3 (center) bearing. Endplay .003-.008".

Camshaft:—Five bearing type. Non-adjustable chain drive.
See Pontiac Shop Notes for Camshaft Removal and Camshaft Bearing finished sizes.
Bearing Type—Steel-backed, babbitt-lined type.
Clearance—.0015-.025". Endplay .002-.005".
Timing Chain—Morse Side-Guide type. Width 25/32". Pitch ⅜". Length 56 links.
Camshaft Setting—Sprockets are marked. Mesh chain with sprockets turned so that '0' marks are adjacent and in line with a straightedge across the shaft centers.

Valves:—

	Head Diameter	Stem Diameter	Seat Angle
Intake	1 13/32"	.310"	30°
Exhaust	1 11/32"	.310"	45°

Valve Lift—19/64" (all valves).
Stem-to-Guide Clearance—Free fit to .0006" clearance (for new guides).
Valve Guides—Removable, tapered guides (.001" taper to the inch, with greatest clearance at top). IMPORTANT—Measure clearance at bottom end. Valve should just fall through of own weight when started in guide. NOTE—When valves serviced, guides should be cleaned with wire brush or taper reamer (Tool P.R. 131).
Tappet Clearance—.009-.011" all valves, engine hot. Use .009" and .011" feelers as 'go' and 'no go' gauges. Hood sill must be removed to adjust clearance of valves in front cluster.
Valve Springs—Install springs with one closed coil at bottom two closed coils at top. Valve spring dampener installed on top of each spring. Use new dampener whenever dampener is removed

	Spring Pressure	Spring Length
Valve Closed	52 lbs.	1 29/32"
Valve Open	82 lbs.	1 39/64"

Valve Timing—See Camshaft Setting (above).
Intake Valves—Open 5° BTDC. Close 39° ALDC.
Exhaust Valves—Open 45° BLDC. Close 5° ATDC.
These figures correct with .0125" tappet clearance.
To Check Valve Timing—Set #1 intake valve tappet clearance at .0125". This valve should open with piston 5° before top dead center with first straight line of ignition mark on flywheel '1 IGN. 1&8/' slightly past indicator. Reset tappet clearance at .010".
Motor Gauge—Weidenhoff Adapter #114, Rod #42.

Lubrication:—Pressure. Gear type oil pump on right hand side of crankcase. Dip pump gears in oil before installing (pump does not require priming).
See Pontiac Shop Notes for Pump removal & installation.
Normal Oil Pressure—5 to 40 lbs.
Oil Pressure Relief Valve—Built in pump cover. Not adjustable. Relief valve ball clearance should be .0145-.0165".
Oil Pump Clearances—Shaft bearing .0005-.002". Idle gear bearing .0005-.002". Driving gear backlash .003-.004". Backlash between pump gears .006-.008". Pump gear end clearance .002-.006".
Capacity and Oil—7 qts. Use SAE. #10-W for first 500 miles in new cars. After 500 miles use SAE. #30 (above 95°F.), #20 (32° to 95°F.), #10-W (0° to 32°F.).

CLUTCH:—Own make, single plate, dry disc type. No release lever adjustment necessary for wear.
See article in Mechanical Equipment Section for data.
Clutch Pedal Adjustment—Clearance between clutch pedal and pedal felt retainer board (on under side of toeboard) should be ⅝". Adjust by loosening lock nut and turning pedal stop screw. Lash or free movement of clutch pedal should be 1". Adjust by changing length of clutch pedal link (adjusting screw on outer end of link).
Clutch Facings—Moulded type, 2 required. 6¼" I.D., 9⅞" O.D., ⅛" thick.
NOTE—Cap screws used to hold clutch cover on flywheel are sufficiently long to relieve clutch spring tension. To disassemble clutch, back off cap screws equally, one turn at a time. Clutch springs should force cover free of flywheel flange. If cover sticks, strike sharply on radius outside spring cups before screws completely removed.

STEERING:—**Front Suspension**—Independent type. Entire suspension unit (coil spring housing with built-in shock absorber unit, wheel support arm and radius rod) pivoted on kingpin and turns with front wheel.
See article in Mechanical Equipment Section for data.
King Pin Inclination—7° (with load on wheels).
Camber—1-2° (with load on wheels). No adjustment provided. Replace front frame cross tube and check suspension unit housing and wheel support arm. Do not bend cross tube hot or cold.
Caster (King Pin Tilt)—0°. Adjust by shims at frame cross tube brackets. Frame must be absolutely level when checking caster. Use jacks to set frame height (vertical distance from floor) as follows: 15 11/16" to bottom of frame cross tube at center, 19" to lower face of rear spring horns.
Toe In—0-1/16". Adjust by changing length of tie rod.
Lubrication—Entire suspension unit must be kept filled with special Shock Insulating Fluid to level of filler plug on front of unit (capacity 2½ qts.).
NOTE—Suspension unit is removed by taking out kingpin (kingpin locked in place by tapered lock bolt in usual manner). Kingpin is carried at top and bottom on 32 loose rollers retained by convex plug and snap rings. Use special loading tool to insert rollers after kingpin has been installed. Insert kingpin at bottom with longest end (from slot) upward, tap ball thrust bearing in place between top of steering knuckle and upper support boss (with dust shield at top) before pushing kingpin up into place. Check steering knuckle endplay (between thrust bearing and upper support boss) and insert shim if more than .006". Install roller retainer plugs with convex face in.
Leveling Frame—Car is leveled by turning adjusting plugs in housing covers of suspension units. To adjust, remove cap screw in center of adjusting plug, lift out adjusting plug lock, use special wrench to turn adjusting plug until distance from lower face of cross tube yoke to bottom of brake drum is 5⅛" with car weight on wheels. Adjusting plug must not be turned in more than 2 turns from flush position with housing cover. Replace lock and cap screw.
Steering Gear:—Saginaw Model, Worm-and-Roller
See article in Mechanical Equipment Section for data.

BRAKES:—**Service**—Bendix hydraulic, Duo-Servo, single anchor type. Hand lever applies rear wheel service brakes.
See article in Mechanical Equipment Section for data.
Wheel Cylinders—Diameter (front wheels, 1"), (rear wheels—15/16").
Drum Diameter—12".
Lining—Width 1¾". Thickness 3/16". Length per wheel 23 3/16" (10 3/16" Primary or front shoe, 13" Secondary or rear shoe).
Clearance—.010" at heel and toe of each shoe.
Hand Brake Adjustment:—See Service Brakes.

NOTE:—Models 36-26A Deluxe Six and 36-26B Master Six are similar except that Knee Action standard on Model 36-26A only. All other data below applies to both models.

ENGINE NUMBER:—First number—6-84,001. Stamped on top left hand corner of block.

ENGINE SPECIFICATIONS:—Type—6 cyl. 'L' head.
Bore—3⅜". **Stroke**—3⅞".
Displacement—208 cubic inches.
Rated Horsepower—27.4 (SAE).
Developed Horsepower—80 at 3600 R.P.M.
Compression Ratio & Pressure—6.2-1 Std. cast-iron head. Pressure 149 lbs. at 1000 R.P.M. or approximately 106 lbs. at cranking speed.
NOTE—Special thick head gasket which reduces comp. ratio to 5.7-1 may be installed if desired.
Vacuum Reading—Gauge should show steady reading of 18-20" of HG. with engine idling at 360 R.P.M. or 6 M.P.H.
See Pontiac Shop Notes for Radiator & Fender Removal.

PISTONS:—Electro-plated cast-iron. Tin-plated to thickness of .00075-.00125" after finishing and cannot be ground. Use finished replacement pistons.
Length—3½".
Weight—Held to 1/16 oz. maximum variation.
Removal—Pistons and rods removed from above
Clearance—Top .022". Bottom .0015". See Fitting New Pistons.
Replacement Pistons:—Finished pistons furnished in three standard sizes (marked by letter stamped on head) as follows: 'A'—3.3720", 'B'—3.3730", 'C'—3.3740", and .005", .010", .015", .020", .030" oversize. Pistons up to .030" oversize held to same weight as standard.
Fitting New Pistons:—Check clearance by inserting .002" feeler ½" wide between piston and cylinder wall at right angles to pin hole. Pressure to withdraw feeler must be 10-25 lbs. Piston taper allowance .0005".

PISTON RINGS:—Two compression rings above pin, one oil control ring below pin per piston. Lower ring groove drilled radially with ten ⅛" oil drain holes. Piston also has two ⅛" drain holes drilled on each side above pin hole.

Ring	Width	End Gap	Side Clearance
Comp.	⅛"	.007-.017"	.001-.0025"
Oil Cont.	3/16"	.007-.017"	.001-.0025"

NOTE—Install compression rings with groove or step downward.

PISTON PIN:—Diameter 15/16". **Length** 3 1/16".
Pin is locked in piston by lock screw in one boss. Opposite end slotted to allow boss to slide freely on pin.
Pin Fit in Piston—*See Pontiac Shop Notes.*
Pin Fit in Rod Bushing—.0003-.0005" clearance. See Connecting Rod Upper Bearing.
Fitting Pins—*See Pontiac Shop Notes.*

CONNECTING ROD:—Length—7 11/16" (center-to-center). **Weight**—Held to 1/16 oz. maximum variation.
Piston Pin Bushing (Upper Bearing)—Split bushed type. *See Pontiac Shop Notes for complete data.*
Crankpin Journal Diameter—2".
Lower Bearing—Interchangeable steel-backed, cadium-silver alloy lined type. Bearings furnished .0005" undersize for service.
Clearance—.0005-.0015". Sideplay .005-.010".
Bearing Adjustment:—None (no shims). Replace bearings. Do not file bearing caps. Clearance must be kept below .0015".
Installing Rods:—Rods not offset. Install rods in same cylinders from which removed.

CRANKSHAFT:—Four bearing. Integral counterw'ts.
See Pontiac Shop Notes for Harmonic Balancer data.
Journal Diameters—#1, 2¼"; #2, 2 9/32"; #3, 2 15/16"; #4, 2⅜".
Bearing Type—Interchangeable steel-backed, cadium-silver lined type. Upper and lower bearing halves interchangeable. Bearings furnished standard and .001" undersize.
Clearance—.001-.003".
Bearing Adjustment:—None (no shims). Replace berings. Do not file bearing caps. Bearing upper halves can be removed without removing crankshaft by turning bearing out as crankshaft is rotated.
End Thrust:—Taken by #3 rear center bearing. Endplay .003-.008". Adjusted by replacing bearing.

CAMSHAFT:—Four bearing. Non-adjustable chain drive.
See Pontiac Shop Notes for Camshaft Removal and Camshaft Bearing finished sizes.
Journal Diameters—#1, 2"; #2, 1 31/32"; #3, 1 15/16"; #4, 1 29/32".
Bearing Type—Steel-backed, babbitt-lined.
Clearance—.0015-.0025". Endplay .002-.005".
End Thrust:—Taken by steel thrust plate assembled behind camshaft sprocket. Endplay .002-.005". Adjusted by replacing thrust plate.
Timing Chain:—Morse. Width 1". Pitch ⅜". Length 56 links or 21".
Camshaft Setting:—Sprockets are marked. Mesh chain with sprockets turned so that 'O' marks are adjacent and in line with a straightedge across the shaft centers.

VALVES:—Head Diameter Stem Diameter Length
Intake ..... 1 17/32" ..... .310-.311" ..... 4 15/16"
Exhaust ..... 1 15/32" ..... .310-.311" ..... 4 15/16"

	Seat Angle	Lift	Stem Clearance
Intake	30°	19/64"	Free fit to .0006"
Exhaust	45°	19/64"	Free fit to .0006"

Tappet Clearance—.009-.011" all valves (hot). For sustained high speed driving .011" exhaust setting is recommended. Use .009" and .011" feelers as 'go' and 'no go' gauges. Hood sill must be removed to adjust clearance of front valves.
Valve Guides:—Removable, tapered guides (.001" taper to the inch, with greatest clearance at top). IMPORTANT—Measure clearance at bottom end. Valve should just fall through of own weight when started in guide. NOTE—When valves serviced, guides should be cleaned with wire brush or taper reamer (Tool P.R. 131).
Valve Springs:—Install with one closed coil at bottom two closed coils at top. Dampners installed on top of each spring. Use new dampner whenever dampner is removed.

	Spring Pressure	Spring Length
Valve Closed	52 lbs	1 29/32"
Valve Open	82 lbs	1 19/32"

Valve Lifters:—Single piece cast-iron. Furnished .005" oversize. Use special piloted reamer (J-551) when installing oversize lifter. Clearance .0005-.0015".
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 5° BTDC. Close 39° ALDC.
Exhaust Valves—Open 45° BLDC. Close 5° ATDC.
NOTE—Figures correct with .0125" lash.
To Check Valve Timing—Set tappet clearance on #6 intake valve at .0125". This valve should open with piston 5° (.0092") before top dead center and first straight line of ignition mark '/IGN. 1&6/' slightly past indicator (left front face of housing). Reset tappet clearance .010".
Motor Gauge—Weidenhoff Adapter #114 Rod # 42.

LUBRICATION:—Pressure. Gear type oil pump on right hand side of crankcase.
NOTE—Whenever oil pump is to be removed turn engine over until #1 piston is at top dead center on compression stroke. On cars with conventional front springs, jack up frame until pump will clear spring. Dip pump gears in oil before installing. Prick punch mark on pump is down when gears are correctly meshed and distributor rotor in #1 position. After installing reset ignition timing.
Oil Pump Drive Clearances—Shaft bearing .0005-.002". Drive gear backlash .003-.004".
Oil Pump Gear Clearances—Idle gear bearing .0005-.002". Backlash .006-.008". End clearance .002-.006".
Normal Oil Pressure:—35-45 lbs. with oil warm.
Oil Pressure Regulator:—In oil pump, non-adjustable.
Crankcase Capacity:—6 qts. (full).

CLUTCH:—Own Make with Long 10CF-CS driven member. Single plate, dry disc type. See article in Clutch Section for relining and assembling directions.
Facings—Moulded type, 2 required. Inside Diam. 6¼". Outside Diam. 9⅞". Thickness ⅛".
Adjustment—Clearance between clutch pedal and underside of toeboard should be ⅝". Adjust by loosening locknut and turning stopscrew at lower end of pedal under shaft. Free movement or lash of pedal should be 1". Adjust by turning link screw at clutch fork end of link.
Removal—Remove floor and toeboards and front seat, disconnect universal joint, support engine at rear and remove rear engine support cross member, block up support tube against body cross sill and slide universal joint yoke and ball back as far as possible with yoke horizontal, remove transmission lowering engine slightly at rear if necessary to clear support tube. Then remove clutch housing bottom cover, clutch control countershaft, unhook clutch pedal pull-back spring, remove clutch fork ball support, clutch fork and throwout bearing. Loosen capscrews mounting clutch cover on flywheel turning all screws out evenly to release springs. If clutch cover sticks in flywheel strike cover plate sharply on radius outside spring cups before removing screws completely. Remove clutch from below without taking off housing.

STEERING:—Steering Gear—Saginaw Worm-and-Roller type.
See article in Mechanical Equipment Section for data.
Front Suspension Model 36-26A:—Independent 'Knee Action' type. See article in Steering Section.
NOTE—All specifications are identical with those given for eight cylinder Model 36-28 on next page.
Front Suspension Model 36-26B:—Conventional 'I' beam section front axle with reverse-elliott ends and semi-elliptic springs.
Kingpin Inclination—7°10' crosswise.
Caster—1¼° plus or minus ¼°. Adjustable by inserting wedge shims between axle and spring.
Camber—1½° plus 0° or minus 1°. No adjustment. Bending of axle to correct camber not recommended.
Toe In—0-⅛" measured 9" above floor. Adjustable in usual manner by changing length of tie rod.
Steering Geometry—Inner wheel turned 38°, outer wheel 29°. Check tie rod ends and kingpin for looseness, replace steering arms.

BRAKES:—Service—Bendix Hydraulic, Duo-Servo, Single anchor type. Hand lever applies rear wheel brakes.
See article in Mechanical Equipment Section for data.
Wheel Cylinders—(36-26A) 1" diameter on front wheels, 15/16" rear wheels, (36-26B) 15/16" diameter all wheels.
Drum Diameter—12".
Lining—Woven & Moulded type. Width 1¾" Thickness 3/16". Length 23 1/16" per wheel.
Clearance—.010" at heel and toe of each shoe.
Hand Brake Adjustment—See Service Brakes.

ENGINE NUMBER:—First number—8-44,001. Stamped on boss on left hand top corner of block.

ENGINE SPECIFICATIONS:—**Type**—8 cyl., 'L' head **Bore**—3¼". **Stroke**—3½". **Displacement**—232.3 cubic inches. **Rated Horsepower**—33.8 (SAE). **Developed Horsepower**—87 at 3800 R.P.M. **Compression Ratio & Pressure**—6.2-1 Std. Cast-iron head. Pressure 144 lbs. at 1000 R.P.M. or approximately 106 lbs. at cranking speed.
NOTE—Special thick head gasket which reduces comp. ratio to 5.7-1 may be installed if desired.
Vacuum Reading—Gauge should show steady reading of 18-20" of HG. with engine idling at 360 R.P.M. or 6 M.P.H.
See Pontiac Shop Notes for Radiator & Fender Removal.

PISTONS:—Electro-plated cast-iron. Tin-plated to thickness of .00075-.00125" after finishing and cannot be ground. Use finished replacement pistons. **Length**—3 9/16". **Weight**—All pistons held to 1/16 oz. max. variation. **Removal**—Pistons and rods removed from above. **Clearance**—Top .022". Bottom .0015". See Fitting New Pistons.

Replacement Pistons:—Finished pistons furnished in three standard sizes (marked by letter stamped on head) as follows: 'A'—3.247", 'B'—3.248", 'C'—3.249" and .005", .010", .015", .020", .030" oversize. Pistons up to .030" oversize held to same weight as standard.

Fitting New Pistons:—Check clearance by inserting .002" feeler ½" wide between piston and cylinder wall at right angles to pin hole. Pressure required to withdraw feeler must be 10-25 lbs. Piston taper allowance .0005".

PISTON RINGS:—Two compression rings above pin, one oil control ring below pin per piston. Lower ring groove drilled radially with ten ⅛" oil drain holes. Piston also has two ⅛" drain holes drilled on each side above pin hole.

Ring	Width	End Gap	Side Clearance
Comp.	⅛"	.007-.017"	.001-.0025"
Oil Cont.	3/16"	.007-.017"	.001-.0025"

NOTE—Install compression rings with groove or step downward.

PISTON PIN:—Diameter 15/16". Length 2⅞". Pin is locked in piston by lock screw. Opposite end slotted to allow boss to slide freely on pin. **Pin Fit in Piston**—*See Pontiac Shop Notes.* **Pin Fit in Rod Bushing**—.0003-.0005" clearance. See Connecting Rod Upper Bearing (below). **Fitting Pins**—*See Pontiac Shop Notes.*

CONNECTING ROD:—**Length**—7 11/16" (center-to-center). **Weight**—Held to 1/16 oz. max. variation. **Piston Pin Bushing (Upper Bearing)**—Split bushed type. *See Pontiac Shop Notes for complete data.* **Crankpin Journal Diameter**—2". **Lower Bearing**—Interchangeable steel-backed, cadium-silver alloy lined type. Bearings furnished .0005" undersize for service. **Clearance**—.0005-.0015". Sideplay .005-.010".

Bearing Adjustment:—None (no shims) Replace bearings. Do not file bearing caps. Clearance must be kept below .0015".

Installing Rods:—Connecting rod lower bearings are offset. Install rods with narrow half of bearing toward nearst main bearing (widest half of bearing toward front on #2, 4, 6, 8 or toward rear on #1, 3, 5, 7).

CRANKSHAFT:—Five bearing. Integral counterweights. *See Pontiac Shop Notes for Harmonic Balancer data.* **Journal Diameters**—#1, 2¼"; #2, 2 9/32"; #3, 2 5/16"; #4, 2 11/32"; #5 2⅜". **Bearing Type**—Interchangeable steel-backed, cadium-silver lined type. Upper and lower bearing halves interchangeable. Bearings furnished standard and .001" undersize. **Clearance**—.001-.003".

Bearing Adjustment:—None (no shims). Replace bearings. Do not file bearing caps. Bearing upper halves can be removed without removing crankshaft by turning bearing out as crankshaft is rotated.

End Thrust:—Taken by #3 (center) bearing. Endplay .003-.008". Adjusted by replacing bearing.

CAMSHAFT:—Five bearing. Non-adjustable chain drive. *See Pontiac Shop Notes for Camshaft Removal and Camshaft Bearing finished sizes.* **Journal Diameters**—#1, 2"; #2, 1 31/32"; #3, 1 15/16"; #4, 1 29/32"; #5, 1⅞". **Bearing Type**—Steel-backed babbitt-lined. **Clearance**—.0015-.0025". Endplay .002-.005".

End Thrust:—Taken by a thrust plate assembled behind camshaft sprocket. Endplay .002-.005". Adjusted by replacing thrust plate.

Timing Chain:—Morse. Width 25/32". Pitch ⅜". Length 56 links or 21".

Camshaft Setting:—Sprockets are marked. Mesh chain with sprockets turned so that 'O' marks are adjacent and in line with a straightedge across the shaft centers.

VALVES:—Head Diameter Stem Diameter Length
Intake .....1 13/32".....310-.311".....4¾"
Exhaust .....1 11/32".....310-.311".....4¾"

	Seat Angle	Lift	Stem Clearance
Intake	30°	19/64"	Free fit to .0006"
Exhaust	45°	19/64"	Free fit to .0006"

Tappet Clearance—.009-.011" all valves (hot). For sustained high speed driving .011" exhaust setting recommended. Use .009" and .011" feelers as 'go' and 'no go' gauges. Hood sill must be removed to adjust clearance of front valves.

Valve Guides:—Removable, tapered guides (.001" taper to the inch, with greatest clearance at top). IMPORTANT—Measure clearance at bottom end. Valve should just fall through of own weight when started in guide. NOTE—When valves serviced, guides should be cleaned with wire brush or taper reamer (Tool P.R. 131).

Valve Springs:—Install with one closed coil at bottom, two closed coils at top. Dampners installed on top of each spring. Use new dampner whenever dampner is removed.

	Spring Pressure	Spring Length
Valve closed	52 lbs.	1 29/32"
Valve Open	82 lbs.	1 19/32"

Valve Lifters:—Single piece cast-iron. Furnished .005" oversize. Use special piloted reamer (J-551) when installing oversize lifter. Clearance .0005-.0015".

Valve Timing:—See Camshaft Setting above. **Intake Valves**—Open 5° BTDC. Close 39° ALDC. **Exhaust Valves**—Open 45° BLDC. Close 5° ATDC. NOTE—Figures corect with .0125" lash. **To Check Valve Timing**—Set tappet clearance on #8 intake valve at .0125". This valve should open with piston 5° (.0082") before top dead center and first straight line of ignition mark '/IGN. 1&8/' slightly past indicator (left front face of housing). Reset tappet clearance .010". **Motor Gauge**—Weldenhoff Adapter #114 Rod #42.

LUBRICATION:—Pressure. Gear type oil pump on right hand side of crankcase.
NOTE—Whenever oil pump is to be removed, turn engine over until #1 piston at top dead center on compression stroke. On cars with conventional front springs jack up frame until pump will clear spring. Dip pump gears in oil before installing. Prick punch mark on pump is down when gears are correctly meshed and distributor rotor in #1 position. After installing reset ignition timing. **Oil Pump Drive Clearances**—Shaft bearing .0005-.002". Drive gear backlash .003-.004". **Oil Pump Gear Clearances**—Idle gear bearing .0005-.002". Backlash .006-.008". End clearance .002-.006".

Normal Oil Pressure:—35-45 lbs. with oil warm.

Oil Pressure Regulator:—In oil pump, non-adjustable.

Crankcase Capacity:—7 qts. (full).

CLUTCH:—Own make with Long 10CF-CS driven member. Single plate, dry disc type. See article in Clutch Section for relining and assembling directions. **Facings**—Moulded type, 2 required. Inside Diam. 6¼". Outside Diam. 9⅞". Thickness ⅛". **Adjustment**—Clearance between clutch pedal and underside of toeboard should be ⅝". Adjust by loosening locknut and turning stopscrew at lower end of pedal under shaft. Free movement or lash of pedal should be 1". Adjust by turning link screw at clutch fork end of link. **Removal**—Remove floor and toeboards and front seat, disconnect universal joint, support engine at rear and remove rear engine support cross member, block up support tube against body cross sill and slide universal joint yoke and ball back as far as possible with yoke horizontal, remove transmission lowering engine slightly at rear if necessary to clear support tube. Then remove clutch housing bottom cover, clutch control countershaft, unhook clutch pedal pull-back spring, remove clutch fork ball support, clutch fork and clutch throwout bearing. Loosen capscrews mounting clutch cover on flywheel turning all screws out evenly to release springs. If clutch cover sticks in flywheel strike cover plate sharply on radius outside spring cups before removing screws completely. Remove clutch from below without taking off housing.

STEERING:—**Steering Gear**—Saginaw Worm-and-Roller type.
See article in Mechanical Equipment Section for data.

Front Suspension:—Independent 'Knee Action' type. See article in Steering Section. All specifications below apply with car weight on wheels. **Wheel Setting (Front Suspension Height)**—5⅜" from bottom of cross tube to bottom of brake drum. **King Pin Inclination**—8¾° crosswise. **Camber**—Minus ¼° to plus ¼°. Not adjustable. **Caster**—0°. Caster effect secured by trailing wheel behind suspension unit. **Toe In**—0-1/16". Adjustable in usual manner by changing length of tie rod. **Tread**—58 13/32". **Steering Geometry**—Inner wheel turned 38°, outer wheel 29°. Check tie rod ends and kingpin for looseness.

BRAKES:—**Service**—Bendix Hydraulic, Duo-Servo, Single anchor type. Hand lever applies rear wheel brakes.
See article in Mechanical Equipment Section for data. **Wheel Cylinders**—1" diameter (front), 15/16" diameter (rear). **Drum Diameter**—12". **Lining**—Woven & Moulded type. Width 1¾". Thickness 3/16". Length 23 1/16" per wheel. **Clearance**—.010" at heel and toe of each shoe.

Hand Brake Adjustment:—See Service Brake Adjustment.

NOTE:—Hood Panel. To remove, unfasten wing nuts on inside, two (rear), one (top front).

ENGINE NUMBER:—First number, 6-220001. Stamped on top left corner of engine block.

ENGINE SPECIFICATIONS:—6 cylinder, 'L' head.
Bore—3 7/16". **Stroke**—4".
Displacement—222.7 cubic inches.
Rated Horsepower—28.3 (S.A.E.).
Developed Horsepower—85 at 3600 R.P.M.
Compression Ratio & Pressure—6.2-1 Std. cast-iron head. Pressure 140-143 lbs. @ 1000 R.P.M. or approx. 115 lbs. at cranking speed.
Vacuum Reading—18-20" steady at 7 M.P.H.
See Pontiac Shop Notes for Radiator & Fender Removal.

PISTONS:—Electro-plated, chrome nickel alloy. Tin-plated .00075-.00125" thick after finishing and cannot be ground. Use finished replacement pistons. Pistons fitted in following standard sizes (marked by letter on top of head and on top of cylinder block)—'A'—3.4355", 'B'—3.436", 'C'—3.4365", 'D'—3.437", 'E'—3.4375". See Replacement Pistons below.
Length—3 37/64".
Weight—Held to 1/16 oz. maximum variation.
Removal—Pistons and rods removed from above.
Clearance—Skirt .002". See Fitting New Pistons.

Original Bore Size:—*See Pontiac Shop Notes.*

Replacement Pistons:—*See Pontiac Shop Notes.*

Fitting New Pistons:—Insert .002" feeler ½" wide between piston and cylinder wall at right angles to pin hole. Pressure to withdraw feeler must be 10-25 lbs. Piston taper allowance .0005".

PISTON RINGS:—Two undercut compression rings above pin, one oil control ring below pin, per piston. Lower ring groove drilled radially with ten .1402" oil drain holes (2 in each boss for pin lub.).

Ring	Width	End Gap	Side Clearance
Compression..	⅛"	.007-.012"	.0015-.003"
Oil Control	3/16"	.007-.012"	.001-.0025"

NOTE—Install comp. rings with groove down.

PISTON PIN:—Diameter—15/16". **Length**—3 1/16". Pin is locked in piston by lockscrew in one boss. Opposite end slotted, slides freely in boss.
Pin Fit in Piston—*See Pontiac Shop Notes.*
Pin Fit in Rod Bushing—.0003-.0005". See Connecting Rod Upper Bearing below.
Replacement Pins—Three oversize pins furnished in service. Can be identified by daub of paint on end of pins as follows: .001" (red and brown), .003" (red), .005" (blue).
Fitting Pins—*See Pontiac Shop Notes.*

CONNECTING ROD:—Length—7 9/16" (center-to-center). Weight—32 ozs. Held to 1/16 oz. variation.
Piston Pin Bushing (Upper Bearing)—Split bushed type. *See Pontiac Shop Notes for complete data.*
Crankpin Journal Diameter—2".
Lower Bearing—Removable steel-backed, babbitt-lined type. Bearings furnished std. and .001" under.
Clearance—.0005-.0015". **Sideplay**—.005-.010".

Bearing Adjustment:—None (no shims). *See Pontiac Shop Notes for Fitting and Installing Bearings.*

Installing Rods:—Rods not offset. Install rods in same cylinder from which removed.

CRANKSHAFT:—4 bearing. Integral counterweights.
See Pontiac Shop Notes for Harmonic Balancer data.
Journal Diameters—#1, 2⅜"; #2, 2 13/32"; #3, 2 15/16"; #4, 2½".
Bearing Type—Interchangeable steel-backed, babbitt-lined type. Upper and lower halves interchangeable. Bearings furnished std. and .001" undersize.
Clearance—.001-.003".

Bearing Adjustment:—None (no shims). *See Pontiac Shop Notes for Fitting and Installing Bearings.*

End Thrust:—Taken by #3 (rear center) bearing. Endplay .003-.008". No adjustment other than replacing bearing.

CAMSHAFT:—4 bearing, non-adjustable, chain-drive.
See Pontiac Shop Notes for Camshaft Removal and Camshaft Bearing finished sizes.
Journal Diameters—#1, 2"; #2, 1 31/32"; #3, 1 15/16"; #4, 1 29/32".
Bearing Type—Removable steel-backed, babbitt-lined type.
Clearance—.0015-.0025".

End Thrust:—Taken by steel thrust plate assembled behind camshaft sprocket. **Endplay** .002-.005". No adjustment. Replace plate.

Timing Chain:—Morse. Width ¾" (nominal). Pitch ⅜". Length 56 links or 21".

Camshaft Setting:—Sprockets marked. Mesh chain with sprockets turned so that 'O' marks are adjacent and in line with a straightedge across the shaft centers.

VALVES:—	Head Diam.	Stem Diam.	Length
Intake	1 19/23"	.310-.311"	4 15/16"
Exhaust	1 15/32"	.310-.311"	4 15/16"

	Seat Angle	Lift	Stem Clearance
Intake	30°	19/64"	Free fit to .0006"
Exhaust	45°	19/64"	Free fit to .0006"

Tappet Clearance—.011-.013" all valves (hot). For sustained high speed driving .013" exhaust setting is recommended. Use .011" and .013" feelers as 'go' and 'no go' gauges.

Valve Guides:—Removable, tapered guides (.001" taper to the inch, with greatest clearance at top). IMPORTANT—Measure clearance at bottom end. Valve should just fall through of own weight when started in guide. NOTE—When valves serviced, guides should be cleaned with wire brush or taper reamer (Tool P.R. 131).

Valve Springs:—Install with two close coils at top. Dampeners installed on top of each spring. Use new dampeners whenever removed from engine. Use care when removing split type spring keepers.

	Spring Pressure	Spring Length
Valve Closed	56 lbs.	1 29/32"
Valve Open	96 lbs.	1 39/64"

Valve Lifters:—Single piece cast-iron. Furnished .005" oversize. Use special piloted reamer (J-551) when installing oversize lifter. **Clearance**—.0005-.0015".

VALVE TIMING:—See Camshaft Setting above.
Intake Valves—Open 5° BTDC. Close 39° ALDC.
Exhaust Valves—Open 45° BLDC. Close 5° ATDC.

To Check Valve Timing:—Set tappet clearance #6 intake valve at .0125". This valve should open with piston 5° (.0096") before top dead center and first straight line of ignition mark '/IGN.1&6/' slightly past indicator (left front face of housing).
Motor Gauge—Weldenhoff Adapter #114, Rod #42.

LUBRICATION:—Pressure. Gear type oil pump on right hand side of engine.
See Pontiac Shop Notes for Pump Clearances.
NOTE—Whenever oil pump is to be removed (remove right engine side pan) turn engine over until #1 piston is at top dead center on compression stroke. To assemble, dip gears in oil, place prick-punch mark on oil pump gear down, see that distributor rotor is in #1 position, mesh gears, reset ignition timing.

Normal Oil Pressure:—35-45 lbs. with warm oil.

Oil Pressure Regulator:—In oil pump, non-adjust.

Crankcase Capacity:—6 quarts (refill).

CLUTCH:—Own—Long 10CF-CS driven member. Single plate, dry disc type.
See article in Mechanical Equipment Section for data.
Facings—Woven type, 2 required, I.D. 6", O.D. 10", .125" thick.
Adjustment—Clearance between pedal and underside of pedal felt retainer board should be ½". Adjust by loosening locknut and turning stopscrew at lower end of pedal. Free movement of pedal should be ¾". Adjustable link provided.

Removal:—Remove transmission (see Transmission Removal below), bottom housing cover, unlock pedal pull-back spring, remove fork ball support, fork, and throwout bearing. Loosen mounting screws evenly to release springs. Remove assembly from below.

TRANSMISSION:—Pontiac—Synchro-mesh in second and high gears. All gears helical type.
See article in Mechanical Equipment Section for data.

Removal:—Remove floor center panel, front seat, disconnect rear universal joint (wire trunnions), remove shaft housing to transmission capscrews, rear engine support bolts, jack up rear of engine, remove fastening bolts, pull unit straight back freeing main drive gear, then up and forward at front, removing transmission and coupling from front propeller shaft and housing. Remove assembly through floor opening.

UNIVERSAL JOINTS:—Mechanics—Model 2C. Roller bearing type. Two used.
See article in Mechanical Equipment Section for data.
Front Propeller Shaft Bearing:—*See Pontiac Shop Notes for complete data.*

REAR AXLE:—Pontiac, semi-floating, spiral bevel gear type with Hotchkiss drive.
See article in Mechanical Equipment Section for data.
Ratio—4.375-1 Std., 4.625-1 Mt., 4.125-1 Plains.
Backlash—.003-.010" new. Shim adjustment.

Removal:—To remove axle shaft, remove wheel, brake drum, 4 nuts freeing backing plate, static collector, pull axle shaft bearing retainer away from backing plate (do not shift backing plate or brake line damage may result) and withdraw axle shaft and bearing assembly (Tool No. J-942). Replace one nut to hold backing plate in place. With axle shafts removed, differential assembly may be removed by disconnecting rear universal joint and removing housing capscrews.
Wheel Bearing Adjustment—None.

SHOCK ABSORBERS:—Delco—Model 1947-A,B (front), 1174-U (rear). Double acting, piston type. Direct acting on rear.
See article in Mechanical Equipment Section for data.

STEERING:—Steering Gear—Saginaw Worm-and-Roller type with center steering. Specifications below apply with car weight on wheels (curb weight).
See article in Mechanical Equipment Section for data.

Front Suspension:—Independent, linked parallelogram type with coil springs.
See article in Mechanical Equipment Section for data.
Kingpin Inclination—4½-5°.
Caster—Minus ¾° to minus 1¼°. Adjustable.
Camber—¾° to 1¼°. Adjustable (½ turn max. adj.).
Toe In—0-1/16".
Steering Geometry—Inner wheel 22½-23½°. Outer wheel 20°.

BRAKES:—Service—Bendix Hydraulic, duo-servo, single anchor type. Hand lever applies rear service brks.
See article in Mechanical Equipment Section for data.
Wheel Cylinders—Front wheel—1", rear 15/16".
Drum Diameter—12". Out-of-round—.004-.005".
Lining—Moulded type. Width 1¾". Thickness 3/16". Length per wheel 23 1/16".
Clearance—.010" at heel and toe of each shoe.

Hand Brake Adjustment:—See Service Brakes.

NOTE:—Hood Panel. To remove, unfasten wing nuts on inside, two (rear), one (top front).

ENGINE NUMBER:—First number 8-83001. Stamped on boss on left hand top corner of block.

ENGINE SPECIFICATIONS:—8 cylinder, 'L' head.
Bore—3¼". **Stroke**—3¾".
Displacement—248.9 cubic inches.
Rated Horsepower—33.8 (S.A.E.)
Developed Horsepower—100 at 3800 R.P.M.
Compression Ratio & Pressure—6.2-1 std. cast-iron head. Pressure 140-143 lbs. @ 1000 R.P.M. or approx. 115 lbs. at cranking speed.
Vacuum Reading—Steady reading of 18-20" with engine idling at 376 R.P.M. or 7 M.P.H.
See Pontiac Shop Notes for Radiator & Fender Removal.

PISTONS:—Electro-plated, chrome nickel alloy. Tin-plated .00075-.00125" thick after finishing and cannot be ground. Use finished replacement pistons. Pistons fitted in following standard sizes (marked by letter on top of head and on top of cylinder block)—'A'—3.247", 'B'—3.2475", 'C'—3.248", 'D'—3.2485", 'E'—3.249". See Replacement Pistons below.
Length—3 19/32".
Weight—Held to 1/16 oz. maximum variation.
Removal—Pistons and rods removed from above.
Clearance—Skirt .002". See Fitting New Pistons.
Original Bore Size:—*See Pontiac Shop Notes.*
Replacement Pistons:—*See Pontiac Shop Notes.*
Fitting New Pistons:—Insert .002" feeler ½" wide between piston and cylinder wall at right angles to pin hole. Pressure to withdraw feeler must be 10-25 lbs. Piston taper allowance .0005".

PISTON RINGS:—Two undercut compression rings, above pin, one oil control ring below pin, per piston. Lower ring groove drilled radially with ten .1402" oil drain holes. Also two drain holes in each boss for pin lubrication.

Ring	Width	End Gap	Side Clearance
Compression	.124"	.007-.012"	.0015-.003"
Oil Control	.186"	.007-.012"	.001-.0025"

NOTE—Install comp. rings with groove down.

PISTON PIN:—Diameter—15/16". **Length** 2⅞".
Pin is locked in piston by lockscrew in one boss. Opposite end slotted, slides freely in boss.
Pin Fit in Piston—*See Pontiac Shop Notes.*
Pin Fit in Rod Bushing—.0003-.0005". See Connecting Rod Upper Bearing below.
Replacement Pins—Three oversize pins furnished in service. Can be identified by daub of paint on end of pin as follows: .001" (red and brown), .003" (red), .005" (blue).
Fitting Pins—*See Pontiac Shop Notes.*

CONNECTING ROD:—Length—7 9/16" (center to center). **Weight**—29⅞ oz. Held to 1/16 oz. max. var.
Piston Pin Bushing (Upper Bearing)—Split bushed type. *See Pontiac Shop Notes for complete data.*
Crankpin Journal Diameter—2".
Lower Bearing—Removable steel-backed, babbitt-lined type. Furnished standard and .001" undersize.
Clearance—.0005-.0015". **Sideplay**—.005-.010".
Bearing Adjustment:—None (no shims). *See Pontiac Shop Notes for Fitting and Installing Bearings.*
Installing Rods:—Rods not offset. Install rods in same cylinder from which removed.

CRANKSHAFT:—5 bearing. Integral counterweights.
See Pontiac Shop Notes for Harmonic Balancer data.
Journal Diameters—#1, 2⅜"; #2, 2 13/32"; #3, 2 7/16"; #4, 2 15/32"; #5, 2½".
Bearing Type—Interchangeable steel-backed, babbitt-lined type. Upper and lower halves interchangeable. Furnished std., .001" undersize.
Clearance—.001-.003".
Bearing Adjustment:—None (no shims). *See Pontiac Shop Notes for Fitting and Installing Bearings.*
End Thrust:—Taken by #4 (rear center) bearing. Endplay .003-.008". No adjustment other than replacing bearing.

CAMSHAFT:—5 bearing, non-adjustable chain drive.
See Pontiac Shop Notes for Camshaft Removal and Camshaft Bearing finished sizes.
Journal Diameters—#1, 2"; #2, 1 31/32"; #3, 1 15/16"; #4, 1 29/32"; #5, 1⅞".
Bearing Type—Removable steel-backed, babbitt-lined.
Clearance—.0015-.0025".
End Thrust:—Taken by steel thrust plate assembled behind camshaft sprocket. **Endplay** .002-.005". No adjustment. Replace plate.
Timing Chain:—Morse. Width 1". Pitch ⅜". Length 56 links or 21".
Camshaft Setting:—Sprockets are marked. Mesh chain with sprockets turned so that 'O' marks are adjacent and in line with a straightedge across the shaft centers.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1 15/32"	.310-.311"	4¾"
Exhaust	1 11/32"	.310-.311"	4¾"

	Seat Angle	Lift	Stem Clearance
Intake	30°	19/64"	Free fit to .0006"
Exhaust	45°	19/64"	Free fit to .0006"

Tappet Clearance—.011-.013" all valves (hot). For sustained high speed driving .013" exhaust setting is recommended. Use .011" and .013" feelers as 'go' and 'no go' gauges.
Valve Guides:—Removable, tapered guides (.001" taper to the inch, with greatest clearance at top). IMPORTANT—Measure clearance at bottom end. Valve should just fall through of own weight when started in guide. NOTE—When valves serviced, guides should be cleaned with wire brush or taper reamer (Tool P.R. 131).
Valve Springs:—Install with two close coils at top. Dampeners installed on top of each spring. Use new dampeners whenever removed from engine. Use care when removing split type spring keepers.

	Spring Pressure	Spring Length
Valve Closed	56 lbs.	1 29/32"
Valve Open	96 lbs.	1 39/64"

Valve Lifters:—Single piece cast-iron. Furnished .005" oversize. Use special piloted reamer (J-551) when installing oversize lifter. **Clearance**—.0005-.0015".

VALVE TIMING:—See Camshaft Setting above.
Intake Valves—Open 5° BTDC. Close 39° ALDC.
Exhaust Valves—Open 45° BLDC. Close 5° ATDC.
To Check Valve Timing:—Set tappet clearance #1 intake valve at .0125". This valve should open with piston 5° (.0089") before top dead center, and first straight line of ignition mark '/IGN. 1&8/' slightly past indicator (left front face of housing).
Motor Gauge—Weidenhoff Adapter #114, Rod #42.

LUBRICATION:—Pressure. Gear type oil pump on right hand side of crankcase.
See Pontiac Shop Notes for Pump Clearances.
NOTE—Whenever oil pump is to be removed (remove right engine side pan) turn engine over until #1 piston is at top dead center on compression stroke. To assemble, dip gears in oil, place prick-punch mark on oil pump gear down, see that distributor rotor is in #1 position, mesh gears, reset ignition timing.
Normal Oil Pressure:—35-45 lbs. with warm oil.
Oil Pressure Regulator:—In oil pump, non-adjust.
Crankcase Capacity:—7 quarts, refill.

CLUTCH:—Own—Long 10 CF-CS driven member. Single plate, dry disc type.
See article in Mechanical Equipment Section for data.
Facings—Woven type, 2 required, I.D. 6", O.D. 10", .125" thick.
Adjustment—Clearance between pedal and underside of pedal felt retainer board should be ½". Adjust by loosening locknut and turning stopscrew at lower end of pedal. Free movement of pedal should be ¾". Adjustable link provided.
Removal:—Remove transmission (see Transmission Removal below), bottom housing cover, unlock pedal pull-back spring, remove fork ball support, fork, and throwout bearing. Loosen mounting screws evenly to release springs. Lower assembly.

TRANSMISSION:—Pontiac—Synchro-mesh on second and high gears. All gears helical type.
See article in Mechanical Equipment Section for data.
Removal:—Remove floor center panel, front seat, disconnect rear universal joint (wire trunnions), remove shaft housing to transmission capscrews, rear engine support bolts, jack up rear of engine, remove fastening bolts, pull unit straight back freeing main drive gear, then up and forward at front removing transmission and coupling from front propeller shaft and housing. Remove assembly through floor opening.

UNIVERSAL JOINTS:—Mechanics—Model 2C. Roller bearing type. 2 used.
See article in Mechanical Equipment Section for data.
Front Propeller Shaft Bearing:—*See Pontiac Shop Notes for complete data.*

REAR AXLE:—Pontiac, semi-floating, spiral bevel gear type with Hotchkiss drive.
See article in Mechanical Equipment Section for data.
Ratio—4.375-1 Std., 4.625-1 Mt., 4.125-1 Plains.
Backlash—.003-.010" new. Shim adjustment.
Removal:—To remove axle shaft, remove wheel, brake drum, 4 nuts freeing backing plate, static collector, pull axle shaft bearing retainer away from backing plate (do not shift backing plate or brake line damage may result) and withdraw axle shaft and bearing assembly (Tool No. J-942). Replace one nut to hold backing plate in place. With axle shafts removed, differential assembly may be removed by disconnecting rear universal joint and removing housing capscrews.
Wheel Bearing Adjustment—None.

SHOCK ABSORBERS:—Delco—Model 1947-A, B (front), 1174-U (rear). Double acting, piston type. Direct acting on rear.
See article in Mechanical Equipment Section for data.

STEERING:—Steering Gear—Saginaw Worm-and-Roller type with center steering. Specifications below apply with car weight on wheels (curb weight).
See article in Mechanical Equipment Section for data.
Front Suspension:—Independent, linked parallelogram type with coil springs.
See article in Mechanical Equipment Section for data.
Kingpin Inclination—4½-5°.
Caster—Minus ¾° to minus 1¼°. Adjustable.
Toe In—0-1/16".
Steering Geometry—Inner wheel 22½-23½°. Outer wheel 20°.

BRAKES:—Service—Bendix Hydraulic, duo-servo, single anchor. Hand lever applies rear service brakes.
See article in Mechanical Equipment Section for data.
Wheel Cylinders—Front wheel—1", rear 15/16".
Drum Diameter—12". **Out-of-round**—.004-.005".
Lining—Moulded type. Width 1¾". Thickness 3/16". Length per wheel 23 1/16".
Clearance—.010" at heel and toe of each shoe.
Hand Brake Adjustment:—See Service Brakes.

SERIAL NUMBER:—First number 6DA-1001. On top left frame siderail under engine hood.

ENGINE NUMBER:—First number 6-399501. Stamped on boss on top left front corner of block.

ENGINE SPECIFICATIONS:—6 cylinder, 'L' head.
Bore—3 7/16". **Stroke**—4".
Displacement—222.7 cu. ins. **Rated HP.**—28.3.
Developed Horsepower—85 at 3520 R.P.M.
Compression Ratio—6.2-1 Std. cast-iron head.
Compression Pressure—140-143 lbs. at 1000 R.P.M. or approximately 115 lbs. at cranking speed.
Vacuum Reading—Steady 18-20", 376 RPM., 7 MPH.

PISTONS:—Electro-plated, chrome nickel alloy. Tin-plated .00075-.00125" thick after finishing. Cannot be ground.
Length—3 37/64". **Weight**—26.68 ozs.
Removal—Pistons and rods removed from above.
Clearance—Top .023". Skirt .002".
Original Bore & Piston Sizes:—*See Pontiac Shop Notes.*
Replacement Pistons:—*See Pontiac Shop Notes.*
Fitting New Pistons:—Insert .002"x½" feeler between piston and cylinder wall. Pull to withdraw feeler must be 10-25 lbs. Piston taper .0005" max.

PISTON RINGS:—Two compression rings above pin, one oil control ring below pin. Lower ring groove drilled radially with 10 oil drain holes. Rings furnished in .005", .010", .020", & .030" oversizes.
See Pontiac Shop Notes for Compression Ring data.

Ring	Width	End Gap	Side Clearance
Compression	.1235-.1240"	.007-.017"	.0015-.003"
Oil Control	.1860-.1865"	.007-.017"	.001-.0025"

PISTON PIN:—Diameter—15/16". **Length**—3 1/16". Pin locked in piston. Other end slotted.
Pin Fit in Piston—*See Pontiac Shop Notes.*
Pin Fit in Rod Bushing—.0003-.0005".
Replacement Pins:—.001", .003", .005" oversize.
Fitting Pins:—*See Pontiac Shop Notes for data.*

CONNECTING ROD:—Length—7 9/16". **Weight**—32 ozs.
Piston Pin Bushing (Upper Bearing)—Split bushed type. *See Pontiac Shop Notes for data.*
Crankpin Journal Diameter—2".
Lower Bearing—Removable steel-backed, white bearing metal alloy type. Furnished standard and .001" undersize.
Clearance—.0005-.0015". **Sideplay**—.005-.010".
Bearing Adjustment:—None (no shims). *See Pontiac Shop Notes for Fitting and Installing Bearings.*
Installing Rods:—Rods not offset. Connecting rods may be installed in either direction.

CRANKSHAFT:—4 bearing, integral counterweights.
See Pontiac Shop Notes for Balancer data.
Journal Diameters—#1, 2⅜"; #2, 2 13/32"; #3, 2 15/32"; #4, 2½".
Bearing Type—Interchangeable steel-backed, white bearing metal alloy type. Furnished standard and .001" undersize. **Clearance**—.001-.003".
Bearing Adjustment:—See Pontiac Shop Notes.
End Thrust:—Taken by #3 (rear center) bearing.
Endplay—.003-.008". To adjust, replace bearing.

CAMSHAFT:—Four bearing, non-adjustable chain drive.
See Pontiac Shop Notes for Camshaft Removal and Bearing finished sizes.
Journal Diameters—#1, 2"; #2, 1 31/32"; #3, 1 15/16"; #4, 1 29/32".
Bearing Type—Removable steel-backed, babbitt lined type. **Clearance**—.0015-.0025".
End Thrust:—Taken by steel thrust washer assembled behind camshaft sprocket. No adjustment other than replacing plate. **Endplay**—.002-.005".
Timing Chain:—Morse. Width 1" (¾" nominal). Pitch ⅜". Length 56 links or 21".
Camshaft Setting:—Sprockets are marked. Mesh chain with '0' marks on sprockets adjacent and in line with a straightedge across the shaft centers.

VALVES:—	Head Diameter	Stem Diameter	Length
Intake	1 19/32"	.310-.311"	4 15/16"
Exhaust	1 15/32"	.310-.311"	4 15/16"

	Seat Angle	Lift	Stem Clearance
Intake	30°	19/64"	Free fit to .0006"
Exhaust	45°	19/64"	Free fit to .0006"

Tappet Clearance—.011-.013" all valves (hot). High limit .013" exhaust setting recommended for sustained high speed driving. Use .011" feeler as 'go', .013" feeler as 'no go'.
Valve Guides:—Removable, tapered guides (.001" taper to the inch, with greatest clearance at top). IMPORTANT—Measure clearance at bottom end. Valve should just fall through of own weight when started in guide. NOTE—When valves serviced, guides should be cleaned with wire brush or taper reamer (Tool P.R. 131).
Valve Springs:—Intake and exhaust springs identical. Install with two closed coils at top. Dampeners installed on top of each spring. Always use new dampeners. **Spring Free Length**—2 9/16".

	Spring Pressure	Spring Length
Valve Closed	54½ lbs.	1 29/32"
Valve Open	96 lbs.	1 19/32"

Valve Lifters:—Single piece, cast iron. Furnished .005" oversize. Use special pilot reamer (J-551) when installing oversize lifter. **Clearance**—Free fit.

VALVE TIMING:—See Camshaft Setting above.
Intake Valves—Open 5° BTDC. Close 39° ALDC.
Exhaust Valves—Open 45° BLDC. Close 5° ATDC.
To Check Valve Timing:—Set tappet clearance #6 intake valve at .0125". This valve should open with piston 5° (.0096") before top dead center and first straight line of ignition mark '/IGN.ONE/' slightly past indicator (left front face of housing).
Motor Gauge—Weidenhoff Adapter #114, Rod #42.

LUBRICATION:—Pressure system. Gear type oil pump located on right side of engine.
See Pontiac Shop Notes for Oil Pump Removal, Installation, and gear clearances.
Normal Oil Pressure:—35-45 lbs. with warm oil.
Oil Pressure Regulator—In pump. Non-adjustable.
Crankcase Capacity:—6 quarts.

COOLING SYSTEM:—Water Pump. Centrifugal, belt-driven, packless type.
See article in Mechanical Equipment Section for data.
Removal—Drain radiator and block, disconnect hose, remove mounting bolts and lift off fan and pump as an assembly.
Thermostat:—Harrison. In cyl. head water outlet.
Setting—Closed 140°F. Start to open 145°F. Fully open 172°F.
Water Capacity—16 quarts.

CLUTCH:—Own—Long 10CF-CS driven member. Single plate, dry disc type.
See article in Mechanical Equipment Section for data.
Facings—Woven Joined type, 2 required, I.D. 6", O.D. 10", thickness ⅛".
Pedal Adjustment:—Clearance between pedal and underside of felt retainer board should be ½". Adjust by loosening lockscrew and turning adjusting screw. Free movement of pedal should be 1" plus or minus ¼". Adjustable rod provided.
Clutch Helper Spring:—*See Pontiac Shop Notes.*
Removal:—Remove transmission (see Transmission Removal below), remove bottom housing cover, unlock pedal pull-back spring, remove fork ball support, fork and throwout bearing. Loosen cover bolts remove assembly from below.

TRANSMISSION:—Own—All helical gear type with synchro-mesh shift on second and high.
Safety Shift Gear Control—Positive remote control shift by lever mounted on steering column below wheel. Available as optional equipment.
See article in Mechanical Equipment Section for data.
Removal:—Remove floor center panel, front seat assembly, and speedometer cable. (On cars with Safety Shift Gear Control disconnect control cable from selector plate hook and transmission case, withdraw cable and disconnect outer lever from cover shift shaft). Disconnect rear U-joint, remove shaft housing to transmission capscrews, rear engine support bolts, jack up rear of engine to have drain plug clear crossmember, remove fastening bolts. Pull unit straight back (use support at rear to keep in alignment) freeing clutch shaft, then up and forward at front, removing transmission with coupling from propellor shaft. Lift assembly out through floor opening.
NOTE—On cars with Safety Shift Gear Control check shift linkage adjustments after installing transmission.

UNIVERSAL JOINTS:—Mechanics—Model 2C. Roller bearing type. Two used.
See article in Mechanical Equipment Section for data.
Front Propeller Shaft Bearing:—*See Pontiac Shop Notes for complete data.*

REAR AXLE:—Own—Semi-floating, spiral bevel gear type with Hotchkiss drive.
See article in Mechanical Equipment Section for data.
Ratio—Std. 4.375-1. Mt. 4.625-1. Plains 4.125-1.
Backlash—Not less than .003".
Removal:—To remove axle shaft, remove wheel, brake drum, 4 nuts freeing backing plate, static collector, pull axle shaft (Tool J-942). NOTE—Do not shift backing plate or brake line damage may result. With axle shafts removed, differential assembly may be removed by disconnecting rear U-joint and removing housing capscrews.
Wheel Bearing Adjustment—None.

SHOCK ABSORBERS:—Delco—Model 1947-A, B (front), P-1193-U (rear). Hydraulic, double acting type. Direct acting on rear only.
See article in Mechanical Equipment Section for data.

STEERING:—Steering Gear—Saginaw Worm-and-Roller type with center steering.
See article in Mechanical Equipment Section for data.
Front Suspension:—Independent, linked parallelogram type with coil springs.
See article in Mechanical Equipment Section for data.
Specifications below apply with car weight on wheels (at curb weight) with tires properly inflated.
Kingpin Inclination—4½-5°.
Caster—Minus ¾° to minus 1¼°. Adjustable.
Camber—Minus ½° to 1° pos. ½ turn max. adj.
Toe In—0-1/16".
Steering Geometry—Inner wheel 22½-23½°. Outer wheel 20°.

BRAKES:—Service—Bendix Duo-Servo, hydraulic, single anchor type. Hand lever applies rear brakes.
See article in Mechanical Equipment Section for data.
Wheel Cylinder Bore—Front wheel 1". Rear 15/16".
Drum—12". Chrome nickel iron. Out-of-round .005". (maximum indicator reading).
Lining—Moulded type. Width 1¾". Thickness 3/16". Length per wheel 23 1/16".
Clearance—.010" at heel and toe of each shoe.
Braking Power—53% front wheels. 47% rear.
Hand Brake Adjustment:—See Service Brakes above.

SERIAL NUMBER:—First number 8DA-1001. On top left frame siderail just ahead of steering gear.

ENGINE NUMBER:—First number 8-140001. Stamped on boss on top left front corner of engine.

ENGINE SPECIFICATIONS:—8 cylinder, 'L' head.
Bore—3¼". **Stroke**—3¾".
Displacement—248.9 cu. ins. **Rated HP.**—33.8.
Developed Horsepower—100 HP. at 3700 R.P.M.
Compression Ratio—6.2-1 Std. cast-iron head.
Compression Pressure—140-143 lbs. at 1000 R.P.M. or approximately 115 lbs. at cranking speed.
Vacuum Reading—Steady 18-20", 376 RPM., 7 MPH.

PISTONS:—Electro-plated, chrome nickel-alloy. Tin-plated .00075-.00125" thick after finishing.
Length—3 19/32". **Weight**—24.25 oz. (stripped).
Removal—Pistons and rods removed from above.
Clearance—Top .023". Skirt .002".
Original Bore & Piston Sizes:—*See Pontiac Shop Notes.*
Replacement Pistons:—*See Pontiac Shop Notes.*
Fitting New Pistons:—Insert .002" X ½" feeler between piston and cylinder wall. Pull to withdraw feeler must be 10-25 lbs. Piston taper .0005" max.

PISTON RINGS:—Two compression rings above pin, one oil control ring below pin. Lower ring groove drilled radially with 10 oil drain holes. Rings furnished in .005", .010", .020", and .030" oversizes.
See Pontiac Shop Notes for Compression Ring data.

	Width	End Gap	Side Clearance
Compression	.1235-.1240"	.007-.017"	.0015-.003"
Oil Control	.1860-.1865"	.007-.017"	.001-.0025"

PISTON PIN:—Diameter—15/16". **Length**—2⅞". Pin locked in piston by lockscrew. Other end slotted.
Pin Fit in Piston—*See Pontiac Shop Notes.*
Pin Fit in Rod Bushing—.0003-.0005".
Replacement Pins:—Oversize pins (painted on ends) .001" (Red & Brown), .003" (Red), .005" (Blue).
Fitting Pins:—*See Pontiac Shop Notes for data.*

CONNECTING ROD:—Length 7 9/16". **Weight** 31¾ oz.
Piston Pin Bushing (Upper Bearing)—Split bushed type. *See Pontiac Shop Notes for data.*
Crankpin Journal Diameter—2".
Lower Bearing—Removable steel-backed, white bearing metal alloy type. Furnished standard and .001" undersize.
Clearance—.0005-.0015". **Sideplay**—.005-.010"
Bearing Adjustment:—None (no shims). *See Pontiac Shop Notes for Fitting and Installing Bearings.*
Installing Rods:—Rods not offset. Connecting rods may be installed in either direction.

CRANKSHAFT:—5 bearing, integral counterweights.
See Pontiac Shop Notes for Balancer data.
Journal Diameters—#1, 2⅜"; #2, 2 13/32"; #3, 2 7/16"; #4, 2 15/32"; #5, 2½".
Bearing Type—Interchangeable, steel-backed, white bearing metal alloy type. Furnished standard and .001" undersize. **Clearance**—.001-.003".
Bearing Adjustment:—None (no shims). *See Pontiac Shop Notes for Fitting and Installing Bearings.*
End Thrust:—Taken by #4 (rear center) bearing.
Endplay—.003-.008". Adjust by replacing bearing.

CAMSHAFT:—Five bearing, non-adjustable chain drive. *See Pontiac Shop Notes for Camshaft Removal and Bearing finished sizes.*
Journal Diameters—#1, 2"; #2, 1 31/32"; #3, 1 15/16"; #4, 1 29/32"; #5, 1⅞".
Bearing Type—Removable steel-backed, babbitt lined type. **Clearance**—.0015-.0025".
End Thrust:—Taken by steel thrust washer assembled behind camshaft sprocket. No adjustment other than replacing plate. **Endplay**—.002-.005".
Timing Chain:—Morse. Width 1". (¾" nominal). Pitch ⅜". Length 56 links or 21".
Camshaft Setting:—Sprockets are marked. Mesh chain with '0' marks on sprockets adjacent and in line with a straightedge across the shaft centers.

VALVES:

	Head Daimeter	Stem Diameter	Length
Intake	1 15/32"	.310-.311"	4¾"
Exhaust	1 11/32"	.310-.311"	4¾"

	Seat Angle	Lift	Stem Clearance
Intake	30°	19/64"	Free fit to .0006"
Exhaust	45°	19/64"	Free fit to .0006"

Tappet Clearance—.011-.013" all valves (hot). High limit .013" exhaust setting recommended for sustained high speed driving. Use .011" feeler as 'go,' .013" feeler 'no go.'
Valve Guides:—Removable, tapered guides (.001" taper to the inch, with greatest clearance at top). IMPORTANT—Measure clearance at bottom end. Valve should just fall through of own weight when started in guide. NOTE—When valves serviced, guides should be cleaned with wire brush or taper reamer (Tool P.R. 131).
Valve Springs:—Intake and exhaust springs identical. Install with two closed coils at top. Dampeners installed on top of each spring. Always use new dampeners if removed. **Spring Free Length**—2 9/16".

	Spring Pressure	Spring Length
Valve Closed	54½ lbs.	1 29/32"
Valve Open	96 lbs.	1 19/32"

Valve Lifters:—Single piece, cast iron. Furnished .005" oversize. Use special pilot reamer (J-551) when installing oversize lifter. **Clearance**—Free fit.
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 5° BTDC. Close 39° ALDC.
Exhaust Valves—Open 45° BLDC. Close 5° ATDC.
To Check Timing—Set tappet clearance #3 intake valve at .0125". This valve should open with piston 5° or .0089" before top dead center with first straight line of flywheel mark '/IGN.ONE/' slightly past indicator in inspection hole in left front face of flywheel housing.
Motor Gauge—Weidenhoff Adapter #114, Rod #42.

LUBRICATION:—Pressure system. Gear type oil pump located on right side of engine.
See Pontiac Shop Notes for Oil Pump Removal, Installation, and gear clearances.
Normal Oil Pressure:—35-45 lbs. at 40 M.P.H.
Oil Pressure Regulator—In pump. Non-adjustable.
Crankcase Capacity:—7 quarts.

COOLING SYSTEM:—Water Pump. Centrifugal, belt-driven, packless type.
See article in Mechanical Equipment Section for data.
Removal—Drain radiator and block, disconnect hose, remove mounting bolts and lift off fan and pump as an assembly.
Thermostat:—Harrison. In cyl. head water outlet.
NOTE—Install thermostat with bellows down.
Setting—Closed 140°F. Start to open 145°F. Fully open 172°F.
Water Capacity:—19 quarts.

CLUTCH:—Own—Long 10CF-CS driven member. Single plate, dry disc type.
See article in Mechanical Equipment Section for data.
Facings—Woven Joined type, 2 required, I.D. 6", O.D. 10", thickness ⅛".
Pedal Adjustment:—Clearance between pedal and underside of felt retainer board should be ½". Adjust by loosening lockscrew and turning adjusting screw. Free movement of pedal should be 1" plus or minus ¼". Adjustable rod provided.
Clutch Helper Spring:—*See Pontiac Shop Notes.*
Removal:—Remove transmission (see Transmission Removal below), remove bottom housing cover, unlock pedal pull-back spring, remove fork ball support, fork and throwout bearing. Loosen cover bolts evenly remove assembly from below.

TRANSMISSION:—Own—All helical gear type with synchromesh shift on second and high.
Safety Shift Gear Control—Positive remote control shift by lever mounted on steering column below wheel. Available as optional equipment.
See article in Mechanical Equipment Section for data.
Removal:—Remove floor center panel, front seat assembly, and speedometer cable. (On cars with Safety Shift Gear Control disconnect control cable from selector plate hook and transmission case, withdraw cable and disconnect outer lever from cover shift shaft). Disconnect rear U-joint, remove shaft housing to transmisson capscrews, rear engine support bolts, jack up rear of engine to have drain plug clear crossmember, remove fastening bolts. Pull unit straight back (use support at rear to keep in alignment) freeing clutch shaft, then up and forward at front, removing transmission with coupling from propeller shaft. Lift assembly out.
NOTE—On cars with Safety Shift Gear Control check shift linkage adjustments after installing transmission.

UNIVERSAL JOINTS:—Mechanics—Model 2C. Roller bearing type. Two used.
See article in Mechanical Equipment Section for data.
Front Propeller Shaft Bearing:—*See Pontiac Shop Notes for complete data.*

REAR AXLE:—Own—Semi-floating, spiral bevel gear type with Hotchkiss drive.
See article in Mechanical Equipment Section for data.
Ratio—Std. 4.375-1. Mt. 4.625-1. Plains 4.125-1.
Backlash—Not less than .003".
Removal:—To remove axle shaft, remove wheel, brake drum, 4 nuts freeing backing plate, static collector, pull axle shaft (Tool J-942). NOTE—Do not shift backing plate or brake line damage may result. With axle shafts removed, differential assembly may be removed by disconnecting rear U-joint and removing housing capscrews.
Wheel Bearing Adjustment—None.

SHOCK ABSORBERS:—Delco—Model 1947-A,B (front), S-1163-U (rear). Hydraulic, double acting type. Direct acting on rear only.
See article in Mechanical Equipment Section for data.

STEERING:—Steering Gear—Saginaw Worm-and-Roller type with center steering.
See article in Mechanical Equipment Section for data.
Front Suspension:—Independent, linked parallelogram type with coil springs.
See article in Mechanical Equipment Section for data.
Specifications below apply with car weight on wheels (at curb weight) with tires properly inflated.
Kingpin Inclination—4½-5°.
Caster—Minus ¾° to minus 1¼°. Adjustable.
Camber—Minus ½° to 1° pos. ½ turn max. adj.
Toe In—0-1/16".
Steering Geometry—Inner wheel 22½-23½°. Outer wheel 20°.

BRAKES:—Service—Bendix Duo-Servo, hydraulic, single anchor type. Hand lever applies rear brakes.
See article in Mechanical Equipment Section for data.
Wheel Cylinder Bore—Front wheel 1". Rear 15/16".
Drum—Chrome nickel iron. Diameter—12". Out-of-round .005" (maximum indicator reading).
Lining—Moulded type. Width 1¾". Thickness 3/16". Length per wheel 23 1/16".
Clearance—.010" at heel and toe of each shoe.
Braking Power—53% front wheels, 47% rear.
Hand Brake Adjustment:—See Service Brakes above.

FRONT FENDER & RADIATOR (UNIT) REMOVAL:—*See Pontiac Shop Notes for complete instructions.*

SERIAL NUMBER:—First number 6EA-1001 (Deluxe 115), 6EB-1001 (Deluxe 120) with prefixes as follows: P—Pontiac, Mich., C—South Gate, Calif., L—Linden, N. J. On plate on left end of frame front cross member under hood.

ENGINE NUMBER:—First number 6-486200. Stamped on boss on top left front corner of engine block.

ENGINE SPECIFICATIONS:—6 cylinder, 'L' head.
Bore—3 7/16". **Stroke**—4".
Displacement—222.7 cu. ins. **Rated HP.**—28.3.
Developed Horsepower—85 at 3520 R.P.M.
Compression Ratio—6.20-1 standard cast-iron head.
Compression Pressure—140-143 lbs. at 1000 R.P.M. or approximately 115 lbs. at cranking speed.
Vacuum Reading—18-20" steady at 7 M.P.H.

PISTONS:—Electro-plated, chrome nickel type with rib between bosses. Cannot be ground.
Length—3 37/64". **Weight**—27⅛ ozs. (stripped).
Removal—Pistons and rods removed from above.
Clearance—Top .0175-.0295". Skirt .002".
Original Bore & Piston Sizes, Replacement Pistons:—*See Pontiac Shop Notes for data.*
Fitting New Pistons:—Insert .0015"x½" feeler between piston and cylinder wall. Pull to withdraw feeler must be 10-25 lbs. Piston taper .0005" max.

PISTON RINGS:—Two compression rings above pin, one oil control ring below pin. Oil ring groove drilled radially with 10 oil drain holes.
See Pontiac Shop Notes for compression ring data.

Ring	Width	End Gap	Side Clearance
Compression	.0930-.0935"	.009-.014"	.0015-.003"
Oil Control	.1860-.1865"	.007-.017"	.001-.0025"

Replacement Rings:—.005", .010", .020", .030" oversize.

PISTON PIN:—**Diameter**—15/16". **Length**—3 1/16". Pin locked in one boss. Free end slotted.
Pin Fit in Piston—*See Pontiac Shop Notes.*
Pin Fit in Rod Bushing—.0003-.0005".
Replacement Pins:—.001", .003", .005" oversize.
Fitting Pins:—*See Pontiac Shop Notes for data.*

CONNECTING ROD:—**Length** 7 9/16". **Weight** 2.16 lbs.
Piston Pin Bushing (Upper Bearing)—Split bushed type. *See Pontiac Shop Notes for complete data.*
Crankpin Journal Diameter—2⅛".
Lower Bearing—Removable steel-backed, babbitt-lined type. Furnished std. & .001" undersize.
Clearance—.0005-.0015". **Endplay**—.005-.010".
Bearing Adjustment:—None (no shims). *See Pontiac Shop Notes for Fitting and Installing Bearings.*

CRANKSHAFT:—4 bearing type with integral counterweights. Balancer mounted on forward end.
See Pontiac Shop Notes for Balancer Removal and Rear Main Bearing Oil Seal Renewal.
Journal Diameters—#1, 2½"; #2, 2 17/32"; #3, 2 19/32"; #4, 2⅝".
Bearing Type—Interchangeable steel-backed, babbit-lined type. Furnished Std. & .001" undersize.
Clearance—.001-.003".
Bearing Adjustment:—None (no shims). Replace bearings. Do not file caps. *See Pontiac Shop Notes.*
End Thrust:—Taken by #3 (rear center) bearing.
Endplay—.003-.008". To adjust, replace bearing.

CAMSHAFT:—4 bearing. Non-adjustable chain drive.
See Pontiac Shop Notes for Camshaft Removal and Camshaft Bearing Finished Sizes.
Journal Diameters—#1, 2"; #2, 1 31/32"; #3, 1 15/16"; #4, 1 29/32".
Bearing Type—Removable steel-backed, babbitt-lined type. **Clearance**—.0015-.0025".
End Thrust:—Taken by steel thrust plate assembled behind camshaft sprocket. No adjustment other than replacing plate. **Endplay**—.002-.005".

Timing Chain:—Morse. Width 1" (¾" nominal). Pitch ⅜". Length 56 links or 21".
See Pontiac Shop Notes for Timing Chain Cover Oil Seal squeak correction data.
Camshaft Setting:—Sprockets are marked. Mesh chain with '0' marks on sprockets adjacent and in line with straightedge across shaft centers.

VALVES:—	Head Diameter	Stem Diameter	Length
Intake	1 19/32"	.310-.311"	5.718"
Exhaust	1 15/32"	.310-.311"	5.718"

	Seat Angle	Lift	Stem Clearance
Intake	30°	19/64"	Free fit to .0006"
Exhaust	45°	19/64"	Free fit to .0006"

Tappet Clearance:—.011-.013" all valves (hot and running). Use .011" and .013" feelers as 'go' and 'no go' gauges. NOTE—Car manufacturer recommends .013" exhaust clearance for high speed driving.
Valve Guides:—Removable, tapered guides (.001" taper to the inch, with greatest clearance at top). IMPORTANT—Measure clearance at bottom end. Valve should just fall through guide of own weight when started in guide. NOTE—Guides should be cleaned with wire brush or taper reamer Tool P.R. 131. Replacement guides straight cut, ream to fit valve after installing with reamer P.R. 131.
Valve Springs:—Intake and exhaust springs identical. Install with two closed coils at top and dampener on top of each spring. New dampeners should be used whenever springs installed. **Free Length**—2 5/16".

	Spring Pressure	Spring Length
Valve Closed	54½ lbs.	1 29/32"
Valve Open	96 lbs.	1 19/32"

Valve Lifters:—Single piece, cast-iron, cylindrical type. Furnished .005" oversize. Use pilot reamer J-706-P when installing oversize lifter to insure alignment of lifter hole and valve stem.
Clearance—Free fit. Lifter should just be free enough to move freely with finger touch.
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 5° BTDC. Close 39° ALDC.
Exhaust Valves—Open 45° BLDC. Close 5° ATDC.
To Check Timing—Set tappet clearance #6 intake valve at .0125". This valve should open with piston 5° or .0096" before top dead center with first straight line of flywheel mark '/IGN.ONE/' slightly past indicator in left front face of flywheel housing
Motor Gauge—Weidenhoff Adapter #114, Rod #42.

LUBRICATION:—Gear type pump (right of engine).
See Pontiac Shop Notes for Oil Pump Removal Instructions and Pump Gear Clearances.
Normal Oil Pressure:—35-45 lbs. with warm oil.
Oil Pressure Regulator—In pump. Non-adjustable.
Crankcase Capacity:—6 quarts (refill).

COOLING SYSTEM:—**Capacity**—17 quarts.
See Pontiac Shop Notes for Radiator Core Removal.
Water Pump:—Packless, sealed ball-bearing shaft.
See article in Mechanical Equipment Section for data.
Removal—Remove fan belt, pump mounting bolts and lower hose. Lift off pump and fan assembly.
Thermostat:—Harrison. In cylinder head outlet.
Setting—Closed 140° F. Start 145°. Fully open 172°.
Temperature Gauge:—AC. #1510771 (dash), #1510772 (engine). Electric type.
See article in Mechanical Equipment Section for data.

CLUTCH:—**Inland.** 'Diaphragm' type, single plate, dry disc type with Long 9CF-CS driven member.
See article in Mechanical Equipment Section for data.
Facings—Moulded type, 2 required. Inside Diam. 5¾". Outside Diam. 9". Thickness .125".
NOTE—Install plain facing toward flywheel, facing with cushioned segments on pressure plate side.
Pedal Adjustment:—Pedal free movement ⅞-1⅛" (adjusting nut under locknut at fork end of pedal link). Pedal toeboard clearance (felt retainer to pedal arm) 1" (setscrew and locknut at lower end).
Removal:—Remove transmission (see below), take off bottom housing cover, unlock pedal pull-back spring, remove fork ball support, fork and throwout bearing. Remove cover screws (turn screws out a few turns at a time until tension relieved). Move clutch away from flywheel at bottom and remove.

TRANSMISSION:—**Own.** All helical gears, constant-mesh, synchro-mesh (second & high), sliding gear (low & reverse) with remote shift control.
Transmission Control:—Pontiac 'Safety Shift' type.
See articles in Mechanical Equipment Section for data.
Removal:—Remove floor mat, floor center panel and front seat assembly. Disconnect speedometer cable and selector control cable at transmission. Remove selector shaft outer lever (on left side). Remove propeller shaft by disconnecting rear U-joint and pulling to rear to disengage U-joint front yoke from transmission main shaft. Support transmission at rear and remove transmission mounting capscrews. Pull unit straight back freeing main drive gear, then up and forward at front lifting out through floor opening. NOTE—See Mechanical Equipment Section for Shifter Linkage adjustment.

UNIVERSAL JOINTS:—**Mechanics Type 2C.** Roller bearing. *See article in Mechanical Equipment Section.*

REAR AXLE:—**Own.** Semi-floating, hypoid gear type with Hotchkiss drive.
See article in Mechanical Equipment Section for data.
Ratio—3.9-1 (Plains 25). 4.1-1 (Std. 25, Plains 26). 4.3-1 (Mount. 25, Std. 26). 4.55-1 (Mount. 26).
Backlash—Not less than .003". Limits .003-.012".
Removal:—Disconnect drive shaft at rear universal, remove axle shafts (see below), remove capscrews on carrier flange, pull carrier assembly out.
Axle Shaft Removal—Hoist rear of car, remove wheel, brake drum and 4 nuts which secure backing plate to housing (do not shift backing plate to prevent brake line damage). Pull shaft (Puller J-942) taking care not to drag shaft on oil seal.
Wheel Bearing Adjustment—None (sealed type).

SHOCK ABSORBERS:—**Delco.** Model 1947-C (right front), 1947-D (left frt.), 1116-V (rear—Dom.), 1754-A,B (rear—Exp.). Double acting, hydraulic type. Valve changes made during production. Direct acting on rear (Domestic) only.
See article in Mechanical Equipment Section for data.

STEERING:—**Steering Gear.** Saginaw Worm-and-Roller type. New type tie rod and drag link.
See article in Mechanical Equipment Section for data.
Front Suspension:—Independent, linked parallelogram type with coil springs.
See article in Mechanical Equipment Section for data.
Kingpin Inclination—4½-5°.
Caster—0° to minus ¾°. Adjustable.
Camber—Neg. ½° to pos. 1°. ½ turn max. adj'mt.
Toe In—0-1/16". Adjust tie rod for each wheel.
Steering Geometry—Inner wh'12½-23½°.Outer 20°.

BRAKES:—**Service**—Bendix hydraulic, duo-servo, single anchor type without eccentric adjustment. Hand lever applies rear wheel service brakes.
See article in Mechanical Equipment Section for data.
Drums—Chrome nickel iron. Diameter 11".
Wheel Cylinder Bore—Front wheel 1". Rear 15/16".
Lining—D-R Multibestos (primary), L-8 Multibestos (secondary). Width 1¾". Thickness 3/16". Length per wheel 21 5/16".
Clearance—.015" (both ends of secondary shoe).
Braking Power—47% rear, 53% front.
Hand Brake:—See Service Brakes above.

FRONT FENDER & RADIATOR (UNIT) REMOVAL:—*See Pontiac Shop Notes for complete instructions.*

SERIAL NUMBER:—First number 8EA-1001 with prefixes as follows: P—Pontiac, Mich., C—South Gate, Calif., L—Linden, N. J. On plate on left end of frame front cross member under hood.

ENGINE NUMBER:—First number 8-159601. Stamped on boss on top left front corner of engine block.

ENGINE SPECIFICATIONS:—8 cylinder, 'L' head.
Bore—3¼". **Stroke**—3¾".
Displacement—248.9 cu. ins. **Rated HP.**—33.8.
Developed Horsepower—100 (6.2-1 Std. cast-iron hd.), 110 (7.0-1 Optl. HC. cast-iron hd.) at 3700 RPM.
Compression Ratios & Pressures—As follows:

Head	Pressure: at 1000 RPM	at Crank'g Speed
6.2-1 Standard	140-143 lbs.	Approx. 115 lbs.
7.0-1 High Comp	169 lbs.	Approx. 137 lbs.

Vacuum Reading—18-20" steady at 7 M.P.H.

PISTONS:—Electro-plated, chrome nickel type with rib between bosses. Cannot be ground.
Length—3 19/32". **Weight**—24.25 ozs. (stripped).
Removal—Pistons and rods removed from above.
Clearance—Top .0175-.0295". Skirt .002".
Original Bore & Piston Sizes, Replacement Pistons:—*See Pontiac Shop Notes for data.*
Fitting New Pistons:—Insert .0015"x½" feeler between piston and cylinder wall. Pull to withdraw feeler must be 10-25 lbs. Piston taper .0005" max.

PISTON RINGS:—Two compression rings above pin, one oil control ring below pin. Oil ring groove drilled radially with 10 oil drain holes.
See Pontiac Shop Notes for compression ring data.

Ring	Width	End Gap	Side Clearance
Compression	.0930-.0935"	.009-.014"	.0015-.003"
Oil Control	.1860-.1865"	.007-.017"	.001-.0025"

Replacement Rings:—.005", .010", .020", .030" oversize.

PISTON PIN:—**Diameter**—15/16". **Length**—2⅞".
Pin locked in one boss. Free end slotted.
Pin Fit in Piston—*See Pontiac Shop Notes.*
Pin Fit in Rod Bushing—.0003-.0005".
Replacement Pins:—.001" (red & brown), .003" (red), .005" (blue) oversize. Painted on ends.
Fitting Pins:—*See Pontiac Shop Notes.*

CONNECTING ROD:—**Length** 7 9/16". **Weight** 29⅞ ozs.
Piston Pin Bushing (Upper Bearing)—Split bushed type. *See Pontiac Shop Notes for complete data.*
Crankpin Journal Diameter—2".
Lower Bearing—Removable steel-backed, babbitt-lined type. Furnished std. & .001" undersize.
Clearance—.0005-.0015". **Sideplay**—.005-.010".
Bearing Adjustment:—None (no shims). *See Pontiac Shop Notes for Fitting and Installing Bearings.*

CRANKSHAFT:—5 bearing with integral count'weights. *See Pontiac Shop Notes for Balancer Removal.*
Journal Diameters—#1, 2⅜"; #2, 2 13/32"; #3, 2 7/16"; #4, 2 15/32"; #5, 2½".
Bearing Type—Interchangeable steel-backed, babbit-lined type. Furnished Std. & .001" undersize.
Clearance—.001-.003".
Bearing Adjustment:—None (no shims). Replace bearings. Do not file caps. *See Pontiac Shop Notes.*
End Thrust:—Rear center (#4) bearing.
Endplay—.003-.008".

CAMSHAFT:—5 bearing. Non-adjustable chain drive. *See Pontiac Shop Notes for Camshaft Removal and Camshaft Bearing Finished Sizes.*
Journal Diameters—#1, 2"; #2, 1 31/32"; #3, 1 15/16"; #4, 1 29/32"; #5, 1⅞".
Bearing Type—Removable steel-backed, babbitt-lined type. **Clearance**—.0015-.0025".
End Thrust:—Thrust plate behind camshaft sprocket.
Endplay—.002-.005".

Timing Chain:—Morse. Width 1" (¾" nominal). Pitch ⅜". Length 56 links or 21".
See Pontiac Shop Notes for Timing Chain Cover Oil Seal squeak correction data.
Camshaft Setting:—Sprockets are marked. Mesh chain with '0' marks on sprockets adjacent and in line with a straightedge across shaft centers.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1 15/32"	.310-.311"	5.53"
Exhaust	1 11/32"	.310-.311"	5.53"

	Seat Angle	Lift	Stem Clearance
Intake	30°	19/64"	Free fit to .0006"
Exhaust	45°	19/64"	Free fit to .0006"

Tappet Clearance:—.011-.013" all valves (hot and running). Use .011" and .013" feelers as 'go' and 'no go' gauges. NOTE—Car manufacturer recommends .013" exhaust clearance for high speed driving.
Valve Guides:—Removable, tapered guides (.001" taper to the inch, with greatest clearance at top). IMPORTANT—Measure clearance at bottom end. Valve should just fall through guide of own weight when started in guide. NOTE—Guides should be cleaned with wire brush or taper reamer Tool P.R. 131. Replacement guides straight cut, ream to fit valve after installing with reamer P.R. 131.
Valve Springs:—Intake and exhaust springs identical. Install with two closed coils at top and dampener on top of each spring. New dampeners should be used whenever springs installed. **Free Length**—2 5/16".

	Spring Pressure	Spring Length
Valve Closed	54½ lbs.	1 29/32"
Valve Open	96 lbs.	1 19/32"

Valve Lifters:—Cast-iron, barrel type. Furnished .005" oversize. Use pilot reamer J-551 when installing oversize lifter to insure alignment of lifter hole and valve stem.
Clearance—Free fit. Lifter should move freely with finger touch.
Valve Timing:—See Camshaft Setting.
Intake Valves—Open 5° BTDC. Close 39° ALDC.
Exhaust Valves—Open 45° BLDC. Close 5° ATDC.
To Check Timing—Set tappet clearance #8 intake valve at .0125". This valve should open with piston 5° or .0089" before top dead center with first straight line of flywheel mark '/IGN.ONE/' slightly past pointer in left front face of flywheel housing.
Motor Gauge—Weidenhoff Adapter #114, Rod #42.

LUBRICATION:—Pressure type (pump on right side of engine). *See Pontiac Shop Notes for Oil Pump data.*
Normal Oil Pressure:—35-45 lbs. with warm oil.
Oil Pressure Regulator—On pump. Not adjustable.
Crankcase Capacity:—7 quarts (refill).

COOLING SYSTEM:—**Capacity**—19 quarts.
See Pontiac Shop Notes for Radiator Core Removal.
Water Pump:—Packless, sealed ball-bearing shaft. *See article in Mechanical Equipment Section for data.*
Removal—Remove fan belt, lower hose and pump mounting bolts. Lift off pump and fan assembly.
Thermostat:—Harrison. In cylinder head outlet.
Setting—Closed 140° F. Start 145°. Fully open 172°.
Temperature Gauge:—AC. #1510771 (dash), #1510772 (engine). Electric type.
See article in Mechanical Equipment Section for data.

CLUTCH:—**Inland.** 'Diaphragm' type, single plate, dry disc type with Long 9¼CF-CS driven member. *See article in Mechanical Equipment Section for data.*
Facings—Moulded type, 2 required. Inside Diam. 5¾". Outside Diam. 9¼". Thickness .125".
NOTE—Install plain facing toward flywheel, facing with cushioned segments on pressure plate side.
Pedal Adjustment:—Pedal free movement ⅞-1⅛" (adjusting nut under locknut at fork end of pedal link). Pedal toeboard clearance (felt retainer to pedal arm) 1" (setscrew and locknut at lower end of pedal).
Removal:—Remove transmission (see Transmission Removal below), take off bottom housing cover, unlock pedal pull-back spring, remove fork ball support, fork and throwout bearing. Loosen cover screws a little at a time to relieve tension, then take screws out. Move clutch assembly away from flywheel at bottom and lower assembly out.

TRANSMISSION:—**Own.** All helical gears, constant-mesh, synchro-mesh (second & high), sliding gear (low & reverse) with remote shift control.
Transmission Control:—Pontiac 'Safety Shift' type. *See articles in Mechanical Equipment Section for data.*
Removal:—Remove floor mat, floor center panel and front seat assembly. Disconnect speedometer cable and selector control cable at transmission. Remove selector shaft outer lever (on left side). Remove propeller shaft by disconnecting rear U-joint and pulling to rear to disengage U-joint front yoke from transmission main shaft. Support transmission at rear and remove mounting capscrews. Pull unit straight back freeing main drive gear, then up and forward at front lifting out through floor opening. NOTE—See Mechanical Equipment Section for shifter linkage adjustment.

UNIVERSAL JOINT:—**Mechanics Type 2C.** Roller bearing. *See article in Mechanical Equipment Section.*

REAR AXLE:—**Own.** Semi-floating, hypoid gear type with Hotchkiss drive.
See article in Mechanical Equipment Section for data.
Ratio—4.1-1 Std. 4.3-1 Mount. 3.9-1 Plains.
Backlash—Not less than .003". Limits .003-.012".
Removal:—Disconnect drive shaft at rear universal (wire trunnions to prevent loss of rollers), remove axle shafts (see below), remove capscrews on carrier flange, pull carrier assembly out.
Axle Shaft Removal—Hoist rear of car, remove wheel, brake drum and 4 nuts which secure backing plate to housing (do not shift backing plate preventing brake line damage). Pull shaft (Puller J-942) taking care not to drag shaft on oil seal.
Wheel Bearing Adjustment—None (sealed type).

SHOCK ABSORBERS:—**Delco.** Model 1947-C (right front), 1947-D (left front), 1116-V (rear-Domestic), 1754-A, B (rear-Export). Double acting, hydraulic type. Valve changes made during production. Direct acting on rear (Domestic) only.
See article in Mechanical Equipment Section for data.

STEERING:—**Steering Gear.** Saginaw Worm-and-Roller type. New type tie rod and drag link.
See article in Mechanical Equipment Section for data.
Front Suspension:—Independent, linked parallelogram type with coil springs.
See article in Mechanical Equipment Section for data.
Kingpin Inclination—4½-5°.
Caster—0° to minus ¾°. Adjustable.
Camber—Neg. ½° to pos. 1°. ½ turn max. adj'mt.
Toe In—0-1/16". Adjust tie rod for each wheel.
Steering Geometry—Inner wh'12 2½-23½°. Outer 20°.

BRAKES:—**Service**—Bendix hydraulic, duo-servo, single anchor type without eccentric adjustment. Hand lever applies rear wheel service brakes.
See article in Mechanical Equipment Section for data.
Wheel Cylinder Bore—Front wheel 1". Rear 15/16".
Drums—Chrome nickel iron. Diameter 11".
Lining—D-R Multibestos (primary), L-8 Multibestos (secondary). Width 1¾". Thickness 3/16". Length per wheel 21 5/16".
Clearance—.015" (both ends of secondary shoe).
Braking Power—47% rear, 53% front.
Hand Brake:—See Service Brakes above.

ENGINE NUMBER:—Stamped on upper left hand corner of cylinder block.

ENGINE:—Own model. Six cylinder, 'L' head type.

Bore—3⅜". **Stroke**—5".

Piston Displacement—268 cubic inches.

Rated Horsepower—27.3.

Developed Horsepower—85 at 3200 R.P.M.

Compression Ratio—5.3-1 ('33), 5.4-1 ('34-35).

Compression Pressure—95 lbs. at 1000 R.P.M. or 78-82 lbs. at cranking speed.

Pistons:—Lynite, Lo-EX aluminum alloy, 'T' slot, cam ground type. Refinish cylinders to take standard replacement pistons furnished .005", .010", .020", .030", .040", .050", .060" oversize as well as semi-finished. Exact size of piston is stamped on head. Piston length 4".

Weight—.81 lbs. stripped, 1.29 lbs. with rings and pin.

Removal—Pistons removed from above, rods from below. To remove assemblies, take off rod bearing caps, install brass guards on rod bolts (necessary to avoid marring crankpin surface), push piston up until pin is exposed, remove retaining rings and push out pin, remove piston from above, remove rod from below. Use new retaining rings when installing pistons.

Clearance—.030" top. .0006-.0014" bottom.

Fitting New Pistons—Use standard oversize piston (size stamped on head), refinish cylinder bore to size giving correct clearance. Do not use feeler gauges to check clearance.

Installing Pistons—Slot should be at left. Piston stamped with arrow and word 'Front.' Arrow should point toward front of engine on all pistons.

Piston Pins:—Diameter .9834". Length 2.903". Pin floats in piston and rod. Held by retaining rings. See Removal of Piston above.
Clearance in Rod—.0003".
Clearance in Piston—.0000-.0003" with piston and pin at normal temperature (70°F.).

Piston Rings:—Two compression rings, two oil control rings per piston. Lower ring groove drilled radially with oil drain holes.

Ring	Width	End Gap	Wall Thickness
Comp All	3/32"	.007-.015"	.145"
Oil Cont. (3)	5/32"	.007-.015"	.145"
Oil Cont. (4)	3/16"	.007-.015"	.145"

Connecting Rod:—Weight 2.47 lbs. Length 10½".
Crankpin Journal Diameter—2 3/16".
Lower Bearing Type—Spun-babbitt lined integral with rod and bearing cap. No shims.
Clearance—.0015-.0025". Sideplay .003-.007".
Adjustment—None (no shims). Replace rods. Do not file bearing caps.

Crankshaft:—Seven bearings. Integral counterweights.
Journal Diameters—2.625" all bearings.
Bearing Type—Precision type steel-backed, babbitt-lined. No shims.
Clearance—.002".

Adjustment—None (no shims). Replace removable bearings. Bearings are precision type and need not be line-reamed after installing. All bearings should be replaced as a set. When installing bearings see that lip on bearing is engaged in slot in crankcase and bearing cap (necessary to prevent bearing from rotating).
End Thrust—Taken by rear bearing. Endplay .003-.007".

Camshaft:—Four bearings. Non-adjustable chain drive.
Bearing Type—Steel-backed, babbitt-lined.
Clearance—.0015-.002".

End Thrust—Taken by spring-loaded plunger or thrust plug in camshaft sprocket and thrust plate on chain case cover.
Timing Chain—Morse 766 Bushed Joint type. Width 1½". Pitch .500". Length 24" or 48 links.

Camshaft Setting—Sprockets are marked. Mesh chain with sprockets turned so that marks are adjacent and in line with a straightedge across the shaft centers. Install chain with camshaft sprocket off engine. Insert dowel-type capscrew with ground shoulder first (in reamed-top hole) to center camshaft sprocket. Sprocket capscrews are offset so that sprocket cannot be installed incorrectly.

Valves:—

	Head Diameter	Stem Diameter	Length
All Valves	1 13/16"	.3437"	5¾"

	Seat Angle	Lift	Stem Clearance
All Valves	45°	5/16"	.002-.004"

Tappet Clearance—.007" (intake), .008" (exhaust) engine warm.

Valve Springs—	Spring Pressure	Spring Lgth.
Valves Closed	58-62 lbs.	2⅜"
Valves Open	90 lbs.	2 1/16"

Valve Timing—See Camshaft Setting above.
Intake Valves open—at TDC. Close—50° ALDC.
Exhaust Valves open—48° BLDC. Close— 2° ATDC.

To Check Valve Timing:—Set tappet clearance #1 intake valve at .012". This valve should open with piston on top dead center when flywheel mark 'UDC.#1' lines up with indicator in inspection hole in flywheel housing (right hand side of engine). Reset tappet clearance at .007" with engine warm.

Lubrication:—Pressure type. Gear type oil pump located in oil pan.
Normal Oil Pressure—30 lbs. at 35 M.P.H.
Oil Pressure Relief Valve—Operates at 30-35 lbs. Located under nut on left hand side of crankcase. Adjustable by turning nut. Turn nut in (clockwise) to increase, or out (counter-clockwise) to decrease oil pressure.
Capacity and Oil—6 qts. Use SAE. #30 (summer), #20 (winter).

CLUTCH:—**Own Make (S2, 3, 4), Long Model 9AB (S7).** Single plate, dry disc type. NOTE—Long Model 9AB may be used for replacement on Model S4.
See article in Mechanical Equipment Section for data.
Facings—Woven type, 2 required. Thickness 5/16". Inside Diameter 6⅛". Outside Diameter 9¾".

Automatic Clutch:—Own (Reo) type. Optional equipment.
Clutch Pedal Adjustment—Free movement of clutch pedal must be 1". Adjustment is made by means of transverse bolt at bottom of clutch pedal.

STEERING—**Steering Gear**—Ross Cam-and-Roller type. See article in Steering Section for complete adjustment instructions.

Front Suspension:—Conventional 'I' beam section front axle with Reverse Elliott type ends and semi-elliptic springs.
Kingpin Inclination—8° crosswise.
Caster—4°. Use wedge shims installed between spring and spring seat on axle to correct caster.
Camber—1½°. Axle may be bent cold for minor corrections of camber.
Toe In—0-⅛". Adjust in usual manner by loosening clamp bolts and turning tie rod.

BRAKES:—**Service**—Lockheed hydraulic, double anchor type. See article in Brake Section for complete adjustment instructions.
Drum Diameter—12".
Lining—Moulded type. Width 1¾". Thickness .177". Length 24 5/16" per wheel.
Clearance—.010" toe, .005" heel for each shoe.

Hand Brake:—External contracting type on drum at rear of transmission.
Adjustment—With lever in fully released position, adjust position of brake band lever on pull link so that clearance at ends of brake bands is 1/32". Anchor bracket is not adjustable.
Drum Diameter—7".
Lining—Width 2½". Thickness 3/16". Length 20 5/16".
Clearance—1/32" uniformly around band.

SERIAL NUMBER:—First number 6A-100 (1935), 6D-100 (1936). On front end of left frame siderail under fender.

ENGINE NUMBER:—Stamped on upper left hand corner of cylinder block.

ENGINE SPECIFICATIONS:—Type—6 cyl., 'L' head.
Bore—3⅜". **Stroke**—4¼".
Displacement—228 cubic inches.
Rated Horsepower—27.3 (SAE).
Developed Horsepower—85 (1935), 90 (1936) at 3400 R.P.M.
Compression Ratio—7.0-1 (1935), 6.5-1 (1936).
Compression Pressure—115 lbs. at 1000 RPM. or 90 lbs. at cranking speed (1935), 110 lbs. at 1000 RPM. or 85 lbs. at cranking speed (1936).
Vacuum Reading—Gauge should show steady reading of approximately 17" with engine idling at 350 R.P.M.

PISTONS:—Own Lo-ex aluminum alloy, 'T' slot, cam ground type. Use finished replacement pistons (see Replacement Pistons).
Length—4".
Weight—12.96 ounces (stripped).
Removal—Pistons removed from above, rods from below. To remove assemblies, take off rod bearing caps, install brass guards on rod bolts (necessary to avoid marring crankpin surface), push piston up in cylinder until pin is exposed, remove retaining rings, push pin out, remove piston from above, remove rod from below. Use new retaining rings when installing pistons.
Clearance—Top .027-.033", bottom .0024-.0032".
Replacement Pistons:—Refinish cylinders to take standard replacement pistons furnished .005", .010", .020", .030", .040" oversize and also semi-finished. Exact size of piston stamped on head.
Fitting New Pistons:—Use standard oversize piston (size stamped on top), refinish cylinder bore to size giving correct clearance.
Installing Pistons:—Slot should be at left. Pistons stamped with arrow and word (Front). Arrow must point toward front of engine on all pistons.

PISTON RINGS:—Two compression, two oil control rings per piston, all above pin. Lower ring grooves drilled radially with oil drain holes.

Ring Specifications—1935

Ring	Width	End Gap	Wall Thickness
Comp. All	⅛"	.007-.012"	.145"
Oil Cont. (3)	5/32"	.009-.014"	.145"
Oil Cont. (4)	3/16"	.009-.014"	.145"

Ring Specifications—1936

Ring	Width	End Gap	Side Clear.
Comp. (#1, 2)	3/32"	.009-.014"	.0015-.0025"
Oil (#3)	3/32"	.009-.014"	.0015-.0025"
Oil (#4)	¼"	.009-.014"	.0015-.0025"

PISTON PIN:—Diameter—63/64". **Length**—2.903-2.898". Pin floats in piston and rod. Held by retaining rings at each end. See Piston Removal above.
Pin Fit in Piston—.0000-.0003" tight with piston at room temperature of 70° F. Heat piston to 160° when installing pin.
Pin Fit in Rod Bushing—.000-.0003" clearance.

CONNECTING ROD:—Length—10½" (cent.-to-cent.).
Weight—41.02 ounces (assembled).
Upper Bearing (Piston Pin Bushing)—Bronze.
Crankpin Journal Diameter—2.1875".
Lower Bearing—Removable steel-backed, babbitt-lined type.
Clearance—.0015-.0025". Sideplay .005-.010".
Bearing Adjustment:—Shims (1935), None (no shims) 1936. Replace bearings. Do not file rods or caps.
Installing Rods:—Rods are marked. Install with marks and oil spray hole in lower end toward camshaft side of engine.

CRANKSHAFT:—Seven bearing. Integral and removable counterweights.
Journal Diameters—2⅝" all bearings.
Bearing Type—Precision type, removable steel-backed, babbitt-lined.
Clearance—.001-.003".
Bearing Adjustment:—Shims (1935), None (no shims) 1936. Replace bearings. Do not file bearing caps.
End Thrust:—Taken by rear (#7) bearing. Endplay .003-.007".

CAMSHAFT:—4 bearing. Non-adjustable chain drive.
Journal Diameters—#1, 2 3/16"; #2, 2⅛"; #3, 2 1/16"; #4, 1½".
Bearing Type—Steel-backed, babbitt-lined.
Clearance—.0015".
End Thrust:—Taken by spring-loaded hardened steel plunger in camshaft hub and thrust plate on chain case cover. See that spring and plunger are in place when replacing cover.
Timing Chain:—Morse. Type DO-7654. Width 1". Pitch .500". Length 48 links or 24".
Camshaft Setting:—Sprockets are marked. Mesh chain with sprockets turned so that marks are adjacent and in line with a straightedge across the shaft centers. Install chain with camshaft sprocket off engine. Insert dowel-type capscrew with ground shoulder first (in hole with reamed top) to center camshaft sprocket. Capscrew holes are offset so that sprocket cannot be assembled incorrectly.

VALVES:—

	Head Diameter	Stem Diameter	Length
All valves	1 13/16"	.34475"	6.078"
	Seat Angle	**Lift**	**Stem Clearance**
All valves	45°	5/16"	.001-.0035"

NOTE—Alloy steel exhaust valve seat inserts used.
Tappet Clearance—.007" Int., .008" Exh. engine hot.
Valve Guides:—Pressed in block and finish reamed for correct stem clearance.

Valve Springs:—	**Spring Pressure**	**Spring Length**
Valve Closed	50-54 lbs.	2⅜"
Valve Open	135-145 lbs.	2 1/16"

Valve Lifters:—One piece nickel-iron and steel, mushroom type. Diameter ⅝". Clearance in guides .0005-.001". Serviced by replacing guides.
Valve Timing (1935):—See Camshaft Setting above.
Intake Valves—Open At TDC. Close 50° ALDC.
Exhaust Valves—Open 48° BLDC. Close 2° ATDC.
To Check Valve Timing—Set tappet clearance #1 intake valve at .012". This valve should open with piston #1 on top dead center when flywheel mark 'UDC.#1' lines up with indicator in inspection hole in flywheel housing at right of engine. Reset tappet clearance at .007" with engine warm.
Motor Gauge—Weidenhoff Adapter #104, Rod #2.
Valve Timing (1936):—See Camshaft Setting above.
Intake Valves—Open 5° BTDC. Close 45° ALDC.
Exhaust Valves—Open 35° BLDC. Close 5° ATDC.
To Check Valve Timing—Set tappet clearance #1 intake valve at .012". This valve should open with piston 5° or .0100" before top dead center when flywheel mark 'Intake Opens' lines up with pointer in inspection hole in right front of flywheel housing. Reset tappet clearance at .007" hot.
Motor Gauge—Weidenhoff #104 Adapter, #2 Rod.

LUBRICATION:—Pressure. Gear type oil pump located in oil pan.
Normal Oil Pressure:—40 lbs. at 40 M.P.H.
Oil Pressure Relief Valve:—Operates at 35 lbs. when engine is hot. Located under nut on left hand side of crankcase. Adjustable by turning nut. Turn nut in or clockwise to increase pressure and out or counter-clockwise to decrease.
Crankcase Capacity:—6 qts. (refill).

CLUTCH:—Borg & Beck Model 10-A6. Single plate, dry disc type. See article in Clutch Section for relining and asembling directions.
Facings—Woven (pressure plate side), moulded flywheel side), 2 required. Inside Diam. 6". Outside Diam. 9⅞". Thickness ⅛".
Adjustment—Free movement of clutch pedal must be 1". To adjust, loosen transverse bolt which clamps pedal to shaft, move pedal forward to provide 1" free movement, tighten bolt.
Removal—Disconnect drive shaft and remove transmission (jack up rear of engine if necessary). Remove throwout bearing and collar assembly, loosen pedal bolt on shaft and drop flywheel under-pan. Take out short (right) shaft and yoke by turning shaft until capscrews can be removed from below. Pry and block release levers in disengaged position. Then take out capscrews in pressure plate and remove clutch disc and pressure plate from below.

STEERING:—Steering Gear—Ross Model 540, Cam-and-lever type. See article in Steering Section for adjustment procedure.
Front Suspension:—Conventional 'I' beam section front axle with Reverse-Elliott ends and semi-elliptic springs.
Kingpin Inclination—8° crosswise.
Camber—1½°. Axle may be bent cold for minor corrections.
Caster—1½°. Use wedge shims inserted between spring and spring seat to correct caster.
Toe In—0-1/16". Adjust in usual manner by loosening clamp bolts and turning tie rods.
Tread—59 3/16" (front), 61¼" (rear).

BRAKES:—Service—Lockheed Hydraulic, double anchor type. Hand lever applies separate brake at rear of transmission. See article in Brake Section for complete adjustment procedure.
Drum Diameter—11".
Lining—Moulded type. Width 1¾". Thickness ¼". Length 28¼" per wheel.
Clearance—.010" at heel, .005" at toe.
Hand Brake:—Drum diameter 6". Woven type lining. Width 2". Thickness 5/32". Length 18 9/16".
Clearance—1/32-3/64".
Adjustment—With lever in fully released position, adjust position of brake band lever on pull link so that clearance at ends of brake band is 1/32-3/64".

1939 MODELS

ENGINE HOOD:—Champion—Engine hood hinged at cowl and lifts from forward end. To raise hood, pull out hood lock handle (radiator emblem) at bottom, lift hood up at forward end.

1939 MODELS

HOOD SIDE PANEL REMOVAL:—To remove the separate hood side panels, take out two screws on top side of panel and two wing screws on bottom side, lift panel out.

1939 MODELS

RADIATOR REMOVAL:—To remove radiator, remove brace rods, uncouple hose connections, free radiator from shell and lift straight up.

1935-39 MODELS

ORIGINAL BORE SIZE:—May be determined by marks stamped on top of block opposite each cylinder bore as follows:

Dictator 1935-37		Six, Comm. 1938-39		President 1935-39	
Mark	Size	Mark	Size	Mark	Size
'8'	3.248"	'25'	3.3125"	'25'	3.0625"
'85'	3.2485"	'3'	3.313"	'2'	3.0620"
'9'	3.249"	'35'	3.3135"	'15'	3.0615"
'95'	3.2495"	'4'	3.314"	'1'	3.061"
'0'	3.250"	'45'	3.3145"	'5'	3.0605"

NOTE—Sizes listed for President above also apply to Commander Model 1B (1935).

Champion Model

Mark	Size
0	3.000"
05	3.0005"
1	3.001"
15	3.0015"
2	3.002"
25	3.0025"

NOTE—Variation in any one engine is held to .001" maximum difference between individual bores.

1939 MODELS

CYLINDER HEAD INSTALLATION:—Coat both bottom of head gasket and lower face of cylinder head with Perfect Seal Gasket Cement (use sparingly), coat head capscrews with white lead. Tighten head screws to tension of 600-650 in. lbs. (Champion), 1000 in. lbs. (Commander & President) and recheck before starting engine.

1939 MODELS

CONNECTING ROD 'PALNUT' INSTALLATION:—Used on some cars only. Consists of special patented locknut installed on top of regular nut instead of cotterpin. To install Palnut, tighten regular nut to tension of 650 in. lbs., turn up Palnut until it contacts regular nut (open face of Palnut out), then tighten Palnut ¼-⅓ turn additional to lock it in place.
NOTE—On Champion tighten regular nut to 300-325 in. lbs. tension.

1939 MODELS

PISTON PIN REMOVAL & INSTALLATION:—Champion—Tapered pin and nut secures pin in rod. To remove pin, place rod and piston on assembling fixture No. J1293, take nut off and install on opposite end of pin and turn nut down pulling pin out. To install, place pin on fixture, slip piston and rod on pin, tighten pin nut (rock rod to insure lock pin seats properly). One nut only used on tapered lock pin.

1939 MODELS

SELF-LOCKING TAPPETS:—Champion—Tappet screws slotted on upper end and require no locknuts. When tappet screws replaced, car manufacturer recommends that screws must check as follows: Pull required to move tappet screw must be 25 in. lbs. minimum (4 lbs. pull on 6" wrench).

1936-39 MODELS

VIBRATION DAMPENER:—President—Consists of a spring-loaded flywheel mounted on four tapered rubber cushions between a friction facing on the fan pulley and a damper plate on the front end of the crankshaft. The flywheel oscillation is controlled by the friction of the friction facing and the compression of the rubber cushions. Flywheel radial movement is controlled by a fibre ring on the fan pulley hub. Spring tension is adjusted by shims under spring in flywheel, compression of rubber cushions adjusted by shims on bolt sleeve between cushion and damper plate.

Servicing—Damper can be removed from crankshaft as an assembly. If disassembled, note position of all parts and reassemble in same order. Fibre ring should be press fit on pan pulley hub and should have .004-.006" clearance in flywheel. Install shims under springs, as required, to secure 50 lbs. pressure per spring or 200 lbs. total with damper bolts tightened. Install shims on rubber cushions so that cushions compressed .015" (.020" for 1936) with bolts tightened (plate against spacers).
NOTE—When installing crankshaft nut, make certain that copper-asbestos gasket in place under nut (necessary to prevent oil leaks at this point).

Commander Model:—Consists of a flywheel mounted on two rubber rings on forward end of crankshaft. Compression of rubber rings is limited by length of vibration damper and fan pulley hub and does not require checking or adjusting.

1935-39 MODELS

CAMSHAFT GEAR:—Sizes—Furnished in three sizes: 'S'—Standard, 'H'—High Limit, 'L'—Low Limit. When replacing gear on engine with considerable service, install next largest size. For reconditioned engine with new camshaft and main bearings, use same size gear.

Removal & Installation—Gear hub recess threaded for installation of special pullers and pushers. Do not drive on gear with hammer which may loosen gear on hub. Use gear pusher.
NOTE—Champion gear hubs not threaded. Use Puller HM-925 screwed in holes provided in gears and also for crankshaft fan driving pulley removal. Use Pusher No. HM-861X to install gears and pulley.

1938-39 MODELS

OIL PUMP INSTALLATION:—Commander. To insure correct rotor position of distributor when pump installed, install pump as follows: Remove distributor, crank engine over (with piston #1 on compression) until vibration damper mark 'UDC/1-6' lines up with pointer on gear case, sight down distributor shaft hole and mesh oil pump drive gear so that drive tongue on shaft is 30° from the horizontal and offset toward the top.

Champion:—Install oil pump as follows: Turn engine over until #1 piston at TDC. entering power stroke (flywheel mark U.D.C.1-6 in line with pointer on left rear engine plate). Engage pump shaft with camshaft gear with key-way pointing down (keyway will rotate to rear when gears meshed), assemble pump to engine. Check distributor drive tongue position by sighting down distributor shaft hole (distributor out). With #1 cylinder in firing position, tongue should be parallel with camshaft and offset (narrow half of shaft) toward camshaft.

President:—Install oil pump as follows: Turn engine over until piston #1 is on TDC entering power stroke with vibration damper mark 'UDC/1-8' lined up with pointer on gear case, turn pump shaft so that distributor drive slot is two teeth clockwise (viewed from below) from correct installed position with slot parallel to camshaft (wide side of shaft toward camshaft). Shaft will be rotated into position as gears are meshed. Check by sighting down distributor shaft hole (distributor out) to see that shaft slot parallel to camshaft and wide halve of shaft toward camshaft.

1935-39 MODELS

REAR SUPPORT INSTALLATION (OVERDRIVE TRANSMISSION):—On cars with Overdrive, rear support (must be removed to remove transmission) should be installed with original shims in same location in order to maintain alignment. These shims located between support and frame at each end. If shims lost or readjustment necessary, install support as follows: Hold support in place under transmission case, install sufficient shims at each end to take up all except 1/16" clearance between support and frame, install frame bolts, tighten bolts securely with shims in place. This clearance will provide correct compression of the support rubber cushions.
NOTE—1/32" clearance at each end for 1935 cars.

1936-39 MODELS

HILL HOLDER ADJUSTMENT:—On cars with Hill-Holder (optional equipment), check action whenever clutch adjusted to make certain that brakes release just before clutch engages.

Adjustment—Loosen locknut on end of Hill-holder control rod, shorten rod for earlier brake release, lengthen rod for later release, tighten locknut.

NOTE—On Champion, adjusting sleeve and locknut provided on rod.

1938-39 (Dictator 1935-37)

VALVE SPRING SERVICING:—Commander—Valve springs will not clear lifter and tappet adjusting screw when in extended position and should be installed as follows: Place spring seat in place on bottom of spring, use 'C' type valve lifter to compress spring slightly so that it will clear tappet adjusting screw as it is pressed up into place, install valves, compress spring, install valve spring seat locks. NOTE—Make certain that valve lifter tension spring installed on top of each valve lifter ('36-39).

SERIAL NUMBER:—First number 5,133,401. On plate on left frame side rail under front fender.

ENGINE NUMBER:—Stamped on front center of engine block directly behind water pump.

ENGINE:—Six cylinder, 'L' head type. Cylinders cast enbloc.
Dimensions—Bore 3¼". Stroke 4⅝". Displacement 230 cubic inches.
Horsepower—Rated 25.4. Developed 85 at 3200-3600 R.P.M.
Compression Ratio—5.5-1 Standard, 6.0-1 Optional.
Compression Pressure—Approximately 95 lbs. (5.5-1 head), 100-105 lbs. (6.0-1 head) at cranking speed.
Vacuum Reading—Steady reading of 18-20" at idling speed

Pistons:—Own make. Cast-iron, electro-plated type. Piston skirt is tin-plated after finishing and cannot be ground. Recondition cylinders to size for which finished replacement piston available.
Length—3⅞".
Weight—1.68 lbs. (stripped), 2.3 lbs. (with rings and pin).
Removal—Pistons and rods removed from above.
Clearance—.012-.018" top, .002" skirt.
Fitting New Pistons—Use .002" feeler stock to check clearance.

Piston Rings:—Four rings per piston, three compression, one oil control, all above pin.

Ring	Width	End Gap	Wall Thickness
Compression	⅛"	.013-.018"	.135"
Oil Control	3/16"	.018-.021"	.135"

Piston Pin:—Diameter ⅞". Length 2⅞". Pin is locked in rod.
Pin Fit in Piston—.0001-.0003" clearance.

Connecting Rod:—Weight 39½ ozs. Length 9 1/32".
Crankpin Journal Diameter—2⅛".
Lower Bearing Type—Spun babbitt integral with rod and cap.
Clearance—.0005-.002". Sideplay .005-.009".
Adjustment—None (no shims). Replace rods. Do not file rods or caps.

Crankshaft:—Four bearing. Integral counterweights.
Journal Diameters—2½" all bearings.
Bearing Type—Removable steel-backed, babbitt-lined.
Clearance—.0005-.0025".
Adjustment—None (no shims). Replace bearings. Do not file bearing caps.
End Thrust—Taken by #3 intermediate main bearing. Endplay .003-.006".

Camshaft:—Four bearing. Spiral gear drive.
Timing Gears—Crankshaft gear cast-iron. Camshaft gear Celeron.
Camshaft Setting—Gears are marked. Mesh marked tooth of crankshaft gear between two marked teeth of camshaft gear.

Valves:	Head Diameter	Stem Diameter	Length
Intake	1⅝"	11/32"	5⅜"
Exhaust	1½"	11/32"	5⅜"

	Seat Angle	Lift	Stem Clearance
Intake	45°	5/16"	.001-.003"
Exhaust	45°	5/16"	.001-.003"

Tappet Clearance—.004" Int., .006" Exh., engine hot.

Valve Springs—	Pressure	Length
Valve Closed	48-53 lbs.	2 1/32"
Valve Open	71-76 lbs.	1 23/32"

Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 5° ATDC. Close 53° ALDC.
Exhaust Valves—Open 38° BLDC. Close 10° ATDC.
To Check Valve Timing—Set tappet clearance #1 intake valve at .010". This valve should open with piston 5° or .0111" after top dead center when flywheel mark 'IN.OP/1-6' lines up with indicator in inspection hole in top surface of flywheel housing. Reset tappet clearance at .004" with engine hot.
Motor Gauge—Weidenhoff Adapter #104. Rod #2.

Lubrication:—Pressure type. Gear type oil pump mounted on right side of crankcase.
Normal Oil Pressure—20 lbs. at 25 M.P.H.
Oil Pressure Relief Valve—Operates at 27 lbs. Located on right hand side of crankcase. Not adjustable.
Capacity & Oil—7 qts. (dry), 6 qts. (refill). Use SAE. #30 or 20 (summer, #10 (winter).

CLUTCH:—**Long Model 9ABM.** Single plate dry disc type. See article in Clutch Section for complete relining and assembling directions.
Facings—Moulded type, 2 required. Thickness 9/64". Inside Diameter 5½". Outside Diameter 9¼".
Adjustment—Free movement of clutch pedal should be 1". To adjust, loosen locknut and turn adjusting screw on clutch throw-out shaft lever.

STEERING:—**Steering Gear**—Ross Cam-and-Lever type. See article in Steering Section for complete adjustment directions.

Front Suspension:—Conventional 'I' beam section front axle with Reverse Elliott type ends and semi-elliptic springs.
Kingpin Inclination—8° crosswise.
Caster—½-1½°. Adjust by inserting wedge shims between spring and spring pad on axle.
Camber—1°. No adjustment provided.
Toe In—1/16-⅛". Adjust in usual manner by loosening clamp bolts and turning tie rod.

BRAKES:—**Service**—Bendix Duo-Servo Mechanical type with vacuum power operation. Hand lever applies all four service brakes. See article in Brake Section for complete adjustment directions.
Drum Diameter—12⅛".
Lining—Moulded type. Width 1½". Thickness ¼". Length 26 3/16" per wheel.
Clearance—.008" at heel and toe of each shoe.

Hand Brakes:—See Service Brakes above.

Power Unit:—Bendix Vaccum cylinder with internal valve. See article in Brake Section for complete data.

SERIAL NUMBER:—First number, 5,145,001 (Year Ahead Model) 5,200,001. On plate on left frame side member under left front fender.

ENGINE NUMBER:—Stamped on left hand side of cylinder block at center.

ENGINE:—Six cylinder, 'L' head type. Cylinders cast enbloc.
Dimensions—Bore, 3¼". Stroke, 4⅛". Displacement, 205.3 cu. ins.
Horsepower—Rated, 25.4. Developed, 88 H.P. at 3600 R.P.M.
Compression—6.3-1. Compression pressure, 137 lbs. at 1200 R.P.M. or 109.5-116 lbs. at 150 R.P.M. (cranking speed).
Vacuum Reading—Gauge should show steady reading of 18-20" with engine idling.

Pistons:—Lynite, aluminum alloy, slotted skirt, cam ground type. Piston diameter is smaller (.00825-.01075") across pin bosses. Piston skirt is also tapered from top to bottom (.000-.001" larger diameter at bottom). Service pistons stamped with exact size as measured at right angles to piston pin bosses ¼" up from bottom of skirt. Standard oversize pistons, 002", .004" .010", .015", .020", .030".

NOTE:—Four ring piston superseded by three ring piston. Replacement pistons are three ring type.
Length—3¾".
Weight—15 ozs. (stripped), 22.08 ozs. (with rings and pin).
Removal—Piston and rod assembly removed from top of engine.
Clearance—Top, .032-.036". Bottom, .0015" selective fit.
Installing New Pistons—Use .0015" feeler stock ½" wide to check clearance insert feeler in cylinder at right angles to pin bosses on side opposite slot (invert piston, insert in bore with pin parallel to crankpin). Pull required to withdraw feeler should be 9-14 lbs. Piston selected for bore should be within this range.

NOTE:—Install pistons with slot on minimum pressure side (away from camshaft).

Piston Rings:—4 rings (early), 3 rings (later) per piston, all above pin. 3 compression (early), 2 compression (later), 1 oil (all) ring. Lower ring groove drilled radially with ten 5/32" oil drain holes.

NOTE:—Top groove on later 4 groove piston unfinished. No ring should be fitted in this groove.

Ring	Width	End Gap	Wall Thickness	Groove Depth
Comp. (all)	⅛"	.013-.018"	.135-.145"	.146-.153"
Oil Cont.	3/16"	.013-.018"	.125-.135"	.184-.190"

NOTE:—Compression rings are Perfect Circle '70' and should be installed with the step downward. Oil control ring is Perfect Circle '85'.

Piston Pin:—Diameter .8741-.8745". Length, 2⅞". Pin is clamped in rod. Piston pin hole in piston is line reamed and burnished.
Pin Fit in Piston:—Light push fit. Clearance, .0001-.0003". With this clearance rod should rock on piston of its own weight.

NOTE:—New pins are fitted and furnished with all replacement pistons.

Connecting Rod:—Weight, 33.44 ozs. Length, 8¼"
Big End Bearing—Spun babbitt-lined type. No shims.
Clearance—.0005-.002". Sideplay .005-.009".
Adjustment—None (no shims). Do not file bearing caps.

Crankshaft:—Four main bearing type with integral counterweights.
Journal Sizes—2.2495-2.5000" (2¼") diameter (all bearings).
Bearing Type—Steel-backed, babbitt-lined type. No shims.
Clearance—.0005-.0025".
Adjustment—None (no shims). Replace removable bearings. Do not file bearing caps.
End Thrust—Taken by #1 (front) main bearing. Endplay, 003-.006". Adjusted by shims.

Camshaft:—Four bearing type. Camshaft drive—Non-adjustable chain.
Bearing Type—Split, steel-backed, babbitt-lined type.
Clearance—.00075-.00225" (front), .002-.00375" (all others).
Camshaft Endplay—Controlled by spring loaded plug in camshaft which bears on thrust plug plate on chain case cover. Thrust taken by thrust plate behind camshaft hub. Not adjustable. Do not stretch or tamper with thrust plug spring. See that thrust plug is in place when replacing cover.
Chain—Morse #1866. Width, 1¼". Length, 23" or 46 links. Pitch, .500".
Camshaft Setting—Sprockets are marked. Mesh chain with sprockets turned so that marks are adjacent and in line with a straightedge across the shaft centers.

Valves:—	Head Diameter	Stem Diameter	Length	Seat Angles	Lift
Intake	1 15/32"	11/32"	5 7/32"	45°	.3437"
Exhaust	1 9/32"	11/32"	5 7/32"	45°	.3437"

Stem-to-Guide Clearance—.001-.003" (all valves).
Tappet Clearance—.004" (intake), .006" (exhaust) engine hot.
Valve Springs—Taper type with flat coil type damper installed on all springs at top. Thread damper down over spring from top to provide minimum clearance of 7/32" between top of damper and top of spring (spring not compressed). Install springs with small end up.

	Spring Pressure	Spring Length
Valve Closed	59-64 lbs.	2 3/32"
Valve Open	98-108 lbs.	1 ¾"

NOTE—Valve lifter guides are integral with crankcase. Special support tools or clamps (HMJ-593) can be used to hold lifters up while camshaft is being removed. Valve lifters are removed from bottom of engine.

Valve Timing

Intake Valves Open—15° BTDC. Close—43° ALDC.
Exhaust Valves Open—48° BLDC. Close—10° ATDC.
To Check Valve Timing—Set tappet clearance #1 intake valve at .010". This valve should open with piston #1 15° or .0876" before top dead center when flywheel mark 'IN.OP./1-6' registers with indicator on housing (inspection hole on left hand front face of flywheel housing below starter). Reset tappet clearance at .004".
Motor Gauge—Weidenhoff Adapter #104, Rod #2.

Lubrication:—Pressure type. Gear type oil pump located on lower end of inclined accessory shaft at right of crankcase.
Oil Pressure—40 lbs. at 26.8 M.P.H.
Oil pressure Relief Valve—Operates at 40 lbs. Adjustable.

CLUTCH:—Borg & Beck Models 9A1, 9A3 (Yr. Ahead). Clutch Model No. 554 (9A1), 853 (9A3) stamped on cover. Single plate, dry disc type. No adjustment required for wear. See article in Clutch Section for relining and assembling directions.
Clutch Pedal Adjustment—Free movement of clutch pedal must be 1" minimum. Adjust by turning clutch release adjustment lever set screw (on left hand side of clutch housing). On cars with free-wheeling check setting of free-wheeling unit positive lock control rod after adjusting clutch pedal.
Free-Wheeling control rod—To adjust, remove clevis pin holding control rod on clutch release shaft lever, turn control rod clevis until clevis pin can just be inserted with free-wheeling unit positive lock pin lever in the extreme rear position and both springs (thrusting against lock pin lever swivel) compressed equally. Gear shift lever must be in neutral and free-wheeling control in free-wheeling position.
Clutch Facings—Moulded type, 2 required, 5¾" ID., 9" OD., .133" thick.

STEERING:—Steering Gear—Ross Model 140, Cam-and-Lever type. See article in Steering Section for adjustments.

Front Suspension:—Conventional 'I' beam section front axle with Reverse-Elliott ends and semi-elliptic springs.
Kingpin Inclination—9½° crosswise.
Caster—1-1½°. Adjust by inserting wedge shims between spring and spring pad on axle. Spring pad should incline 1½° down toward rear.
Camber—1-1½°. No adjustment. Axle may be bent cold to correct camber.
Toe In—1/16-⅛". Adjust in usual manner by changing length of tie rod.

BRAKES:—Service—Midland Steeldraulic, single shoe, self-energizing, internal expanding, mechanically operated brakes. Hand lever applies all four service brakes. See article in Brake Section for relining and complete adjustment procedure.
Drum Diameter—11⅛".
Lining—Moulded type. Width 1¾". Thickness ¼". Length per wheel 29⅛".
Clearance—.010" at heel and toe of each shoe.

Hand Brake Adjustment:—See Service Brakes.

Power Unit:—Bendix vacuum power unit used as standard equipment on 'Year Ahead Models.' See article in Brake Section for complete data.

SERIAL NUMBER:—First number (73 '33) 8,040,001 (B '34) 8,045,001 (Year Ahead B '34) 8,100,001. Stamped on plate on left frame side member under front fender.

ENGINE NUMBER:—Stamped on boss on upper left center of engine block.

ENGINE (1933):—Eight cylinder, In line, 'L' head type.
Dimensions—Bore 3 1/16". Stroke 4". Displacement 236 cubic inches.
Horsepower—Rated 30. Developed 100 at 3800 R.P.M.
Compression Ratio—5.5-1 Standard, 6.0-1 Optional.
Compression Pressure—Approximately 95 lbs. (5.5-1 head), 100-105 lbs. (6.0-1 head) at cranking speed.
Vacuum Reading—Steady reading of 18-20" at idling speed.

ENGINE (1934):—Eight cylinder, In line, 'L' head type.
Dimensions—Bore, 3 1/16". Stroke, 3¾". Displacement, 221 cu. ins.
Horsepower—Rated, 30. Developed, 103 H.P. at 4000 R.P.M.
Compression—6.3-1. Compression pressure, 128 lbs. at 1200 R.P.M. or 101.5-106 lbs. at 150 R.P.M. (cranking espeed).
NOTE:—The standard 6.3-1 cylinder head is aluminum.
Vacuum Reading—Steady reading of 18-20" at idling speed.

Pistons (73 '33):—Own make. Cast-iron electro-plated type. Pistons are tin-plated after finishing and cannot be ground. Recondition cylinders to size for which finished replacement pistons available.
Length—3 13/16".
Weight—1.56 lbs. (stripped), 2.2 lbs. (with rings and pin).
Clearance—.012-.018" top, .002" skirt.
Fitting New Pistons—Use .002" feeler stock to check clearance.

Pistons (All B '34):—Lynite, aluminum alloy, cam-ground, slotted. Piston diameter is smaller (.00825-.01075") across pin bosses. Piston skirt also tapered from top to bottom (000-.001" larger diameter at bottom). Service pistons stamped with exact size as measured at right angles to piston pin bosses ¼" up from bottom of skirt. Standard oversize pistons, .002", .004", .010", .015", .020", .030".
NOTE—Four ring piston superseded by three ring piston. Replacement pistons are three ring type.
Length—3¾".
Weight—13.44 ozs. (stripped), 19.68 ozs. (with rings and pin).
Removal—Piston and rod assembly removed from top of engine.
Clearance—Top, .030-.036". Bottom, .0015" selective fit.

Installing New Pistons—Use .0015" feeler stock ½" wide to check clearance (invert piston, insert in bore with pin parallel to crankshaft and feeler on side opposite slot). Use spring scale to check feeler tension. Pull required to withdraw feeler should be 9-14 lbs. Piston selected should be within this range.
NOTE:—Install pistons with slot on minimum pressure side (to left or away from camshaft).

Piston Rings:—4 rings ('33, '34 B), 3 rings (Yr. Ah'd) per piston, all above pin. 3 compression ('33, '34 B), 2 compression (Yr. Ah'd), 1 oil control (all). Lower ring groove drilled radially with ten 5/32" oil drain holes.
NOTE—Top groove on later 4 groove (aluminum) pistons unfinished. No ring should be fitted in this groove.

Ring	Width	End Gap	Wall Thickness - 1933 — 1934
Compression (all)	⅛"	.013-.018"	.125" .125-.135"
Oil Control (#4)	3/16"	.013-.021"	.125" .115-.125"

Compression rings are Perfect Circle '70' and should be installed with the step downward. Oil Control ring is Perfect Circle '85'.

Piston Pin:—Diameter, .8741-.8745". Length, 2⅝". Pin is clamped in rod. Piston pin hole in piston is line-reamed and burnished.
Pin Fit in Piston—Light push fit. Clearance, .0001-.0003". With this clearance, connecting rod should rock freely on piston of its own weight.
NOTE:—New pins are fitted and furnished with all replacement pistons.

Connecting Rod:—Weight 26 ounces (1933), 28.96 ounces (1934).
Length—8⅛" (1933), 8¼" (1934).
Crankpin Journal Diameter—1⅞" all models.
Big End Bearing—Spun babbitt-lined type. No shims used.
Clearance—.0005-.002". Sideplay .005-.010".
Adjustment—None (no shims used). Do not file bearing caps.

Crankshaft:—Nine main bearing type with bolted-on counterweights.
Journal Sizes—2.3435-2.3440" (2 11/32") diameter (all bearings).
Bearing Type—Steel-backed, babbitt-lined or lead-bronze (Clevite) type. No shims used.
Clearance—.0005-.0025".
Adjustment—None (no shims used). Do not file bearing caps. Replace removable bearings.
End Thrust—Taken by #1 (front) main bearing. Endplay, .003-.006". Adjustable by adding or removing shims.

Camshaft:—Six bearing type. Camshaft drive, helical gears.
Bearing Type—Split, steel-backed, babbitt-lined type.
Clearance—.00075-.00225" (front), .002-.00375" (all others).
Camshaft Gears—Cast-iron (crankshaft), Bakelite and Fabric (camshaft).
Camshaft Setting—Gears are marked. Mesh marked tooth on crankshaft gear between two marked teeth on camshaft gear. Use gear pullers and pushers to remove and install gears.

Valves:—	Head Diameter	Stem Diameter	Length	Seat Angle
Intake	1 13/32"	11/32"	5 7/32"	45°
Exhaust	1 9/32"	11/32"	5 7/32"	45°

Valve Lift—.34375" ('73 '33, First B '34), .28125" (Year Ahead B '34).
Stem-to-Guide Clearance—.001-.003" (all valves).
Tappet Clearance—.004" (intake), .006" (exhaust) engine hot.

Valve Springs:—	Pressure & Length 1933	Pressure & Length 1934
Valve Closed	48-53 lbs. at 2 1/32"	59-64 lbs. at 2 3/32"
Valve Open	71-76 lbs. at 1 23/32"	98-108 lbs. at 1 ¾"

Valve Timing:—See Camshaft Setting above.

Model 73 ('33), First B ('34)
Intake Valves—Open 15° BTDC. Close 43° ALDC.
Exhaust Valves—Open 48° BLDC. Close 10° ATDC.

Year Ahead Model B (1934)
Intake Valves—Open At TDC. Close 40° ALDC.
Exhaust Valves—Open 45° BLDC. Close 11° ATDC.
To Check Valve Timing—Set tappet clearance #1 intake valve at .010". This valve should open with piston 15° or .0846" ('73 '33), .0876" (First B '34) when flywheel mark 'IN.OP./1-8' lines up with indicator on housing for 73 '33 and First B '34 cars, or when piston reaches top dead center with flywheel mark 'UDC/1-8' at indicator on Year Ahead Model B '34. Reset tappet clearance at .004" with engine hot.
Motor Gauge—Weidenhoff Adapter #104, Rod #2.

LUBRICATION:—Pressure type. Gear type oil pump located in crankcase.
Normal Oil Pressure—30 lbs. at 30 M.P.H. (1933), 40 lbs. at 20 M.P.H. (1934).
Oil Pressure Relief Valve—Operates at 30 lbs. (1933), 40 lbs. (1934). Located under plug on left side of crankcase in front of oil filler. Not adjustable.
Capacity & Oil—6½ qts. Use SAE. #30 (summer) or #40 for high speed driving, #20 or #10 (winter).

CLUTCH:—Long Model 9ABM. Single plate, dry disc type. See article in Clutch Section for complete relining and assembling directions.
Facings—Moulded type, 2 required. Thickness 9/64". Inside Diameter 5½". Outside Diameter 9¼".
Adjustment—Free movement of clutch pedal should be 1". To adjust, loosen locknut and turn clutch release adjustment screw on left side of clutch housing. Check free-wheeling control setting after adjusting clutch.
Free-Wheeling Control Setting—Place shift lever in neutral and free-wheeling button in free-wheeling position. Remove clevis pin linking control rod to clutch release shaft lever, turn control rod clevis until pin can just be inserted with free-wheeling positive lock pin lever in the extreme rear position and both springs compressed equally.

STEERING:—Steering Gear—Ross Cam-and-Roller type. See article in Steering Section for complete adjustment directions.
Front Suspension:—Conventional 'I' beam section front axle with Reverse Elliott type ends and semi-elliptic springs.
Kingpin Inclination—8° crosswise.
Caster—½-1½° (73), 1-1½° (B). Adjust by inserting wedge shims between spring and spring pad on axle.
Camber—0-1°. No adjustment provided.
Toe In—1/16-⅛". Adjust in usual manner by loosening clamp bolts and turning tie rod.

BRAKES:—Service—Bendix Duo-Servo Mechanical type with vacuum power operation. Hand lever applies all four service brakes. See article in Brake Section for complete adjustment directions.
Drum Diameter—12⅛".
Lining—Moulded type (1933), Composite (1934). Width 1½". Thickness ¼". Length 26 3/16" (1933), 26⅞" (1934) per wheel.
Clearance—.008" (1933), .010" (1934) at heel and toe of each shoe.
Hand Brake:—See Service Brake and Service Brake adjustment.
Power Unit:—Bendix vacuum cylinder with internal valve. See article in Brake Section for complete data.

SERIAL NUMBER:—First number (82) 7,040,001, (C) 7,045,001, (Yr. Ahead 'C') 7,100,001. On plate on left hand frame side member under left front fender.

ENGINE NUMBER:—Stamped on boss on upper left center of engine block.

ENGINE:—Eight cylinder In Line, 'L' head type. Cylinders cast enblock.

Dimensions—Bore, 3 1/16". Stroke, 4¼". Displacement, 250.4 cu. ins.

Horsepower—Rated, 30. Developed, 110 H.P. at 3600 R.P.M.

Compression Ratio—5.5-1 Std. 82, 6.0-1 Optl. 82. 6.3-1 Std. Model C and Yr. Ahead C.

Compression Pressure—Approximately 95 lbs. (5.5-1 head), 100-105 lbs. (6.0-1 head), 114-117 lbs. (6.3-1 head) at cranking speed (150 R.P.M.).

Vacuum Reading—Gauge should show steady reading of 18-20" with engine idling.

Pistons (82 '33):—Nelson Bohnalite, aluminum alloy, Invar strut, split skirt type. Replacement pistons furnished in standard and .002", .004", .010", .015", .020", .030" oversize.

Weight—14.72 ozs. (stripped), 21.60 ozs. (with rings and pin).

Removal—Pistons and rods removed from above.

Clearance—Top .0305-.0355". Bottom .0015" selective fit.

All other data same as for Lynite pistons below.

Pistons (C & Yr. Ahd. C):—Lynite aluminum alloy, slotted, cam ground type. Diameter is smaller (.00825-.01075") across pin bosses. Piston skirt is also tapered from top to bottom (.000-.001" larger diameter at bottom). Service pistons are stamped with exact size as measured at right angles to piston pin bosses ¼" up from bottom of piston skirt. Standard oversize pistons, .002", .004", .010", .015", .020", .030".

NOTE—Four ring piston superseded by three ring piston. Replacement pistons are three ring type.

Length—3¾".

Weight—13.44 ozs. (stripped), 19.68 ozs. (with rings and pin).

Removal—Piston and rod assembly removed from top of engine.

Clearance—Top, .030-.036". Bottom, .0015" selective fit.

Installing New Pistons—Use .0015" feeler stock ½" wide inserted between piston and cylinder wall on pressure side (opposite side from slot) with piston inverted in bore and piston pin bosses parallel to slot. Use spring scale to check feeler tension. Pull required to withdraw feeler should be 9-14 lbs. Piston selected for bore should be within this range.

NOTE:—Install pistons with slot on minimum pressure side (to left or away from camshaft).

Piston rings:—4 rings ('33, '34 C), 3 rings (Yr. Ah'd) per piston, all above pin. 3 compression ('33, '34 C) 2 compression (Yr. Ah'd), 1 oil control (all). Lower ring groove drilled radially with ten 5/32" oil drain holes.

NOTE—Top groove on later 4 groove pistons unfinished. No ring should be fitted in this groove.

Ring	Width	End Gap	Wall Thickness
Compression (all)	⅛"	.013-.018"	.125-.135"
Oil Control (#4)	3/16"	.013-.021"	.115-.125"

NOTE:—Compression rings are Perfect Circle '70' and should be installed with step downward. Oil Control Ring is Perfect Circle '85'.

Piston Pin:—Diameter, .8741-.8745". Length, 2⅝". Pin is clamped in rod. Piston pin hole in piston is line-reamed and burnished.

Pin Fit in Piston—Light push fit. Clearance, .0001-.0003". With this clearance, rod should rock freely in piston of its own weight.

NOTE:—New pins are fitted and furnished with all replacement pistons.

Connecting Rod:—Weight—30 ozs. ('33), 32 ozs. ('34). **Length**—8" (center-to-center).

Crankpin Journal Diameter—1⅞".

Lower Bearing—(82 '33) Spun babbitt type. (C & Yr. Ahd. C) Removable lead-bronze (Clevite) bearings.

Clearance—.0005-.0020" (82), .00075-.00275" (C & Yr. Ah'd C); Sideplay .005-.009" (82), .005-.010" (C & Yr. Ah'd C).

Adjustment—None (no shims). Do not file caps. Replace rods (82), bearings (C and Yr. Ahead C). Bearings furnished in standard .005", .010", .020" undersize. Bearings cannot be reamed and crankshaft journals must be turned down to provide correct clearance (.0005-.002") when new bearings are installed.

NOTE:—Bearings are provided with small integral tongue which fits into recess in rod and bearing cap. In installing new bearings, see that tongue enters recess so that bearings are restrained from turning, see that oil holes line up, and that bearings do not project beyond edges of rod and bearing cap after bearings have been pressed into place.

Crankshaft:—Nine main bearing type with bolted-on counterweights.

Journal Sizes—2.3435-2.3440" (2 11/32") diameter (all bearings).

Bearing Type—Removable steel-backed, babbitt-lined type (82), removable lead-bronze type (C & Yr. Th'd C).

Clearance—.0005-.0025" (82). .001-.003" (C).

Adjustment—None (no shims). Do not file bearing caps. Replace removable bearings.

End Thrust—Taken by #1 (front) main bearing. Endplay, .003-.006". Adjustable by adding or removing shims.

Camshaft:—Six bearing type. Camshaft drive, helical gears.

Bearing Type—Split, steel- backed, babbitt-lined type.

Clearance—.00075-.00225" (front), .002-.00375" (all others).

Camshaft Gears—Cast-iron (crankshaft), Bakelite and Fabric (camshaft).

Camshaft Setting—Gears are marked. Mesh marked tooth on crankshaft gear between two marked teeth on camshaft gear. Use gear pullers and pushers to remove and install gears.

Valves:—	Head Diameter	Stem Diameter	Length
Intake	1 13/32"	11/32"	5 7/32"
Exhaust	1 9/32"	11/32"	5 7/32"

Seat Angle—45° (all valves). Lift .34375".

Stem-to-Guide Clearance—.004" (intake), .006" (exhaust) engine hot.

Tappet Clearance—.004" (intake), .006" (exhaust) engine hot.

Valve Springs (82 '33)—	Spring Pressure	Spring Length
Valve Closed	48-53 lbs.	2 1/32"
Valve Open	71-76 lbs.	1 23/32"

Valve Springs (1934)—	Spring Pressure	Spring Length
Valve Closed	59-64 lbs.	2 3/32"
Valve Open	98-108 lbs.	1 ¾"

Valve Timing

Intake Valves open 15° BTDC. Close 43° ALDC.
Exhaust Valves open 48° BLDC. Close 10° ATDC.

To Check Valve Timing—Set tappet clearance #1 intake valve at .010". This valve should open with piston #1 15° or .0915" before top dead center when flywheel mark 'IN.OP./1-8' lines up with indicator on housing. Reset tappet clearance at .004" with engine hot or cold.

Lubrication—Pressure type. Gear type oil pump located in crankcase.

Oil Pressure—30 lbs. at 30 M.P.H. (82), 40 lbs. at 27.4 M.P.H. (1934).

Oil Pressure Relief Valve—Under plug on left hand side of crankcase in front of oil filter. Operates at 30 lbs. ('33), 40 lbs. ('34).

Crankcase Capacity—6½ qts. (for 1933 and 1934 models).

CLUTCH:—Long Model 9ABM. Single plate, dry disc type. No adjustment required for wear. See article in Clutch Section for relining and assembling directions.

Facings—Moulded type, 2 required. Thickness 9/64". Inside Diameter 5½". Outside Diameter 9¾".

Adjustment—Free movement of clutch pedal 1". To adjust, loosen locknut and turn clutch release adjustment screw on left side of clutch housing. Check free-wheeling control setting after adjusting clutch.

Free-Wheeling Control Setting—Place shift lever in neutral and free-wheeling button in free-wheeling position. Remove clevis pin linking control rod to clutch release shaft lever, turn control rod clevis until pin can just be inserted with free-wheeling positive lock pin lever in the extreme rear position and both springs compressed equally.

STEERING:—Steering Gear—Ross Cam-and-Roller type. See article in Steering Section for complete adjustment directions.

Front Suspension:—Conventional 'I' beam section front axle with Reverse Elliott type ends and semi-elliptic springs.

Kingpin Inclination—8° crosswise.

Caster—½-1½°. Adjust by inserting wedge shims between spring and spring pad on axle.

Camber—1°. No adjustment provided.

Toe In—1/16-⅛". Adjust in usual manner by loosening clamp bolts and turning tie rod.

BRAKES:—Service—Bendix Duo-Servo Mechanical type with vacuum power operation. Hand lever applies all four service brakes. See article in Brake Section for complete adjustment directions.

Drum Diameter—13⅛".

Lining—Moulded type. Width 1¾". Thickness ¼". Length per wheel 28".

Clearance—.008" (1933), .010" (1934) at heel and toe of each shoe.

Hand Brake:—See Service Brake and Service Brake adjustment.

Power Unit:—Bendix vacuum cylinder with internal valve. See article in Brake Section for complete data.

NOTE—Models designated as '1-A' have conventional front axle, '2-A' types have independently sprung front wheels. All other data is the same for all cars.

SERIAL NUMBER: — First number (1-A) 5,500,001, (2-A) 5,212,001. On plate on left frame side member under front fender.

ENGINE NUMBER:—Stamped on left center of cylinder block.

ENGINE:—Dictator, Six cylinder, 'L' head type.
Bore—3¼". **Stroke**—4⅛".
Piston Displacement—205 cubic inches.
Rated Horsepower—25.4.
Developed Horsepower—88 at 3600 R.P.M. (std. hd.).
Compression Ratio—6.3-1 Std., 6.9-1 Optl.
Compression Pressure—109.5-116 lbs. (Std. 6.3-1 head), 110-120 lbs. (Optl. 6.9 head) at cranking speed (150 R.P.M.).
Vacuum Reading—Gauge should show steady reading of 18-20" with engine idling.

NOTE—Special 6.9-1 head is aluminum and special copper-asbestos head gasket must be used (steel-bestos gasket used with standard cast-iron head).

Pistons: — Lynite, aluminum alloy, 'T' slot, cam ground type (.00825-.01075") smaller diameter across pin bosses, skirt is not tapered vertically).
Weight—.94 lbs. (without rings or pin).
Removal—Pistons and rods removed from above.
Clearance—Top .016-.018". Bottom .0015".
Original Bore Size—*See Studebaker Shop Notes.*
Replacement Pistons—Pistons with pins fitted furnished .002", .004", .010", .015", .020", .030" oversize. Replacement pistons stamped on head with exact size as measured at right angles to pin bosses ¼" up from bottom of skirt. Piston length 3¾".
Fitting New Pistons—Use .002" feeler stock 1" wide to check clearance. Insert piston in bore upside down with pin bosses parallel to crankshaft, and feeler between piston and cylinder wall midway between bosses on camshaft side (opposite side from piston slot). Pull required to withdraw feeler should be 7-15 lbs. Piston selected for bore should be within this range.
Installing Pistons—Slot should be on minimum pressure side (away from camshaft).

Piston Rings:—Three rings per piston, two compression, one oil control, all above pin. Oil ring groove is drilled radially with ten 5/32" oil drain holes. Compression rings are Perfect Circle '70' and should be installed with the step downward. All pistons have a heat insulating groove above the top compression ring, this groove is slightly narrower than ring grooves and no ring is fitted.

Ring	Width	End Gap	Wall Thickness
Comp. All	⅛"	.013-.021"	.145"
Oil Cont.	3/16"	.013-.021"	.135"

Piston Pin:—Diameter ⅞". Length 2⅞". Pin is locked in rod. Pin hole in piston is line-reamed and burnished.
Clearance in Piston—.0001-.0003" or light push fit. With this clearance rod will rock on piston of own weight. Pins are fitted and furnished with new pistons.

Connecting Rod:—2.09 lbs. Length 8¼".
Crankpin Journal Diameter—2.06175-2.06275".
Lower Bearing—Integral spun babbitt-lined type.
Clearance—.0005-.002". Sideplay .005-.009".
Adjustment—None. Replace rods. Do not file caps.

Crankshaft:—Four bearings. Integral counterweights.
Journal Diameters—2.2495-2.250" all bearings.
Bearing Type—Interchangeable steel-backed, babbitt-lined type.
Clearance—.0005-.0025".
Adjustment—None. Replace bearings. Do not file caps.
End Thrust—Taken by #1 (front) bearing. End-play .003-.006". Adjusted by shims.

Camshaft:—Four bearing. Helical gear drive.
NOTE—High lift camshaft used starting with Engine No. D-47576. See Valves (following) for changes in specifications for these cars.
Bearing Type—Split steel-backed, babbitt-lined type.
Clearance—.00075" (front), .002-.00375" (all others).
End Thrust—Taken by steel thrust washer between #1 bearing and camshaft gear.
Timing Gears—Crankshaft gear cast-iron. Camshaft gear Celeron Fabric. Camshaft gear furnished for service in three sizes: 'S' standard, 'L' low limit, 'H' high limit.
See Studebaker Special Shop Notes for Camshaft Gear Removal.
Camshaft Setting—Gears are marked. Mesh marked tooth on crankshaft gear between two marked teeth on camshaft gear. Use gear pullers and pushers to remove or install gears.

Valves:—

	Head Diameter	Stem Diameter	Length
Intake	1 15/32"	11/32"	5 7/32"
Exhaust	1 9/32"	11/32"	5 7/32"

	Seat Angle	Lift	Stem-to-Guide Clearance
All Valves	45°	5/16"	.001-.003"

Tappet Clearance—.004" Int., .006" Exh. Hot (Before Engine No. D-47576), .016" all valves with engine cold (After Eng. No. D-47576).
Valve Springs—New type. Install springs with closed coils at top. No spring damper used.

	Spring Pressure	Length
Valve Closed	63-68 lbs.	2 1/16"
Valve Open	98-108 lbs.	1¾"

See Studebaker Special Shop Notes for Valve Spring Installation Instructions.
Valve Timing—See Camshaft Setting above.

Cars before Engine No. D-47576
Intake Valves—Open 5° BTDC. Close 40° ALDC.
Exhaust Valves—Open 40° BLDC. Close 5° ATDC.

Cars with Engine No. D-47576 and up
Intake Valves—Open 15° BTDC. Close 43° ALDC.
Exhaust Valves—Opens 48° BLDC. Close 10° ATDC.
To Check Valve Timing—Set tappet clearance #1 intake valve at .010" (Before Eng. No. D-47576), .020" (After Eng. No. D-47576). This valve should open with piston 5° or .0098" BTDC. (Before Eng. No. D-47576), 15° or .0942" (After Eng. No. D-47576) when flywheel mark 'IN.OP.1-6' lines up with indicator in inspection hole in left front face of flywheel housing below starter. Reset tappet clearance at .004" hot (Before No. D-47576), .016" cold (After No. D-47576).
Motor Gauge—Weidenhoff Adapter #104, Rod #2.

Lubrication:—Pressure. Gear type oil pump located on right side of crankcase.
Normal Oil Pressure—40 lbs. at 26.8 M.P.H.
Oil Pressure Relief Valve—Operates at 40 lbs. Located on right hand front corner of crankcase. Screw adjustment.
Capacity and Oil—5 qts. Use SAE. #30 (summer 45° to 90°F.—average driving), #40 (summer above 90°F.—high speed driving), #20 (winter 45° to 0°F.), #10 (winter below 0°F.).

CLUTCH:—**Borg & Beck Model 9A6. Single plate, dry disc type. No adjustment required for wear.**
See article in Mechanical Equipment Section for data.
Clutch Pedal Adjustment — Free movement of clutch pedal must be 1" minimum. Adjust by turning clutch release adjustment lever set screw (on left hand side of clutch housing). On cars with free-wheeling check setting of free-wheeling unit positive lock control rod after adjusting clutch pedal.
Free-wheeling Control Rod—To adjust, remove clevis pin holding control rod on clutch release shaft lever, turn control rod clevis until clevis pin can just be inserted with free-wheeling unit positive lock pin lever in the extreme rear position and both springs (thrusting against lock pin lever swivel) compressed equally. Gear shift lever must be in neutral and free-wheeling control in free-wheeling position.
Clutch Facings—Moulded type, 2 required, 5¾" I. D.. 9" O. D., ⅛" thick.
Installing New Facings—Driven plate is segmented (alternate segments convex and concave) with horseshoe tongue in each segment. Each facing is riveted separately to convex side of plate segments. Old rivets should be drilled out to avoid damage to tongues. Insert new rivets with head on plate side (if split) or on facing side (if rolled).

NOTE—In reassembling clutch, release levers must be set to equal height within .005". Use special clutch finger setting disc HMJ-285.

STEERING:—**Front Suspension**—**(2-A)**—Independent with transverse spring. All specifications and service for this type suspension same as for Commander and President Models (see next page).
See article in Mechanical Equipment Section for data.
(1-A)—Conventional 'I' beam section axle with Reverse-Elliott ends and semi-elliptic springs. Specifications and data below.
Kingpin Inclination—9½° crosswise.
Caster—1-1½°. Adjust by inserting wedge shims between spring and spring pad on axle. Spring pad should incline 1½° down toward rear.
Camber—1-1½°. No adjustment. Axle may be bent cold to correct camber.
Toe In—1/16-⅛". Adjust in usual manner by changing length of tie rod.
Steering Gear:—Ross Model, Cam-and-Lever type.
See article in Mechanical Equipment Section for data.

BRAKES:—**Service**—Lockheed Hydraulic, four wheel type. Hand lever applies rear wheel brakes.
See article in Mechanical Equipment Section for data.
Wheel Cylinders—Stepped or two-stage bore type:
Front Wheel—Front Shoe Cyl. 1⅜". Rear—1".
Rear Wheels—Front Shoe Cyl. 1¼". Rear—1".
NOTE—Wheel cylinder bore size marked on casting. Cylinders not interchangeable.
Brake Drum Diameter—11⅛".
Lining—Moulded type. Width 1¾". Thickness ¼". Length per wheel 23".
Clearance—.010" toe, .005" heel on each shoe.
Hand Brake Adjustment:—**See Service Brakes.**

SERIAL NUMBER:—First number (Comm.) 8,103,001, (Pres.) 7,101,001. On plate on left frame side member under front fender.

ENGINE NUMBER:—Stamped on boss on upper left center of cylinder block.

ENGINE:—Own. Eight cylinder, In line, 'L' head type.
Bore—3 1/16". **Stroke**—4¼".
Piston Displacement—250 cubic inches.
Rated Horsepower—30.
Developed Horsepower—(Comm.) 107 at 3800 R.P.M. (Pres.) 110 at 3600-3800 R.P.M.
Compression Ratio—(Comm.) 6.0-1 (cast-iron head), (Pres.) 6.5-1 (aluminum head). The 6.5-1 aluminum head is optional on Commander models.
Compression Pressure—94-104 lbs. (6.0-1 head), 105-115 lbs. (6.5-1 head) at cranking speed (150 R.P.M.).
Vacuum Reading—Gauge should show steady reading of 18-20" with engine idling.

Pistons:—Lynite, aluminum alloy, "T" slot, cam ground type (.00825-.01075" smaller diameter across pin bosses, piston not tapered vertically).
Weight—.84 lbs. (without rings or pin).
Removal—Pistons and rods removed from above.
Clearance—Top .015-.018". Bottom .0015".
Original Bore Size—*See Studebaker Shop Notes.*
Replacement Pistons—Pistons with pins fitted furn. .002", .004", .010", .015", .020", .030" oversize. Replacement pistons stamped on head with exact size as measured at right angles to pin bosses ¼" from bottom of skirt. Piston length 3¾".
Fitting New Pistons—Use .003" feeler stock 1" wide to check clearance. Insert piston in bore upside down with pin bosses parallel to crankshaft, and feeler between piston and cylinder wall midway between bosses on camshaft side (opposite side from slot). Pull required to withdraw feeler should be 7-13 pounds.
Installing Pistons—Slot should be on minimum pressure side (away from camshaft).

Piston Rings:—Three rings per piston, two compression, one oil control, all above pin. Oil ring groove is drilled radially with ten 5/32" oil drain holes. Compression rings are Perfect Circle '70' and should be installed with step downward. All pistons have a heat insulating groove above the top compression ring, this groove is slightly narrower than ring grooves, and no ring is fitted.

Ring	Width	End Gap	Wall Thickness
Comp. All	⅛"	.013-.018"	.135"
Oil Cont.	3/16"	.013-.018"	.125"

NOTE—Inner rings installed back of oil ring.

Piston Pin:—Diameter ⅞". Length 2⅝". Pin is locked in rod. Pin holes in piston are line-reamed and burnished.
Clearance in Piston—.0001-.0003" or light push fit. With this clearance rod will rock on piston of own weight. Fitted pins furn. with new pistons.

Connecting Rod:—Weight 2 lbs. Length 8".
Crankpin Journal Diameter—1.87425-1.87525".
Bearing Type—Removable Clevite (steel-backed, lead-bronze lined type).
Clearance—.00075-.00275". Sideplay .005-.009".
Adjustment—None. Replace bearings. Do not file caps. New bearings should be pressed in place in rod and cap (upper and lower halves interchangeable) so that tongues on bearings engage grooves in rod and cap and oil holes line up. Bearings cannot be reamed, and crankpins must be turned down to size giving correct clearance. Bearings furnished .005", .010", .020" undersize and standard.

Crankshaft:—Nine bearings. Bolted-on counterweights.
Journal Diameters—2.3435-2.3440" all bearings.
Bearing Type—Interchangeable steel-backed, babbitt-lined type.
Clearance—.001-.003".
Adjustment—None. Replace bearings. Do not file caps.
End Thrust—Taken by #1 (front) bearing. End-play .003-.006. Adjusted by shims.

Camshaft:—Six bearings. Helical gear drive.
Bearing Type—Split steel-backed, babbitt-lined.
Clearance—.00075" (front), .002-.00375" (all others).
End Thrust—Taken by steel thrust washer between #1 bearing and camshaft gear.
Timing Gears—Crankshaft gear cast-iron, camshaft gear Celeron Fabric. Camshaft gears furnished for service in three sizes, 'S' standard, 'L' low limit, 'H' high limit.
See Studebaker Special Shop Notes for Camshaft Gear Removal.
Camshaft Setting—Gears are marked. Mesh marked tooth of crankshaft gear between two marked teeth on camshaft gear. Use gear pullers.

Valves:—	Head Diameter	Stem Diameter	Length
Intake	1 13/32"	11/32"	5 7/32"
Exhaust	1 9/32"	11/32"	5 7/32"

	Seat Angle	Lift	Stem-to-Guide Clearance
All Valves	45°	11/32"	.001-.003"

Tappet Clearance—.004" Int., .006" Exh. eng. hot.
NOTE—On engines so marked on valve cover plate, set tappet clearance at .016" cold (all valves).
Valve Springs—Springs installed with closed coils at top. Cup type valve cages used on all springs at top.

	Spring Pressure	Length
Valve Closed	59-64 lbs.	2 3/32"
Valve Open	98-108 lbs.	1¾"

Valve Timing—See Camshaft Setting (above).
Intake Valves—Open 15° BTDC. Close 43° ALDC.
Exhaust Valves—Open 48° BLDC. Close 10° ATDC.
To Check Valve Timing—Set tappet clearance #1 intake valve at .010" (or .020" when regular running clearance of .016" used). This valve should open with piston 15° or .0915" before top dead center when flywheel mark 'IN.OP/1-8' lines up with indicator. Reset tappet clearance at .004" hot (or .016" cold on engines so marked).
Motor Gauge—Weidenhoff Adapter #104, Rod #2.

Lubrication:—Pressure. Gear type oil pump located in crankcase.
Normal Oil Pressure—40 lbs. at 27.4 M.P.H.
Oil Pressure Relief Valve—Operates at 40 lbs. On left front corner of crankcase. Screw adjustment.
Capacity and Oil—8 qts. Use SAE. #30 (summer 45° to 90°F.—average driving), #40 (summer above 90°F.—high speed driving), #20 (winter 45° to 0° F.), #10 (winter below 0°F.).

CLUTCH:—Long Model 9AB. Single plate, dry disc type. No adjustment required for wear. See article in Clutch Section for relining and assembling directions.
Clutch Pedal Adjustment—Free movement of clutch pedal must be 1" minimum. Adjust by turning clutch release adjustment lever set screw (on left hand side of clutch housing). On Commander cars check setting of free-wheeling unit positive lock control rod after adjusting pedal.
Free-wheeling Control Rod—To adjust, loosen clevis pin holding control rod on clutch release shaft lever, turn control rod clevis until clevis pin can just be inserted with free-wheeling unit positive lock pin lever in the extreme rear position and both springs (thrusting against lock pin lever swivel) compressed equally. Gear shift lever must be in neutral and free-wheeling control in free-wheeling position.
Clutch Facings—Moulded type, 2 required, 5½" I.D., 9¾" O.D., 9/64" thick.
Installing New Facings—One facing riveted to main driving plate, one facing riveted to spring segments. To remove old facings, drill out 12 iron rivets holding sections together, then drill out brass facing rivets after separating sections. Spring segments should be riveted to facings so that clearance is between center portion of spring segment and facing at outer circumference (center portion of spring segments will bear against main plate when sections assembled).
NOTE—Use alignment shaft and adjusting sleeve HMJ-278, HMJ-278-2 to set up release levers in reassembling clutch, or use straightedge across top of stamped steel cover plate and set lever height at ⅞" below. Levers must be equal within .020".

STEERING:—Front Suspension—Independent type with transverse spring.
See article in Mechanical Equipment Section for data.
Kingpin Inclination—9½° crosswise.
Caster—½° (-¼ to +¾°) with car weight on wheels, tires properly inflated, and frame level (car unloaded). Caster determined by spring mounting. No adjustment possible.
Camber—1-1½° with car weight on wheels, car unloaded and on level floor, frame height normal (bounce car up and down several times), tires properly inflated. Camber adjusted by adding or removing shims located between steering knuckle support arm and steering knuckle support arm outer bearing. Shims are 1/32" thick. One shim will change camber angle ¼°. Maximum allowable number of shims is six.
Toe In—1/16-⅛". Adjust by changing length of longer tie rod (shorter tie rod need not be adjusted). Tie rod has right and left hand threads.

Steering Gear:—Ross Model, Cam-and-Lever type.
See article in Mechanical Equipment Section for data.

BRAKES:—Lockheed Hydraulic, four wheel type. Hand lever applies rear wheel brakes. See article in brake Section for complete adjustment procedure.
Wheel Cylinders—Stepped or two-stage bore type: Front Wheels—Front Shoe Cyl. 1⅜". Rear 1".
Rear Wheels—Front Shoe Cyl. 1¼". Rear 1".
NOTE—Wheel cylinder bore size marked on casting. Not interchangeable.
Drum Diameter—12⅛" (1-B), 13⅛" (1-C).
Lining—Moulded type. Width 1¾". Thickness ¼". Length per wheel 25" (1-B), 27½" (1-C).
Clearance—.010" toe, .005" heel, for each shoe.
Hand Brake Adjustment:—See Service Brakes.

ENGINE NUMBER:—First number—D-63,001. Stamped on left center of engine block.

ENGINE SPECIFICATIONS:—**Type**—6 cyl., 'L' head.
Bore—3¼". **Stroke**—4⅜".
Displacement—217.8 cubic inches.
Rated Horsepower—25.4 (NACC).
Developed Horsepower—90 at 3400 R.P.M.
Compression Ratio & Pressure—6.3-1 Std. cast-iron head. Pressure 105 lbs. at cranking speed of 150 R.P.M.
Vacuum Reading—Gauge should show steady reading of 18" with engine idling at 450 R.P.M. or 8 M.P.H.

PISTONS:—Lynite, aluminum alloy, 'T' slot, Cam Ground type with .00825-.01075" greater diameter at right angles to piston pin bosses.
Weight—15.2 ozs. **Length**—3¾".
Removal—Pistons and rods removed from above.
Clearance—.0005" as measured ¼" up on skirt at right angles to pin bosses for new pistons. See Fitting New Pistons.
Original Bore Sizes:—*See Studebaker Shop Notes.*
Replacement Pistons:—Finished pistons with fitted pins furnished .002", .004", .010", .015", .020", .030" oversize. Exact size of all new pistons as measured ¼" up on skirt at right angles to pin bosses is stamped on head.
Fitting New Pistons:—Check clearance by inserting .002" hardened feeler 1" wide between piston and cylinder wall on pressure or camshaft side at right angles to pin bosses. Piston should be inserted in inverted position with slot away from camshaft. Pressure required to withdraw feeler must be between 7-15 lbs.
Installing Pistons:—Slot should be on minimum pressure side or away from camshaft.

PISTON RINGS:—Two compression, one oil control ring per piston, all above pin. Lower ring groove drilled with ten 5/32" oil drain holes.
NOTE—Narrow heat deflector groove located above top ring groove. No ring fitted in this groove.

Ring	Width	End Gap	Wall Thickness
Comp.	⅛"	.013-.018"	.135"
Oil Cont.	3/16"	.013-.018"	.145"

NOTE—Compression rings are undercut. Install these rings with step or groove down.

PISTON PIN:—Diameter ⅞". Length 2⅞".
Pin is locked in connecting rod.
Pin Fit in Piston—.0002" clearance or light push fit.
NOTE—New pins fitted and furnished with all new replacement pistons.

CONNECTING ROD:—Weight 33.2 ozs. Length 8⅛".
Crankpin Journal Diameter—2.18675-2.18775".
Lower Bearing—Integral spun-babbitt lined type.
Clearance—.0005-.002". **Sideplay** .005-.009".
Bearing Adjustment:—None (no shims). Replace rods on exchange basis. Do not file rods or caps. Rods furnished with bearings standard and .010", .020" undersize.
Installing Rods:—Lower bearings are offset. Install rods with narrow half of bearing toward front in cylinders #1, 3, 5 and toward rear in #2, 4, 6. Marks on rods and caps must be together and oil escape hole in upper half of rod lower bearing must be toward right or camshaft side of engine on all rods.

CRANKSHAFT:—Four bearing. Integral counterweights.
Journal Diameters—2½" all bearings .
Bearings—Interchangeable steel-backed, babbitt-lined type. No shims.
Clearance—.0005-.0025".
Bearing Adjustment:—None (no shims). Replace bearings. Do not file bearing caps. No fitting or line reaming necessary for new bearings.
End Thrust:—Taken by thrust plate assembled between front main bearing and crankshaft gear. Adjusted by adding or removing shims between thrust plate and bearing. Endplay should be .003-.006".

CAMSHAFT:—Four bearing. Helical gear drive.
Bearings—Split, steel-backed, babbitt-lined type.
Clearance—.00075-.00225" (front), .002-.00375" (all others).
NOTE—When bushings installed see that oil holes in bushing and block line up.
End Thrust:—Taken by steel thrust washer and spacer between gear hub and front bearing. Endplay .006" maximum.
Timing Gears:—Cast-iron (crankshaft), Celoron Fabric (camshaft). Camshaft gears furnished in three sizes marked 'S'—standard, 'H'—high limit, 'L'—low limit. Use next largest size to take up backlash when replacing gears.
NOTE—Screw thread for gear puller and pusher formed in camshaft gear hub recess. Gear must not be driven on or off of shaft.
Camshaft Setting:—Gears are marked. Mesh marked tooth on crankshaft gear between two marked teeth on camshaft gear.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1 15/32"	11/32"	5 7/32"
Exhaust	1 9/32"	11/32"	5 7/32"

	Seat Angle	Lift	Stem Clearance
Intake	45°	11/32"	.001-.003"
Exhaust	45°	11/32"	.001-.003"

Tappet Clearance—.016" all valves (cold).
Valve Guides:—Pressed in block from upper end.
Valve Springs:—No damper used. Install springs with closed-coil end at top. Replace springs if more than 10% weaker than specifications given below.

	Spring Pressure	Spring Length
Valve Open	1¾"	125-135 lbs.

NOTE—Valve spring will not clear tappet adjusting screw when extended. To install spring, place spring seat in position on spring, compress spring slightly with compressor so that it clears tappet adjusting screw, insert valve, compress spring fully and install valve spring seat locks.
Valve Lifters:—Barrel type operating directly in cylinder block (no separate guides). Lifters are same diameter throughout and can be removed from top or bottom.
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open at 15° BTDC. Close 49° ALDC.
Exhaust Valves—Open 54° BLDC. Close 10° ATDC.
To Check Valve Timing—Set tappet clearance #1 intake valve at .020". This valve should open with piston 15° or .0942" before top dead center when mark 'IN.OP/1-6' on vibration dampener at front of engine line up with pointer on gear case cover. Reset tappet clearance at .016".
Motor Gauge—Weidenhoff #114 Adapter, #2 Rod.

LUBRICATION:—Pressure type. Gear type oil pump located on right side of crankcase.
Normal Oil Pressure—40 lbs. min. at 40 M.P.H.
Oil Pressure Regulator—Located at right front corner of engine. Operates at 40 lbs. Not adjustable. Timing gears lubricated by overflow from regulator.
Crankcase Capacity—6 qts.
NOTE—Whenever oil pump is taken off engine, drive gear must be properly remeshed when pump is replaced so that distributor rotor position will be correct. To install pump, remove distributor, turn engine over until mark 'UDC/1-6' on vibration dampener lines up with pointer on chain case cover, sight down distributor shaft hole, mesh oil pump gear so that distributor drive slot is horizontal and offset toward top.

CLUTCH:—**Borg & Beck Model 9A6.** Single plate dry disc type. See article in Clutch Section for relining and assembling instructions.
Facings—Woven (pressure plate side), molded (flywheel side), 2 required. Inside Diam. 5⅝". Outside Diam. 9¼". Thickness .133".
Adjustment—Free movement of clutch pedal must be 1" minimum. To adjust, loosen locknut and turn adjustment lever setscrew on left side of clutch housing. Check Hill-Holder after adjusting clutch
Hill-Holder Adjustment:—On cars with Hill-Holder, check action after adjusting clutch to see that brakes release just before clutch engages. Adjust by loosening locknut and turning adjusting nut at end of hill holder control rod. Shorten rod for earlier brake release or lengthen rod for later release.
Clutch Removal:—Disconnect drive shaft at front universal, support engine at rear end, remove transmission and clutch cover, take out screws mounting clutch on flywheel turning all screws out evenly to release clutch spring tension.

STEERING:—**Steering Gear:** Ross Cam-and-Lever type. Model 140—first cars, Model T-14—later cars beginning with following serial numbers—**3A** 5526354 (South Bend), 5851960 (Pacific Coast) except 5526359-5526376 inc., **4A** 5246240 (South Bend), 5801504 (Pacific Coast) except 5801547, 5801655, and 5801657. See article in Steering Section.
Front Suspension Model 3A—Conventional 'I' beam section front axle with semi-elliptic springs.
King Pin Inclination—9½° crosswise.
Caster—1-1½°. Adjusted by inserting wedge shims between spring and spring pad on axle. Spring pad should incline 1½° toward rear (see Spring Camber)
Camber—1-1½°. No adjustment. Axle may be bent cold for minor camber adjustments.
Toe In—1/16-⅛". Adjust in usual manner by changing length of tie rod.
Spring Camber—⅛" minimum. Measure by stretching cord between spring eye centers and noting distance from cord to top of spring main plate at center. Camber must be positive (cord above spring) between each spring and bearing) is 1⅜".
Front Suspension Model 4-A:—Planar type independent suspension with transverse spring. See article in Steering Section for complete description and adjustment procedure.
NOTE—All specifications for this type same as for President Model 2C (see next page).

BRAKES:—**Service**—Lockhead Hydraulic, four wheel type. Hand lever applies rear wheel brakes.
See article in Mechanical Equipment Section for data.
Wheel Cylinders—Stepped or two-stage bore type:
Front Wheels—Front Shoe Cyl. 1⅜". Rear—1".
Rear Wheels—Front Shoe Cyl. 1¼". Rear—1".
NOTE—Wheel cylinder bore size marked on casting. Cylinders not interchangeable.
Brake Drum Diameter—11⅛".
Lining—Moulded type. Width 1¾". Thickness ¼". Length per wheel 23".
Clearance—.010" toe, .005" heel on each shoe.
Hand Brake Adjustment:—See Service Brakes.
Hill-Holder:—Optional on all models. See article in Brake Section and also Clutch Section above.

ENGINE NUMBER:—First number—B-7901. Stamped on left center of engine block.

ENGINE SPECIFICATIONS:—Type—8 cyl., 'L' head.
Bore—3 1/16". **Stroke**—4¼".
Displacement—250.4 cubic inches.
Rated Horsepower—30 (NACC).
Developed Horsepower—115 at 3600 R.P.M.
Compression Ratio—6.5-1 Std. aluminum head.
Compression Pressure—105-115 lbs. at cranking speed of 150 R.P.M.
Vacuum Reading—Gauge should show steady reading of 18" with engine idling at 450 R.P.M. or 8 M.P.H.
NOTE—Tighten aluminum cylinder heads only when engine is cold.

PISTONS:—Lynite, aluminum alloy, "T" slot, Cam Ground type with elliptical skirt .00825-.01075" greater in diameter at right angles to pin bosses. Recondition cylinders to take finished replacement pistons.
Weight—13.6 ozs. **Length**—3¾".
Removal—Pistons and rods removed from above.
Clearance—.0015" as measured ¼" upon skirt at right angles to pin bosses for new pistons. See Fitting New Pistons.
Original Bore Size:—*See Studebaker Shop Notes.*
Replacement Pistons:—Finished pistons with fitted pins furnished .002", .004", .010", .015", .020", .030" oversize. Exact size of all new pistons as measured ¼" up on skirt at right angles to pin bosses is stamped on head.
Fitting New Pistons:—Check clearance by inserting .003" hardened feeler 1" wide between piston and cylinder wall on pressure or camshaft side at right angles to pin bosses. Piston should be inserted in inverted position with slot away from camshaft. Pressure requried to withdraw feeler must be between 7-13 lbs.
Installing Pistons:—Slot should be on minimum pressure side or away from camshaft.

PISTON RINGS:—Two compression, one oil control ring per piston, all above pin. Lower ring groove drilled radially with ten 5/32" oil drain holes. Do not increase size or number of holes.
NOTE—A narrow heat deflector groove is located above the top compression ring. No ring it fitted in this groove.

Piston Ring Specifications.

Ring.	Width.	End Gap.	Wall Thickness.
Comp.	⅛"	.013-.018"	.135"
Oil Cont.	3/16"	.013-.018"	.145"

NOTE—Compression rings are undercut or stepped and must be installed with this step downward. Inner rings used behind oil ring on all engines.

PISTON PIN:—Diameter ⅞". **Length** 2⅝".
Pin is locked in connecting rod.
Clearance in Piston—.0002" or light push fit.
NOTE—New pins are fitted and furnished with all new replacement pistons.

CONNECTING ROD:—Weight 32 ozs. **Length** 8".
Crankpin Journal Diameter—1.87425-1.87525".
Lower Bearing—Removable steel-backed, lead-bronze lined type.
Clearance—.00075-.00275". Sideplay .005-.010".
Bearing Adjustment:—None. Replace bearings. Do not file caps. New bearings should be pressed in place in rod and cap (upper and lower halves interchangeable) so that tongues on bearings engage grooves in rod and cap and oil holes line up. Bearings cannot be reamed, and crankpins must be turned down to size giving correct clearance. Bearings furnished .005", .010", .020" undersize and standard.
Installing Rods:—Oil escape hole in upper half of rod lower bearing must be toward right or camshaft side of engine on all rods.

CRANKSHAFT:—Nine bearings with bolted-on counterweights.
See Studebaker Shop Notes for Damper data.
Journal Diameters—2 11/32" all bearings.
Bearings—Interchangeable steel-backed, babbitt lined type. No shims.
Clearance—.001"-.003".
Bearing Adjustment:—None (no shims). Replace bearings. Do not file bearing caps. No fitting or line reaming necessary for new bearings.
End Thrust:—Taken by thrust plate assembled between front main bearing and crankshaft gear. Adjusted by adding or removing shims between thrust plate and bearing. Endplay should be .003-.006".

CAMSHAFT:—Six bearing. Helical gear drive.
Bearings—Split, steel-backed, babbitt-lined type.
Clearance—.00075-.00225" (front), .002-.00375" (all others).
NOTE—When new bearing installed, see that oil holes in bearings and block line up.
End Thrust:—Taken by steel thrust washer and spacer assembled between gear hub and front bearing. Endplay .006" maximum.
Timing Gears:—Cast-iron (crankshaft), Celoron Fabric (camshaft). Camshaft gears furnished in three sizes marked 'S'—standard, 'H'—high limit, 'L'—low limit. Use next largest size to take up backlash when replacing gears.
NOTE—Screw thread for gear puller and pusher formed in camshaft gear hub recess. Gears must not be driven on or off of shaft.
Camshaft Setting:—Gears are marked. Mesh marked tooth of crankshaft gear between two marked teeth on camshaft gear.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1 13/32"	11/32"	5 7/32"
Exhaust	1 9/32"	11/32"	5 7/32"

	Seat Angle	Lift	Stem Clearance
Intake	45°	11/32"	.001-.003"
Exhaust	45°	11/32"	.001-.003"

Tappet Clearance—.016" all valves (cold).
Valve Guides:—Pressed in block from upper end.
Valve Springs:—Springs installed with closed coils at top. Damper (cup type valve cage) used on all springs at top. Replace springs if more than 10% weaker than specifications below.

	Spring Length	Spring Pressure
Valve Open	1¾"	125-135 lbs.

Valve Lifters:—Mushroom type with separate guides. Guide assemblies (groups of four) bolted to crankcase and removable from above.
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 15° BTDC. Close 49° ALDC.
Exhaust Valves—Open 54° BLDC. Close 10° ATDC.
To Check Valve Timing—With tappet clearance of .020", #1 intake valve should open with piston 15° or .0915" before top dead center when mark 'IN.OP/1-8' on flywheel lines up with pointer in inspection hole in right top surface of housing.
Motor Gauge—Weidenhoff #104 Adapter, #2 Rod.

LUBRICATION:—Force-feed by oil pump to main bearings, connecting rod bearings, camshaft bearings, and valve lifters. Splash from connecting rod bearing escape hole to cylinder walls and piston pins. Timing gears lubricated by oil by-passed by oil pressure regulator relief valve.
Normal Oil Pressure—40 lbs. minimum at 40 M.P.H.
Oil Pressure Relief Valve—Operates at 40 lbs. Located at right front cor. of engine. Not adjustable.
Crankcase Capacity—8 qts.
Oil Pump:—Gear type located in the oil pan. Driven by vertical shaft from camshaft (drive gear on oil pump shaft—distributor driven through tongue-and-slot coupling above gear).
NOTE—Whenever oil pump is taken off engine, drive gear must be properly meshed with camshaft so that distributor rotor position will be correct. To install pump, turn engine over until #1 piston is on top dead center entering power stroke with flywheel mark 'UDC/1-8' at indicator on clutch housing. Turn pump shaft so that distributor drive slot is two teeth clockwise (viewed from below) from correct installed position with slot parallel to camshaft and wide half of coupling toward camshaft. Shaft will be rotated to this position as gears are meshed. Check by sighting down distributor drive shaft hole (distributor off engine) or see that rotor is opposite #1 segment in distributor cap (see wiring diagram).

CLUTCH:—Long Model 9AB-10CI. Single plate, dry disc type.
See article in Mechanical Equipment Section for data.
Facings—Moulded type, 2 required. Inside Diam. 6". Outside Diam. 10". Thickness .137".
Adjustment—Free movement of clutch pedal must be 1" minimum. To adjust, loosen locknut and turn adjustment lever setscrew on left side of clutch housing. Check Hill-Holder setting.
Hill-Holder Adjustment:—On cars with Hill-Holder, check action after adjusting clutch. Brakes should be released just before clutch engages. Adjust by loosening locknut and turning adjusting nut at end of hill-holder control rod. Shorten rod for earlier brake release or lengthen rod for later release.
Clutch Removal:—Disconnect clutch pedal linkage, disconnect drive shaft at front universal, remove transmission, take off clutch pan under clutch housing, take out clutch mounting screws turning all screws out evenly to release clutch spring tension, remove clutch from below.

STEERING:—Steering Gear—Ross Model 620 Cam-and-lever type with cam lever follower mounted on roller bearings.
See article in Mechanical Equipment Section for data.
Front Suspension:—Planar type independent suspension with transverse spring.
See article in Mechanical Equipment Section for data.
Kingpin Inclination—9½° crosswise.
Caster—Minus ¼ to plus ¾°. Not adjustable.
Camber—1-1½°. Check with tires properly inflated, car on level floor, after bouncing car up and down several times so that wheels are in normal running position.
Toe In—3/16" (⅛-7/32"). Adjustable.

BRAKES:—Lockheed Hydraulic, four wheel type. Hand lever applies rear wheel brakes.
See article in Mechanical Equipment Section for data.
Wheel Cylinders—Stepped or two-stage bore type:
Front Wheels—Front Shoe Cyl. 1⅜". Rear 1".
Rear Wheels—Front Shoe Cyl. 1¼". Rear 1".
NOTE—Wheel cylinder bore size marked on casting. Not interchangeable.
Drum Diameter—12⅛".
Lining—Moulded type. Width 1¾". Thickness ¼". Length per wheel 25".
Clearance—.010" toe, .005" heel on each shoe.
Hand Brake Adjustment:—See Service Brakes.
Hill-Holder:—Optional on all models.
See article in Mechanical Equipment Section for data.

ENGINE NUMBER:—First number D-112,601. Stamped on left center of engine block.

ENGINE SPECIFICATIONS:—6 cylinder, 'L' head.
Bore—3¼". **Stroke**—4⅜".
Displacement—217.8 cubic inches.
Rated Horsepower—25.4 (NACC).
Developed Horsepower—90 at 3400 R.P.M.
Compression Ratio & Pressure—6.0-1 cast-iron head. Pressure 105 lbs. at 150 R.P.M. (cranking speed).
Vacuum Reading—Steady reading of 18" with engine idling at 450 R.P.M. or 8 M.P.H.
NOTE—Optl. 7.0-1 aluminum head (devel. 94 HP. at 3400 R.P.M.) used at altitudes of 5000 ft. and over. Compression press. 111-118 lbs. at cranking speed. Ign. and valve timing same as std. head.

PISTONS:—Lynite, aluminum alloy, T-slot, cam ground (.00825-.01075" larger diam. 90° from pin bosses). **Weight**—15.2 ozs. **Length**—3¾".
Removal—Pistons and rods removed from above.
Clearance—.0005" new. Measure ¼" up on skirt 90° from pin bosses. See Fitting New Pistons.
Original Bore Sizes:—*See Studebaker Shop Notes.*
Replacement Pistons:—Finished pistons (pins fitted) furnished .002", .004", .010", .015", .020", .030", oversize. Exact size stamped on piston head.
Fitting New Pistons:—Insert .002"x1" hardened feeler between piston and wall on camshaft side (T-slot away from camshaft, piston inverted). 7-15 lbs. to withdraw feeler.
Installing Pistons:—T-slot away from camshaft.

PISTON RINGS:—2 compression, 1 oil control, all above pin. Ten 5/32" oil drain holes in lower ring groove. Ring oversizes: .010", .020", .030". Heat deflector groove above top ring groove.

Ring	Width	End Gap	Wall Thickness
Compression	⅛"	.013-.018"	.145"
Oil Control	3/16"	.013-.018"	.135"

NOTE—Install comp. rings with step down.

PISTON PIN:—Diameter—⅞". **Length**—2⅞".
Pin locked in connecting rod.
Pin Fit in Piston—.0002" clearance or light push fit.
NOTE—Replacement pistons have pins fitted.

CONNECTING ROD:—Weight—33.2 ozs. **Length**—8⅛".
Crankpin Journal Diameter—2.18675-2.18775".
Lower Bearing—Integral spun-babbitt lined type.
Clearance—.0005-.002". **Sideplay**—.005-.009".
Bearing Adjustment:—None. Replace rods. Rods furnished std. and .010", .020" undersize on exchange basis.
Installing Rods:—Install rods with narrow half of bearing toward front in cylinders #1, 3, 5, toward rear in #2, 4, 6. Marks on caps and rods must be together and oil hole toward camshaft.

CRANKSHAFT:—4 bearing, integral counterweights.
Journal Diameters—2½" all bearings.
Bearing Type—Removable steel-backed, babbitt-lined. **Clearance**—.0005-.0025".
Bearing Adjustment:—None. (No shims). Replace bearings (no fitting or line reaming required). Furnished std., .010", .020" undersize.
End Thrust:—Thrust plate between front main bearing and crankshaft gear. Shim adjustment.
Endplay—.003-.006".

CAMSHAFT:—Four bearing. Helical gear drive.
Bearings—Split, steel-backed, babbitt-lined type.
Clearance—.00075-.00225" (#1), .002-.00375" (others).
NOTE—Oil holes in bushing and block must match.
End Thrust:—Steel thrust washer and spacer between gear hub and front bearing. **Endplay**—.003-.006".
Timing Gears:—Cast-iron (crankshaft), Celeron Fabric (camshaft). Camshaft gears furnished in 3 sizes marked 'S' standard, 'H' high limit, 'L' low limit. Use next largest size gear to takeup backlash.
NOTE—Screw thread for gear puller and pusher formed in camshaft gear hub recess. Do not drive gear on or off shaft.
Camshaft Setting:—Mesh gears so that marked tooth on camshaft gear meshes with two marked teeth on crankshaft gear.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1 15/32"	11/32"	5 7/32"
Exhaust	1 9/32"	11/32"	5 7/32"

	Seat Angle	Lift	Stem Clearance
All valves	45°	11/32"	.001-.003"

Tappet Clearance—.016" all valves (cold). Remove right hood side panel for work on valves.
Valve Guides—Pressed in block from above (1 5/32" below upper rim of valve seat) with stepped end down. Ream inside diameter to .3430-.3445".
Valve Springs:—Install with closed-coil at top. Damper used on top of spring. Replace springs if 10% weaker than specifications listed below.

	Spring Pressure	Spring Length
Valve Open	125-135 lbs.	1¾"

NOTE—Spring will not clear tappet adjusting screw when extended. To install spring, place spring seat in position on spring, compress spring slightly with compressor so that it clears tappet adjusting screw, insert valve, compress spring fully and install valve spring seat locks.
Valve Lifters:—Barrel type (no separate guides). Can be removed from top. Furnished .0005", .001" ov'size.

VALVE TIMING:—See Camshaft Setting above.
Intake Valves—Open 15° BTDC. Close 49° ALDC.
Exhaust Valves—Open 54° BLDC. Close 10° ATDC.
To Check Valve Timing:—Set tappet clearance #1 intake valve at .020". This valve should open with piston 15° or .0942" before top dead center when mark 'IN.OP/1-6' on vibration dampener at front of engine lines up with pointer on gear case cover. Reset tappet clearance at .016" (cold—70° F.).
Motor Gauge—Weidenhoff Adapter #104, Rod #2.

LUBRICATION:—Pressure. Gear type oil pump.
Normal Oil Pressure—40 lbs. min. at 40 M.P.H.
Oil Pressure Regulator—Located at right front corner of engine. Operates at 40 lbs. Not adjustable. Timing gears lubricated by overflow from regulator.
Crankcase Capacity—5½ quarts (dry).
NOTE—Install oil pump as follows (to insure correct rotor position on distributor): remove distributor, turn engine over until mark 'UDC/1-6' on vibration dampener lines up with pointer on gear case cover, sight down distributor shaft hole, mesh oil pump gear so that distributor drive slot is horizontal and offset toward top.

CLUTCH:—Borg & Beck Model 9A6. Mod. #869 stamped on cover. Single plate, dry disc type.
See article in Mechanical Equipment Section for data.
Facings—Moulded (flywheel side) and woven (pressure plate side), 2 required. I.D. 5⅝", O.D. 9¼", .133" thick.
Adjustment—Free movement of clutch pedal must be 1" minimum. To adjust, loosen locknut and turn adjustment lever setscrew on left side of clutch housing. Check Hill-Holder after adjusting clutch.
Hill-Holder Adjustment:—On cars with Hill-Holder check action after adjusting clutch to see that brakes release just before clutch engages. Adjust by loosening locknut and turning adjusting nut at end of hill-holder control rod. Shorten rod for earlier brake release or lengthen rod for later release.
Removal:—Remove transmission (see Transmission Removal below), support engine at rear, remove clutch housing, turn mounting screws out evenly to release spring tension, remove clutch assembly.

TRANSMISSION:—Warner—Model AS23-T86 (std.), AS29-T86 (with overdrive). All helical gear type with synchronizing shift on second and high gears.
See article in Mechanical Equipment Section for data.
Removal:—Disconnect front and rear universal joints at companion flanges, remove capscrews at clutch housing, pull transmission back and up.
NOTE—On cars with overdrive, rear support should be shimmed to give 1/16" clearance between frame and each end of support before frame bolts are tightened. *See Studebaker Shop Notes.*

UNIVERSAL JOINTS:—Thompson Products—Rubber bushing type, two used.
NOTE—Single punch mark at front and double punch marks at rear must be aligned with respective marks at each coupling.
See Article in Mechanical Equipment Section.

REAR AXLE:—Spicer—Semi-floating, hypoid gear type with Hotchkiss drive.
See article in Mechanical Equipment Section for data.
Ratio—Std. 4.55-1. Optl. 4.82-1.
Backlash—.005-.007". Shim adjustment.
Removal:—Disconnect brake cables and fluid tube, rear universal joint, remove spring U-bolts, and disconnect springs. Axle assembly can then be removed.
Wheel Bearing Adjustment—Controlled by shims between brake backing plates and flanges on housing. Endplay .001-.005". Difference in shim thickness on either side must not exceed .005".

SHOCK ABSORBERS:—Delco—Early: Models 1173-L (5A—front), 1171-S (6A—front), 1172-U (rear—all models). **Late:** Models 1180-L (5A—front), 1181-S (6A—front), 1182-U (rear—all models). Direct acting hydraulic types. Late type is adjustable.
See separate articles in Mechanical Equipment Section.

STEERING:—Steering Gear—Ross Cam-&-Lever type. Model T-14.
See article in Mechanical Equipment Section for data.
Front Suspension Model 5A:—'I' beam axle with Reverse-Elliott ends and semi-elliptic springs. Specifications below apply with car unloaded on level floor.
King Pin Inclination—9½° crosswise.
Caster—1-1½°. Adjusted by inserting wedge shims between spring and spring pad on axle. Spring pad should incline 1½° toward rear (see Spring Camber).
Camber—1-1½°. No adjustment. Axle may be bent cold for minor camber adjustments.
Toe In—1/16-⅛". Adjust by changing length of tie rod.
Spring Camber—⅛" minimum. Measure by stretching cord between spring eye centers and noting distance from cord to top of spring main plate at center. Camber must be positive (cord above spring).
Front Suspension Model 6A:—Planar type independent suspension. See President 3C, 4C (next page) for specifications.

BRAKES:—Service. Lockheed Hydraulic, double anchor type. Hand lever applies rear service brakes.
See article in Mechanical Equipment Section for data.
Wheel Cylinders—Stepped or two-stage bore type:
Front Wheels—Front shoe cyl. 1⅜". Rear 1".
Rear Wheels—Front shoe cyl. 1¼". Rear 1".
NOTE—Wheel cylinder bore size marked on casting.
Drum Diameter—11".
Lining—Front shoe—woven. Rear shoe—moulded. Width 1¾". Thickness 3/16". Length per wheel 9 11/16".
Clearance—.010" toe, .005" heel, for each shoe.
Braking Power—45% rear.
Hand Brake Adjustment:—See Service Brakes.
Hill-Holder:—Optional on all models. See separate article in Brake Section for adjustments.

SERIAL NUMBER:—Stamped on plate on left frame side member under front fender. First number 7,111,001 (South Bend), 7,800,801 (Los Angeles).

ENGINE NUMBER:—Stamped on left side of engine First number B-15501.

ENGINE SPECIFICATIONS:—8 cylinder, 'L' head.
Bore—3 1/16". **Stroke** 4¼".
Displacement—250.4 cu. ins. **Rated HP.**—30.
Developed Horsepower—115 at 3600 R.P.M.
Compression Ratio—6.5-1 Al. head Std.
Compression Pressure—105-115 lbs. @ 150 R.P.M.
Vacuum Reading—18" idling at 450 RPM. or 8 MPH.

PISTONS:—Lynite, aluminum alloy, T-slot, tin-plated, cam ground type.
Weight—13.6 ozs. **Length**—3¾".
Removal—Pistons and rods removed from above.
Clearance—.0015" (¼" up on skirt 90° from pin).

Original Bore Sizes:—*See Studebaker Shop Notes.*

Replacement Pistons:—Finished pistons (pins fitted) furnished .002", .004", .010", .015", .020", .030" oversize. Exact size stamped on piston head.

Fitting New Pistons:—Insert .003"x1" hardened feeler between piston and wall on camshaft side (T-slot away from camshaft, pin bosses parallel with crank shaft). Pull to withdraw feeler 7-15 lbs.

Installing Pistons:—T-slot away from camshaft.

PISTON RINGS:—2 compression, 1 oil control, all above pin. Ten 5/32" oil drain holes in lower ring groove. Oversize rings furnished .010", .020", .030". Heat deflector groove above top ring groove.

Ring	Width	End Gap	Side Clearance
Compression	⅛"	.013-.018"	.0015-.002"
Oil Control	3/16"	.013-.018"	.0015-.002"

NOTE—Install comp. rings with step down. Inner ring used behind oil control ring.

PISTON PIN:—Diameter—⅞". Length—2⅝".
Pin is locked in rod.
Pin Fit in Piston—.0001-.0003" clearance or light push fit.
NOTE—Replacement pistons have pins fitted.

CONNECTING ROD:—Weight—32 ozs. **Length**—8".
Crankpin Journal Diameter—1.87425-1.87525".
Lower Bearing—Removable steel-backed, lead-bronze lined type.
Clearance—.00075-.00275". **Sideplay**—.005-.010".

Bearing Adjustment:—None. Replace bearings. Press in new bearings so that tongues engage in slots and oil holes line up. Crankpins must be turned down to size. Bearings furnished .005", .010", .020" undersize and standard. Bearing halves identical.

Installing Rods:—Oil hole in rod toward camshaft.

CRANKSHAFT:—9 bearing, bolted counterweights. Rubber and friction disc vibration damper mounted on forward end. See Studebaker Shop Notes for vibration damper data.
Journal Diameters—2 11/32" all bearings.
Bearing Type—Interchangeable steel-backed, babbitt-lined. No shims. **Clearance**—.001-.003".

Bearing Adjustment:—None. Replace bearings. (No line reaming or fitting necessary). Furnished .010", .015" undersize.

End Thrust:—Thrust plate between front main bearing and crankshaft gear. Shim adjustment.
Endplay—.003-.006".

CAMSHAFT:—Six bearing. Helical gear drive.
Bearings—Split, steel-backed, babbitt-lined.
Clearance—.00075-.00225" (#1), .002-.00375" (others)
NOTE—Oil holes in bushing and block must match.

End Thrust:—Steel thrust washer and spacer between gear hub and front bearing. **Endplay**—.003-.006".

Timing Gears:—Cast-iron (crankshaft), Celeron Fabric (camshaft). *See Studebaker Shop Notes for Gear Sizes and Gear Removal Instructions.*

Camshaft Setting:—Mesh gears so that marked tooth on camshaft gear meshes with two marked teeth on crankshaft gear.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1 13/32"	11/32"	5 7/32"
Exhaust	1 9/32"	11/32"	5 7/32"

	Seat Angle	Lift	Stem Clearance
All valves	45°	11/32"	.001-.003"

Tappet Clearance—.016" cold—all valves.

Valve Guides:—Pressed in block from above (1 5/16" below top of block) with stepped end down. Ream inside diameter to .343-.344".

Valve Springs:—Install with closed-coil at top. Damper used on top of spring. Replace springs if 10% weaker than specifications listed below.

	Spring Length	Spring Pressure
Valve Open	1¾"	125-135 lbs.

Valve Lifters:—Mushroom type with bolted-on guides (in clusters of four). Can be removed from side.

VALVE TIMING:—See Camshaft Setting above.
Intake Valves—Open 15° BTDC. Close 49° ALDC.
Exhaust Valves—Open 54° BLDC. Close 10° ATDC.

To Check Valve Timing:—With tappet clearance of .020", #1 intake valve should open with piston 15° or .0915" before top dead center when mark 'IN.OP./1-8' on flywheel lines up with pointer in inspection hole on right top side of flywheel housing. Reset tappet clearance at .016" cold.
Motor Gauge—Weldenhoff Adapter #104, Rod #2.

LUBRICATION:—Pressure. Gear type oil pump.
See Studebaker Shop Notes for Oil Pump Installation directions.
Normal Oil Pressure—40 lbs. min. at 40 M.P.H.
Oil Pressure Regulator—Located at right front corner of engine. Operates at 40 lbs. Not adjustable.
Crankcase Capacity—8 quarts (dry).

COOLING SYSTEM:—Water Pump—Centrifugal, belt driven, with adjustable type packing.
See article in Mechanical Equipment Section for data.
Removal—With all water drained and fan belt removed, disconnect pump inlet hose, take out pump mounting bolts, lift fan and pump assembly off.

Thermostat:—Bishop & Babcock or Fulton. In upper radiator hose.
Setting—Start to open 148-153°F.

Water Capacity:—16 quarts.

CLUTCH:—Long Model 9AB-10CI. Single plate, dry disc type. *See article in Mechanical Equipment Section.*
Facings (3C)—Molded type, 2 required. Inside diam. 6". Outside Diam. 10". Thickness .137".
Facings (4C)—Chevron or spiral wound (flywh. side) molded (pressure plate side). 1 of each required. Inside diam. 6". Outside Diam. 9½". Thick. .125".
Adjustment—Free movement of clutch pedal must be 1" min. Adjustment lever setscrew at housing Check Hill-Holder after adjusting clutch.

Hill-Holder Adj.:—*See Studebaker Shop Notes.*

Removal:—Disconnect clutch pedal linkage, remove transmission (see Transmission Removal below), support engine at rear, remove clutch bell housing, clutch mounting screws, pull assembly out.

TRANSMISSION:—Warner. All helical gear type with synchronizing shift on second and high. Overdrive (automatic—no free wheeling) optional.
See article in Mechanical Equipment Section for data.

Removal:—Disconnect front and rear universal joints. On cars with vacuum shift, disconnect vacuum power cylinder rod. On cars with overdrive, disconnect rear support at frame ends (attach washers at each end for proper clearance when reinstalling support). Remove transmission mounting capscrews at clutch housing, pull transmission back and lift out. *See Studebaker Shop Notes for Overdrive Rear Support Installation instructions.*

UNIVERSAL JOINTS:—**Spicer.** Model 1311 (frt.), 1318 (rear). Needle bearing type.
See article in Mechanical Equipment Section for data.
NOTE—Arrows on front universal yoke and propeller shaft must be in alignment.

REAR AXLE:—Spicer Model 41-2. Semi-floating, hypoid gear type with Hotchkiss drive.
See article in Mechanical Equipment Section for data.
Ratio (3C)—4.55-1 Standard. 4.73-1 Optional.
Backlash—.005-.007". Shim adjustment.

Removal:—Hoist rear of car, disconnect propeller shaft at rear universal, brake line, and shock absorbers, remove spring U-bolts, disconnect rear spring shackles, pull axle assembly out.
NOTE—Bleed brake lines when axle reinstalled.

Wheel Bearing Adjustment—Shims provided between flanged end of axle housing and brake backing plate. To adjust, remove wheel, hub, drum, and backing plate (retained by 6 nuts). Remove shims to decrease endplay, add shims to increase. Shim thickness at both wheels must be equal within .005".
Endplay—.001-.005". Measure with dial indicator.

SHOCK ABSORBERS:—Delco (3C)—Early: Models 1171S (front), 1172X (rear). **Late:** 1181S (front), 1182X (rear). Direct acting type. Late type adjustable.
See article in Mechanical Equipment Section for data.

STEERING:—Steering Gear—Ross Cam-&-Lever type. Model T-14.
See article in Mechanical Equipment Section for data.

Front Suspension:—Planar type independent suspension with transverse spring. Specifications below apply with car unloaded on level floor.
See article in Mechanical Equipment Section for data.

Kingpin Inclination—As follows:

9½°	Dictator (South Bend)	Ser. #5,258,246 & before.
	(Pacific)	Ser. #5,803,288 & before.
	President	Ser. #7,111,836 & before.

5½°—3C, 6A (after above Serial Nos.).
Caster—Minus ¼° to plus ¾°. Not adjustable.
Camber—1-1½°. Adjustable.
Toe In—⅛-7/32". Adjustable.

BRAKES:—Lockheed Hydraulic, double anchor type. Hand lever applies rear service brakes.
See article in Mechanical Equipment Section for data.
Wheel Cylinders—Stepped or two-stage bore type:
Front Wheels—Front shoe cyl. 1⅜". Rear 1".
Rear Wheels—Front shoe cyl. 1¼". Rear 1".
NOTE—Wheel cylinder bore size marked on casting.
Drum—Budd composite. Diameter—11".
Lining—Front shoe—woven. Rear shoe—moulded. 3C—Width 1¾". Thick. ¼". Length per wheel 21½".

Hand Brake Adjustment:—See Service Brakes.

Hill-Holder:—Optional equipment.
See article in Mechanical Equipment Section for data.

1938 MODEL NOTE:—First 7A cars called Studebaker Six, later cars Commander. First 8A cars called Commander, later cars State Commander.

SERIAL NUMBER:—Stamped on plate on frame under left front fender. First numbers as follows:

	7A	8A	9A
South Bend	5,582,001	4,090,001	4,110,001
Los Angeles	5,857,501	4,800,001	4,802,301

ENGINE NUMBER:—First number H-101 ('38), H-42501 ('39). Stamped on boss on left side of block at rear.

ENGINE SPECIFICATIONS:—6 cylinder, 'L' head.
Bore—3 5/16". Stroke—4⅜".
Displacement—226 cubic inches.
Rated Horsepower—26.35 (NACC).
Developed Horsepower—90 HP. (Std. head), 94 HP. (Optl. high altitude head) at 3400 RPM.
Compression Ratio—6.0-1 Std. cast-iron head. 7.0-1 aluminum hd. Optl. (high altitude only).
See Studebaker Shop Note for Head installation.
Compression Pressure—105 lbs. (Std. head), 110 lbs. (Optl. head)at 150 RPM. (cranking speed).
Vacuum Reading—18-20" at 450 RPM. or 8 MPH.

PISTONS:—Lynite, aluminum alloy, tin-plated, T-slot, cam ground type. **Length**—3¾".
Removal—Pistons and rods removed from above.
Clearance—.0005" new. Measure ¼" up on skirt 90° from pin bosses. See Fitting New Pistons.
Original Bore Sizes:—*See Studebaker Shop Notes.*
Replacement Pistons:—Finished pistons (pins fitted) furnished std. and .002", .004", .010", .015", .020", .030" oversize. Exact size stamped on piston head.
Fitting New Pistons:—Insert .002" X 1" feeler between piston and wall on camshaft side (pin parallel to crankshaft, T-slot away from camshaft). Pull to withdraw feeler must be between 7-15 lbs.
Installing Pistons:—T-slot away from camshaft.

PISTON RINGS:—2 (P-C#70) compression, 1 (#85) oil ring per piston, all above pin. Narrow heat-dam groove (no ring fitted) above top ring. Oil ring groove drilled with ten 5/32" oil drain hole.

Ring	Width	End Gap	Side Clearance
Compression	⅛"	.013-.018"	.0015-.002"
Oil Control	3/16"	.013-.018"	.0015-.002"

NOTE—Install compression rings with step down.
Replacement Rings:—Oversizes .010", .020", .030".

PISTON PIN:—Diameter—⅞". **Length**—2⅞".
Pin locked in connecting rod.
Pin Fit in Piston—Light push fit (rod should rock in piston of own weight. Clearance .0001-.0003".
NOTE—Replacement pistons have pins fitted.

CONNECTING ROD:—Weight—33.2 ozs. **Length**—8⅛".
Crankpin Journal Diameter—2.18675-2.18775".
Lower Bearing—Spun babbitt. Rods exchanged.
Clearance—.0005-.002". **Sideplay**—.005-.009".
Bearing Adjustment:—None. Replace rods. Rods furnished std. and .010", .020" undersize. Ream to give clearance of .0005-.002". *See Studebaker Shop Notes for 'Palnut' installation (some cars).*
Installing Rods:—Install rods with narrow half of bearing toward front in cylinders #1, 3, 5, toward rear in #2, 4, 6. Marks on caps and rods must be together and oil hole toward camshaft.

CRANKSHAFT:—4 bearing, integral counterweights with vibration dampener at forward end.
Journal Diameters—2.4995-2.500" all bearings.
Journal Diameters—2½".
Bearing Type—Removable steel-backed, babbitt-lined type. **Clearance**—.0005-.0025".
Bearing Adjustment:—None (no shims). Replace bearings. Furnished Std., .010", .020" undersize. Tighten bearing cap bolts to 1100 in. lbs.
End Thrust:—Thrust plate assembled between front bearing and crankshaft gear. Controlled by shims between plate and bearing. **Endplay** .003-.006".

CAMSHAFT:—Four bearing. Helical gear drive.
Bearings—Steel-backed, babbitt-lined, split type bushings. When replacing, oil holes in block and bushing must be in alignment.
Clearance—.00075-.00225"(#1), .002-.00375"(others).
End Thrust:—Steel thrust washer and spacer between gear hub and front bushing.
Timing Gears:—Crankshaft (cast-iron). Camshaft (Celeron Fabric). *See Studebaker Shop Notes for Gear Removal & Replacement Gear size selection.*
Camshaft Setting:—Mesh marked camshaft gear tooth with two marked teeth on crankshaft gear.

VALVES:

	Head Diameter	Stem Diameter	Length
Intake	1 15/32"	11/32"	5 7/32"
Exhaust	1 9/32"	11/32"	5 7/32"

	Seat Angle	Lift	Stem Clearance
All valves	45°	11/32"	.001-.003"

Tappet Clearance—.016" all valves (cold). Remove right hood side panel for work on valves. *See Studebaker Shop Notes for Side Panel Removal.*
Valve Guides:—Pressed in block from above (1 5/32" below upper edge of valve seat) with stepped end down. Ream to inside diameter of .3435-.3445".
Valve Springs:—Install with closed coil at top. Damper on top of spring. Replace spring if 10% weak. *See Studebaker Shop Notes for Valve Spring Installation instructions.*

	Spring Pressure	Spring Length
Valve Open	125-135 lbs.	1¾"

Valve Lifters:—Barrel type (no separate guides). Can be removed from top. Furnished .0005", .001" ov'size.
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 15° BTDC. Close 49° ALDC.
Exhaust Valves—Open 54° BLDC. Close 10° ATDC.
To Check Timing—Set tappet clearance #1 intake valve at .020". This valve should open with piston 15° or .0942" before top dead center when mark 'IN-OP.1-6/' on vibration damper at front of engine lines up with pointer on gear case cover. Reset tappet clearance at .016" (cold).
Motor Gauge—Weidenhoff Adapter #104, Rod #2.

LUBRICATION:—Pressure system with oil pump mounted on right of engine. *See Studebaker Shop Notes for Oil Pump installation instructions.*
Normal Oil Pressure:—40 lbs. (min.) at 40 MPH.
Oil Pressure Regulator:—Located on right front corner of engine. Operates at 40 lbs. Not adjustable.
Crankcase Capacity:—5½ qts. ('38), 6 qts. ('39).

COOLING SYSTEM:—Capacity—14½ qts.
Water Pump:—Centrifugal with adjustable packing. *See article in Mechanical Equipment Section for data.*
Removal—With water drained and fan belt removed, disconnect pump inlet hose, take out pump mounting bolts, lift fan and pump assembly off.
Thermostat:—Bishop & Babcock or Fulton. In cylinder head water outlet. Install with bellows down.
Setting—Starts to open 148-153° ('38), 156-160° ('39).

CLUTCH:—Borg & Beck Model 9A6. Model #869 stamped on cover. Single plate, dry disc type. *See article in Mechanical Equipment Section for data.*
Facings—Moulded (flywheel side), Woven (opposite side). Inside Diam. 5⅝". Outside Diam. 9¼". Thickness .133".
Adjustment—Free travel 1" (min.). Sleeve adjustment on rod connecting pedal to shaft lever. Turn sleeve out for greater travel, in for less. Check Hill-Holder after adjusting clutch.
Hill-Holder Adjustment:—On cars with Hill-Holder check action after adjusting clutch to see that brakes release just before clutch engages. Adjust by loosening locknut and turning adjusting nut at end of hill-holder control rod. Shorten rod for earlier brake release or lengthen rod for later release.
Removal:—Remove transmission (see Transmission Removal following), support engine at rear, remove rear engine mountings, remove clutch housing. Take out mounting screws and remove clutch.

TRANSMISSION:—Warner. Synchro-mesh, all helical gear, 'horizontal' type with conventional shift lever Std. Overdrive Transmission Optl. (1939 type has electrical 'kick-down' control).
See article in Mechanical Equipment Section for data.
1939 Overdrive Note—Adjust Overdrive control whenever accelerator pedal linkage disturbed.
Transmission Control:—Evans-Studebaker vacuum type (1938), Own remote control (1939) Optional. *See article in Mechanical Equipment Section for data.*
Removal:—Remove shift lever or disconnect shifter shafts, disconnect drive shaft at front and rear universals, disconnect rear support at frame ends (Overdrive transmissions). Remove transmission mounting screws at clutch housing, pull transmission back and lift out. *See Studebaker Shop Notes for Overdrive Rear Support Installation directions.*

UNIVERSAL JOINTS:—Thompson (1938). Spicer Models 1271-OIX front, 1278-OIX rear (1939).
See article in Mechanical Equipment Section for data.

REAR AXLE:—Spicer Model 41-2. Semi-floating, hypoid gear type with Hotchkiss drive.
See article in Mechanical Equipment Section for data.
Ratio—4.55-1 Std., 4.82-1 Optl.
Backlash—.005-.007". Shim adjustment
Removal:—Hoist rear of car, disconnect propeller shaft at rear universal, brake line, and shock absorbers, remove spring U-bolts, disconnect rear spring shackles, withdraw axle assembly.
Wheel Bearing Adjustment—Shims provided between flanged end of axle housing and brake backing plate. To adjust, remove wheel, hub, drum, and backing plate (retained by 6 nuts). Remove shims to decrease endplay, add shims to increase. Shim thickness at both wheels must be equal within .005".
Endplay—.001-.005". Measure with dial indicator.

SHOCK ABSORBERS:—Houdaille. Front—BEDVS ('38), BBFS ('39), Rear—ASC ('38), ACHS ('39). Double acting, hydraulic, adjustable type with thermostatic control (rear only).
See article in Mechanical Equipment Section.

STEERING:—Steering Gear—Ross Cam-and-Twin-Lever type. Model T-14.
See article in Mechanical Equipment Section for data.
Front Suspension:—Planar type independent suspension with transverse spring. Specifications below apply with car unloaded on level floor.
See article in Mechanical Equipment Section for data.
Kingpin Inclination—5½°.
Caster—Minus ¼° to plus ¾°. Not adjustable.
Camber—¼-¾°. Adjustable.
Toe In—1/16-⅛". Adjusted by turning right hand ('38), center ('39) tie rod. Other tie rods not adjustable.

BRAKES:—Service—Lockheed hydraulic, double anchor type. Hand lever applies rear service brakes.
See article in Mechanical Equipment Section for data.
Wheel Cylinders—Stepped or two-stage bore type: Front Wheels—Front shoe cylinder 1⅜". Rear 1". Rear Wheels—Front shoe cylinder 1¼". Rear 1".
NOTE—Wheel cylinder bore size marked on casting.
Drum—Budd composite. Diameter—11".
Lining—Front shoe—woven. Rear—moulded. Width 2". Thick. 3/16". Length per wheel 19 11/16".
Clearance—.010" toe, .005" heel, for each shoe.
Hand Brake Adjustment:—See Service Brakes.
Hill-Holder:—Optional equipment.
See article in Mechanical Equipment Section for data.

SERIAL NUMBER:—Stamped on plate on frame under left front fender. First numbers as follows:

	South Bend	Los Angeles
4C	7,120,101	7,801,801
5C	7,125,501	7,802,501

ENGINE NUMBER:—First number B-24601 ('38), B-30201 ('39). Stamped on left side of engine at rear.

ENGINE:—**Own.** 8 Cyl., 'L' head type.
Bore—3 1/16". **Stroke**—4¼".
Displacement—250.4 cubic inches.
Rated Horsepower—30 AMA.
Developed Horsepower—110 at 3600 RPM.
Compression Ratio—6.0-1 Std. cast-iron head.
Compression Pressure—105 lbs. at 150 RPM.
Vacuum Reading—18" at 450 RPM., 8 MPH.
See Studebaker Shop Notes for Head Installation.

PISTONS:—Lynite, aluminum alloy, T slot, Cam-ground, tin-plated type. **Length** 3¾".
Weight—13.6 ozs. (stripped).
Removal—Pistons and rods removed from above.
Clearance—.0015" (¼" up on skirt 90° from pin).
Original Bore Sizes:—***See Studebaker Shop Notes.***
Replacement Pistons:—Finished pistons (with pins fitted) furnished .002", .004", .010", .015", .020", .030" oversize. Exact size stamped on piston head.
Fitting New Pistons:—Install .003" x 1" hardened feeler between piston and cylinder wall on camshaft side (T slot away from camshaft, pin bosses parallel to crankshaft). Pull to withdraw feeler must be 7-15 lbs.
Installing Pistons:—T-slot away from camshaft.

PISTON RINGS:—Two compression, 1 oil control ring, all above pin with narrow heat-dam groove (no ring) above top ring groove. Oil ring groove drilled with ten 5/32" oil drain holes.

Ring	Width	End Gap	Side Clearance
Compr.	⅛"	.013-.018"	.0015-.002"
Oil Contr.	3/16"	.013-.018"	.0015-.002"

NOTE—Install Compression rings with step down. Inner ring used with oil ring only.
Replacement Rings:—Oversizes .010", .020", .030".

PISTON PIN:—**Diameter** ⅞". **Length** 2⅝". Pin is locked in rod by clampscrew.
Pin Fit in Piston—Light push fit (rod should rock in piston of own weight). Clearance .0001-.0003". NOTE—Replacement pistons have pins fitted.

CONNECTING ROD:—**Weight** 32 ozs. **Length** 8".
Crankpin Journal Diameter—1.87425-1.87525".
Lower Bearing—Removable, steel-backed, lead-bronze lined type.
Clearance—.00075-.00275". **Sideplay** .005-.010".
Bearing Adjustment:—None. Replace bearings. Furnished Std. and .005, .010", .020" undersize. Crankpin must be turned down to size (bearings should not be reamed). See that tongues on bearings engage slots and that oil holes line up.
See Studebaker Shop Notes for 'Palnut' installation
Installing Rods:—Oil hole in rod toward camshaft.

CRANKSHAFT:—9 bearing with bolted counterweights. Vibration dampener mounted on forward end. ***See Studebaker Shop Notes for Vibration Dampener data.***
Journal Diameters—2.3435-2.3440" all bearings.
Bearing Type—Removable steel-backed, babbitt-lined type. **Clearance** .001-.003".
Bearing Adjustment:—None (no shims). Replace bearings. Do not file bearing caps. Tighten bearing cap bolts to 1100 in. lbs. Bearings furnished .010", .015" undersize.
End Thrust:—Thrust plate between front main bearing and crankshaft gear with shim adjustment.
Endplay—.003-.006".

CAMSHAFT:—Six bearing. Helical gear drive.
Bearings—Split steel-backed, babbitted bushings.
Clearance—.00075-.00225"(#1), .002-.00375"(others). NOTE—Oil holes in bushing & block must line up.
End Thrust:—Steel thrust washer and spacer between gear hub and bearing. **Endplay**—.003-.006".
Timing Gears:—Cast-iron (crankshaft), Celeron Fabric (camshaft). ***See Studebaker Shop Notes for Gear Removal and Replacement Gear Size selection.***
Camshaft Setting:—Mesh marked tooth on camshaft gear between two marked teeth on crankshaft gear.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1 13/32"	11/32"	5 7/32"
Exhaust	1 9/32"	11/32"	5 7/32"

	Seat Angle	Lift	Stem Clearance
All Valves	45°	11/32"	.001-.003"

Tappet Clearance:—.016" all valves, engine cold. Remove right hood side panel for work on valves. ***See Studebaker Shop Note for Side Panel Removal.***
Valve Guides:—Pressed in block from above (1 5/16" below top of block) with stepped end down. Ream to inside diameter of .343-.344".
Valve Springs:—Install with closed-coil up and dampener on top of spring. Replace springs if 10% weak.

	Spring Pressure	Spring Length
Valve Open	125-135 lbs.	1¾"

Valve Lifters:—Mushroom type in bolted-on guide brackets (clusters of four). Assemblies may be removed through valve opening on side of engine.
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 15° BTDC. Close 49° ALDC.
Exhaust Valves—Open 54° BLDC. Close 10° ATDC.
To Check Valve Timing—Set tappet clearance #1 intake valve at .020". This valve should open with piston 15° or .0915" before top dead center when 'IN.OP/1-8' mark on vibration dampener at front of engine lines up with pointer on gear cover. Reset tappet clearance at .016" cold.
Motor Gauge—Weidenhoff Adapter #104. Rod #40.

LUBRICATION:—Pressure type. Gear type oil pump in crankcase. ***See Studebaker Shop Notes for Oil Pump Installation directions.***
Normal Oil Pressure—40 lbs. min .at 40 MPH.
Oil Pressure Regulator—Located at right front corner of engine. Opens at 40 lbs. Not adjustable.
Crankcase Capacity—8 qts.

COOLING SYSTEM:—**Capacity**—17 quarts.
Water Pump:—Centrifugal with adjustable packing. ***See article in Mechanical Equipment Section for data.***
Removal—Drain water, remove fan belt, disconnect hose, take out mounting bolts, lift pump out.
Thermostat:—Bishop & Babcock or Fulton. In cylinder head outlet. Install with bellows down.
Setting—Starts to open 148-153° ('38), 156-160° ('39).

CLUTCH:—**Long Model 9½CF-CS ('38), Inland ('39).** Single plate, dry disc types. Semi-centrifugal (Long), Diaphragm type (Inland). NOTE—Long 9½CF-CS driven member also used with Inland clutch.
See article in Mechanical Equipment Section for data.
Facings—Moulded (flywheel side), Woven (away from flywheel). Inside Diam. 6". Outside Diam. 9½". Thickness .125".
Adjustment:—Clutch pedal free movement must be 1" Min. Sleeve adjustment on rod connecting pedal and shaft lever. Check Hill Holder after adjusting
Hill Holder Adjustment:—***See Studebaker Shop Notes.***
Removal:—Disconnect clutch pedal linkage, remove Transmission (see Transmission Removal below), support engine at rear, remove rear engine mountings and clutch housing, take out mounting screws in clutch cover flange (turn all screws out evenly), remove clutch assembly. CAUTION—Support pressure plate by hand to avoid distorting pressure plate tension springs (Inland Clutch).

TRANSMISSION:—**Warner.** Synchro-mesh, all helical gear, 'horizontal' type with conventional shift lever Std., Overdrive Transmission Optl. (1939 type has electrical 'kick-down' control).
See article in Mechanical Equipment Section for data.
1939 Overdrive Note—Adjust Overdrive control whenever accelerator pedal linkage disturbed.
Transmission Control:—Evans-Studebaker vacuum type (1938), Own remote control (1939) Optional.
See article in Mechanical Equipment Section for data.
Removal:—Remove shift lever or disconnect shifter shaft and cable, disconnect drive shaft at front and rear universals, disconnect rear support at frame ends (Overdrive transmission only). Remove transmission mounting screws at clutch housing, pull transmission straight back and lift out. ***See Studebaker Shop Notes for Overdrive Rear Support Installation directions.***

UNIVERSAL JOINTS:—**Spicer.** Model 1271-01X (front), 1278-01X (rear). Needle bearing type.
See article in Mechanical Equipment Section for data.

REAR AXLE:—**Spicer Model 41-2.** Semi-floating, Hypoid gear type with Hotchkiss drive.
See article in Mechanical Equipment Section for data.
Ratio—4.55-1 Std., 4.82-1 Optl.(Std.with Overdrive).
Backlash—.005-.007". Shim adjustment.
Removal:—Hoist rear of car, disconnect brake line, shock absorbers, drive shaft at rear universal, rear spring U bolts and rear spring shackles, withdraw axle assembly from beneath car. NOTE—Bleed brake lines when axle installed.
Wheel Bearing Adjustment:—Shims located between flanged end of axle housing and brake backing plate. To adjust, remove wheel, hub, brake drum, and backing plate (retained by 6 bolts). Remove shims (shim thickness at each wheel must be equal within .005").
Endplay—.001-.005" (measured with dial indicator).

SHOCK ABSORBERS:—**Houdaille.** Front—BEDVS ('38), BBFS ('39). Rear—ACS ('38), ACHS ('39). Double acting, hydraulic, adjustable type with thermostatic control (rear only).
See article in Mechanical Equipment Section for data.

STEERING:—**Steering Gear**—Ross Model T-14. Cam-and-twin lever type.
See article in Mechanical Equipment Section for data.
Front Suspension:—Planar type independent suspension with transverse spring. Specifications below apply with car weight on wheels but without load.
See article in Mechanical Equipment Section for data.
Kingpin Inclination—5½° crosswise.
Caster—Minus ¼° to plus ¾°. Not adjustable.
Camber—¼-¾°. Adjustable.
Toe In—1/16-⅛". Adjustable by turning right hand ('38), center ('39) tie rod. Other tie rods not adjustable.

BRAKES:—**Service**—Lockheed hydraulic, double anchor type. Hand lever applies rear service brakes.
See article in Mechanical Equipment Section for data.
Wheel Cylinders—Stepped or two-stage bore type:
Front—Front Shoe Cylinder 1⅜". Rear 1".
Rear—Front Shoe Cylinder 1¼". Rear 1".
NOTE—Wheel cylinder bore size marked on casting.
Drum—Budd Composite. Diameter 11".
Lining—Front shoe—woven. Rear shoe—moulded. Width 2¼". Thickness 3/16". Length per wheel 19 11/16".
Clearance—.010" toe, .005" heel each shoe.
Brake Power—45% rear, 55% front.
Hill-Holder:—Optional equipment.
See article in Mechanical Equipment Section for data.
Hand Brake:—See Service Brakes above.

ENGINE HOOD & SIDE PANEL:—*See Studebaker Shop Notes.*

SERIAL NUMBER:—On plate on frame under left front fender. 1st number G-0001 (South Bend), G-800001 (Los Angeles).

ENGINE NUMBER:—Stamped on pad at the upper left front of cylinder block. First number 101.

ENGINE SPECIFICATIONS:—6 cylinder, 'L' head.
Bore—3". **Stroke**—3⅞".
Displacement—164.3 cu. in. **Rated HP.**—21.6.
Developed Horsepower—78 at 4000 RPM.
Compression Ratio—6.5-1 Std. cast-iron hd.
Compression Pressure—100 lbs. at 130 RPM. (cranking speed).
Vacuum Reading—Steady 17-18" at 8 MPH. Idle speed.
See Studebaker Shop Notes for Head installation.

PISTONS:—Aluminum alloy, tin-plated, T-slot, cam ground type.
Length—2⅝". **Weight**—.53 lbs.
Removal—Pistons and rods removed from above.
Clearance—.0005" new. See Fitting New Pistons.
Original Bore Size:—*See Studebaker Shop Notes.*
Replacement Pistons:—Finished pistons (pins fitted) furnished standard and .002", .004", .010", .015", .020", .030" oversize. Exact size stamped on piston head.
Fitting New Pistons:—Insert .002"x1" feeler between piston and wall on camshaft side (pin parallel to crankshaft, T-slot away from camshaft). Pull to withdraw feeler must be between 16 to 22 lbs. NOTE—Cylinder bore out-of-round and taper .002" maximum.
Installing Pistons:—T-slot away from camshaft.

PISTON RINGS:—3 rings, all above pin—#1 Comp. P-C 200 (with step up), #2 Comp. P-C 70 (with step down), #3 Oil P-C 85 (slotted type). Oil ring groove drilled with drain holes. Heat-dam groove (no ring) above #1 ring groove.

Ring	Width	End Gap	Side Clearance
Comp. (Top)	3/32"	.007-.017"	.0015-.002"
Comp. (#2)	⅛"	.007-.017"	.0015-.002"
Oil Control	3/16"	.007-.017"	.0015-.002"

Replacement Rings:—.010", .020", .030" oversize.

PISTON PIN:—**Diameter** .7491-.7495". **Length** 2⅝". Pin locked in rod by tapered lockscrew and nut (small end of connnecting rod not split).
Pin Fit in Piston—.0001-.0003" clearance or light push fit. Replacement pistons have fitted pins.
See Studebaker Shop Notes for Pin removal and installation instructions.

CONNECTING ROD:—**Length** 6 7/16". **Weight** 1.28 lbs.
Crankpin Journal Diameter—1.81175-1.81275".
Lower Bearing—Spun babbitt. Exchange rods furnished std. and .010" and .020" undersize.
Clearance—.0005-.002". **Sideplay**—.005-.009".
Bearing Adjustment:—None. Replace rods. *See Studebaker Shop Notes for 'Palnut' installation.*
Installing Rods:—Narrow portion of bearing to front (#1,3,5), to rear (#2,4,6). Side marked with number and oil spray hole toward camshaft.

CRANKSHAFT:—4 bearing, integral counterweights.
Journal Diameters—2.437-2.4375".
Bearing Type—Removable steel-backed, babbitt-lined type. **Clearance**—.0005-.0025".
Bearing Adjustment:—None (no shims). Replace bearings. Furnished Std., .010", .020" undersize. Tighten bearing cap screws to 1100 in. lbs.
NOTE—Front oil pan seal block may be removed for access to front main bearing cap by removing lower timing gear cover screws (on front face).
End Thrust:—Thrust plate assembled between front bearing and crankshaft gear. Controlled by shims between plate & journal face. **Endplay** .003-.006".

CAMSHAFT:—Four bearing with helical gear drive.
Journal Diameters—#1, 1.74750-1.74800"; #2, 1.71625-1.71700"; #3, 1.68575-1.68650; #4, 1.62325-1.62400".
Bearings—Steel-backed, babbitt-lined bushings. Align oil hole in block and bushing.
Clearance—.00075-.00225" (#1), .001-.00275" (others).
End Thrust:—Steel thrust washer and spacer assembled between gear hub and front bushing.
Timing Gears:—Crankshaft (cast-iron), Camshaft (Celeron Fabric). *See Studebaker Shop Notes for Gear Removal & Replacement Gear size selection.*
Backlash—.001-.003".
Camshaft Setting:—Mesh marked camshaft gear tooth between two marked teeth on crankshaft gear.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1 11/32"	.310-.311"	4 11/32"
Exhaust	1 9/32"	.310-.311"	4 11/32"

	Seat Angle	Lift	Stem Clearance
All Valves	45°	5/16"	.001-.0035"

Tappet Clearance:—.016" (cold) all valves. *See Studebaker Shop Notes for Hood Side Panel removal and Self-Locking tappet data.*
Valve Guides:—Pressed in block from above 1 3/16" below top of block. Finish ream to .312-.3135".
Valve Springs:—Install with closed coils at top. Replace if springs 10% weak.

	Spring Pressure	Spring Length
Valve Open	77-83 lbs.	1 7/16"

Valve Lifters:—Mushroom type. Lifter clearance in block .0005-.0015".
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 15° BTDC. Close 49° ALDC.
Exhaust Valves—Open 54° BLDC. Close 10° ATDC.
To Check Timing—Set tappet clearance #1 intake valve at .020". This valve should open with piston 15° or .0835" before top dead center when flywheel mark 'IN.OP.1-6/' lines up with pointer on left rear engine plate. Reset tappet clearance at .016" (cold).

LUBRICATION:—Pressure system with oil pump mounted on right side of engine. *See Studebaker Shop Notes for Oil Pump installation instructions.*
Normal Oil Pressure:—40 lbs. at 40-60 M.P.H.
Oil Pressure Regulator:—Opens with 40 lbs. pressure. On right front corner of block. Not adjustable.
Crankcase Capacity:—5 quarts.

COOLING SYSTEM:—**Capacity**—10½ quarts.
Water Pump:—Packless, sealed ball-bearing shaft.
See article in Mechanical Equipment Section for data.
Removal—Drain water, remove fan belt, fan blades and pulley, pump hose and 3 pump mounting cap screws.
Thermostat:—In cylinder head water outlet.
Setting—Starts to open 156° F. to 160° F.
Temperature Gauge:—Auto-Lite (Motometer) Vapor tension type. Part No. H-9210.
See article in Mechanical Equipment Section for data.

CLUTCH:—**Borg & Beck Model 8A7.** Single plate, dry disc type. Identified by #925 stamped on cover.
See article in Mechanical Equipment Section for data.
Facings—Molded (flywheel side), woven (pressure plate side), Inside Diam. 5⅛". Outside Diam. 7⅞". Thickness .125".
justing sleeve on connector link. Check Hill-holder.
Adjustment—Free travel 1" (min.). Turn clutch adjusting sleeve on connector link. Check Hill-holder.
Removal:—Remove transmission (see below), take off clutch housing, take out mounting screws in clutch cover flange (turn all screws out evenly), remove clutch.

TRANSMISSION:—**Warner.** Model AS1-T84F (std.), AS2-T84F-R7A (overdrive with electrical 'kick-down' control, optl.). Helical gear and synchro-mesh (second & high), sliding spur (low & reverse).
NOTE—R7A overdrive can be installed on std. transmission by removing transmission extension.
Transmission Control:—Remote control, steering column mounted mechanical shift.
See articles in Mechanical Equipment Section for data.
Removal (Std.):—Disconnect shift rods and speedometer cable, remove propeller shaft. Place jack under engine rear plate, free rear engine mountings. Take out transmission mounting bolts, pull transmission out.
Overdrive Model—Same as Std. (above) except that top radiator hose must be disconnected, exhaust pipe loosened at manifold and engine rear plate, clutch shaft pulled free of engine, overdrive shift lever and solenoid leads disconnected, engine rear support cross-member removed, and rear of engine lowered so that transmission clears underside of frame X-member when removed.

UNIVERSAL JOINTS:—**Spicer, 1261-01 (front), 1268-02 (rear).** Needle bearing type.
See article in Mechanical Equipment Section for data.

REAR AXLE:—**Spicer Model 23.** Semi-floating, hypoid gear type with Hotchkiss drive.
See article in Mechanical Equipment Section for data.
Ratio—4.56-1 standard. 4.1-1 optional.
Backlash—.005-.007". Shim adjustment.
Removal:—Hoist rear of car, disconnect propeller shaft at rear universal, hydraulic brake lines, brake cables, and shock absorbers. Remove spring U-bolts, disconnect rear spring shackles, and withdraw axle assembly from car.
Wheel Bearing Adjustment—Shims provided between flanged end of axle housing and brake backing plate. To adjust, remove wheel, hub and drum assembly (Puller J-446), and backing plate. Remove shims to decrease endplay, add shims to increase. Shims furnished .003", .005", .010", .030" thick.
Endplay—.001-.005". Measure with dial indicator.

SHOCK ABSORBERS:—**Houdaille.** Double acting, hydraulic, adjustable type.
See article in Mechanical Equipment Section for data.

STEERING:—**Steering Gear**—Ross Model T-12. Cam-and-Twin Lever type.
See article in Mechanical Equipment Section for data.
Front Suspension:—Planar type independent suspension with transverse spring.
See article in Mechanical Equipment Section for data.
Kingpin Inclination—5½°.
Caster—5½-6½°.
Camber—¼-¾°. Shim adjustment.
Toe In—1/16-⅛". Adjustable tie rod at center (between steering & idler arms). End rods not adjustable.

BRAKES:—**Service.** Lockheed hydraulic, single anchor type. Hand lever applies rear service brakes.
See article in Mechanical Equipment Section for data.
Drums—Diameter 9".
Lining—Front shoe (U.S. #714) 10 3/16". Rear shoe (Man. DV-2921) 7 13/16". Width 1¾". Thickness 3/16".
Clearance—.010" toe, .006" heel, for each shoe.
Braking Power—43% rear.
Hand Brake Adjustment:—See Service Brakes.
Hill-Holder:—Optional equipment.
See article in Mechanical Equipment Section for data.

ENGINE NUMBER:—First number 5001 (K '32), 20,501 (KU '33). Stamped on left hand side of engine block at center of engine.

ENGINE:—Own make. Six cylinder, 'L' head type.
Dimensions—Bore 2 15/16". Stroke 4¾". Displacement 193 cubic inches.
Horsepower—Rated 20.7. Developed 70 HP. at 3200 R.P.M. (Std. 5.8-1 head), 80 HP. at 3200 R.P.M. (Optl. 7.1-1 head).
Compression Ratio—5.8-1 Std. 7.1-1 Optl. Ratio of each head cast in upper surface of head casting.
Compression Pressure—Approximately 80 lbs. (Std. 5.8-1 head), 125 lbs. at 200 R.P.M. (Optl. 7.1-1 head).
Vacuum Reading—Gauge should show steady reading of 18-19" at idling speed.

Pistons:—Own. Aluminum alloy, 'T' slot, 'Cam' ground type with greater greater clearance across pin bosses. Finished replacement pistons furnished for cylinder bores of size indicated (see Reconditioning Cylinders below): 'B' 2.9375-2.938", 'D' 2.9385-2.939", 'F' 2.9395-2.940", 'J' 2.9415", 'L' 2.9425", 'BO' 2.9475-2.948", 'DO' 2.9485-2.949", 'FO' 2.9495-2.950", 'LO' 2.9525", 'BB' 2.9575", 'DD' 2.9585", 'FF' 2.9595". Letter designating size is stamped on head.
Weight—9¼ ounces stripped. Length 3 3/16".
Removal—Pistons and rod assembly removed from below by removal of crankshaft counterweights.
Clearance—Top, .016". Bottom, .0005".
Reconditioning Cylinders—Size of original bore indicated by letter stamped on edge of valve chamber opposite cylinder as follows: 'A' 2.9375", 'B' 2.938", 'C' 2.9385", 'D' 2.939", 'E' 2.9395", 'AO' 2.9475", 'BO' 2.948", 'CO' 2.9485", 'DO' 2.949", 'EO' 2.9495". Recondition cylinder to standard size for which piston and rings are available (see Piston and Ring Sections). Same size piston must be installed in all cylinders to maintain balance.
Fitting New Pistons—Use feeler gauge .0015-.002" thick to check clearance. Pull of 3-4 lbs. should be required to withdraw feeler from between piston and cylinder wall at right angles to pin boss on side opposite slot.
NOTE:—Install pistons with 'T' slot to left.

Piston Rings:—Two compression, two oil rings per piston, all above pin. Lower (oil ring) groove drilled radially with oil drain holes.
NOTE—Use standard or oversize rings of size indicated for replacement pistons marked as follows: 'B, D, F' 2.937", 'J' 2.940", 'L' 2.942", 'BO, DO, FO' 2.947", 'LO' 2.952", 'BB, DD, FF' 2.957".

Ring	Width	End Gap	Wall Thickness	Groove Depth
Comp. (both)	3/32"	.006-.016"	.123"	.156"
Oil Cont. (Upper)	⅛"	.006-.016"	.128"	.156"
Oil Cont. (Lower)	3/16"	.006-.016"	.128"	.156"

Piston Pin:—Diameter, ¾". Length, 2 7/16". Pin floats in piston and rod and is held by retaining rings. Pin hole in connecting rod is bronze-bushed.
NOTE—Pins furnished standard and .002", .005", .010" oversize
Pin Fit in Piston—Snug fit with piston heated to 200°F.
Pin Clearance in Rod Bushing—.0003".

Connecting Rod:—Weight, 29.44 ozs. Length, 8 3/16" (center-to-center).
Crankpin Journal Diameter—1 15/16".
Big End Bearing—Spun babbitt type. Laminated shims used.
Clearance—.001". Sideplay .006-.010".
Adjustment—Shims (laminated type). Do not file rods or caps.
NOTE:—Connecting rod lower bearings are offset. Install rods with right hand offset in cylinders #1, 2, 4 and left hand offset in cylinders #3, 5, 6.

Crankshaft:—Three main bearing type with integral counterweights.
Journal Sizes—#1—2 11/32", #2—2⅜", #3—2 13/32" diameter.
Bearing Type—Removable bronze-backed, babbitt-lined type. Shims used.
Bearing Clearance—.001".
Adjustment—Shims (laminated type).
End Thrust—Taken by #2 (center) main bearing. Endplay, .006-.012"

Camshaft:—Gear driven from crankshaft.
Gear Type—Crankshaft gear—steel. Camshaft gear—GE. Bakelite.
End Thrust—Taken by spring and plunger on front end of shaft.
Camshaft Setting—Gears are marked. Mesh marked tooth on camshaft gear between two marked teeth on crankshaft gear.

Valves:	Head Diameter	Stem Diameter	Length	Seat Angle	Lift
All Valves	1⅜"	5/16"	5 3/32"	45°	11/32"

Stem-to-Guide Clearance—.0015-.003" (intake), .003-.005" (exhaust).

Tappet Clearance—	Running (engine hot)	Timing
Intake	.006"	.010"
Exhaust	.008"	.010"

Valve Springs—Spring pressure 53 lbs. with valve closed.

Valve Timing

Intake Valves Open—10°40' BTDC. Close—60° ALDC.
Exhaust Valves Open—50° BLDC. Close—18°44' ATDC.
NOTE:—Timing figures are correct for .010" tappet clearance.

To Check Timing—Set tappet clearance #1 intake valve at .010". This valve should close with piston .0528" before top dead center when a point on the flywheel approximately 2.55 teeth before top dead center mark lines up with indicator in inspection hole in left front face of flywheel housing. Reset tappet clearance at .006" with engine hot.
Motor Gauge—Weidenhoff Adapter #114. Rod #42.

LUBRICATION:—Duo-flow (splash) system with positive pump feed to oil troughs and timing gears by oscillating plunger type pump. Pump mounted on right side of crankcase.
Normal Oil Pressure—3 lbs.
Oil Pressure Relief Valve—Operates at 3 lbs. Not adjustable. Located on right side of crankcase at rear of engine. Combined with oil pressure signal light switch. See article on Hudson Signal Lights in Electrical Equipment Section for complete data.
Capacity & Oil—6 qts. (refill). Use SAE. #30 (above 40° F.). #20W (40° to 0°F.).

CLUTCH:—Single plate type operating in oil. No adjustment for wear required
Clutch Pedal Adjustment—Pedal position should be adjusted so that clevis pin in yoke at rear end of clutch link is at rear of slot with clutch engaged and pedal against rubber bumper on toeboard. To adjust, remove clevis pin, loosen locknut, turn yoke on pedal rod.
Clutch Lubrication—Oil in clutch should be drained and replaced at 5000 mile intervals. To drain oil, turn flywheel until filler plug on front face is visible in inspection hole in left front of flywheel housing, remove plug, turn flywheel so that plug hole is down, allow sufficient time for old oil to drain out, turn flywheel and insert mixture of 1/6 pint light engine oil and 1/6 pint kerosene. See that plug is replaced securely.
Facings—Driven plate is 5⅜" inside diameter, 8 11/16" outside diameter, .203" thick. Facing consists of 90 cork inserts mounted on driven plate.

STEERING:—Steering Gear—Gemmer Worm-and-Sector type. See article in Steering Section for complete adjustmnt instructions.

Front Suspension:—Conventional 'I' beam section front axle with Elliott type ends and semi-elliptic springs.
Kingpin Inclination—7° crosswise.
Caster—3°. Adjust by inserting wedge shims between spring and spring pad on axle.
Camber—2°. No adjustment. Axle may be bent cold for minor corrections.
Toe In—0-⅛". Adjusted in usual manner by loosening clamp bolts and turning tie rod.

BRAKES:—Service—Bendix Mechanical, Duo-Servo, Single anchor type. Hand lever applies all four service brakes. See article in Brake Section for complete adjustment instructions.
Drum Diameter—11" (K '32), 9" (KU '33).
Lining (K '32)—Moulded type. Width 1¾". Thickness 5/32". Length 21" per wheel.
Lining (KU '33)—Moulded type. Width 1¾". Thickness 3/16". Length 19" per wheel.
Clearance—.008" anchor pin end, .014" adjusting screw end of each shoe.

ENGINE NUMBER:—First number 15,001. Stamped on left side of cylinder block at center.

ENGINE:—Own make. Eight cylinder, In line, 'L' head type.

Dimensions—Bore 2 15/16". Stroke 4½". Displacement 244 cubic inches.

Horsepower—Rated 27.6. Developed 94 at 3200 R.P.M.

Compression—5.8-1. No optional heads. Pressure 80 lbs. at 125 R.P.M.

Vacuum Reading—Gauge should show steady reading of 18-19" with engine idling.

Pistons:—Own. Aluminum alloy, 'T' slot type. Pistons are 'cam' ground with greater clearance across pin bosses. Finished replacement pistons furnished for cylinder bores of size indicated (see Reconditioning Cylinders below): 'B' 2.9375-2.938", 'D' 2.9385-2.939", 'F' 2.9395-2.940", 'J' 2.9415", 'L' 2.9425", 'BO' 2.9475-2.948", 'DO' 2.9485-2.949", 'FO' 2.9495-2.950", 'LO' 2.9525", 'BB' 2.9575", 'DD' 2.9585", 'FF' 2.9595". Letter designating size is stamped on head.

Weight—9¼ ounces stripped. Length 3 3/16".

Clearance—Top, .016". Bottom, .0005".

Removal—Pistons and rod assembly removed from below by removal of crankshaft counterweights.

Reconditioning Cylinders—Size of original bore indicated by letter stamped on edge of valve chamber opposite cylinder as follows: 'A' 2.9375", 'B' 2.938", 'C' 2.9385", 'D' 2.939", 'E' 2.9395", 'AO' 2.9475", 'BO' 2.948", 'CO' 2.9485", 'DO' 2.949", 'EO' 2.9495". Recondition cylinder to standard size for which piston and rings are available (see Piston and Ring Sections). Same size piston must be installed in all cylinders to maintain balance.

Fitting New Pistons—Use feeler gauge .0015-.002" thick to check clearance. Pull of 3-4 lbs. should be required to withdraw feeler from between piston and cylinder wall at right angles to pin boss on side opposite slot.

NOTE:—Install pistons with 'T' slot to left.

Piston Rings:—Two compression, two oil rings used per piston. Lower (oil ring) groove is drilled radially.

NOTE—Use standard or oversize rings of size indicated for replacement pistons marked as follows: 'B, D, F' 2.937", 'J' 2.940", 'L' 2.942", 'BO, DO, FO' 2.947", 'LO' 2.952", 'BB, DD, FF' 2.957".

Ring	Width	End Gap	Wall Thickness	Groove Depth
Comp. (2)	3/32"	.006-.016"	.123"	.156"
Oil Ring (Upper)	⅛"	.006-.016"	.128"	.156"
Oil Ring (Lower)	3/16"	.006-.016"	.128"	.156"

Wrist Pin:—Diameter, ¾". Length, 2 7/16". Pin floats in piston and rod.

NOTE—Pins furnished for service standard and .002", .005", .010" oversize.

Clearance in Rod Bushing—.0003". Pin hole in connecting rod is broached, and diamond-bored in piston. Bearing in rod is bronze bushing.

Pin Fit in Piston—Snug fit with piston at 200°F.

Connecting Rod:—Weight, 29.44 ozs. Length, 8 3/16" center-to-center.

Crankpin Journal Diameter—1 15/16".

Big End Bearing Type—Spun babbitt. Diamond-bore finish.

Clearance—.001". Sideplay .006-.010".

Adjustment—Shims (laminated type). Do not file rods or caps.

NOTE:—Connecting rod lower bearings are offset. Install rods with right hand offset in cylinders #1, 3, 5, 7 and left hand offset in cylinders #2, 4, 6, 8.

Crankshaft:—Five main bearing type with eight counterweights.

Journal Sizes—#1—2 9/32". #2—2 5/16". #3—2 11/32". #4—2⅜". #5—2 13/32".

Bearing Type—Separate babbitt-lined, bronze-backed type.

Bearing Clearance—.001".

Adjustment—Shims (laminated type).

End Thrust—Taken by #3 (center) bearing. End clearance, .006-.012".

Camshaft:—Gear driven from crankshaft.

Gear Type—Crankshaft gear, steel. Camshaft gear, GE. Bakelite.

Camshaft Setting—Gears are marked. Mesh marked tooth on crankshaft gear between two marked teeth on camshaft gear.

Valves:—	Head Diameter	Stem Diameter	Length	Seat Angle	Lift
Intake	1½"	5/16"	5 3/32"	45°	11/32"
Exhaust	1⅜"	5/16"	5 3/32"	45°	11/32"

Stem-to-Guide Clearance—.0015-.003" (intake), .003-.005" (exhaust).

Tappet Clearance—	Running (hot)	Timing
Intake	.006"	.010"
Exhaust	.008"	.010"

Valve Springs—Spring pressure 53 lbs. with valve closed.

Valve Timing

Intake Valves Open—10°40' BTDC.	Close—60° ALDC.
Exhaust Valves Open—50° BLDC.	Close—18°44' ATDC.

NOTE:—Timing figures are correct for .010" tappet clearance.

To Check Timing—Set tappet clearance #1 intake valve at .010". This valve should open with the piston .0494" before top dead center when a point on the flywheel approximately 2.55 teeth before the dead center mark lines up with the indicator in the inspection hole in the left front face of the flywheel housing. Reset tappet clearance at .006" with engine hot.

Motor Gauge—Weidenhoff Adapter #114. Rod #42.

LUBRICATION:—Duo-flow (splash) system with positive pump feed to oil troughs and timing gears by oscillating plunger type pump. Pump mounted on right side of crankcase.

Normal Oil Pressure—3 lbs.

Oil Pressure Relief Valve—Operates at 3 lbs. Not adjustable. Located on right side of crankcase at rear of engine. Combined with oil pressure signal light switch. See article on Hudson Signal Lights in Electrical Equipment Section for complete data.

Capacity & Oil—7 qts. (refill). Use SAE. #30 (above 40° F.), #20W (40° to 0°F.).

CLUTCH:—**Own Make.** Single plate type operating in oil. No adjustment for wear required.

Clutch Pedal Adjustment—Free movement of clutch pedal should be 1½". To adjust, take out clevis pin at lower end of clutch pedal connecting link, loosen locknut on clevis at lower end, turn clevis.

Clutch Lubrication—Oil in clutch should be drained and replaced at 5000 mile intervals. To drain oil, turn flywheel until filler plug on front face is visible in inspection hole in left front face of flywheel housing, remove plug, turn flywheel so that plug hole is down, allow sufficient time for old oil to drain out, turn flywheel and insert mixture of 1/6 pint light engine oil and 1/6 pint kerosene. See that plug is replaced securely.

Facings—9 13/16" driven plate with cork inserts.

STEERING:—**Steering Gear**—Gemmer Worm-and-Sector type. See article in Steering Section for complete adjustmnt instructions.

Front Suspension:—Conventional 'I' beam section front axle with Elliott type ends and semi-elliptic springs.

Kingpin Inclination—7° crosswise.

Caster—3°. Adjust by inserting wedge shims between spring and spring pad on axle.

Camber—2°. No adjustment. Axle may be bent cold for minor corrections.

Toe In—0-⅛". Adjusted in usual manner by loosening clamp bolts and turning tie rod.

BRAKES:—**Service**—Bendix Mechanical, Duo-Servo, Single anchor type. Hand lever applies all four service brakes. See article in Brake Section for complete adjustment instructions.

Drum Diameter—9".

Lining—Moulded type. Width 2¼". Thickness 3/16". Length 19" per wheel.

Clearance—.008" anchor pin end, .014" adjusting screw end of each shoe.

Hand Brake:—See Service Brakes above.

ENGINE NUMBER:—First number 48,000 ('34), 103,001 ('35). Stamped on left hand side of crankcase opposite #1 cylinder ('34), #6 cylinder ('35).

ENGINE:—Own. Six cylinder, 'L' head type.
Bore—3". **Stroke**—5".
Piston Displacement—212.058 cubic inches.
Rated Horsepower—21.6.
Developed Horsepower, Compression Ratio & Pressures—To check pressure, remove spark plugs, crank engine with wide open throttle.

Model	Ratio	Horsepower	Pressure at 150 R.P.M.
K, KU, KS	5.75-1	80 @ 3600	80 lbs.
K, KU, KS	6.25-1	85 @ 3600	116 lbs.
K, KU, KS	7.00-1	89½ @ 3600	128 lbs.
G, GU	6.00-1	88 @ 3800	111 lbs.
G, GU	7.00-1	100 @ 3800	128 lbs.

NOTE—6.25-1 and 7.0-1 heads are aluminum composite. High octane fuel must be used with these heads.
Vacuum Reading—Gauge should show steady reading of 18-20" with engine idling.

Pistons:—Own, Lo-Ex silicon-aluminum alloy, "T" slot, cam ground type. Use finished replacement pistons when reconditioning engine. See Reconditioning paragraph .
Weight—9.6 ozs. ('34), 10.88 ozs. ('35) stripped; 14.5 ozs. ('34), 12.99 ozs. ('35) with rings and pin.
Length—3 3/16".
Removal—Pistons and rods removed from above.
Clearance—Top .016". Bottom .0005" ('34), .002" ('35).
NOTE—1935 pistons may be installed in 1934 engines as complete sets only.
Reconditioning Cylinders—Size of original bore indicated by letter stamped on lower edge of valve chamber opposite cylinder as follows: A-3.000", B-3.0005", C-3.001", D-3.0015", E-3.002", AO-3.010", BO-3.0105", CO-3.001", DO-3.0115", EO-3.012". Recondition cylinder to standard oversize for which replacement piston and rings are available (see piston and ring data below).
Replacement Pistons—Standard and oversize pistons marked by letter on head available for cylinder bores of size indicated: 'B'-3.000 & 3.0005", 'D'-3.001 & 3.0015", 'F'-3.002 & 3.0025", 'J'-3.004", 'L'-3.005". 'BO'-3.010 & 3.0105", 'DO'-3.011 & 3.0115", 'FO'-3.012 & 3.0125", 'LO'-3.015", 'BB'-3.020", 'DD'-3.021, 'FF'-3.022". All pistons installed in engine must be of same weight as indicated by mark on head.
Fitting New Pistons—Use feeler gauge .0015-.002" thick to check clearance. It should be possible to withdraw feeler from between piston and cylinder wall on side opposite slot when grasped between thumb and forefinger with 3-4 lbs. pull.
Installing Pistons—Slot should be to left or away from valves.

Piston Rings:—Four rings per pistons, two compression, two oil control rings ('34—all rings above pin, '35—lower oil control ring below pin). Lower ring groove drilled radially with oil drain holes. Rings are positioned by pin in piston ring groove.

1934 Piston Rings

Ring	Width	End Gap	Wall Thickness
Comp. (all)	3/32"	.006-.016"	.123"
Oil Cont. (upper)	⅛"	.006-.016"	.128"
Oil Cont. (lower)	3/16"	.006-.016"	.128"

1935 Piston Rings

Comp.	.093"	.006-.016"	.123"
Oil Cont.	.187"	.006-.016"	.128"

NOTE—Use standard or oversize rings of size indicated for replacement pistons (see Replacement Piston section above); 3.000"—B, D, F,; 3.003"—J; 3.005"—L; 3.010"—BO, DO, FO; 3.015"—LO; 3.020"—BB, DD, FF. If rings are filed, clearance at pin must be kept uniform with end gap.
Piston Pin:—Diameter ¾". Length 2 7/16". Pin floats in piston and rod. Held by retaining rings. Pins furnished standard, .002", .005", .010" oversize.
Pin Fit in Piston—Snug fit with piston at 200°F.
Clearance in Rod Bushing—.0003".
Connecting Rod:—Weight 28.96 ozs. Length 8 3/16".
Crankpin Journal Diameter—1 15/16".
Lower Bearing—Spun-babbitt lined type.
Clearance—.001". Sideplay .006-.010".
Adjustment—Shims (laminated type). Do not file rod or caps.
Installing Rods—Connecting rod lower bearings are offset. Install rods with right hand offset (widest half of bearing toward rear) in cylinders #1, 2, 4, and rods with left hand offset (widest half of bearing toward front) in #3, 5, 6.
Crankshaft:—Three bearings. Integral counterweights.
Journal Diameters—#1, 2 11/32"; #2, 2⅜"; #3, 2 13/32".
Bearing Type—Removable bronze-backed, babbitt-lined.
Clearance—.001".
Adjustment—Laminated shims. Do not file caps.
End Thrust—Taken by #2 (center) bearing. End-play .006-.012".
Camshaft:—Three bearing. Gear driven.
Timing Gears—Crankshaft gear Steel. Camshaft gear GE. Bakelite.
End Thrust—Taken by spring-loaded plunger in camshaft gear and thrust plate on gear cover.
Camshaft Setting—Gears are marked. Mesh marked tooth on crankshaft gear between two marked teeth on camshaft gear.

Valves:—

	Head Diam.	Stem Diam.	Length
All Valves	1⅜"	5/16"	5 11/32"

	Seat Angle	Lift	Stem Clearance
Intake	45°	11/32"	.0015-.003"
Exhaust	45°	11/32"	.003-.005"

Tappet Clearance—.006" Int., .008" Exh. engine hot.
Valve Spring—Cages installed on all springs at bottom. Install with open side toward cylinder.

	Spring Pressure	Length
Valve Closed	44 lbs.	2"
Valve Open	102 lbs.	1 21/32"

Valve Timing—See Camshaft Setting (above).
Intake Valves—Open 10°40' BTDC. Close 60° ALDC.
Exhaust Valves—Open 50° BLDC. Close 18°44' ATDC
To Check Valve Timing—Set tappet clearance #1 intake valve at .010". This valve should open with piston 10°40' or .0562" before top dead center when a point on the flywheel approximately 3.17 teeth before top dead center mark 'UDC.1-6' lines up with the indicator. Reset tappet clearance at .006" with engine warm and running.
Motor Gauge—Weldenhoff Adapter #114, Rod #43.

LUBRICATION:—Duo-flow (splash) system with positive pump feed to oil troughs and timing gears. Oscillating plunger type oil pump mounted on right side of crankcase.
Normal Oil Pressure—3 lbs.
Oil Pressure Relief Valve—Operates at 3 lbs. Located on right hand side of crankcase at rear (combined with oil pressure signal light switch). See Signal Lights in Equipment Section. No adjustment required.
Capacity & Oil—5 qts. (refill), 6 qts. (dry). Use SAE. #30 (above 40°F), 20-W (40° to 0°F), #10-W (0° to —15°F).

CLUTCH:—**Own make.** Single plate type operating in oil. No adjustment for wear required.
See article in Mechanical Equipment Section for data.
Clutch Pedal Adjustment—Free movement of clutch pedal must be 1½". To adjust, loosen locknut on clutch pedal connecting link, remove clevis pin at lower end of link, turn clevis until free movement of pedal is 1½", replace pin and tighten locknut. See adjustment for Automatic Clutch linkage below.
Automatic Clutch Control—On cars with Automatic clutch, check control linkage whenever clutch pedal is adjusted. Depress accelerator pedal, pull back on clutch control unit cable left side of engine), check clearance between back of slot in cable yoke and clevis pin which attaches it to operating lever. This clearance should be ⅞".
Clutch Lubrication—Oil in clutch should be drained and replaced at 5000-15000 mile intervals. To drain oil, turn flywheel until filler plug is visible in inspection hole (left hand front face of flywheel housing), remove plug, turn flywheel until star stamped on flywheel is visible in inspection hole, allow at least one minute in this position for draining, turn flywheel until filler plug hole is visible, insert 1/3 pint Hudsonite Clutch Compound, replace filler plug.
Clutch Facings—Driven plate is 5⅜" I.D., 8⅝" O.D., .203" thick. Facing consists of 90 cork inserts mounted on driven plate.

STEERING:—**Front Suspension**—Conventional 'I' beam section front axle with Elliott type ends and semi-elliptic springs (standard), or Axle-flex articulated axle (optional). Data and adjustments for both types are the same.
Kingpin Inclination—7° crosswise.
Caster—2½-3½° ('34), 3¼-3¾° ('35). Adjust by inserting wedge shims between springs and spring pad on axle.
Camber—½°. No adjustment. Axle may be bent cold to correct camber.
Toe In—⅛" measured 10" above ground. Adjust by loosening tie rod end clamp bolts and rotating tie rod in direction that wheels revolve to increase toe-in, or in opposite direction to decrease toe-in.
NOTE—End thrust on kingpin is taken by five ball bearings in plug above kingpin. Bearing lower race is machined directly in kingpin end.
Steering Gear:—Gemmer Worm-and-Sector type. See article in Steering Section for adjustments.

BRAKES:—**Service**—Bendix mechanical, Duo-Servo, Single anchor type. Hand lever applies all service brakes. See article in Brake Section for complete adjustment procedure.
Drum Diameter—9".
Lining—Moulded type. Width 1¾" (except KU), 2¼" (KU only). Thickness 3/16". Length per wheel 19 3/16".
Clearance—.008" toe, .014" heel, for each shoe.
Hand Brake Adjustment:—See Service Brakes.

AUTOMATIC SHIFT (ELECTRIC HAND):—Bendix electro-pneumatic type optional on 1935 models.
See article in Mechanical Equipment Section for data.

ENGINE NUMBER:—First number—157,000. Stamped on left side of cylinder block opposite #6 cylinder.

ENGINE SPECIFICATIONS:—Type—6 cyl. 'L' head.
Bore—3". **Stroke**—5".
Displacement—212 cubic inches.
Rated Horsepower—21.6 (AMA).
Developed Horsepower—88 at 3800 R.P.M. (Std. 6.0-1 head), 100 at 3800 R.P.M. (Optl. 7.0-1 head).
Compression Ratio & Pressure—To check pressures, remove spark plugs, crank engine with throttle wide open.
Std. 6.0-1 Head .....111 lbs. at 215 R.P.M.
Optl. 7.0-1 Head .....127 lbs. at 207 R.P.M.
Vacuum Reading—Gauge should show steady reading of 18-19" of HG. with engine idling at 350 R.P.M. or 7 M.P.H.
NOTE—High Octane fuel must be used in engines with optional high compression 7.0-1 head.

PISTONS:—Own Lo-Ex aluminum alloy, 'T' slot, Cam ground type. Use finished replacement pistons when reconditioning engine. See Reconditioning parag'ph.
Weight—10.5 ozs. stripped. Stamped on piston head.
Length—3 3/16".
Removal—Pistons and rods removed from above.
Clearance—Top .016". Skirt .002". See Fitting New Pistons.
NOTE—These pistons are interchangeable with 1935 and may be installed in complete sets on 1934 model.

Reconditioning Cylinders:—Size of original bore indicated by letter stamped on lower edge of valve chamber opposite cylinder as follows: A-3.000", B-3.0005", C-3.001", D-3.0015", E-3.002", AO-3.010", BO-3.0105", CO-3.011", DO-3.0115", EO-3.012". Recondition cylinder to standard oversize for which replacement piston and rings are available (see piston and ring data below).

Replacement Pistons:—Standard and oversize pistons marked by leter on head available for cylinder bores of size indicated: 'B'-3.000&3.0005", 'D'-3.001&3.0015", 'F'-3.002 & 3.0025", 'J'-3.004", 'L'-3.005", 'BO'-3.010 & 3.0105", 'DO'-3.011 & 3.0115", 'FO'-3.012 & 3.0125", 'LO'-3.015", 'BB'-3.020", 'DD'-3.021", 'FF'-3.022". All pistons installed in engine must be of same weight as indicated by mark on head.

Fitting New Pistons:—Use .0015" feeler ½" wide on side opposite slot at right angles to pin bosses to check clearance. Tension to withdraw feeler must be 3-4 lbs.

Installing Pistons:—Slot toward left or away from camshaft.

PISTON RINGS:—Two compression, one oil ring above pin, one oil ring below pin per piston. Upper oil ring groove drilled with twelve 5/16" oil drain holes and two 5/16" holes to pins. Lower oil ring groove drilled with four 5/16" holes and two oil drain slots. Rings are straight cut and are positioned by pin in piston ring groove.

Ring	Width	End Gap	Wall Thickness
Comp.	3/32"	.005" Min.	.123"
Oil (both)	3/16"	.005" Min.	.128"

NOTE—Use standard or oversize rings of size indicated for replacement pistons (see Replacement Piston section above): 3.000"—B, D, F; 3.003"—J; 3.005"—L; 3.010"—BO, DO, FO; 3.015"—LO; 3.020"—BB, DD, FF. If rings are filed, clearance at pin must be kept uniform with end gap.

PISTON PIN:—Diameter ¾". **Length** 2 7/16".
Pin floats in piston and rod. Held by locking ring at each end. Pin hole in rod is bronze-bushed. Pins furnished standard, .002", .005", .010" oversize.
Pin Fit in Piston—Hand push fit with piston heated to 200° F.
Pin Fit in Rod Bushing—.0003" clearance. With this clearance rod will just turn of own weight.

CONNECTING ROD:—Weight 29.4 ozs. **Length** 8 3/16".
Crankpin Journal Diameter—1 15/16".
Lower Bearing—Spun-babbitt lined type. Rods serviced on 'exchange' basis.
Clearance—.001". **Sideplay**—.006-.010".

Bearing Adjustment:—Laminated shims. Do not file rods or caps.

Installing Rods:—Lower bearings are offset. Install rods with right hand offset (widest half of bearing toward rear) in cylinders #1, 2, 4, and rods with left hand offset (widest half of bearing toward front) in cylinders #3, 5, 6. Oil scoop on bearing cap must be toward camshaft on all rods.

CRANKSHAFT:—3 bearing. Integral counterweights.
See Hudson Shop Notes for Crankshaft and Vibration Dampener removal, Main Bearing Removal, Installation and Line-Reaming data.
Journal Diameters—#1, 2 11/32"; #2, 2⅜"; #3, 2 13/32".
Bearing Type—Removable bronze-backed, babbitt-lined. Bearings furnished for service reamed to standard size or unfinished (1/32" extra stock).
Clearance—.001".

Bearing Adjustment:—Shims. *See Hudson Shop Notes.*

End Thrust:—Taken by flanges on #2 (center) main bearing. Endplay .006-.012". Adjusted by replacing bearing.

CAMSHAFT:—Three bearing. Gear driven.
Journal Diameters—#1, 2"; #2, 1 31/32"; #3, 1½".
Bearing Clearance—.0015".

End Thrust:—Taken by spring-loaded plunger in end of camshaft and thrust plate on gear case cover.
NOTE—If gear case cover removed, see that spring and plunger are in place when cover is replaced.

Timing Gears:—Crankshaft gear cast-iron. Camshaft gear GE. or Cont. Diamond Fibre Bakelite.

Camshaft Setting:—Gears are marked. Mesh marked tooth of crankshaft gear between two marked teeth on camshaft gear.

VALVES:—	Head Diameter	Stem Diameter	Length
All valves	1⅜"	⅜"	5 11/32"

	Seat Angle	Lift	Stem Clearance
Intake	45°	11/32"	.0015-.003"
Exhaust	45°	11/32"	.003-.005"

Tappet Clearance:—.006" Intake, .008" Exhaust (hot).

Valve Guides:—Removable type. Pressed in block. Finish ream guides after installation to size giving correct clearance.

Valve Springs:—Cages installed on bottom of all springs. Springs should be installed with open side of cage toward cylinder.

	Spring Pressure	Spring Length
Valve Closed	44 lbs.	2"
Valve Open	102 lbs.	1 21/32"

Valve Lifters:—Slipper type operating in individual removable guides. Lifter is prevented from turning by pin in guide.

Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 10°40' BTDC. Close 60° ALDC.
Exhaust Valves—Open 50° BLDC. Close 18°44' ATDC.
These figures correct with .010" tappet clearance.
To Check Timing—Set tappet clearance #1 intake valve at .010". This valve should open with piston 10°40' or .0562" before top dead center when point on flywheel approximately 3.94 teeth before 'UDC.1-6/' mark lines up with indicator in hole in left front face of flywheel housing. Reset tappet clearance at .006". hot.
Motor Gauge—Weldenhoff #114 Adapter, #44 Rod.

LUBRICATION:—Duo-flow (splash) system. Force feed by oil pump to conecting rod troughs and timing gears. Splash to all other points from troughs.
Normal Oil Pressure—3 lbs.
Oil Presure Regulator—Operates at 3 lbs. Located on right side of crankcase. Not adjustable.
Crankcase Capacity—6 qts. refill.

Oil Pump:—Oscillating plunger type pump mounted on right side of crankcase and driven by gears from the camshaft.

Oil Pressure Indicator:—Consists of signal light on instrument panel and switch built in oil pressure regulator. See article in Equipment Section for complete data.

CLUTCH:—Own Make. Single plate, cork insert type operating in oil. Driven plate can be recorked but is customarily replaced.
See article in Mechanical Equipment Section for data.
Clutch Plate—Thickness .203". Inside diameter 5.375" Outside Diameter 8.625". **Facing**—90 cork inserts.

Adjustment:—Free movement of clutch pedal must be 1½" at all times. To adjust, remove clevis pin in clutch pedal link rod (between frame and leg of 'X' member below clutch pedal shaft), loosen locknut at top of clevis, turn clevis to shorten or lengthen rod as required, tighten locknut, replace clevis pin. On cars with automatic clutch control, check linkage whenever clutch is adjusted.
Automatic Clutch Linkage Adjustment—Hold accelerator pedal in depressed position, pull backward on clutch control power unit rod at left of engine. With rod in extreme rear position check clearance between back of slot in rod yoke and clevis pin which attaches it to operating lever. Clearance at this point must be ⅞".

Servicing:—Oil in clutch should be renewed at 5000 mile intervals. *See Hudson Special Shop Notes for instructions.*

STEERING:—Steering Gear—Gemmer Worm-and-Sector type. See article in Steering Section for adjustments.
NOTE—An adjustable drag link with ¾" adjustment (made by shifting shims from front to rear of pitman arm ball seat) is used on Model 61 after #6110394 (except 6110601 to 6110650), Model 62 after #623419 (except 623506 to 623661 incl.).

Front Suspension:—Conventional 'I' beam section front axle with Elliott type ends and semi-elliptic springs. Torque arm at each end of axle connected to frame at rear by rubber-bushed bolt maintains axle alignment.
Specifications & Adjustment—Kingpin inclination, Caster, Camber, Toe In, Steering Geometry, and Kingpin thrust bearing specifications and adjustment same as Hudson (see 1936 Hudson 8 page).

BRAKES:—Service—Bendix hydraulic, Duo-Servo, Single Anchor type. Brake pedal connected to rear wheel brakes through cable linkage for additional reserve mechanical aplication of brakes. Hand lever aplies rear wheel brakes through this same linkage.
See article in Mechanical Equipment Section for data.
Brake Drum Diameters—10 1/16".
Brake Lining—Moulded & Woven type. Width 1¾". Thickness 7/32". Length 22⅛" per wheel.
Brake Clearance—.010" heel and toe of each shoe.

Brake Pedal Adjustment:—For correct mechanical follow-up feature, adjust position of nut on connecting rod so that clearance between face of nut and end of push rod is 1 29/32" with equalizer against stop.
Hand Brake Adjustment:—See Service Brakes.

AUTOMATIC SHIFT (ELECTRIC HAND):—Bendix electro-pneumatic type. Optional equipment.
See article in Mechanical Equipment Section for data.

SERIAL NUMBER:—First Number:—Commercial Model (70) 70101, Deluxe (71) 71101, Super (72) 72101. Stamped on plate on right front door hinge pillar post.

ENGINE NUMBER:—First number 250,000 (all models). Stamped on left side of block opposite #6 cylinder.

ENGINE SPECIFICATIONS:—6 cyl. L head type.
Bore—3". **Stroke**—5". **Displacement**—212 cu. ins.
Rated Horsepower—21.6 A.M.A.

Developed Horsepower—	70, 71	72
Std. 6.25-1	96 @ 3900	101 @ 4000
Optl. 7.0-1 'Super Power'	102 @ 3900	107 @ 4000

Compression Ratio & Pressure—Check at cranking speed, spark plugs removed, throttle wide open.
Std. 6.25-1 head ..... 103 lbs. at 170 R.P.M.
Optl. 7.0-1 head ..... 119 lbs. at 170 R.P.M.
Vacuum Reading—18-21" at 350 R.P.M. or 7 M.P.H.

PISTONS:—Own Lo-Ex aluminum alloy, 'T' slot, cam ground type. Use finished replacement pistons.
Weight—10.5 ozs. stripped. **Length** 3 3/16".
Removal—May be removed from above or below.
Clearance—.016" top, .002" skirt (see below).
Original Bore Size:—*See Hudson Shop Notes.*
Replacement Pistons:—*See Hudson Shop Notes.*
Fitting New Pistons:—3-4 lb. tension should be required to withdraw .0015" feeler ½" wide from between piston and cylinder wall on side opposite slot at right angles to pin bosses.
Installing Pistons:—Slot away from camshaft side.

PISTON RINGS:—Two compression, one oil ring above pin, 1 oil ring below pin. Rings positioned by pin in grooves.

Ring	Width	End Gap	Side Clearance
Compression	3/32"	.009-.011"	.001"
Oil (both)	3/16"	.009-.011"	.001"

Replacement Rings:—*See Hudson Shop Notes.*

PISTON PIN:—**Diameter**—¾". **Length**—2 7/16".
Pin floats in piston and rod, held by locking rings. Pin hole in rod bronze-bushed. Pins furnished std., .002", .005", .010" oversize.
Pin Fit in Piston—.0003" clearance or hand push fit with piston heated to 200° F.
Pin Fit in Rod Bushing—.0003" clearance.

CONNECTING ROD:—**Weight** 29.4 ozs. **Length** 8 3/16".
Crankpin Journal Diameter—1 15/16".
Lower Bearing—Spun-babbitt. Rods exchanged. Finished bearings furnished standard and undersize (special order).
Clearance—.001". **Sideplay**—.006-.010".
Bearing Adjustment:—Laminated shims. Do not file.
Installing Rods:—Offset. Install rods with widest half of bearing toward rear (#1, 2, 4), toward front (#3, 5, 6). Oil scoop on all rods toward camshaft.

CRANKSHAFT:—3 bearing, integral counterweights *See Hudson Shop Notes for Crankshaft and Vibration Dampener removal, Main Bearing Removal, Installation and Line-Reaming data.*
Journal Diameters—#1, 2 11/32; #2, 2⅜"; #3, 2 13/32".
Bearing Type—Bronze-backed, babbitt-lined. Furnished std., and unfinished (1/32" extra stock—ream to desired undersize). **Clearance**—.001".
Bearing Adjustment:—Shims. *See Hudson Shop Notes.*
End Thrust:—Taken by center bearing. Replace bearing to adjust. Endplay.006-.012".

CAMSHAFT:—Three bearing. Gear driven.
Journal Diameters—#1, 2"; #2, 1 31/32"; #3, 1½".
Bearing Clearance—.0015".
End Thrust:—Taken by thrust washer assembled between front face of crankcase and rear side of camshaft front flange, and by spring-loaded button in camshaft hub and thrust plate on gear cover. See that spring and button in place under cover.
Timing Gears:—Crankshaft gear cast-iron. Camshaft gear GE. or Continental Diamond Fibre Bakelite.
Camshaft Setting:—Mesh marked tooth of crankshaft gear between two marked teeth on camshaft gear.

VALVES:—

	Head Diameter	Stem Diameter	Length
All Valves	1⅜"	⅜"	5 11/32"

	Seat Angle	Lift	Stem Clearance
Intake	45°	11/32"	.0015-.003"
Exhaust	45°	11/32"	.003-.005"

Tappet Clearance—.006" Int., .008" Exh., engine hot.
Valve Guides:—2 9/16" long. Top 1 1/16" below top of block. Finish ream to size after installation.
Valve Springs:—Cadmium plated. Install spring seat and spring dampener on bottom of all springs.

	Spring Pressure	Spring Length
Valve Closed	44 lbs.	2"
Valve Open	102 lbs.	1 21/32"

Valve Lifters:—Roller shoe type, fitted in removable guides. *See Hudson Shop Notes for lifter removal.*
Valve Timing:—See camshaft setting above.
Intake Valves—Open 14° 40' BTDC. Close 60° ALDC.
Exhaust Valves—Open 50° BLDC. Close 18°44' ATDC.
These figures correct with .010" tappet clearance.
To Check Timing—Set tappet clearance #1 intake valve at .010". This valve should open with piston 10°40' or .0562" BTDC. when point on flywheel approximately 3.94 teeth before 'UDC.1-6/' mark lines up with pointer in hole in left front face of flywheel housing. Reset tappet clearance at .006" hot.
Motor Gauge—Weidenhoff Adapter #114, Rod #44.

LUBRICATION:—Duo-flow (pressure and positive splash) system.
Oil Pump:—Oscillating plunger type, gear driven by camshaft. Mounted on right side of crankcase.
Normal Oil Pressure—3 lbs. (no gauge).
Oil Pressure Regulator:—Located on right side of crankcase at rear. Opens at 3 lbs. Not adjustable.
Oil Pressure Indicator:—Teleflash Oil Pressure indicator. See article in Electrical Equipment Section.
Checking Oiling System:—*See Hudson Shop Notes.*
Crankcase Capacity:—5 qts. (refill), 6 qts. (dry).

COOLING SYSTEM:—**Water Pump.** Centrifugal, belt-driven, packless type.
See article in Mechanical Equipment Section for data.
Removal—With water drained and fan belt removed, disconnect water hoses at pump, remove mounting bolts and lift fan and pump assembly off.
Thermostat:—On 72 only. In water outlet on cyl. hd.
Setting—Start to open 150-155°F. Fully open 185°F.
Water Capacity:—13 quarts.

CLUTCH:—**Own make.** Single plate, cork insert type, operating in oil.
See article in Mechanical Equipment Section for data.
Driven Member—Thickness .203". Inside Diameter 5.375", Outside Diam. 8.625". Facing 90 cork inserts.
Automatic Clutch Control:—Optional equipment.
See article in Mechanical Equipment Section for data.
Adjustment:—Pedal free movement must be 1½". To adjust, remove clevis pin at lower end of connecting link on throw-out shaft lever, loosen locknut, turn clevis. On cars with Automatic Clutch control, check setting whenever clutch adjusted.
Clutch Oil Servicing:—*See Hudson Shop Notes for data.*
Removal:—Remove transmission (see Transmission Removal following), take out 16 clutch cover capscrews and remove clutch assembly from below.

TRANSMISSION:—**Own make.** Constant-mesh, helical gears with synchronizing unit (second and high speeds). Sliding spur gears (low and reverse).
Electric Hand:—Bendix type electro-pneumatic gear shift Optional Equipment.
See article in Mechanical Equipment Section for data.
Removal:—Remove Electric Hand and Automatic Clutch Control units and wiring from transmission first, if car so equipped. See separate articles in Mechanical Equipment Section for necessary adjustments on these units when reinstalling. Disconnect transmission side bumpers, interlock straps, speedometer cable and drive shaft at front universal. Take out bell housing-to-engine mounting bolts, pull transmission straight back.

UNIVERSAL JOINTS:—Spicer. 1271 (front), 1278 (rear). Needle bearing type.
See article in Mechanical Equipment Section for data.

REAR AXLE:—**Own make.** Semi-floating, spiral bevel gear type.
See article in Mechanical Equipment Section for data.
Ratio—4.11-1 Std., 4.56-1 Optl. 3.89-1, 3.56-1 Special.
Backlash—.0005-.003". Screw adjustment.
Removal:—Remove rear wheel and hub assembly (use screw type puller only), take out four nuts on bearing cap bolts, push bolts out through backing plate remove shims, pull wheel bearing and axle shaft, disconnect drive shaft at rear universal, remove 8 nuts from axle housing-to-carrier stud bolts, withdraw differential assembly.
Wheel Bearing Adjustment:—Controlled by shims under bearing cap. Measure endplay by dial indicator clamped to backing plate with plunger against end of axle shaft. To adjust, remove bearing caps (as directed above), add or remove shims equally at both wheels. **Endplay**—.004-.010".

SHOCK ABSORBERS:—**Monroe.** 637502 (front), 635703 (rear). Hydraulic, direct acting type.
See article in Mechanical Equipment Section for data.

STEERING:—**Steering Gear**—Gemmer Model 305. Worm and Roller type.
See article in Mechanical Equipment Section for data.
Front Suspension:—Conventional 'I' beam section front axle with Elliott type ends and semi-elliptic springs. Axle alignment maintained by torque arm at each end (71, 72—not used on 70).
See article in Mechanical Equipment Section for data.
Torque Arms—*See Hudson Special Shop Notes.*
Kingpin Inclination—7° crosswise. NOTE—Loose ball type thrust bearing used. See 1936 page for data.
Caster—1-2° and equal within ½° for both wheels. To adjust (71, 72), loosen capscrews at front of torque arm, insert shim between arm and axle at upper screw or remove shim at lower screw to decrease caster, remove shim at upper screw or insert shim at lower screw to increase caster. Shims .020" thick, change caster ½°. To adjust (70), install wedge shims between spring and spring seat.
Camber—1-1½°. No adjustment.
Toe In—⅛" measured 10" up from ground. Adjust by loosening clamp bolts and turning tie rod.
Steering Geometry—Inner wheel 20°. Outer 17¾°.

BRAKES:—**Service**—Bendix Hydraulic, Duo-servo, Single anchor type with Mechanical follow-up. Hand lever applies rear service brakes.
See article in Mechanical Equipment Section for data.
Drum—Alloy-steel. Diameter—10 1/16".
Lining—Moulded and woven type. Width 1¾". Thickness 7/32". Length 22⅛" per wheel.
Clearance—.010" heel and toe of each shoe.
Hand Brake:—See Service Brakes above.
Hill-Holder:—Optional on all models.
See article in Mechanical Equipment Section for data.

SERIAL NUMBER:—First number:—Business Models (80) 80101, (88) 88101; Deluxe (81) 81101; Super (82) 82101. On right front door hinge post.

ENGINE NUMBER:—First number same as Serial Number (above). On boss on left side of block near top front or on top of block between #1 and #2 exhaust manifold flanges.

ENGINE SPECIFICATIONS:—6 cyl. L head type.
Bore—3". **Stroke**—5". **Displacement**—212 cu. ins.
Rated Horsepower—21.6 A.M.A.

Developed Horsepower—	80, 81, 88	82
Std. 6.25-1	96 @ 3900	101 @ 4000
Optl. 7.0-1 'Super Power'	102 @ 3900	107 @ 4000

Compression Ratio & Pressure—Check at cranking speed, spark plugs removed, throttle wide open.

Std. 6.25-1 head	103 lbs. at 170 R.P.M.
Optl. 7.0-1 head	119 lbs. at 170 R.P.M.

Vacuum Reading—18-21" at 350 R.P.M. or 7 M.P.H.

PISTONS:—Own Lo-Ex aluminum alloy, 'T' slot, cam ground type. Use finished replacement pistons.
Weight—10.5 ozs. stripped. **Length**—3 3/16".
Removal—May be removed from above or below.
Clearance—.016" top, .002" skirt (see below).
Original Bore Size:—*See Hudson Shop Notes.*
Replacement Pistons:—*See Hudson Shop Notes.*
Fitting New Pistons:—3-4 lb. tension should be required to withdraw .0015" feeler ½" wide from between piston and cylinder wall on side opposite slot at right angles to pin bosses.
Installing Pistons:—Slot away from camshaft side.

PISTON RINGS:—Two compression, one oil ring above pin, 1 oil ring below pin. Rings positioned by pin in grooves.

Ring	Width	End Gap	Side Clearance
Compression	3/32"	.005-.010"	.001"
Oil (both)	3/16"	.005"	.001"

Replacement Rings:—*See Hudson Shop Notes.*

PISTON PIN:—Diameter—¾". **Length**—2 7/16".
Pin floats in piston and rod, held by locking rings. Pin hole in rod bronze-bushed. Pins furnished std., .002", .005", .010" oversize.
Pin Fit in Piston—.0003" clearance or hand push fit with piston heated to 200° F.
Pin Fit in Rod Bushing—.0003" clearance.

CONNECTING ROD:—Weight 30.3 oz. **Length** 8 3/16". *See Hudson Shop Notes for Connecting Rod change on late cars.*
Crankpin Journal Diameter—1 15/16".
Lower Bearing—Spun-babbitt. Rods exchanged. Finished bearings furnished standard and undersize (special order).
Clearance—.001". **Sideplay**—.006-.010".
Bearing Adjustment:—None (no shims). Replace rods. *See Hudson Shop Notes for connecting rod palnut (locknut) installation instructions.*
Installing Rods:—Offset. Install rods with widest half of bearing toward rear (#1, 2, 4), toward front (#3, 5, 6). Oil scoop on all rods toward camshaft.

CRANKSHAFT:—3 bearing, integral counterweights *See Hudson Shop Notes for Crankshaft and Vibration Dampener removal, Main Bearing Removal, Installation and Line-Reaming data.*
Journal Diameter—#1, 2 11/32", #2, 2⅜", #3, 2 13/32".
Bearing Type—Bronze-backed, babbitt-lined. Furnished std., and unfinished (1/32" extra stock—ream to desired undersize). **Clearance**—.001".
Bearing Adjustment:—Shims. *See Hudson Shop Notes.*
End Thrust:—Taken by center bearing. Replace bearing to adjust. Endplay .006-.012".

CAMSHAFT:—Three bearing. Gear driven.
Journal Diameters—#1, 2"; #2, 1 31/32"; #3, 1½"
Bearing Clearance—.0025".
End Thrust:—Taken by thrust washer on front face of crankcase and by spring-loaded button in camshaft hub and thrust plate on gear cover. See that spring and button in place under cover.
Timing Gears:—Crankshaft gear cast-iron. Camshaft gear GE. or Continental Diamond Fibre Bakelite.
Camshaft Setting:—Mesh marked tooth of crankshaft gear between 2 marked teeth on camshaft gear.

VALVES:—Lighter valves (smaller stem diameter) used, than on previous models. New pilot size necessary for valve tools. *See Hudson Shop Notes for data.*

Head Diameter	Stem Diameter	Length
All valves 1⅜"	11/32"	5 11/32"

	Seat Angle	Lift	Stem Clearance
Intake	45°	11/32"	.0015-.003"
Exhaust	45°	11/32"	.003-.005"

Tappet Clearance—.006" Int., .008" Exh., engine hot.
Valve Guides: 2 9/16" long. Top 1 1/16" below top of block. Finish ream to size after installation.
Valve Springs:—Cadmium plated. Install spring seat and spring dampener on bottom of all springs.

	Spring Pressure	Spring Length
Valve Closed	44 lbs.	2"
Valve Open	102 lbs.	1 21/32"

Valve Lifters:—Roller shoe type, fitted in removable guides. *See Hudson Shop Notes for Lifter Removal.*
Valve Timing:—See camshaft setting above.
Intake Valves—Open 10°40' BTDC. Close 60° ALDC.
Exhaust Valves—Open 50° BLDC. Close 18°44' ATDC.
These figures correct with .010" tappet clearance.
To Check Timing—Set tappet clearance #1 intake valve at .010". This valve should open with piston 10°40' or .0562" BTDC. when point on flywheel approximately 3.94 teeth before 'UDC.1-6/' mark lines up with pointer in hole in left front face of flywheel housing. Reset tappet clearance at .006" hot.
Motor Gauge—Weidenhoff Adapter #114. Rod #44.

LUBRICATION:—Duo-flo (pressure & splash) system.
Oil Pump:—Oscillating plunger type, gear driven by camshaft. Mounted on right center of crankcase.
Normal Oil Pressure—3 lbs. (no gauge).
Oil Pressure Regulator:—Located on right side of crankcase at rear. Opens at 3 lbs. Not adjustable.
Oil Pressure Indicator:—Teleflash Oil Pressure indicator. See article in Electrical Equipment Section.
Checking Oiling System:—*See Hudson Shop Notes.*
Crankcase Capacity:—5 qts. (refill), 6 qts. (dry).
NOTE—Capacity decreased ½ qt. after car #43845.

COOLING SYSTEM:—Water Pump. Centrifugal, belt-driven, packless type.
See article in Mechanical Equipment Section for data.
Removal—With water drained and fan belt removed, disconnect water hoses at pump, remove mounting bolts and lift fan and pump assembly off.
Thermostat:—Std. on 82, optl. on others. In water outlet on cylinder head.
Setting—Start to open at 150-155°F. Fully open 185°F.
Water Capacity:—12½ quarts.

CLUTCH:—Own make. Single plate, cork insert type operating in oil. *See Mechanical Equip. Section.*
Adjustment:—Pedal free movement must be 1½". To adjust, remove clevis pin at lower end of connecting link on throw-out shaft lever, loosen locknut, turn clevis. On cars with Automatic Clutch control, check setting whenever clutch adjusted.
Driven Member—80 Utility coach, coupe and sedan, 81. Thickness .203". Inside Diameter 5.375". Outside Diameter 8.625". Facing 90 cork inserts. **All others**—Thickness .203". Inside Diam. 6.375". Outside Diameter 9.75". Facing 108 cork inserts.
Automatic Clutch Control:—Optional equipment. *See article in Mechanical Equipment Section for data.*
Clutch Oil Servicing:—*See Hudson Shop Notes.*
Removal:—Remove transmission (see Transmission Removal following) take out 16 clutch cover capscrews and remove clutch assembly from below.

TRANSMISSION:—Own make. Constant-mesh, helical gears with synchronizing unit (second and high speeds). Sliding spur gears (low and reverse).
Electric Hand:—Bendix type electro-pneumatic gear shift Optional Equipment.
See article in Mechanical Equipment Section for data.
Removal:—Remove Electric Hand and Automatic Clutch Control units and wiring from transmission first, if car model so equipped. See separate articles in Mechanical Equipment Section for necessary adjustments on these units when reinstalling. Disconnect transmission side bumpers, interlock straps, speedometer cable and drive shaft at front universal. Take out bell housing-to-engine mounting bolts, pull transmission straight back.

UNIVERSAL JOINTS:—Spicer. 1271 (front), 1278 (rear). Needle bearing type.
See article in Mechanical Equipment Section for data.

REAR AXLE:—Own make. Semi-floating, spiral bevel gear type.
See article in Mechanical Equipment Section for data.
Ratio—4 1/9-1, 4 5/9-1, 5 1/8-1.
Backlash—.0005-.003". Screw adjustment.
Removal:—Remove rear wheel and hub assembly (use screw type puller only), take out four nuts on bearing cap bolts, push bolts out through backing plate remove shims, pull wheel bearing and axle shaft, disconnect drive shaft at rear universal, remove 8 nuts from axle housing-to-carrier stud bolts, withdraw differential assembly.
Wheel Bearing Adjustment:—Controlled by shims under bearing cap. Measure endplay by dial indicator clamped to backing plate with plunger against end of axle shaft. To adjust, remove bearing caps (as directed above), add or remove shims equally at both wheels. **Endplay**—.004-.010".

SHOCK ABSORBERS:—Monroe. 156577 (front), 156578 (rear). Hydraulic, direct acting type.
See article in Mechanical Equipment Section for data.

STEERING:—Steering Gear—Gemmer Model 305. Worm and Roller type. *See Mechanical Equip. Section.*
Front Suspension:—Conventional 'I' beam section front axle with Elliott type ends and semi-elliptic springs. Axle alignment maintained by torque arm at each end (81, 82—not used on 80, 88).
Kingpin Inclination—7° crosswise. *See Hudson Shop Notes for Kingpin Thrust Bearing data.*
Caster—1-2° and equal within ½° for both wheels. To adjust (81, 82), loosen capscrews at front of torque arm, insert shim between arm and axle at upper screw or remove shim at lower screw to decrease caster, remove shim at upper screw or insert shim at lower screw to increase caster. Shims .020" thick, change caster ½°. To adjust (80, 88), install wedge shims between spring and spring seat.
Camber—1-1½°. No adjustment.
Toe In—⅛" measured 10" up from ground. Adjust by loosening clamp bolts and turning tie rod.
Steering Geometry—Inner wheel 20°. Outer 17¾°.

BRAKES:—Service—Bendix Hydraulic, Duo-servo, Single anchor type with Mechanical follow-up. Hand lever applies rear service brakes.
See article in Mechanical Equipment Section for data.
Drum—Alloy-steel. Diameter—10 1/16".
Lining—Moulded (primary), Woven (secondary). Width 1¾". Thickness 3/16". Lgth. 22⅛" per wheel.
Clearance—.010" heel and toe of each shoe.
Hand Brake:—See Service Brakes above.
Hill-Holder:—Optional on all models.
See article in Mechanical Equipment Section for data.

SERIAL NUMBER:—First number 1001 (1933), 13,820 (1934), 27,001 (1935), 42,002 (1936). On left frame rail near front spring rear shackle or on body sill at left front door opening.

ENGINE NUMBER:—Stamped on right front upper corner of cylinder block. 1st no. 42,000 ('36).

ENGINE:—Own Model 77. Four cylinder, 'L' head type.
Bore—3⅛". **Stroke—4⅜".**
Piston Displacement—134.2 cubic inches.
Rated Horsepower—15.63.
Developed Horsepower—48 at 3200 R.P.M.
Compression Ratio—5.13-1 ('33-35). 5.7-1 ('36).
Compression Pressure—83 lbs. at 120 R.P.M. ('33-35). 87 lbs. at 216 R.P.M. ('36).
Vacuum Reading—Gauge should show steady reading of 18-20" with engine idling.

NOTE—Cylinder bores are offset ⅛" from centerline of crankshaft toward valve side of engine.

Pistons:—Hard Grey Iron (cast-iron). Light weight type, relieved at pin bosses. Length, 3¾".
Weight—23-25 ozs. (without rings or pin).
Removal—Pistons and rods removed at top.
Clearance—Top .007-.008". Bottom .0025-.003".
Fitting New Pistons—Use .0025" feeler stock to check clearance. Pull required to withdraw feeler from between piston and cylinder wall must be 4 lbs. plus or minus 2 lbs.

Piston Rings:—Three compression rings, one oil control ring per piston, all above pin. Oil ring groove drilled radially with oil drain holes.

Ring	Width	End Gap	Wall Thickness
Comp. (Top)	3/32"	.010-.012"	.132"
Comp. (2,3)	3/32"	.007-.012"	.132"
Oil Cont.	3/16"	.007-.015"	.140"

NOTE—Wall thickness of .140" on all 1936 rings.

Piston Pin:—Diameter .875". Length 2.713". Pin floats in piston and rod. Retained by locking rings. Pins furnished .001" and .003" oversize.
Clearance in Piston—.0002-.0004". Hand press fit.
Clearance in Rod Bushing—.0004-.0006". Thumb press fit.

Connecting Rod:—Length 9 3/16" (center-to-center).
Lower Bearing Diameter—1 15/16".
Bearing Type—Spun babbitt-lined type.
Clearance—.001-.0025". Sideplay .006-.008".
Adjustment—None (no shims). Replace rods.
Installing Rods—Connecting rod lower bearings are offset. Install rods with short side of bearing toward nearest main bearing (short side forward on #1 and 3, toward rear on #2, 4). Oil hole in lower bearing upper half must be toward right (away from camshaft) on all rods.

Crankshaft:—Three main bearing type.
Journal Diameters—2 3/16" (all bearings).
Bearing Type—Interchangeable steel-backed, babbitt-lined type.
Clearance—.001-.0025".
Adjustment—None (no shims). Replace bearings. Do not file bearing caps.
End Thrust—Taken by #1 (front) main bearing. Endplay .004-.006". Adjustable by shims between crankshaft thrust washer and shaft.

Camshaft:—Four bearing. Non-adjustable chain drive.
Bearing Type—Removable bushing (front), machined in crankcase (all others).
Bearing Clearance—.002".
End Thrust—Taken by thrust plate behind camshaft sprocket and spring loaded plunger in forward end of camshaft bearing against thrust stud on chain case cover.

NOTE—When replacing chain case cover see that plunger and spring are in place in camshaft.
Timing Chain—Link Belt #33403-2. Width 1¼". Pitch ½". Length 23½" or 47 links.
Camshaft Setting—Sprockets are marked. With pistons #1 and 4 at TDC. marks should be adjacent and in line with a straightedge across the shaft centers. Remove camshaft sprocket to install chain.

Valves:—	Head Diameter	Stem Diameter	Length
Intake	1 17/32"	.372"	5 13/64" (5¾" over all)
Exhaust	1 15/32"	.371"	5 13/64" (5¾" over all)

	Seat Angle	Lift	Stem Clearance
Intake	45°	21/64"	.002-.004"
Exhaust	45°	21/64"	.003-.005"

NOTE—Hard alloy steel inserts are used for exhaust valve seats.
Tappet Clearance—.004" Int., .006" Exh. engine hot.
Valve Guides—Removable type installed with taper end up. Remove old guides from above and press in new guides until lower end extends ¾" below valve spring recess machined in block. Exhaust guide longer than intake guide.

Valve Springs—	Pressure	Length
Valve Closed	46½ lbs.	2¼"
Valve Open	85½ lbs.	1 15/16"

Valve Lifters—One piece mushroom type. Operate in guide holes reamed in block. Clearance in guides .0008". Serviced by reaming guide hole and installing lifters furnished .005" oversize.

Valve Timing

Intake Valves—Open at TDC. Close 45° ALDC.
Exhaust Valves—Open 40° BLDC. Close 5° ATDC.
To Check Valve Timing—Set tappet clearance #1 intake and exhaust valves at .010". Intake valve opens with piston on top dead center when flywheel mark 'T.C.I.O.1-4' lines up with pointed end of inspection hole cover plate screw (top of flywheel housing on left hand side). Exhaust valve closes with piston 5° or .0103" down on intake stroke when flywheel mark 'E.C.' lines up with indicator. Reset tappet clearance at .004" (intake), .006" (exhaust) with engine hot.
Motor Gauge—Weidenhoff Adapter #104, Rod #2.

Lubrication:—Pressure. Gear type oil pump located at left of crankcase.
NOTE—When installing oil pump, turn engine over until 'IGN' mark on flywheel lines up with pointed end of inspection cover screw on left top side of flywheel housing with #1 piston on compression stroke. Rotate distributor shaft so that rotor is in #1 firing position, then mesh oil pump gear so that tongue-and-slot connection to distributor shaft is engaged without changing position of distributor shaft.
Normal Oil Pressure—30 lbs. at 30 M.P.H.
Oil Pressure Relief Valve—Located under plug on oil pump cover. Operates at 30 lbs. Adjustable by adding or removing shims in plug above spring.
Crankcase Capacity—4 quarts (refill).

CLUTCH:—Rockford-Borg & Beck Model 8-II. Single plate, dry disc type.
See article in Mechanical Equipment Section for data.
Clutch Facings—Molded type, 2 required, 5⅛" I.D., 7⅞" O.D., .125" thick.
Clutch Pedal Adjustment—Clutch pedal free movement should be ¾-1" (providing clearance of 1/16" between clutch release levers and clutch release bearing within housing). To adjust, loosen lock nut, turn turnbuckle on end of clutch lever link cable.
Removal:—Remove transmission (see Transmission Removal below for 1935-36 models), take out clutch mounting screws, lift assembly out.

TRANSMISSION:—Own Make. Sliding spur gear type (all speeds).
See article in Mechanical Equipment Section for data.
Removal (1935-36):—Remove front seat, cowl trim pads, accelerating pedal and bracket (on '36 cars accelerator pedal can be pulled out from rubber connection at lower end), and floor boards. Alignment bolts (engine-to-bell housing) should enter from front, if not, they must be reversed. Turn fan so two top blades form 'V', cover with cloth to prevent injury to radiator core. Attach lifting block in #4 spark plug hole. On 1935 cars, remove bolts from right hand torque arm and left hand rear engine abutment, raise rear of engine until bell housing clears cross shaft, remove engine-to-bell housing bolt nuts, lift transmission out from above. On 1936 cars, remove lower nuts from rear transmission mounting bolts, raise engine to allow removal of rubber mounting rings and mounting bracket-to-transmission capscrews, then continue to raise engine until bell housing clears brake cross shaft, remove engine-to-bell housing bolt nuts, lift transmission out from above.
NOTE—On 1936 cars, upper rebound rubber rings should be compressed to outside diameter of 1 11/16" with lower nuts drawn up tight. Adjust by upper nuts.

UNIVERSAL JOINTS:—'Detroit-Universal'. Series 200. Ball and trunnion type. Two used.
See article in Mechanical Equipment Section for data.

REAR AXLE:—Own—Semi-floating, spiral bevel gear type, straddle mounted pinion, Hotchkiss drive.
See article in Mechanical Equipment Section for data.
Ratio—4.3-1.
Backlash—.006-.012". Shim adjustment.
Removal:—Hoist rear of car, disconnect rear universal, brake cables, shock absorbers, remove spring U-bolts, disconnect rear spring shackles, pull assembly out from car.
Wheel Bearing Adjustment—Endplay controlled by shims between bearing retainer and backing plate. To adjust, remove wheel, hub assembly, oil seal and bearing retainer and add or remove shims.

SHOCK ABSORBERS:—Monroe—Single acting, hydraulic.
See article in Mechanical Equipment Section for data.

STEERING:—Steering Gear—Saginaw Worm-and-Sector (1933-35). Lavine Worm-and-Block (1936).
See separate articles in Mechanical Equipment Section.
Front Suspension:—Conventionel 'I' beam section axle with Reverse-Elliott ends and semi-elliptic springs.
Kingpin Inclination—7½° (crosswise).
Camber—2°. No adjustment.
Caster—1-2°. Adjust by inserting shims between spring and spring pad on axle.
Toe In—3/32". Adjust by loosening tie rod clamp bolts and rotating tie rod.
NOTE—Kingpin bushing diameter, .625". End thrust is taken by a taper roller bearing assembled between axle end and steering knuckle lower yoke. Tie rod ends are rubber bushed.

BRAKES:—Service—Bendix Mechanical, Duo-Servo, Single anchor. Hand lever applies 4 service brakes.
See article in Mechanical Equipment Section for data.
Drum Diameter—9".
Lining—Moulded type. Width 1¾". Thickness 3/16". Length 19 3/ 16" per wheel.
Clearance—.010" at heel and toe of each shoe.
Hand Brake:—See Service Brakes.

SERIAL NUMBER:—On frame front cross member at center and on right side of cowl under hood. First number 37-1001 ('37), 65,001 ('38).

ENGINE NUMBER:—Stamped on right front upper corner of cylinder block.

ENGINE SPECIFICATIONS:—4 cylinder, 'L' head.
Bore—3⅛". Stroke—4⅜".
Displacement—134.2 cubic inches.
Rated Horsepower—15.63 (AMA).
Developed Horsepower—48 at 3200 R.P.M.
Compression Ratio & Pressure—5.7-1 cast-iron head, no optl. Pressure 87 lbs. at 216 R.P.M.
Vacuum Reading—Gauge should show steady reading of 18½" with engine idling at 7 M.P.H.
NOTE—Cylinder bore offset ⅛" from center line of crankshaft toward valve side of engine.

PISTONS:—Full skirt, cast-iron, light weight type.
Weight—21-23 oz. (stripped). **Length—3¾".**
Removal—Pistons and rods removed from above.
Clearance—Top .016". Skirt .0025-.003".
Replacement Pistons:—Finished pistons furnished .003", .005", .010", .015", .020", .025", .030", .035", .040" oversize.
Fitting New Pistons:—Use .0025" feeler stock to check clearance. Pull required to withdraw feeler from between piston and cylinder wall must be 4 lbs. plus or minus 2 lbs.

PISTON RINGS:—Three compression, one oil control ring per piston, all above pin. Oil ring groove drilled radially with oil drain holes.

Ring	Width	End Gap	Wall Thickness
Comp (Top)	3/32"	.010"	.140"
Comp (#2, 3)	3/32"	.008-.013"	.140"
Oil Cont.	3/16"	.008-.013"	.098-.103"

NOTE—Wall thickness .140" for all 1937 rings.

PISTON PIN:—Diameter—.9375". Length—2.682".
Pin floats in piston and rod. Retained by locking rings. Pins furnished .001", .003" oversize.
Pin Fit in Piston—Hand press fit. Clearance .0002-.0004".
Pin Fit in Rod Bushing—Thumb press fit. .0004-.0006".

CONNECTING ROD:—Length 9 3/16". Weight 34 ozs.
Upper Bearing (Piston Pin Bushing)—Bronze.
Crankpin Journal Diameter—1 15/16".
Lower Bearing—Spun babbitt-lined type.
Clearance—.001". **Sideplay**—.004-.009".
Bearing Adjustment:—None (no shims). Replace rods.
Installing Rods:—Connecting rod lower bearings are offset. Install rods with short side of bearing toward nearest main bearing (short side forward on #1 and 3, toward rear on #2 and 4). Oil hole in lower bearing upper half must be toward right (away from camshaft) on all rods.

CRANKSHAFT:—Three main bearing type.
Journal Diameter—2.334" all bearings.
Bearing Type—Removable (slip-in) steel-backed, babbitt-lined. Bearings furnished .010" undersize.
Clearance—.001-.0025".
Bearing Adjustment:—None (no shims). Replace bearings. Do not file bearing caps.
End Thrust:—Taken by front (#1) main bearing. Endplay .004-.006". Adjustable by shims between crankshaft thrust washer and shaft.

CAMSHAFT:—4 bearing. Non-adjustable chain drive.
Bearing Type—Removable bushing (front), machined in crankcase (all others).
Bearing Clearance—.002".
End Thrust:—Taken by thrust plate behind camshaft sprocket and spring loaded plunger in forward end of camshaft bearing against thrust stud on chain case cover.
Timing Chain:—Link-Belt #33403-2. Width 1¼". Pitch ½". Length 23½" or 47 links.
Camshaft Setting:—Sprockets are marked. With pistons #1 and 4 at TDC. marks should be adjacent and in line with a straightedge across the shaft centers. Remove camshaft sprocket to install chain.

VALVES:—Head Diam. Stem Diam. Length
Intake.....1 17/32".....372".....5 13/64" (5¾" overall)
Exhaust ..1 15/32".....371".....5 13/64" (5¾" overall)

	Seat Angle	Lift	Stem Clearance
Intake	45°	21/64"	.002-.004"
Exhaust	45°	21/64"	.003-.005"

NOTE—Exhaust valve seat inserts used.
Tappet Clearance—.004" Int., .006" Exh., engine hot.
Valve Guides:—Removable type installed with taper end up. Remove old guides from above and press in new guides until lower end extends ¾" below valve spring recess machined in block. Exhaust guide longer than intake guide.

Valve Springs:—	Pressure	Length
Valve Closed	46½ lbs.	2¼"
Valve Open	85½ lbs.	1 15/16"

NOTE—Spring free length 2 11/16".
Valve Lifters:—One piece mushroom type. Operate in guide holes reamed in block. Clearance in guides .0008". Serviced by reaming guide hole and installing lifters furnished .005" oversize.
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open at TDC. Close 45° ALDC.
Exhaust Valves—Open 40° BLDC. Close 5° ATDC.
To Check Valve Timing—Set tappet clearance #1 intake valve at .010". This valve should start to open with piston on top dead center when flywheel mark 'T.C.I.O.1-4' lines up with pointed end of inspection plate cover screw (top of flywheel housing, left hand side). Reset tappet clearance at .004" (hot).
Motor Gauge—Weidenhoff Adapter #104, #2 Rod.

LUBRICATION:—Pressure system. Gear type oil pump mounted on left hand outer crankcase wall.
NOTE—When installing oil pump, turn engine over until 'IGN' mark on flywheel lines up with pointed end of inspection cover screw on left top side of flywheel housing with #1 piston on compression stroke. Rotate distributor shaft so that rotor is in #1 firing position, then mesh oil pump gear so that tongue-and-slot connection to distributor shaft is engaged without changing position of distributor shaft.
Normal Oil Pressure:—30 lbs. at 30 M.P.H.
Oil Pressure Regulator:—Located under plug on oil pump cover. Operates at 30 lbs. Adjustable by adding or removing shims in plug above spring.
Oil Pressure Gauge:—King-Seeley Electric type, K-S Part No. 6275 (dash unit), 6425 (motor unit).
See article in Mechanical Equipment Section for data.
Crankcase Capacity—4 qts. (refill).

COOLING SYSTEM:—Water Pump. Centrifugal, belt-driven, with adjustable type packing.
See article in Mechanical Equipment Section for data.
Removal—With water drained and fan belt removed, remove pump mounting bolt nuts and pull fan and pump assembly out.
Thermostat:—None.
Water Capacity:—11 quarts.

CLUTCH:—Rockford Cover Assembly, Borg & Beck Driven Plate. Single plate, dry disc type.
See article in Mechanical Equipment Section for data.
Facings—Moulded, 2 required. I.D. 5⅛". O.D. 7⅞". Thickness ⅛".
Adjustment—Clutch pedal free movement should be ¾-1" (providing clearance of 1/16" between clutch release levers and clutch release bearing within housing). To adjust, loosen lock nut, turn turnbuckle on end of clutch lever link cable.
Removal:—Remove transmission (see Transmission Removal below), take out clutch mounting screws evenly, lift assembly out.

TRANSMISSION:—Warner—Model T84-C (pass. cars), T82-D ('38 trucks). Helical gears (second & high speeds), sliding spur (low and reverse). Synchronizer for second and high speeds.
See article in Mechanical Equipment Section for data.
Removal:—Remove front seat, cover door trim, gear shift lever (at retaining collar), disconnect accelerator pedal from rubber socket, remove toe boards, loosen radiator mounting bolts (at bottom) and brace rods (for fan clearance), disconnect propeller shaft at front, remove lower nuts from mounting bolts at rear of transmission, jack up rear of engine removing transmission rear mounting bracket, and raising until it clears frame cross member, remove housing to engine bolts (bolts should be driven in from front or engine side—holding motor plate in position). Lift out transmission from above.
NOTE—Upper snubbing rubber on mounting bolts should be compressed to ⅝" with lower nuts drawn up tight. Adjust to this thickness with upper nuts.

UNIVERSAL JOINTS:—'Detroit-Universal'—Series 200 (All '37 - early '38) ball & trunnion with plain bearings. Series 4100 (later '38) roller bearings.
See article in Mechanical Equipment Section for data.

REAR AXLE:—Own—Pass. cars and Economy Pickup.
Spicer 21-1—All other trucks. Semi-floating, spiral bevel gear type with Hotchkiss drive.
See article in Mechanical Equipment Section for data.
Ratio—4.3-1 (own). 4.7-1, 5.1-1 (Spicer).
Backlash—.005-.010". Shim adjustment.
Removal:—Hoist rear of car, disconnect rear universal, brake cables, shock absorbers, remove spring U-bolts, disconnect rear spring shackles, pull assembly out from car.
Wheel Bearing Adjustment—Endplay controlled by shims between bearing retainer and backing plate. To adjust, remove wheel, hub assembly, oil seal and bearing retainer and add or remove shims.

SHOCK ABSORBERS:—Monroe. Front—152941 ('37), 635702 ('38). Rear—152942 ('37), 635703 ('38 pass.), 636450 ('38 pickup). Direct acting, hydraulic type.
See article in Mechanical Equipment Section for data.

STEERING:—Steering Gear—Gemmer Model 120. Worm-and-Sector type.
See article in Mechanical Equipment Section for data.
Front Suspension—Conventional 'I' beam section axle with Reverse-Elliot ends and semi-elliptic springs.
Kingpin Inclination—7½° crosswise.
Camber—2° or 21/32". No adjustment.
Caster—3°. Wedge shims bet. spring and axle.
Toe In—3/32". Adjust by loosening tie rod clamp bolts and rotating tie rod.
NOTE—Kingpin bushing diameter .750". End thrust taken by taper roller bearing assembled between axle end and steering knuckle lower yoke.

BRAKES:—Service—Bendix Mechanical, Duo-Servo., Single anchor type. Hand lever applies the service brakes.
See article in Mechanical Equipment Section for data.
Drum—Steel. Diameter—9".
Lining—Moulded type. Width 1¾". Thickness 3/16". Length 19 3/16" per wheel.
Clearance—.010" at heel and toe of each shoe.
Hand Brake:—See Service Brakes.

SERIAL NUMBER:—First number 91751 (see Note). Stamped on front center of front frame cross-member and on right side of cowl under engine hood. NOTE—Cars manufactured after beginning of fiscal year (Sept. 1, 1938), Serial No. 89001 and up, are 1939 cars.

ENGINE NUMBER:—First number 91751. Stamped on boss on right front upper corner of cylinder block.

ENGINE SPECIFICATIONS:— 4 cylinder, 'L' head type.
Bore—3⅛". **Stroke**—4⅜".
Displacement—134.2 cubic inches.
Rated Horsepower—15.63 (A. M. A.).
Developed Horsepower—48 HP. at 3200 R.P.M.
Compression Ratio—5.7-1 cast-iron hd.
Compression Pressure—87 lbs. at 217 R.P.M.
Vacuum Reading—Steady 18½" idling at 7 M.P.H.
NOTE—Cylinder bore offset ⅛" from center line of crankshaft toward valve side of engine.

PISTONS:—Full skirt, semi-steel, light weight type.
Weight—21-23 ozs. (stripped). **Length**—3¾".
Removal—Pistons and rods removed from above.
Clearance—Top .016". Skirt .0025-.003".
Replacement Pistons:—Finished pistons furnished Std. and .003", .005", .010", .015", .020", .025", .030" oversize.
Fitting New Pistons:—Use .0025" feeler stock ⅜" wide inserted between piston and cylinder wall to check clearance. Pull required to withdraw feeler must be 4 lbs. plus or minus 2 lbs.

PISTON RINGS:—Three compression, one oil control ring per piston, all above pin. Oil ring groove drilled for oil drainage.

Ring	Width	End Gap	Side Clearance
Compression	3/32"	.008-.013"	.0015"
Oil Control	3/16"	.008-.013"	.0015"

Wall Thickness—.130-.140" (Comp.), .098-.103" (oil).
Replacement Rings:—Furnished Std. and .003", .005", .010", .015", .020", .025", .030", .040" oversize.

PISTON PIN:—Diameter—15/16" (.9375"). **Length**—2.682". Pin floats in piston and rod. Retained by locking rings. Furnished .001", .003", .005" oversize.
Pin Fit in Piston—.0002-.0004" clearance or hand push fit with piston dry.
Pin Fit in Rod Bushing—.0004-.0006" clearance or thumb press fit.

CONNECTING ROD:—Weight 34 ozs. **Length** 9 3/16".
Upper Bearing (Piston Pin Bushing)—Bronze.
Crankpin Journal Diameter—1.9395" (1 15/16").
Lower Bearing—Spun-babbitt-lined type.
Clearance—.001-.0025". **Sideplay**—.005-.009".
Bearing Adjustment:—None (no shims). Replace or rebabbitt rods. Do not file rods or bearing caps. Rods furnished Standard and .010" undersize.
Installing Rods:—Lower bearings offset. Install rods with short side of bearing toward nearest main bearing (toward front of engine for #1 & 3, toward rear for #2 & 4) with oil squirt hole in rod toward right (away from camshaft) on all rods.

CRANKSHAFT:—Three main bearing type.
Journal Diameters—2.334" all bearings.
Bearing Type—Removable slip-in steel-backed, babbitt-lined type. Bearings furnished Standard and .010" undersize.
Clearance—.001-.0025".
Bearing Adjustment:—None (no shims). Replace bearings. Do not file caps.
End Thrust:—Taken by #1 front bearing. Adjustable by adding or removing shims between crankshaft thrust washer and shaft. **Endplay**—.004-.006".

CAMSHAFT:—4 bearing. Non-adjustable chain drive.
Bearing Type—Removable bushing (front), machined in crankcase (all others).
Bearing Clearance—.002-.0035".
End Thrust:—Taken by thrust plate behind camshaft sprocket and spring-loaded plunger in forward end of camshaft bearing against thrust stud on cover.
Timing Chain:—Link-Belt #33403-2. Width 1¼". Pitch ½". Length 23½" or 47 links.
Camshaft Setting:—With #1 piston on top dead center, mesh chain so that timing marks on sprockets are adjacent and in line with a straightedge across the shaft centers.

VALVES:

	Head Diam.	Stem. Diam.	Length
Intake	1 17/32"	.372"	5 13/64" (5¾" overall)
Exhaust	1 15/32"	.371"	5 13/64" (5¾" overall)

	Seat Angle	Lift	Stem Clearance
Intake	45°	21/64"	.002-.004"
Exhaust	45°	21/64"	.003-.005"

NOTE—Exhaust valve seat inserts are used.
Tappet Clearance:—.004" Int., .006" Exh., engine warm. NOTE—Whenever valves ground or new valves installed, car manufacturer recommends .010" setting for all valves for at least 100 miles to allow valves to seat properly.
Valve Guides:—Removable. Installed with taper end up. Remove old guides from above and press in new guides until lower end extends ¾" below valve spring seat recess in block. Exhaust guide longer than intake guide.
Valve Springs:—Free length 2 11/16".

	Spring Pressure	Length
Valve Closed	46½ lbs.	2¼"
Valve Open	85½ lbs.	1 15/16"

Valve Lifters:—Mushroom type. Guide holes reamed directly in block. Serviced by reaming guide hole and installing lifters furnished .005", .010", .020" oversize. **Clearance**—.0007-.001".
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open TDC. Close 45° ALDC.
Exhaust Valves—Open 40° BLDC. Close 5° ATDC.
To Check Timing—Set tappet clearance #1 intake valve at .010" (cold). This valve should open with piston on top dead center when flywheel mark 'T.C. I.O.1-4' lines up with pointed end of inspection plate screw in inspection hole on left top face of flywheel housing (permissible variation ¼" either way from mark). Reset tappet clearance at .004" warm.

LUBRICATION:—Pressure system. Gear type oil pump mounted on outer left side of crankcase.
Oil Pump Installation Note—Turn engine over until 'IGN' mark on flywheel lines up with indicator (inspection hole in top left surface of flywheel housing) with #1 piston on compression stroke, turn distributor shaft so that rotor is at #1 segment in distributor cap, mesh oil pump gear so that distributor not disturbed when tongue-and-slot drive coupling engaged.
Normal Oil Pressure:—30 lbs. at 30 M.P.H.
Oil Pressure Regulator:—Located under plug on oil pump cover. Opens at 30 lbs. Adjustable by adding or removing shims within plug above spring.
Oil Pressure Gauge:—King-Seeley Electric. K-S No. 6275 (dash unit), No. 6425 (engine unit).
See article in Mechanical Equipment Section for data.
Crankcase Capacity:—4 quarts.

COOLING SYSTEM:—Capacity—11 quarts.
Water Pump:—Adjustable packing type.
See article in Mechanical Equipment Section for data.
Thermostat:—None used. Accessory thermostat (for installation in cylinder head outlet) available.
Temperature Gauge (Pass. Cars):—King-Seeley Electric. K-S No. 7205 (Engine Unit). Engine unit controls Signal Light on instrument panel.
Commercial Cars—King-Seeley Electric. K-S No. 6632 (dash unit), No. 5700 (engine unit).
See article in Mechanical Equipment Section for data.

CLUTCH:—Rockford Cover Assembly (with Borg & Beck Driven Plate). Single plate, dry disc type.
See article in Mechanical Equipment Section for data.
Facings—Moulded type, 2 required. Inside Diam. 5⅛". Outside Diam. 7⅞". Thickness ⅛".
Adjustment:—Pedal free movement must be ¾-1" (providing 1/16" clearance between release levers and release bearing). To adjust, loosen locknut, turn yoke on rear end of clutch control lever cable.
Removal:—Remove transmission (see Transmission Removal below) and flywheel bell housing, take out mounting screws in clutch cover evenly, lift out clutch cover assembly and driven plate.

TRANSMISSION:—Warner Model AS3-T84D. Constant-mesh, synchro-mesh, helical gears (Second and High), sliding spur gears (Low and Reverse).
See article in Mechanical Equipment Section for data.
Removal:—Remove front seat cushion and cover door trim; disconnect gear shift lever at retaining collar, and accelerator pedal from rubber socket, remove toeboards, loosen radiator mounting nuts and brace rod, disconnect propeller shaft at front universal, remove bell housing hand hole cover and unhook throw-out bearing retracting spring. Remove lower nuts on mounting bolts at rear of transmission, jack up rear of engine (see that fan blades do not damage radiator) to clear frame crossmember, remove transmission mounting bracket, remove bell housing bolts, pull transmission straight back.

UNIVERSAL JOINTS:—Detroit Series 4100. Needle bearing, ball-and-trunnion type. 2 used.
See article in Mechanical Equipment Section for data.

REAR AXLE:—Own Model 48. Passenger car models.
Spicer Model 21-1. Truck models. semi-floating, spiral bevel gear type with Hotchkiss drive.
See articles in Mechanical Equipment Section for data.
Ratio—4.1-1 passenger cars. 4.7-1 Std. trucks. 5.1-1 Panel Delivery and Optional on other truck models.
Backlash—.004-.008" Shim adjustment.
Removal:—Hoist rear of car, disconnect drive shaft at rear universal, disconnect brake cables, shock absorbers, spring U bolts and rear shackles, pull assembly out.
Wheel Bearing Adjustment:—To adjust, remove wheel, hub assembly, oil seal, and bearing retainer. Remove shims between retainer and backing plate at both wheels equally. **Endplay**—.004-.006".

SHOCK ABSORBERS:—Monroe. Model 637509—frt., 637508—rear (Std. Control), 637645—frt., 637644—rear (H.D. Control). Direct acting hydraulic type.
See article in Mechanical Equipment Section for data.

STEERING:—Steering Gear—Gemmer Model 120. Worm-and-sector type.
See article in Mechanical Equipment Section for data.
Front Suspension:—Front axle Own Model 48. Conventional 'I' beam section with Reverse-Elliott ends.
Kingpin Inclination—7½° crosswise.
Camber—2° or 21/32". Not adjustable.
Caster—3°. Adjustable by using wedge shims between spring and spring pad on axle.
Toe In—1/16-⅛" Passenger cars. 3/32" Trucks. Adjust by turning tie rod.
Steering Geometry (Toe Out on Turns)—Inner wheel turned 23°15', outer wheel 20°.

BRAKES:—Service—Bendix Mechanical, duo-servo, single anchor. Hand lever applies all service brakes.
See article in Mechanical Equipment Section for data.
Drum—Steel—Diameter 9" (passenger cars and trucks). Alloy cast-iron—Diameter 11" (Panel).
Lining—Moulded type. Width 1¾". Thickness 3/16". Length per wheel 19 3/16" (passenger cars and trucks), 23 15/16" (panel).
Clearance—.010" at heel and toe of each shoe.
Braking Power—55% front, 45% rear.
Hand Brake:—See Service Brakes above.

SERIAL NUMBER:—First number #39-1001. Stamped on plate on right side of cowl under engine hood and on center of front frame cross-member.

ENGINE NUMBER:—First number 39-1001. Stamped on right front upper corner of engine block.

ENGINE:—Own Model 39. 4 cylinder, 'L' head type.
Bore—3⅛". Stroke—4⅜". Displ'mt.—234.2 cu. ins.
Rated Horsepower—15.63.
Developed Horsepower—61 at 3600 RPM. Std. Head.
Compression Ratio—6.35-1 (Std.), 6.81-1 (High Alt.), Cast-iron heads, 7.0-1 (Optl. HC.) aluminum head.
Compression Pressure—105 lbs. at 185 RPM. (Std. hd.).
Vacuum Reading—Steady 21-23" at 7 MPH. idling speed.
NOTE—Cylinders offset ⅛" from center-line of crankshaft toward camshaft side of engine.

PISTONS:—Aluminum alloy, 'T' slot, Cam Ground, Tin-plated type with narrow 'heat-dam' above top piston ring.
Weight—12 ozs. (stripped). **Length—3¾".**
Removal—Pistons and rods removed from above.
Clearance—.0025" skirt. See Fitting New Pistons.
Replacement Pistons:—Finished pistons furnished Std. and .002", .005", .010", .020", .030" oversize.
Fitting New Pistons:—Use .0025" feeler stock ¾" wide inserted between piston and cylinder wall on side opposite slot to check clearance. Pull required to withdraw feeler must be within 5 to 10 lbs.
Installing Pistons:—Slot toward left (valve) side.

PISTON RINGS:—Two compression, one oil control ring per piston, all above pin with narrow 'heat-dam' groove (no ring) above top ring. Oil ring groove drilled for oil drainage.

Ring	Width	End Gap	Side Clearance
Compr.	3/32"	.008-.013"	.002"
Oil Contr.	3/16"	.008-.013"	.002"

Wall Thickness—.130-.140" (Comp.), .098-.103" (oil).
NOTE—Install taper-face compression ring with mark 'TOP' up.
Replacement Rings:—Furnished Std. and .005", .010", .020", .030" oversize.

PISTON PIN:—Diameter .8117-.8121". **Length** 2 25/32". Pin locked in connecting rod by clampscrew.
Pin Fit in Piston—.0001-.0009" clearance or light push fit with piston at 60° F.
Replacement Pins:—Furnished Std. and .005" oversize.

CONNECTING ROD:—Weight 34 ozs. **Length** 9 3/16".
Crankpin Journal Diameter—1.9395" (1 15/16").
Lower Bearing—Spun babbitt-lined type.
Clearance—.001-.0025". **Sideplay**—.005-.009".
Bearing Adjustment:—None (no shims). Replace or rebabbitt rods. Do not file rods or bearing caps. Rods furnished Standard and .010" undersize.
Installing Rods:—Lower bearings offset. Install rods with short side of bearing toward nearest main bearing (toward front of engine for #1 and 3, toward rear for #2 and 4) with oil squirt hole in rod toward right (away from camshaft) on all rods.

CRANKSHAFT:—Three main bearing type.
Journal Diameters—2.334" all bearings.
Bearing Type—Removable slip-in steel-backed, babbitt-lined type. Bearings furnished Standard and .010" undersize.
Clearance—.001-.0025".
Bearing Adjustment:—None (no shims). Replace bearings. Do not file bearing caps.
End Thrust:—Taken by #1 front bearing. Adjustable by adding or removing shims between crankshaft thrust washer and shaft. **Endplay**—.004-.006".

CAMSHAFT:—4 bearing. Non-adjustable chain drive.
Bearing Type—Removable bushing (front), machined in crankcase (all others).
Bearing Clearance—.002-.0035".
End Thrust:—Taken by thrust plate behind camshaft sprocket and spring-loaded plunger in forward end of camshaft bearing against thrust stud on chain case cover. NOTE—Make certain that plunger and spring in place when replacing chain case cover.
Timing Chain:—Link Belt. Width 1¼". Pitch ½". Length 47 links or 23½".
Camshaft Setting:—With #1 piston on top dead center, mesh chain so that timing marks on sprockets are adjacent and in line with straightedge across shaft centers.

VALVES:—

	Head Diam.	Stem Diam.	Length
Intake	1 17/32"	.373"	5¾" (overall)
Exhaust	1 15/32"	.3725"	5¾" (overall)

	Seat Angle	Lift	Stem Clearance
Intake	45°	23/64"	.0015-.00325"
Exhaust	45°	23/64"	.002-.00375"

NOTE—Separate valve seat inserts not used.
Tappet Clearance:—.014" all valves, engine cold.
Valve Guides:—Removable. Installed with taper end up. Remove old guides from above and press in new guides until lower end extends ¾" below valve spring seat recess in block.
Valve Springs:—Free length 2.684". Cylindrical dampener installed within each spring at upper end.

	Spring Pressure	Length
Valve Closed	59.5 lbs.	2.165"
Valve Open	100 lbs.	1.814"

Valve Lifters:—Mushroom type. Guide holes reamed directly in block. Serviced by reaming guide hole and installing lifters furnished .005", .010", .020" oversize. **Clearance**—.0007-.001".
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 9° BTDC. Close 50° ALDC.
Exhaust Valves—Open 47° BLDC. Close 12° ATDC.
To Check Timing—Set tappet clearance #4 intake valve at .020" (cold). This valve should begin to open with piston 9° or .039" before top dead center when flywheel marked 'I.O.' lines up with pointed end of indicator screw in inspection hole in top left surface of flywheel housing (¼" variation of mark permissible). Reset tappet clearance at .014".

LUBRICATION:—Pressure type. Gear type oil pump mounted on outer left side of crankcase.
Oil Pump Installation Note—Turn engine over until 'TC.IGN' mark on flywheel lines up with indicator (inspection hole in top left surface of flywheel housing) with #1 piston on compression stroke, turn distributor shaft so that rotor is at #1 segment in distributor cap, mesh oil pump gear so that distributor not disturbed when tongue-and-slot drive coupling engaged.
Normal Oil Pressure:—30 lbs. at 30 M.P.H.
Oil Pressure Regulator:—Located under plug on oil pump cover. Opens at 30 lbs. Adjustable by adding or removing shims within plug above spring.
Oil Pressure Gauge:—King-Seeley Electric. K-S No. 7047 (dash unit), No. 6425 (engine unit).
See article in Mechanical Equipment Section for data.
Crankcase Capacity:—4 quarts.

COOLING SYSTEM:—Water Capacity—11¾ qts.
Water Pump:—New packless type with ball-bearing shaft.
See article in Mechanical Equipment Section for data.
Removal—Drain water, remove fan belt and fan blades, loosen radiator mounting nuts, take out mounting bolts and lift pump out.
Thermostat:—Harrison. In outlet elbow on head.
Setting—Starts to open 140-147°F. Fully open 170°F.
Temperature Gauge:—King-Seeley Electric. K-S No. 7041 (dash unit), No. 7000 (engine unit).
See article in Mechanical Equipment Section for data.

CLUTCH:—Long Model 8½CB-CS6 (with Borg & Beck or Long Driven Member). Single plate, dry disc type.
See article in Mechanical Equipment Section for data.
Facings—Molded type, 2 required. Inside Diam. 5⅛" (Borg & Beck), 6" (Long); Outside Diam. 7⅞" (Borg & Beck), 8½" (Long); Thickness .125" (all).
Adjustment:—Pedal free movement must be ¾-1" (providing 1/16" clearance between release levers and release bearing). To adjust, loosen locknut, turn clevis on rear end of clutch fork cable.
Removal:—Remove transmission (see Transmission Removal below) and flywheel bell housing, take out mounting screws on clutch cover rim, lift clutch assembly and driven plate out.

TRANSMISSION:—Warner Model AS3-T84D. Constant-mesh, synchro-mesh, helical gears (Second & High), sliding spur gear (Low & Reverse).
See article in Mechanical Equipment Section for data.
Removal:—Remove front seat cushion and cover door trim; disconnect gear shift lever at retaining collar, and accelerator pedal from rubber socket, remove toeboards, loosen radiator mounting nuts and brace rod, disconnect propeller shaft at front universal, remove bell housing hand hole cover and disconnect clutch throw-out bearing retracting spring. Remove lower nuts on mounting bolts at rear of transmission, jack up rear of engine (See that fan blades do not damage radiator) to clear frame cross-member, remove transmission mounting bracket, remove bell housing to transmission case bolts, pull transmission straight back and lift out.

UNIVERSAL JOINTS:—Detroit Series 4100. Needle bearing, ball-and-trunnion type. 2 used.
See article in Mechanical Equipment Section for data.

REAR AXLE:—Own Model 39. Semi-floating, spiral bevel gear type with Hotchkiss drive.
See article in Mechanical Equipment Section for data.
Ratio—4.3-1 Std., 4.55-1 Deluxe.
Backlash—.004-.008". Shim adjustment.
Removal:—Hoist rear of car, disconnect brake tube and cables, shock absorbers, spring U bolts and rear shackles, pull assembly out.
Wheel Bearing Adjustment:—To adjust, remove wheel, hub assembly, oil seal, and bearing retainer. Remove shims from between retainer and backing plate. **Endplay**—.004-.006" (total both shafts).

SHOCK ABSORBERS:—Monroe. Model 637509—frt., 637508—rear (Std. control), 637645—frt., 637644—rear (H.D. control). Direct acting, hydraulic type.
See article in Mechanical Equipment Section for data.

STEERING:—Steering Gear—Gemmer Model 120. Worm-and-sector type.
See article in Mechanical Equipment Section for data.
Front Suspension:—Front axle Own Model 39. Conventional 'I' beam section with Reverse-Elliott ends.
Kingpin Inclination—7½° crosswise.
Camber—2°. Not adjustable.
Caster—3°. Adjustable by using wedge shims between spring and spring pad on axle.
Toe In—1/16-⅛". Adjustable by loosening tie rod clamp bolts and turning tie rod.
Steering Geometry (Toe out on Turns)—Inner wheel turned 23°15', outer wheel 20°.

BRAKES:—Service—Wagner-Lockheed Hydraulic, Single Anchor type. Hand lever applies rear wheel service brakes.
See article in Mechanical Equipment Section for data.
Drums—Alloy cast-iron. Diameter 9".
Lining—Moulded type. Width 1¾", Thickness 3/16", Length per wheel 18".
Clearance—.010" toe, .006" heel for each shoe.
Braking Power—56% front, 44% rear.
Hand Brake:—See Service Brakes above.

1940 MECHANICAL CAR MODEL INDEX

IMPORTANT—Refer to "FIELD & PRODUCTION CHANGES, NEW TYPE UNITS, SPECIAL SERVICE NOTES" at front of 1940 Tune Up & Electrical pages.

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NOTE:—All Specifications and Service Data for car models same as for corresponding 1939 model.

GRAHAM SPECIAL SHOP NOTES (1940)

For all data see Graham Special Shop Notes in 'M' Section of manual (or 1938 Supplement).

HUPMOBILE SKYLARK MODEL R (1940)

For all data see Hupmobile Skylark Model R (1939) 'M' page.

LINCOLN V12 MODEL (1940)

For all data see Lincoln V12 model (1938) 'M' page.

HOOD LATCH NOTE:—Latch handles located in driver's compartment on extreme right and left sides and must be released before hood can be raised.

SERIAL NUMBER:—First number 65-343. Stamped on plate on left side of cowl under engine hood. On Export cars, Serial Number also stamped on left frame side rail below engine oil level gauge.

ENGINE NUMBER:—First number 65-501. Stamped on left side of crankcase above Starter Bendix.

ENGINE SPECIFICATIONS:—Own. Four cylinder, 'L' head type. Cylinders cast En-bloc and bolted to aluminum alloy crankcase which is integral with flywheel housing.
Bore—2.26". **Stroke**—3.125"
Displacement—50.144 cu. ins. **Rated HP**—8.17.
Developed Horsepower—22 at 3800 RPM.
Compression Ratio—7.4-1 Std. Cast Iron head.
Compression Pressure—135 lbs. at 200 RPM.
Vacuum Reading—Steady 18-20" idling at 7 MPH.

PISTONS:—Bohn Autothermic, aluminum alloy, steel strut, split skirt, cam ground type with tin-plate finish. **Length**—2.083".
Weight—5.125 ozs. (without rings or pin).
Removal—Pistons and rods removed from above.
Clearance—Top .0125-.017". Skirt .0005".
Replacement Pistons:—Pistons furnished in standard size and .003", .005", .010", .020", .030" oversize.
Fitting New Pistons:—Use .0025" feeler installed between pistons and cylinder wall on side opposite slot at right angles to piston pin. Pull required to withdraw feeler must be 7-12 lbs.
Installing Pistons:—Slot toward left hand side.

PISTON RINGS:—Two compression, one oil control ring per piston, all above pin. Oil ring groove drilled with oil drain holes.

Ring	Width	End Gap	Side Clearance
Compr.	.0925-.0935"	.010-.020"	.001-.0015"
Oil Contr.	.1235-.1240"	.010-.018"	.001-.0015"

Replacement Rings:—Furnished standard size and .003", .005", .010", .020", .030" oversize.

PISTON PIN:—Diameter—.6095". **Length**—1.9375". Pin is locked in connecting rod by clampscrew.
Pin Fit in Piston—Free to .0002" clearance. When correctly fitted and installed, 2 lbs. pressure at end of rod should be required to rock rod.
Replacement Pins:—Furnished .003", .005" oversize.

CONNECTING ROD:—Weight 11 ozs. **Length** 5.75".
Crankpin Journal Diameter—1.25".
Lower Bearing—Spun babbitt-lined type. No shims.
Clearance—.0008-.0022". **Sideplay**—.004-.009".
Bearing Adjustment:—None (no shims). Replace rods. Do not file rods or bearing caps.
Installing Rods:—Lower bearings offset. Install with wide half away from center of engine.

CRANKSHAFT:—Three bearing, counterweighted type.
Journal Diameters—#1—1.9975", #2 & 3—2.4975".
Bearing Type—Babbitt-lined bushings front (with integral retainer) and rear (with separate retainer). Center bearing conventional split type.
Clearance—.001-.003".
Bearing Adjustment:—None. Replace bearings. Crankcase should be heated to temperature of boiling water (212°) to remove and install bearings. To remove bearing retainers proceed as follows:
Front Bearing Removal—Remove timing gear cover, pull both timing gears, take out four capscrews in retainer flange, use gear puller to remove bearing.
Center Bearing Removal—Conventional split type.
Rear Bearing Removal—Remove transmission and Clutch (see Transmission and Clutch Sections for directions), remove flywheel by removing 4 bolts and prying centering flange off crankshaft carefully. Remove nuts on bolts in bearing retainer flange, screw capscrews in each of two tapped holes in retainer, turn screws up evenly to force retainer and bearing out.
Replacement Bearings:—.003", .006", .009" undersize.
End Thrust:—By rear bearing. **Endplay**—.004-.006".

CAMSHAFT:—Three bearing. Helical gear drive.
NOTE—Front camshaft bushing retained by setscrew in upper part of crankcase. Screw must be removed in order to remove bushing.
Bearing Type—Bronze Bushings. **Clearance**—.002".
Replacement Bearings:—Front bushing furnished finished to size. Other bushings must be reamed.
End Thrust:—By rear face of camshaft gear hub and front end of front camshaft bushing. When installing timing gears, install camshaft gear first, tighten nut securely with endplay removed and shaft free.
Timing Gears:—Cast iron helical gears.
Camshaft Setting:—Mesh marked crankshaft gear tooth between two marked teeth on camshaft gear.

VALVES:—Intake marked 'INL', exhaust 'EXH' under head.

	Head Diameter	Stem Diameter	Length
Intake Valves	1.125"	.279"	3.25"
Exhaust Valves	1.03125"	.279"	3.25"

	Seat Angle	Lift	Stem Clearance
All Valves	45°	.257"	.0012-.0032"

Tappet Clearance:—.011" Int., .012" Exh. (hot 130°).
Valve Guides:—Pressed in block. Top of guide should be 1" below valve port. Finish ream new guides to inside diameter of .2807-.2817".
Valve Lifters:—Plunger type. Operate in individual guides in cylinder block. Guides removable from lower end after block removed from crankcase. Serviced by installing new lifter and guide assembly.
Lifter Clearance in Guide—.001".
Valve Springs:—Spring free length 1.6875".

	Spring Pressure	Spring Length
Valve Closed	28 lbs.	1¼"
Valve Open	44 lbs.	1"

Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 19° BTDC. Close 50° ALDC.
Exhaust Valves—Open 57° BLDC. Close 12° ATDC.
To Check Timing—Check tappet clearance of #1 intake valve (.011" warm). This valve should open with piston 19° or .115" before top dead center when point on flywheel 1 5/32" before '/' (TDC) mark lines up with indicator on housing under pit cover.

LUBRICATION:—Pressure system. Gear type oil pump.
Oil Pump:—Gear type. In crankcase at rear of engine. To remove pump, remove cylinder block from crankcase, take off flat cover on crankcase over oil pump driving gear, pull this gear, remove woodruff key in shaft. Remove oil pan, take out two screws holding oil pump body to crankcase, withdraw pump. Install pump in same manner.
NOTE—Oil pump screen (on elbow on pump cover in crankcase should be cleaned at 10000 mile intervals (average conditions), 2000-3000 mile intervals (extremely dusty or dirty conditions).
Normal Oil Pressure:—30 lbs. at 50 MPH.
Oil Pressure Regulator:—Spring-loaded ball check valve type located on right hand side of crankcase above pump (in large plug). Not adjustable.
Crankcase Capacity:—6 pints or 3 quarts.

COOLING:—Circulation—Thermo-syphon (no pump).
Capacity—6 quarts.

CLUTCH:—Rockford Model UCLA-3-1748. Single plate, dry disc type.
See article in Mechanical Equipment Section.
Facings—Moulded type, 2 used. Inside Diam. 6.5". Outside Diam. 8.4375". Thickness .125". NOTE—Front face floats between driven disc and flywheel (after Motor No. 65-500), rear facing riveted to pressure plate (driven disc is not lined).
Adjustment—Clutch pedal free travel should be 1". Turn adjustable link for correct free travel.
Removal:—Disconnect drive shaft at front universal flange, remove flywheel housing top cover, take out screws in flywheel housing rear cover, remove rear cover and transmission as a unit. Take out screws in clutch cover around flywheel rim (turn all screws out evenly to relieve pressure), lift clutch out.
NOTE—Car manufacturer recommends that engine be removed for easier access to clutch.

TRANSMISSION:—Warner Model AS1-T84E. Constant mesh, synchro-mesh, helical gears (Second & High), sliding spur gears (Low & Reverse).
See article in Mechanical Equipment Section for data.
Removal:—Disconnect drive shaft at front universal flange, drop shaft, take off nuts on transmission mounting studs, pull transmission back.
NOTE—If transmission removed for work on clutch, take out rear flywheel cover screws and remove transmission and cover as an assembly.

UNIVERSAL JOINTS:—Detroit Series 4100. Roller bearing Ball and Trunnion type. 2 used.
See article in Mechanical Equipment Section for data.

REAR AXLE:—Spicer Model 10. Semi-floating, sprial bevel gear type with Hotchkiss drive.
See article in Mechanical Equipment Section for data.
Ratio—5.25-1. **Backlash**—.006-.008".
Removal:—Disconnect drive shaft at rear universal. Disconnect brake cables and shock absorber links. Free spring clips at axle housing (or disconnect spring shackles to remove springs with axle), remove axle assembly from beneath car.
Axle Shaft Removal—Remove wheel, take out four capscrews in bearing retainer flange, remove grease retainer, bearing shims, brake flange. Use axle shaft puller to remove shaft and bearing.
Wheel Bearing Adjustment:—Controlled by shims under bearing retainer at outer end of axle shaft. Remove wheel, take out capscrews in retainer, remove retainer to adjust. **Endplay**—.008".

SHOCK ABSORBERS (PASS. CARS):—Monroe. Front: Model 1415 (right), 1414 (left). Rear: Conv'tble Sedan 1422 (right), 1423 (left); Others Bantam No. 8899 (right), 8900 (left). Single acting, hydraulic type. ***See article in Mechanical Equipment Section.***

SHOCK ABSORBERS (STATION WAGON & COMM'L):—Own Make. Friction disc type. Same as used on previous models. ***See 1938 Bantam 'M' page for servicing data.***

STEERING:—Steering Gear. Ross S-12. Cam-and-Lever type. ***See article in Mechanical Equipment Section.***
Front Suspension:—Conventional 'I' beam section front axle with transverse spring. Axle positioned by torque arm at each end.
Kingpin Inclination—1°30' crosswise.
Caster—15°. Not adjustable.
Camber—1°15'. Not adjustable.
Toe In—.0625-.125". Adjust tie rod.
Steering Geometry (Toe-out on turns)—With outer wheel turned 20°, inner wheel should be turned 24°18'.

BRAKES:—Service—Own Make. Four wheel, mechanical type. Hand lever applies all four service brakes.
Drums—Steel. Diameter 8".
Lining—Moulded type. Width 1.125". Thickness .1718". Length 13" per wheel.
Clearance—Shoes are self-centralizing.
Hand Brake:—See Service Brakes above.

TORQUE WRENCH SPECIFICATIONS:—*See Torque Wrench article in Mechanical Equipment Section for tightening specifications for Cylinder Head, Main & Connecting Rod Bolts, etc.*

FRONT END ASSEMBLY:—Radiator, fenders, and headlamps mounted on front fender iron assembly and reinforcement plate extending under radiator shell, fender and headlamp with cross bar ahead of radiator core attached to fenders. Assembly held by one bolt in center of front frame cross-member and attached to body at hood side panels, front fenders and fender skirt.

Front Fender Removal—Fender forms hood side panel, headlamp shell and part of radiator shell. May be removed as follows: Disconnect headlamp wires at junction block and fresh air intake at dash. Remove radiator grille, lower front fender bolts at radiator lower panel and radiator pan, bolts and nuts at cowl (on Series 50, 70, remove trim pad at front door hinge pillar for access to nuts), bolts holding fender assembly to upper radiator shell panel and fender iron to mounting strap, lift fender out.

HOOD SIDE PANEL:—No separate hood side panels (part of fender). See Front Fender Removal above.

ENGINE ASSEMBLY:—**Removal.** Engine and transmission may be removed from car as follows: Remove hood and hood center hinge. Remove front end assembly (fenders and radiator) as a unit. Disconnect wires at junction boxes, radiator hose and other connecting parts. Remove battery, disconnect gear shift linkage, clutch linkage and fuel pump intake line. Take out screws attaching front of torque tube to transmission and bolts holding engine to engine mountings. **Do not loosen engine mountings on frame or complete realignment with rear axle will be required when engine installed.** Hoist engine and transmission assembly out of car.

Installation:—Lower engine and transmission carefully in place (engage torque tube connection without disturbing alignment). Tighten front engine support-to-mounting bolts and torque tube-to-transmission screws. Install transmission steady rest (use original number of shims at each end). Install rear engine support-to-mounting screws, raise rear of engine (with jack under transmission) until supports are clear of mountings at each side, then lower slowly until one support just rests on mounting and shim up opposite mounting to level engine supports. Install transmission steady rest brace rod (leave nuts at cross-member loose while tightening bolt at X-member, then tighten nuts at cross-member so that no tension placed on rod).

Alignment—To check alignment, roll car on level floor with front wheels set straight ahead. Rear wheel tracks should overlap front wheel tracks an equal amount on each side. To adjust engine alignment, shift rear engine mountings on frame and shim transmission steady rest mounting at each end so that universal ball joint is exactly in center of car.

PISTONS:—'Dome head' type same as 1939 (with dome cut back 1/32" from piston edge and land clearance of .023-.030" on 40, 50, .026-.033" on 60, 70, 80, 90 and top edge of skirt relieved at horizontal slot) except that narrower top compression ring used (now 3/32", was ⅛"). Top ring has increased bearing surface in ring groove to prevent ring and land failure. Ring grooved depth increased from .148" to .166" (40, 50), .162" to .179" (60, 70, 80, 90). Top ring wall thickness increased from .140" to .155" (40, 50), .155" to .172" (60, 70, 80, 90).

CYLINDER BORE SIZES:—Original production (new engine) bore size indicated on all engines by number and color of paint marks on lower crankcase flange, under gasket, in line with each cylinder (not uniform for all cylinders of one block). See table below for sizes and markings. On engines where engine number followed by dash, all cylinders are .010" oversize.

PISTONS (ORIGINAL & REPLACEMENT):—Pistons graded for size in .0003" steps and marked by one or two color marks below pin bosses within piston skirt. Paper sticker on replacement pistons indicates piston size and cylinder bore for which intended. Pistons fitted in .010" oversize blocks are all low limit .010" oversize (see Replacement Piston table). All replacement pistons furnished with pins fitted. See table below for piston size for all bore diameters.

Series 40, 50—Original Production

Piston Diameter 3 3/32", #1394812 (1940)

Piston & Engine Mark	Piston Diameter	Cylinder Diameter
1—Yellow	3.0892-3.0895"	3.0910-3.0913"
2—Yellow	3.0895-3.0898"	3.0913-3.0916"
1—Green	3.0898-3.0901"	3.0916-3.0919"
2—Green	3.0901-3.0904"	3.0919-3.0922"
1—White	3.0904-3.0907"	3.0922-3.0925"
2—White	3.0907-3.0910"	3.0925-3.0928"
1—Red	3.0910-3.0913"	3.0928-3.0931"
2—Red	3.0913-3.0916"	3.0931-3.0934"

Series 60, 70, 80, 90—Original Production

Piston Diameter 3 7/16", #1394823 (1940)

Piston & Engine Mark	Piston Diameter	Cylinder Diameter
1—Yellow	3.4340-3.4343"	3.4360-3.4363"
2—Yellow	3.4343-3.4346"	3.4363-3.4366"
1—Green	3.4346-3.4349"	3.4366-3.4369"
2—Green	3.4349-3.4352"	3.4369-3.4372"
1—White	3.4352-3.4355"	3.4372-3.4375"
2—White	3.4355-3.4358"	3.4375-3.4378"
1—Red	3.4358-3.4361"	3.4378-3.4381"
2—Red	3.4361-3.4364"	3.4381-3.4384"

Replacement Oversize Pistons

Pistons furnished in following oversizes, graded and marked in same manner as for previous cars. *See Buick Shop Note 'M' page in Manual (or 1938 Supplement) for size graduations and markings for these oversize pistons.*

Oversize	40, 50 — Part No.	60, 70, 80,90
.001"	1394813	1394824
.005"	1394814	1394825
.010"	1394815	1394826
.015"	1394816	1394827
.020"	1394821	1394828
.030"	1394822	1394829

REPLACEMENT PISTON RINGS:—Car manufacturer supplies oversize rings in sizes listed below and recommends that they be fitted to pistons as follows:

Ring Oversize	Piston Oversize
.010"	.005" to .010"
.020"	.011" to .020"
.030"	.021" to .030"

NOTE—Cylinder bores up to .005" max. taper can usually be serviced by installing Perfect Circle X-90 piston ring sets (supplied by car manufacturer).

Excessive Oil Consumption Note—When installing rings to correct this condition use a fine hone very lightly on all bores (just enough to dull glaze surface and not changing bore size). This will allow quicker break-in of new rings.

New Top Compression Ring—New service tool KMO-297-E (40, 50), KMO-297-D (60, 70, 80, 90) necessary for removing and replacing this ring.

REPLACEMENT MAIN BEARINGS:—Bearings are furnished (singly) or finished (sets only) as follows:

Unfinished—Have .012-.014" diameter extra babbitt stock and must be line-reamed to size.

Finished—Furnished in sets of 5 only which are finish-reamed as a set and require no reaming when installed (must not be used singly).

ROCKER ARMS:—Same as 1939. Rocker arms are mounted on tubular shaft and held against side of shaft brackets by spring installed on shaft between adjacent rocker arms. Shaft retained in brackets by pilot setscrew installed in top of #2 bracket. When installing rocker arms, make certain that lug on side of arm at adjusting screw end is toward bracket (all rocker arms Series 40, 50, intake rocker arms Series 60, 70, 80, 90). Exhaust rocker arms for Series 60, 70, 80, 90 are straight (no offset) and do not have reference lug.

Rocker Arm Clearance—.002-.004".

Rocker Arm Lubrication Connection:—Metering restriction for oil feed to hollow rocker arm shaft located in cylinder head and oil pipe fitted directly into top of #1 bracket. #1 and #2 brackets are same part and shaft pilot screw is self-tapping type.

OIL PUMP:—Slot in pump shaft engages tongue on end of distributor shaft. Distributor shaft only pinned to drive gear.

Drive Clearances—Drive shaft bearing .001-.0025". Drive gear backlash .003-.005".

Pump Gear Clearances—Idler gear bearing .001-.0025". Backlash .003-.006". End Clearance .0005-.004".

Relief Valve Clearance—.003-.006".

CLUTCH OVER-CENTER RETURN SPRINGS:—Used on all models. Similar in design to corresponding 1939 models. Connected between frame cross-member and equalizer shaft (40, 60), bracket and clutch pedal (50, 70, 80, 90).

Adjustment—Tighten nut under frame cross-member (40, 60), bracket mounting eyebolt (50, 70, 80, 90) by turning nut up to limit of threads so as to stretch spring as much as possible.

TRANSMISSION STEADY REST:—Transmission support at universal joint housing which is part of engine mounting. Consists of cross-member bolted to leg of 'X' member at each end and to universal joint housing at center. A positioning brace rod is connected between the steady rest and the lower center plate of the 'X' member.

Adjustment—Bolt holes in frame and support are slotted and shims installed at each of support for for centering. Make certain that shims in place when installing steady rest, tighten nuts on two center bolts up tight against spacer, adjust steady rest so that no upward tension placed on transmission, adjust brace rod so that it is tight with no tension placed on rod.

SERIES 60, 70 NOTE:—All data on Rear Axle, Shock Absorbers and Steering given below applies also to Series 60 and 70 cars.

SERIAL NUMBER:—First number 13596807 (Flint), 23601856 (California), 33611856 (Linden). Stamped on top right frame side rail at dash.

ENGINE NUMBER:—First number (40) 4—, (50) 5—3786214 (same number for both series). On boss on right side of crankcase to rear of fuel pump. NOTE—Dash (—) following engine number indicates engine equipped with .010" oversize pistons.

ENGINE SPECIFICATIONS:—Own 40, 50. 8 cylinder, 'I' head type. **Bore**—3 3/32". **Stroke**—4⅛".
Displacement—248 cu. ins. **Rated HP.**—30.63.
Developed Horsepower—107 at 3400 RPM.
Compression Ratio—6.1-1 Std. cast-iron head.
Compression Pressure—126 lbs at 1000 RPM., 112 lbs. at cranking speed (uniform within 6 lbs.).
Vacuum Reading—Steady 18-20" idling at 7-8 MPH.
See Buick Shop Notes for Engine Removal and Installation.

PISTONS:—Modified 'Dome Head', aluminum alloy, tri-slot, cam ground, anodized finished type.
See Buick Shop Notes for description and all Replacement Piston specifications and data. **Length**—4 9/32". **Weight**—14¼ ozs. (stripped), 20.16 (with rings & pin).
Removal—Pistons and rods removed from above. **Clearance**—.0021" (.0018-.0024") top of skirt.
Fitting New Pistons:—If micrometer used, check at points on each side of vertical slot at top of skirt, and at lower end of slot (light contact only). Clearance above correct for pistons at 70° F. If feeler gauge used, install ½" wide feeler between piston and cylinder wall on side opposite slot (piston inverted, pin parallel to crankshaft). Piston should pass on .0015" feeler, hold on .00225" feeler.
Installing Pistons:—Slot away from camshaft.

PISTON RINGS:—Two compression (new top ring), two oil control rings, all above pin (heat-dam groove above top ring). Oil ring grooves drilled for oil drains. NOTE—Install top compression ring with relief up, #2 with mark 'TOP' up.

Ring	Width	End Gap	Side Clearance
Compr. ①	3/32"	.010-.020"	.0015-.003"
Oil Control	3/16"	.010-.015"	.0015-.003"

①—Wall thickness Top .155", #2 .140".
Replacement Rings:—***See Buick Shop Notes.***

PISTON PIN:—Diameter—.8127". **Length**—2 11/16". Pin clamped in rod. Not furnished separately (all replacement pistons have pins installed).
Pin Fit in Piston—.0003-.0004" at 70° F. (easy finger push fit at room temperature).
NOTE—Use #25 wrench (5½") only on pin bolt.

CONNECTING ROD:—Length—7⅝". **Weight**—30¾ ozs. Maximum weight variation ⅛ ounce.
Crankpin Journal Diameter—2".
Lower Bearing—Spun babbitt-lined type.
Clearance—.0008-.0018". **Sideplay**—.005-.010".
Bearing Adjustment:—Shims. Do not file rods or caps.
Installing Rods:—Marks on rod and cap toward rear of engine, oil hole to camshaft. Align rod and cap. NOTE—Use special ground bolts on rod caps.

CRANKSHAFT:—5 bearing, 8 integral counterweights.
Journal Diameters—#1, 2 5/16"; #2, 2⅜"; #3, 2 7/16"; #4, 2½"; #5, 2 9/16".
Bearings—Steel-backed, babbitt-lined type.
See Buick Shop Notes for Replacement Bearing data.
Clearance—.0007-.0022".
Bearing Adjustment:—Shims. Do not file caps.
End Thrust:—Center (#3) bearing. **Endplay** .004-.008".

CAMSHAFT:—5 bearing. Non-adjustable chain drive.
Journal Diameters—#1, 2 5/32"; #2, 2⅛"; #3, 2 3/32"; #4, 2 1/16"; #5, 1¾".
Bearing Type—Steel-backed, babbitt bushings.
Clearance—.0005-.0035". **Endplay**—.004-.008".
End Thrust:—Thrust plate between front bearing and camshaft sprocket.
Timing Chain:—Link-Belt. Width 1". Pitch .500". Length 24½" or 49 links. Initial slack ¼-⅜". 1" worn.
Camshaft Setting:—Mesh copper-plated washers on chain (10 links apart) with sprocket marks upward.

VALVES:—

	Head Diam.	Stem Diam.	Overall Length
Intake	1 17/32"	.3720"	5.1"
Exhaust	1 11/32"	.3715"	5.1"

	Seat Angle	Lift	Stem Clearance
Intake	45°	.348"	.0015-.0035"
Exhaust	45°	.348"	.0021-.0039"

Series 50 Note—Cylinder head must be removed in order to take out #16 push rod.
Tappet Clearance:—.015" all valves—engine hot.
Valve Guides:—Press fit in head, installed with taper end up. Finish ream for correct clearance.
Valve Springs:—Double springs on all valves. Spring free length 1⅞" (inner), 2 5/16" (outer).

	Inner Spring Pressure	Inner Spring Length	Outer Spring Pressure	Outer Spring Length
Closed	15½-20½ lbs.	1 21/32"	26½-31½ lbs.	1 15/16"
Open	45-51 lbs.	1 5/16"	67-73 lbs.	1 19/32"

Valve Lifters:—Barrel type, cast-iron. Lifter guide holes reamed in block. **Clearance**—.0005-.0025".
Rocker Arms:—***See Buick Shop Notes for installation and fitting directions.***
Valve Timing:—See Camshaft Setting above.
Timing Points (Valve .004" Open)
Intake Valves—Open 13° BTDC. Close 68° ALDC.
Exhaust Valves—Open 55° BLDC. Close 22° ATDC.
Opening & Closing Points
Intake Valves—Open 26° BTDC. Close 81½° ALDC.
Exhaust Valves—Open 68° BLDC. Close 35° ATDC.
Valve Timing Check—With .015" tappet clearance, #2 or 7 exhaust valve should be .145" open (actual valve opening—use dial indicator) with #1 & 8 pistons at TDC and flywheel mark 'TDC/1-8' at indicator (inspection hole, right front face of housing).

LUBRICATION:—Pressure type (gear type oil pump in crankcase). ***See Buick Shop Notes for Oil Pump data.***
Normal Oil Pressure:—45 lbs. at 35 MPH.
Oil Pressure Regulator:—On pump. Opens at 45 lbs. Non-adjustable type.
Crankcase Capacity:—8 qts. (dry), 6 qts. (refill).

COOLING SYSTEM:—Capacity—13¼ quarts.
Water Pump:—Ball-bearing, packless type.
See article in Mechanical Equipment Section for data.
Thermostat:—Harrison. In cylinder head outlet.
Setting—Opens at 148-155° F. Fully open 173° F.
Temperature Gauge:—AC #1510906 Thermo gauge.
See article in Mechanical Equipment Section for data.

CLUTCH:—Own Make with Long 10CS-CT or Borg & Beck 'Borglite' driven member. Single plate, 'crown spring' type.
See article in Mechanical Equipment Section for data.
Facings—Spiral or chevron wound woven (Long), Spiral wound molded woven (B&B), 2 used. Inside Diam. 6½" (B&B), 6¾" (Long). Outside Diam. 10". .125" thick.
Adjustment:—Pedal free movement ¾-1" (adjusting clevis and locknut on link at clutch fork). Pedal toeboard clearance (underside) ⅞" (setscrew and locknut at lower end of pedal).
Removal:—Remove Rear Axle & Transmission (see below), take off clutch underpan, release return spring (back off nut on spring eyebolt on 50), disconnect linkage, remove yoke and release bearing retainer, mark clutch and flywheel (reassemble to marks), remove mounting screws in cover flange.
See Buick Shop Notes for 'Over-center' Return Spring installation and adjustment.

TRANSMISSION:—Own Make. All helical gear, constant-mesh, synchro-mesh (second and high), sliding gear (low and reverse) with new remote shift.
Transmission Control:—Buick 'Handi-shift' type.
See articles in Mechanical Equipment Section for data.
Removal:—Remove Rear Axle (see below), disconnect shifter rods at transmission, remove selector (lower) lever, rear transmission support (wire shims to ends of support for correct replacement) and steady rest rod, upper mounting bolts, install guide pins (J-851), remove lower bolts, pull transmission out.
NOTE—See Mechanical Equipment Section for shifter linkage adjustment when installing transmission.
Transmission Steady Rest—***See Buick Shop Notes for installation and adjustment instructions.***

UNIVERSAL JOINT:—Saginaw or Spicer 202-5. 1 used.
See article in Mechanical Equipment Section for data.

REAR AXLE (40, 50, 60, 70):—Own Make. Semi-floating, hypoid gear type with torque tube drive.
See article in Mechanical Equipment Section for data.
Ratio—4.4-1 (white) Std. 40, 50. 3.9-1 (red) Std. 60, 70, Optl. 40. 3.6-1 (blue) Optl. 60. Paint marks on outer ends of axle shaft flanges. **Backlash** .008-.010".
Removal:—Hoist rear of car; disconnect parking brake at equalizer, hydraulic brake line at fitting anchored to left channel iron-strut, lower end of shock absorber links, rear radius rod at axle end, lower end of chassis springs (tie springs to bumper for clearance). Disconnect torque tube at universal joint ball, remove axle assembly from beneath car. IMPORTANT—2 piece torque tube assembly used (flanged at rear end and bolted to carrier). **Torque tube should never be dismantled at rear end except for gasket replacement.** Furnished as complete assembly only.
Axle Shaft Removal:—***See Mechanical Equipment Section.*** NOTE—Right shaft is ¾" longer than left.
Wheel Bearing Adjustment—None.
Rear Suspension:—Coil springs, conventional axle.
See article in Mechanical Equipment Section for data.

SHOCK ABSORBERS (40, 50, 60, 70):—Delco. Front—Model 1948-A. **Rear**—2105-A, B. Double acting hydraulic. Parallel cylinder type used on rear.
See article in Mechanical Equipment Section for data.

STEERING (40, 50, 60, 70):—Steering Gear. Saginaw Worm-and-Double roller type.
See article in Mechanical Equipment Section for data.
Front Suspension:—Independent, linked parallelogram type.
See article in Mechanical Equipment Section for data.
Kingpin Inclination—3½-4½° crosswise.
Camber—Negative ¼° to Pos. 1°. Not adjustable.
Caster—⅜° ± ⅜°. Adjustable.
Toe In—0-1/16". Adjust rods equally.
Steering Geometry (Toe-out on Turns)—Inner wheel turned 22° ± ¾°, outer wheel 20°.

BRAKES:—**Service**—Bendix hydraulic, duo-servo, single anchor type without eccentric adjustment. Hand lever applies rear wheel service brakes.
See article in Mechanical Equipment Section for data.
Drums—Centrifuse type. Diameter 12".
Lining—Woven—Ferodo BZ-10 (primary), Moulded Manhattan Raybestos #2320K (secondary). Width 1¾". Thickness 3/16". Length 9 15/16" (primary), 12¾" (secondary).
Clearance—.015" at both ends of secondary shoe (with primary shoe forced out against drum).
Braking Power—47% rear, 53% front.
Hand Brake:—See Service Brakes above.
NoRol:—Optl. *See Mechanical Equipment Section.*

SERIES 60, 70 NOTE:—For data on Rear Axle, Shock Absorbers and Steering, refer to preceding Series 40, 50 data. All other data listed below applies to Series 60 and 70.

SERIAL NUMBER:—First number 13596807 (Flint), 23601856 (California), 33611856 (Linden). Stamped on top right frame side rail at dash.

ENGINE NUMBER:—First number (60) 6—, (70) 7—, (80) 8—, (90) 9-381200 (same number all series). On boss on right side of crankcase to rear of fuel pump. NOTE—Dash (—) following engine number indicates engine equipped with .010" oversize pistons.

ENGINE SPECIFICATIONS:—Own 60, 70, 80, 90. 8 cylinder 'I' head type. **Bore** 3 7/16". **Stroke** 4 5/16". **Displacement**—320.2 cu. ins. **Rated HP.**—37.81. **Developed Horsepower**—141 at 3600 RPM. **Compression Ratio**—6.25-1 Std. cast-iron head. **Compression Pressure**—130 lbs. at 1000 RPM., 114 lbs. at cranking speed (uniform within 6 lbs.). **Vacuum Reading**—Steady 18-20" idling at 7-8 MPH. ***See Buick Shop Notes for Engine Removal and Installation instructions.***

PISTONS:—Modified 'Dome Head', aluminum alloy, tri-slot, cam ground, anodized finished type. ***See Buick Shop Notes for description and all Replacement Piston specifications and data.*** **Length** 4 7/16". **Weight**—17¼ ozs. (stripped), 24.96 (with rings and pin).

Removal—Pistons and rods removed from above. **Clearance**—.0023" (.0020-.0026") top of skirt.

Fitting New Pistons:—If micrometer used, check at points on each side of vertical slot at top of skirt, and at lower end of slot (light contact only). Clearance above correct for pistons at 70° F. If feeler gauge used, install ½" wide feeler between piston and cylinder wall on side opposite slot (piston inverted, pin parallel to crankshaft). Piston should pass on .0015" feeler and hold on .00225" feeler.

Installing Pistons:—Slot away from camshaft.

PISTON RINGS:—Two compression (new top ring), two oil control rings, all above pin (heat-dam groove above top ring). Oil ring grooves drilled for oil drains. NOTE—Install top compression ring with relief up, #2 with mark 'TOP' up.

Ring	Width	End Gap	Side Clearance
Compr. ①	3/32"	.010-.020"	.0015-.003"
Oil Control	3/16"	.010-.015"	.0015-.003"

①—Wall thickness Top .172", #2 .150".

Replacement Rings:—***See Buick Shop Notes.***

PISTON PIN:—Diameter—.8747". **Length**— 3 1/16". Pin clamped in rod. Not furnished separately (all replacement pistons have pin installed).

Pin Fit in Piston—.0003-.0004" at 70° F. (easy finger push fit at room temperature).

NOTE—Use #25 wrench (5½") only on pin bolt.

CONNECTING ROD:—Length 8¼". **Weight** 38 ozs. Maximum weight variation ⅛ ounce. **Crankpin Journal Diameter**—2¼". **Lower Bearing**—Spun babbitt-lined type. **Clearance**—.0008-.0018". **Sideplay**—.005-.010".

Bearing Adjustment:—Shims. Do not file rods or caps.

Installing Rods:—Marks on rod and cap toward rear of engine, oil hole to camshaft. Align rod and cap. NOTE—Use special ground bolts on rod caps.

CRANKSHAFT:—5 bearing, 8 integral counterweights. **Journal Diameters:**—#1, 2 9/16"; #2, 2⅝"; #3, 2 11/16"; #4, 2¾"; #5, 2 13/16". **Bearings**—Steel-backed, babbitt-lined type. ***See Buick Shop Notes for bearing replacement data.*** **Clearance**—.0007-.0022".

Bearing Adjustment:—Shims. Do not file caps.

End Thrust:—Center (#3) bearing. **Endplay** .004-.008".

CAMSHAFT:—5 bearing. Non-adjustable chain drive. **Journal Diameters**—#1, 2 5/32"; #2, 2⅛"; #3, 2 3/32"; #4, 2 1/16"; #5, 1¾". **Bearing Type**—Steel-backed, babbitt bushings. **Clearance**—.0005-.0035". **Endplay**—.004-.008".

End Thrust:—Thrust plate between front bearing and camshaft sprocket.

Timing Chain:—Link-Belt. Width 1". Pitch .500". Length 25" or 50 links. Initial slack ¼-⅜". 1" worn.

Camshaft Setting:—Mesh copper-plated washers on chain (10 links apart) with sprocket marks upward.

VALVES:—

	Head Diam.	Stem Diam.	Overall Length
Intake	1 25/32"	.3720"	5¼"
Exhaust	1 7/16"	.3715"	5¼"

	Seat Angle	Lift	Stem Clearance
Intake	45°	.347"	.0015-.0035"
Exhaust	45°	.342"	.0021-.0039"

Series 70 Note—Cylinder head must be removed in order to take out #16 push rod.

Tappet Clearance:—.015" all valves—engine hot.

Valve Guides:—Press fit in head, installed with taper end up. Finish ream for correct clearance.

Valve Springs:—Double springs used on all valves. Spring free length 1⅞" (inner), 2 5/16" (outer).

	Inner Spring Pressure	Inner Spring Length	Outer Spring Pressure	Outer Spring Length
Closed	15½-20½ lbs.	1 21/32"	26½-31½ lbs.	1 15/16"
Open	45-51 lbs.	1 5/16"	67-73 lbs.	1 19/32"

Valve Lifters:—Barrel type, cast-iron. Lifter guide holes reamed in block. **Clearance**—.0005-.0025".

Rocker Arms:—***See Buick Shop Notes for installation and fitting directions.***

Valve Timing:—See Camshaft Setting above.

Timing Points (Valve .004" Open)

Intake Valves—Open 14° BTDC. Close 71° ALDC.
Exhaust Valves—Open 56° BLDC. Close 25° ATDC.

Opening & Closing Points

Intake Valves—Open 27° BTDC. Close 84½° ALDC.
Exhaust Valves—Open 69° BLDC. Close 38½° ATDC.

Valve Timing Check—With .015" tappet clearance, #2 or 7 exhaust valve should be .155" open (actual valve opening—use dial indicator) with #1 & 8 pistons on TDC and flywheel mark 'TDC/1-8' at indicator (inspection hole, right front face of housing).

LUBRICATION:—Pressure type (gear type oil pump in crankcase). ***See Buick Shop Notes for oil pump data.*** **Normal Oil Pressure**—45 lbs. at 35 MPH. **Oil Pressure Regulator**—On pump. Opens at 45 lbs. Non-adjustable type. **Crankcase Capacity**—10 qts. (dry), 8 qts. (refill).

COOLING SYSTEM:—Capacity—17 quarts.

Water Pump:—Ball-bearing, packless type. ***See article in Mechanical Equipment Section for data.*** **Removal**—Remove fan belt, pump mounting bolts, lift off pump and fan assembly.

Thermostat:—Harrison. In cylinder head water outlet. **Setting**—Opens at 148-155° F. Fully open 173°.

Temperature Gauge:—AC #1510906 Thermo gauge. ***See article in Mechanical Equipment Section for data.***

CLUTCH:—Own make with Borg & Beck 'Borglite' driven member. Single plate, dry disc type. ***See article in Mechanical Equipment Section for data.*** **Facings**—Spiral wound molded woven, grooved type. 2 used. Inside Diam. 6½". Outside D. 10½". ⅛" thick.

Adjustment:—Pedal free movement ¾-1" (adjusting clevis and locknut on link at clutch fork). Pedal toeboard clearance (underside) ⅞" (setscrew and locknut at lower end of pedal).

Removal:—Remove Rear Axle & Transmission (see below), take off clutch underpan, release return spring (back off nut on spring eyebolt on 70, 80, 90), disconnect linkage, remove yoke and release bearing retainer, mark clutch and flywheel (reassemble to these marks), remove mounting screws in cover flange. NOTE—Metal spacers may be used between release levers and cover to relieve spring tension. ***See Buick Shop Notes for 'Over-center' return spring installation and adjustment.***

TRANSMISSION:—Own Make. All helical gear, constant-mesh, synchro-mesh (second and high), sliding gear (low and reverse) with new remote shift.

Transmission Control:—Buick 'Handi-shift' type. ***See articles in Mechanical Equipment Section for data.***

Removal:—Remove Rear Axle (see below), disconnect shift linkage at transmission, remove rear transmission support (wire shims to ends of support for correct replacement) and steady rest rod, remove upper mounting bolts, install guide pins (J-851), remove lower mounting bolts, pull transmission out. ***NOTE—See Mechanical Equipment Section for shifter linkage adjustment when installing transmission.***

Transmission Steady Rest—***See Buick Shop Notes for installation and adjustment instructions.***

UNIVERSAL JOINT:—Saginaw or Spicer 202-3. 1 used. ***See article in Mechanical Equipment Section for data.***

REAR AXLE (80, 90):—Own Make. Semi-floating, hypoid gear type with torque tube drive. See Series 40, 50 (preceding page) for 60, 70 data. ***See article in Mechanical Equipment Section for data.*** **Ratio**—4.182-1 (80), 4.555-1 (90). **Backlash** .008-.010".

Removal:—Hoist rear of car; disconnect parking brake at equalizer, hydraulic brake line at fitting anchored to left channel iron-strut, lower end of shock absorber links, rear radius rod at axle end, lower end of chassis springs (wire springs to bumper for clearance). Disconnect torque tube at universal joint ball, remove axle assembly from beneath car.

Axle Shaft Removal:—***See Mechanical Equipment Section.*** NOTE—Right axle shaft 15/16" longer than left shaft.

Wheel Bearing Adjustment—None.

Rear Suspension:—Coil springs, conventional axle. ***See article in Mechanical Equipment Section for data.***

SHOCK ABSORBERS (80, 90):—Delco. Front—Model 1902-E, **F. Rear**—1751-R, S. Double acting, hydraulic. See Series 40, 50 (preceding page) for 60, 70 data. ***See article in Mechanical Equipment Section for data.***

STEERING (80, 90):—Steering Gear. Saginaw Worm-and-Double roller type. See Series 40, 50 page (preceding) for 60, 70 data. ***See article in Mechanical Equipment Section for data.***

Front Suspension:—Independent, linked parallelogram type with coil springs. **Kingpin Inclination**—4-5° crosswise. **Camber**—Negative ¼° to Pos. 1°. Not adjustable. **Caster**—0° ± ⅜°. Adjustable. **Toe In**—0-1/16". Adjust rods equally. **Steering Geometry (Toe-out on turns)**—Inner wheel turned 24° ± ¾°, outer wheel 20°.

BRAKES:—Service—Bendix hydraulic, duo-servo, single anchor type without eccentric adjustment. Hand brake applies rear wheel service brakes. ***See article in Mechanical Equipment Section for data.*** **Drums**—12" centrifuse (60,70). 14" cast-iron (80,90). **Lining**—Woven—Ferodo BZ-10 (primary), Moulded Manhattan Raybestos #2320K (secondary). Width 2¼" (60, 70), 2" (80, 90). Length—Primary 10" (60, 70), 12 1/16" (80, 90), Secondary 12 15/16" (60, 70), 14¾" (80, 90). **Clearance**—.015" at both ends of secondary shoe (with primary shoe forced out against drum). **Braking Power**—47% rear, 53% front.

Hand Brake:—See Service Brakes above.

NoRol:—Optl. ***See Mechanical Equipment Section.***

TORQUE WRENCH SPECIFICATIONS:—*See Torque Wrench article in Mechanical Equipment Section for tightening specifications for Cylinder Head, Main & Connecting Rod Bolts, etc.*

HOOD & SIDE PANEL REMOVAL:—Hood hinged at cowl and lifts from forward end. Tilt radiator ornament back to free latch, lift hood slightly, free safety catch under forward edge of hood, lift up. NOTE—1940 V8 Models equipped with automatic safety catch (released by radiator ornament).

Side Panels—Secured by a screw at each corner at top edge and by 3 screws (V8), by clips (V16) along lower edge. To remove, take out screws and lift panel off.

FRONT SHEET METAL ASSEMBLY:—Radiator, radiator grilles and front fenders all bolted together (may be removed or installed as a unit). One bolt in center of radiator support engages enlarged hole in frame front cross member (enlarged hole permits moving entire assembly fore-and-aft, shims under mounting bolt control height). Fender-to-body bolt holes also enlarged to permit shifting assembly.

Alignment—Assembly must be aligned in following order: 1) Install and center hood (proper clearance at cowl must also be secured). 2) Install fender and grille assembly (leaving bolts loose), align with hood and tighten bolts. 3) Adjust radiator tie rods and tighten for snug fit (check radiator shutter for free movement). NOTE—Do not attempt to change front end alignment by shifting tie rods (may cause radiator shutter frame misalignment).

RADIATOR REMOVAL (ALL SERIES):—To remove radiator core, drain cooling system, remove hoses and radiator tie rods, disconnect shutter rod at thermostat (V8). Remove air cleaner (V8), ignition coils (V16), generator, fan and inlet elbow on left fuel pump (V16). Disconnect headlamp wires at block on right fender and remove harness from radiator (V8). Take out radiator mounting screws at each side and lift out core.

CYLINDER HEAD GASKETS (V8 MODELS):—Care must be exercised to install proper gasket. Use of wrong gasket may cause sluggish engine performance. Part No. 1419114 (50, 52), 1419759 (60S, 62, 72, 75) stamped between inner bores.

Installation—Interchangeable between banks. Install large triangular hole on inner edge to rear.

CYLINDER HEAD IDENTIFICATION (V8 MODELS):—Cadillac 72, 75; La Salle 50, 52. Same cylinder head used on both (provides higher compression ratio on 72, 75). All production cylinder heads marked with piston displacement and compression ratio as follows: Right Hand Head 322-625 and 346-670, Left Hand Head—322-625 (La Salle 50, 52), 346-670 (Cadillac 72, 75). Replacement heads marked with both ratios (both right and left hand heads).

Cadillac 60S, 62. These heads have ratio of 6.25-1. Interchangeable between these models only.

CYLINDER HEAD INSTALLATION:—V8 Models. Two capscrews used at water outlet connection on each head have oversize head and are ½" longer. Must not be used in any other position (will damage head if installed in any other holes).

V16 Models. Install short capscrews along lower edge of head, coat all screws with white lead before installing (necessary to prevent leaks as screws enter water jacket). Tighten screws from center of head outward, retighten with engine warmed up.

LOWERING COMPRESSION RATIO (V8 MODELS):—Standard compression ratio may be lowered by installing two shims between cylinder head and block.

REPLACEMENT PISTONS (ALL MODELS):—Finished aluminum alloy, T-slot, cam ground pistons with anodized finish furnished for service in sizes (with piston skirt diameter limits) listed below.

CADILLAC V8 AND LA SALLE V8

Size	La Salle V8	Cadillac V8
Standard	3.3726-3.3746"	3.4979-3.4999"
.003" oversize	3.3761-3.3776"	3.5014-3.5029"
.005" oversize	3.3781-3.3796"	3.5034-3.5049"
.010" oversize	3.3831-3.3846"	3.5084-3.5099"
.015" oversize	3.3881-3.3896"	3.5135-3.5149"
.030" oversize	3.4031-3.4046"	3.5284-3.5299"

CADILLAC V16

Size	Cadillac V16
Standard	3.2483-3.2503"
.005" oversize	3.2538-3.2553"
.010" oversize	3.2588-3.2603"
.015" oversize	3.2638-3.2653"
.030" oversize	3.2788-3.2803"

PISTON PIN SERVICING (V8 MODELS):—Removal. Heat piston in boiling water to expand pin hole, push pin out by hand from ribbed boss end (one boss marked by raised rib on underside within piston). Do not use arbor press to remove pins.

Pin Bushing in Connecting Rod:—Split type. Press out old bushing in arbor press (use sudden jerk to start bushing). Use special tool kit No. HM-250 to install new bushings. Insert bushing with split at right angles to rod center-line, and oil hole lined up with oil hole in rod, press bushing into rod with special bushing replacer and arbor press. Finish bushing by pressing burnishing bar through bushing (use kerosene as lubricant) using 2 or 3 ton arbor press, check pin fit, repeat burnishing operation until correct clearance secured.

Installing Pin:—Heat piston in boiling water, coat pin with engine oil, press pin in by hand from side opposite ribbed boss.

PISTON PIN REMOVAL & INSTALLATION (V16):—Rod web split at pin hole with clampscrew below pin (pin hole not split open) and pin must be removed and installed as follows: With locking screw removed, use tool J-1167 to spread split end of connecting rod, then tap pin out of piston and rod with brass drift. Install in same manner.

CONNECTING RODS (V8 MODELS):—Rods are split at an angle at lower end to permit removal through top of block. Caps doweled in rod and held by special capscrews (unequal length) with lockwashers under head. Use new lockwashers (Part #1419129)

Connecting Rod Bearing Installation:—Bearing halves not interchangeable (upper half has oil holes for piston pin oil channel and spray hole for cylinder wall lubrication). When installing upper halves, oil holes must line up with drilled holes in rod.

MAIN BEARING SERVICING (ALL MODELS):—Removal. To remove bearing upper halves (without removing crankshaft), use cotterpin with head flattened to "T' shape inserted in crankshaft oil hole, rotate crankshaft in reverse direction to turn bearing shell out. Rotate new bearing shell in place in same manner (making sure locating lug on bearing shell in correct position to seat in groove in block).

Rear Main Bearing Oil Seal Installation:—With crankshaft out of engine (remove bearing shells to prevent damaging), install length of new packing making certain that it is inserted behind sheet metal retainer, drive packing up into place in crankcase with tool J-1177 (pound handle of tool with hammer to seat packing), cut off each end of packing flush with bearing edge before removing tool. Install packing in bearing cap in same manner

CAMSHAFT BEARING SERVICING (V8 MODELS):—Removal. To remove camshaft, remove radiator and engine front cover, transmission and flywheel housing, distributor and oil pump drive gear, valve lifter assemblies, timing chain and sprockets. Pull camshaft out, press old bushings out (use tool J-829).

Camshaft Bushing Installation:—Paint outside surface of bearings with white lead, install front bearing first, rear bearing second, center bearing last (in each case, pilot installing tool in other two bearings). Make certain that oil holes aligned.

CAMSHAFT SERVICING (V16 MODELS):—Camshaft must be removed for all service operations.

Removal & Installation:—Remove front end assembly (radiator & frt. fenders) as unit, disconnect the flexible pipes from gasoline lines to fuel pumps and jack up front of engine, remove crankshaft balancer and pulley, chain case cover, timing chain and camshaft sprocket, valves, valve lifters, vacuum pump and operating plunger. Install special camshaft tool J-1210 (attach by turning tool into tapped hole for sprocket screw), withdraw camshaft. When installing camshaft, make certain that front camshaft bearing is properly installed.

VALVE SERVICING (V8 MODELS):—Valves should be checked with gauge J-1055 for correct stem length when installed (grind off end of stem until gauge slides in place with valve in closed position).

NOTE—Valve lifter assemblies must be removed before valve springs can be compressed to remove spring keepers and free valves. Use tool J-827 to hold plungers down when re-installing lifters. Use tool J-257-X to compress valve springs for spring keeper removal and installation.

LUBRICATION SYSTEM SERVICING (V8 MODELS):—Clean all oil lines and channels in block before installing new main or connecting rod bearings. To clean channels in block, remove oil pump and take out plug at front end of crankcase oil header (left side at angle of crankcase and cylinder block). Use compressed air and shots of kerosene at plug hole to clean lines (if engine dismantled, take out plugs at line to each bearing, clean lines with wire brush). Clean oil hole at lower end of each rod.

Oil Pump Specifications:—Oil pump drive gear Backlash .008-.012", Endplay .001-.004" (new), .006" (worn). Drive shaft clearance in pump body .0010-.0025" (new), .005" (worn). Pump gear clearance in pump body .002-.004" (new), .006" (worn).

LUBRICATION SYSTEM SERVICING (V16 MODEL):—Clean oil passages in block in same manner as for V8 models. If auxiliary relief valve for hydraulic valve lifter lines removed (located at rear of left hand lifter passage) make certain that relief hole turned so that oil will flow against camshaft and not on oil pump gears when valve reinstalled. Do not disturb plugs in crankcase directly above each valve lifter oil passage.

Oil Pump Specifications—Same as V8 models above.

CLUTCH BALANCING (ALL MODELS):—Balance clutch after installation by running the engine (with rear wheels jacked up) at speeds of 24 to 30 MPH. (for V8), 32 to 38 MPH. (for V16) and checking vibration. Add ⅛" washers with 5/16" hole under mounting screw heads (start at point where clutch drilled for balance) until vibration gone.

Clutch Housing Removal (V16):—Clutch must be removed before housing can be taken off engine (housing will not clear clutch and flywheel).

Locking Pin Removal:—Replacement clutches furnished by car manufacturer equipped with a locking pin (or block) under each release lever. These 3 pins must be removed when clutch installed on car (pins released when cover tightened) to avoid damage when car operated (pins will drop into clutch housing).

ENGINE HOOD, SIDE PANEL REMOVAL & FRONT SHEET METAL ASSEMBLY ALIGNMENT:—*See Cadillac Shop Notes.*

SERIAL & ENGINE NUMBER:—1st number 6320001 (60S), 8320001 (62), 7320001 (72), 3320001 (75). On crankcase to rear of left cylinder block and on left frame side member opposite steering gear.

ENGINE SPECIFICATIONS:—**Own.** 8 cylinder, 90° Vee, L head type. Upper crankcase and cylinder blocks cast Enbloc. **Bore**—3½". **Stroke**—4½". **Displacement**—346 cu. ins. **Rated HP**—39.20. **Developed Horsepower**—135 (60S, 62), 140 (72, 75) at 3400 RPM. **Compression Ratio**—6.25-1 (Std. 60S, 62; Optl. 72, 75), 6.7-1 (Std., 72, 75; Optl. 60S, 62), 5.75-1 (Optl.). *See Cadillac Shop Notes for Head installation, head gasket data, and changing compression ratios.* **Compression Pressure**—155 lbs. (60S, 62), 170 lbs. (72, 75) at 1000 RPM or approximately 105-110 lbs. (60S, 62), 110-115 lbs. (72, 75) at cranking speed. **Vacuum Reading**—Steady 20-21" idling at 7-8 MPH.

PISTONS:—Lynite or Bohn Lo-Ex aluminum alloy, 'T' slot, Cam Ground type with Anodized finish (special hard oxide bearing surface). **Length**—4⅛". **Weight**—18.30 ozs. (stripped), 25.10 ozs. (complete). **Removal**—Pistons and rods removed from above. **Clearance**—Skirt .0020-.0025". See Fitting Pistons. **Replacement Pistons:**—*See Cadillac Shop Notes.* **Fitting New Pistons:**—Check piston diameter with micrometer gauge at right angles to pin hole just below lower ring groove and also ½" above lower edge. If feeler gauges (⅜-½" wide, 7-10" long) used, insert feeler next to T-slot. Piston should fall through bore of own weight on .002" feeler, and hold on .0025" feeler. NOTE—Cylinder bore out-of-round .0005" maximum, taper .0003". **Installing Pistons:**—T-slot to left, for all pistons.

PISTON RINGS:—2 compression, 2 oil control rings per piston, all above pin. Oil ring grooves drilled.

Ring	Width	End Gap	Side Clearance
Compr. (Top)	3/32"	.007-.012"	.0023-.0041"
Compr. (#2)	⅛"	.007-.012"	.0013-.0026"
Oil Control	5/32"	.007-.015"	.0013-.0026"

Replacem't Rings:—.003",.005",.010",.015",.030" oversize.

PISTON PIN:—**Diameter**—⅞. **Length**—3 1/16". Pin floats in piston and rod. Held by locking rings. *See Cadillac Shop Notes for pin servicing data.* **Pin Fit in Piston**—.0004" press fit (ribbed end), .0000" clearance or free fit at 70° F. (plain end). **Pin Fit in Rod Bushing**—.0002-.0008" clearance (new), .0018" (worn limit).

CONNECTING ROD:—**Weight** 37.472 ozs. **Length** 8¾". **Crankpin Journal Diameter**—2.4590-2.4595". **Lower Bearing**—Steel-backed, babbitt-lined type. **Clearance**—.0015-.0025" (new), .0045" Max. (worn). **Sideplay**—.008-.014". **Bearing Adjustment:**—None (no shims). Replace bearings. Do not file rod or caps. *See Cadillac Shop Notes for connecting rod and bearing installation data.* **Installing Rods:**—Numbers on rods and bearing caps on same side and installed in same numbered cylinders with marks down toward oil pan.

CRANKSHAFT:—3 bearing with 6 counterweights. *See Cadillac Shop Notes for main bearing servicing and rear main bearing oil seal renewal.* **Journal Diameters**—2½" all bearings. **Bearings**—Removable steel-backed, babbitt-lined. **Clearance**—.0015-.0025" (new), .005" Max. (worn). **Bearing Adjustment:**—None (no shims). Replace bearings. Do not file bearing caps. **End Thrust:**—Taken by center (#2) bearing. **Endplay**—.001-.005" (new), .010" Max. (worn).

CAMSHAFT:—3 bearing, non-adjustable chain drive. *See Cadillac Shop Notes for camshaft bushing data.* **Journal Diameters**—#1 and #2, 2.4071-2.4078"; #3, 2.0009-2.0016". **Bearing Type**—Steel-backed, babbitt bushings. **Clearance**—.0015-.0033" (new), .0045" Max. (worn). **End Thrust:**—Taken by thrust plate behind camshaft sprocket. No endplay should be permitted. **Timing Chain:**—Morse Type C #3682-R Side Guide type. Width 1¼". Pitch ⅜". Length 23¼" or 62 links. NOTE—Install chain 'endless' as an assembly with sprockets. Use Tool J-836 to pilot camshaft sprocket. **Camshaft Setting:**—Sprockets marked. Mesh chain with sprockets turned so that '0' marks are adjacent and in line with a straightedge across shaft centers.

VALVES:—	Head Diameter	Stem Diameter	Length
Intake	1.876-1.886"	.3415-.3425"	5 33/64"
Exhaust	1.626-1.636"	.3405-.3415"	5 33/64"

	Seat Angle	Lift	Stem Clearance
Intake	45°	.335"	.0012-.0032"
Exhaust	45°	.345"	.0022-.0042"

NOTE—Stem clearance worn limit .005" (all valves). Valve heads not slotted. *See Cadillac Shop Notes for valve servicing.* **Tappet Clearance:**—None (automatic take-up used). **Valve Guides:**—Press in block (long step end down). **Valve Lifters:**—Wilcox-Rich 'Zero-lash' type hydraulic lifters (Mushroom type) in removable brackets. *See article in Mechanical Equipment Section for data.* **Clearance**—.0010-.0024" (new), .0035" (worn).

Valve Springs:—Free length 2.210".

	Spring Pressure	Spring Length
Valve Closed	66 lbs.	1.926"
Valve Open	145 lbs.	1.581"

Valve Timing:—See Camshaft Setting above. **Intake Valves**—Open at TDC. Close 42° ALDC. **Exhaust Valves**—Open 52° BLDC. Close 10° ATDC. **Valve Timing Check**—#1 cylinder (front-left bank) intake valve should open with piston at TDC and mark 'C.1/6' on crankshaft pulley aligned with chain case cover pointer (on right side).

LUBRICATION:—Pressure type (gear type pump in crankcase). *See Cadillac Shop Notes for oil pump data.* **Normal Oil Pressure:**—15 lbs. idling, 25 lbs. at 30 MPH. **Oil Pressure Regulator:**—Opens at 30 lbs. On oil pump. Non-adjustable. **Crankcase Capacity**—7 quarts.

COOLING SYSTEM:—**Capacity**—24½ quarts. *See Cadillac Shop Notes for radiator core removal.* **Water Pump:**—Self-adjusting packing type. *See article in Mechanical Equipment Section for data.* **Thermostat:**—Mounted in radiator top tank, linked to radiator shutters by rod on forward side. **Setting**—(Std. Type) Starts to open 153-158° F., fully open at 175° F. (High Reading Type—use with Heaters) Starts to open 168-173° F. Fully open 190°. **Shutter Adjustment**—Adjust clevis on threaded end of rod to secure 1/16" tension (shutters closed). **Temperature Gauge:**—AC Electric. #1510773 (dash unit), #1510774 (engine unit). *See article in Mechanical Equipment Section for data.*

CLUTCH:—**Long Model 11CF-10½CI (60S, 62), 11CF-TI (72,75).** Semi-centrifugal, single plate, dry disc type. NOTE—Borg & Beck Model 11A6 (marked #945) Single plate, dry disc type with 'Borglite' driven member used on early cars. *See article in Mechanical Equipment Section for data.* **Facing (Long)**—Spiral or Chevron wound (spiral grooved) woven, 2 used. Inside Diam. 7". Outside Diam. 10½" (60S, 62), 11" (72, 75). Thickness .137". *See article in Mechanical Equipment Section for data.* **Pedal Adjustment:**—Pedal free travel ⅞-1⅛" (adjusting nut on connector link at clutch fork). **Removal:**—Remove transmission (see below), drop clutch housing pan, punch mark clutch cover, pressure plate and flywheel, remove 6 cover screws. NOTE—Install driven disc with oil guard (cover over dampener springs) to rear. *See Cadillac Shop Notes for clutch locking pin removal (on replacement clutches) and balancing data.*

TRANSMISSION:—**Own Make.** All helical gear, constant-mesh, synchro-mesh (second & high), sliding gear (low & reverse) with remote shift. *See article in Mechanical Equipment Section for data.* **Transmission Control:**—Remote steering col. shift. *See article in Mechanical Equipment Section for data.* **Removal:**—Support engine with jack under rear end of oil pan (use wooden block to avoid damage to pan), remove propeller shaft (disconnect front and rear universals), free transmission extension at engine rear support, remove crossmember with engine rear support, disconnect speedometer cable, remove shifter rods from levers at transmission, support transmission at rear, take out mounting screws, pull straight back (plug clutch connection shaft bearing drain hole as soon as accessible to prevent lubricant loss), lower front end of transmission and remove.

UNIVERSAL JOINTS:—**Mechanics 3C.** Needle bearing. *See article in Mechanical Equipment Section for data.*

REAR AXLE:—**Own Make.** Hypoid gear, semi-floating type with Hotchkiss drive. NOTE—Manufacturer recommends Carrier Assembly serviced by factory. **Ratio**—3.92-1 (60S, 62), 4.31-1 (72), 4.58-1 (75). **Backlash**—.004-.010". Screw adjustment. **Removal:**—Disconnect rear universal, remove axle shafts (see below), and carrier flange capscrews. **Axle Shaft Removal:**—Remove wheel, axle shaft nut, dust seal from rim of drum, pull off hub and drum, disconnect brake line and remove backing plate. Pull shaft and bearing assembly (use Tool J-838). **Wheel Bearing Adjustment**—None.

SHOCK ABSORBERS:—**Delco. Front**—1946-G, H (except 75), 1951-C, D (75). **Rear**—1751-G, H (60S), V, W (62); 2007-N, P (72), 2010-C, D (75). Double acting, hydraulic. *See article in Mechanical Equipment Section for data.*

STEERING:—**Steering Gear**—Saginaw Worm-and-Double Roller type (All except 72), new Re-circulating Ball type (72). *See article in Mechanical Equipment Section for data.* **Front Suspension:**—Independent linked parallelogram type with coil springs. *See article in Mechanical Equipment Section for data.* **Kingpin Inclination**—5°6' (60S, 62), 5°1' (72, 75). **Caster**—Neg. 1¾° to Neg. 2¾° (60S, 62, 72), Neg. ½° to Neg. 1° (75). Equal within ½°. **Camber**—0 to Pos. ¾° (except 75), 0 to Pos. ½° (75). **Toe In**—1/32-3/32" (at rest). Adjusters at outer end of each rod (except 75), turn tie rods (75). **Steering Geometry (Toe-out on turns)**—Inner wheel turned 22¼-23¾° (except 75), 22¾-24¼° (75). Outer 20°.

BRAKES:—**Service.** Bendix hydraulic, duo-servo, single anchor type (eccentric on 75 only). Hand lever applies rear wheel service brakes. *See article in Mechanical Equipment Section for data.* **Drums**—Centrifuse. Diameter—11.995-12.005" (60S, 62, 72), 13.995-14.005" (75). **Lining**—Molded. Length—Primary 11 17/32" (60S, 62, 72), 13 21/32" (75); Secondary 12 31/32" (60S, 62, 72), 15 1/32" (75). Width—Front wheel 2¼". Rear 2" (60S, 62), 2½" (72), 2¼" (75). Thickness 3/16" (60S, 62, 72), ¼" (75). **Clearance**—.015" both ends of secondary shoe—with primary shoe forced out against drum (60S, 62, 72). .010" both ends of secondary shoe with primary just free of drag (75). **Hand Brake:**—See Service Brakes above.

ENGINE HOOD, SIDE PANEL REMOVAL & FRONT SHEET METAL ASSEMBLY ALIGNMENT:—*See Cadillac Shop Notes.*

SERIAL & ENGINE NUMBER:—1st number 5320001. On upper rear corner of left cylinder block and on left frame side bar opposite steering gear.

ENGINE SPECIFICATIONS:—16 cylinder, 135° Vee, 'L' head. Cylinder banks and crankcase cast integral. *See Cadillac Shop Notes for head installation data.*
Bore—3¼". Stroke 3¼".
Displacement—431 cu. ins. Rated HP.—67.60.
Developed Horsepower—185 HP. at 3600 R.P.M.
Compression Ratio—6.75-1 Std. 6.08-1 Optl.
Compression Pressure—180 lbs. at 1000 R.P.M. or approximately 110-115 lbs. at cranking speed.
Vacuum Reading—Steady 20-21" idling at 7-8 MPH.

PISTONS:—Lynite & Bohn Lo-Ex aluminum alloy, 'T' slot, cam ground type with anodized finish (special hard oxide bearing surface). **Length—3¾".**
Weight—15.28 ozs. (stripped), 21.136 ozs. (complete).
Removal—Pistons and rods removed from above.
Clearance—.0020-.0025" skirt. See Fitting Pistons.
Replacement Pistons:—*See Cadillac Shop Notes.*
Fitting New Pistons:—Check piston diameter with micrometer gauge at right angles to pin hole just below lower ring groove and also ½" above lower edge. If feeler gauges (⅜-½" wide, 7-10" long) used, insert feeler next to T-slot. Piston should fall through bore of own weight on .002" feeler and hold on .0025" feeler. NOTE—Cylinder bore out-of-round .0005" Max., taper .0003".
Installing Pistons:—Slot to left, for all pistons.

PISTON RINGS:—Two compression, one oil control ring per piston, all above pin.

Ring	Width	End Gap	Side Clearance
Comp. (Top)	3/32"	.007-.015"	.0030-.0043"
Comp. (#2)	⅛"	.007-.015"	.0013-.0026"
Oil Control	3/16"	.007-.015"	.0013-.0026"

Replacement Rings: .003",.005",.010",.015",.030" oversize.

PISTON PIN:—Diameter—13/16". Length—2 25/32".
Pin is locked in rod by locking screw. Oil grooves broached for full length of pin hole in piston.
See Cadillac Shop Notes for special pin removal and installation instructions.
Pin Fit in Piston—.0001-.0006" clearance (new), .0018" (worn).
Replacement Pins:—Undersizes not furnished.

CONNECTING ROD:—Weight 24.528 ozs. Length 6⅜".
Crankpin Journal Diameter—1.9988-1.9993".
Lower Bearing—Steel-backed, babbitt-lined.
Clearance—.0015-.0025" (new), .0045" (worn).
Sideplay—.008-.014".
Bearing Adjustment:—None (no shims). Replace bearings. Do not file connecting rods or caps.
Installing Rods:—Numbers on rods and bearing caps on same side and installed in same numbered cylinders with marks down toward oil pan.

CRANKSHAFT:—9 bearing, integral counterweights.
See Cadillac Shop Notes for main bearing servicing and rear main bearing oil seal renewal.
Journal Diameters—2½ all bearings.
Bearings—Bronze-backed, babbitt-lined (center), steel-backed, babbitt-lined (all others).
Clearance—.0015-.0025" (new), .005" Max. (worn).
Bearing Adjustment:—None (no shims). Replace bearings. Do not file bearing caps. Upper halves can be rotated out without removing crankshaft.
End Thrust:—Taken by #5 (center) bearing.
Endplay—.001-.005" (new), .010" (worn).

CAMSHAFT:—5 bearing, non-adjustable chain drive.
See Cadillac Shop Notes for camshaft removal and installation instructions.
Bearing Type—Steel-backed, babbitt bushings.
Clearance—.0013-.0025" (new), .004" (worn).
End Thrust:—Taken by thrust plate flange at front bearing. **Endplay** .005-.015" (new), .020" (worn).
Timing Chain:—Morse Type C #3682-R. Width 1¼". Pitch ⅜". Length 23¼" or 62 links.
Camshaft Setting:—Sprockets marked. Mesh chain with sprockets turned so that '0' marks are adjacent and in line with a straightedge across shaft centers.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1.495-1.505"	.3415-.3425"	5 19/32"
Exhaust	1.370-1.380"	.3405-.3415"	5 39/64"

	Seat Angle	Lift	Stem Clearance
Intake	45°	.290"	.0010-.0030"
Exhaust	45°	.302"	.0020-.0040"

NOTE—Worn limit for stem clearance .005" (all valves). Valve heads not slotted.
Tappet Clearance:—None (automatic take-up used).
Valve Guides:—Pressed in block (taper end down).
Valve Lifters:—Wilcox-Rich 'Zero-lash' type hydraulic lifters. Barrel type operating in reamed holes.
See article in Mechanical Equipment Section for data.
NOTE—Two sizes of lifter used, must be re-installed in same guide hole from which removed. Large lifter stamped 'B' in oil groove. Large guide hole stamped 'B' beside hole. Valves must be removed first.
Lifter Clearance—.0015-.0025" (new), .0035" (worn).

Valve Springs:—Damper used at bottom. Free length 2.074".

	Spring Pressure	Length
Valve Closed	50 lbs.	1 25/32"
Valve Open	100 lbs.	1 15/32"

Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 6° BTDC. Close 28° ALDC.
Exhaust Valves—Open 44° BLDC. Close 12° ATDC.
To Check Timing—#1 cylinder (front—left bank) intake valve should open with piston 6° or .0112" before top dead center with ignition mark 'IG/A' aligned with pointer on chain case cover. NOTE—Intake opening and ignition timing same point.

LUBRICATION:—Pressure system. Main oil header in left crankcase wall (feed from pump) for main, connecting rod, and camshaft bearings. Pipe from this header through filter feeds oil header above each line of valve lifters (non-adjustable auxiliary relief valve at rear of left line).
Oil Pump:—Helical gear type. In rear of crankcase.
Normal Oil Pressure:—15 lbs. idling, 25 lbs. at 30 MPH.
Oil Pressure Regulator:—Piston type built in oil pump. Opens at 30 lbs.
Crankcase Capacity:—11 quarts.

COOLING SYSTEM:—Capacity—30 quarts.
See Cadillac Shop Notes for radiator core removal.
Water Pump:—Packless type, sealed ball-bearing shaft (2 used—one pump for each bank, driven in tandem with fan pulley by double Vee belt).
See article in Mechanical Equipment Section for data.
Removal—Drain cooling system, back off belt adjustment, remove hose and pump mounting screws.
Belt Adjustment:—Loosen two mounting bolts on fan bracket, lift fan pulley and bracket assembly up (right bolt hole slotted, pivots on left bolt), until all slack removed from belt, tighten bolts.
NOTE—Replace belts together as matched sets.
Thermostat:—Harrison. In radiator top tank. Linked to radiator shutters by rod on forward side.
Setting—(Std. Type) Starts to open 153-158° F., fully open at 175° F. (High Reading Type—use with Heaters) Starts to open 168-173° F. Fully open 190° F.
Shutter Adjustment—Disconnect shutter rod at lever on front of radiator top tank, loosen locknut, turn clevis so that rod extends 1/16" past lever (provides slight tension with shutters closed).
Temperature Gauge:—AC Electric. #1510773 (dash unit), #1510774 (engine unit).
See article in Mechanical Equipment Section for data.

CLUTCH:—**Long Model 12CB-11½.** Single plate, dry disc type. No adjustment required.
See article in Mechanical Equipment Section for data.
Facings—Spiral or chevron wound woven (spirally grooved), 2 used. Inside Diam. 7". O.D. 11½". Thick. .137". NOTE—Install driven disc with oil guard (cover over dampener springs) to rear.
Adjustment:—Free movement of pedal should be ⅞-1⅛" (adjusting nut on connector link at fork).
Removal:—Remove transmission (see below), drop clutch housing pan, punch mark clutch cover, pressure plate, and flywheel (re-install to these marks), remove 12 cover screws (release tension evenly).
See Cadillac Shop Notes for clutch housing note, locking pin removal (replacement clutches) & balancing data.

TRANSMISSION:—**Own Make.** Constant-mesh, synchro-mesh, all helical gear type (sliding gear, low & reverse).
Transmission Control:—Remote steering col. shift.
See articles in Mechanical Equipment Section for data.
Removal:—Remove propeller shaft, free transmission extension at engine rear support, remove crossmember (with engine rear support), disconnect speedometer cable, remove shifter rods from levers at transmission, support transmission at rear, take out mounting screws, pull straight back (plug clutch connection shaft bearing drain hole as soon as accessible to prevent lubricant loss), lower front end of transmission and remove from car.

UNIVERSAL JOINTS:—**Mechanics Model 3C.** Needle bearing type. Two used.
See article in Mechanical Equipment Section for data.

REAR AXLE:—**Own Make.** Hypoid gear, semi-floating type with Hotchkiss drive.
See article in Mechanical Equipment Section for data.
NOTE—Manufacturer recommends Differential Carrier Assembly be returned to factory for servicing.
Ratio—4.31-1. **Backlash**—.004-.010". Screw adj.
Removal:—Disconnect drive shaft at rear universal, remove axle shafts (see below), remove capscrews on carrier flange, pull carrier assembly out.
Axle Shaft Removal—Remove rear wheels, take off axle shaft nut, pull wheel hub and brake drum, disconnect brake line and remove backing plate. Pull shaft and bearing assembly out (use Tool J-838).
Wheel Bearing Adjustment—None.

SHOCK ABSORBERS:—**Delco Model 1951-C, D (front), 2010-C, D (rear).** Double acting, hydraulic type.

STEERING:—**Steering Gear**—Saginaw Worm-and-Double Roller type with offset steering column and universal joint connection (Mechanics type).
See articles in Mechanical Equipment Section for data.
Front Suspension:—Independent linked parallelogram type with coil springs.
See article in Mechanical Equipment Section for data.
Kingpin Inclination—5°1' crosswise.
Caster—Neg. ½° to Neg. 1°. Adjustable.
Camber—0° to Pos. ½°. Shim adjustment.
Toe In—1/32-3/32" (at rest), 0-1/16" (in motion).
Steering Geometry (Toe-out on turns)—Inner wheel turned 22¾-24¼°, outer wheel 20°.

BRAKES:—**Service.** Bendix hydraulic, duo-servo, single anchor type with eccentric adjustment and rigid wheel cylinders. Hand lever applies rear service brakes. *See Mechanical Equipment Section for data.*
Drums—Centrifuse. Diameter 13.995-14.005".
Lining—Moulded. Length per shoe 13 21/32" (primary), 15 1/32" (secondary). Width 2¼". ¼" thick.
Clearance—.010" at each end of secondary shoe.
Braking Power—43% rear, 57% front wheels.
Hand Brake:—See Service Brakes.

HOOD LOCK & HOOD ADJUSTMENT:—Hood is Alligator type with hood control knob located under left side of instrument panel. To open hood, pull out on control knob (hood will raise slightly), reach under front of hood opening, press up on safety catch tab, lift hood up.

Hood Alignment (At Cowl):—Raise hood, remove side panels (see below), release hood hinge springs, close and lock hood. Loosen hood hinge to cowl bolts, shift hood to secure uniform spacing between cowl and rear edge of hood, tighten hinge bolts and assemble springs, raise hood and install side panels. To center hood, remove counterbalancing springs, loosen hinge mounting screws and shift hood sideways.

(At Radiator Grille)—If distance between hood and grille greater at center than at sides, raise hood and place two thin pieces of wood between side panels and hood to support hood, place two pieces of wood between two bottom louvres of grille (one on each side of center molding—pieces must fit snugly between louvres), place short jack between lower radiator splash guard and frame front cross-member (with short piece of wood between jack and splash guard). Pump jack slowly until hood distance at center slightly less than at sides (will even up when jack released), release jack and check alignment. To center hood at front, loosen radiator support bolts at front cross-member and adjust radiator brace rods.

Hood Lock Adjustment:—Raise hood, loosen lockscrews on control cable adjusting sleeve (in slot on baffle at top of grille), push dash control knob all the way in, see that latch plate in locked position, move adjusting sleeve until it contacts lever on latch, then tighten lockscrew securely.

Side Panel Removal:—Raise hood, remove side panel attaching screws (on upper edge, screws located in bracket at rear end, at radiator shell, and in edge of grille—grille upper baffle can be removed, if necessary, for access to these screws), lift panel out.

Radiator Grille Removal:—Raise hood fully, remove bolts attaching hood latch lower plate to grille, remove baffle. Reach through opening between radiator and grille, remove screws attaching grille to fenders. Remove screws on each side attaching grille to hood front side panels, remove grille. NOTE—Lower baffle is riveted to grille. If baffle being replaced, bolts may be used instead of rivets.

FRONT END REMOVAL:—Front Fenders, Radiator, and Grille may be removed as a unit for work on front of engine or for Independent Suspension Unit removal as follows: Raise hood, loosen lockscrew at hood lock control cable adjusting sleeve and disconnect cable. Drain radiator and disconnect upper and lower hose connections. Remove bolts attaching radiator brace rod to top of radiator support. Disconnect headlamp wires from junction block on each side, remove wiring harness from clip at radiator. Remove bolts attaching fenders to body, frame, and running boards, remove nuts from 2 bolts attaching radiator support to front cross-member. Attach chain hoist under outside flange of radiator support, raise assembly until it clears chassis. Re-install assembly in same manner and align hood as directed above.

RADIATOR CORE REMOVAL:—To remove radiator core (without disturbing grille), drain radiator, remove lower hose connection, disconnect upper hose. Raise hood and remove side panels (see above), disconnect front end of radiator brace rods, loosen both sides of brace rod at dash and turn rod up to allow clearance for radiator core. Remove headlamp wiring harness from clip at each top corner of radiator core. Remove two bolts on each side which hold radiator core in shell, tilt top of core to rear to clear shell and lift out.

ENGINE REMOVAL:—Drain radiator and cylinder block, remove hood and side panels (see above). Remove Fenders, Radiator, and Grille as an assembly (see Front End Removal above). Disconnect generator leads and free wiring loom from support clip, remove battery and starting cables. Disconnect distributor low and high tension leads, take out ignition coil mounting screws, lay coil on cowl. Disconnect gas line at fuel pump, throttle and choke controls at carburetor, and accelerator rod at bellcrank. Disconnect exhaust pipe from manifold. Remove front floor mat and floor plate over transmission, disconnect vacuum and air lines at shift cylinder, disconnect piston rod lever from transmission (See Chevrolet Transmission Control article in Mechanical Equipment Section for directions and adjustment instructions when shift cylinder re-installed). Disconnect clutch pedal link and pull-back spring. Remove bolts in universal joint ball retainer, slide retainer and ball back on shaft, take out 4 screws holding universal trunnion bearings on front yoke, remove trunnion bearings. Remove 4 bolts from transmission rear support, remove front and side engine mounting bolts, remove bolts in starter cross-shaft. Remove third cylinder head bolt from rear on left side, install engine lifting eye bolt in this bolt hole, attach hoist and lift engine until clear of mountings, pull engine forward and lift to clear front cross-member, then roll chassis back until engine is free. When engine re-installed, adjust mountings and align engine hood as directed above.

ENGINE MOUNTINGS:—Adjustment—Tighten front engine mounting bolts (replace mountings if oil-soaked), tighten rear mounting bolts at transmission (studs must be tight in case), clearance between cross-member and 'U' section plate should be .005-.015" **(limits fore and aft engine movement)**, if clearance excessive, remove mounting and bend plate to obtain correct clearance. Tighten side engine mounting bracket bolts. Take out engine side mounting bolts, check clearance between mounting and bracket at each side, clearance must be 1/16" (if clearance excessive, use 3/8" plain washer to shim for proper clearance, if clearance less than 1/16", loosen bracket bolts and push mounting up or if necessary remove brackets and file holes with round file to give 1/16" clearance). Tension on side mountings must be equal at each side.

HARMONIC BALANCER:—Serviced as complete assembly only (component parts not serviced separately). **Removal**—Remove Front End Assembly as a unit first (see directions above). Use Chevrolet Harmonic Balancer Puller and Driver (consists of puller body, puller screw and pinned driver head), attach puller body to balancer by means of 2 cap-screws in two tapped holes in balancer, pull balancer by turning up puller screw.

Installation—Place driver in starting crank jaws of balancer, install puller body (as above), line up keyway in balancer and key in crankshaft, turn puller screw down to contact driver, then use puller screw as driver and drive balancer in place.

MAIN BEARINGS:—Installation—Front intermediate bearing shell marked 'I' in oil groove and must be used in #2 bearing cap. Front intermediate (#2) and Rear intermediate (#3) bearing caps must be installed with mark 'FRONT' (#2 cap) toward front, 'REAR' (#3 cap) toward rear.

Line-Boring—Bearings must be line-bored with .008" shims (four .002" shims) under each end of bearing caps. After line-boring, Rear intermediate (#3 bearing must be faced to provide proper endplay. Adjust as directed below.

Endplay Adjustment—Crankshaft endplay and oil slinger clearance controlled by rear intermediate (#3) bearing. When installing new bearings, this bearing should be machined on front flange just enough to clean up the face of the bearing flange. Then machine rear flange of bearing to obtain endplay of .004-.007" (measure with feeler gauge inserted between rear side of #3 bearing and crankshaft with shaft in extreme rear position.

CRANKSHAFT OIL SEALS:—Rear—New type rear main bearing cap used (mounted on four bolts and two locating dowels) with wick type oil seal installed in groove in cap and crankcase. Seal bears on outer rim of crankshaft flange (oil slinger and check valve in oil return hole in bearing cap have been discontinued). To install new seal in bearing cap, insert packing in groove and roll firmly in place with rounded tool (roll from both ends toward center). Use round block of wood (same diameter as crankshaft flange) to hold packing in place, cut both ends off evenly and flush with bearing cap face. Install upper half of seal in crankcase in same manner with engine out of car and crankshaft removed (see Engine Removal instructions above).

Front (Timing Gear Cover) Oil Seal—Spring-loaded leather type installed in pocket in timing gear cover. To install new seal, place seal on special Oil Seal Replacer J-995 with free end of leather toward end of tool, seat seal in cover with few light hammer blows on tool. NOTE—Timing gear cover must be centered on crankshaft when installed on engine to prevent balancer damaging oil seal. To install cover, coat seal with grease, install centering guide J-966 on crankshaft, install cover and tighten cover screws.

CAMSHAFT BEARINGS:—Installation. Oil groove extends 70° around bearing from oil hole. To insure proper alignment with oil hole in block, mark front of bore opposite oil hole. Align oil hole in bearing with mark (with groove toward bottom of engine away from oil hole in block), press bearings in place and stake to prevent movement. Finally line ream bushings.

TIMING GEARS:—Installation—With gears off, check Gear alignment (controlled by shims behind Crankcase Front End Plate). Using new Camshaft Thrust Plate, hold in place on End Plate (before assembling on camshaft). Lay straightedge across crankshaft shoulder and thrust plate. Add or remove shims to align these two surfaces. Set End Plate screws with punch. Camshaft gear is press fit on hub. Remove and install gear in arbor press with camshaft out of engine. Press gear on shaft until no perceptible clearance remains between gear and thrust plate but plate turns freely (clearance should be .003" Maximum). CAUTION—Press on gear hub only when installing gear on shaft (gear will be

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damaged if pressure applied to rim). New thrust plate must be used whenever gear removed (plate damaged by gear removal sleeve).

VALVE GUIDE INSTALLATION:—Use special valve guide drivers J-1089 (Intake), J-1090 (Exhaust) to install guides. Drivers have stop-collars which correctly position guides so that distance from cylinder head to top of guide is 1 1/16" (Intake), 61/64" (Exhaust). After guides installed, rough ream to inside diameter of .341", then finish ream to .343" diameter.

ROCKER ARMS:—Two types of intake arms used. Install arms with slight angle toward front of engine for cylinders #1, 3, 5; angle toward rear for #2, 4, 6. All exhaust rocker arms straight. Replace worn rocker arms and worn shafts. Replacement arms furnished with finished bushings installed. Assemble rocker arm shafts with open end toward center of engine with steel baffle pressed in open end of rear rocker shaft vertical. Oil pipe connector is a brass sleeve which slips over end of each shaft and should be installed on shafts first and rocker assemblies then installed as a unit. CAUTION—Tighten rocker arm shaft support nuts to 25-30 ft. lb. tension only. Excessive tightening may distort shaft and cause rocker arms to bind.

OIL LEAD TO VALVE ROCKER ARMS:—Installation—New assembly must be used (nipple and pipe assembly Part No. 839186) whenever assembly removed from engine. To install proceed as follows: insert pipe in block, coat threads of nipple with white lead and screw in block (on right side), install nipple and sleeve nut on lower end of pipe (left side of block) and secure in place, then bend pipe in upward loop and connect to oil distributor, bend pipe on right side of engine to clear push rod cover and bend upper end so that it passes through hole in cylinder head, connect pipe to valve rocker shaft coupling. Fill cooling system, run engine and check all connections for oil and water leaks.

CHECKING OILING SYSTEM:—Oil Pan—Check whenever oil pan removed. Use Gauge No. J-969-3 to check oil nozzle height for connecting rod clearance (remove pan gasket, hook end of gauge over pan rail, position gauge in trough with word 'front' toward front of engine). Open end of nozzle must be directly below gauge. Use Gauge No. 969-2 to check oil trough height. Gauge stem should just touch edge of all troughs. Use Gauge No. J-969-1 to check nozzle aim (use water pressure, see that nozzle stream hits hole in target gauge). Use wrench J-793-2 to adjust nozzles. Recheck nozzle height.

NOTE—Oil pipes in pan have been redesigned and if 1939 type Target Gauge used to check 1940 oil pans, center extension on gauge must be cut off flush with lower edge of gauge (to clear oil manifold lead)—this will not affect gauge use on 1939 and previous models. Special nozzle J-793-3 should be used for water connection to oil manifold and pan should be tilted at 45° angle so that nozzles are not covered by water in troughs.

Conn cting Rod Dipper Height—Use Oil Trough Depth & Connector Rod Dipper Height Gauge J-969-2. Place gauge over connecting rod with two side pins on gauge resting on lower face of crankcase (pan gasket must be removed). End of dipper should just touch face of cross bar on gauge with rod in lowest position. If dipper does not touch gauge, it should be replaced; if dipper interferes with gauge, correct by bending dipper.

OIL DISTRIBUTOR:—New design located within recess in left side of engine block (under cover plate). Distributor valve mounted on plate which is clamped on block by cover so that entire valve assembly is within engine. Oil Distributor operates in same manner as units used on previous models.
CAUTION—Inner and outer gaskets used with valve assembly plate must not be interchanged—see assembly directions below.
Removal—To dismantle oil distributor, take out three screws in cover plate, remove cover plate, outer gasket, valve assembly plate, inner gasket.
Assembly—Install cork gasket with **two center holes** between valve assembly plate and block, and use cork gasket with **center cut out** between valve assembly plate and cover, tighten cover screws securely.

TAPPET CLEARANCE ADJUSTMENT:—Normalizing Engine—Tappet clearance changes while engine is warming up and should be adjusted only after engine has been 'normalized' as follows: Run engine at 600 RPM and check oil temperature with thermometer at overflow pipe on valve rocker shaft connector until no change noted in oil temperature for period of five minutes (oil temperature will become stabilized at some point between 150-225° F.). This normalizing period will be from 5 to 30 minutes depending on engine temperature when started. Tappet clearance should be adjusted only after oil temperature reaches point where no further change occurs during 5 minutes operation at 600 RPM.

REAR SPRING SEATS & SHACKLES (PASS. CARS):—Bracket welded on front of housing at each spring. Spring seat attached to bracket by means of rubber bushed bolt (spacer sleeve through which bolt passes, used to prevent collapse of bracket through tightening bolts with too great pressure). Rubber washers used between bracket and each end of spring seat. Spring seat attached to springs through conventional U-bolts. IMPORTANT—When reassembling spring seat to bracket (when installing rear axle), eye bolt nut must not be tightened until all other connections made and car weight resting on all 4 wheels.

Tight Shackle Pin Correction—If shackle pins tight or seized, remove pin and bushing assembly from rear spring hanger, enlarge eye in hanger approximately .005-.010" with a drift, install new pin and bushing assembly.

REAR SPRING SEATS (TRUCK MODELS):—Fitting. Whenever rear spring seats are adjusted, clearance between spring seat and rear axle housing must be checked as follows: Block up rear of car under frame side rails, drop rear of spring by disconnecting spring shackle, take out spring U-bolts, remove spring seats (lower spring cap secured by means of 2 screws). File face of each spring seat half evenly (place in bench vise) until spring seat gives slight drag when placed on housing and rotated. CAUTION—File both halves evenly.

AXLE SHAFT (PASSENGER CARS):—To Install. Assemble new oil deflector, gasket (coat with shellac or paint on both sides), line up extra hole (center of three closest together) with notch in hub flange in axle shaft (also oil pocket in oil deflector with this notch), insert six new bolts and peen into place in countersink around bolt holes in flange using special Peening Tool and Anvil so that these parts are riveted together. NOTE—Axle shafts are of unequal length, longer shaft used on right side.

Endplay Adjustment—When installing shaft, select correct spacer block (see below) so that when installed on pinion shaft between inner ends of axle shafts, shaft endplay will be from a Free Fit to .014" maximum clearance.

Axle Spacer (Pass. Cars)—Three spacer blocks furnished which give four sizes as follows: Narrow—1.0105", Medium—1.0195" and 1.0295", Wide—1.0345".

NOTE—These dimensions are taken across ground surfaces and spacers should be installed with ground surface toward axle shaft end. Medium spacer ground on all four sides and may be installed either way to secure the two different sizes.

AXLE SHAFT (½, ¾, ¾ TON SPEC.):—These shafts heavier construction but serviced in same manner as Pass. Car axles (above) except that Axle Spacers furnished in three sizes only as follows:

Axle Spacer (Trucks)—Narrow-1.1485", Wide-1.1575" and 1.1675" (ground on all four sides).

CAB-OVER-ENGINE MODELS

ENGINE COVER REMOVAL:—To take off engine cover proceed as follows: Remove seat cushion and seat back, take out 4 bolts on cover at gear shift lever and raise assembly to rear, remove floor mats on each side, remove engine cover screws (at rear and at front on each side). Lift engine cover out by raising forward end and pulling out towards front.

NOTE—Right floor pan has hand hole for access to engine oil stick, crankcase oil filler pipe, and for lubrication of distributor and starter.

Left Floor Pan Note—Whenever floor pan removed, disconnect accelerator linkage by passing wire through accelerator spring and pull it upward exposing cotter pin retainer, then pull cotter pin out.

FRONT COWLING REMOVAL:—Take out 6 retaining screws on each side (2 top screws nuts accessible through side ventilators—not used on late models), remove 2 screws at top of cowling and take off radiator filler cap. Lift cowling up and forward. When replacing cowling, rubber insulators at upper screws must be installed between cowling and dash at each side. NOTE—With cowling removed, radiator may be taken out allowing access to water pump, fan belt, harmonic balancer, generator and front engine mountings.

REMOTE CONTROL TYPE GEARSHIFT LEVER:—Removal—Disconnect gearshift lever from top of engine cover, loosen wire on clutch boot, raise boot above transmission cover tower. Remove nut from stub gearshift lever and raise reverse latch Bowden cable support onto top of lever. Use gearshift lever removing tool K-353 to remove lever assembly from transmission cover. When installing lever, see that end of reverse latch shift rod seats in upper part of 'U' shaped bracket at end of reverse latch Bowden cable and that retaining nuts are tight so that rod anchored in bracket.

ENGINE HOOD, SIDE PANEL & RADIATOR GRILLE:—New type Alligator hood with dash-controlled hood lock and safety latch. *See Chevrolet Shop Notes for Hood Lock Operation and Adjustment, Side Panel Removal, and Radiator Grille Removal.*

Front End Assembly Removal—Fenders and Radiator Grille may be removed as a unit for access to Front Suspension. *See Chevrolet Shop Notes for data.*

CAB-OVER-ENGINE & DUBL DUTI PANEL NOTE:—*See Chevrolet Shop Notes for Engine Cover Removal & Front Cowling Removal (for access to engine).*

FLEET MODEL NOTE:—Special Economy Engine available for all models. May be identified by special Tune Up Specification Plate on Push Rod Cover listing special settings. Special carburetor used has stop pin to limit throttle opening to ½ throttle.

SERIAL NUMBER:—First No. 1001 with model prefix as follows: KA (Special Deluxe), KB (Master 85), KH (Master Deluxe), KC (Half Ton), KD (¾ Ton), KE (¾ Ton Spec.), WA, WB (1½ Ton), WC (School Bus), WD, WE, WF (Cab-over-Engine Trucks). Stamped on right side of floor pan in front of front seat (KA, KB, KH), On plate on right side of cowl under engine hood (KC, KD, KE, WA, WB, WC), On plate on rear of dash (WD, WE, WF).

ENGINE NUMBER:—First No. 2697268 (Flint), B-105462 (Buffalo) with special prefix for each model as follows: Pass. Cars—None (Flint), B (Buffalo); Half Ton—K (Flint), KB (Buffalo); ¾ & ¾ Ton Special—AT (Flint), ATB (Buffalo); 1½ Ton—T (Flint), TB (Buffalo); 1½ Ton Cab-over-engine—H (Flint only), Dubl Duti Panel—E (Flint only). Stamped on right side of block to rear of distributor.

ENGINE SPECIFICATIONS:—**Own.** 6 cyl., 'I' head type. **Bore**—3½". **Stroke**—3¾".

Displacement—216.5 cu. ins. **Rated HP.**—29.4.

Developed Horsepower—85 at 3400 RPM (Pass. Cars), 78 at 3200 RPM (Trucks except Cab-over-Engine), 80 at 3100 RPM (Cab-over-Engine Trucks).

Compression Ratio—6.25-1 Std. cast-iron head.

Compression Pressure—112 lbs. at 65 RPM (cranking speed), 90 lbs. Min. and all cylinders even within 5-10 lbs. NOTE—Engine must be at normal operating temperature (idle at 600 RPM for 20 minutes).

Vacuum Reading—Steady 18-21" with engine idling.

Engine Removal & Mounting Adjustment:—*See Chevrolet Shop Notes for instructions.*

Cylinder Head Installation:—Use new gasket and install with mark 'This Side Up' upward. Use guide pins to align head.

PISTONS:—**Pass. Cars**—Cast gray iron, dome head, cam ground, tin-plated with slipper type skirt.

Trucks—Same as Pass. Cars except 1½ ozs. heavier and may be identified by small forged boss on lower center of each piston pin boss.

Weight—25.3 ozs. (Pass. Car), 26.9 ozs. (Trucks) with bushings installed. **Length**—4 11/64".

Removal—Pistons & rods removed from above.

Clearance—.0147-.0183" Top, .0017-.0023" Skirt.

Replacement Pistons:—Finished pistons with bushings and pins fitted furnished Standard and .003", .010", .020", .030", .040" oversize. NOTE—Hone cylinder for .003" oversize, rebore and hone for other sizes (rebore .002" less than piston oversize, finish by honing for piston clearance below). Bore taper and out-of-round must not exceed .001".

Fitting Pistons:—Use feeler gauge between piston and cylinder wall at right angles to pin bosses. Piston should pass through bore with light pressure on .002" feeler and lock on .003" feeler.

PISTON RINGS:—Two compression, one oil control ring per piston, all above pin. Oil ring groove drilled for oil drainage. NOTE—Compression rings have tapered face. Install with mark 'TOP' upward.

Ring	Width	End Gap	Side Clearance
Compr.	.1235-.1240"	.005-.015"	.0015-.0035"
Oil Cont.	.1860-.1865"	.005-.015"	.0015-.0035"

Check side clearance with .002" feeler. #1 ring very free, #2 ring just free, #3 ring light drag.

Replacement Rings:—Furnished Standard and .005", .010", .015", .020", .030", .040" oversize.

PISTON PIN:—**Diameter** .8645-.8650". **Length** 3.135-3.165". Pin locked in rod, piston bronze bushed. NOTE—New pistons fitted with bushings and pins.

Pin Fit in Piston—Thumb push fit (room temp.).

Replacement Pins:—Std. & .003", .005", .010" oversize.

CONNECTING ROD:—**Length** 6 13/16". **Weight** 28.3 ozs.

Crankpin Journal Diameters—2.311-2.312".

Lower Bearing—Spun babbitt- lined type.

Clearance—.001-.0025". **Sideplay**—.004-.012" (side clearance between rod and pin bosses .025").

Bearing Adjustment:—Solid shims. Remove shims equally at both sides to secure 'snap fit' (bearing tight to hand but should snap from one side to other with light tap of 8 oz. hammer), **then replace one .002" shim for clearance** (if unequal number, place extra shim on camshaft side). Rod should snap from side to side with one hand pressure with proper fit. NOTE—Palnuts used on rod bolts. Use new palnut, install with open side toward end of bolt, turn finger tight against rod nut, then tighten ½ turn additional.

Installing Rods:—Numbers on rods and caps must be together and installed in same numbered cylinder with numbers and pin clamp bolt toward camshaft side. Install oil dippers on rods with mouth toward camshaft side of engine. Check dipper heights. *See Chevrolet Shop Notes for instructions.*

CRANKSHAFT:—4 bearing, integral counterweights. NOTE—New type rear bearing oil seal (no slinger). *See Chevrolet Shop Notes for Oil Seal and Crankshaft Balancer servicing data.*

Journal Diameters—#1, 2.6835-2.6845"; #2, 2.7145-2.7155"; #3, 2.7455-2.7465"; #4, 2.7765-2.7775". NOTE—Journal taper or out-of-round limits .001", Run-out limits for #2 & #3 bearings .002".

Bearing Type—Steel-backed, babbitt-lined.

Clearance—.002-.004". *See Chevrolet Shop Notes for Main Bearing Line-boring and Installation data.*

Bearing Adjustment:—Solid shims. Remove shims until slight drag secured when shaft turned by hand, **then replace one .002" shim for clearance** (if unequal number of shims used, place extra shim on same side for all bearings).

End Thrust:—Taken by #3 bearing (adjusted by facing new bearings). **Endplay**—.004-.007".

CAMSHAFT:—Four bearing. Helical gear drive.

Journal Diameters—#1, 2.0282-2.0292"; #2, 1.9657-1.9667"; #3, 1.0932-1.0942"; #4, 1.8407-1.8417". NOTE—Journal out-of-round limits .001". Run-out limits .002" (straighten if excessive).

Bearing Type—Steel-backed, babbitt-lined bushings. *See Chevrolet Shop Notes for bearing installation and line-reaming instructions.*

Clearance—.002-.004".

End Thrust:—Taken by thrust plate behind camshaft gear (adjusted by changing gear position on shaft). **Endplay**—Free to .003" maximum.

Timing Gears:—Crankshaft gear Steel. Camshaft gear Bakelite & Fabric. Maximum gear run-out .003" crankshaft, .004" camshaft. NOTE—1940 crankshaft gear is new (for new Valve Timing). Do not install 1939 gear on 1940 models.

Backlash—.002-.005". *See Chevrolet Shop Notes for Timing Gear installation & camshaft endplay data.*

Camshaft Setting:—Gears punchmarked. Mesh marked tooth of crankshaft gear with marked space between teeth of camshaft gear.

VALVES:—	Head Diameter	Stem Diameter	Length
Intake	1 41/64"	.3407-.3417"	6 5/64"
Exhaust	1 15/32"	.3397-.3407"	4 13/16"

	Seat Angle	Lift	Stem Clearance
Intake	30°	.2947"	.001-.003"
Exhaust	30°	.3118"	.002-.004"

Tappet Clearance:—.006-.008" Int., .013-.015" Exh. Hot (Engine 'normalized'). Use lower figure for ordinary service, higher figure for severe Truck operation. *See Chevrolet Shop Notes for adjustment data.*

Economy Engines—.010" Int., .016" Exh. Hot.

Valve Guides:—Pressed in head. *See Chevrolet Shop Notes for Installation & Reaming instructions.*

Valve Springs:—Free length 2 7/32". When checked with U15 Tester, spring pressure should be 125-133 lbs. at 1½".

	Pressure	Length
Valve Closed	49-56 lbs.	1 13/16"
Valve Open	121-133 lbs.	1½"

NOTE—Install springs with close-coil end toward cylinder head. Use round valve caps on Intake Valves, hexagonal caps on Exhaust Valves.

Valve Lifters:—New type with pushrod seat brazed on top. **Clearance**—.001" (free fit in guide holes).

Rocker Arm Assembly:—*See Chevrolet Shop Notes.*

Valve Timing:—See Camshaft Setting above. Valve Timing is not same as 1939 (New Crankshaft Gear).

Intake Valves—Open 3° BTDC. Close 35° ALDC.

Exhaust Valves—Open 46° BLDC. Close 5° ATDC.

To Check Timing—With #1 intake valve tappet clearance set at .006", valve should open with piston 3° or .0032" BTDC. with point on flywheel approximately 1.158 teeth before 'U/C' mark in line with indicator in hole in right front face of housing.

LUBRICATION:—Pressure and positive splash system. Same as 1939 except for redesigned oil pan, new Oil Distributor (in block), and new type Overflow Pipe Connector at rocker arm shafts. *See Chevrolet Shop Notes for Oil Distributor, and Rocker Arm Oil Lead and Overflow Pipe servicing.*

Oil Pump Installation—Assemble ground side of idler gear toward cover. Oil pump assembly mounted in crankcase by tapered setscrew. See that screw seated firmly in tapered hole in pump housing before tightening locknut.

Normal Oil Pressure:—15 lbs. at 40 MPH. (KA, KH, KC), 15 lbs. at 43 MPH. (KB), 25 lbs. at 36 MPH. (KD), 25 lbs. at 40 MPH. (KE), 15 lbs. at 30 MPH. (WC Bus), 15 lbs. at 32 MPH. (Other Trucks).

Oil Pressure Regulator:—Located on oil pump cover. Opens at 75 lbs. Non-adjustable type. Pressure normally controlled by Oil Distributor.

Oil Distributor:—*See Chevrolet Shop Notes for data.*

Checking Oiling System:—Should be checked whenever pan removed. *See Chevrolet Shop Notes for data.*

Crankcase Capacity:—5½ qts. dry, 5 qts. refill (all).

COOLING SYSTEM:—**Capacity**—14 qts. (except Cab-over-Engine), 16½ qts. (Cab-over-Engine).

See Chevrolet Shop Notes for Radiator Core Removal.

Water Pump:—Packless, ball-bearing type. NOTE—Pumps interchangeable on all models (except fan). *See article in Mechanical Equipment Section for data.*

Thermostat:—Harrison. In cylinder head outlet.

Setting—Starts to open at 142° F. (Std.), 150° (for Alcohol Anti-freeze). 160° F. (for Permanent Anti-freeze & Economy Engines).

CLUTCH:—**Own Make.** Diaphragm spring, single plate, dry disc type. NOTE—Clutch with 9" disc used on Pass. Cars & ½ Ton, 11" disc on all others. *See article in Mechanical Equipment Section for data.*

Facings—Moulded type, 2 used. Inside Diam. 6⅛"

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(Pass. Cars & ½ Ton), 7" (Others). Outside Diam. 9⅛" (Pass. Cars & ½ Ton), 10¾" (Others). Thickness .135" (Pass. Cars & ½ Ton), .140" (Others).

Adjustment:—Pedal free travel must be ¾-1". To adjust, loosen checknut and turn adjusting nut on connecting link at clutch throwout fork.

Removal:—Remove Transmission and flywheel underpan (see Transmission Removal below), remove throwout bearing from fork, remove fork by prying fork off ball, remove fork mounting (use ⅞ & ¾" wrench). Install Clutch Pilot Tool K-411 (to support clutch), loosen all six cover bolts evenly, remove assembly from below. CAUTION—Do not allow pressure plate to hang on retracting springs (support by hand). When installing clutch, line up 'X' marks on cover and flywheel.

TRANSMISSION (KA, KB, KC, KD, KE, KH):—Own Make. Constant mesh, synchro-mesh (Second & High), sliding gear (Low & Reverse), all helical gear type. NOTE—All transmissions similar except Pass. Car type has remote control shift mechanism in slide cover, Truck type has conventional shift lever and cover assembly and gears are carburized type. ***See article in Mechanical Equipment Section for data.***

Transmission Control (Pass. Cars):—Remote control steering column shift, vacuum-power type Std. ***See article in Mechanical Equipment Section for data and Gearshift Lever Flutter Service Note.***

Removal (KA, KB, KC, KH):—On Pass. Cars, remove floor mat and transmission cover in floor, disconnect and remove vacuum-power cylinder (see Chevrolet Transmission Control article in Mechanical Equipment Section for data and adjustment instructions when re-installed). On Half Ton, remove hand brake lever on transmission case (see Note for 4 Spd. Trans. below). Disconnect cables on brake cross-shaft at rear of transmission, remove cross-shaft. Disconnect and remove speedometer cable and driven gear assembly. Take out capscrews in universal joint ball collar, slide ball and collar back on shaft housing. Take out four capscrews holding universal joint needle bearing trunnions on front yoke, remove trunnions (use care not to lose needle bearings), push front end of propeller shaft down for clearance. Remove 4 bolts holding transmission rear mounting on frame cross-member, remove 2 top transmission mounting screws, install guide pins in these holes, remove flywheel underpan and lower mounting screws, slide transmission out.

Half Ton Note—When 4 Spd. Transmission used, take out 2 capscrews in master cylinder mounting bracket and remove frame cross-member so that propeller shaft can be dropped down for clearance.

Removal (KD, KE):—Same as other truck models

TRANSMISSION (WA, B, C, D, E, F):—Own Make. Four speed, sliding spur gear type (all speeds). NOTE—This transmission Optional on KC, KD, KE models. ***See article in Mechanical Equipment Section for data.***

Transmission Control (Cab-over-Engine):—Remote control type. ***See Chevrolet Shop Notes for data.***

Removal:—Remove floor boards, hand brake lever from transmission case, speedometer cable. Take out bolts in front universal ball retainer (on rear of transmission), slide retainer and ball back on shaft housing, remove universal joint trunnion lock rings, drive trunnions out of rear yoke to 'split' universal, slide yoke back on shaft. Remove two bolts mounting front shaft assembly on cross-member (at rear universal), lower assembly and pull front propeller shaft and rear universal assembly off drive shaft. Take out 2 top transmission mounting screws, install guide pins in these holes. Remove flywheel underpan, take out lower transmission mounting screws, slide transmission back

UNIVERSAL JOINTS:—Own Make. Needle bearing 'cross' type (all models). One used (Pass. Car & ½ Ton), Two used (others). ***See article in Mechanical Equipment Section.***

REAR AXLE (KA, KB, KC, KD, KE, KH):—Own Make. Semi-floating, hypoid gear type with Torque Tube drive. All axles similar in design except that KC, KD, KE Truck axles are heavier construction. ***See article in Mechanical Equipment Section for data.***

Ratio—4.11-1 (KA, KH), 3.73-1 (KB), 4.11-1 (½ Ton KC), 4.55-1 (¾ Ton KD, ¾ Ton Spec. KE). NOTE—Passenger car axles may be identified by prefix letter of part number stamped on top right side of differential housing as follows: 4 11-1—'B' or no letter, 3.73-1—'C' or 'CB' (Optl. on KA, KH).

Backlash—.005-.008" (all). Screw Adjustment.

Removal:—Raise rear end of car, remove rear wheels and brake drums, install clamps on wheel brake cylinders, disconnect hand brake cables and remove cables from cable clamps on frame, disconnect brake line at axle housing and shock absorber 'I' bolts at spring seats. Remove spring 'U' bolts, disconnect spring shackles and drop springs. Pull axle back to free front end of drive shaft, remove assembly from under car. ***See Chevrolet Shop Notes for Rear Spring Seat data & Correction for Binding Shackles.***

Axle Shaft Removal:—Wheel bolted directly on flange on outer end of shaft. Shaft retained by 'C' washer on inner end of differential case. To remove axle shaft, remove wheel, take out two machine screws in brake drum, remove drum, install clamp on brake cylinder. Take off axle housing cover, remove differential pinion shaft screw, pinion shaft and axle shaft spacer. Push axle shaft in, remove 'C' washer on inner end of shaft, pull shaft out. NOTE—Axle shafts unequal in length, use longer shaft on right side. Truck axle shafts are heavier construction. ***See Chevrolet Shop Notes for Axle Shaft Installation, Spacer data, and Endplay adjustment.***

REAR AXLE (WA, B, C, D, E, F):—Own Make. Full-floating, Hypoid gear type with Torque Tube drive. NOTE—WD model (107⅝"WB.) has Hotchkiss drive. ***See article in Mechanical Equipment Section for data.***

Ratio—5 43-1 Std. (except WC Bus—6.17-1), 6.17-1 Optl. NOTE—Axles identified by prefix letter on part number stamped on top right side of differential housing as follows: 5.43-1—'B' or no letter, 6.17-1—'H' or 'HB'.

Backlash—.005-.008". Screw adjustment.

Removal:—See Model WD Note below. On all other models, take out bolts in front universal joint ball retainer (back of transmission), slide retainer and ball back on shaft housing, remove universal trunnion bearing lock rings, drive trunnion bearings out of rear yoke to 'split' universal, slide yoke back on shaft. Remove two bolts mounting front propeller shaft on frame cross-member (at rear universal), lower assembly and pull front propeller shaft and rear universal assembly off rear drive shaft. Remove axle shafts (see below), take out differential carrier mounting bolts in axle housing, pull differential carrier & drive shaft forward to clear.

Model WD Note—Disconnect drive shaft by taking out four bolts in universal joint yoke, then remove carrier assembly as above. ***See Chevrolet Shop Notes for Rear Spring Seat data.***

Axle Shaft Removal:—Bend lock plate lugs away from capscrew heads, take out 8 capscrews in axle shaft flange, install two ½"x13 capscrews in tapped holes in flange (between regular screw holes), turn these screws up evenly to loosen shaft, withdraw shaft and aluminum gasket. NOTE—Use new aluminum gasket and lock when axle shaft installed.

Wheel Bearing Adjustment:—Remove axle shaft (above), locknut and adjusting nut lock (within wheel hub), use J-870 wrench and tighten adjusting nut tight, then back off 45°, see that wheel hub turns freely by hand, install lock and locknut, bending lock tangs in notches on both nuts.

REAR AXLE (TWO SPEED):—Optl. on all Trucks. ***See article in Mechanical Equipment Section for data.***

Ratio—5.64-1 (high), 8.22-1 (low).

Backlash—.006-.012".

Removal:—Same as regular truck axle (above) except that front propeller shaft should be disconnected from cross-member & rear universal should be 'split'.

Axle Shaft Removal & Wheel Bearing Adjustment:—Same as regular truck axle (above) except that axle shaft retained by studs with locking sleeves under nuts. Use 2 7/16" x 14 screws to loosen shaft.

SHOCK ABSORBERS:—Delco Hydraulic type. Parallel cylinder type front & rear (KA, KH), Direct acting type front, single acting rear (KB), Single acting front & rear (KC, KD, KE). Double acting type Optl. on others. ***See article in Mechanical Equipment Section.***

STEERING:—Steering Gear—Saginaw Worm-and-Roller (Pass.Cars), Worm-and-Sector type (Trucks). ***See article in Mechanical Equipment Section for data.***

Front Suspension (KA, KH):—Independent, parallelogram type with coil springs. ***See article in Mechanical Equipment Section for data.*** NOTE—Make checks with car weight on wheels and special gauges installed front & rear to level frame.

Kingpin Inclination—0° ± ½°. Adjustable.

Camber—Negative ¼° ± ½°. Adjustable.

Toe-In—0-1/16". Adjust left tie rod only.

Steering Geometry (toe-out on turns)—Outer wheel turned 20°, Inner 24° ± 2°. No adjustment.

Front Suspension (Others):—Conventional 'I' beam section front axle with Reverse-Elliott ends and semi-elliptic springs. NOTE—Kingpin bushings 'floating' type on KB, KC, KD, KE models.

Kingpin Inclination—7°10' (except Cab-over-Engine), 8° (Cab-over-Engine) ± 1° crosswise.

Caster—2¼° (KB), 1¾° (KC, KD, KE), 2¾° (WA, WB, WC), 3° (WD, WE, WF) ± ½°. Adjust by installing wedge shims between spring and axle (up to 2°), use tools for greater corrections.

Camber—1° ± ½°. Bend cold for minor corrections.

Toe-In—5/64-⅛". Adjust by turning tie rod.

Steering Geometry (toe-out on turns)—Outer wheel turned 20°, Inner 23° ± 2°. No adjustment.

BRAKES:—Service—Own Make. Hydraulic type. Hand lever applies rear service brakes. ***See article in Mechanical Equipment Section for data.***

Wheel Cylinders—Diameter 1¼" (front wheels—all), 1 3/16" (rear—KA, B, C, D, H), 1⅜" (rear—KE), 1½" (rear—others). Size stamped on wheel cylinder housing under adjusting cup lock spring.

Drums—Cast iron, steel web (except WA, B, C), Pressed steel (WA, B, C). Diameters 11" (all KA, B, C, D, front KE), 14" (rear KE, front WA, B, C, D, E, F), 16" (rear WA, B, C, D, E, F).

Lining—Moulded type on all models.

Model	Width	Thickness	Length
KA,B,C,D,H,KE(front)	1¾"	3/16"	22⅝"
KE (rear)	2"	17/64"	38½"
WA,B,C,D,E,F (front)	2"	17/64"	28⅞"
WA,B,C,D,E,F (rear)	3"	17/64"	35 13/16"

Clearance—Adjusting Cover backed off 4 Notches (KA, B, C, D, E, H all wheels), 5 Notches (WA, B, C, D, E, F front wheels), adjusting pinion shaft backed off ¾ turn (WA, B, C, D, E, F rear wheels) from slight drag position.

Braking Power—47½% Rear (KA, B, C, D, H), 54¾% Rear (KE), 59% Rear (WA, B, C, D, E, F).

Hand Brake:—See Service Brakes above.

TORQUE WRENCH SPECIFICATIONS:—*See Torque Wrench article in Mechanical Equipment Section for tightening specifications for Cylinder Head, Main & Connecting Rod Bolts, etc.*

ENGINE NUMBER LETTERING ('SPECIAL STANDARD BORE & BEARING SIZES):—Letters used with engine number (**not in circular pads**) denote following 'special standard' sizes: **'A'**—.020" larger standard cylinder bore. **'B'**—.010" smaller standard main and connecting rod bearings. **'AB'**—Cylinder bore, main and connecting bearings 'special standard'.

FRONT END ASSEMBLY (UNIT) REMOVAL:—For work on front of engine, remove radiator shell, radiator core, hood lower side panels and both fenders as a unit as follows: Remove hood, drain radiator, disconnect headlight wires at junction block on left fender upper shield, remove engine water inlet and outlet hoses, free fenders from body and running board and lift assembly off.

ORIGINAL PISTON AND CYLINDER BORE SIZES:—All original production new engine piston and bore sizes and markings are same as for corresponding 1939 car models. *See 1939 Chrysler Shop Notes for complete data.*

REPLACEMENT PISTONS:—Finished Pistons—Furnished in standard size and .003", .005", .010", .015", .020", .023", .025", .030", .040", .050", .060" oversize. **Semi-finished Pistons**—Furnished in two sizes: (1) for cylinder bores from standard to .023" oversize, (2) for bores .025-.050" oversize. Pistons are finished except for skirt (head and ring grooves finished). **Piston skirt must be cam ground** and not finished circular. IMPORTANT—Second group pistons (.025-.050") must not be used for oversizes below .025" due to piston head and ring grooves being finished to different size than first group.

ENGINE ASSEMBLY REMOVAL:—Remove Front End Assembly as a unit (see above). Remove front floor boards and propeller shaft (for cars equipped with two shafts, see removal directions under propeller shaft center bearing following). Disconnect: hand brake cable, starter cable, battery ground cable, speedometer cable and gear shifter rod and cable at transmission (on cars with overdrive, remove solenoid coil and disconnect wires and overdrive control cable), fuel pump flexible line at pump, exhaust pipe at manifold, throttle and choke controls, heat indicator tube and bulb at head, oil gauge line at flexible tube, starter cable at starter, coil wires and clutch pedal linkage. Remove front and rear engine support bolts, loosen engine side splash pans, attach hoist and lift engine out.

REAR ENGINE SUPPORTS (C26, 27):—Insulators on rear support may be replaced without removing floor boards as follows: Support engine at rear, remove rear engine support bolts and remove cross member bolts at frame. Then remove insulators.

CONNECTING ROD & MAIN BEARING UNDERSIZES:—Replacement bearings furnished in standard size and .002", .010", .012" undersizes. **Fit .002" bearings** for standard crankshafts that show slight wear. **Fit .010" bearings** to 'Special Standard' crankshafts (see Engine Number Lettering in 1st column). **Fit .012" bearings** to 'Special Standard' crankshafts that show slight wear.

REPLACEMENT MAIN BEARING CAPS:—Furnished for service where original cap damaged or broken. These replacement caps same as original caps except for stud holes being 1/64" larger and bearing cap length which is 1/16" shorter. These replacement caps must be fitted due to caps being reamed on master reamer at factory and not on engine (as original bearing caps).

Fitting—Replacement caps must be fitted to engine by filing or shimming to obtain proper bearing clearance. This is only necessary when replacement cap originally fitted to engine (caps should not be shimmed or filed to compensate for wear.

MAIN BEARINGS:—Removal (with engine in car)—Remove oil pan (see Oil Pan Removal following), oil suction pipe and screen assembly, crankshaft pulley shield (De Soto, Dodge & Plymouth) which is secured by 2 screws, main bearing cap-to-cylinder head oil lines, and main bearing caps (see Front Main Bearing Cap Removal below). Use puller No. C-305 to remove #1 and #5 caps on Chrysler 8. Upper bearing shells can then be removed without removing crankshaft by using an old bearing shell or Tool No. C-584 (inserted in oil hole in crankshaft). Turn crankshaft to rotate bearing out.

Front Main Bearing Cap Removal:—With oil pan removed, oil pan front gasket oil seal plate (not used on Chrysler 8) can be removed by taking out 2 screws on lower edge of timing chain cover (not necessary to remove cover) permitting access to front main bearing cap.

Fitting Bearings:—Use .002" feeler and check clearance in same manner as on previous models (see 1939 Chrysler Shop Notes for instructions).

CRANKSHAFT OIL SEALS:—Servicing—Car manufacturer recommends that new oil seals be installed if chain cover or rear bearing cap removed.

Front Oil Seal:—Leather oil seal mounted in timing chain cover. When installing seal, leather should be soft and pliable, soaked in thin oil for approximately thirty minutes, then rolled with smooth bar. Use Chain Case Cover Oil Seal Centering Tool C-522 installed behind crankshaft starting jaw (tighten jaw finger tight only) while tightening timing chain cover in place.

Rear Oil Seal:—Located at rear bearing. Consists of three separate seals as follows: 1—Bearing oil seal formed in two halves. Lower half mounted on rear of bearing cap and held by retainer screwed (3 screws with lockwashers) to rear face of cap. Upper half retained in same manner with retainer screwed in place on rear face of crankcase. 2—Bearing cap seal. Groove on each side of cap (immediately to rear of stud holes) fitted with seal. Seal assembled in groove with double-over end in toward bearing. 3—Bearing cap gaskets. L-shaped cap gaskets assembled around oil slinger groove (at rear of cap). Install gaskets (one on each side).

CAMSHAFT REMOVAL:—Remove Front End Assembly as a unit (see removal directions in first column). Remove cylinder head, fuel pump, oil pump, valve tappet cover plates, crankshaft pulley, front motor support (with front of engine jacked up), timing chain cover, camshaft sprocket and timing chain. If valves and valve springs are not to be removed, prop valves up by inserting wooden wedges at opposite sides under valve head. Raise tappets and hold in this position (use spring type clothes pins or similar tool to hold tappets up). Withdraw camshaft (rotate shaft while withdrawing to clear any obstructions).

Chrysler 8 Note—In addition to instructions listed above, two oil feeder lines in valve chamber must be removed and #4 piston must be on top dead center in order to remove camshaft.

EXHAUST VALVE SEAT INSERTS:—Refacing and Replacement Insert Installation. *All data same as for 1939 cars. See 1939 Chrysler Shop Notes for complete data. Inserts furnished Std. & .010" oversize. Use tool set C-387.*

OIL PAN REMOVAL:—Drain oil and replace drain plug. Remove clutch housing underpan (on six cylinder cars this prevents damage to oil pan gaskets on housing underpan dust seal. Remove oil level indicator and drop oil pan.

Installation:—With oil pan clean, install new oil pan gaskets. IMPORTANT—On six cylinder engines, oil pan end gaskets (front and rear) must protrude ¼" to ⅛" above oil pan. Side gaskets installed with ends resting on top of protruding end gaskets. With gaskets in this position, they will be properly compressed when oil pan screws are tightened.

OIL PUMP REMOVAL:—Turn engine over until distributor rotor in firing position for #1 cylinder (allow engine to remain in this position while pump off engine). Remove capscrew in pump body and remove oil pump.

Installation:—When installing oil pump where crankshaft has been moved while pump off engine, turn crankshaft until #1 cylinder is at firing position (both valves closed, piston on compression), set distributor rotor at #1 terminal and install pump. Then reset ignition timing (see 'T&E' page).

RADIATOR CORE REMOVAL:—Chrysler C25, De Soto S7, Dodge D14, D17. Drain cooling system. Remove hood, radiator inlet hose (at top tank), outlet house (at pump), fan blade assembly (by removing screws at pump flange and lifting blades off), and radiator core-to-support capscrews (three on each side). With core tilted to rear, lift up and remove.

Chrysler C26, C27:—Remove hood and and carburetor air cleaner. Remove water pump (see 1940 Chrysler C26, C27 'M' page for instructions). Remove water pump back plate and headlight wires from clips along top of radiator core, radiator outlet hose and elbow at bottom of core, and core-to-support capscrews and nuts. Tilt radiator core toward engine as far as possible and lift core out (car manufacturer recommends that two men lift core out of car so as to prevent core damage).

Plymouth P9, P10:—Remove hood and take off water pump (see 1940 Plymouth P9, P10 'M' page for instructions). Disconnect hose at radiator top tank. Unclip headlight wires along top of core and move wires so as to clear core. Remove radiator core-to-support capscrews at each side. Tilt radiator core back and lift out of car.

PROPELLER SHAFT CENTER BEARING REMOVAL AND INSTALLATION:—Used on all passenger car models with two propeller shafts. To remove, take out rear propeller shaft, disconnect front universal (at rear of transmission), remove center bearing-to-frame mounting screws, slide front propeller shaft (with bearing) out through frame opening in X-member. To install, reverse procedure.

HAND BRAKE ADJUSTMENT:—The hand brake assembly has been redesigned slightly so that adjustments can now be made from beneath car as follows: Fully release hand lever (cable length adjusted by means of clevis at lower end). Adjust anchor screw for .015-.020" band to drum clearance by bending back tab of anchor screw lock and turning screw (on lower right side of brake), then lock screw by bending tab against flat of screw. Loosen guide bolt locknut and adjust guide bolt adjusting nut for .015-.020" band to drum clearance (these two nuts located in front of release springs at left side), then tighten locknut. Turn large adjusting bolt nut (on lower end of bolt below springs) for .015-.020" band to drum clearance for upper half of band. Groove in upper end of this nut must contact ridge on band operating lever spacer above nut.

NOTE—Clearance between side of anchor bracket at center of band and anchor must not exceed .005"

FRONT END ASSEMBLY (UNIT) REMOVAL:—Should be removed as a unit for work on front of engine. *See Chrysler Shop Notes for directions.*

SERIAL NUMBER:—On right front door hinge post. First number: Detroit—7,625,001 (Royal), 6,955,201 (Windsor). Canada—9,714,601 (Royal).

ENGINE NUMBER:—First number C25-1001. Stamped on left side of block between #1 and #2 cylinders. *See Chrysler Shop Notes for engine number lettering ('Special Standard' bore and bearing sizes).*

ENGINE SPECIFICATIONS:—6 cylinder, 'L' head type. **Bore**—3⅜". **Stroke**—4½".
Displacement—241.5 cu. ins. **Rated HP**—27.34.
Developed Horsepower—108 (Std. 6.5-1 hd.), 112 HP (Optl. 7.0-1 hd.—Std. 7 pass.) at 3600 RPM.
Compression Ratio and Pressure—As follows:

Ratio	Pressure at 1000 RPM	At 100 RPM
6.5-1 cast-iron hd.	140-150 lbs.	Approx. 115 lbs.
7.0-1 aluminum hd.	150-160 lbs.	Approx. 120 lbs.

Vacuum Reading—Steady 18-21" idling at 6 MPH. *See Chrysler Shop Notes for Engine Removal data.*

PISTONS:—Aluminum alloy, U-slot, cam ground, tin coated. **Length** 3⅞". **Weight** 17.5 ozs. (stripped).
Removal—Pistons and rods removed from above.
Clearance—Top .0115". Skirt .0000-.0010".
Original Bore & Piston Sizes, Replacement Pistons:—*See Chrysler Shop Notes for sizes and markings.*
Fitting New Pistons:—Check piston size with micrometer across large diameter at bottom of skirt. Insert .002" feeler between cylinder wall and piston (pin removed) on side opposite slot. With piston and block at 70° F, pull to withdraw feeler 5-7 lbs.
Installing Pistons—Slot away from camshaft.

PISTON RINGS:—4 rings, all above pin—#1 Compression (upper inner edge beveled), #2 Comp. (lower outer edge stepped), #3 & 4 (slotted oil rings).

Ring	Width	End Gap	Side Clearance
Comp. (Top)	⅛"	.007-.015"	.002-.004"
Comp. (#2)	⅛"	.007-.015"	.0015-.0035"
Oil Control	5/32"	.007-.015"	.001-.0025"

Replacement Rings:—Std. & .003", .005", .010", .015", .020", .023", .025", .030", .040", .050", .060" oversize.

PISTON PIN:—**Diameter**—55/64". **Length**—2⅞". Floating type. Pin hole in rod bronze bushed.
Pin Fit in Piston—Thumb push fit with piston heated to 130°F.
Pin Fit in Rod Bushing—Thumb push fit at 70°F.
Replacement Pins:—Std. & .003", .005", .008" oversize.

CONNECTING ROD:—**Weight**—33.9 ozs. (with bearings and bolts). **Length**—7⅞".
Crankpin Journal Diameter—2⅛".
Lower Bearing—Removable, precision type, steel-backed babbitt. *See Chrysler Shop Notes for undersizes.* **Clearance** .0005-.0025". **Sideplay** .0055-.0115".
Bearing Adjustment:—None (no shims). Install bearings with boss engaging groove in rod and cap.
Installing Rods:—Oil spit hole toward camshaft.

CRANKSHAFT:—4 bearings, 9 integral counterweights. *See Chrysler Shop Notes for Replacement Main Bearing Caps and Crankshaft Front and Rear Oil Seals.*
Journal Diameters—2½" all bearings.
Bearing Type—Removable, precision type steel-backed, babbitt-lined. **Clearance**—.001-.002".
Bearing Adjustment:—*See Chrysler Shop Notes for bearing removal, front main bearing cap removal, replacement bearing sizes and adjustment data.*
End Thrust:—Taken by flange faces on rear (#4) main bearing. **Endplay**—.003-.007".

CAMSHAFT:—4 bearing. Non-adjustable chain drive. *See Chrysler Shop Notes for camshaft removal.*
Journal Diameters—#1, 2"; #2, 1 31/32"; #3, 1 15/16"; #4, 1¼".
Bearing Type—Removable steel-backed, babbitt-lined bushings (except #4 machined in block).
Clearance—.001-.003" (#1), .0015-.0035" (all others).
End Thrust:—Taken by thrust plate behind camshaft sprocket hub. **Endplay**—.002-.006".
Timing Chain:—Morse Type 1883-N, No. 2661. Width 1". Pitch .500" (½"). Length 24" or 48 links.
Camshaft Setting:—Sprockets marked. Mesh chain with sprockets turned so that '0' marks are adjacent and in line with a straightedge across shaft centers.

VALVES:

	Head Diameter	Stem Diameter	Length
Intake	1 21/32"	.340-.341"	4 25/32"
Exhaust	1 17/32"	.340-.341"	4 25/32"

	Seat Angle	Lift	Stem Clearance
All Valves	45°	⅜"	.0015-.0035"

See Chrysler Shop Notes for Exh. valve seat insert data.
Tappet Clearance:—.008" Int., .010" Exh. (hot & idling). .002" additional exh. clearance desirable for sustained high speeds. NOTE—Tappet screws self-locking (no locknuts). Remove right front wheel, lower housing panel and pump shield for access.
Valve Guides:—Remove from above. Press new guides in (stepped end down) with upper end ⅞" below top of block, finish ream (Tool CM-83) to .3425-.3435".
Valve Springs:—Install with closely coiled ends to top.

Free length 2".	Spring Pressure	Length
Valve Closed	40-45 lbs.	1¾"
Valve Open	107-115 lbs.	1⅜"

Valve Lifters:—Mushroom type (remove from below). Stem diam. ⅝". Ream holes from above (pilot in valve stem guide). Oversizes .001", .008", .030", .060".
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 12° BTDC. Close 44° ALDC.
Exhaust Valves—Open 50° BLDC. Close 6° ATDC.
Valve Timing Check—With .014" (cold) tappet clearance #6 intake valve should open with #6 piston 12° or .063" BTDC with 12th graduation before DC mark on impulse neutralizer aligned with pointer on chain cover. Reset tappet cl. at .008" hot.

LUBRICATION:—Pressure (pump on right of engine). *See Chrysler Shop Notes for oil pump removal.*
Normal Oil Pressure:—30-45 lbs. @ 30 MPH, 15 idling.
Oil Pressure Relief Valve:—Under plug below starter. Opens at 40-45 lbs. To increase pressure use heavy (green), to decrease light (red), spring.
Crankcase Capacity:—5 quarts (refill).

COOLING SYSTEM:—**Capacity**—18 quarts. *See Chrysler Shop Notes for radiator core removal.*
Water Pump:—Packless type with belt drive. *See article in Mechanical Equipment Section for data.*
Removal—Drain water. Remove fan blade assembly, pulley, radiator outlet hose at pump, by-pass elbow (with small hose), pump mounting stud nuts, fan belt adjusting strap at generator, adjusting strap stud and lower pump stud from block.
Thermostat—Bishop & Babcock or Fulton. On head.
Setting—Starts to open 157-162°F. Fully open 183°F.

CLUTCH:—**Borg & Beck Model 10A7, 11A6 (Taxi) with 'Borglite' driven member.** #940 (10A7), #941 (11A6) stamped on cover. Single plate, dry disc type with spiral grooved facings, pressure plate oil baffle & pedal over-center return spring. *See article in Mechanical Equipment Section for data.*
Facings—Spiral wound moulded woven, 2 used. Inside Diam. 7" (10A7), 6½" (11A6), Outside Diam. 10" (10A7), 11" (11A6). Thickness ⅛" (all).
Adjustment:—Pedal should just clear toeboard (adjust stopscrew on lower end) and have 1" free movement (adjusting nut on link rod at clutch fork).
Removal:—Remove release fork pull-back spring, Transmission (see following) and housing underpan. Disconnect release fork from pivot and pull out as far as possible. Mark cover and flywheel, remove cover screws evenly, lower assembly out.

TRANSMISSION:—**Own Make.** All helical gear, constant-mesh, synchro-mesh (second & high), sliding gear (low & reverse). Warner Model R7B overdrive with electrical 'kick-down' Optl. on Windsor. *See article in Mechanical Equipment Section for data.*
Transmission Control:—Steering column shift Std. *See article in Mechanical Equipment Section for data.*
Removal:—Remove propeller shaft (loosen comp. flange nut if transmission to be disassembled—see Chrysler Shop Notes for Propeller Shaft Center Bearing Removal on 7 pass.). Disconnect speedometer cable, battery ground cable, hand brake cable, and gear shift rod and cable at transmission. Remove mounting stud nuts and lockwashers. Pull unit back, lower and remove from under car.
Overdrive Transmission Removal—Same as above, plus the following: Remove hand brake assembly (U-joint flange, brake drum, band and support). Disconnect solenoid wires (remove coil) and overdrive cable at case. Remove 2 upper mounting studs (insert pilot studs) and withdraw assembly.

UNIVERSAL JOINTS:—**Detroit-Universal Series 7200.** *See article in Mechanical Equipment Section for data.*
Propeller Shaft Center Bearing:—Used on 7 passenger sedans. *See Chrysler Shop Notes for servicing.*

REAR AXLE:—**Own Make.** Semi-floating, Hypoid gear type with Hotchkiss drive. *See article in Mechanical Equipment Section for data.*
Ratio—3.9-1 (Std.), 4.3-1 (Windsor with OverDr.—Std. 7 pass.), 4.56-1 (7 pass. with Overdrive).
Backlash—.006-.010". Screw adjustment.
Removal:—Disconnect drive shaft at rear universal. Remove axle shafts (see below) and capscrews on carrier flange. Pull carrier assembly out.
Axle Shaft Removal—Remove wheel, hub, and drum assembly (use screw type hub puller—Tool C-319), block brake pedal, disconnect brake line at wheel cylinder, take off backing plate with oil seal, pull shaft and bearing (Tool C-158). NOTE—Use Tool C-358 to pull oil washer, C-201, 2 to install.
Wheel Bearing Adjustment:—Shims between backing plate and axle housing. With wheel and hub removed, check endplay with dial indicator. To adjust, remove backing plate (see above), add or remove shims (.010", .0125", .015" .030" thick) equally at both wheels. **Endplay**—.003-.008".

SHOCK ABSORBERS:—**Domestic**—Delco or Monroe Direct acting. **Export**—Delco Direct acting or Delco Adjustable direct acting (Spec. Equip. Dom. also). *See articles in Mechanical Equipment Section for data.*

STEERING:—**Steering Gear.** Gemmer Model 305 Worm-and-Roller type with 'Push-pull' adjustment. *See article in Mechanical Equipment Section for data.*
Front Suspension:—Independent, linked parallelogram type with coil springs. *See article in Mechanical Equipment Section for data.*
Kingpin Inclination—4¾° to 6°.
Camber—Pos. ¼°. Limits 0° to Pos. ¾°.
Caster—Neg. 1° to Pos. 1°. Not adjustable.
Toe In—1/16" (0-⅛"). Turn both rods equally.
Steering Geometry—Inner wheel 22°. Outer 20°.

BRAKES:—**Service.** Lockheed hydraulic, double anchor type. Hand lever applies independent shaft brake. *See article in Mechanical Equipment Section for data.*
Wheel Cylinders—Stepped or two-stage bore type.
Drums—Centrifuse type. Diameter—11".
Lining—Molded. Width 2". Thickness 13/64". Length (front shoe) 11 15/32", (rear shoe) 7 31/32".
Clearance—.012" toe, .006" heel, for each shoe.
Hand Brake:—On drum at rear of transmission.
Adjustment—*See Chrysler Shop Notes for data.*
Drum—Cast-iron type. Diameter—6".
Lining—Width 2". Thick. 5/32". Length 17 1/16".

FRONT END ASSEMBLY (UNIT) REMOVAL:—Should be removed as a unit for work on front of engine. *See Chrysler Shop Notes for directions.*

SERIAL NUMBER:—Stamped on plate on right front door hinge pillar post. First number for each model

Traveler	New Yorker	Saratoga	C-27
6,750,101	6,613,401	6,673,501	7,806,551

ENGINE NUMBER:—First number C-26: C26-1001, C27: C27-1001. Stamped on left side of cylinder block between #2 and #3 cylinders. *See Chrysler Shop Notes for Engine Number Lettering ('Special Standard' bore and bearing sizes).*

ENGINE SPECIFICATIONS:—8 cylinder, 'L' head type.

Bore—3¼". **Stroke**—4⅞".

Displacement—323.5 cu. ins. **Rated HP**—33.80.

Developed Horsepower—130 HP (C26—6.8-1 Cast-iron hd.), 137 HP (C27—6.8-1 Aluminum hd.), 143 HP (C26 & C27 with optl. 7.45-1 hd.) at 3400 RPM.

Compression Ratio and Pressure—As follows:

Ratio	Pressure at 1000 RPM	At 100 RPM
6.8-1 hd. (see Note)	150-160 lbs.	Approx. 118 lbs.
7.45-1 aluminum hd.	160-170 lbs.	Approx. 124 lbs.

NOTE—Cast-iron head (C26), Aluminum (C27).

Vacuum Reading—Steady 18-21" idling at 6 MPH. *See Chrysler Shop Notes for engine removal instruct'ns.*

PISTONS:—Aluminum alloy, U-slot, cam ground, tin coated type. **Length**—3⅞".

Weight—16.33 ozs. (stripped).

Removal—Pistons and rods removed from above.

Clearance—Top .011". Skirt .0000-.0010". See Fitting New Pistons (following).

Original Bore & Piston Sizes, Replacement Pistons:—*See Chrysler Shop Notes for sizes and markings.*

Fitting New Pistons:—Check piston size with micrometer at bottom of skirt with gauge at right angles to pin bosses. Insert .002" feeler between cylinder wall and piston (with pin removed) opposite piston slot. Pull to withdraw feeler should be 5 to 7 lbs. Cylinders should be reconditioned when taper exceeds .0015" or out-of-round .002". Reconditioned cylinder bores should be within limits of .0005".

Installing Pistons:—Slot away from camshaft.

PISTON RINGS:—4 rings, all above pin—#1 Compression (upper inner edge beveled), #2 Comp. (lower outer edge stepped), #3 & 4 (slotted oil rings). NOTE—Compression rings are coated type.

Ring	Width	End Gap	Side Clearance
Comp. (top)	⅛"	.007-.015"	.002-.0035"
Comp. (#2)	⅛"	.007-.015"	.0015-.003"
Oil Control	5/32"	.007-.015"	.001-.0025"

Replacement Rings:—Std. & .003", .005", .010", .015", .020", .023", .025", .030", .040", .050", .060" oversize.

PISTON PIN:—**Diameter**—55/64". **Length**—2¾". Pin floats in piston and rod. Held by retaining ring at each end. Pin hole in rod bronze bushed.

Pin Fit in Piston—Thumb push fit with piston heated to 130°F.

Pin Fit in Rod Bushing—Thumb push fit at room temperature.

Replacement Pins:—Std. & .003", .005", .008" oversize.

CONNECTING ROD:—**Weight**—34.3 ozs. (with bearings and bolts). **Length**—9".
Crankpin Journal Diameter—2 3/16".

Lower Bearing—Removable, precision type, steel-backed, babbitt-lined. *See Chrysler Shop Notes for undersizes.*

Clearance—.001-.003". **Sideplay**—.006-.011".

Bearing Adjustment:—None (no shims). Replace bearings. Do not file rods or caps. Install new bearings with boss engaging groove in rod and cap.

Installing Rods:—Lower bearings are offset. Install rods with widest portion of bearing toward the rear on #1, #3, #5, and #7; toward the front on #2, #4, #6 and #8. Oil hole in upper bearing half must be toward camshaft side of engine on all rods.

CRANKSHAFT:—5 bearing type with 8 integral counterweights. Impulse neutralizer mounted on front end. *See Chrysler Shop Notes for Replacement Main Bearing Caps and Crankshaft Front and Rear Oil Seals.*

Journal Diameters—2 45/64" all bearings.

Bearing Type—Removable, precision type, steel-backed, babbitt-lined.

Clearance—.001-.002".

Bearing Adjustment:—*See Chrysler Shop Notes for Bearing removal, front main bearing cap removal, replacement bearing sizes and adjustment data.*

End Thrust:—Taken by flange faces on rear (#5) main bearing. **Endplay**—.003-.007".

CAMSHAFT:—6 bearing. Non-adjustable chain drive. *See Chrysler Shop Notes for camshaft removal.*

Journal Diameters—#1, 2 1/16"; #2, 2 1/32"; #3, 2"; #4, 1 31/32"; #5, 1 15/16"; #6, 1⅜".

Bearing Type—Removable steel-backed, babbitt-lined bushings (except #6 machined in crankcase).

Clearance—.001-.003" (#1), .0015-.0035" (all others). NOTE—Replacement bushings furnished finish reamed (reaming, scraping or burnishing not required).

End Thrust:—Taken by thrust plate assembled behind camshaft sprocket hub. **Endplay**—.002-.006".

Timing Chain:—Whitney #668983 center link guide type. Width 1¼". Pitch .500" (½"). Length 47 links or 23½".

Camshaft Setting:—Sprockets marked. Mesh chain with sprockets turned so that '0' marks are adjacent and in line with a straightedge across shaft centers.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1 17/32"	.340-.341"	5⅞"
Exhaust	1 11/32"	.340-.341"	5⅞"

	Seat Angle	Lift	Stem Clearance
All Valves	45°	⅜"	.0015-.0035"

See Chrysler Shop Notes for Exh. valve seat insert data.

Tappet Clearance:—.008" Intake, .010" Exhaust (with engine hot and running). .002" additional exhaust clearance desireable for sustained high speeds. NOTE—Tappet screws are self-locking type (no locknuts used). Remove right front wheel, lower housing panel and fuel pump shield for access to valves.

Valve Guides:—Remove from above. Press new guides in place with upper end 13/16" (Intake), 1" (Exhaust) below top of cylinder block. Install with taper end up (Intake), down (Exhaust) and ream (with Tool CM-83) to inside diameter of .3425-.3435". Counterbore exhaust guide at top to diameter of .365-.375" and ⅜" deep after installed in block.

Valve Springs:—Install with closely coiled ends at top. Free length 2 25/64".

	Spring Pressure	Length
Valve Closed	52-58 lbs.	2 1/32"
Valve Open	129-137 lbs.	1 21/32"

Valve Lifters:—Mushroom type (remove from below with oil pan, camshaft and valves out of engine). Stem diameter ⅝". Ream guide holes from above (with reamer piloted in valve guide to insure alignment of lifter). Lifters furnished for service in Std. & .001", .008", .030", .060" oversize.
Clearance in block—.000-.001".

Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 6° BTDC. Close 50° ALDC.
Exhaust Valves—Open 44° BLDC. Close 12° ATDC. Above figures correct with tappet clearance of .011" Intake, .014" Exhaust (cold).
Valve Timing Check—With .011" (cold) tappet clearance #8 intake valve should open with #8 piston 6° or .0170" BTDC with 6th graduation before DC mark on impulse neutralizer aligned with pointer on chain cover. Reset tappet clearance to .006" (hot and idling).
NOTE—Car manufacturer recommends use of Timing Indicator (Tool C-435) inserted in timing hole in cylinder head over #8 piston (measures piston travel).
Motor Gauge—Weidenhoff Adapter #103, Rod #12.

LUBRICATION:—Pressure system with gear type oil pump mounted on right side of crankcase. *See Chrysler Shop Notes for oil pump removal and installation.*

Normal Oil Pressure:—30-45 lbs. at car speed of 30 MPH. 15 lbs. at idling speed.

Oil Pressure Relief Valve:—Located under plug on lower left side of crankcase. Adjustable. To adjust, remove cap, withdraw locking wire, turn slotted plug clockwise to increase pressure, or counter-clockwise to decrease pressure. Valve opens at 40-45 lbs.

Crankcase Capacity:—6 quarts (refill).

COOLING SYSTEM:—**Capacity**—24 quarts. *See Chrysler Shop Notes for radiator core removal.*

Water Pump:—Packless type with sealed ball-bearing shaft (factory lubricated). *See article in Mechanical Equipment Section for data.*
Removal—Drain cooling system, loosen fan shroud-to-radiator core cap screws, remove fan belt, cylinder head water outlet elbow (with radiator inlet hose and water pump by-pass hose and elbow). Disconnect pump inlet hose and take out pump-to-back plate screws. Remove nut from stud in front lower right hand side of pump (pull pump forward and use stud pliers between pump and back plate to remove this stud). Lift out water pump, fan and shroud. NOTE—Back-plate assembled between pump and cylinder block (not removed with water pump).

Thermostat:—Bishop & Babcock or Fulton. In cylinder head outlet elbow. Install with bellows down.
Setting—Starts to open at 150° F. to 155° F. Fully open at 176° F.

Temperature Gauge:—Motometer (Auto-Lite) Vapor tension type. A-L Part No. H-9355. *See article in Mechanical Equipment Section for data.*

Drain Valves:—Two drain valves used. One drain valve in center of radiator lower tank at front. Cylinder block drain valve on lower edge of water jacket on left side of engine.

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CLUTCH (C26 WITHOUT FLUID DRIVE):—Borg & Beck Model 11A6 with 'Borglite' driven member. #941 stamped on cover. Single plate, dry disc type with spiral grooved facings, pressure plate oil baffle and pedal over-center return spring.
See article in Mechanical Equipment Section for data.
Facings—Spiral wound moulded woven, 2 used. Inside Diam. 6½". Outside Diam. 11". Thickness ⅛".

Adjustment:—Clutch pedal should just clear underside of toeboard. To adjust, loosen locknut and turn stopscrew located to rear of pedal arm above shaft. Free movement of pedal should be 1". To adjust, turn clutch release fork adjusting nut on connector link at clutch release fork.

Removal:—Remove clutch release fork pull-back spring. Remove transmission (see Transmission Removal following) and clutch underpan. Disconnect release fork from pivot and pull out as far as possible. Punch mark cover and flywheel (assemble to these marks when re-installing clutch assembly to maintain balance). Remove clutch cover screws (release spring tension evenly by turning each screw out a few turns at a time). Assembly can then be lowered out through pan opening.

CLUTCH (C26 WITH FLUID DRIVE AND C27):—Borg & Beck Model 10A6 with 'Borglite' driven member. #939 stamped on cover. Single plate, dry disc type with spiral grooved facings, pressure plate oil baffle and pedal over-center return spring. Clutch assembly mounted on clutch driving plate at rear of fluid drive unit. NOTE—No spring dampener used on clutch driven member.
See article in Mechanical Equipment Section for data.

Adjustment:—Same as for C26 above.

Removal:—Remove floor board, clutch release fork pull-back spring and cotter pin and clevis from end of release fork rod. Pull release fork out of housing. Remove transmission (see Transmission Removal following) and clutch housing underpan (jack up rear of engine enough to allow pan to clear frame cross member). Punch mark clutch cover and clutch driving plate (assemble to these marks when re-installing clutch assembly to maintain balance). Remove clutch cover-to-driving plate screws (release spring tension evenly by turning each screw out a few turns at a time). Clutch assembly and driven member can then be lowered out through pan opening.

FLUID DRIVE (STD. ON C27, OPTL. ON C26):—Consists of fluid coupling assembled to rear of engine in place of conventional flywheel.
See article in Mechanical Equipment Section for data.

Removal:—Remove clutch (see removal instructions above for C26 with Fluid Drive and C27). If fluid drive to be disassembled, turn unit over until one filler plug is at bottom center, remove plug with 1⅛" socket wrench and allow unit to drain. Remove fluid drive-to-crankshaft stud nuts freeing assembly. Then pull fluid drive and clutch driving plate assembly to rear and lower assembly out through pan opening.

TRANSMISSION:—Own Make. All helical gear type, constant-mesh, synchro-mesh (second and high), sliding gear (low and reverse). Warner Model R7B overdrive with electrical 'kick-down' control standard on C27, optional on C26 (New Yorker and Saratoga—not available on Traveler).
See articles in Mechanical Equipment Section for data.

Transmission Control:—Remote control, steering column mounted mechanical shift.
See article in Mechanical Equipment Section for data.

Removal (C26):—Remove propeller shaft by disconnecting front and rear universal joints. Loosen companion flange nut if transmission to be disassembled. Disconnect speedometer cable, battery ground cable, hand brake cable, and gear shift rod and cable at transmission. Remove transmission-to-clutch housing mounting stud nuts and washers. Pull transmission back, down and out of car. NOTE—Use pilot studs inserted in place of two upper mounting studs when installing transmission to avoid springing clutch driven member.
Overdrive Transmission Removal (C26)—Same as for standard transmission above, plus the following: Remove hand brake assembly (universal joint flange, brake drum, brake band and support). Disconnect solenoid wires (remove coil) and overdrive control cable clevis at lever on overdrive case. Remove two upper mounting studs (insert pilot studs) and withdraw transmission and overdrive as an assembly.

Removal (C27):—Remove floor boards. Disconnect battery ground cable at transmission. Remove rear propeller shaft, four front companion flange nuts, four frame-to-center bearing mounting screws, slide bearing and front shaft back through frame X-member opening (if spacer used between frame and bearing mounting, replace spacer when re-installing). Remove universal joint flange and brake drum from shaft, and clevis pin from brake cable. Take off brake assembly from overdrive case. Disconnect solenoid wires and remove coil. Disconnect speedometer and gear shifter rod and cable at transmission. Remove transmission-to-clutch housing mounting stud nuts, two upper mounting studs (install two nuts on end of stud and turn stud out) and replace with pilot studs. Withdraw transmission and overdrive as an assembly.

UNIVERSAL JOINTS:—Detroit-Universal Series 7300. Cross type with roller bearings. Two used on C26. Three used with Center bearing on C27.
See article in Mechanical Equipment Section for data.

Propeller Shaft Center Bearing (C27):—*See Chrysler Shop Notes for removal and installation data.*

REAR AXLE (C26):—Own Make. Semi-floating, hypoid gear type with Hotchkiss drive.
See article in Mechanical Equipment Section for data.
Ratio—3.91-1 (standard). 4.1-1 (special). 4.3-1 or 4.89-1 (with overdrive and fluid drive).
Backlash—.006-.010". Screw adjustment.

Removal:—Drain differential, remove both axle shafts (see below) and universal flange bolts at rear universal and lower propeller shaft. Take out carrier-to-axle housing capscrews (nuts used on C27) and lift out differential gear carrier assembly.

Axle Shaft Removal—Remove wheel, hub, and drum assembly (use screw type hub puller—Tool C-319 for C26, C-476 for C27). Block brake pedal, disconnect brake line at wheel cylinder, take off oil seal and backing plate and pull axle shaft and bearing with Tool C-158. NOTE—Use Tool C-358 to pull axle shaft oil seal washer and drift C-201 or C-202 to install washer.

Wheel Bearing Adjustment:—Adjusting shims located between flanged ends of axle housing and brake backing plate. Remove wheel and hub assembly (see above). Check endplay with dial indicator (make sure that brake bolts are tight and tap end of axle shaft so that bearing cups are seated). To adjust, remove oil seal and backing plate, add or remove shims equally at both ends of axle housing until endplay is correct. **Endplay**—.003-.008". NOTE—Adjusting shims furnished .010", .0125", .015" and .030" thick.

REAR AXLE (C-27):—Own Make. New type, semi-floating, hypoid gear type with Hotchkiss drive. New barrel type differential with adjustable type drive gear thrust pad.
See article in Mechanical Equipment Section for data.
Ratio—4.55-1.
All other data same as for C26 Rear Axle above.

SHOCK ABSORBERS:—Delco or Monroe. Direct acting, hydraulic types. Delco Models 1130 and 1134 are adjustable type.

Car Model	Make	Front	Rear
C23 (Standard)	Delco	1000-C	1001-T
C23 (Standard)	Monroe	854568	854570
C23 (Spec. Equip.)	Delco	1134-E	1130-W
C23 (Export)	Delco	1002-C	1003-T
C24 (Standard)	Delco	1134-E	1130-W

See articles in Mechanical Equipment Section for data.

STEERING:—Steering Gear—Gemmer Model 335 Worm-and-Roller type with 'push-pull' adjustment.
See article in Mechanical Equipment Section for data.

Front Suspension:—Independent, linked parallelogram type with coil springs.
See article in Mechanical Equipment Section for data.
Specifications below apply with car weight on wheels and no passenger load.
Kingpin Inclination—4¾° to 6°.
Camber—Positive ¼° (desired). Limits 0° to Positive ¾°. Adjustable.
Caster—Negative 1° to Positive 1°. Not adjustable.
Toe In—1/16" (desired). Limits 0" to ⅛". Adjust by loosening clamp bolts on ends of both tie rods and turning rods equally, tighten clamp bolts. NOTE—Clamp bolt on left end of long tie rod should be turned below tie rod to give clearance for extreme turns.
Steering Geometry (toe-out on turns)—Inner wheel turned 21°30'. Outer wheel turned 20°.

BRAKES:—Service—(Front Wheels): New Lockheed hydraulic, Two-Cylinder type (front shoe anchored at bottom and actuated by top cylinder, rear shoe anchored at top and actuated by bottom cylinder). **(Rear Wheels):** Lockheed hydraulic, double anchor type (same as 1939 except for redesigned wheel cylinder). Hand lever applies independent propeller shaft brake.
See articles in Mechanical Equipment Section for data.
Wheel Cylinders—New straight cut bore type with new piston assembly (no spring) used on both front and rear brakes. Cylinder bore diameter 1⅛".
Drums—Centrifuse type. Diameter—12".
Lining—Molded. Width 2". Thickness 13/64". Length—Rear wheel rear shoe 9⅝", all other shoes 12 9/16".
Clearance—Toe (wheel cylinder end) .007" for all shoes. Heel (anchor bolt end) .006" for all shoes except rear wheel rear shoes—.007" rear wheel rear shoes only.
Braking Power—61% front wheels, 39% rear wheels.

Hand Brake:—On drum at rear of transmission.
Adjustment—*See Chrysler Shop Notes.*
Drum—Cast-iron. Diameter—7".
Lining—Width 2½". Thickness 5/32". Length 20⅛".

Power Brake Unit (C27):—Bendix Internal Valve type.
See article in Mechanical Equipment Section for data.

ENGINE REMOVAL NOTE:—Engine removal from chassis required for all service work. *See Crosley Special Shop Notes for removal directions.*

SERIAL NUMBER:—First number 390-10000. Stamped on front face of cowl below battery shelf (in engine compartment).

ENGINE NUMBER:—First number C-10000. Stamped on top center of engine block at rear of carburetor.

ENGINE SPECIFICATIONS:—Waukesha. Two cylinder, 'L' head, horizontal opposed, air-cooled type with shrouded cylinders and air circulating fan built in flywheel.

Bore—3". **Stroke**—2¾". **Rated Horsepower**—7.2.

Displacement—38.87 cubic inches.

Developed Horsepower—13.5 at 4000 R.P.M.

Compression Ratio—5.5-1.

Compression Pressure—90 lbs. at cranking speed.

Vacuum Reading—No means of connecting gauge.

PISTONS:—Electric furnace cast iron. Matched for equal weight within ⅛ oz.

Weight—18.5 ozs. (with pin). **Length** 2⅝".

Removal—Pistons & rods removed from above with engine out of chassis. *See Crosley Special Shop Notes for engine removal instructions.*

Clearance—.004-.0055". See Fitting Pistons.

Fitting New Pistons:—Use feeler gauges installed between piston and cylinder wall at right angles to pin hole. Piston should pass through bore on .004" feeler and lock on .0055" feeler.

Replacement Pistons:—Finished pistons furnished Standard and .010", .020", .040" oversize.

PISTON RINGS:—Two compression, one oil control ring per piston, all above pin.

Ring	Width	End Gap	Side Clearance
Compr. #1	⅛"	.010-.015"	.002-.0035"
Compr. #2	⅛"	.010-.015"	.0015-.003"
Oil Contr.	3/16"	.010-.018"	.001-.0025"

NOTE—Install oil ring with scraper edge down.

Replacement Rings:—Furnished Standard and .010", .020", .040" oversize.

PISTON PIN:—Diameter ⅝". Pin floats in piston and rod, held by locking ring at each end.

Pin Fit in Piston—.0002" clearance or thumb push fit at normal temperature.

Pin Fit in Rod Bushing—.0003" clearance. Ream new bushings with ⅝" reamer for this clearance.

Replacement Pins:—Std. and .005", .010" oversize.

CONNECTING ROD:—Weight 12.5 ozs. **Length** 4⅝".

Lower Bearing—Removable steel-backed, babbitt lined type.

Crankpin Journal Diameters—1½".

Clearance—.0025". **Sideplay**—.008".

Adjustment:—None (no shims). Replace bearings. Do not file bearing caps.

Replacement Bearings:—Furnished Std. and .003" undersize. Install bearings with locating lugs fitted in notches in rod and cap. NOTE—Bearings can be renewed through pan opening without removing engine from chassis.

CRANKSHAFT:—Two bearing, counterweighted type. *See Crosley Special Shop Notes for Engine Removal directions for main bearing and crankshaft oil seal servicing.*

Journal Diameters—Front 1⅝". Rear 2¼".

Bearing Type—Steel-backed, babbitt-lined bushings (not split). Front bearing mounted in timing gear housing cover.

Clearance—.001-.003" (frt.), .0015-.003" (rear).

Adjustment:—None. Replace bearings. *See Crosley Special Shop Notes for Crankshaft Removal directions.*

End Thrust:—Taken by rear bearing. Adjustable by replacing fiber thrust washer. **Endplay**—.003-.005".

CAMSHAFT:—Proferal (alloy iron). Two bearing, gear driven.

Bearing Type—Removable bushing in rear cover (front), machined in crankcase (rear).

Clearance—.001-.003".

Endplay—.006-.009". Controlled by timing gear.

See Crosley Special Shop Notes for Camshaft Removal and front bushing servicing data.

Timing Gears:—Allowable runout .001". To renew gears, remove camshaft (see Crosley Shop Notes for data), use puller to remove old gears.

Camshaft Setting:—Mesh gears so that 'C' mark on camshaft gear and punchmark on crankshaft gear line up (install gears with these marks forward).

VALVES:—

	Head Diameter	Stem Diameter
Intake	1⅜"	5/16"
Exhaust	1 5/32"	5/16"

	Seat Angle	Lift	Stem Clearance
Intake	45°	.300"	.002-.003"
Exhaust	45°	.300"	.003-.004"

Tappet Clearance—.006-.0065" Intake, .007-.0075" Exhaust, Cold. Not adjustable. NOTE—After grinding valves, check tappet clearance with feeler gauge. Grind off end of valve stem if clearance less than minimum above.

Valve Springs:—Free length 1 27/32".

	Pressure	Length
Valve Closed	20 lbs.	1½"
Valve Open	41 lbs.	1 15/64"

Valve Guides:—Guides can be removed and renewed with engine out of car and dismantled (See Shop Notes for engine removal directions). Ream new guides with 5/16" reamer for correct stem clearance (above).

Valve Lifters:—Mushroom type. Remove from below with camshaft out of engine (see Shop Notes for Camshaft removal directions).

Lifter Clearance—.0005-.0015".

Valve Timing:—See Camshaft Setting above.

Intake Valves—Open 20° BTDC. Close 60° ALDC.

Exhaust Valves—Open 60° BLDC. Close 20° ATDC.

To Check Valve Timing—Intake valve should open when point on flywheel 5.5 teeth before TDC mark (half round notch on rim of flywheel) lines up with small ribcast on top center of crankcase. Exhaust closing point is 5.5 teeth past TDC point.

LUBRICATION:—Pressure to crankshaft, connecting rod and camshaft bearings.

Oil Pump:—Rotary vane type mounted on timing gear cover and driven directly from camshaft.

Removal—Take out 4 screws mounting pump on timing gear cover, remove pump. Serviced by replacement. Use new gasket when installing pump.

Normal Oil Pressure:—30-45 lbs. with warm oil.

Oil Pressure Regulator:—On timing gear case cover. Adjustable by varying valve spring tension (increase tension to increase oil pressure).

Crankcase Capacity—2 quarts.

COOLING:—Air-cooled by suction fan built in flywheel which draws air past cylinder barrel and head fins through ducts formed by shroud bolted over cylinders.

Cooling Fan Capacity—700 cu. ft. of air per minute at 3600 R.P.M.

CLUTCH:—Rockford. Single plate dry disc type.

See article in Mechanical Equipment Section for data.

Facings—Not furnished separately (each facing consists of 4 segments).

Adjustment:—Clutch pedal free travel should be 1.5". To adjust, loosen locknut and turn clevis on connector cable at lower end of throw-out yoke.

Removal:—Remove transmission (see Transmission Removal below) and rear axle as an assembly (do not disconnect drive shaft at rear of transmission case as for transmission removal only). Disconnect clevis at bottom of clutch yoke, remove throw-out bearing from top of yoke, take out six capscrews mounting clutch lever brackets on flywheel, remove clutch assembly.

TRANSMISSION:—Warner Model AS1-T92. Sliding spur gear type (all speeds).

See article in Mechanical Equipment Section for data.

Removal:—Hoist rear of car to remove weight from springs, disconnect springs at rear axle, disconnect brake cables and conduits at backing plates, shock absorber links, exhaust pipe and muffler at torque tube. Block up rear of engine, disconnect speedometer cable and clutch cable clamp on bottom of transmission case, take off control housing and remove shift lever assembly. Take out capscrews in torque tube flange on rear face of transmission case, pull rear axle and propeller shaft assembly to rear **being careful not to lose spring and two washers on shaft at rear of speedometer gear.** Take out four capscrews mounting transmission on flywheel housing, pull transmission straight back and remove.

UNIVERSAL JOINTS:—None used.

REAR AXLE:—Spicer (Salisbury) Model 11. Semi-floating spiral bevel gear type with Torque Tube drive.

See article in Mechanical Equipment Section for data.

Ratio—5.14-1 or 5.57-1.

Backlash—.004-.008". Shim adjustment.

Removal:—Disconnect shock absorber links, brake cables and conduits at backing plate. Hoist rear end of car to remove weight from springs, disconnect springs at axle. Free exhaust pipe and muffler from torque tube, block up rear end of transmission (supported by torque tube). Take out capscrews in torque tube flange on rear of transmission case, pull torque tube and rear axle assembly to rear and remove **being careful not to lose spring and two washers on front end of propeller shaft at rear of speedometer gear.**

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Axle Shaft Removal—Remove hub cap, wheel, axle nut, pull hub (use puller No. 202318). Disconnect brake cable and conduit on backing plate, take out four capscrews and remove backing plate being careful not to lose bearing adjusting shims (between backing plate and axle housing flange). Pull axle and bearing out.

Wheel Bearing Adjustment:—Check endplay with dial indicator. Adjust by removing backing plate (see Axle Shaft Removal above) and adding or removing shims between backing plate and axle housing.

Endplay—.002-.007" between shaft and thrust block (total for both shafts).

TORQUE TUBE & PROPELLER SHAFT ASSEMBLY:—Spicer No. 98-1107X. Shaft is supported by bearing at center of torque tube and has splined joint at each end to engage transmission mainshaft (front), rear axle pinion shaft (rear). Torque tube has flanged ends which bolt directly to transmission case and rear axle housing.

Propeller Shaft Removal—Remove rear axle and torque tube as a unit (see Rear Axle Removal above), withdraw propeller shaft through forward end of torque tube.

CAUTION—When installing assembly in car make certain that spring and washers assembled on forward end of propeller shaft (necessary to prevent endplay in shaft).

SHOCK ABSORBERS:—Delco Model 1201G, H (front), 1201J, K (rear). Single acting, hydraulic type.
See article in Mechanical Equipment Section for data.

STEERING:—Steering Gear—Ross Model S-12. Cam-and-Lever type.
See article in Mechanical Equipment Section for data.

Front Suspension:—Conventional 'I' beam section front axle with reverse Elliott ends and semi-elliptic springs.

Kingpin Inclination—6°30' crosswise.

Camber—2°. No adjustment provided.

Caster—9°. No adjustment provided.

Toe In—3/64-1/16". Adjust in usual manner by loosening tie rod clamp bolts and turning rod.

BRAKES:—Service—Hawley. Four wheel, mechanical type with 'floating' lining. Hand lever applies all four service brakes.
See article in Mechanical Equipment Section for data.

Drum Diameter—6".

Lining—Width 1". Thickness 5/32". Length 18⅜" per wheel. NOTE—Lining furnished in correct length to fit loosely around shoe assembly with 1/16-⅛" gap at ends (not riveted on shoes).

Clearance—Just clear of drag.

Hand Brake:—See Service Brakes above.

CROSLEY SPECIAL SHOP NOTES

ENGINE REMOVAL (FOR SERVICING):—Engine should be removed from chassis for all major service work as follows: Disconnect battery ground cable, distributor cables, choke and throttle connections, oil gauge tube line at engine. Close shut-off valve at gasoline tank, disconnect gas line at sediment bulb. Remove exhaust pipe (connecting manifold and muffler), accelerator bracket, generator, starting motor (accessible by removing plate in driver's compartment). Disconnect clutch cable bracket on transmission case, clutch cable clevis at clutch yoke, speedometer cable at transmission. Block up front end of car and remove front axle assembly and wheels. Drain oil, remove oil pan and oil suction tube (pan retained by Phillips type screws). Remove hold-down bolts in front motor support, block engine and transmission up, take out capscrews mounting transmission on flywheel housing, pull engine forward. Take out capscrews mounting torque tube on rear face of transmission case, remove transmission. Lower engine to floor, raise front end of car, remove engine from below.
Installation—Install engine in same manner. Check ignition timing if distributor disturbed.

PISTON & CONNECTING ROD REMOVAL:—With engine removed from chassis (above), take out 7 Phillips screws in each shroud, remove shrouds from cylinders. Remove cylinder heads and oil pan (pan retained by 9 Phillips screws). Take out connecting rod bearing cap screws, push piston and rod assembly out through cylinder barrel.

CAMSHAFT REMOVAL:—With engine removed from chassis (above), remove intake and exhaust manifold assembly, cylinder shrouds (retained by 7 Phillips screws in each shroud), cylinder heads, and oil pan (retained by 9 Phillips screws). Remove connecting rod and piston assemblies, gear housing cover (with oil pump), and valve cover. Block up valves by placing 5/16"x¾" capscrew between crankcase and spring washer on each valve, pull camshaft and timing gear assembly out through front of crankcase.

CRANKSHAFT REMOVAL:—For Main Bearing & Crankshaft Oil Seal Servicing. With engine removed from chassis (above), dismantle engine and remove camshaft (see Camshaft Removal above). Take out 4 capscrews mounting flywheel on crankshaft flange, pull flywheel. Pull crankshaft out through front end of crankcase by hand.

Main Bearing Renewal—Drive old bearings out (rear bearing in crankcase, front bearing in gear housing cover), drive new bearing bushings in place. Bearings are precision type and need not be reamed.

Oil Seal Renewal—Drive old oil seals out of crankcase (rear), gear housing cover (front) with drift pin. Use mandril or hardwood block to drive new seals in place. CAUTION—When installing crankshaft use care not to damage leather oil seals.

CAMSHAFT BUSHING RENEWAL:—Take out 8 capscrews in gear housing cover and Phillips screws in oil pan which enter gear cover, remove gear cover. Drive or press camshaft bushing out of timing gear cover and install new bushing in same manner.

NOTE—Rear camshaft bushing is integral with crankcase and cannot be serviced.

FRONT WHEEL & AXLE ASSEMBLY REMOVAL: For Engine Removal from chassis. Raise front end of car until front wheels clear floor, disconnect brake cables at levers on backing plates and cable conduit from backing plate clamps. Disconnect drag link at pitman arm, disconnect shock absorber links at axle. Remove front spring 'U' bolts at axle. Hoist front end of car and roll wheel and axle assembly out from under car.

FRONT END ASSEMBLY (UNIT) REMOVAL:—Should be removed as a unit for work on front of engine. *See Chrysler Shop Notes for directions.*

SERIAL NUMBER:—On right front door hinge post. First number. Detroit—5,688,001 (Custom), 6,064,301 (Deluxe), 5,096,701 (Taxi). Canada—9,393,281.

ENGINE NUMBER:—First number S-7-1001. Stamped on left side of block between #1 and #2 cylinders *See Chrysler Shop Notes for engine number lettering ('Special Standard' bore and bearing sizes).*

ENGINE SPECIFICATIONS:—6 cylinder, 'L' head type. **Bore**—3⅜". **Stroke**—4¼".
Displacement—228 1 cu. ins **Rated HP**—27 34.
Developed Horsepower—100 HP (Std. 6 5-1 head), 105 HP (Optl. 7 0-1 hd—Std. 7 pass.) at 3600 RPM.
Compression Ratio and Pressure—As follows:

Ratio	Pressure at 1000 RPM	At 100 RPM
6 5-1 cast-iron hd	145-155 lbs.	Approx. 115 lbs.
7.0-1 aluminum hd.	150-160 lbs	Approx 120 lbs.

Vacuum Reading—Steady 18-21" idling at 6 MPH *See Chrysler Shop Notes for Engine Removal data.*

PISTONS:—Aluminum alloy, U-slot, cam ground, tin coated. **Length** 3⅞". **Weight** 17 5 ozs (stripped).
Removal—Pistons and rods removed from above
Clearance—Top .0115". Skirt .0000-.0010".
Original Bore & Piston Sizes, Replacement Pistons:—*See Chrysler Shop Notes for sizes and markings.*
Fitting New Pistons:—Check piston size with micrometer across large diameter at bottom of skirt Insert .002" feeler between cylinder wall and piston (pin removed) on side opposite slot With piston and block at 70° F, pull to withdraw feeler 5-7 lbs
Installing Pistons—Slot away from camshaft

PISTON RINGS:—4 rings, all above pin—#1 Compression (upper inner edge beveled), #2 Comp. (lower outer edge stepped), #3 & 4 (slotted oil rings)

Ring	Width	End Gap	Side Clearance
Comp (Top)	⅛"	.007-.015"	.002-.004"
Comp (#2)	⅛"	.007-.015"	.0015-.0035"
Oil Control	5/32"	.007-.015"	.001-.0025"

Replacement Rings:—Std & .003", .005", .010", .015", .020", .023", .025", .030", .040", .050", .060" oversize

PISTON PIN:—**Diameter**—.55/64" **Length**—2⅞" Floating type Pin hole in rod bronze bushed
Pin Fit in Piston—Thumb push fit with piston heated to 130°F
Pin Fit in Rod Bushing—Thumb push fit at 70°F
Replacement Pins:—Std & .003", .005", .008" oversize.

CONNECTING ROD:—**Weight**—35 2 ozs (with bearings and bolts). **Length**—8".
Crankpin Journal Diameter—2⅛"
Lower Bearing—Removable, precision type, steel-backed babbitt *See Chrysler Shop Notes for undersizes.* **Clearance** .0005-.0025" **Sideplay** .0055-.0115".
Bearing Adjustment:—None (no shims) Install bearings with boss engaging groove in rod and cap
Installing Rods:—Oil spit hole toward camshaft

CRANKSHAFT:—4 bearing type with 7 counterweights *See Chrysler Shop Notes for replacement Main Bearing Caps and Crankshaft Front and Rear Oil Seals.*
Journal Diameters—2½" all bearings
Bearing Type—Removable, precision type steel-backed, babbitt-lined **Clearance**—.001-.002".
Bearing Adjustment:—*See Chrysler Shop Notes for bearing removal, front main bearing cap removal, replacement bearing sizes and adjustment data.*
End Thrust:—Taken by flange faces on rear (#4) main bearing **Endplay**—.003-.007"

CAMSHAFT:—4 bearing Non-adjustable chain drive *See Chrysler Shop Notes for camshaft removal.*
Journal Diameters—#1, 2"; #2, 1 31/32"; #3, 1 15/16"; #4, 1¼".
Bearing Type—Removable steel-backed, babbitt-lined bushings (except #4 machined in block).
Clearance—.001-.003" (#1), .0015-.0035" (all others).
End Thrust:—Taken by thrust plate behind camshaft sprocket hub. **Endplay**—.002-.006".
Timing Chain:—Morse Type 1883-N, No. 2661. Width 1". Pitch .500" (½"). Length 24" or 48 links.
Camshaft Setting:—Sprockets marked. Mesh chain with sprockets turned so that '0' marks are adjacent and in line with a straightedge across shaft centers.

VALVES:

	Head Diameter	Stem Diameter	Length
Intake	1 21/32"	.340-.341"	4 25/32"
Exhaust	1 17/32"	.340-.341"	4 25/32"

	Seat Angle	Lift	Stem Clearance
All Valves	45°	⅜"	.0015-.0035"

See Chrysler Shop Notes for Exh. valve seat insert data.
Tappet Clearance:—.008" Int., .010" Exh. (hot & idling). .002" additional exh. clearance desirable for sustained high speeds. NOTE—Tappet screws self-locking (no locknuts). Remove right front wheel, lower housing panel and pump shield for access.
Valve Guides:—Remove from above. Press new guides in (stepped end down) with upper end ⅞" below top of block, finish ream (Tool CM-83) to .3425-.3435".
Valve Springs:—Install with closely coiled ends to top.

	Spring Pressure	Length
Free length 2".		
Valve Closed	40-45 lbs.	1¾"
Valve Open	107-115 lbs.	1⅜"

Valve Lifters:—Mushroom type (remove from below). Stem diam. ⅝". Ream holes from above (pilot in valve stem guide). Oversizes .001", 008", .030", .060".
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 12° BTDC Close 44° ALDC.
Exhaust Valves—Open 50° BLDC. Close 6° ATDC.
Valve Timing Check—With .014" (cold) tappet clearance #6 intake valve should open with #6 piston 12° or .059" BTDC with 12th graduation before DC mark on impulse neutralizer aligned with pointer on chain cover. Reset tappet cl. at .008" hot.

LUBRICATION:—Pressure (pump on right of engine). *See Chrysler Shop Notes for oil pump removal.*
Normal Oil Pressure:—30-45 lbs. @ 30 MPH, 15 idling.
Oil Pressure Relief Valve:—Under plug below starter Opens at 40-45 lbs. To increase pressure use heavy (green), to decrease light (red), spring.
Crankcase Capacity:—5 quarts (refill).

COOLING SYSTEM:—**Capacity**—17 quarts. *See Chrysler Shop Notes for radiator core removal.*
Water Pump:—Packless type with belt drive. *See article in Mechanical Equipment Section for data.*
Removal—Drain water Remove fan blade assembly, pulley, radiator outlet hose at pump, by-pass elbow (with small hose), pump mounting stud nuts, fan belt adjusting strap at generator, adjusting strap stud and lower pump stud from block.
Thermostat—Bishop & Babcock or Fulton. On head.
Setting—Starts to open 157-162°F. Fully open 183°F.

CLUTCH:—**Borg & Beck Model 10A7, 11A6 (Taxi) with 'Borglite' driven member.** #938 (10A7), #931 (11A6) stamped on cover. Single plate, dry disc type with spiral grooved facings, pressure plate oil baffle & pedal over-center return spring. *See article in Mechanical Equipment Section for data.*
Facings—Spiral wound moulded woven, 2 used. Inside Diam 7" (10A7), 6½" (11A6), Outside Diam. 10" (10A7), 11" (11A6) Thickness ⅛" (all).
Adjustment:—Pedal should just clear toeboard (adjust stopscrew on lower end) and have 1" free movement (adjusting nut on link rod at clutch fork).
Removal:—Remove release fork pull-back spring, Transmission (see following) and housing underpan. Disconnect release fork from pivot and pull out as far as possible. Mark cover and flywheel, remove cover screws evenly, lower assembly out.

TRANSMISSION:—**Own Make.** All helical gear, constant-mesh, synchro-mesh (second & high), sliding gear (low & reverse). Warner Model R7B overdrive with electrical 'kick-down' control optl. *See article in Mechanical Equipment Section for data.*
Transmission Control:—Steering column shift Std. *See article in Mechanical Equipment Section for data.*
Removal:—Remove propeller shaft (loosen comp. flange nut if transmission to be disassembled—see Chrysler Shop Notes for Propeller Shaft Center Bearing Removal on 7 pass). Disconnect speedometer cable, battery ground cable, hand brake cable, and gear shift rod and cable at transmission. Remove mounting stud nuts and lockwashers. Pull unit back, lower and remove from under car.
Overdrive Transmission Removal—Same as above, plus the following: Remove hand brake assembly (U-joint flange, brake drum, band and support). Disconnect solenoid wires (remove coil) and overdrive cable at case. Remove 2 upper mounting studs (insert pilot studs) and withdraw assembly.

UNIVERSAL JOINTS:—**Detroit-Universal Series 7200.** Cross type. NOTE—Series 4200 Ball & Trunnion Type used also. *See Mechanical Equipment Section.*
Propeller Shaft Center Bearing:—Used on 7 passenger sedans. *See Chrysler Shop Notes for servicing.*

REAR AXLE:—**Own Make.** Semi-floating, Hypoid gear type with Hotchkiss drive. *See article in Mechanical Equipment Section for data.*
Ratio—4 1-1 (Std. 5 pass.). 4 3-1 (5 pass with overdrive—Std. 7 pass). 4 56-1 (7 pass. with Overdrive).
Backlash—.006-.010". Screw adjustment.
Removal:—Disconnect drive shaft at rear universal. Remove axle shafts (see below) and capscrews on carrier flange. Pull carrier assembly out.
Axle Shaft Removal—Remove wheel, hub, and drum assembly (use screw type hub puller—Tool C-319), block brake pedal, disconnect brake line at wheel cylinder, take off backing plate with oil seal, pull shaft and bearing (Tool C-158). NOTE—Use Tool C-358 to pull oil washer, C-201, 2 to install.
Wheel Bearing Adjustment:—Shims between backing plate and axle housing. With wheel and hub removed, check endplay with dial indicator To adjust, remove backing plate, add or remove shims equally at both wheels. **Endplay**—.003-.008".

SHOCK ABSORBERS:—**Domestic**—Delco Direct Acting.
Export—Delco Direct Acting or Delco Adjustable Direct acting (Special Equip Dom also). *See article in Mechanical Equipment Section for data.*

STEERING:—**Steering Gear.** Gemmer Model 305 Worm-and-Roller type with 'Push-pull' adjustment. *See article in Mechanical Equipment Section for data.*
Front Suspension:—Independent, linked parallelogram type with coil springs. *See article in Mechanical Equipment Section for data.*
Kingpin Inclination—4¾° to 6°
Camber—Pos. ¼°. Limits 0° to Pos ¾°.
Caster—Neg. 1° to Pos. 1° Not adjustable
Toe In—1/16" (0-⅛") Turn both rods equally
Steering Geometry—Inner wheel 22°. Outer 20°.

BRAKES:—**Service.** Lockheed hydraulic, double anchor type. Hand lever applies independent shaft brake. *See article in Mechanical Equipment Section for data.*
Wheel Cylinders—Stepped or two-stage bore type.
Drums—Centrifuse type Diameter—11".
Lining—Molded Width 2". Thickness 13/64". Length (front shoe) 11 15/32", (rear shoe) 7 31/32".
Clearance—.012" toe, .006" heel, for each shoe.
Hand Brake:—On drum at rear of transmission.
Adjustment—*See Chrysler Shop Notes for data.*
Drum—Cast-iron type Diameter—6"
Lining—Width 2". Thick. 5/32". Length 17 1/16".

FRONT END ASSEMBLY (UNIT) REMOVAL:—Should be removed as a unit for work on front of engine. ***See Chrysler Shop Notes for directions.***

SERIAL NUMBER:—On right front door hinge post.

	Detroit	Canada
D14 Deluxe	30,216,001	9,420,231
D17 Special	4,349,001	9,494,721

ENGINE NUMBER:—First number D-14-1001. Stamped on left side of block between #1 and #2 cylinders. ***See Chrysler Shop Notes for Engine Number Lettering ('Special Standard' bore and bearing sizes).***

ENGINE SPECIFICATIONS:—6 cylinder, 'L' head type. **Bore**—3¼". **Stroke**—4⅜".
Displacement—217.8 cu. ins. **Rated HP**—25.35.
Developed Horsepower—87 HP at 3600 RPM.
Compression Ratio—6.5-1 cast-iron head. No optl.
Compression Pressure—140-150 lbs. at 1000 RPM or approximately 113 lbs. at cranking speed.
Vacuum Reading—Steady 18-21" idling at 6 MPH. ***See Chrysler Shop Notes for engine removal instructions.***

PISTONS:—Aluminum alloy, cam ground, split skirt, steel strut, tin coated type. **Length**—3 11/16". **Weight**—15.2 ozs. (stripped).
Removal—Pistons and rods removed from above.
Clearance—Top .011". Skirt .00025-.00075".
Original Bore & Piston Sizes, Replacement Pistons:—***See Chrysler Shop Notes for sizes and markings.***
Fitting New Pistons:—Check piston size with micrometer gauge on skirt across piston pin support ribs. Insert .002" feeler between cylinder wall and piston on side opposite slot. With piston and block at 70°F pull to withdraw feeler should be 10-16 lbs.
Installing Pistons:—Slot away from camshaft.

PISTON RINGS:—4 rings, all above pin—#1 Compression (upper inner edge stepped), #2 Comp. (lower outer edge stepped), #3 and 4 (slotted oil rings).

Ring	Width	End Gap	Side Clearance
Comp. (Top)	⅛"	.007-.015"	.002-.004"
Comp. (#2)	⅛"	.007-.015"	.0015-.0035"
Oil Control	5/32"	.007-.015"	.001-.0025"

Replacement Rings:—Std. & .003", .005", .010", .015", .020", .023", .025", .030", .040", .050", .060" oversize.

PISTON PIN:—**Diameter**—55/64". **Length**—2¾". Floating type. Pin hole in rod bronze bushed.
Pit Fit in Piston—Thumb push fit with piston heated to 160°F.
Pin Fit in Rod Bushing—Thumb push fit at 70°F.
Replacement Pins:—Std. & .003", .005", .008" oversize.

CONNECTING ROD:—**Weight**—30.4 ozs. (with bearings and bolts). **Length**—7 15/16".
Crankpin Journal Diameter—2 1/16".
Lower Bearing—Removable, precision type, steel & bronze backed, babbitt. ***See Chrysler Shop Notes for undersizes.***
Clearance—.0005-.0025". **Sideplay**—.0055-.0115".
Bearing Adjustment:—None (no shims). Install bearings with boss engaging groove in rod and cap.
Installing Rods:—Wide portion of bearing to rear (#1, 3, 5), to front (#2, 4, 6). Oil hole to camshaft.

CRANKSHAFT:—4 bearing type with 7 counterweights. ***See Chrysler Shop Notes for Replacement Main Bearing Caps and Crankshaft Front and Rear Oil Seals.***
Journal Diameters—2½" all bearings.
Bearings—Removable, precision type, babbitt (#4 steel-backed—others bronze & steel backed).
Clearance—.001-.002".
Bearing Adjustment:—***See Chrysler Shop Notes for bearing removal, front main bearing cap removal, replacement bearing sizes and adjustment data.***
End Thrust:—Taken by flange faces on rear (#4) main bearing. **Endplay**—.003-.007".

CAMSHAFT:—4 bearing. Non-adjustable chain drive. ***See Chrysler Shop Notes for camshaft removal.***
Journal Diameters—#1, 2"; #2, 1 31/32"; #3, 1 15/16"; #4, 1¼".
Bearing Type—Removable steel-backed, babbitt-lined bushings (except #4 machined in block).
Clearance—.001-.003" (#1), .0015-.0035" (all others).
End Thrust:—Taken by thrust plate behind camshaft sprocket hub. **Endplay**—.002-.006".
Timing Chain:—Morse Type 1883-N, No. 2661. Width 1". Pitch .500" (½"). Length 24" or 48 links.
Camshaft Setting:—Sprockets marked. Mesh chain with sprockets turned so that '0' marks are adjacent and in line with a straightedge across shaft centers.

VALVES:—

	Head Diameter	Stem Diameter	Length
All valves	1 15/32"	.340-.341"	4 25/32"

	Seat Angle	Lift	Stem Clearance
Intake	45°	5/16"	.001-.003"
Exhaust	45°	5/16"	.003-.005"

See Chrysler Shop Notes for Exh. valve seat insert data.
Tappet Clearance:—.006" Int., .008" Exh. (hot & idling). .002" addt'l exh. clearance desirable for sustained high speeds. NOTE—Tappet screws self-locking (no locknuts). Remove right front wheel, lower housing panel and pump shield for access.
Valve Guides:—Remove from above. Press new guides in (stepped end down) with upper end ⅞" below top of block, then finish ream (Tool CM-83) to .342-.343" Intake, .344-.345" Exhaust.
Valve Springs:—Install with closely coiled ends to top.

	Free length 2 3/32".	Spring Pressure	Length
Valve Closed		34-38 lbs.	1¾"
Valve Open		77-83 lbs.	1 7/16"

Valve Lifters:—Mushroom type (remove from below). Stem diam. ⅝". Ream holes from above (pilot in valve stem guide). Oversizes .001", .008", .030", .060". **Clearance in Block**—.000-.001".
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 6° ATDC. Close 46° ALDC.
Exhaust Valves—Open 42° BLDC. Close 8° ATDC.
Valve Timing Check—With .011" (cold) tappet clearance, #6 intake valve should open with #6 piston 6° or .0153" ATDC with 6th graduation after DC mark on impulse neutralizer in line with pointer. Reset tappet clearance at .006" (hot and idling).

LUBRICATION:—Pressure (pump on right of engine). ***See Chrysler Shop Notes for oil pump removal.***
Normal Oil Pressure:—30-45 lbs. @ 30 MPH, 15 idling.
Oil Pressure Relief Valve:—Under plug below starter. Opens at 40-45 lbs. To increase pressure use heavy (green)spring, to decrease use light (red) spring.
Crankcase Capacity:—5 quarts (refill).

COOLING SYSTEM:—**Capacity**—15 quarts. ***See Chrysler Shop Notes for radiator core removal.***
Water Pump:—Packless type with belt drive. ***See article in Mechanical Equipment Section for data.***
Removal—Drain water. Remove fan blade assembly, pulley, radiator outlet hose at pump, by-pass elbow (with small hose), pump mounting stud nuts, fan belt adjusting strap at generator, and belt adjusting strap stud from block. Pull pump off.
Thermostat—Bishop & Babcock or Fulton. On head **Setting**—Starts to open 157-162°F. Fully open 183°F.

CLUTCH:—**Borg & Beck Model 10A7, 11A6 (Taxi) with 'Borglite' driven member.** #928 (10A7), #931 (11A6) stamped on cover. Single plate, dry disc type with spiral grooved facings, pressure plate oil baffle & pedal over-center return spring. ***See article in Mechanical Equipment Section for data.***
Facings—Spiral wound moulded woven, 2 used. Inside Diam. 7" (10A7), 6½" (11A6). Outside Diam. 10" (10A7), 11" (11A6). Thickness ⅛" (all).
Adjustment:—Pedal should just clear toeboard (adjust stopscrew on lower end) and have 1" free movement (adjusting nut on link rod at clutch fork).
Removal:—Remove release fork pull-back spring, Transmission (see following) and housing underpan. Disconnect release fork from pivot and pull out as far as possible. Mark cover and flywheel, remove clutch cover screws evenly, lower assembly out.

TRANSMISSION:—**Own Make.** All helical gear, constant-mesh, synchro-mesh (second & high), sliding gear (low & reverse) with remote shift. ***See article in Mechanical Equipment Section for data.***
Transmission Control:—Steering column shift Std. ***See article in Mechanical Equipment Section for data.***
Removal:—Remove propeller shaft (loosen comp. flange nut if transmission to be disassembled—See Chrysler Shop Notes for Propeller Shaft Center Bearing Removal on 7 pass.). Disconnect speedometer cable, battery ground cable, hand brake cable, and gear shift rod and cable at transmission. Remove mounting stud nuts and lockwashers. Pull unit back, lower and remove from car.

UNIVERSAL JOINTS:—**Detroit-Universal Series 4200 (3 & 5 pass.), Series 7200 (7 pass.).** Roller bearings with ball & trunnion (4200), cross type (7200). ***See articles in Mechanical Equipment Section for data.***
Propeller Shaft Center Bearing:—Used on 7 passenger sedans. ***See Chrysler Shop Notes for servicing.***

REAR AXLE:—**Own Make.** Semi-floating, hypoid gear type with Hotchkiss drive. ***See article in Mechanical Equpiment Section for data.***
Ratio—3.9-1 (Coupe), 4.1-1 (5 pass.), 4.3-1 (7 pass.).
Backlash—.006-.010". Screw adjustment.
Removal:—Disconnect drive shaft at rear universal. Remove axle shafts (see below) and capscrews on carrier flange. Pull carrier assembly out.
Axle Shaft Removal—Remove wheel,hub, and drum assembly (use screw type hub puller—Tool C-319), block brake pedal, disconnect brake line at wheel cylinder, take off backing plate with oil seal, pull shaft and bearing (Tool C-158). NOTE—Use Tool C-358 to pull oil washer, C-201, 2 to install.
Wheel Bearing Adjustment:—Shims between backing plate and axle housing. With wheel and hub removed, check endplay with dial indicator. To adjust, remove backing plate, add or remove shims at both wheels equally. **Endplay**—.003-.008".

SHOCK ABSORBERS:—**Domestic**—Delco Direct Acting. **Export**—Delco Direct Acting or Delco Adjustable Direct Acting (Special Equip. Dom. also). ***See article in Mechanical Equipment Section for data.***

STEERING:—**Steering Gear**—Chrysler (Gemmer design Model 300) standard. Gemmer Model 305 'push-pull' adjustment (7 pass.). Worm-and-roller types. ***See articles in Mechanical Equipment Section for data.***
Front Suspension:—Independent, linked parallelogram type with coil springs. ***See article in Mechanical Equipment Section for data.***
Kingpin Inclination—4¾° to 6°.
Camber—Pos. ¼°. Limits 0° to Pos. ¾°.
Caster—Neg. 1° to Pos. 1°. Not adjustable.
Toe In—1/16" (0-⅛"). Turn both rods equally.
Steering Geometry—Outer wheel 20°, Inner 22°.

BRAKES:—**Service.** Lockheed hydraulic, double anchor type. Hand brake applies independent shaft brake. ***See article in Mechanical Equipment Section for data.***
Wheel Cylinders—Stepped or two-stage bore type.
Drums—Cast-iron. Diameter—11".
Lining—Molded. Width 2". Thickness 13/64". Length (front shoe) 11 15/32", (rear shoe) 7 31/32".
Clearance—.012" toe, .006" heel, for each shoe.
Hand Brake:—On drum at rear of transmission.
Adjustment—***See Chrysler Shop Notes for data.***
Drum—Cast-iron. Diameter—6".
Lining—Width 2". Thick. 5/32". Length 17 1/16".

MERCURY NOTE:—All '95' Engine data below applies to Mercury as well as Ford models with '95' Engine.

GRILLE REMOVAL (FORD DELUXE):—Made up of right and left sections but can be removed as an assembly. To remove, raise hood, take out one screw at top of grille at each side, light baffle-to-fender brace bolt at top, 6 grille-to-side louvre bolts (accessible between core and grille), 1 grille-to-side louvre bolt at each side at bottom (accessible by reaching under grille). Pull assembly out at top, lift off.

OIL PAN REMOVAL:—To remove oil pan, disconnect radius rods at rear end, remove oil level indicator and tube, attach hoist to front bumper bars and raise front end of car, push radius rods down and install block between bolt and cross-member. Remove oil pan screws, maneuver pan off.

CYLINDER SLEEVES:—Replaceable dry type hardened cylinder sleeves use on part production for 1940 Ford '60', '85' and Mercury Engines. Engines with sleeves can be identifed by letters 'HS' stamped on top of block beside inner front corner of left cylinder hd.

Servicing:—To recondition engines with cylinder sleeves, sleeves should be replaced. Car manufacturer recommends use of KRW #6055A Sleeve Puller and Replacer (sleeves should not be pressed in with arbor press). **Sleeves furnished in standard size and should be fitted with new standard size pistons only.**

Fitting Pistons on Sleeve Equipped Engines:—Special gauge thicknesses used (not same as for engines without sleeves). Use .50" wide feeler inserted between cylinder wall and piston at right angles to pin. Pull to withdraw feeler should be 7-12 lbs. (60 Eng.), 6-10 lbs. (85 & 95 Eng.). Feeler thicknesses as follows:

'60' Engine with steel pistons—.0025".
'85' Engine with steel pistons—.003".
'95' Engine with steel pistons—.003".

NOTE—If aluminum pistons used on '85' and '95' Engines, feeler thickness should be .0025".

REPLACEMENT PISTONS ('60' ENGINES):—Steel-alloy pistons only used on these models. Finished pistons furnished in following sizes:

Part No.	Piston Sizes
52-6110-A	Standard
52-6110-B	.0025" Oversize
52-6110-C	.005" Oversize
52-6110-D	.015" Oversize
52-6110-E	.030" Oversize
52-6110-F	.045" Oversize

REPLACEMENT PISTONS ('85'&'95' ENGINES):—Steel alloy pistons used on passenger cars and trucks (except '95' Trucks which are equipped with aluminum pistons). Finished pistons furnished in following sizes:

Steel Alloy Pistons

'85' — Part No. — '95' (except Truck)	Piston Sizes
91-A-6110-A	Standard
91-A-6110-B	.0025" Oversize

NOTE—For .005" to .060" oversize pistons on '85' Engines use Aluminum Pistons listed below.

Aluminum Pistons

'85' — Part No. — '95' Truck	Piston Sizes
———— 99-T-6110-A	Standard
———— 99-T-6110-B	.0025" Oversize
91-A-6110-C 99-T-6110-C	.005" Oversize
91-A-6110-D 99-T-6110-D	.015" Oversize
91-A-6110-E 99-T-6110-E	.030" Oversize
91-A-6110-F 99-T-6110-F	.045" Oversize
91-A-6110-G 99-T-6110-G	.060" Oversize

NOTE—Aluminum pistons not fitted to same clearance as steel pistons. When installing aluminum pistons, use .002" feeler (.0025" feeler for engines with sleeves) with 6-10 lb. pull on feeler.

CONNECTING ROD BEARING SERVICING:—Bearings float between connecting rods and crankpin. Special Replacement bearings furnished oversize on outer diameter (for oversize rods) and undersize on inner diameter (undersize crankpins) as follows:

'60' Engine

Part No.	Connecting Rod Oversize	Crankpin Undersize
92-A-6211-A	Std.	Std.
92-A-6211-B	Std.	.003"
92-A-6211-C	Std.	.010"
92-A-6211-D	.004"	.003"
92-A-6211-E	.008"	.010"
92-A-6211-F	.008"	.003"
92-A-6211-G	.004"	.010"
92-A-6211-H	.004"	Std.
92-A-6211-J	.008"	Std.
92-A-6211-K	Std.	.0015"
92-A-6211-L	Std.	.020"

'60' Note—These bearings used only with new 1940 Connecting Rod 92A-6200, and new Crankshaft 022A-6303 (crankshaft has larger crankpins and main bearing journals). These new bearings do not have end flanges.

'85' & '95' Engines

Part Numbers 85 Eng.	95 Eng.	Con. Rod Oversize	Crankpin Undersize
81-A-6211-A	99-A-6211-A	Std.	Std.
81-A-6211-D	99-A-6211-B	.004"	.003"
81-A-6211-E	99-A-6211-C	.008"	.010"
81-A-6211-F	99-A-6211-D	.008"	.003"
81-A-6211-G	99-A-6211-E	.004"	.010"
————	99-A-6211-F	Std.	.015"
81-A-6211-J	99-A-6211-G	.004"	Std.
81-A-6211-K	99-A-6211-H	.008"	Std.
81-A-6211-L	99-A-6211-L	Std.	.0015"
————	99-A-6211-M	Std.	.020"

CRANKSHAFT BEARINGS:—Replacement bearings furnished in Standard Size and Undersizes as shown below. In addition, Rear Main Bearings (flanged on both ends—take crankshaft end thrust) furnished in special lengths as follows:

'60' Engine

Part Numbers Frt. & Center	Rear	Size
92-A-6333-A	92-A-6331-A	Standard
92-A-6333-B	92-A-6331-B	.005" Undersize
92-A-6333-C	92-A-6331-C	.010" Undersize
————	92-A-6331-D①	Standard
————	92-A-6331-E①	.005" Undersize
————	92-A-6331-F①	.010" Undersize
92-A-6333-D	92-A-6331-G②	.015" Undersize
92-A-6333-E	92-A-6331-H	.020" Undersize

①—.015" Oversize in length.
②—.010" Undersize in length.

'60' Note—These bearings used only with new 1940 Crankshaft 022A-6303 (has larger bearing journals).

'85' & '95' Engines

Part Numbers Frt. & Center	Rear	Size
81-A-6333-A	81-A-6331-A	Standard
81-A-6333-B	81-A-6331-B	.005" Undersize
81-A-6333-C	81-A-6331-C	.010" Undersize
————	81-A-6331-D①	Standard
————	81-A-6331-E①	.005" Undersize
————	81-A-6331-F①	.010" Undersize
81-A-6333-D	81-A-6331-G	.015" Undersize
81-A-6333-E②	81-A-6331-H②	Standard

①—.015" Oversize in length.
②—O.D. .015" Oversize. .010" Undersize in length.

PISTON PIN FITTING:—Steel Pistons. Pins can be removed and installed without heating pistons. Pins, pistons, and rod bushings held to close limits so no fitting required. Check clearance as follows:
Pin Fit in Piston—With piston and pin at same temperature and clean, pin should drop through pin hole in piston (clearance .0007" maximum).
Pin Fit in Rod Bushing—With pin installed, hold pin so that rod hangs vertically, then rotate pin. Lower end of rod should move upward through arc of ½" max. before dropping back to vertical.

Aluminum Pistons:—Pistons must be heated by immersion in boiling water for one minute, or on special piston heater to a temperature not to exceed 200°F. for pin removal and installation. Pins, pistons, and rod bushings held to close limits so that no fitting required. Check clearances as follows:
Pin Fit in Piston—Pin should be hard hand push fit in piston with piston at room temperature.
Pin Fit in Rod Bushing—Same as for steel pistons

TIMING GEARS (FORD 85, 95 & MERCURY):—New type aluminum alloy Camshaft Gear used for partial production on 1940 Engines. Can be replaced without removing camshaft as follows:

Camshaft Gear (Aluminum Alloy Type):—Gear is bolted on camshaft hub flange by four offset cap-screws. To remove gear, remove screw in front end of crankshaft, pull fan and pulley assembly (use puller 6312-A), remove timing gear cover. Bend back lockplate tangs, take out four camshaft gear mounting screws, remove gear. When replacing gear, make certain that marks on camshaft and crankshaft gears are lined up and see that lockplate tangs are bent up against flats on mounting screws. Use 6312-B Pulley Replacer tool to install pulley and fan assembly.

NOTE—Camshaft gear mounting screw holes offset so gear can only be installed in correct position.

VALVE SERVICING (ALL FORD AND MERCURY ENGINES):—Complete valve assembly (valve, spring, guide) should be removed as follows:

Valve Assembly Removal:—Use special bar type lifter V-78 (All Fords and Mercury) inserting the end of lifter through valve spring coils to engage flanged lower end of guides, pull guide down slightly, withdraw 'C' type guide retainer, lift valve assembly out through top of block.

Valve Assembly Dismantling:—Use special bench fixture V-130 (85 Valves), S-214 (60 Valves). Consists of special press by which valve spring can be compressed to free spring retainer (fixture has stop which prevents excessive valve spring compression).

Valve Grinding and Tappet Clearance Note for all V8 Models):—To perform these operations with minimum amount of hand cranking, note which valves are fully open (first column in table below), grind or check valves listed on same line of table—then turn shaft 'til next 'valve open' point reached.

Valves Open	Valves to Grind
1. 4X & 1N	3X, 8N, 6N, 7X, 3N, 2X
2. 3X & 8N	1X, 7N, 5X, 2N, 4X, 1N
3. 1X & 7N	8X, 5N, 6X, 4N
OR	
1. 8X & 5N	1X, 7N, 6N, 7X, 3N, 2X
2. 6N & 7X	5X, 2N, 4X, 1N, 8X, 5N
3. 5X & 2N	6X, 4N, 3X, 8N

NOTE—'X' Exhaust Valve. 'N' Intake Valve.

Tappet Clearance Checking (All Models):—Use special two-step feeler to check clearance with valve lifter on heel of cam (see above). First .0125" step should be 'go', second .0135" 'no go'.

Exhaust Valve Seat Insert Grinding Note:—Seat inserts are exceedingly hard (high-tungsten, chrome-alloy steel). Manufacturer recommends eccentric-grinding equipment be used to reface these inserts.

ENGINE HOOD NOTE:—To raise hood, pull out on latch handle on front of hood at center, press in on button in upper edge of grille (under handle) to release secondary (safety) catch.

OIL PAN REMOVAL:—*See Ford Shop Notes for data.*

SERIAL & ENGINE NUMBER:—Stamped on top of clutch housing and on left frame side member in front of dash bracket.

ENGINE SPECIFICATIONS:—**Own '60'.** 8 Cylinder, 90° Vee, L head. Both banks & crankcase cast enbloc. **Bore**—2.6". **Stroke**—3.2". **Displacement**—136 cu. ins. **Rated Horsepower**—21.6.
Developed Horsepower—60 at 3500 R.P.M.
Compression Ratio—6.6-1 Std. No Optl. ratios.
Compression Pressure—158 lbs. at 2800 R.P.M. max., or 105 lbs. at cranking speed of 100 R.P.M.
Vacuum Reading—18-20" steady at 5-7 M.P.H.

CYLINDER SLEEVES:—Hardened, dry type cylinder sleeves used on engines marked 'HS' on cylinder block just above upper front corner of left cylinder head.
Servicing:—*See Ford Shop Notes for complete data.*

PISTONS:—Steel alloy, light wgt., cam-ground. Recondition cylinders for finished replacement pistons.
Weight—226-231 grams (without rings or pin).
Removal—Pistons and rods removed from above.
Clearance—See Fitting New Pistons.
Replacement Pistons:—*See Ford Shop Notes for data.*
Fitting New Pistons:—Use .002" feeler (.0025" feeler for engines with sleeves), .50" wide, inserted between piston and cylinder wall at right angles to pin. Pull to withdraw feeler—7-12 lbs.

PISTON RINGS:—Two compression, one oil ring, all above pin. Oil ring groove drilled with drain holes.
NOTE—Expander used with #2 Compr. and oil ring.

Ring	Width	End Gap	Side Clearance
Compr. #1	.092-.0925"	.012-.017"	.0025-.003"
Compr. #2	.092-.0925"	.012-.017"	.002-.0025"
Oil Cont.	.1535-.154"	.012-.017"	.0015-.002"

Replacement Rings:—Furnished (sets in cartons only) Std. and .005", .015", .030", .045" oversize.

PISTON PIN:—**Diameter** .6876-.6879". **Length** 2.368". Floating type (locking rings in piston at each end). Pin hole in connecting rod bronze-bushed.
Pin Fit in Piston—.0004" clearance.
Pin Fit in Rod Bushing—.0001" clearance. *See Ford Shop Notes for Pin Fitting Directions.*
Replacement Pins:—Std. & .002" over- & under-size.

CONNECTING ROD:—**Length** 6.125". **Weight** 295 grams.
Crankpin Journal Diameter—1.699" (connecting rod diameter on crankpin 1.800").
Bearing Type—Steel-backed, special-alloy lined. Bearing floats in both rods (side-by-side mounting) with bearing surface on both inner and outer face.
Bearing Dimensions—Length 1.403", .09995" thick. These bearings do not have end flanges.
Clearance—.0005-.002" (total diametrical).
Sideplay—.010-.022" (total).
Bearing Adjustment:—None (no shims). Do not file.
Replacement Bearings:—*See Ford Shop Notes for special bearings for Oversize Rods & Undersize Crankpins.*
Installing Rods:—Marks on rods and caps must be together and installed in same numbered cylinder with marks pointing down toward oil pan.

CRANKSHAFT:—New 3 bearing type with larger main and connecting rod journals and integral counterweights.
Journal Diameters—2.099" (all bearings).
Bearing Type—Steel-backed, special-alloy lined.
Clearance—.001-.003" (or slight drag with .002" feeler assembled in bearing for clearance check).
Bearing Adjustment:—None (no shims). Do not file.
End Thrust:—Taken by rear bearing. Adjust by replacing bearing. **Endplay**—.002-.005".
Replacement Bearings:—*See Ford Shop Notes for Undersizes and special long bearings.*

CAMSHAFT:—Three bearings. Helical gear drive.
Bearing Diameters—1.498" (all bearings).
Bearings—Steel-backed, babbitt-lined bushings.
Clearance—.002".
End Thrust:—Taken by gear hub and cover plate. Adjusted by replacing coverplate. **Endplay**—.005-.015".
Timing Gears:—Cast alloy steel (crankshaft), Bakelized Fabric (Camshaft). **Backlash**—.004" max.
Camshaft Setting:—Mesh '0' marked tooth of crankshaft gear with '/' marked space on camshaft gear (this mark must line up with mark on gear hub).

VALVES:—

	Head Diameter	Stem Diameter	Length
All Valves	1.281"	.2795"	4.375"

	Seat Angle	Lift	Stem Clearance
All Valves	45°	.251"	.0015-.0035"

See Ford Shop Notes for Valve Servicing data.
NOTE—Inserts used for exhaust valves only.
Tappet Clearance:—.0125-.0135". No adjustment.
Valve Guides:—Split type retained by 'C' washer and valve spring. *See Ford Shop Notes for servicing data.*
Valve Lifters:—Barrel type in reamed holes in block. **Diameter**—.8295". **Clearance**—.0005-.001".

Valve Springs:—	Pressure	Length
Valve Closed	26-30 lbs.	2.05"
Valve Open	48-52 lbs.	1.80"

Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 9½° BTDC. Close 54½° ALDC.
Exhaust Valves—Open 57½° BLDC. Close 6½° ATDC
To Check Valve Timing—No flywheel marks provided. If dead center point established for any cylinder on flywheel, intake valve for this cylinder should open approximately 3.22 flywheel teeth before this point with the piston .027" BTDC.
Motor Gauge—Weidenhoff Adapter #114. Rod #40.

LUBRICATION:—Pressure. Gear type oil pump mounted on front main bearing cap in crankcase.
Normal Oil Pressure:—30 lbs. at 2000 R.P.M.
Oil Pressure Regulator:—Under plug above front camshaft bearing. Opens at 30 lbs. Not adjustable.
Oil Pressure Gauge:—King-Seeley Electric. Ford No. 01A-9273-A (dash unit), No. 48-9278 (engine unit). *See article in Mechanical Equipment Section for data.*
Crankcase Capacity:—4 qts.

COOLING SYSTEM:—**Capacity**—13 quarts (all).
Water Pump:—Packless 2 used (1 for each bank). *See article in Mechanical Equipment Section for data.*
Removal—Slack off belt adjustment, unscrew large mounting nut behind pulley, pull pump out.
Thermostat:—In each cylinder head outlet (2 used). **Setting**—Starts to open at 145°F. Fully open 180°.
Temperature Gauge:—King-Seeley Electric. Ford No. 01A-10883A (dash unit), 99A-10884 (engine unit). *See article in Mechanical Equipment Section for data.*

CLUTCH:—**Long Model 9CF-CS.** Semi-centrifugal, single plate, dry disc type. *See article in Mechanical Equipment Section for data.*
Facings—Moulded type, 2 required. Inside Diam. 5.76". Outside Diam. 9". Thickness .137".
Adjustment:—Pedal free movement should be 1.0-1.25". To adjust, remove clevis pin at end of connector rod, adjust clevis on rod.
Removal:—Slide rear axle and transmission to rear as a unit to expose clutch (see Transmission Removal (below), take out mounting screws in cover.

TRANSMISSION:—**Own Make.** Constant-mesh, synchro-mesh (second & high), sliding gear (low & reverse), all helical gears (pass. car), second & high only (comm.). *See article in Mechanical Equipment Section for data.*
Transmision Control (022A):—Remote steering column mounted, mechanical shift. *See article in Mechanical Equipment Section for data.*
Removal:—To remove, disconnect hand brake cable, hydraulic brake line at torque tube connection (bleed lines when re-connected), speedometer cable, shock absorber links. Disconnect rear spring at center frame connection. Take out universal joint ball housing screws, slide rear axle assembly back to disengage drive shaft at splined joint. Support engine at rear, take out rear engine mounting bolts, clutch housing screws, pull trans'm straight back.
NOTE—Disconnect gear shifter rods from levers at transmission on passenger cars.

UNIVERSAL JOINT:—**Spicer Model 202-7.** Steel bushing type. Single joint at rear of transmission case. *See article in Mechanical Equipment Section for data.*

REAR AXLE:—**Own Make.** ¾ floating, Spiral bevel gear type with Torque Tube drive. *See article in Mechanical Equipment Section for data.*
Ratio 4.44-1 Std., 4.55-1 Comm. **Backlash** .012" max.
Removal:—Disconnect hand brake cables, hydraulic brake line at torque tube connection (bleed lines when re-connected), speedometer cable, shock absorber links. Disconnect rear spring at center frame connection. Take out universal joint ball housing mounting screws, pull axle assembly to rear to disengage drive shaft at splined joint.
Axle Shaft Removal—Axle must be dismantled and shaft removed through differential housing at inner end. *See Ford Axle article in Mechanical Equipment Section for data.*

SHOCK ABSORBERS:—**Houde (Houdaille).** Type BBDM (Front), BBDX (Rear). **Ford Nos.**—**Front 022A** 01A-18045A (right), 6A (left) arms stamped 10. **022C** 01A-18045B (right), 6B (left). **Rear All** 01A-18080A (right), 1A (left). Double acting, hydraulic, adjustable type. *See article in Mechanical Equipment Section for data.*

STEERING:—**Steering Gear**—Gemmer Model 305 Worm-and-Roller type with 'push-pull' adjustment. *See article in Mechanical Equipment Section for data.*
Front Suspension:—Conventional 'I' beam section front axle with Reverse Elliott ends and transverse spring. Axle positioned by radius rods.
Kingpin Inclination—8° crosswise (all models).
Caster—9° Max., 4½° Min. (all models). Must be equal within ½°. Axle may be bent cold to correct caster if proper tools (wedges and blocks to prevent crushing axle flange) are used.
Camber—1° Max., ¼° Min. (all models). Must be equal within ¼°, right wheel must not exceed left. Adjust as for caster (see caster data above).
Toe In—1/16". Set at 1-10 ratio to Camber. Adjust by loosening clamp bolts and turning tie rod.
Steering Geometry (Toe out on turns)—Outer wheel turned 20°. Inner 23⅓°. Allowable variation ½°.

BRAKES:—**Service**—Lockheed Hydraulic, double anchor, non-energizing type. Hand lever applies rear wheel service brakes. *See article in Mechanical Equipment Section for data.*
Wheel Cylinders—Stepped or two-stage bore type: Front Wheel—Front cylinder 1.25". Rear 1.00". Rear Wheel—Front cylinder 1.125". Rear 1.00".
Drums—Cast iron. Diameter 12".
Lining—Woven type (forward shoe—all wheels), Moulded type (rear shoe—all wheels). Width 1.75". Thickness .20". Length per shoe 13.18" (forward shoe—all wheels), 10.1" (rear shoe—all wheels).
Clearance—Least possible amount without drag.
Hand Brake:—See Service Brakes above.

ENGINE HOOD NOTE:—To raise hood, pull out on latch handle on front of hood at center, press in on button in upper edge of grille (under handle) to release secondary (safety) catch.

GRILLE & OIL PAN REMOVAL:—*See Ford Shop Notes.*

SERIAL & ENGINE NUMBER:—Stamped on top of clutch housing and on left frame member in front of dash bracket.

ENGINE SPECIFICATIONS (01A, C):—**Own 85, 8 cyl., 90°** Vee, L head. Both banks & crankcase cast Enbloc.
Bore—3.062". **Stroke**—3.75".
Rated Horsepower—30. **Displacement** 221 cu. ins.
Developed Horsepower—85 at 3800 R.P.M.
Compression Ratio—6.20-1 (Pass. Cars, Comm. ¾&1 Ton), 5.9-1 (Other Trucks). Cast iron head.
Compression Pressure—140 lbs. (6.20-1 hd.), 130 lbs. (5.9-1 hd.) at 2400 RPM maximum. 100 lbs. at cranking speed of 100 RPM.
Vacuum Reading—Steady 18-20" at 5-7 MPH.

ENGINE SPECIFICATIONS (09C):—**Own 95.** See Mercury 'M' page for complete 95 Engine data.

CYLINDER SLEEVES:—Hardened, dry type cylinder sleeves used on engines marked 'HS' on cylinder block beside inner front corner of left cylinder head.
Servicing:—*See Ford Shop Notes for complete data.*

PISTONS:—Steel alloy, light wgt., cam ground type. Recondition for finished replacement pistons.
Weight—333-337 grams (without rings or pin).
Removal—Pistons and rods removed from above.
Clearance—See Fitting New Pistons.
Replacement Pistons:—*See Ford Shop Notes for data.*
Fitting New Pistons:—Use .0025" feeler (.003" feeler for engines with sleeves), .50" wide, inserted between piston and cylinder wall at right angles to pin. Pull to withdraw feeler—6-10 lbs. NOTE—If aluminum pistons fitted, use .002" feeler (.0025" feeler for engines with sleeves) with 6-10 lbs. pull.

PISTON RINGS:—Two compression, one slotted oil ring, all above pin (drain holes in oil ring groove).
NOTE—Expander used with #2 Compr. and oil ring.

Ring	Width	End Gap	Side Clearance
Compr. #1	.0915-.0920"	.012-.017"	.0025-.003"
Compr. #2	.0915-.0920"	.012-.017"	.002-.0025"
Oil Contr.	.1535-.1540"	.012-.017"	.0015-.002"

Replacement Rings:—Furnished (sets in cartons only) Std. and .005", .015", .030", .045", .060" oversize.

PISTON PIN:—**Diameter**—.7501-.7504". **Length**—2.850" (steel pistons), 2.780" (aluminum pistons). Floating type. Pin hole in rod bronze-bushed.
Pin Fit in Piston:—.0005" clearance (steel pistons), +.0001" to —.0001" (aluminum pistons).
Pin Fit in Rod Bushing—.0001" clearance. *See Ford Shop Notes for Pin Fitting directions.*
Replacement Pins:—Std. & .002" over- & under-size.

CONNECTING ROD:—**Length** 7.002". **Weight** 476 grams.
Crankpin Journal Diameter—1.999" (connecting rod diameter on crankpin—2.220").
Bearing Type—Steel-backed, special-alloy lined. Bearing floats in both rods (side-by-side mounting) with bearing surface on inner and outer faces.
Bearing Dimensions—Length 1.747". Thickness .1095". These bearings do not have end flanges.
Clearance—.0005-.002" (total diametrical).
Sideplay—.010-.022" (total).
Bearing Adjustment:—None (no shims). Do not file.
Replacement Bearings:—*See Ford Shop Notes for special bearings for oversize rods and undersize crankpins.*
Installing Rods:—Marks on rods and caps must be together and installed in same numbered cylinder with marks pointing down toward oil pan.

CRANKSHAFT:—3 bearing. Integral counterweights.
Journal Diameters—2.499" (all bearings).
Bearing Type—Steel-backed, special-alloy lined.
Clearance—.001-.003" (or slight drag with .002" feeler assembled in bearing for clearance check).
Bearing Adjustment:—None (no shims). Do not file.
End Thrust:—Taken by rear main bearing. Adjust by replacing bearing. **Endplay**—.002-.006".
Replacement Bearings:—*See Ford Shop Notes for Undersizes and special long main bearings.*

CAMSHAFT:—Three bearing. Helical gear drive.
NOTE—New Camshaft Gear used. See Timing Gears.
Bearing Diameters—1.797" (all bearings).
Bearings—Steel-backed, babbitt-lined bushings.
Clearance—.002".
End Thrust:—Taken by gear hub and cover plate. Adjusted by replacing coverplate. **Endplay**—.005-.015".
Timing Gears:—Cast alloy iron (crankshaft), Bakelized Fabric—pressed on shaft, or Aluminum Alloy—bolted on shaft (camshaft). **Backlash**—.004" max.
See Ford Shop Notes for Timing Gear Replacement.
Camshaft Setting:—Mesh '0' marked tooth of crankshaft gear with '/' marked space on camshaft gear (this mark must be in line with mark on hub).

VALVES:—

	Head Diameter	Stem Diameter	Length
All Valves	1.537"	.3115"	4.750-4.751"

	Seat Angle	Lift	Stem Clearance
All Valves	45°	.292"	.0015-.0035"

See Ford Shop Notes for Valve Servicing data.
NOTE—Seat inserts used for all valves.
Tappet Clearance:—.0125-.0135". No adjustment.
Valve Guides:—Split type retained by 'C' washer and valve spring. *See Ford Shop Notes for servicing data.*
Valve Lifters:—Barrel type in reamed holes in block. **Diameter**—.9995". **Clearance**—.0005-.001".

Valve Springs:	Pressure	Length
Valve Closed	37-40 lbs.	2.13"
Valve Open	76-80 lbs.	1.84"

Valve Timing:—See Camshaft Setting above.
Intake Valves—Open at TDC. Close 44° ALDC.
Exhaust Valves—Open 48° BLDC. Close 6° ATDC.
To Check Valve Timing—No flywheel marks provided. Intake valve opens with piston at TDC.

LUBRICATION:—Pressure. Gear type oil pump mounted in crankcase at rear of engine.
Normal Oil Pressure:—30 lbs. at 2000 R.P.M.
Oil Pressure Regulator:—Under plug above front camshaft bearing. Opens at 30 lbs. Not adjustable.
Oil Pressure Gauge:—King-Seeley Electric. Ford Nos: Dash Unit—01A-9273A (Std.), 01A-9273B (Deluxe). Engine Unit—Ford No. 48-9278 (all models).
See article in Mechanical Equipment Section for data.
Crankcase Capacity:—5 qts.

COOLING SYSTEM:—**Capacity** 22 qts. (Passenger Cars, & Trucks except Cab-over-Engine), 23 qts. (Cab-over-Engine), 20 qts. (Commercial).
Water Pump:—Packless type, 2 used (1 for each bank). *See Mechanical Equipment Section for data.*
Removal—Slack off drive belt, support engine at forward end, remove front engine mounting bolts, take out mounting screws in pump body.
Thermostat:—In each cylinder head outlet (2 used).
Setting—Start to open at 145°F. Fully open 180°.
Temperature Gauge:—King-Seeley Electric. Ford No. Dash Unit—01A-10883A (Std), 01A-10883B (Deluxe). Engine Unit—99A-10884 (all models).
See article in Mechanical Equipment Section for data.

CLUTCH:—**Long Model 9CF-CS.** Semi-centrifugal, single plate, dry disc type.
See article in Mechanical Equipment Section for data.
Facings—Molded type, 2 required. Inside Diam. 5.76". Outside Diam. 9". Thickness .137".
Adjustment:—Pedal free movement should be 1.0-1.25". To adjust, remove clevis pin at end of connector rod, adjust clevis on rod.
Removal:—Slide rear axle and transmission to rear as a unit to expose clutch (see Transmission Removal below), take out mounting screws in cover.

TRANSMISSION:—**Own Make.** Constant-mesh, synchro-mesh (Second & High), sliding gear (low & reverse), all helical gear type. NOTE—Four speed spur gear type optional on Commercial.
See articles in Mechanical Equipment Section for data.
Transmission Control (01A):—Steering col. shift Std.
See article in Mechanical Equipment Section for data.
Removal:—Disconnect rear shock absorbers, hand brake cables, hydraulic brake line at torque tube connection (bleed lines when re-connected), speedometer cable. Disconnect rear spring at center frame connection, take out universal joint ball housing screws, slide rear axle assembly back to disengage drive shaft at splined joint. Support engine at rear, take out rear engine mounting bolts and clutch housing screws, pull trans'm straight back. NOTE—Disconnect gear shifter rods from levers at transmission on passenger cars.

UNIVERSAL JOINT:—**Spicer 202-6 (Std.), 202-8 (01C, 09C with 4 spd. trans.).** Steel bushing type. 1 used.
See article in Mechanical Equipment Section for data.

REAR AXLE:—**Own Make.** ¾ floating, Spiral Bevel gear type with Torque Tube drive.
See article in Mechanical Equipment Section for data.
Ratio—3.78-1 Std.; 3.54-1, 4.11-1 Optl.
Backlash—.012" max.
Optional Axle:—Columbia Two-speed type.
See article in Mechanical Equipment Section for data.
Removal:—Disconnect rear shock absorbers, hand brake cables, hydraulic brake line at torque tube connection (bleed lines when re-connected), speedometer cable. Disconnect rear spring at center frame connection, take out universal joint ball housing screws, pull axle assembly to rear to disengage splined joint, remove axle assembly.
Axle Shaft Removal—*See Ford Axle article in Mechanical Equipment Section for data.*

SHOCK ABSORBERS:—**Houde (Houdaille).** Type BBDM (frt.), BBDX (rear). **Ford Nos.—Front 01A** 01A-18045A (right), 6A (left) arms stamped 10. **01C, 09C** 01A-18045B (right), 6B (left). **Rear All** 01A-18080A (right), 1A (left). Double acting, hydraulic, adjustable. *See article in Mechanical Equipment Section.*

STEERING:—**Steering Gear**—Gemmer Model 305 Worm-and-Roller type with 'push-pull' adjustment.
See article in Mechanical Equipment Section for data.
Front Suspension:—Conventional 'I' beam section front axle with Reverse Elliott ends and transverse front spring. Axle positioned by radius rods.
Kingpin Inclination—8° crosswise.
Caster—9° Max., 4½° Min. Must be equal within ½°. Axle may be bent cold to correct caster if proper tools (to prevent axle flange damage) used.
Camber—1° Max., ¼° Min. Must be equal within ¼° and right wheel must not exceed left. Adjust as for Caster (see Caster adjustment above).
Toe In—1/16". Set at 1-10 ratio to Camber. Adjust by loosening tie rod clamp bolts and turning tie rod.
Steering Geometry—Inner wheel 23⅓°. Outer 20°.

BRAKES:—**Service.** Lockheed hydraulic, double anchor type. Hand lever applies rear service brakes.
See article in Mechanical Equipment Section for data.
Drums—Cast iron. Diameter 12".
Wheel Cylinders—Stepped or two-stage bore type: Front Wheel—Front cylinder 1.25". Rear 1.00". Rear Wheel—Front cylinder 1.125". Rear 1.00".
Lining—Woven (forward shoes), Molded (rear shoes). Width 1.75". Thickness .20". Length per shoe 13.18" (forward shoes), 10.1" (rear shoes).
Clearance—Least possible amount without drag.
Hand Brake:—See Service Brakes above.

MODEL DESIGNATION:—Models, Engine Type, and Wheelbases for all trucks are as follows:

¾ Tonner

Model	Engine	Wheelbase
01D	85	122"
02D	60	122"
09D	95	122"

1 Tonner

01Y	85	122"
02Y	60	122"
09Y	95	122"

Cab-Over-Engine Models

011W	85	101"
01W	85	134"
018W	85	158"
091W	95	101"
09W	95	134"
098W	95	158"

Other Models

01T, U	85	134"
018T	85	158"
014T (School Bus)	85	194"
09T, U	95	134"
098T	95	158"
094 (School Bus)	95	194"

SERIAL & ENGINE NUMBER:—Stamped on top of clutch housing.

ENGINE SPECIFICATIONS & SERVICE DATA:—*See Ford '60', Ford '85', and Mercury (for '95' Engine) 'M' pages for complete data.* All data (Cylinder Sleeves, Pistons, Pins, Rings, Connecting Rods, Main Bearings, Camshaft, Valves, Lubrication and Cooling System) same as for passenger cars except as noted.

CLUTCH:—Long Model 9CF-CS (02D, 02Y), 11CF-CI (all others). Semi-centrifugal, single plate, dry disc type. *See article in Mechanical Equipment Section.*

Facings—Molded type, 2 required. Inside Diam. 5.76" (9CF), 6.5" (11CF). Outside Diam. 9" (9CF), 11" (11CF). Thickness .137" (all).

Adjustment:—Pedal free movement should be 1.5-1.75". To adjust, remove clevis pin at end of connector rod, adjust clevis on rod.

Removal:—Remove transmission (see Transmission Removal below). Take out mounting screws in clutch cover flange.

TRANSMISSION (3 SPD.):—Own Make. Std. on ¾ & 1 Tonner. Constant-mesh, synchro-mesh (Second & High), helical gears (Second & High), sliding spur gears (Low & Reverse). 4 Spd. Trans. Optl. *See article in Mechanical Equipment Section for data.*

Removal:—Remove 4 front companion flange bolt nuts at front universal. Take out 2 bolt nuts at coupling shaft center support (all except 101" WB. Cab-Over-Engine). Lower propeller shaft assembly to floor. Support engine at rear end, take out rear engine mounting bolts and clutch housing mounting screws. Pull transmission straight back and remove.

TRANSMISSION (4 SPD.):—Own Make. Std. on all models except ¾ & 1 Tonner. Sliding spur gear type. *See article in Mechanical Equipment Section for data.*

Removal:—Same as for 3 Spd. transmission above.

UNIVERSAL JOINTS:—Spicer. Needle bearing types.

Spicer Model Nos.

Wheelbase	Front	Center	Rear
101"	1351-17	None	1358-104
122"	1318-103	1311-102	1318-103
134 & 158"	1358-4	1351-107	1358-104
194"	1358-5	1351-107	1358-105

See article in Mechanical Equipment Section for data.

Coupling Shaft Bearing:—With the change from Torque Tube Drive to Hotchkiss Drive a new type cushion mounted Coupling Shaft Ball Bearing bolted to underside of intermediate frame cross member is now used. Bearing is mounted on end of coupling shaft in a sleeve with a felt retainer sleeve on each end and a bearing baffle over the front end. Bearing is retained by center universal companion flange. Bearing and sleeve assembly mounted in center support which is bolted to underside of frame cross member.

REAR AXLE (STD.):—Own Make. Full-floating, Spiral Bevel gear type with straddle-mounted pinion and new Hotchkiss drive. *See article in Mechanical Equipment Section for data.*

Ratio—¾ & 1 Tonner: 4.857-1 (Std. 85), 6.67-1 (Std. 60), 4.11-1 (Optl.). Other Trucks: 6.67-1 (Std.), 5.14-1 stamped with SS or 5.83-1 (Optl.).

Backlash—.004-.016".

Removal:—Split rear universal joint by taking out 2 U bolts and nuts. Lower propeller shaft. Disconnect hand brake cables at equalizer (¾ & 1 Tonner) and flexible hydraulic brake line at rear axle (bleed lines when re-connected). Disconnect rear springs (semi-elliptic type) and withdraw axle assembly from beneath truck.

Axle Shaft Removal—Take out two screws (except ¾ & 1 Tonner) and remove hub cap, remove nuts on 8 hub studs which hold axle shaft flange in place, turn the two special screws (in tapped holes in flange) up evenly to break flange loose from wheel hub, **back these screws out,** strike axle shaft flange at center to loosen centering cones on studs, remove cones, pull axle shaft out (wheel not disturbed).

Wheel Bearing Adjustment—Remove axle shaft (above), use special bearing adjusting wrench and remove bearing locknut (outer nut), nut retainer, and grease retainer (except ¾ & 1 Tonner). Adjust inner bearing adjusting nut by turning up until tight and then backing off ⅛ turn, install grease retainer, bearing nut retainer, outer bearing locknut, turn locknut up tight.

NOTE—When installing axle shaft, make certain that gasket in place under shaft flange, cones in place on studs and that two loosening screws backed off sufficiently so that stud nuts can be tightened securely. Turn the two loosening screws in just enough to prevent loosening in service.

REAR AXLE (OPTL.):—Two-speed type. *See article in Mechanical Equipment Section for data.*

Ratio—5.83-1 (Direct), 8.11-1 (2nd speed).

Backlash—.006-.020".

Removal:—Same as for standard axle (above) except that control linkage must also be disconnected.

SHOCK ABSORBERS:—Houde (Houdaille). Double acting, hydraulic, adjustable. Used on front end only. *See article in Mechanical Equipment Section for data.*

STEERING:—Steering Gear—Gemmer Model 305 Worm-and-Roller type with 'Push-pull' adjustment. *See article in Mechanical Equipment Section for data.*

Front Suspension:—Conventional 'I' beam section front axle with Reverse Elliott ends and new semi-elliptic springs.

Kingpin Inclination—7° crosswise.

Caster—3½° Max., 1° Min. Must be equal within ½°. NOTE—Caster angle controlled by wedge shims inserted between axle pads and springs. To increase caster, insert taper wedge shims equally at both sides (make certain that spring tie bolts extend through wedge anchoring spring to axle).

Camber—1° Max., ¼° Min. Must be equal within ¼° and right wheel must not exceed left wheel. NOTE—Axle may be bent cold to correct Camber provided that proper tools (wedges and blocks to prevent crushing axle flange) used.

Toe In—1/16". Set at 1-10 ratio to Camber. Toe-in increases with load on trucks and should be set with truck empty. Adjust by loosening clamp bolts and turning tie rod.

Steering Geometry (Toe out on Turns)—Outer wheel turned 20°. Inner wheel 23° (¾ & 1 Tonner), 23¾° (101" WB.), 22⅔° (134" WB.), 22¼° (158" WB.). Allowable variation ½°.

BRAKES:—Service. Lockheed, hydraulic, double anchor type. Hand lever applies rear wheel service brakes (¾ & 1 Ton), independent shaft brake (all others). *See article in Mechanical Equipment Section for data.*

Drums—Cast-iron. Diameter: ¾ Ton (12" front & rear). 1 Ton (12" front, 14" rear). Other Trucks (14" front, 15" rear).

Wheel Cylinders—Stepped type used on ¾ Ton (front & rear wheels), 1 Ton (front). Sizes as follows:

	Front Wheel Front	Front Wheel Rear	Rear Wheel Front	Rear Wheel Rear
¾ Ton	1.25"-1.00"		1.25"-1.00"	
1 Ton	1.25"-1.00"		1.375"-1.375"	
All Others	1.375"-1.375"		1.50"-1.50"	

Lining—Forward shoes (Woven—all wheels ¾ Ton, front wheel 1 Ton. Molded—All Others). Rear shoes (Molded—All Models).

	Width	Thickness	Length per Shoe Forward	Length per Shoe Rear
¾ Ton (all)	1.75"	.20"	13.18"	10.1"
1 Ton (front)	1.75"	.20"	13.18"	10.1"
1 Ton (rear)	2.00"	.268"	15.53"	10.75"
Others (front)	3.50"	.268"	15.53"	10.75"
Others (rear)	3.50"	.33"	16.64"	11.52"

Clearance—Least possible amount without drag.

Hand Brake (¾ & 1 Ton):—See Service Brakes above.

Hand Brake (Others):—On drum at rear of transmission.

Adjustment—Fully release hand brake lever. Flat on cam should rest on ear of band (if not, remove pin in lower end of hand lever). Turn anchor screw (on left side) in to give .010" clearance between drum and band, replace locking wire. Loosen lock nut and turn bracket adjusting screw (on right side) to give .010" clearance for lower half of band, tighten lock nut. Tighten adjusting rod nut (on right side) to give .010" clearance for upper half of band (slotted side of nut up). Adjust brake rod clevis so that pin enters clevis and hand brake lever with flat of cam on ear of band and lever in fully released position.

Drum Diameter—7.81".

Lining—Woven. Width 2.5". Thickness 0.250".

SERIAL NUMBER:—First No. 505001 (107), 605001 (108), 700001 (109). Stamped on plate inside right rear door (Sedans), or on seat frame (Coupes).

ENGINE NUMBER:—First No. 515001 (107), 615001 (108), 710001 (109). Stamped on plate at right side of crankcase and on Serial No. Plate.

ENGINE SPECIFICATIONS:—Six cylinder, 'L' head. Engines same for both models except that Supercharger installed on Models 107 & 109 only.
Bore—3¼". Stroke 4⅜". Displacement 217.8 cu. ins.
Rated Horsepower—25.35 A.M.A.
Developed Horsepower—93 at 3800 RPM (108), 120 at 4000 RPM (107 & 109 Supercharged).
Compression Ratio—Cast iron. 6.65-1 Std., 7.0-1 & 7.25-1 Optl. (all models).
Compression Pressure—125 lbs. (108), 130 lbs. (107 & 109) at cranking speed (Std. Hd.).
Vacuum Reading—15-17" idling at 5-7 M.P.H.

PISTONS:—Bohn autothermic, aluminum alloy, cam ground, plated type with special cylinder wall lubrication system. *See 1938 Graham Shop Notes.*
Weight—14⅛ ozs. (stripped). Length—3⅝".
Removal—Pistons and rods removed from above.
Clearance—Top .024". Skirt .0025".
Replacement Pistons:—Finished pistons (with pins fitted) furnished in oversizes of 3.247" to 3.252" (in .001" steps), 3.252" to 3.274" (in .002" steps) and 3.277". NOTE—Piston size stamped on head.
Fitting New Pistons:—Use .0025" feeler ½" wide inserted between piston and cylinder wall at right angles to pin. Pull required to withdraw feeler must be 10-15 lbs. at all points in cylinder.
Installing Pistons:—Install pistons with four vertical grooves on skirt toward camshaft (right side).

PISTON RINGS:—Two compression, two oil control rings per piston, all above pin.

Ring	Width	End Gap	Side Clearance
Compr.	3/32"	.007-.015"	.0015" Min.
Oil Cont.	5/32"	.007-.015"	.0015" Min.

Replacement Rings & Installation Directions:—*See Graham 1938 Shop Notes for data.*

PISTON PIN:—Diameter 13/16". Length 2 13/16". Pin locked in rod by clampscrew.
Pin Fit in Piston—.0005" clearance (hand push fit).
Replacement Pins:—Furnished Std. and .002", .005", .010" oversize (new pistons have fitted pins).

CONNECTING ROD:—Length 7". Bearing caps dowelled on rods and held by capscrews in blind tapped holes
Crankpin Journal Diameters—2 1/16".
Lower Bearing—Removable steel-backed, cadmium-silver-lined type (not grooved, no oil spray hole).
Clearance—.0008-.0021". Sideplay—.004-.006".
Bearing Adjustment:—None (no shims). Replace bearings. New bearings should be tight with .002" feeler 1" long installed under cap (cap can be sanded on face plate to secure this fit). Install new bearings with tang engaging groove in rod and cap.
Installing Rods:—Lower Bearings offset. Install rod with widest half of bearing toward rear (#1, 3, 5), toward front (#2, 4, 6). Head of piston pin clampscrew should be toward camshaft on all rods.

CRANKSHAFT:—4 bearing, integral counterweights with Lanchester type Vibration dampener.
Journal Diameters—2⅜" all bearings.
Bearing Type (Front)—Cadmium-silver lined bushing inserted in hole in crankcase from forward end with bushing flange doweled to crankcase.
Bearing Type (Others)—Conventional removable steel-backed, cadmium-silver lined type.
Clearance (all Bearings)—.0008-.0021".
Bearing Adjustment & Replacement:—*See Graham 1938 Shop Notes for Crankshaft Bearing data.*
End Thrust:—Taken by front bearing. Adjusted by adding or removing shims furnished .002", .008" thick. **Endplay—.004-.006".**

CAMSHAFT:—4 Bearing. Non-adjustable Chain Drive.
Journal Diameters—#1, 1⅞"; #2, 1 13/16"; #3, 1¾"; #4, 1¼". Bearing Type—Bronze bushings.
End Thrust:—Taken by spring-loaded plunger in forward end of camshaft.
Timing Chain:—Link-Belt No. 336. Width 1". Pitch .500". Length 23" or 46 links.
Camshaft Setting:—Sprockets are marked. With #1 and #6 pistons on top dead center and marks on both sprockets on upper left side, mesh chain so there are exactly 9 links or 10 pins (inclusive of pins meshed opposite marks) between marks.

VALVES:—	Head Diameter	Stem Diameter	Length
Intake	1 33/64"	.341"	4 61/64"
Exhaust	1 21/64"	.341"	4 61/64"

	Seat Angle	Lift	Stem Clearance
Intake	30°	5/16"	.002-.003"
Exhaust	45°	5/16"	.002-.003"

Tappet Clearance:—.010" all valves, engine hot.
Valve Guides:—Pressed in block. Ream after installation for correct clearance.
Valve Springs:—Spring free length 2".

	Spring Pressure	Length
Valve Closed	44 lbs.	1 21/32"
Valve Open	98 lbs.	1 11/32"

Valve Lifters:—Cylindrical type. Diameter 1". Operate in guide holes 1 21/32" long finished in block.
Lifter Clearance in Guide—.0005-.0015".
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 8.5° BTDC. Close 54.5° ALDC.
Exhaust Valves—Open 41° BLDC. Close 11° ATDC.
To Check Timing—Set tappet clearance #6 exhaust valve at .012". This valve should close when flywheel mark 'EC-1' lines up with indicator under cover on right front face of flywheel housing. Reset tappet clearance at .010" with engine hot.

SUPERCHARGER:—107 & 109 Only. Centrifugal type. Carburetor mounted directly on top of case (Supercharger blower between carburetor and engine).
See article in Mechanical Equipment Section for data.
Supercharger Removal & Drive Data:—*See Graham 1938 Shop Notes for data.*

LUBRICATION:—Pressure system. Gear type oil pump located in crankcase.
Normal Oil Pressure:—45 lbs. at 30 M.P.H.
Oil Pressure Regulator:—Located on right side of crankcase at rear of engine number plate. Opens at 50 lbs. Adjusted by adding or removing washers between spring and plunger.
Oil Pressure Gauge:—King-Seeley Electric type.
See article in Mechanical Equipment Section for data.
Crankcase Capacity:—5 quarts (refill).

COOLING SYSTEM:—Capacity—14 quarts (108), 15 quarts (107), 16 quarts (109).
Water Pump:—Packless type, sealed ball bearing shaft.
See article in Mechanical Equipment Section for data.
Removal—Remove fan belt, pump mounting bolts, and remove fan and pump as an assembly.
Thermostat:—Detroit Lubricator. In cyl. head outlet.
Setting—Starts to open 150° F. Fully open 180° F.
Temperature Gauge:—King-Seeley Electric type.
See article in Mechanical Equipment Section for data.

CLUTCH:—Long Model 9½CF-CS. Semi-centrifugal, single plate, dry disc type.
See article in Mechanical Equipment Section for data.
Facings—Chevron or Spiral wound Moulded type, 2 required. I.D. 6". O.D. 9½". Thickness .125".
Adjustment—Free movement of clutch pedal must be about 1¼". To adjust, loosen lock nut above pivot block at pedal, turn adjusting nut below pivot block on connector rod until proper clearance obtained.
Removal:—Remove Transmission (See Transmission below), take off clutch housing underpan, take out clutch mounting screws in cover flange (turning all screws out evenly, remove clutch from below.

TRANSMISSION:—Warner. Horizontal type (shift lever and cover on side of case). All helical gear type.
See article in Mechanical Equipment Section for data.
Overdrive Transmission:—Warner Model AS9-T88 with electrical 'kick-down' control. Optl. on 107&108.
See article in Mechanical Equipment Section for data.
Transmission Control:—Own remote control type.
See article in Mechanical Equipment Section for data.
Removal:—Disconnect hand brake and clutch linkage, disconnect propeller shaft at front universal, support engine at rear, remove rear engine mounting cross-member, take out transmission mounting bolts, pull transmission straight back and remove. NOTE—On cars with remote gear shift, disconnect shifter rods at side of transmission case.

UNIVERSAL JOINTS:—(107 & 108)—Detroit Universal Model 4200 Ball-and-trunnion type. **(109)**—Spicer. Needle bearing type, 2 used.
See article in Mechanical Equipment Section for data.

REAR AXLE:—Spicer Model 41-2. Semi-floating, Hypoid Gear type with Hotchkiss drive.
See article in Mechanical Equipment Section for data.
Ratio—4.27-1 (107 & 108), 4.09-1 (109) Std. 4.55-1 Optl. (all models).
Backlash—.004-.008" Shim adjustment.
Removal:—Hoist rear of car, disconnect propeller shaft at rear universal, brake line, and shock absorbers, remove spring U-bolts, disconnect rear spring shackles, withdraw axle assembly.
Wheel Bearing Adjustment—Shims provided between flanged end of axle housing and brake backing plate. To adjust, remove wheel, hub, and drum assembly. Remove shims. **Endplay .002-.007".**

SHOCK ABSORBERS:—Delco or Gabriel. Direct acting, hydraulic type.
See article in Mechanical Equipment Section for data.

STEERING:—Steering Gear—Ross Model T-14 Cam-and-Twin Lever type (107 & 108), Gemmer Model 305 Worm-and-Roller type (109).
See article in Mechanical Equipment Section for data.
Front Suspension:—Spicer, conventional 'I' beam section front axle with Reverse-Elliott ends and semi-elliptic springs.
Kingpin Inclination—7½° crosswise.
Caster—3½°. Adjusted by inserting wedge shims between spring and spring pad on axle.
Camber—1°.
Toe In—⅛". Adjust in usual manner by changing length of tie rod.

BRAKES:—Service—'Graham-Lockheed' hydraulic type. Hand lever applies independent shaft brake. (107 & 108), rear wheel service brakes (109).
See article in Mechanical Equipment Section for data.
Drum—11" Centrifuse type (107 & 108), 10" Cast Iron (109).
Lining—Moulded Type. Width 1¾" (107 & 108), 2" (109). Thickness ¼". Length per wheel 23" (107 & 108).
Clearance—.006" heel, .010" toe, for each shoe.
Hand Brake (107 & 108):—At rear of transmission.
Adjustment—*See Graham 1938 Shop Notes for data.*
Drum Diameter—6".
Lining—Width 2". Thickness 5/32". Length 18 9/16".
Hand Brake (109):—See Service Brakes above.
NoRol:—Optl. *See article in Mechanical Equipment Section.*

TORQUE WRENCH SPECIFICATIONS:—*See Torque Wrench article in Mechanical Equipment Section for tightening specifications for Cylinder Head, Main & Connecting Rod Bolts, etc.*

ENGINE HOOD (BONNET) LOCK:—Alligator type hood (hinged at front) with integral side panels and instrument panel lock. To raise hood, push forward on lock handle located under edge of instrument panel to left of steering column, lift rear of hood.

Hood Removal—Unlock and raise hood. Remove bonnet-to-bonnet support bolts, bonnet lamp wire terminals from connectors and bonnet-to-bonnet hinge bolts (3 at each side). Lift bonnet straight up and remove.

Hood Alignment—Hood hinge U-shaped (cross bar with up right arm at each end). Cross bar fitted with adjustable bracket at each end which are held to frame bracket by 2 screws. Frame brackets bolted to frame. Hinge positioning washers located at end of cross bar and secured by cotter pin. Fender position (at front end) controlled by brace secured to frame with adjusting nut and lock nut at fender brace (under hood in front of radiator core). Radiator louvre assembly position controlled fender-to-louvre bolts. Hood adjustment secured as follows: 1) Frame Bracket Bolts—for slight fore-and-aft and side wise movement 2) Hinge Bracket Screws—for full fore-and-aft movement and slight sidewise movement. 3) Fender Brace Rod—for full sidewise movement of front end of fender. 4) Louvre Panel-to-Fender Bolts (beneath fender)—for fitting front edge of hood (panel should be pushed forward as far as possible).

Radiator Louvre Panel Removal—Remove panel-to-fender bolts from under fender. Remove front bumper bolt and and loosen rear bolt permitting bumper assembly to be lowered. Remove center front screw from under panel and lift panel off.

FRONT FENDER REMOVAL:—Unlock and raise hood. Disconnect headlamp wires at junction block, unclip wires from fender and dash and push headlamp cables through hole in fender (remove battery if left fender to be removed). Remove fender bolts at following points: running board, brace rod top nut, louvre panel, fender cross member (with spacers), brace to cross member screw, core baffle to fender screws (right fender only), radiator lower tank shield screws, hood support screws, apron support to inspection cover screw, and horn bracket to frame screws. Lift fender off.

Right Front Fender Inspection Hole Plate Removal—This plate replaces fender dust shield (now welded to fender) used on 1939 models for access to valve tappets, fuel pump, and oil pump. To remove, unlock and raise hood, remove horn mounting bolts and push horns forward (in engine compartment). Raise front end of car, remove right front wheel and 12 cap screws along the top, bottom and front edge of plate (under fender).

RADIATOR CORE REMOVAL:—Drain radiator and remove upper and lower hoses. Disconnect radiator stay rod bolts at radiator and remove 2 radiator mounting bolts. Lift core out of car.

ENGINE ASSEMBLY REMOVAL:—All engines can be removed as follows: Remove bonnet (see Hood Removal), front seat cushion, accelerator pedal, front floor mat, transmission hole cover, clutch housing to engine bolts, engine ground strap, radiator core (see Radiator Core Removal), radiator stay rods and horns. Disconnect generator, starter, temperature gauge, and oil check valve wires and remove wiring harness from clips on left side of engine. Disconnect flexible fuel pump feed line and remove fuel line to carburetor. Disconnect throttle linkage leading from accelerator cross shaft and remove cross shaft (pull shaft toward spring and slip shaft out of opposite bracket). Disconnect windshield wiper hose at manifold. Remove spark plug wires and bracket, distributor cap, carburetor and air cleaner. Disconnect exhaust pipe at manifold. Remove front engine support bolts and nuts. Hoist engine out of car (use Tool J-917 attached to engine) move engine forward carefully to disconnect from transmission mainshaft. Finally, remove distributor, generator, fuel pump and clutch.

Installation—Reverse procedure listed above and note following point. Wrap a piece of soft wire around clutch throwout bearing oil seal with ends of wire extending up through clutch housing, lower engine in place (use care not to damage clutch driving plate assembly when engaging transmission mainshaft), pull wire out (this will prevent edge of seal from curling over).

ENGINE FRONT SUPPORT REMOVAL:—Drain cooling system. Remove generator, fan belt, radiator outlet hose and raise front end of car. Remove radiator lower tank shield, vibration dampener (see Vibration Dampener Removal) and timing gears (see Timing Gear Removal). Block up front end of engine and remove front engine mounting bolts and nuts. Take out engine support bolt and locks and remove plate.

Installation:—Reverse procedure listed above and note the following points: Clean front face of cylinder block thoroughly and use new gaskets. When replacing engine mounting bolts, tighten nuts until upper and lower plates are against spacer.

CRANKSHAFT SIZE CODE:—Cars equipped with .010" undersize main bearing pins and connecting rod pins identified by marks stamped on left front corner of cylinder block on bottom face beside oil reservoir gasket (visible without removing oil reservoir) as follows:

MU—.010" undersize main bearing pins.

PU—.010" undersize connecting rod pins.

PMU—.010" undersize main and connecting rod pins.

NOTE—These pins require .010" undersize bearings.

ORIGINAL BORE SIZE:—Original production (new engine) bore size indicated by code mark stamped on lower edge of valve chamber opposite cylinders. See table below for size and code marks.

Code Mark	Cylinder Diameter	Code Mark	Cylinder Diameter
A	3.000"	AO	3.010"
B	3.0005"	BO	3.0105"
C	3.001"	CO	3.011"
D	3.0015"	DO	3.0115"
E	3.002"	EO	3.012"

Note—Recondition cylinders to size for which replacement pistons and rings available (see below).

REPLACEMENT PISTONS:—Standard and oversize pistons marked by letter stamped on head and furnished for **cylinder diameter** sizes listed below. See Replacement Rings (following) for ring sizes.

Piston Mark	Piston Size	Cylinder Size
B	2.9985"	3.000" & 3.0005"
D	2.9995"	3.001" & 3.0015"
F	3.0005"	3.002" & 3.0025"
J	3.0025"	3.004"
L	3.0035"	3.005"
BO	3.0085"	3.010" & 3.0105"
DO	3.0095"	3.011" & 3.0115"
FO	3.0105"	3.012" & 3.0125"
LO	3.0135"	3.015"
BB	3.0185"	3.020"
DD	3.0195"	3.021"
FF	3.0205"	3.022"

Piston Markings—Code marks stamped on head of piston as follows: Letter indicates bore size for which piston to be used (see above). One number above the other indicates weight (lower number indicates ounces, top number ¼ ounces). Original factory pistons carry two additional marks (one mark indicates cylinder in which piston installed and other mark indicates cylinder block number). NOTE—All pistons in one engine should be of same weight (carry same weight marks on head).

REPLACEMENT RINGS:—Use standard or oversize rings for replacement pistons listed above. Ring size and pistons for which each ring size applies listed in table below.

Ring Size	Piston Mark	Ring Size	Piston Mark
3.000"	B, D, F	3.010"	BO, DO, FO
3.003"	J	3.015"	LO
3.005"	L	3.020"	BB, DD, FF

Note—If rings filed, keep clearance at pin uniform with end gap (.005" minimum).

PISTON PIN SERVICING:—When replacing pins car manufacturer recommends that oversize piston pins be fitted to the piston boss and new piston pin bushings be installed in rod. NOTE—Piston pin bosses are diamond-bored and should not be reamed.

Replacement Piston Pins—Furnished in standard size and .002", .005", .010" oversize.

Fitting Pins—Pins should be a hand press fit in piston with piston heated to 200°F. (heat in boiling water or electric furnace—do not use torch or direct heat) Replace pin bushing in rod and ream or burnish to .0003" greater diameter than pin (giving desired .0003" clearance on pin). To check pin fit in rod bushing, hold piston with rod in horizontal position, rod should just turn on pin of own weight. CAUTION—Do not ream piston pin bosses in piston.

CONNECTING ROD PALNUTS:—Palnut (locknut) used in place of cotter pin for locking connecting rod bolt nuts. Consists of single thread tempered steel with turned up edges.

Installation—After tightening bolt nuts (see Tightening Specifications in Mechanical Equipment Section), install palnut with smooth face toward nut, turn palnut on finger tight, then lock in place with wrench an additional ¼-⅓ turn. NOTE—Car manufacturer recommends use of new palnuts whenever rods reassembled.

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VIBRATION DAMPENER REMOVAL:—Dampener can be removed from beneath car without removing radiator core or louvre panel as follows: Remove radiator louvre panel center moulding. Remove bumper front bolts and loosen rear bolts and lower bumper. Remove fan belt, unscrew crankshaft starting jaw, place dampener puller (Tool J-676-B) jaw over dampener and puller screw through starting crank hole. Turn screw and pulling dampener off shaft and remove from under car.

CRANKSHAFT REMOVAL:—Remove engine (see Engine Assembly Removal), timing gear cover, oil pan and disconnect connecting rods. Remove main bearing caps (use Tool J-377 for front and rear caps). Lift crankshaft out with flywheel and crankshaft gear.

Installation:—Reverse procedure listed above for removal and note following points. Front and rear oil seal grooves in caps and case must be cleaned of all old packing. After caps secured in place (see Tightening Specifications in Mechanical Equipment Section), drive new packing in grooves using Tool J-932 (install in horizontal groove first on front cap). See Connecting Rod Palnut data above for rod installation. See Timing Gear Installation (following).

MAIN BEARINGS:—Adjustment—Laminated shims provided on top of caps. Remove caps (use Puller J-377 for front and rear caps) and remove shims until clearance is .001". See Crankshaft Installation for bearing cap installation data.

Replacement Bearings:—Finished bearings (with attaching screws) furnished standard and .010" undersize (see Crankpin Size Code for original bearing sizes). Unfinished bearings furnished with 1/32" extra stock and must be line-reamed (see below).

Removal:—Bearing shells are removable type and are held in case and caps by screws. To replace bearings, crankshaft must be removed (see Crankshaft Removal above). With shaft out of engine, take out screws securing shells in cap and case.

Installation:—With crankshaft removed, secure bearings shells in case and cap with machine screws. If unfinished bearings installed, line-ream as directed below. Install crankshaft (see Crankshaft Installation). Add or remove shims on bearing caps until .001" clearance obtained. Tighten bearing cap stud nuts (see Tightening Specifications in Mechanical Equipment Section).

Line-Reaming Main Bearings:—Where unfinished bearings used for replacement, bearings must be line-reamed to size as follows: Install bearings in caps and case, place .021" shim pack between case and caps, tighten cap stud nuts. Line-ream bearings. Thrust flange on center bearing must then be faced for .006-.012" endplay. After line-reaming bearings, adjust for proper clearance as directed above for installation.

CAMSHAFT REMOVAL:—Remove bonnet (see Hood Removal), radiator (see Radiator Core Removal), radiator louvre panel assembly, vibration dampener (see Vibration Dampener Removal), fan blades, fan belt, timing gear cover, camshaft gear (3 bolts), valve chamber cover, cylinder head, valves, tappets, oil pump, fuel pump and distributor (on Six cylinder cars, remove distributor shaft and support assembly). Loosen front engine support and raise front end of engine until camshaft clears radiator tank lower shield. Withdraw camshaft with thrust button and spring.

Camshaft Bearing Removal:—Remove camshaft as directed above. Remove oil pan and bearings. See Rear Camshaft Bearing Installation for Six Cylinder Engines following.

Replacement Camshaft Bearings:—Finished bearings available which are reamed sufficiently oversize to provide correct running fit when installed in engine without reaming or scraping. Standard bearings with added wall thickness provided for installations where reaming equipment to be used. These bearings should be line reamed to give .001" clearance.

Rear Camshaft Bearing Installation (Six Cylinder only):—Due to new location of distributor at top rear of cylinder block, distributor gear is now cut in rear bearing journal with a specal cut-out machined in camshaft rear bushing for the distributor support shaft gear. Whenever rear bearing replaced, this cut-out must be made in bearing after installing in engine as follows: With distributor drive shaft and support assembly off engine, remove drive shaft and insert hole saw (1⅛" hole saw mounted on end of ½" cold rolled stock of sufficient length to extend through support) in place in support. Cut bearing (use nut on end of shaft and turn saw with ratchet wrench) using light pressure to give a clean cut. NOTE—Place oil soaked rag under bearing to catch chips (avoiding necessity of removing crankshaft). Remove support and use extreme care to remove all bearing chips and cuttings.

TIMING GEAR REMOVAL:—Drain cooling system. Remove fan belt, radiator outlet hose, vibration dampener (see Vibration Dampener Removal), timing gear cover bolts, cover, cover gasket and vibration dampener spacer. Turn engine over until timing marks (2 teeth mark on camshaft gear, 1 tooth mark on crankshaft gear) coincide. Remove camshaft gear (retained by 3 capscrews and lock wire). Remove crankshaft gear using Puller Tool J-471.

Installation:—Reverse procedure listed above. Replace crankshaft gear with Tool J-483. Mesh timing gear marks as noted above.

Replacement Camshaft Gear:—A special .008" oversize camshaft gear (marked with daub of yellow paint on front face of gear) available for service. Gear backlash .002-.003" (Six), .004-.005" (Eight).

VALVE LIFTER REMOVAL:—Tappets (lifters) may be removed without removing cylinder head as follows: Remove Right Front Fender Inspection Hole Plate (see instructions under Front Fender Removal), remove valve cover plates (right side of engine below intake manifold), valve spring seat retainer, spring seat, dampener, and spring, tappet adjusting screw (replace with short screw with thin head), tappet guide clamp screw and clamp. Lift out tappet and guide assembly. NOTE—This method recommended where a few tappets to be replaced. For removal of all lifters, remove cylinder head and valves.

CHECKING OILING SYSTEM:—See that oil lines securely in place and not bent or damaged. Drop oil reservoir and clean thoroughly every six months. When installing oil reservoir, check flapper valve on rear main bearing oil return tube (soldered in rear of reservoir). Valve must work freely and should be slightly open with reservoir level. Holes in gaskets between crankcase and oil dipper tray and between tray and reservoir must align with oil return tube (tube registers with hole in bearing).

OIL SUCTION PIPE SEAL:—Synthetic rubber suction pipe oil seal fitted in counter-bore in cylinder block flange at point where suction pipe passes through oil pan flange. Seal fitted around pipe and oil pan gasket widened at this point. Seal compressed by pan when pan screws tightened. NOTE—Use new seal whenever pan installed.

CLUTCH OIL:—Servicing—Hudsonite (oil) in clutch must be renewed every 5000 miles. Turn engine over until hexagonal drain plug on front face of flywheel is visible in timing inspection hole on left side of motor rear support above starting motor. Remove drain plug (using special wrench J-472), turn engine over ⅓ revolution until star on flywheel is at inspection hole, allow engine to stand in this position one minute to drain old oil, turn engine over until filler plug is again at inspection hole, insert ⅓ pint Hudsonite (use J-485 gun) replace plug.
Capacity & Oil—⅓ pt. Hudsonite Clutch Compound.

ENGINE HOOD (BONNET) LOCK & FENDER PLATE REMOVAL:—*See Hudson Shop Notes.*

SERIAL NUMBER:—First number 40101. Stamped on plate on right front door hinge pillar post.

ENGINE NUMBER:—Same as Serial No. On top of cylinder block between #1 and 2 exhaust flanges.

ENGINE SPECIFICATIONS:—6 cylinder, 'L' head type.
Bore—3". **Stroke**—4⅛".
Displacement—175 cu. ins. **Rated HP**—21.6.
Developed Horsepower—92 at 4000 RPM.
Compression Ratio—7.0-1 cast-iron head.
Compression Pressure—125 lbs. at 125 RPM.
Vacuum Reading—Steady 18-21" idling at 7 MPH.

PISTONS:—Own Lo-Ex aluminum alloy, 'T' slot, cam ground type. Use finished replacement pistons.
Weight—10.5 ozs. (stripped). **Length**—3 3/16".
Removal—Pistons and rods removed from above.
Clearance—Top .016". Skirt .001-.002".
Original Bore Sizes & Replacement Pistons:—*See Hudson Shop Notes for complete data.*
Fitting New Pistons:—Use .0015" feeler ½" wide inserted between piston and cylinder wall on side opposite slot at right angles to pin. Pull to withdraw feeler must be within 3-4 lbs.
Installing Pistons:—Slot away from camshaft.

PISTON RINGS:—2 compression, 2 oil rings (1 above pin, 1 below pin). Rings positioned by pin in groove.

Ring	Width	End Gap	Side Clearance
Compression	3/32"	.009-.011"	.001"
Oil Cont. (#1)	3/16"	.009-.011"	.001"
Oil Cont. (#2)	5/32"	.009-.011"	.001"

Replacement Rings:—*See Hudson Shop Notes for data.*

PISTON PIN:—**Diameter**—¾". **Length**—2 7/16".
Floating Type. Retained by locking rings. *See Hudson Shop Notes for Pin Servicing data.*
Pin Fit in Piston—.0003" clearance (hand push fit) with piston heated to 200°F.
Pin Fit in Rod Bushing—.0003" clearance.
Replacement Pins:—Std., .002", .005", .010" oversize.

CONNECTING ROD:—**Weight**—30¾". **Length**—8⅝".
Crankpin Journal Diameter 1 15/16".
Lower Bearing—'Bermax' alloy spun type. Exchange rods furnished Std. & .010" undersize. *See Crankshaft Size Code in Hudson Shop Notes for bearing sizes.*
Clearance—.001". **Sideplay**—.006-.010".
Bearing Adjustment:—None (no shims). Replace rods. *See Hudson Shop Notes for Palnut (locknut) data.*
Installing Rods:—Offset. Install rods with widest half of bearing toward rear (#1, 2, 4), toward front (#3, 5, 6). Oil scoop on all rods toward camshaft.

CRANKSHAFT:—3 bearing, integral counterweights. *See Hudson Shop Notes for Crankshaft and Vibration Dampener Removal, Main Bearing Removal, Installation, Replacement Bearings and Line-reaming data.*
Journal Diameters—#1, 2 11/32"; #2, 2⅜"; #3, 2 13/32". **Clearance**—.001".
Bearings—Bronze-backed, 'Bermax' alloy type. *See Crankshaft Size Code Note in Hudson Shop Notes for original bearing sizes.*
Bearing Adjustment:—Shims. *See Hudson Shop Notes.*
End Thrust:—Taken by center bearing. Replace bearing if endplay excessive. **Endplay**—.006-.012".

CAMSHAFT:—3 bearing, gear driven. *See Hudson Shop Notes for Camshaft Removal & Bearing Installation.*
Journal Diameters—#1, 2"; #2, 1 31/32"; #3, 1 9/16".
Bearings—Babbitt type. **Clearance**—.0025".
End Thrust:—Thrust washer between camshaft flange and crankcase. Spring loaded button in camshaft hub bears against thrust plate on gear cover.
Timing Gears:—Crankshaft gear cast-iron. Camshaft gear GE or Continental Diamond Fibre Bakelite.
Camshaft Setting:—Mesh marked crankshaft gear tooth between two marked teeth on camshaft gear.

VALVES:—

	Head Diameter	Stem Diameter	Length
All valves	1⅜"	11/32"	5 11/32"

	Seat Angle	Lift	Stem Clearance
Intake	45°	11/32"	.0025"
Exhaust	45°	11/32"	.004"

Tappet Clearance:—.006" Int., .008" Exh., hot & idling. *See Hudson Shop Notes for Fender Plate Removal.*
Valve Guides:—2 9/16" long. Install with top 1 1/16" below top of block and finish ream to size.
Valve Springs:—Free length 2 17/64". See that dampener installed on bottom of spring with open side toward cylinder.

	Spring Pressure	Length
Valve Closed	40 lbs.	2"
Valve Open	80 lbs.	1 21/32"

NOTE—Replace if pressure below 34 lbs. at 2".
Valve Lifters:—Roller shoe type, fitted in removable guides. *See Hudson Shop Notes for lifter removal.*
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 10°40' BTDC. Close 60° ALDC.
Exhaust Valves—Open 50° BLDC. Close 18°44' ATDC. These figures correct with .010" tappet clearance.
Valve Timing Check—With .010" tappet clearance #1 intake valve should open with piston 10°40' or .0041" BTDC. when point on flywheel approx. 3.95 teeth before 'UDC.1-6/' lines up with indicator in inspection hole above starter. Reset tappet clearance at .006" hot.

LUBRICATION:—Duo-flo (pressure & positive splash).
Oil Pump:—Oscillating plunger type, gear driven by camshaft. Mounted on right side of crankcase.
Normal Oil Pressure—3 lbs. (no gauge).
Oil Pressure Regulator:—Located on right side of crankcase at rear. Opens at 3 lbs. Not adjustable.
Oil Pressure Indicator:—Teleflash Oil Pressure indicator. *See article in Electrical Equipment Section.*
Checking Oiling System:—*See Hudson Shop Notes.*
Crankcase Capacity:—4½ qts. (refill), 5½ (dry). NOTE—Whenever pan installed, place 1½ qts. in upper tray, then 4 qts. through filler.

COOLING SYSTEM:—**Capacity**—13 quarts. *See Hudson Shop Notes for radiator core removal.*
Water Pump:—Centrifugal, belt driven, packless type. *See article in Mechanical Equipment Section for data.*
Thermostat:—Fulton. In cylinder head water outlet.
Setting—Starts to open 150-155°F. Fully open 185°.
Temperature Gauge:—King-Seeley Electric K-S Nos. Dash Unit—8120 (early—white lines), 7755 (later—white diamonds). Engine Unit—7000. NOTE—Gauge inoperative with ignition Off (reads 'H'). *See article in Mechanical Equipment Section for data.*

CLUTCH:—**Own make.** Single plate, cork insert type operating in oil. **Overdrive Cars**—equipped with heavier clutch housing and larger (10") clutch. *See article in Mechanical Equipment Section for data.*
Driven Member—Cork insert type. Inside Diam. 5⅜" Outside Diam. 9". Facing 90 cork inserts .077" thick. See next page for Overdrive Car data.
Pedal Adjustment:—1½" free travel. Adjust yoke on lower end of pedal connector link. Check Automatic Clutch Control & Hill-holder (if used).
Clutch Oil Servicing:—*See Hudson Shop Notes.*
Removal:—Remove transmission (see below), drain clutch oil, take out mounting screws in clutch cover rim, remove clutch assembly from below.
Automatic Clutch Control:—Electric type. Optl. *See article in Mechanical Equipment Section for data.*

TRANSMISSION:—**Own Make.** Constant-mesh, helical gears (Second & High), sliding spur gears (Low & Reverse) with steering column gear shift.
Overdrive:—Warner Model AS13-R6 with electrical 'Kick-down' control optional.
Transmission Control:—Hudson 'Handy-Shift' type. *See separate articles in Mechanical Equipment Section.*
Removal:—Remove front seat cushion and push seat back, remove accelerator pedal. Remove floor mat and transmission hole cover. Disconnect front universal joint. Remove clutch pedal return spring, assist spring, and cross-shaft. Release transmission side bumpers and rods, disconnect handy-shift controls at transmission, remove speedometer cable. Raise front end of car, remove lower flywheel guard and engine rear mounting bolts, raise rear end of engine off frame. Remove clutch housing-to-engine mounting bolts, pull transmission back and lift out. NOTE—Transmission can be taken out without disturbing clutch housing by taking out transmission-to-clutch housing bolts.
Overdrive Transmission Removal—Same as Std. Transmission (above) except overdrive solenoid wires and control cable must also be disconnected.
Installation Note—Wrap one strand of soft wire around throw-out bearing oil seal to prevent leather curling over when transmission installed. Remove wire after transmission installed.

UNIVERSAL JOINTS:—**Spicer.** Front—1261-101 (Std.), 1271-101 (with Ovdr.). Rear—1268-101 (Std.), 1278-101 (with Ovdr.). Needle bearing type. *See article in Mechanical Equipment Section for data.*

REAR AXLE:—**Own Make.** Semi-floating spiral bevel gear type with Hotchkiss drive. *See article in Mechanical Equipment Section for data.*
Ratio—4 5/9-1 (Std., Optl. on Ovdr), 4⅞-1 (Std. on Ovdr., Optl. reg. trans), 4 1/9-1 (optl. all).
Backlash—.0005-.003". Screw adjustment.
Removal:—Disconnect drive shaft at rear universal. Remove axle shafts (see below) and capscrews on carrier flange. Pull carrier assembly out.
Axle Shaft Removal:—Remove wheel and hub (use screw type puller only), remove 4 nuts on bearing cap bolts, push bolts out of backing plate, remove cap (without disturbing brake link), remove shims, pull axle shaft and wheel bearing. Do not drag shaft on oil seals.
Wheel Bearing Adjustment:—Controlled by shims under bearing cap. To adjust, remove bearing cap (see Removal directions above), add or remove shims equally at both wheels. **Endplay**—.002-.004".

SHOCK ABSORBERS:—**Monroe. Front**—160101 (Std.), 160102 (Heavy springs). **Rear**—160107 (Std.), 160108 (Heavy springs). Direct acting, hydraulic. *See article in Mechanical Equipment Section for data.*

STEERING:—**Steering Gear.** Gemmer Model 305 Worm-and-Roller type with 'push-pull' adjustment and new type Center Point Steering linkage. *See article in Mechanical Equipment Section for data.*
Front Suspension:—Independent, linked parallelogram type with coil springs and Autopoise Control. *See article in Mechanical Equipment Section for data.*
Kingpin Inclination—4°36' crosswise.
Caster—0° (Neg. ¼° to Pos. ¼°). Adjustable.
Camber—Positive ¼° to Pos. ¾°. Adjustable.
Toe In—0-1/16". Loosen clamp at outer end of each tube (adjust tubes equally).
Steering Geometry—Inner wheel 24°. Outer 20°50'.

BRAKES (40T,40P):—**Service**—Bendix hydraulic, Double Anchor, duo-servo type with Mechanical Follow-up. Hand lever applies rear service brakes. *See article in Mechanical Equipment Section for data.*
Drums—Alloy steel. Diameter—9 1/16".
Lining—Moulded (primary), woven (secondary). Width 1¾". Thickness 7/32". Length per wheel 19".
Clearance—.010" at heel and toe of each shoe.
Hand Brake:—See Service Brakes above.
Hill-Holder:—Optl. *See Mechanical Equipment Section.*

BRAKES (40 BUSINESS CARS):—Same as Model 41.
See next page for data.

ENGINE HOOD (BONNET) LOCK & FENDER PLATE REMOVAL:—*See Hudson Shop Notes.*

SERIAL NUMBER:—First No. 41101 (41), 43101 (43), 48101 (48). On right front door hinge post.

ENGINE NUMBER:—Same as Serial No. On top of cylinder block between #1 and 2 exhaust flanges.

ENGINE SPECIFICATIONS:—6 cylinder, 'L' head type. **Bore**—3". **Stroke**—5". **Displacement**—212 cubic inches. **Rated HP** 21.6. **Developed Horsepower**—102 (41,43), 98 (48) at 4000 RPM. **Compression Ratio**—6.50-1 cast-iron head. **Compression Pressure**—120 lbs. at 125 RPM. **Vacuum Reading**—Steady 18-21" idling at 7 MPH.

PISTONS:—Own Lo-Ex aluminum alloy, 'T' slot, cam ground type. Use finished replacement pistons. **Weight**—10.5 ozs. (stripped). **Length**—3 3/16". **Removal**—Pistons and rods removed from above. **Clearance**—Top .016". Skirt .001-.002". **Original Bore Sizes & Replacement Pistons:**—*See Hudson Shop Notes for complete data.* **Fitting New Pistons:**—Use .0015" feeler ½" wide inserted between piston and cylinder wall on side opposite slot at right angles to pin. Pull to withdraw feeler must be within 3-4 lbs. **Installing Pistons:**—Slot away from camshaft.

PISTON RINGS:—2 compression, 2 oil rings (1 above pin, 1 below pin). Rings positioned by pin in groove.

Ring	Width	End Gap	Side Clearance
Compression	3/32"	.009-.011"	.001"
Oil Cont. (#1)	3/16"	.009-.011"	.001"
Oil Cont. (#2)	5/32"	.009-.011"	.001"

Replacement Rings:—*See Hudson Shop Notes for data.*

PISTON PIN:—**Diameter**—¾". **Length**—2 7/16". Floating Type. Retained by locking rings. *See Hudson Shop Notes for Pin Servicing data.* **Pin Fit in Piston**—.0003" clearance (hand push fit) with piston heated to 200°F. **Pin Fit in Rod Bushing**—.0003" clearance. **Replacement Pins:**—Std., .002", .005", .010" oversize.

CONNECTING ROD:—**Weight** 30 ozs. **Length** 8 3/16". **Upper Bearing (Piston Pin Bushing)**—Bronze. **Crankpin Journal Diameter** 1 15/16". **Lower Bearing**—'Bermax' alloy spun type. Exchange rods furnished Std. & .010" undersize. *See Crankshaft Size Code in Hudson Shop Notes for bearing sizes.* **Clearance**—.001". **Sideplay**—.006-.010". **Bearing Adjustment:**—None (no shims). Replace rods. *See Hudson Shop Notes for Palnut (locknut) data.* **Installing Rods:**—Offset. Install rods with widest half of bearing toward rear (#1, 2, 4), toward front (#3, 5, 6). Oil scoop on all rods toward camshaft.

CRANKSHAFT:—3 bearing, integral counterweights. *See Hudson Shop Notes for Crankshaft and Vibration Dampener Removal, Main Bearing Removal, Installation, Replacement Bearings and Line-reaming data.* **Journal Diameters**—#1, 2 11/32"; #2, 2⅜"; #3, 2 13/32". **Clearance**—.001". **Bearings**—Bronze-backed, 'Bermax' alloy type. *See Crankshaft Size Code Note in Hudson Shop Notes for original bearing sizes.* **Bearing Adjustment:**—Shims. *See Hudson Shop Notes.* **End Thrust:**—Taken by center bearing. Replace bearing if endplay excessive. **Endplay**—.006-.012".

CAMSHAFT:—3 bearing, gear driven. *See Hudson Shop Notes for Camshaft Removal & Bearing Installation.* **Journal Diameters**—#1, 2"; #2, 1 31/32"; #3, 1 9/16". **Bearings**—Babbitt type. **Clearance**—.0025". **End Thrust:**—Thrust washer between camshaft flange and crankcase. Spring loaded button in camshaft hub bears against thrust plate on gear cover. **Timing Gears:**—Crankshaft gear cast-iron. Camshaft gear GE or Continental Diamond Fibre Bakelite. **Camshaft Setting:**—Mesh marked crankshaft gear tooth between two marked teeth on camshaft gear.

VALVES:—

	Head Diameter	Stem Diameter	Length
All valves	1⅜"	11/32"	5 11/32"

	Seat Angle	Lift	Stem Clearance
Intake	45°	11/32"	.0025"
Exhaust	45°	11/32"	.004"

Tappet Clearance:—.006" Int., .008" Exh., hot & idling. *See Hudson Shop Notes for Fender Plate Removal.* **Valve Guides:**—2 9/16" long. Install with top 1 1/16" below top of block and finish ream to size. **Valve Springs:**—Free length 2 17/64". See that dampener installed on bottom of spring with open side toward cylinder.

	Spring Pressure	Length
Valve Closed	40 lbs.	2"
Valve Open	80 lbs.	1 21/32"

NOTE—Replace if pressure below 34 lbs. at 2". **Valve Lifters:**—Roller shoe type, fitted in removable guides. *See Hudson Shop Notes for lifter removal.* **Valve Timing:**—See Camshaft Setting above. **Intake Valves**—Open 10°40' BTDC. Close 60° ALDC. **Exhaust Valves**—Open 50° BLDC. Close 18°44'ATDC. These figures correct with .010" tappet clearance. **Valve Timing Check**—With .010" tappet clearance #1 intake valve should open with piston 10°40' or .0562" BTDC when a point on the flywheel approx. 3.94 teeth before 'UDC.1-6/' lines up with indicator in inspection hole above starter. Reset tappet clearance at .006" hot.

LUBRICATION:—Duo-flo (pressure & positive splash). **Oil Pump:**—Oscillating plunger type, gear driven by camshaft. Mounted on right side of crankcase. **Normal Oil Pressure**—3 lbs. (no gauge). **Oil Pressure Regulator:**—Located on right side of crankcase at rear. Opens at 3 lbs. Not adjustable. **Oil Pressure Indicator:**—Teleflash Oil Pressure indicator. *See article in Electrical Equipment Section.* **Checking Oiling System:**—*See Hudson Shop Notes.* **Crankcase Capacity:**—4½ qts. (refill), 5½ (dry). NOTE—Whenever pan installed, place 1½ qts. in upper tray, then 4 qts. through filler.

COOLING SYSTEM:—**Capacity**—13 quarts. *See Hudson Shop Notes for radiator core removal.* **Water Pump:**—Centrifugal, belt driven, packless type. *See article in Mechanical Equipment Section for data.* **Thermostat:**—Fulton. In cylinder head water outlet. **Setting**—Starts to open 150-155°F. Fully open 185°. **Temperature Gauge:**—King-Seeley Electric K-S Nos. Dash Unit—8120 (early—white lines), 7755 (later—white diamonds). Engine Unit—7000. NOTE—Gauge inoperative with ignition Off (reads 'H'). *See article in Mechanical Equipment Section for data.*

CLUTCH:—**Own make.** Single plate, cork insert type operating in oil. **Overdrive Cars**—equipped with heavier clutch housing and larger redesigned disc *See article in Mechanical Equipment Section for data.* **Driven Member**—Cork insert type. Inside Diam. 5⅜" (41), 6½" (43, 48). Outside Diam. 9" (41), 10" (43, 48). Facing 90 (41), 108 (43, 48) cork inserts .077" thick. NOTE—43 type used on 40, 41 with Overdrive. **Pedal Adjustment:**—1½" free travel. Adjust yoke on lower end of pedal connector link. Check Automatic Clutch Control & Hill-holder (if used). **Clutch Oil Servicing:**—*See Hudson Shop Notes.* **Removal:**—Remove transmission (see below), drain clutch oil, take out mounting screws in clutch cover rim, remove clutch assembly from below. **Automatic Clutch Control:**—Electric type. Optl. *See article in Mechanical Equipment Section for data.*

TRANSMISSION:—**Own Make.** Constant-mesh, helical gears (Second & High), sliding spur gears (Low & Reverse) with steering column gear shift. **Overdrive:**—Warner Model AS13-R6 with electrical 'Kick-down' control optional. **Transmission Control:**—Hudson 'Handy-Shift' type. *See separate articles in Mechanical Equipment Section.* **Removal:**—Remove front seat cushion and push seat back, remove accelerator pedal. Remove floor mat and transmission hole cover. Disconnect front universal joint. Remove clutch pedal return spring, assist spring, and cross-shaft. Release transmission side bumpers and rods, disconnect handy-shift controls at transmission, remove speedometer cable. Raise front end of car, remove lower flywheel guard and engine rear mounting bolts, raise rear end of engine off frame. Remove clutch housing-to-engine mounting bolts, pull transmission back and lift out. NOTE—Transmission can be taken out without disturbing clutch housing by taking out transmission-to-clutch housing bolts. **Overdrive Transmission Removal**—Same as Std. Transmission (above) except overdrive solenoid wires and control cable must also be disconnected. **Installation Note**—Wrap one strand of soft wire around throw-out bearing oil seal to prevent leather curling over when transmission installed. Remove wire after transmission installed.

UNIVERSAL JOINTS:—**Spicer**—1271-101 (front), 1278-101 (rear). Needle bearing type. *See article in Mechanical Equipment Section for data.*

REAR AXLE:—**Own Make.** Semi-floating spiral bevel gear type with Hotchkiss drive. *See article in Mechanical Equipment Section for data.* **Ratio**—4 1/9-1 (Std., Optl. on Overdrive), 4 5/9-1 (Std. on Overdrive, Optl. reg. transmission). **Backlash**—.0005-.003". Screw adjustment. **Removal:**—Disconnect drive shaft at rear universal. Remove axle shafts (see below) and capscrews on carrier flange. Pull carrier assembly out. **Axle Shaft Removal & Wheel Bearing Adjustment**—Same as on Model 40—see preceding page.

SHOCK ABSORBERS:—Direct acting, hydraulic types.

Car Model	Make	Front	Rear
41, 48 (std. springs)	Monroe	160101	160107
41, 48 (hvy. springs)	Monroe	160102	160108
43 (Dom. & Exp.)	Delco	1007-C	1008-S

See separate articles in Mechanical Equipment Section.

STEERING:—**Steering Gear.** Gemmer Model 305 Worm-and-Roller type with 'push-pull' adjustment and new type Center Point Steering linkage. *See article in Mechanical Equipment Section for data.* **Front Suspension:**—Independent, linked parallelogram type with coil springs and Autopoise Control. *See article in Mechanical Equipment Section for data.* **Kingpin Inclination**—4°36' crosswise. **Caster**—0° (Neg. ¼° to Pos. ¼°). Adjustable. **Camber**—Positive ¼° to Pos. ¾°. Adjustable. **Toe In**—0-1/16". Loosen clamp at outer end of each tube (adjust tubes equally). **Steering Geometry**—Inner wheel 24°. Outer 20°50'.

BRAKES:—**Service.** Bendix hydraulic, duo-servo, single anchor type with eccentric adjustment. Mechanical follow-up (pedal linked to hand brake cables) provided. Hand lever applies rear service brakes. *See articles in Mechanical Equipment Section for data.* **Drums**—Alloy steel. Diam. 10 1/16" (41,48), 11 1/16" (43). **Lining**—Moulded (primary), woven (secondary). Thickness 7/32". Width 1¾". Length per wheel 22⅛". 41,48), 23 15/16" (43). **Clearance**—.010" at heel and toe of each shoe. **Hand Brake:**—See Service Brakes above. **Hill-Holder:**—Optl. *See Mechanical Equipment Section.*

ENGINE HOOD (BONNET) LOCK & FENDER PLATE REMOVAL:—*See Hudson Shop Notes.*

SERIAL NUMBER:—1st number 44101 (44), 47101 (47). On plate on right front door hinge pillar post.

ENGINE NUMBER:—Same as Serial No. On top of cylinder block between #1 and 2 exhaust flanges.

ENGINE SPECIFICATIONS:—8 cylinder, 'L' head type.
Bore—3". **Stroke**—4½".
Displacement—254 cubic inches. **Rated HP**—28.8.
Developed Horsepower—128 at 4200 RPM.
Compression Ratio—6.50-1 cast-iron head.
Compression Pressure—119 lbs. at 125 RPM.
Vacuum Reading—Steady 18-21" idling at 7 MPH.

PISTONS:—Own Lo-Ex aluminum alloy, 'T' slot, cam ground type. Use finished replacement pistons.
Weight—10.5 ozs. (stripped). **Length**—3 3/16".
Removal—Piston and rod assemblies may be removed from above or below.
Clearance—Top .016". Skirt .001-.002".
Original Bore Sizes & Replacement Pistons:—*See Hudson Shop Notes for complete data.*
Fitting New Pistons:—Use .0015" feeler ½" wide inserted between piston and cylinder wall on side opposite slot at right angles to pin. Pull to withdraw feeler must be within 3-4 lbs.
Installing Pistons:—Slot away from camshaft.

PISTON RINGS:—2 compression, 2 oil rings (1 above pin, 1 below pin). Rings positioned by pin in groove.

Ring	Width	End Gap	Side Clearance
Compression	3/32"	.009-.011"	.001"
Oil Cont. (#1)	3/16"	.009-.011"	.001"
Oil Cont. (#2)	5/32"	.009-.011"	.001"

Replacement Rings:—*See Hudson Shop Notes for data.*

PISTON PIN:—**Diameter**—¾". **Length**—2 7/16". Floating Type. Retained by locking rings. *See Hudson Shop Notes for Pin Servicing data.*
Pin Fit in Piston—.0003" clearance (hand push fit) with piston heated to 200°F.
Pin Fit in Rod Bushing—.0003" clearance.
Replacement Pins:—Std., .002", .005", .010" oversize.

CONNECTING ROD:—**Weight** 30 ozs. **Length** 8 3/16".
Upper Bearing (Piston Pin Bushing)—Bronze.
Crankpin Journal Diameter 1 15/16".
Lower Bearing—'Bermax' alloy spun type. Exchange rods furnished Std. & .010" undersize. *See Crankshaft Size Code in Hudson Shop Notes for bearing sizes.*
Clearance—.001". **Sideplay**—.006-.010".
Bearing Adjustment:—None (no shims). Replace rods. *See Hudson Shop Notes for Palnut (locknut) data.*
Installing Rods:—Offset. Install rods with widest half of bearing toward rear (#1, 3, 5, 7), toward front (#2, 4, 6, 8). Oil scoop on all rods toward camshaft.

CRANKSHAFT:—5 bearing, integral counterweights. *See Hudson Shop Notes for Crankshaft and Vibration Dampener Removal, Main Bearing Removal, Installation, Replacement Bearings and Line-reaming data.*
Journal Diameters—#1, 2 9/32"; #2, 2 5/16"; #3, 2 11/32"; #4, 2⅜"; #5, 2 13/32".
Bearings—Bronze-backed, 'Bohnolloy' type. *See Crankshaft Size Code Note in Hudson Shop Notes for original bearing sizes.*
Clearance—.001".
Bearing Adjustment:—Shims. *See Hudson Shop Notes.*
End Thrust:—Taken by center bearing. Replace bearing if endplay excessive. **Endplay**—.006-.012".

CAMSHAFT:—5 bearing, gear driven. *See Hudson Shop Notes for Camshaft Removal.*
Journal Diameters—#1, 2.029"; #2, 1.998"; #3, 1.966"; #4, 1.935"; #5, 1.498".
Bearings—Babbitt type. **Clearance**—.0025".
End Thrust:—Thrust washer between camshaft flange and crankcase. Spring loaded button in camshaft hub bears against thrust plate on gear cover.
Timing Gears:—Crankshaft gear cast-iron. Camshaft gear GE or Continental Diamond Fibre Bakelite.
Camshaft Setting:—Mesh marked crankshaft gear tooth between two marked teeth on camshaft gear.

VALVES:

	Head Diameter	Stem Diameter	Length
Intake	1½"	11/32"	5 3/32"
Exhaust	1⅜"	11/32"	5 3/32"

	Seat Angle	Lift	Stem Clearance
Intake	45°	11/32"	.0025"
Exhaust	45°	11/32"	.004"

Tappet Clearance:—.006" Int., .008" Exh., hot & idling. *See Hudson Shop Notes for Fender Plate Removal.*
Valve Guides:—2 9/16" long. Install with top 15/16" below top of block and finish ream to size.
Valve Springs:—Free length 2 17/64". See that dampener installed on bottom of spring with open side toward cylinder.

	Spring Pressure	Length
Valve Closed	40 lbs.	2"
Valve Open	80 lbs.	1 21/32"

NOTE—Replace if pressure below 34 lbs. at 2".
Valve Lifters:—Roller shoe type, fitted in removable guides. *See Hudson Shop Notes for lifter removal.*
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 10°40' BTDC. Close 60° ALDC.
Exhaust Valves—Open 50° BLDC. Close 18°44' ATDC.
These figures correct with .010" tappet clearance.
Valve Timing Check—With .010" tappet clearance #1 intake valve should open with piston 10°40' or .0494" BTDC when a point on the flywheel approx. 3.97 teeth before 'UDC.1-8/' mark lines up with indicator in inspection hole above starter. Reset tappet clearance at .006" hot and idling.

LUBRICATION:—Duo-flo (pressure & positive splash).
Oil Pump:—Oscillating plunger type, gear driven by camshaft. Mounted on right side of crankcase.
Normal Oil Pressure—3 lbs. (no gauge).
Oil Pressure Regulator:—Located on right side of crankcase at rear. Opens at 3 lbs. Not adjustable.
Oil Pressure Indicator:—Teleflash Oil Pressure indicator. *See article in Electrical Equipment Section.*
Checking Oiling System:—*See Hudson Shop Notes.*
Crankcase Capacity:—7 qts. (refill). NOTE—Install 2 qts. add'tl oil in upper tray when pan installed.

COOLING SYSTEM:—**Capacity**—18 quarts. *See Hudson Shop Notes for radiator core removal.*
Water Pump:—Centrifugal, belt driven, packless type. *See article in Mechanical Equipment Section for data.*
Thermostat:—Fulton. In cylinder head water outlet.
Setting—Starts to open 150-155°F. Fully open 185°.
Temperature Gauge:—King-Seeley Electric K-S Nos. Dash Unit—8120 (early—white lines), 7755 (later—white diamonds). Engine Unit—7000. NOTE—Gauge inoperative with ignition Off (reads 'H'). *See article in Mechanical Equipment Section for data.*

CLUTCH:—**Own make.** Single plate, cork insert type operating in oil. **Overdrive Cars**—equipped with heavier clutch housing and larger redesigned disc assembly and hub section. *See article in Mechanical Equipment Section for data.*
Driven Member—Cork insert type. Inside Diam. 6½". Outside Diam. 10". Facing 108 corks .077" thick.
Pedal Adjustment:—1½" free travel. Adjust yoke on lower end of pedal connector link. Check Automatic Clutch Control & Hill-holder (if used).
Clutch Oil Servicing:—*See Hudson Shop Notes.*
Removal:—Remove transmission (see below), drain clutch oil, take out mounting screws in clutch cover rim, remove clutch assembly from below.
Automatic Clutch Control:—Electric type. Optl. *See article in Mechanical Equipment Section for data.*

TRANSMISSION:—**Own Make.** Constant-mesh, helical gears (Second & High), sliding spur gears (Low & Reverse) with steering column gear shift.
Overdrive:—Warner Model AS13-R6 with electrical 'Kick-down' control optional.
Transmission Control:—Hudson 'Handy-Shift' type. *See separate articles in Mechanical Equipment Section.*
Removal:—Remove front seat cushion and push seat back, remove accelerator pedal. Remove floor mat and transmission hole cover. Disconnect front universal joint. Remove clutch pedal return spring, assist spring, and cross-shaft. Release transmission side bumpers and rods, disconnect handy-shift controls at transmission, remove speedometer cable. Raise front end of car, remove lower flywheel guard and engine rear mounting bolts, raise rear end of engine off frame. Remove clutch housing-to-engine mounting bolts, pull transmission back and lift out. NOTE—Transmission can be taken out without disturbing clutch housing by taking out transmission-to-clutch housing bolts.
Overdrive Transmission Removal—Same as Std. Transmission (above) except overdrive solenoid wires and control cable must also be disconnected.
Installation Note—Wrap one strand of soft wire around throw-out bearing oil seal to prevent leather curling over when transmission installed. Remove wire after transmission installed.

UNIVERSAL JOINTS:—**Spicer.** Front—1271-101 (except 47 without Ovdr.), 1281-101 (47 Std.). Rear—1278-101. Needle bearing. *See article in Mechanical Equipment Section.*

REAR AXLE:—**Own Make.** Semi-floating spiral bevel gear type with Hotchkiss drive. *See article in Mechanical Equipment Section for data.*
Ratio—4 1/9-1 (Std., Optl. on Overdrive), 4 5/9-1 (Std. on Ovdr., Optl. on reg. transmission).
Backlash—.0005-.003". Screw adjustment.
Removal:—Disconnect drive shaft at rear universal. Remove axle shafts (see below) and capscrews on carrier flange. Pull carrier assembly out.
Axle Shaft Removal:—Remove wheel and hub (use screw type puller only), remove 4 nuts on bearing cap bolts, push bolts out of backing plate, remove cap (without disturbing brake link), remove shims, pull axle shaft and wheel bearing. Do not drag shaft on oil seals.
Wheel Bearing Adjustment:—Controlled by shims under bearing cap. To adjust, remove bearing cap (see Removal directions above), add or remove shims equally at both wheels. **Endplay**—.002-.004".

SHOCK ABSORBERS:—**Delco.** Model 1007-C (front), 1008-S (rear) for Domestic & Export. Direct, hydraulic. *See article in Mechanical Equipment Section.*

STEERING:—**Steering Gear.** Gemmer Model 335. Worm-and-Roller type with 'push-pull' adjustment and new type Center Point Steering linkage. *See article in Mechanical Equipment Section for data.*
Front Suspension:—Independent, linked parallelogram type with coil springs and Autopoise Control. *See article in Mechanical Equipment Section for data.*
Kingpin Inclination—4°36' crosswise.
Caster—0° (Neg. ¼° to Pos. ¼°). Adjustable.
Camber—Positive ¼° to Pos. ¾°. Adjustable.
Toe In—0-1/16". Loosen clamp at outer end of each tube (adjust tubes equally).
Steering Geometry—Inner wheel 24°. Outer 20°50'.

BRAKES:—**Service.** Bendix hydraulic, duo-servo, single anchor type with eccentric adjustment. Mechanical follow-up (pedal linked to hand brake cables) provided. Hand lever applies rear service brakes. *See articles in Mechanical Equipment Section for data.*
Drums—Alloy steel. Diameter—11 1/16".
Lining—Moulded (primary), woven (secondary). Thick. 7/32". Width 1¾". Length per whl. 23 15/16".
Clearance—.010" at heel and toe of each shoe.
Hand Brake:—See Service Brakes above.
Hill-Holder:—Optl. *See Mechanical Equipment Section.*

ENGINE HOOD, SIDE PANEL REMOVAL & FRONT SHEET METAL ASSEMBLY ALIGNMENT:—*See Cadillac Shop Notes.*

SERIAL & ENGINE NUMBER:—1st number 2320001 (50), 4320001 (52). On crankcase to rear of left cylinder block & on frame opposite steering gear.

ENGINE SPECIFICATIONS:—Own. 8 cylinder, 90° Vee, 'L' head type. Upper crankcase and cylinder blocks cast Enbloc. **Bore**—3⅜". **Stroke**—4½". **Displacement**—322 cu. ins. **Rated HP** 36.45. **Developed Horsepower**—130 at 3400 RPM. **Compression Ratio**—6.25-1 Std. 5.75-1 Optl. *See Cadillac Shop Notes for Head installation, head gasket data, and changing compression ratios.* **Compression Pressure**—155 lbs. at 1000 RPM or approx. 105-110 lbs. at cranking speed (Std. head). **Vacuum Reading**—Steady 20-21" idling at 7-8 MPH.

PISTONS:—Lynite or Bohn Lo-Ex aluminum alloy, 'T' slot, Cam Ground type with Anodized finish (special hard oxide bearing surface). **Length**—4⅛". **Weight**—16.88 ozs. (stripped), 25.12 ozs. (complete). **Removal**—Pistons and rods removed from above. **Clearance**—Skirt .0020-.0025". See Fitting Pistons.
Replacement Pistons:—*See Cadillac Shop Notes.*
Fitting New Pistons:—Check piston diameter with micrometer gauge at right angles to pin hole just below lower ring groove and also ½" above lower edge. If feeler gauges (¼-½" wide, 7-10" long) used, insert feeler next to T-slot. Piston should fall through bore of own weight on .002" feeler, and hold on .0025" feeler. NOTE—Cylinder bore out-of-round .0005" maximum, taper .0003".
Installing Pistons:—T-slot to left, for all pistons.

PISTON RINGS:—2 compression, 2 oil control rings per piston, all above pin. Oil ring grooves drilled for oil drains.

Ring	Width	End Gap	Side Clearance
Compr. (Top)	3/32"	.007-.012"	.0023-.0041"
Compr. (#2)	⅛"	.007-.012"	.0013-.0026"
Oil Control	5/32"	.007-.015"	.0013-.0026"

Replacem't Rings:—.003",.005",.010",.015",.030" oversize.

PISTON PIN:—**Diameter**—⅞". **Length**—2 15/16". Pin floats in piston and rod. Held by locking rings. *See Cadillac Shop Notes for special pin removal and installation instructions.* **Pin Fit in Piston**—.0004" press fit (ribbed end), .0000" clearance or free fit at 70° F. (plain end). **Pin Fit in Rod Bushing**—.0002-.0008" clearance (new), .0018" (worn limit).

CONNECTING ROD:—**Weight** 37.472 ozs. **Length** 8¾". **Crankpin Journal Diameter**—2.4590-2.4595". **Lower Bearing**—Steel-backed, babbitt-lined type. **Clearance**—.0015-.0025" (new), .0045" Max. (worn). **Sideplay**—.008-.014".
Bearing Adjustment:—None (no shims). Replace bearings. Do not file rod or caps. *See Cadillac Shop Notes for connecting rod and bearing installation data.*
Installing Rods:—Numbers on rods and bearing caps on same side and installed in same numbered cylinders with marks down toward oil pan.

CRANKSHAFT:—3 bearing with 6 counterweights. *See Cadillac Shop Notes for main bearing servicing and rear main bearing oil seal renewal.* **Journal Diameters**—2½" all bearings. **Bearings**—Removable steel-backed, babbitt-lined. **Clearance**—.0015-.0025" (new), .005" Max. (worn).
Bearing Adjustment:—None (no shims). Replace bearings. Do not file bearing caps.
End Thrust:—Taken by center (#2) bearing. **Endplay**—.001-.005" (new), .010" Max. (worn).

CAMSHAFT:—3 bearing, non-adjustable chain drive. *See Cadillac Shop Notes for camshaft bushing data.* **Journal Diameters**—#1 and #2, 2.4071-2.4078"; #3, 2.0009-2.0016". **Bearing Type**—Steel-backed, babbitt bushings. **Clearance**—.0015-.0033" (new), .0045" Max. (worn).
End Thrust:—Taken by thrust plate behind camshaft sprocket. No endplay should be permitted.
Timing Chain:—Morse. Type C #3682-R Side Guide type. Width 1¼". Pitch ⅜". Length 23¼" or 62 links. NOTE—Install chain 'endless' as an assembly with sprockets. Use Tool J-836 to pilot camshaft sprocket.
Camshaft Setting:—Sprockets marked. Mesh chain with sprockets turned so that '0' marks are adjacent and in line with a straightedge across shaft centers.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1.876-1.886"	.3415-.3425"	5 33/64"
Exhaust	1.626-1.636"	.3405-.3415"	5 33/64"

	Seat Angle	Lift	Stem Clearance
Intake	45°	.335"	.0012-.0032"
Exhaust	45°	.345"	.0022-.0042"

NOTE—Stem clearance worn limit .005" (all valves). Valve heads not slotted. *See Cadillac Shop Notes for valve servicing.*
Tappet Clearance:—None (automatic take-up used).
Valve Guides:—Press in block (long step end down).
Valve Lifters:—Wilcox-Rich 'Zero-lash' type hydraulic lifters (Mushroom type) in removable brackets. *See article in Mechanical Equipment Section for data.* **Clearance**—.0010-.0024" (new), .0035" (worn).
Valve Springs:—Free length 2.210".

	Spring Pressure	Spring Length
Valve Closed	66 lbs.	1.926"
Valve Open	145 lbs.	1.581"

Valve Timing:—See Camshaft Setting above. **Intake Valves**—Open at TDC. Close 42° ALDC. **Exhaust Valves**—Open 52° BLDC. Close 10° ATDC. **Valve Timing Check**—#1 cylinder (front-left bank) intake valve should open with piston at TDC and mark 'C.1/6' on crankshaft pulley aligned with chain case cover pointer (on right side).

LUBRICATION:—Pressure type (gear type pump in crankcase). *See Cadillac Shop Notes for oil pump data.*
Normal Oil Pressure:—15 lbs. idling, 25 lbs. at 30 MPH.
Oil Pressure Regulator:—Opens at 30 lbs. On oil pump. Non-adjustable type.
Crankcase Capacity:—7 quarts.

COOLING SYSTEM:—**Capacity**—25 quarts. *See Cadillac Shop Notes for radiator core removal.*
Water Pump:—Self-adjusting packing type. *See article in Mechanical Equipment Section for data.* **Removal**—Drain water, remove pump belt, hose and pump mounting screws. Lift pump out.
Thermostat:—Mounted in radiator top tank, linked to radiator shutters by rod on forward side. **Setting**—(Std. Type) Starts to open 153-158° F., fully open at 175° F. (High Reading Type—use with Heaters) Starts to open 168-173° F. Fully open 190°. **Shutter Adjustment**—Adjust clevis on threaded end of rod to secure 1/16" tension on thermostat with shutters closed.
Temperature Gauge:—AC Electric. #1510773 (dash unit), #1510774 (engine unit). *See article in Mechanical Equipment Section for data.*

CLUTCH:—**Long Model 10CF-TI.** Semi-centrifugal, single plate, dry disc type. NOTE—Borg & Beck Model 11A6 (marked #946) Single plate, dry disc type with 'Borglite' driven member used on early cars. *See article in Mechanical Equipment Section for data.* **Facings (Long)**—Spiral or chevron wound woven (spiral grooved). Inside Diam. 6¾". Outside Diam. 10". Thickness .137".
Pedal Adjustment:—Pedal free travel ⅞-1⅛" (adjusting nut on connector link at clutch fork).
Removal:—Remove transmission (see below), drop clutch housing pan, punch mark clutch cover, pressure plate, and flywheel (re-install to these marks), remove 6 cover screws (release tension evenly). NOTE—Install driven disc with oil guard (cover over dampener springs) to rear. *See Cadillac Shop Notes for clutch locking pin removal (on replacement clutches) and balancing data.*

TRANSMISSION:—**Own Make.** All helical gear, constant-mesh, synchro-mesh (second & high), sliding gear (low & reverse) with remote shift. *See article in Mechanical Equipment Section for data.*
Transmission Control:—Remote steering col. shift. *See article in Mechanical Equipment Section for data.*
Removal:—Support engine with jack under rear end of oil pan (use wooden block to avoid damage to pan), remove propeller shaft (disconnect front and rear universals), free transmission extension at engine rear support, remove crossmember with engine rear support, disconnect speedometer cable, remove shifter rods from levers at transmission, support transmission at rear, take out mounting screws, pull straight back (plug clutch connection shaft bearing drain hole as soon as accessible to prevent lubricant loss), lower front end of transmission and remove.

UNIVERSAL JOINTS:—**Mechanics 3C.** Needle bearing. *See article in Mechanical Equipment Section for data.*

REAR AXLE:—**Own Make.** Hypoid gear, semi-floating type with Hotchkiss drive. *See article in Mechanical Equipment Section for data.* NOTE—Manufacturer recommends Carrier assembly be serviced by factory. **Ratio**—3.92-1. **Backlash**—.004-.010". Screw adjustment.
Removal:—Disconnect rear universal, remove axle shafts (see below), carrier flange capscrews and carrier.
Axle Shaft Removal:—Remove wheel, axle shaft nut, dust seal from rim of drum, pull off hub and drum, disconnect brake line and remove backing plate. Pull shaft and bearing assembly (use Tool J-838). **Wheel Bearing Adjustment**—None.

SHOCK ABSORBERS:—**Delco.** 1946-G, H (front), 1751-V, W (rear). Double acting, hydraulic type. *See article in Mechanical Equipment Section for data.*

STEERING:—**Steering Gear**—Saginaw Worm-and-Double Roller type. *See article in Mechanical Equipment Section for data.*
Front Suspension:—Independent linked parallelegram type with coil springs. *See article in Mechanical Equipment Section for data.* **Kingpin Inclination**—5°6' crosswise. **Caster**—Negative 1¾° to Neg. 2¾°. Adjustable. **Camber**—0° to Positive ¾°. Adjustable. **Toe In**—1/32-3/32" (at rest). Adjusters at outer end of each tie rod. Adjust equally. **Steering Geometry (Toe-out on Turns)**—Inner wheel turned 22¼-23¾°. Outer wheel 20°.

BRAKES:—**Service.** Bendix hydraulic, duo-servo, single anchor type without eccentric adjustment. Hand lever applies rear wheel service brakes. *See article in Mechanical Equipment Section for data.* **Drums**—Centrifuse. Diameter—11.995-12.0005". Drum out-of-round .007", Turn down limit .030" cut. **Lining**—Molded. Length—Primary 11 17/32", Secondary 12 31/32". Width 2" (50,52), 2¼" (50 Com'l front), 2½" (50 Com'l rear). Thickness 3/16". **Clearance**—.015" at both ends of secondary shoe with primary shoe forced out against drum. **Braking Power**—45½% front wheels, 54½% rear.
Hand Brake:—See Service Brakes above.

TORQUE WRENCH SPECIFICATIONS:—*See Torque Wrench article in Mechanical Equipment Section for tightening specifications for Cylinder Head, Main & Connecting Rod Bolts, etc.*

RECONDITIONED ENGINES & CYLINDER BLOCKS:

Engines—Reconditioned engines (with Heads and oil pan furnished in one size only (Part No. 06H-6012).

Cylinder Blocks—Cylinder blocks with fitted pistons furnished as follows:

Part No.	Size
06H-6014-A	Std.
06H-6014-B	.015" Oversize
06H-6014-C	.030" Oversize

REPLACEMENT PISTONS:—Finished pistons are furnished in Standard Size & Oversizes as listed below with each size graded in steps as follows:

Standard Pistons

Part No.	Size
06H-6110-B2	2.8732-2.8735"
06H-6110-B4	2.8743-2.8746"
06H-6110-B6	2.8755-2.8758"
06H-6110-B8	2.8767-2.8770"

.015" Oversize

06H-6110-C2	2.8882-2.8885"
06H-6110-C4	2.8893-2.8896"

.030" Oversize

06H-6110-D2	2.9032-2.9035"
06H-6110-D4	2.9043-2.9046"

PISTON RINGS:—Piston Rings (and Expanders for #2 Compression Ring & Oil Ring) are furnished in Sets in Cartons and singly in following sizes:

Sets in Cartons

Part No.	Size
06H-6149-A	Standard
06H-6149-B	.015" Oversize
06H-6149-C	.030" Oversize

Single Rings & Expanders

Part No.	Type	Size
06H-6150-B①	Upper Compr.	Standard
06H-6150-C①	Upper Compr.	.015" Oversize
06H-6150-D①	Upper Compr.	.030" Oversize
06H-6152-C	Lower Compr.	Standard
06H-6152-D	Lower Compr.	.015" Oversize
06H-6152-E	Lower Compr.	.030" Oversize
06H-6153-C	Oil Control	Standard
06H-6153-D	Oil Control	.015" Oversize
06H-6153-E	Oil Control	.030" Oversize

①—No expanders used.

PISTON PIN FITTING:—Steel Pistons. Pins can be removed and installed without heating pistons. Pins, pistons, and rod bushings held to close limits so that no fitting required. Clearances can be checked as follows:

Pin Fit in Piston—With piston and pin at same temperature and clean, pin should drop through pin hole in piston (total clearance not to exceed .0007").

Pin Fit in Rod Bushing—With pin installed, hold pin so that rod hangs vertically, then rotate pin. Lower end of rod should move upward through arc not greater than ½" before dropping back to vertical position.

TIMING GEARS:—Camshaft Gear—New type aluminum alloy camshaft gear is bolted on camshaft hub flange by four offset capscrews and can be replaced without removing camshaft from engine. To remove gear, remove screw in front end of crankshaft, pull fan and dampener assembly (use Puller 6130-A), remove timing gear cover. Bend back lockplate tangs and take out four camshaft gear mounting screws, remove gear. When replacing gear, make certain that marks on camshaft gear and crankshaft gear are lined up and see that lockplate tangs are bent up against flats on mounting screws. Use 6360-B Dampener Replacer tool to install dampener assembly.

NOTE—Camshaft gear mounting screw holes are offset so that gear can only be installed in correct position.

Crankshaft Gear—To replace crankshaft gear, pull fan and dampener assembly (see Camshaft Gear Removal above), use 6306-C puller to remove crankshaft gear, 6306-D Gear Replacer to install gear.

VALVE SERVICING:—Complete valve assembly (valve, spring, guide) should be removed from the engine and dismantled on the bench as follows:

Valve Assembly Removal—Use special bar type lifter, VZ-185, inserting end of lifter through spring coils to engage flanged lower end of guide, pull guide down slightly to release retaining 'C' washer, pull 'C' washer out, lift valve assembly out through top of block.

Valve Assembly Dismantling—Use special bench fixture to compress valve spring so that spring retainer can be removed, then remove spring, separate guide halves and remove valve. Re-assemble valves in same manner.

Valve Installation Note—Intake valve guides have relief groove cut on one edge of each guide half. Install guides with this relief groove up.

Valve Seat Insert Grinding:—Manufacturer recommends use of eccentric grinding equipment to reface seat inserts (inserts are high-tungsten, chrome-alloy steel and are exceedingly hard).

Hydraulic Valve Lifter Servicing:—When lifters removed they should be installed dry (will fill with oil and become quiet more rapidly than if installed with oil film between plunger and cylinder which will trap air in unit). Whenever lifters removed from engine, service as follows:

Lifter Installation—Remove plunger from lifter body, wash out all oil, dry with air, re-install plunger in lifter body and install in engine.

CAUTION—Plunger is selective fit in lifter body and must not be interchanged. Make certain that each plunger re-installed in same lifter from which removed.

Lifter Clearance—Clearance between plunger and valve stem must be .030-.070" with no oil in unit and plunger and spring fully compressed. To check this clearance, see that lifter is on heel of cam, use screwdriver to fully depress plunger in lifter body, check clearance with feeler gauge.

See article in Mechanical Equipment Section for complete Wilcox-Rich 'Zero-lash' hydraulic lifter servicing data.

ENGINE HOOD NOTE:—Turn radiator ornament counter-clockwise to free latch, lift hood up at front.

SERIAL & ENGINE NUMBER:—Stamped on top of clutch housing and on left side of front frame cross-member.

ENGINE SPECIFICATIONS:—**Own Model 06H.** 12 cylinder 75° Vee, L head type. Both blocks and crankcase cast enbloc.
Bore—2.875". **Stroke**—3.75".
Rated Horsepower—39.6. **Displ'mt.**—292 cu. ins.
Developed Horsepower—120 at 3500 RPM.
Compression Ratio—7.2-1 Std. aluminum head.
Compression Pressure—154 lbs. at 1000 RPM. or 110 lbs. at cranking speed of 100 R.P.M.
Vacuum Reading—18-20" steady idling at 5 M.P.H.

PISTONS:—Steey alloy, light weight, cam-ground, with slipper type skirt. Recondition cylinders for finished replacement pistons.
Weight—360 grams (without rings or pin).
Removal—Pistons and rods removed from above.
Clearance—See Fitting New Pistons.
Replacement Pistons:—*See Lincoln-Zephyr Shop Notes for replacement piston and reconditioned block data.*
Fitting New Pistons:—Use .002" feeler, .50" wide, inserted between piston and cylinder wall at right angle to pin. Pull to withdraw feeler—3-6 lbs.

PISTON RINGS:—Two compression, one oil ring, all above pin. Oil ring groove drilled with drain holes. NOTE—Expander used with #2 Compr. and oil ring. Install this #2 Compr. ring with mark 'TOP' up.

Ring	Width	End Gap	Side Clearance
Compr. #1	.093-.0935"	.008-.013"	.0025-.003"
Compr. #2	.093-.0935"	.008-.013"	.002-.0025"
Oil Contr.	.1845-.185"	.008-.013"	.0015-.002"

Replacement Rings:—*See Lincoln-Zephyr Shop Notes for complete Ring and Expander size data.*

PISTON PIN:—**Diameter** .7501-.7504". **Length** 2.607". Floating type (locking ring in piston at each end). Pin hole in connecting rod bronze-bushed.
Pin Fit in Piston—.0005" clearance.
Pin Fit in Rod—.0001" clearance.
See Lincoln-Zephyr Shop Notes for pin fitting data.

CONNECTING ROD:—**Length** 7.40". **Weight** 638 grams.
Crankpin Journal Diameter—2.126".
Bearing Type—Steel-backed, copper-lead lined bearing halves clamped in each rod.
Clearance—.001". **Sideplay**—.002-.006".
Bearing Adjustment:—None (no shims). Replace bearings. Do not file rods or caps. NOTE—Engage tang on bearing in groove in rod and cap. See that long and short bearing cap bolts installed on correct side of rod (rod split at an angle, bolts are unequal length).
Replacement Bearings:—Furnished Std. and .0015", .020", .040" undersize.
Installing Rods:—Marks on rods and caps must be together and installed in same numbered cylinder with marks pointing down toward oil pan.

CRANKSHAFT:—Four bearing with integral counterweights. NOTE—Crankshafts furnished Std. and .020", .040" undersize.
Journal Diameters—2.401" (all bearings).
Bearing Type—Steel-backed, copper-lead lined.
Clearance—.001" (or slight drag with .002" feeler assembled in bearing for clearance check).
Bearing Adjustment:—None (no shims). Replace bearings. Do not file bearing caps. NOTE—See that tang on bearing engages groove in block and bearing cap.
Replacement Bearings:—Furnished Std. and .0015", .020", .040" undersize.
End Thrust:—Taken by rear main bearing. To adjust, replace bearing. **Endplay**—.002-.006".

CAMSHAFT:—Four bearing. Helical gear drive.
NOTE—New bolted-on type Aluminum Alloy camshaft timing gear used (formerly pressed on shaft).
Journal Diameters—1.797" (all bearings).
Bearing Type—Steel-backed, babbitt-lined bushings pressed in block. **Clearance**—.002".
End Thrust:—Taken by gear hub and coverplate. Adjusted by replacing coverplate. **Endplay**—.005-.015".
Timing Gears:—Cast alloy iron (Crankshaft), New Aluminum Alloy—bolted on shaft (Camshaft).
Backlash—.004" Max.
See Lincoln-Zephyr Shop Notes for Timing Gear data.
Camshaft Setting:—Mesh marked tooth of crankshaft gear with space marked by line on camshaft gear (this line must be in line with mark on hub). NOTE—Cap screw holes in camshaft gear and shaft are unevenly spaced insuring correct gear position.

VALVES:—

	Head Diameter	Stem Diameter	Length
All Valves	1.537"	.3115"	4.750-4.751"
	Seat Angle	**Lift**	**Stem Clearance**
All Valves	45°	.292"	.0015-.0035"

NOTE—Valve Seat Inserts used for exhaust valves.
See Lincoln-Zephyr Shop Notes for Valve Servicing data.
Tappet Clearance:—None (hydraulic type lifters).
Valve Guides:—Cast iron, split type. Retained by 'C' washer and valve spring. *See Lincoln-Zephyr Shop Notes.*
Valve Lifters:—Barrel type, hydraulic tappet take-up (Wilcox-Rich Zero-lash type). Diameter .9995".
See article in Mechanical Equipment Section for data.

Valve Springs:—	Pressure	Length
Valve Closed	51-57 lbs.	2.13"
Valve Open	111-121 lbs.	1.84"

Valve Timing:—See Camshaft Setting above.
Int. Valves—Open 10.42° BTDC. Close 35.58° ALDC.
Exh. Valves—Open 50.92° BLDC. Close 8.08° ATDC.
To Check Timing—No flywheel marks provided. If dead center position for any cylinder established on flywheel, intake valve for this cylinder should open approx. 3.24 teeth before this point with piston .0389" before top dead center.
Motor Gauge—Weidenhoff Adapter #114. Rod #40.

LUBRICATION:—Pressure type with gear type oil pump in crankcase at rear of engine.
Normal Oil Pressure—40-45 lbs. at 2000 R.P.M.
Oil Pressure Regulator:—Above crankshaft bearing between cylinder banks at front end of engine. Opens at 50 lbs. Not adjustable.
Oil Pressure Gauge:—King-Seeley Electric. Ford No. Dash Unit—06H-9273-A (except Contl.), 06H-9273-B (Contl.). Engine Unit—No. 48-9278 (all models).
See article in Mechanical Equipment Section for data.
Crankcase Capacity:—5 qts.

COOLING SYSTEM:—**Capacity**—27 quarts.
Water Pump:—Packless type, 2 used (1 for each bank).
See article in Mechanical Equipment Section for data.
Removal—Slack off drive belt, disconnect hose couplings, take out mounting screws on pump.
Thermostat:—In outlet hose for each bank (2 used).
Setting—Starts to open at 145°F. Fully open 180°F.
Temperature Gauge:—King-Seeley Electric. Ford No. Dash Unit—06H-10883-A (except Contl.), 06H-10883-B (Contl.). Engine Unit—No. 99A-10884 (all).
See article in Mechanical Equipment Section for data.

CLUTCH:—**Long Model 10CF-TI.** Semi-centrifugal, single plate, dry disc type.
See article in Mechanical Equipment Section for data.
Facings—Molded type, chevron or spiral wound, 2 required. Inside Diam. 6". Outside Diam. 10". Thickness .140".
Adjustment:—Pedal free movement must be 1.5-2.0". To adjust, loosen locknuts, turn clevis on connector link.
Removal:—Slide transmission and rear axle to rear as a unit to expose clutch (see Transmission Removal below), take out mounting screws in clutch cover.

TRANSMISSION:—**Own Model.** All helical gear, constant-mesh, synchro-mesh (second & high), sliding gear (low & reverse).
Transmission Control (06H):—Steering col. shift Std.
See article in Mechanical Equipment Section for data.
Removal:—Disconnect hand brake cable, hydraulic brake line at torque tube connection (bleed lines when re-connected), speedometer cable, shock absorber links. Disconnect rear spring at center frame connection. Take off universal joint ball housing bolts, slide axle assembly to rear. Disconnect shifter rods from levers at transmission. Support engine at rear, take out rear engine mounting bolts, remove clutch housing mounting screws, pull transmission straight back.

UNIVERSAL JOINT:—**Spicer Model 2102-1.** Needle bearing type. Single joint at rear of transmission.
See article in Mechanical Equipment Section for data.

REAR AXLE:—**Own Model.** ¾ floating, Hypoid Gear type with Torque Tube drive.
See article in Mechanical Equipment Section for data.
Ratio—4.44-1. **Backlash**—.002-.004".
Optl. Axle:—Columbia Two-speed type.
See article in Mechanical Equipment Section for data.
Removal:—Disconnect hand brake cable, hydraulic brake line at torque tube connection (bleed lines when re-connected), speedometer cable, shock absorber links. Disconnect rear spring at center frame connection, take out universal joint ball housing bolts, pull axle assembly to free shaft at joint.
Axle Shaft Removal—*See Lincoln-Zephyr Axle article in Mechanical Equipment Section for data.*

SHOCK ABSORBERS:—**Houde (Houdaille).** Type BBCM (Front), BBCX (Rear). **L-Z Part Nos.**—**Front** 96H-18045B or 06H-18045 (right), 96H-18046B or 06H-18046 (left). **Rear** 96H-18080 or 06H-18080 (right), 96H-18081 or 06H-18081 (left). Double acting, hydraulic, adjustable type.
See article in Mechanical Equipment Section for data.

STEERING:—**Steering Gear**—Gemmer Model 330. Worm-and-roller type with push-pull adjustments.
See article in Mechanical Equipment Section for data.
Front Suspension:—Conventional I-beam section axle with Reverse-Elliott ends and transverse spring. Axle positioned by radius rods and strut rod (anti-sway bar).
Kingpin Inclination—4° crosswise.
Caster—3° Min., 5° Max. Must be equal for both wheels within ½°. No adjustment.
Camber—¼° Min., ¾° Max. Must be equal for both wheels within ¼°, right wheel must not exceed left. No adjustment.
Toe In—1/16". Set at 1-10 ratio to Camber. To adjust, loosen clamp bolts, turn tie rod.
Steering Geometry (Toe out on turns)—Inner wheel turned 23°, outer 20°. Allowable variation ½°.

BRAKES:—**Service**—Bendix Hydraulic, duo-servo, single anchor type without eccentric adjustment. Hand lever applies all four service brakes.
See article in Mechanical Equipment Section for data.
Wheel Cylinders—Diameter 1.125" (front), 1.00" (rear). Not interchangeable from one wheel to another.
Drums—Diameter 12".
Lining—Molded (primary or forward shoe), Woven (secondary shoe). Width 1.75". Thickness .21", Length per shoe 11.95".
Clearance—.010" at each end of each shoe.
Hand Brake:—See Service Brakes above.

FORD TRUCK NOTE:—All Mercury Engine data below applies to Ford Truck Models with '95' Engine as well as Mercury models.

ENGINE HOOD NOTE:—To raise hood, pull out on latch handle on front of hood at center, press in on button in upper edge of grille (under handle) to release secondary (safety) catch.

OIL PAN REMOVAL:—*See Ford Shop Notes for data.*

SERIAL & ENGINE NUMBER:—Stamped on top of clutch housing and on left frame member in front of dash bracket.

ENGINE SPECIFICATIONS:—Own 95. 8 Cylinder, 90° Vee, L head. Both banks & crankcase cast enbloc. **Bore**—3.187". **Stroke**—3.75".
Rated Horsepower—32.5. **Displacement**—239 cu. ins.
Developed Horsepower—95 at 3600 RPM.
Compression Ratio—6.30-1 (Pass. Cars, Ford Comm.), 5.9-1 (Ford Trucks). Cast-iron heads.
Compression Pressure—145 lbs. (6.30-1 hd.), 134 lbs. (5.9-1 head) at 2400 RPM maximum. 100 lbs. at cranking speed of 100 RPM.
Vacuum Reading—Steady 18-20" at 5 MPH.

CYLINDER SLEEVES:—Hardened, dry type cylinder sleeves used on engines marked 'HS' on cylinder block just above upper front corner of left cylinder head.

Servicing:—*See Ford Shop Notes for complete data.*

PISTONS:—Steel alloy, light weight, cam ground type (Mercury), Aluminum alloy, T-slot type (Ford Trucks). Recondition engine for finished replacement pistons.
Weight—Without rings or pin, 358-362 grams (Mercury), 364-368 grams (Ford Truck).
Removal—Pistons and rods removed from above.
Clearance—See Fitting New Pistons.
Replacement Pistons:—*See Ford Shop Notes for data.*
Fitting New Pistons:—Use .0025" feeler (.003" feeler for engines with sleeves), .50" wide, inserted between piston and cylinder wall at right angles to pin. Pull to withdraw feeler—6-10 lbs. NOTE—If aluminum pistons fitted, use .002" feeler (.0025" feeler for engines with sleeves) with 6-10 lbs. pull.

PISTON RINGS:—Two compression, one slotted oil ring, all above pin (drain holes in oil ring groove).
NOTE—Expander used with #2 Compr. and oil ring.

Ring	Width	End Gap	Side Clearance
Compr. #1	.0915-.0920"	.012-.017"	.0025-.003"
Compr. #2	.0915-.0920"	.012-.017"	.002-.0025"
Oil Contr.	.1535-.1540"	.012-.017"	.0015-.002"

Replacement Rings:—Furnished (sets in carton only) Std. and .005", .015", .030", .045", .060" oversize.

PISTON PIN:—Diameter .7501-.7504". **Length** 2.975". Floating type (locking ring in piston at each end). Pin hole in connecting rod bronze-bushed.
Pin Fit in Piston—.0005" clearance.
Pin Fit in Rod Bushing—.0001" clearance. *See Ford Shop Notes for Pin Fitting directions.*

CONNECTING ROD:—Length 7.002". **Weight** 488 grams.
Crankpin Journal Diameter—2.139" (connecting rod diameter on crankpin—2.360").
Bearing Type—Steel-backed, special-alloy lined. Bearing floats in both rods (side-by-side mounting) with bearing surface on both inner and outer face.
Bearing Dimensions—Length 1.747". Thickness .1095". These bearings do not have end flanges.
Clearance—.0005-.002" (total diametrical).
Sideplay—.010-.022" (total).
Bearing Adjustment:—None (no shims). Do not file.
Replacement Bearings:—*See Ford Shop Notes for special bearings for oversize rods and undersize crankpins.*
Installing Rods:—Marks on rods and caps must be together and installed in same numbered cylinder with marks pointing down toward oil pan.

CRANKSHAFT:—3 bearing. Integral counterweights.
Journal Diameters—2.499" (all bearings).
Bearing Type—Steel-backed, special-alloy lined.
Clearance—.001-.003" (or slight drag with .002" feeler assembled in bearing for clearance check).
Bearing Adjustment:—None (no shims). Do not file.
End Thrust:—Taken by rear main bearing. Adjust by replacing bearing. **Endplay**—.002-.006".
Replacement Bearings:—*See Ford Shop Notes for Undersizes and special long main bearings.*

CAMSHAFT:—3 bearing. Helical gear drive (2 types of camshaft gears used—Bakelized Fabric pressed on shaft or new Aluminum Alloy type bolted on shaft).
Bearing Diameters—1.797" (all bearings).
Bearings—Steel-backed, babbitt-lined bushings.
Clearance—.002".
End Thrust:—Taken by gear hub and cover plate. Adjusted by replacing coverplate. **Endplay**—.005-.015".
Timing Gears:—Cast alloy iron (crankshaft), Bakelized Fabric—pressed on shaft, or Aluminum Alloy—bolted on shaft (camshaft). **Backlash**—.004" max. *See Ford Shop Notes for Timing Gear Replacement.*
Camshaft Setting:—Mesh '0' marked tooth of crankshaft gear with '/' marked space on camshaft gear (this mark must be in line with mark on hub).

VALVES:—

	Head Diameter	Stem Diameter	Length
All Valves	1.537"	3115"	4.750-4.751"

	Seat Angle	Lift	Stem Clearance
All Valves	45°	.292"	.0015-.0035"

See Ford Shop Notes for Valve Servicing data.
NOTE—Seat inserts used for all valves.
Tappet Clearance:—.0125-.0135". No adjustment.
Valve Guides:—Split type retained by 'C' washer and valve springs. *See Ford Shop Notes for servicing data.*
Valve Lifters:—Barrel type in reamed holes in block. **Diameter**—.9995". **Clearance**—.0005-.001".

Valve Springs:	Pressure	Length
Valve Closed	37-40 lbs.	2.13"
Valve Open	76-80 lbs.	1.84"

Valve Timing:—See Camshaft Setting above.
Intake Valves—Open at TDC. Close 44° ALDC.
Exhaust Valves—Open 48° BLDC. Close 6° ATDC.
To Check Valve Timing—No flywheel marks provided. Intake valve opens with piston at TDC.

LUBRICATION:—Pressure. Gear type oil pump mounted in crankcase at rear of engine.
Normal Oil Pressure:—30 lbs. at 2000 R.P.M.
Oil Pressure Regulator:—Under plug above front camshaft bearing. Opens at 30 lbs. Not adjustable.
Oil Pressure Gauge:—King-Seeley Electric. Ford No. 09A-9273 (Dash Unit), No. 48-9278 (Engine Unit). *See article in Mechanical Equipment Section for data.*
Crankcase Capacity:—5 qts.

COOLING SYSTEM:—Capacity 22 qts.
Water Pump:—Packless type, 2 used (1 for each bank). *See article in Mechanical Equipment Section for data.*
Removal—Slack off drive belt, support engine at forward end, remove front engine mounting bolts, take out mounting screws in pump body.
Thermostat:—In each cylinder head outlet (2 used). **Setting**—Starts to open at 145°F. Fully open 180°.
Temperature Gauge:—King-Seeley Electric. Ford No. 09A-10883 (Dash Unit), No. 99A-10884 (Eng. Unit). *See article in Mechanical Equipment Section for data.*
NOTE—Gauge reads 212° (hot) when turned off.

CLUTCH:—Long Model 9CF-CS. Single, plate, dry disc, semi-centrifugal type. *See article in Mechanical Equipment Section for data.*
Facings—Moulded type, 2 required. Inside Diam. 5.76". Outside Diameter 9". Thickness .137".
Adjustment:—Pedal free movement must be 1.0-1.25". To adjust, remove pin at throw-out shaft lever end of connecting link, turn clevis on link rod.
Removal:—Slide rear axle and transmission to rear as a unit to expose clutch (See Transmission Removal (below), take out mounting screws in cover.

TRANSMISSION:—Own Make. Constant-mesh, synchro-mesh (second & high), sliding gear (low & reverse), all helical gear type.
Transmission Control:—Remote steering col. shift. *See article in Mechanical Equipment Section for data.*
Removal:—Disconnect rear shock absorbers, hand brake cables, hydraulic brake line (at torque tube connection—bleed lines when re-connected), speedometer cable, shock absorber links. Disconnect rear spring at center frame connection. Take out universal joint ball housing screws, slide rear axle assembly back to disengage drive shaft at splined joint. Support engine at rear, take out rear engine mounting bolts, remove clutch housing screws, pull transmission straight back.
NOTE—Disconnect gear shifter rods from levers at transmission.

UNIVERSAL JOINT:—**Spicer Model 202-6.** Steel bushing type. Single joint at rear of transmission case. *See article in Mechanical Equipment Section for data.*

REAR AXLE—Own make. ¾ floating, Spiral Bevel gear type with Torque Tube drive. *See article in Mechanical Equipment Section for data.*
Ratio—3.54-1 Std., 3.78-1 Optl.
Backlash—.010" max.
Optional Axle:—Columbia Two-speed type. *See article in Mechanical Equipment Section for data.*
Removal:—Disconnect rear shock absorbers, hand brake cables, hydraulic brake line (at torque tube connection—bleed lines when re-connected), speedometer cable, shock absorber links. Disconnect rear spring at center frame connection. Take out universal joint ball housing screws, pull axle assembly to rear to disengage drive shaft at splined joint.
Axle Shaft Removal—*See Mercury Axle article in Mechanical Equipment Section for data.*

SHOCK ABSORBERS:—Houde (Houdaille). Type BBDM (frt.), BBCX (rear). **Ford Nos.—Front** 01A-18045B (right), 01A-18046B (left). **Rear** 09A-18080A (right), 09A-18081A (left). Hydraulic, double acting, adjustable. *See data in Mechanical Equipment Section.*

STEERING:—Steering Gear—Gemmer Model 305 Worm-and-Roller type with 'push-pull' adjustment. *See article in Mechanical Equipment Section for data.*
Front Suspension:—Conventional 'I' beam section front axle with Reverse Elliott ends and transverse spring. Axle positioned by radius rods.
Kingpin Inclination—8° crosswise.
Caster—9° Max., 4½° Min. Must be equal within ½°. Axle may be bent cold to correct caster if proper tools (wedges and blocks to prevent crushing axle flange) are used.
Camber—1° Max., ¼° Min. Must be equal within ¼°, right wheel must not exceed left. Adjust in same manner as for caster (see caster data above).
Toe In—1/16". Set at 1-10 ratio to Camber. Adjust by loosening clamp bolts and turning tie rod.
Steering Geometry (Toe Out on Turns)—Outer wheel turned 20°, Inner wheel 23⅓°. No adjustment.

BRAKES:—**Service.** Lockheed hydraulic, double anchor type. Hand lever applies rear service brakes. *See article in Mechanical Equipment Section for data.*
Drum—Cast iron. Diameter 12".
Wheel Cylinders—Stepped type as follows:
Front Wheel....1.25"-1.00". Rear Wheel....1.125"-1.00".
Lining—Woven (forward shoes), Molded (rear shoes). Width 1.75". Thickness .20". Length per shoe 13.18" (forward shoes), 10.1" (rear shoes).
Clearance—Least possible amount without drag.
Hand Brake:—See Service Brakes above.

TORQUE WRENCH SPECIFICATIONS:—*See Torque Wrench article in Mechanical Equipment Section for tightening specifications for Cylinder Head, Main & Connecting Rod Bolts, etc.*

HOOD LOCK:—Engine hood hinged at cowl and lifts from forward end. To raise hood, turn latch handle located on lower edge of radiator grille at center and release safety catch (under hood) at upper edge of grille.

FRONT END ASSEMBLY REMOVAL:—Radiator core, grille and front fenders can be removed as an assembly for work on front of engine, if necessary, by loosening fenders, core, and side shields.

ENGINE CODE NOTE:—Car manufacturer stamps each engine with a three letter code as a means of identifying original cylinder bore, main bearing, and crankpin and connecting rod bearing sizes. This three letter code stamped on Engine Number Plate on left front top corner of engine block. Each letter indicates engine sizes as follows:

Original Cylinder Bore Size—First letter.

Main Bearing Size—Second letter.

Crankpin & Connecting Rod Bearing Size—Third letter.

Letters indicate following sizes:

'A'.....Standard	'D'.....015" Oversize
'B'.....010" Undersize	'E'.....020" Oversize
'C'.....010" Oversize	

REPLACEMENT PISTONS:—Nash finished replacement pistons furnished in the following sizes:

Standard	.010" Oversize
.001" Oversize	.012" Oversize
.002" Oversize	.015" Oversize
.003" Oversize	.020" Oversize
.005" Oversize	

Semi-finished Pistons—Furnished in one size only —.050" Oversize. These pistons must be finished on suitable machine equipment.

Installation Note—Pistons must be installed with slot in skirt away from camshaft and trademark on inside of piston toward front of engine. Pin bosses in piston offset toward camshaft.

REPLACEMENT PISTON RINGS:—Nash replacement piston rings furnished in the following three sizes: 1—Standard. 2—.010" Oversize. 3—.020" Oversize.

Installation—Car manufacturer recommends that these Sealed Power Spring Type Rings be used as follows:

Standard—For standard up to and including .010" Oversize pistons.

.010" Oversize—For .011" Oversize up to and including .020" Oversize pistons.

.020" Oversize—For .021" Oversize up to and including .030" Oversize pistons.

NOTE—When installing rings, check to following specifications: End Gap—.010-.020" for compression rings; .010-.018" for oil control rings. Side Clearance in ring groove—#1 Compression .002-.0025", #2 Compression .0015-.003". #3 Oil Control .0015-.0025". #4 Oil Control .001-.0025".

VIBRATION DAMPENER:—Rubber cushioned vibration dampener mounted on forward end of crankshaft. Dampener is drilled for lubrication. Car manufacturer recommends that 2 brass filler plugs in outside diameter of dampener flywheel be removed and filled with light engine oil at 3000 mile intervals.

FITTING CONNECTING ROD BEARINGS:—Check crankpin for out-of-round or wear. To check bearing fit, remove connecting rod bearing cap on bearing to be checked and loosen remaining connecting rod bearing caps. Use a .002" shim ½" wide and ½" long. Place shim across bearing and install cap. Tighten bearing cap (with shim in place). Check bearing fit by moving connecting rod on crankpin. If rod moves with heavy drag, bearing fit is correct. Remove bearing cap, take out shim, re-install cap loosely. Repeat fitting operation on remaining connecting rods. After all rod bearings checked, tighten caps securely.

MAIN BEARINGS:—Removal—Main bearing shell upper half can be removed without removing crankshaft by removing bearing cap and inserting suitable tool or pin in oil hole in crankshaft and rotating bearing shell out by turning shaft.

Installation:—Bearing shell upper half can be installed by reversing Removal instructions above. Remove any sharp edges on bearing shell before installing. Tang on shell should seat in notch on block and cap.

Fitting:—Before fitting bearings, journals must be checked for out-of-round or wear. To check bearing fit, remove bearing cap on bearing to be checked and loosen all other main bearing caps. Use a .002" shim ½" wide and ½" long. Place shim across bearing and install bearing cap. Tighten bearing cap (with shim in place). Test bearing fit by rocking crankshaft by hand. **Do not rock crankshaft more than 1" in either direction** or bearing may be damaged by shim. If crankshaft turns with a heavy drag, bearing clearance is correct. Remove bearing cap, take out shim, replace bearing cap loosely and repeat test for remaining bearings. After all bearings checked tighten caps securely. NOTE—On Nash-Lafayette, oil pump is retained by the main bearing capscrew.

CAMSHAFT REMOVAL:—For camshaft removal or camshaft bearing replacement, remove as follows: Remove radiator, grille, and hood side panel for access to engine. Remove fan belt, vibration dampener, timing chain cover, timing chain, distributor and fuel pump. On Ambassador Eight, take off the oil pump and pump driveshaft. Remove front camshaft bearing (takes camshaft end thrust), raise valve lifters to clear camshaft journals and withdraw camshaft from front of engine. NOTE—When re-assembling oil pump and pump driveshaft on Ambassador Eight, slot in end of pump driveshaft (for distributor coupling) should be across the engine.

Crankshaft Sprocket Installation:—Sprocket should be heated for installation on crankshaft. When re-assembling timing chain make certain that sprocket marks are adjacent and in line with a straightedge across the crankshaft and camshaft centers. NOTE—Sprocket should be heated to 212° F. (temperature of boiling water).

HOOD LOCK & ENGINE CODE NOTE:—*See Nash Shop Notes.*

SERIAL NUMBER:—First number R-340000. Stamped on plate on right frame side member under hood.

SERVICE SERIAL NUMBER:—First number N6-31500. On 'Caution Plate' on left front door hinge post.

ENGINE NUMBER:—First number E-339500. On engine block on left side at front. NOTE—Engine number is 500 less than Serial Number on same car.

ENGINE SPECIFICATIONS:—6 cylinder, valve-in-head, Twin Ignition type. NOTE—'Iso-thermal' fuel intake system used (intake manifold cast in cylinder head—water cooled for temperature control).
Bore—3⅜". **Stroke**—4⅜".
Displacement—234.8 cu. ins. **Rated HP**—27.34.
Developed Horsepower—105 at 3400 RPM.
Compression Ratio—6.0-1 cast-iron head.
Compression Pressure—125 lbs. at 350 RPM. or approx. 100-105 lbs. at cranking speed (160 RPM).
Vacuum Reading—18-20" steady idling at 7-8 MPH.

PISTONS:—Nelson-Bohnalite, aluminum alloy, Invar strut, tin plated, split skirt type.
Original Bore Size:—*See Engine Code Note in Nash Shop Notes for complete data.*
Weight—19¼ ozs. (stripped). **Length**—3⅞".
Removal—Pistons and rods removed from above.
Clearance—Top .027-.030". Skirt .001-.002".
Replacement Pistons:—*See Nash Shop Notes for data.*
Fitting New Pistons:—Insert .002" feeler between piston and cylinder wall on side opposite slot. Pull to withdraw feeler should be 10 lbs.
Installing Pistons:—Pin offset toward camshaft. Slot toward left (trademark within piston toward front).

PISTON RINGS:—Two compression, two oil control rings per piston, all above pin. Oil ring grooves drilled for oil drain holes.

Ring	Width	End Gap	Side Clearance
Compr. #1	.124"	.010-.020"	.002-.0025"
Compr. #2	.124"	.010-.020"	.0015-.003"
Oil Contr. #3	.1550"	.010-.018"	.0015-.0025"
Oil Contr. #4	.1550"	.010-.018"	.001-.0025"

NOTE—Wall thickness .145" (for all rings).
Replacement Rings:—*See Nash Shop Notes for data.*

PISTON PIN:—**Diameter**—.8745". **Length**—2.804".
Floating type. Pin retained by locking ring at each end. Pin hole in piston offset to camshaft.
Pin Fit in Piston—Light push fit (piston at 200°F.).
Pin Fit in Rod Bushing—Select fit to .0001" or light push fit at normal temperature.
Replacement Pins:—.001, .003", .005" oversize.

CONNECTING ROD:—**Length**—8¾". **Weight**—36¼ ozs.
Upper Bearing (Piston Pin Bushing)—Bronze.
Crankpin Journal Diameter—2.002".
Lower Bearing—Removable steel-backed, babbitt-lined type. No shims. *See Engine Code Note in Nash Shop Notes for original bearing sizes.*
Clearance—.0015-.0025". **Sideplay**—.008-.012".
Bearing Adjustment:—None (no shims). Replace bearings. Do not file rods or caps. Tangs on bearing shells should be installed on opposite sides of rod.
Replacement Bearings:—.002", .010" undersize.
Installing Rods:—Oil split hole toward camshaft.

CRANKSHAFT:—7 bearings, 4 counterweights.
See Nash Shop Notes for vibration dampener data.
Journal Diameters—2 31/64" all bearings.
Bearings—Interchangeable steel-backed, babbitt-lined type. No shims. **Clearance**—.002".
See Engine Code Note in Nash Shop Notes for original main bearing sizes.
Bearing Adjustment:—None (no shims). *See Nash Shop Notes for removing, installing and fitting bearings.*
Replacement Bearings:—.002", .010" Undersize.
End Thrust:—Center (#4) bearing. Replace bearing to take up excessive endplay. **Endplay**—.004".

CAMSHAFT:—Non-adjustable double-roller chain drive.
See Nash Shop Notes for camshaft removal.
Bearings—Steel-backed, babbitt bushings.
Bearing Clearance—.002".
End Thrust:—Taken by front bearing. Replace bearing to take up excessive endplay.
Endplay—.003" (new), .005" max. (worn).
Timing Chain:—Whitney No. 49205 or Diamond. Width 9/16". Pitch ⅜". Length 60 links or 22½".
Camshaft Setting:—Sprockets marked. Mesh chain with sprocket marks adjacent and in line with a straightedge across the shaft centers.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1¾"	.3725"	5 17/32"
Exhaust	1 19/32"	.3725"	5 17/32"

	Seat angle	Lift	Side Clearance
All Valves	45°	11/32"	.002-.004"

Tappet Clearance:—.015" all valves—engine warm and idling.
Valve Guides:—Press fit. Press in head to shoulder on guide and ream for correct clearance. Replacement guides furnished .002" undersize.
Valve Springs:—Double springs on all valves.
Free Length—1 21/32" (inner), 2" (outer).

	Inner Spring Pressure	Inner Spring Length	Outer Spring Pressure	Outer Spring Length
Closed	21 lbs.	1⅜"	38 lbs.	1 11/16"
Open	51 lbs.	1 1/32"	95 lbs.	1 11/32"

Valve Lifters:—Mushroom type. Lifter guide holes reamed in block. Remove from below (camshaft out).
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 24½° BTDC. Close 70½° ALDC.
Exhaust Valves—Open 49½° BLDC. Close 5° ATDC.
Valve Timing Check—With regular tappet clearance of .015", exhaust valve should close with piston 5° or .0104" after top dead center.
Motor Gauge—Weidenhoff Adapter #113, Rod #37.

LUBRICATION:—Pressure system (gear type oil pump in crankcase. NOTE—Install pump with distributor drive slot turned crosswise of car.
Normal Oil Pressure:—30 lbs. at 20 MPH.
Oil Pressure Relief Valve:—On oil pump cover. Opens at 30 lbs. Turn adjusting screw in to increase.
Oil Pressure Gauge:—King-Seeley Electric. K-S No. 7665 (dash unit), 6125 (engine unit).
See article in Mechanical Equipment Section for data.
Crankcase Capacity:—6 qts. (dry or refill).

COOLING SYSTEM:—**Cap.** 16 qts. (17 with heater).
Water Pump:—Centrifugal, adjustable packing type.
See article in Mechanical Equipment Section for data.
Removal—Drain radiator, disconnect hose and drive coupling, take out mounting screws in pump flange.
Thermostat:—Dole. In water outlet on cyl. head.
Setting—Starts to open at 160° F.
Temperature Gauge:—King-Seeley Electric. K-S No. 7670 (dash unit), 7000 (engine unit). NOTE—Gauge inoperative with ignition Off (reads '212').
See article in Mechanical Equipment Section for data.

CLUTCH:—**Borg & Beck Model 10A7.** Single plate, dry disc type. See Production Change following.
Production Change—Clutch assembly changed from #934 (same as 1939) to #950 (with 'Borglite' driven member) after Dec. 15, 1939. Assembly no. stamped on cover. *See article in Mechanical Equipment Section.*
Facings—Spiral wound moulded woven, 2 used. Inside Diam. 6" (934), 7" (950). Outside Diam. 10". Thickness .125". NOTE—Install plate with mark 'flywheel side' forward (damper toward trans).
Pedal Adjustment:—Free travel ½-1" (adjusting nuts on lower end of pedal connector link). Check NoRol
Removal:—Remove transmission (see below). Disconnect clutch pedal linkage. Support engine at rear, disconnect rear engine mountings. Remove clutch housing and pan. Punch mark flywheel, cover, and pressure plate (re-assemble to these marks). Take out mounting screws in cover flange.

TRANSMISSION:—**Own Make.** All helical gear, constant-mesh (all speeds), synchro-mesh (second & high) with remote type steering column shift.
See article in Mechanical Equipment Section for data.
Cruising Gear (Overdrive):—Warner Model AS12-R6 with electrical 'kick-down' control optl.
See article in Mechanical Equipment Section for data.
Transmission Control:—Steering col. mechanical shift.
See article in Mechanical Equipment Section for data.
Removal:—Disconnect shift rods, speedometer cable, overdrive control and wires (if used), and driveshaft. Remove two upper mounting studs and install pilot studs (to support transmission and avoid bending clutch plate). Remove remaining mounting stud nuts, remove transmission from below. NOTE—When removing transmission from car, do not remove inspection hole plate in car floor.

UNIVERSAL JOINTS:—**Mechanics Type 2C.** Roller bearing type. 2 used.
See article in Mechanical Equipment Section for data.

REAR AXLE:—**Own Make.** Semi-floating, hypoid gear type with Hotchkiss drive.
See article in Mechanical Equipment Section for data.
Ratio—4.1-1 Std., 4 4/9-1 Optl.
Backlash—.005-.007". Shim adjustment.
Removal:—Hoist rear of car, remove axle shafts (see below). Free axle from springs by disconnecting U-bolts and rear shackles and withdraw from car.
Axle Shaft Removal:—Remove wheel and drum. Disconnect brake line and cable. Remove backing plate mounting bolt nuts, oil seal retainer, brake backing plate, bearing adjusting shims and withdraw shaft and bearing (do not drag shaft on oil seal).
Wheel Bearing Adjustment—Shims at flanged end of housing. To adjust, remove backing plate, add or remove shims (equally at both ends of axle).
Endplay—.003-.006".

SHOCK ABSORBERS:—**Delco. Front**—Model 1947-C, **D. Rear**—Model 1006-DD, 1006-EE (heavy springs), 1723-N, P (heavy springs—Export). Double acting, hydraulic. Direct acting on rear (except 1723).
See articles in Mechanical Equipment Section for data.

STEERING:—**Steering Gear.** Gemmer Model 305. Worm-and-Roller type with 'push-pull' adjustment. New type steering linkage with idler arm on right frame side member. *See Mechanical Equip. Section for data.*
Front Suspension:—Independent, linked parallelogram type with coil springs.
See article in Mechanical Equipment Section for data.
IMPORTANT—Insert 2" blocks (Tool J886) between upper support arm and frame flange (at each side) to level frame when checking specifications.
Kingpin Inclination—4½° crosswise.
Caster—0° to Negative ½°. Adjustable.
Camber—Pos. ¼° to Pos. ¾°. Adjustable.
Toe In—1/32-3/32". Adjust tie rod tube for each wheel equally.
Steering Geometry (Toe-out on Turns)—Inner wheel turned 21½°, Outer wheel 20°.

BRAKES:—**Service.** Bendix hydraulic, duo-servo, single anchor type without eccentric adjustment. Hand lever applies rear wheel service brakes.
See article in Mechanical Equipment Section for data.
Drums—Cast-iron. Diameter—10".
Lining—Moulded. Width 2". Thickness 3/16". Length per wheel 22".
Clearance—.015" at each end of secondary shoe with primary shoe forced out against drum.
Braking Power—53% front wheels, 47% rear.
Hand Brake:—See Service Brakes above.
NoRol:—Optl. *See Mechanical Equipment Section.*

HOOD LOCK & ENGINE CODE NOTE:—*See Nash Shop Notes.*

SERIAL NUMBER:—First number B-106300. Stamped on right frame side member under hood.

SERVICE SERIAL NUMBER:—First number N8-13500. On 'Caution Plate' on left front door hinge post.

ENGINE NUMBER:—First number B-105800. On engine block on left side at front. NOTE—Engine number is 500 less than Serial Number on same car.

ENGINE SPECIFICATIONS:—8 cylinder, valve-in-head, Twin Ignition type. NOTE—'Iso-thermal' fuel intake system used (intake manifold cast in cylinder head—water cooled for temperature control).
Bore—3⅛". **Stroke**—4¼".
Displacement—260.8 cu. ins. **Rated HP**—31.25.
Developed Horsepower—115 at 3400 RPM.
Compression Ratio—6.0-1 cast-iron head.
Compression Pressure—110 lbs. at 350 RPM. or approx. 100 lbs. at cranking speed (160 RPM).

PISTONS:—Nelson-Bohnalite, aluminum alloy, Invar strut, tin plated, split skirt type.
Original Bore Size:—*See Engine Code Note in Nash Shop Notes for complete data.*
Weight—16 ozs. (stripped). **Length**—3 11/16".
Removal—Pistons and rods removed from below.
Clearance—Top .018-.022". Skirt .001-.002".
Replacement Pistons:—*See Nash Shop Notes for data.*
Fitting New Pistons:—Insert .002" feeler between piston and cylinder wall on side opposite slot. Pull to withdraw feeler should be 10 lbs.
Installing Pistons:—Pin offset toward camshaft. Slot toward left (trademark within piston toward front).

PISTON RINGS:—Two compression, two oil control rings per piston, all above pin. Oil ring grooves drilled for oil drain holes.

Ring	Width	End Gap	Side Clearance
Compr. #1	.124"	.010-.020"	.002-.0025"
Compr. #2	.124"	.010-.020"	.0015-.003"
Oil Contr. #3	.1240"	.010-.018"	.0015-.0025"
Oil Contr. #4	.1865"	.010-.018"	.001-.0025"

NOTE—Wall thickness .130" compression, .140" oil ring.
Replacement Rings:—*See Nash Shop Notes for data.*

PISTON PIN:—**Diameter**—.8747". **Length**—2.574". Floating type. Pin retained by locking ring at each end. Pin hole in piston offset to camshaft.
Pin Fit in Piston—Light push fit (piston at 200°F.).
Pin Fit in Rod Bushing—Select fit to .0001" or light push fit at normal temperature.
Replacement Pins:—.001", .003", .005" oversize.

CONNECTING ROD:—**Length**—8¾". **Weight**—34 ozs.
Upper Bearing (Piston Pin Bushing)—Bronze.
Crankpin Journal Diameter—2.0015".
Lower Bearing—Removable steel-backed, babbitt-lined type. No shims. *See Engine Code Note in Nash Shop Notes for original bearing sizes.*
Clearance—.0015-.0025". **Sideplay**—.008-.012".
Bearing Adjustment:—None (no shims). Replace bearings. Do not file rods or caps. Tangs on bearing shells should be installed on opposite sides of rod.
Replacement Bearings:—.002", .010" undersize.
Installing Rods:—Oil split hole toward camshaft.

CRANKSHAFT:—9 bearing. No counterweights.
See Nash Shop Notes for vibration dampener data.
Journal Diameters—2 31/64" all bearings.
Bearings—Interchangeable steel-backed, babbitt-lined type. No shims. **Clearance**—.002".
See Engine Code Note in Nash Shop Notes for original main bearing sizes.
Bearing Adjustment:—None (no shims). *See Nash Shop Notes for removing, installing and fitting bearings.*
Replacement Bearings:—.002", .010" Undersize.
End Thrust:—Center (#5) bearing. Replace bearing to take up excessive endplay. **Endplay**—.004".

CAMSHAFT:—Non-adjustable double-roller chain drive.
See Nash Shop Notes for camshaft removal.
Bearings—Steel-backed, babbitt bushings.
Bearing Clearance—.002".
End Thrust:—Taken by front bearing. Replace bearing to take up excessive endplay.
Endplay—.003" (new), .005" Max. (worn).
Timing Chain:—Diamond. Width 9/16". Pitch ⅜". Length 62 links or 23¼".
Camshaft Setting:—Sprockets marked. Mesh chain with sprocket marks adjacent and in line with a straightedge across the shaft centers.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1 21/32"	.3725"	5½"
Exhaust	1 15/32"	.3725"	5½"

	Seat angle	Lift	Side Clearance
All Valves	45°	11/32"	.002-.004"

Tappet Clearance:—.015" all valves—engine warm and idling.
Valve Guides:—Press fit. Press in head to shoulder on guide and ream for correct clearance. Replacement guides furnished .002" undersize.
Valve Springs:—Double springs on all valves.
Free Length—1 21/32" (inner), 2" (outer).

	Inner Spring Pressure	Inner Spring Length	Outer Spring Pressure	Outer Spring Length
Closed	21 lbs.	1⅜"	38 lbs.	1 11/16"
Open	51 lbs.	1 1/32"	95 lbs.	1 11/32"

Valve Lifters:—Mushroom type. Lifter guide holes reamed in block. Remove from below (camshaft out).
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 20° BTDC. Close 74° ALDC.
Exhaust Valves—Open 45° BLDC. Close 10° ATDC.
Valve Timing Check—With regular tappet clearance of .015" Exhaust valve should close with piston 10° or .0400" after top dead center.
Motor Gauge—Weidenhoff Adapter #113, Rod #37.

LUBRICATION:—Pressure system (gear type oil pump in crankcase). NOTE—Slot in pump shaft should be assembled across engine when pump installed.
Normal Oil Pressure:—30 lbs. at 20 MPH.
Oil Pressure Relief Valve:—On oil pump cover. Opens at 30 lbs. Turn adjusting screw in to increase.
Oil Pressure Gauge:—King-Seeley Electric. K-S No. 7665 (dash unit), 6125 (engine unit).
See article in Mechanical Equipment Section for data.
Crankcase Capacity:—7 qts. (dry or refill).

COOLING SYSTEM:—**Capacity.** 17 qts. (add 1 qt. for heater).
Water Pump:—Centrifugal, adjustable packing type.
See article in Mechanical Equipment Section for data.
Removal—Drain radiator, disconnect hose and drive coupling, take out mounting screws in pump flange.
Thermostat:—Dole. In water outlet on cyl. head.
Setting—Starts to open at 160° F.
Temperature Gauge:—King-Seeley Electric. K-S No. 7670 (dash unit), 7000 (engine unit). NOTE—Gauge inoperative with ignition Off (reads '212').
See article in Mechanical Equipment Section for data.

CLUTCH:—**Borg & Beck Model 10A7.** Single plate, dry disc type. See Production Change following.
Production Change—Clutch assembly changed from #919 (same as 1939) to #949 (with 'Borglite' driven member) after Feb. 1, 1940. Assembly No. stamped on cover. *See article in Mechanical Equipment Section.*
Facings—Spiral wound molded woven, 2 used. Inside Diam. 6" (919), 6½" (949). Outside Diam. 10". Thickness .125". NOTE—Install plate with mark 'flywheel side' forward (damper toward trans).
Pedal Adjustment:—Free travel ½-1" (adjusting nuts on lower end of pedal connector link). Check NoRol
Removal:—Remove transmission (see below). Disconnect clutch pedal linkage. Support engine at rear, disconnect rear engine mountings. Remove clutch housing and pan. Punch mark flywheel, cover, and pressure plate (re-assemble to these marks). Take out mounting screws in cover flange.

TRANSMISSION:—**Own Make.** All helical gear, constant-mesh (all speeds), synchro-mesh (second & high) with remote type steering column shift.
See article in Mechanical Equipment Section for data.
Cruising Gear (Overdrive):—Warner Model AS12-R6 with electrical 'kick-down' control optl.
See article in Mechanical Equipment Section for data.
Transmission Control:—Steering col. mechanical shift.
See article in Mechanical Equipment Section for data.
Removal:—Disconnect shift rods, speedometer cable, overdrive control and wires (if used), and driveshaft. Remove two upper mounting studs and install pilot studs (to support transmission and avoid bending clutch plate). Remove remaining mounting stud nuts, remove transmission from below. NOTE—When removing transmission from car, do not remove inspection hole plate in car floor.

UNIVERSAL JOINTS:—**Mechanics Type 3C.** Roller bearing type. 2 used.
See article in Mechanical Equipment Section for data.

REAR AXLE:—**Own Make.** Semi-floating, hypoid gear type with Hotchkiss drive.
See article in Mechanical Equipment Section for data.
Ratio—4.1-1 Std., 4 4/9-1 Optl.
Backlash—.005-.007". Shim adjustment.
Removal:—Hoist rear of car, remove axle shafts (see below). Free axle from springs by disconnecting U-bolts and rear shackles and withdraw from car.
Axle Shaft Removal:—Remove wheel and drum. Disconnect brake line and cable. Remove backing plate mounting bolt nuts, oil seal retainer, brake backing plate, bearing adjusting shims and withdraw shaft and bearing (do not drag shaft on oil seal).
Wheel Bearing Adjustment—Shims at flanged end of housing. To adjust, remove backing plate, add or remove shims (equally at both ends of axle).
Endplay—.003-.006".

SHOCK ABSORBERS:—**Delco. Front**—Model 1947-C, D. **Rear**—Model 1006-DD, 1006-EE (heavy springs), 1723-N, P (heavy springs—Export). Double acting, hydraulic. Direct acting on rear (except 1723).
See articles in Mechanical Equipment Section for data.

STEERING:—**Steering Gear.** Gemmer Model 335. Worm-and-Roller type with 'push-pull' adjustment. New type steering linkage with idler arm on right frame side member. *See Mechanical Equip. Section for data.*
Front Suspension:—Independent, linked parallelogram type with coil springs.
See article in Mechanical Equipment Section for data.
IMPORTANT—Insert 2" blocks (Tool J886) between upper support arm and frame flange (at each side) to level frame when checking specifications.
Kingpin Inclination—4½° crosswise.
Caster—0° to Negative ½°. Adjustable.
Camber—Pos. ¼° to Pos. ¾°. Adjustable.
Toe In—1/32-3/32". Adjust tie rod tube for each wheel equally.
Steering Geometry (Toe-out on Turns)—Inner wheel turned 21½°, Outer wheel 20°.

BRAKES:—**Service.** Bendix hydraulic, duo-servo, single anchor type with eccentric adjustment. Hand lever applies rear wheel service brakes.
See article in Mechanical Equipment Section for data.
Drums—Cast-iron. Diameter 11 1/16".
Lining—Moulded. Width 2¼". Thickness 3/16". Length per wheel 24".
Clearance—.010" at heel and toe of each shoe.
Braking Power—53% front wheels, 47% rear.
Hand Brakes:—See Service Brakes above.
NoRol:—Optl. *See Mechanical Equipment Section.*

HOOD LOCK & ENGINE CODE NOTE:—*See Nash Shop Notes.*

SERIAL NUMBER:—First number H-57000. Stamped on plate on right frame side member under hood.

SERVICE SERIAL NUMBER:—First number LH-57000. On 'Caution Plate' on left front door hinge post.

ENGINE NUMBER:—First number HE-56500. On boss on upper left hand side of engine above front water jacket cover plate. NOTE—Engine No. is 500 less than Serial Number on same car.

ENGINE SPECIFICATIONS:—6 cylinder, 'L' head type. Cylinders cast Enbloc. NOTE—'Iso-thermal' fuel intake system used (intake manifold cast in block water cooled for temperature control).

Bore—3⅜". **Stroke**—4⅜".

Displacement—234.8 cu. ins. **Rated HP**—27.34.

Developed Horsepower—99 at 3400 RPM.

Compression Ratio—6.3-1 cast-iron head.

Compression Pressure—110 lbs. at cranking speed of 160 RPM.

Vacuum Reading—18-20" steady idling at 7-8 MPH.

PISTONS:—Nelson-Bohnalite, aluminum alloy, Invar strut, tin plated, split skirt type.

Original Bore Size:—*See Engine Code Note in Nash Shop Notes for complete data.*

Weight—19¼ ozs. (stripped). **Length**—3⅞".

Removal—Pistons and rods removed from above.

Clearance—Top .027-.030". Skirt .001-.002".

Replacement Pistons:—*See Nash Shop Notes for data.*

Fitting New Pistons:—Insert .002" feeler between piston and cylinder wall on side opposite slot. Pull to withdraw feeler should be 10 lbs.

Installing Pistons:—Pin offset toward camshaft. Slot toward left (trademark within piston toward front).

PISTON RINGS:—Two compression, two oil control rings per piston, all above pin. Oil ring grooves drilled for oil drain holes.

Ring	Width	End Gap	Side Clearance
Compr. #1	.124"	.010-.020"	.002-.0025"
Compr. #2	.124"	.010-.020"	.0015-.003"
Oil Contr. #3	.1550"	.010-.018"	.0015-.0025"
Oil Contr. #4	.1550"	.010-.018"	.001-.0025"

NOTE—Wall thickness .145" (for all rings).

Replacement Rings:—*See Nash Shop Notes for data.*

PISTON PIN:—**Diameter**—.8745". **Length**—2.804". Floating type. Pin retained by locking ring at each end. Pin hole in piston offset to camshaft.

Pin Fit in Piston—Light push fit (piston at 200°F.).

Pin Fit in Rod Bushing—Select fit to .0001" or light push fit at normal temperature.

Replacement Pins:—.001, .003", .005" oversize.

CONNECTING ROD:—**Length**—8¾". **Weight**—36¼ ozs.

Upper Bearing (Piston Pin Bushing)—Bronze.

Crankpin Journal Diameter—2.002".

Lower Bearing—Removable steel-backed, babbitt-lined type. No shims. *See Engine Code Note in Nash Shop Notes for original bearing sizes.*

Clearance—.0015-.0025". **Sideplay**—.008-.012".

Bearing Adjustment:—None (no shims). Replace bearings. Do not file rods or caps. Tangs on bearing shells should be installed on opposite sides of rod.

Replacement Bearings:—.002", .010" undersize.

Installing Rods:—Oil split hole toward camshaft.

CRANKSHAFT:—7 bearings, 4 counterweights.

See Nash Shop Notes for vibration dampener data.

Journal Diameters—2 31/64" all bearings.

Bearings—Interchangeable steel-backed, babbitt-lined type. No shims. **Clearance**—.002".

See Engine Code Note in Nash Shop Notes for original main bearing sizes.

Bearing Adjustment:—None (no shims). *See Nash Shop Notes for removing, installing and fitting bearings.*

Replacement Bearings:—.002", .010" Undersize.

End Thrust:—Center (#4) bearing. Replace bearing to take up excessive endplay. **Endplay**—.004".

CAMSHAFT:—6 bearing. Non-adjustable chain drive.

See Nash Shop Notes for camshaft removal.

Bearings—Steel-backed, babbitt bushings.

Bearing Clearance—.002".

End Thrust:—Taken by front bearing. Replace bearing to take up excessive endplay.

Endplay—.003" (new), .005" Max. (worn).

Timing Chain:—Whitney No. 49205 or Diamond. Pitch ⅜". Width 9/16". Length 60 links or 22½".

Camshaft Setting:—Sprockets marked. Mesh chain with sprocket marks adjacent and in line with a straightedge across the shaft centers.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1 21/32"	3407"	5 55/64"
Exhaust	1 17/32"	3407"	5 55/64"

	Seat Angle	Lift	Stem Clearance
All Valves	45°	5/16"	.002-.004"

Tappet Clearance:—.015" all valves—engine warm and idling. NOTE—For high speed driving .018" max. setting may be used. Remove right front fender shield for access to valve covers.

Valve Guides:—Press fit in block. Press guides in place 1¼"(intake), ¾"(exhaust) below top of block. Ream to correct clearance. Replacement guides furnished .002" undersize.

Valve Springs:—Free length 2½".

	Spring Pressure	Spring Length
Valve Closed	70 lbs.	2"
Valve Open	115 lbs.	1 11/16"

Valve Lifters:—Mushroom type. Lifter guide holes reamed in block. Remove from below (camshaft out).

Valve Timing:—See Camshaft Setting above.

Intake Valves—Open 21½° BTDC. Close 71° ALDC.

Exhaust Valves—Open 71° BLDC. Close 36½° ATDC.

Valve Timing Check—With regular tappet clearance of .015", Intake valve should open with piston 21½° or .1891" BTDC., and Exhaust valve close with piston 36½° or .5118" ATDC.

LUBRICATION:—Pressure system (gear type oil pump in crankcase).

Normal Oil Pressure:—30 lbs. at 20 MPH.

Oil Pressure Relief Valve:—On oil pump cover. Opens at 30 lbs. Turn adjusting screw in to increase.

Oil Pressure Gauge:—King-Seeley Electric. K-S No. 7665 (dash unit), 6125 (engine unit).

See article in Mechanical Equipment Section for data.

Crankcase Capacity:—6 qts. (dry or refill).

COOLING SYSTEM:—**Cap.** 18 qts. (19 with heater).

Water Pump:—Centrifugal, adjustable packing type.

See article in Mechanical Equipment Section for data.

Removal—Drain radiator, disconnect hose and drive coupling, take out mounting screws in pump flange.

Thermostat:—Dole. In water outlet on cyl. head.

Setting—Starts to open at 160° F.

Temperature Gauge:—King-Seeley Electric. K-S No. 7670 (dash unit), 7000 (engine unit). NOTE—Gauge inoperative with ignition Off (reads '212').

See article in Mechanical Equipment Section for data.

CLUTCH:—**Borg & Beck Model 9A6 (early), 9A7 (later).** Single plate, dry disc type.

Production Change—9A6 (#932) used on first cars, 9A7 (#937 & #951 with 'Borglite' driven member) used after Dec. 15, 1939. Assembly No. stamped on cover.

See article in Mechanical Equipment Section for data.

Facings—Spiral wound molded woven, 2 used. Inside Diam. 5⅝" (932), 6" (951). Outside Diam. 9¼". Thickness .125". NOTE—Install plate with mark 'flywheel side' forward (damper toward trans).

Pedal Adjustment:—Free travel ½-1" (adjusting nuts on lower end of pedal connector link). Check NoRol

Removal:—Remove transmission (see below). Disconnect clutch pedal linkage. Support engine at rear, disconnect rear engine mountings. Remove clutch housing and pan. Punch mark flywheel, cover, and pressure plate (re-assemble to these marks). Take out mounting screws in cover flange.

TRANSMISSION:—**Own Make.** All helical gear, constant-mesh (all speeds), synchro-mesh (second & high) with remote type steering column shift.

See article in Mechanical Equipment Section for data.

Cruising Gear (Overdrive):—Warner Model AS12-R6 with electrical 'kick-down' control optl.

See article in Mechanical Equipment Section for data.

Transmission Control:—Steering col. mechanical shift.

See article in Mechanical Equipment Section for data.

Removal:—Disconnect shift rods, speedometer cable, overdrive control and wires (if used), and drive-shaft. Remove two upper mounting studs and install pilot studs (to support transmission and avoid bending clutch plate). Remove remaining mounting stud nuts, remove transmission from below. NOTE—Do not remove inspection hole cover in floor.

UNIVERSAL JOINTS:—**Mechanics Type 2C.** Roller bearing type. 2 used.

See article in Mechanical Equipment Section for data.

REAR AXLE:—**Own Make.** Semi-floating, hypoid gear type with Hotchkiss drive.

See article in Mechanical Equipment Section for data.

Ratio—4.1-1 Std., 4 4/9-1 Optl.

Backlash—.005-.007". Shim adjustment.

Removal:—Hoist rear of car, remove axle shafts (see below). Free axle from springs by disconnecting U-bolts and rear shackles and withdraw from car.

Axle Shaft Removal:—Remove wheel and drum. Disconnect brake line and cable. Remove backing plate mounting bolt nuts, oil seal retainer, brake backing plate, bearing adjusting shims and withdraw shaft and bearing (do not drag shaft on oil seal).

Wheel Bearing Adjustment—Shims at flanged end of housing. To adjust, remove backing plate, add or remove shims (equally at both ends of axle).

Endplay—.003-.006".

SHOCK ABSORBERS:—**Delco. Front**—Model 1947-C, D. **Rear**—Model 1006-DD, 1006-EE (heavy springs), 1723-N, P (heavy springs—Export). Double acting, hydraulic. Direct acting on rear (except 1723).

See articles in Mechanical Equipment Section for data.

STEERING:—**Steering Gear.** Gemmer Model 305. Worm-and-Roller type with 'push-pull' adjustment. New type steering linkage with idler arm on right frame side member. *See Mechanical Equip. Section for data.*

Front Suspension:—Independent, linked parallelogram type with coil springs.

See article in Mechanical Equipment Section for data.

IMPORTANT—Insert 2" blocks (Tool J886) between upper support arm and frame flange (at each side) to level frame when checking specifications.

Kingpin Inclination—4½° crosswise.

Caster—0° to Negative ½°. Adjustable.

Camber—Pos. ¼° to Pos. ¾°. Adjustable.

Toe In—1/32-3/32". Adjust tie rod tube for each wheel equally.

Steering Geometry (Toe-out on Turns)—Inner wheel turned 21½°, Outer wheel 20°.

BRAKES:—**Service.** Bendix hydraulic, duo-servo, single anchor type without eccentric adjustment. Hand lever applies rear wheel service brakes.

See article in Mechanical Equipment Section for data.

Drums—Cast-iron. Diameter—10".

Lining—Moulded. Width 2". Thickness 3/16". Length per wheel 22".

Clearance—.015" at each end of secondary shoe with primary shoe forced out against drum.

Braking Power—53% front wheels, 47% rear.

Hand Brake:—See Service Brakes above.

NoRol:—Optl. *See Mechanical Equipment Section.*

TORQUE WRENCH SPECIFICATIONS:—*See Torque Wrench article in Mechanical Equipment Section for tightening specifications for Cylinder Head, Main & Connecting Rod Bolts, etc.*

F-40 '60' & G-40 '70' ENGINE NOTE:—Same engine used for both F-40 '60' and G-40 '70' models.

HOOD LOCK USED ON 1940 SIX & EIGHT CARS:—Alligator type hood with instrument panel lock. To raise hood, pull out on control knob at left of steering wheel (hood will raise 1½"), press up on safety catch tab under front edge of hood at center. When installing hood, engage front latch, adjust rear edge to secure ⅛" uniform clearance between rear edge of hood and cowl before installing and tightening hinge bracket bolts. Adjust hinges as required for alignment and smooth operation. Hood latch pilot bolt is also adjustable. Side panels are integral with front fenders.

FRONT END SHEET METAL ASSEMBLY REMOVAL:—May be removed to facilitate work on front of engine as follows: drain radiator, disconnect radiator hose, disconnect wires at junction block on fender plate (each side), free wiring harness from clips on radiator top tank and on left fender plate. Disconnect hood latch cable at front and pull back through core support. Remove 2 screws at radiator tie rod bracket between fender and core support, fender to hood hinge hex head bolt and washers (at upper rear edge of fender), frame to fender plate hex head self tapping screws (2 on 'F' & 'L', 1 on 'G') at each side at lower rear end of plate. Disconnect rear of fender from frame brace, running board and body rocker panel ('L' only). On 'G' and 'L' remove lower body to fender capscrew from under car. Remove front bumper assembly and nut from radiator support at center of frame front cross member. On 'L', free fabric splash apron at snap-in fasteners at front cross member. Remove cowl kick pads (inside car) at each side and 3 body-to-fender capscrews. Lift front end assembly clear of center support stud and pull forward. Replace assembly in same manner.

FENDER PLATE REMOVAL:—For access to side engine compartments (for valve adjustment, etc.) remove fender plate as follows: Disconnect wires at junction block and remove from plate, remove 4 ('F' & 'G'), 6 ('L') hex head screws at top edge of plate, 2 screws at radiator tie rod bracket-to-fender and core support, 3 hex head cap screws under fender at front edge of plate, 1 ('G'), 2 ('F' & 'L') hex head self tapping screws at frame at lower rear edge. Slide plate to rear (from under fender) to clear radiator core support. Tip top of plate in until free from fender, raise over shock absorber and slide out to rear and down.

CYLINDER HEAD SERVICING:—Steel-asbestos cylinder head gasket used. **This gasket cannot be reused.** When installing new gasket, coat both sides with thin coat of P.O.B. Perfect Gasket Seal with room temperature of approximately 70° F. (edges at cylinder bore holes must be wiped clean). Plain washers used under cylinder head bolts to prevent leakage at front end. Car manufacturer recommends use of torque wrench (if J-1264 torque wrench used, car manufacturer recommends reading 65-70 lbs. ft.). *See Cylinder Head Tightening Diagrams in Mechanical Equipment Section.*

F-40 & G-40 Note—Same head used on both engines but changed over 1939 by moving hot water heater connection to left side and heater indicator hole size increased due to use of electric type heat indicator.

L-40 Note—Install new neoprene grommet in pump by-pass hole on front end of head whenever cylinder head removed.

OIL PAN REMOVAL:—Steering linkage must be lowered to allow pan removal. Disconnect Pitman Arm from Pitman Arm shaft and steering arm support (on right side) from frame and lower steering relay rod permitting access to oil pan.

L-40 Note—Holes provided in frame cross member for removal of some screws at front end. Car manufacturer recommends front end of car be raised slightly for access to extreme front end screws. To do this, remove 2 front engine mounting cap screws, fender plates (see data following) and disconnect flexible feed line at fuel pump (to avoid lamaging line).

PISTON PINS:—**Servicing**—Standard size pins only furnished for service. Pin bosses in pistons electrolited and must not be reamed. Replacement pistons (standard and oversize) furnished with pins fitted.

Removal:—To remove pin, take out lockscrew, place assembly in boiling water for one minute. With Tool HM-535 push pin out through plain boss end. NOTE—Piston Heater and Pin Assembly Fixture No. J-849 consisting of piston and pin heater compartments and piston holder available.

Fitting:—Pin fit in piston .0001" loose to .0002" tight (plain boss), .0002-.0005" tight (lock screw boss). Pin fit in rod bushing .0003-.0006". If rod bushing worn, press new bushing in place (align oil hole in bushing and rod), burnish with Tool HM-587E and line ream with Reamer HM-586 to .8558-.8562".

Installing:—To install pin, heat piston and pin (as for Removal above), dip pin in hot light engine oil, start pin through plain boss end of piston and through rod (make sure lock screw hole in pin and boss will be aligned), then with Tool HM-535 lightly push pin in place until hole in pin and boss aligned (use punch in hole to correct slight mis-allgnment).

IMPORTANT—Pin must not be forced (if heavy push required, indicates piston has cooled, disassemble and reheat piston and pin). After pin in place, coat screw with graphite and tighten.

CONNECTING ROD BOLT NUT CHANGE:—Later production cars equipped with self tightening (Marsden) type nuts (no cotter key used). May be identified by increased slot length on each face of nut (extends half way up face). These self locking nuts should be tightened to 50-55 lbs. ft. Early cars use conventional castellated nut and cotter key. Tighten conventional type nuts to 30-35 lbs. ft. with Tool J-1264.

MAIN BEARING UPPER HALVES:—**Removal**—May be removed without removing crankshaft by removing bearing cap and inserting pin (Tool HM-J-173) in oil hole in shaft. With tang on pin engaging plain end of bearing shell, rotate shaft in usual direction and turn shell out.

L-40 Note—Front of engine must be raised to remove upper half of front bearing.

Installation—Remove sharp edge from plain end of bearing, insert this end at indented side of support and rotate in place using pin in oil hole.

CRANKSHAFT END THRUST:—Taken by front (#1) bearing. A solid bronze thrust washer plate (.1205-.1245" thick) is dowelled to each face of bearing cap. A steel thrust collar is assembled between front thrust plate and crankshaft gear.

REAR MAIN BEARING OIL SEAL:—Consists of oil slinger on crankshaft to rear of bearing with asbestos covered wiper seal in groove to rear of slinger. Cork strips used to seal vertical joints between cap and block.

Installation—With crankshaft out of engine and bearing cap and shells off, crowd seal in rear groove of bearing support by hand. Use seal compressor Tool J-955 over seal and tap tool 3 or 4 times to seat seal. With tool resting on seal, cut ends flush at each end. Repeat operation for bearing cap. Seal must entirely fill groove and be trimmed flush to prevent oil leaks. Install cork seals in vertical grooves when installing cap.

OIL PUMP:—Gear type pump. Six and Eight pump identical except for gear faces which are ¼" wider on Eight. When assembling pump gear on shaft, press shaft on gear flush with outer end of gear (Six), with gear extending ¼" beyond end of shaft (Eight—Use Tool J-954 which properly positions gear on shaft). Pump drive gear must be assembled with Feeler Gauge J-954-1 between inner face of gear hub and pump body to give proper end clearance for pump shaft. Use new gasket between pump body and cylinder block.

Installation—Set engine in firing position for #1 cylinder with rotor opposite #1 segment in distributor cap. Note position of distributor shaft tongue for proper oil pump drive gear mesh, then raise distributor and mesh pump drive gear with camshaft gear. Replace distributor in position and reset ignition timing.

CLUTCH HOUSING REINFORCING PLATE:—Used on all 'L' models with conventional transmission and on first 6488 'G' cars (with 15" transmission rear extension—same as 1939). Later 'G' cars with 11" extension do not use plate (see note following). Consists of 3/16" steel plate bolted between clutch housing and underpan (replaces conventional gasket). Plate is secured to housing by 2 screws. 12 screws used to bolt underpan (through plate) to housing. When installing reinforcing plate, coat both sides with Permatex.

F-40 and G-40 Note—'G' models (after first 6488 cars—see data above for first cars) and all 'F' models (equipped with conventional transmission) have clutch housings drilled for 12 cap screws. Only 8 cap screws used.

HOOD LOCK, FRONT END SHEET METAL ASSEMBLY & OIL PAN REMOVAL:—*See Oldsmobile Shop Notes.*

SERIAL NUMBER:—On left frame side member under hood. 1st No. as follows:

	F-40	G-40
Lansing, Mich.	F-703001	G-355001
South Gate, Calif.	CF-515001	CG-16001
Linden, N. J.	LF-556001	LG-108001

ENGINE NUMBER:—First number G-79001, GR-3001 (RHD). Same number for both Series. NOTE—Cars with Hydra-matic drive carry prefix GA.

ENGINE SPECIFICATIONS:—6 cylinder, 'L' head.
Bore—3 7/16". **Stroke**—4⅛".
Displacement—229.7 cu. ins. **Rated HP**—28.4.
Developed Horsepower—95 HP (Std. hd.), 90 HP (Optl. LC. hd.) at 3300 RPM.
Compression Ratio—6.1-1 Std., 5.61-1 Optl. LC hd.
Compression Pressure—146 lbs. (Std. hd.), 120 lbs. (Optl. LC. hd.) at 1000 RPM or approximately 102-112 lbs. at cranking speed.
Vacuum Reading—Steady 17" min. at 6 MPH.
See Oldsmobile Shop Notes for Cylinder Head Servicing.

PISTONS:—Aluminum alloy, T-slot, cam ground type with hard oxide bearing surface.
Weight—17.44 ozs. (stripped). **Length**—4 1/32".
Removal—Pistons and rods removed from above.
Clearance—Top .026". Skirt .0013-.0018".
Replacement Pistons:—Finished pistons (pins fitted) .003", .005", .010", .015", .030" oversize. Same wt.as std.
Fitting New Pistons:—Check piston for size with micrometer (pin removed) 90° from pin bosses ⅜" below lower ring groove and ⅜" from bottom of skirt. Insert .002" X ½" feeler between piston (pin removed) and cylinder wall on valve side with piston inverted and T-slot on opposite side from feeler. Pull to withdraw feeler must be 4 to 11 lbs. (piston & block at 70°—low limit below 70°, high above).
Installing Pistons:—Mark 'V-S' on head toward valves (slot away from valves). Pin hole offset 3/32"

PISTON RINGS:—2 compression (tapered, O.D. .001" larger at bottom), 2 oil control rings per piston, all above pin. All rings are coated type.
NOTE—Install compr. rings with mark TOP up.

Ring	Width	End Gap	Side Clearance
Compr.	.0925-.0935"	.008-.018"	.001-.003"
Oil Cont.	.1860-.1865"	.007-.015"	.001-.0025"

Replacement Rings:—.010", .020", .030" oversize.

PISTON PIN:—**Diameter**—.8554-.8557". **Length**—3 5/32". Pin locked in one piston boss by lockscrew (opposite end slotted). Pin bosses are plated and must not be reamed. Standard size pins only serviced.
Pin Fit in Piston—.0001" loose to .0002" tight (plain boss end), .0002-.0005" tight (lock boss end).
Pin Fit in Rod Bushing—.0003-.0006" clearance.
See Oldsmobile Shop Notes for Pin Fitting directions.

CONNECTING ROD:—**Length**—7 13/16". **Weight**—28.0 ozs. (complete except less bearing inserts).
Crankpin Journal Diameter—2.123-2.124".
Lower Bearing—Removable steel-backed, babbitt.
Clearance—.0005-.0025". **Sideplay**—.0055-.0105".
Bearing Adjustment:—None. Replace bearings.
Installing Rods:—Oil spit hole at lower end toward valves and grooves on rod and cap bolt bosses (part number side) matched. Special ground bolts used.
See Oldsmobile Shop Notes for Connecting Rod Bolt Nut change and installation data.

CRANKSHAFT:—4 bearing, 7 integral counterweights.
Journal Diameters—#1, 2.478-2.479"; #2, 2.5405-2.5415"; #3, 2.6655-2.6665"; #4, 2.6855-2.6865".
Bearings—Removable, steel-backed, babbitt. Upper and lower halves interchangeable except #1 (front).
Clearance—.0005-.002" (rear), .001-.003" (all others).
Bearing Adjustment:—None (no shims). Replace bearings. Do not file caps. **Endplay**—.004-.008".
NOTE—Undercut bearing cap bolts (#412550) used at No. 3 cap for improved holding capacity. Always install these special cap bolts at #3 bearing.
See Oldsmobile Shop Notes for Main Bearing Removal, End Thrust and Oil Seal data.

CAMSHAFT:—4 bearing. Non-adjustable chain drive.
Journal Diameters—#1, 1.9970-1.9975"; #2, 1.9345-1.9350"; #3, 1.8720-1.8725"; #4, 1.8095-1.8100".
Bearings—Bronze bushings. **Clearance** .0015-.0035".
End Thrust:—Spring-loaded steel plunger in front end of camshaft bears against steel plate on chain cover.
Timing Chain:—Whitney No. 411239. Width 1". Pitch .500" (½"). Length 47 links or 23½".
Camshaft Setting:—Mesh chain with sprocket marks adjacent and in line with a straightedge across the shaft centers (or use Tool HM-408-0).

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1 9/16"	.3415-.3425"	5 51/64"
Exhaust	1 27/64"	.3410-.3418"	5 51/64"

	Seat Angle	Lift	Stem Clearance
Intake	30°	.303"	.00175-.00375"
Exhaust	45°	.298"	.00245-.00425"

Tappet Clearance:—.008"Int., .011"Exh. Engine warm. NOTE—Self-locking tappet screws are used.
See Oldsmobile Shop Notes for Fender Plate removal.
Valve Guides:—Intake and exhaust guides same. Press guides in so top end ⅞" below top of block (Tool J-1042 positions guide correctly in block). Ream to .34425-.34525" inside diam. (no taper).
Valve Springs:—Same spring used on both valves and on Six and Eight engines. Damper used in top of each spring.

	Spring Pressure	Spring Length
Valve Closed	50½ lbs.	2¼"
Valve Open	95½ lbs.	1 15/16"

Valve Lifters:—Mushroom type. Lifter holes in block. Body Diam. .6235-.6240". Furnished .001", .0015", .002", .005",. 010" oversize. **Clearance**—.0005-.0008". NOTE—Lifter holes have bearing-ized finish. Fit lifters without reaming holes wherever possible.
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 5° BTDC. Close 45° ALDC.
Exhaust Valves—Open 45° BLDC. Close 5° ATDC.
Valve Timing Check—With .0124" tappet clearance, #1 intake valve should open with piston 5° (.0163") before top dead center when a point on the flywheel approximately 2 teeth before TDC mark (steel ball insert) lines up with pointer (inspection hole on left face of housing). Reset tappet clear. .008" hot.

LUBRICATION:—Pressure (gear type pump on right of engine). *See Oldsmobile Shop Notes for Oil Pump data.*
Normal Oil Pressure:—28-33 lbs.
Oil Pressure Regulator:—On pump, opens at 27 lbs. Non-adjustable type.
Crankcase Capacity—5 quarts.

COOLING SYSTEM:—**Capacity**—18 quarts.
Water Pump:—Packless, sealed ball-bearing type.
See article in Mechanical Equipment Section for data.
Thermostat:—Harrison. In cylinder head outlet.
Setting—Starts to open at 152°F. Fully open 173°.
Temperature Gauge:—AC Electric #1510918 (dash), #1510772 (engine unit).
See article in Mechanical Equipment Section for data.

CLUTCH (STD. TRANS.):—**Borg & Beck Model 9A7 with 'Borglite' driven member.** Marked #924 on cover. Single plate, dry disc type. New steel and asbestos composition pressure plate baffle used.
G-40 Note—Steel reinforcing plate (same as 1939) between clutch housing and underpan used on first 6488 cars. Must be removed to take out clutch.
Hydra-matic Drive Car Note—No clutch used.
See article in Mechanical Equipment Section for data.
Facings—Spiral wound (spirally grooved) molded woven, 2 used. Inside Diam. 6". O.D. 9¼". ⅛" thick.
Pedal Adjustment:—Free travel 1-1½" (adjusting clevis and locknut on link at clutch fork).
Removal:—Remove transmission (see following), clutch underpan and reinforcing plate (if used). Take out 6 mounting screws in clutch cover. NOTE—Use 2 long shank mounting screws in second hole on each side of locating dowel. *See Oldsmobile Shop Notes for Clutch Housing Reinforcing Plate data.*

TRANSMISSION (STD.):—**Own Make.** All helical gear, constant-mesh, synchro-mesh (second & high), sliding gear (low & reverse) with new remote shift.
G-40 Note—First 6488 cars use 15" transmission extension (same as '39), later cars 11" extension.
See article in Mechanical Equipment Section for data.
Transmission Control:—Oldsmobile 'Handi-shift' type.
See article in Mechanical Equipment Section for data.
Removal:—Disconnect shift and selector rods and speedometer cable at transmission. Disconnect rear universal and slide propeller shaft and slip yoke to rear. Remove 4 transmission mounting bolts, pull transmission straight back and lift out.

HYDRA-MATIC DRIVE (OPTL.):—**Own Make**—Consists of fluid coupling & automatic transmission.
See article in Mechanical Equipment Section for data.

UNIVERSAL JOINTS:—**Mechanics 2C.** Roller bearing.
See article in Mechanical Equipment Section for data.
NOTE—Slip joint formed at rear of transmission ahead of front universal (driveshaft solid type).

REAR AXLE:—**Own Make.** Semi-floating, hypoid gear type with torque taken through 2 support arms.
See article in Mechanical Equipment Section for data.
Ratio—4.1-1 (F40), 4.3-1 (G40), 4.55-1 (Optl). Ring gear ratio stamped on top side of carrier.
Backlash—.004-.008". Screw adjustment.
Removal:—Disconnect drive shaft at rear universal, (do not disengage spline joint at transmission), remove axle shafts (see below), remove capscrews on carrier flange, pull carrier assembly out.
Axle Shaft Removal:—Hoist rear end, remove wheel, brake drum, backing plate mounting nuts, static collector and loosen bearing retainer (do not allow backing plate to shift to damage brake line). Pull shaft and bearing with puller J-942 (do not allow shaft to drag on oil seal), replace one backing plate nut. **Wheel Bearing Adjustment**—None.
Rear Suspension:—Quadri-coil type (support arms).
See article in Mechanical Equipment Section for data.

SHOCK ABSORBERS:—**Delco. Front**—Model 1947-C (right), 1947-D (left). **Rear**—1754-L (right), 1754-M (left). Double acting, hydraulic types.
See article in Mechanical Equipment Section for data.

STEERING:—**Steering Gear**—Saginaw Worm-and-Double roller type.
See article in Mechanical Equipment Section for data.
Front Suspension:—Independent, linked parallelogram type with coil springs.
See article in Mechanical Equipment Section for data.
Kingpin Inclination—4°51'10".
Caster—0-¾° negative. Adjustable.
Camber—Negative ¼° to Pos. ¾°. Adjustable.
Toe In—1/16-⅛". Adjust each tie rod.
Steering Geometry (Toe-out on Turns)—Inner wheel turned 23° ± ½°. Outer wheel 20°.

BRAKES:—**Service.** Bendix hydraulic, duo-servo, single anchor type without eccentric adjustment. Hand lever applies rear wheel service brakes.
See article in Mechanical Equipment Section for data.
Wheel Cylinder Bore—Front wheel 1 3/32". Rear 1".
Drums—Cast-iron. Diameter—11".
Lining—Molded. Width 1¾". Thickness 3/16". Length—Primary Shoe 9 11/32", Secondary 11 31/32".
Clearance—.015" both ends of secondary shoe (with primary shoe forced out against drum).
Hand Brake:—See Service Brakes above.

HOOD LOCK, FRONT END SHEET METAL ASSEMBLY AND OIL PAN REMOVAL:—*See Oldsmobile Shop Notes.*

SERIAL NUMBER:—On left frame side member under hood. First number L-242001 (Lansing, Mich), CL-190501 (California), LL-202001 (Linden, N. J).

ENGINE NUMBER:—First number L-334001, LR-1801 (RHD) On left side of engine behind water pump. **Hydra-matic Drive Cars**—Carry prefix 'LA'.

ENGINE SPECIFICATIONS:—8 cylinder, 'L' head. **Bore**—3¼". **Stroke**—3⅞" **Displacement**—257 1 cu ins **Rated HP**—33 8 **Developed Horsepower**—110 HP (Std. Hd.), 105 HP (Optl. LC Hd) at 3600 RPM. **Compression Ratio**—6 2-1 Std 5 8-1 Optl. LC Hd **Compression Pressure**—152 lbs (Std Hd.), 145 lbs (Optl LC Hd) at 1000 RPM or approximately 104-114 lbs at cranking speed for Std. head **Vacuum Reading**—Steady 17" min at 6 MPH *See Oldsmobile Shop Notes for Cylinder Head servicing.*

PISTONS:—Aluminum alloy, T-slot, cam ground type with hard oxide bearing surface **Weight**—16 ozs (stripped) **Length**—3 15/16". **Removal**—Pistons and rods removed from above. **Clearance**—Top .026" Skirt .0013-.0018". **Replacement Pistons:**—Finished pistons (pins fitted) .003", .005", .010", .015", .030" oversize Same wt as std **Fitting New Pistons:**—Check piston for size with micrometer (pin removed) 90° from pin bosses ⅜" below lower ring groove and ⅜" from bottom of skirt Insert .002" X ½" feeler between piston (pin removed) and cylinder wall on valve side with piston inverted and T-slot on opposite side from feeler Pull to withdraw feeler must be 4 to 11 lbs (piston and block at 70°F —low lbs pull below 70°, high lbs above). **Installing Pistons**·—Mark 'V-S' on head toward valves (slot away from valves) Pin hole offset 3/32" to left

PISTON RINGS·—2 compression (tapered, O D .001" larger at bottom), 2 oil control rings per piston, all above pin Both oil ring grooves drilled for oil drains All rings are coated. NOTE—Install compr rings with mark TOP up.

Ring	Width	End Gap	Side Clearance
Compr.	.0925-.0935"	.009-.014"	.001-.003"
Oil Cont	.1860-.1865"	.009-.014"	.001-.0025"

Replacement Rings:— .010", .020", .030" oversize.

PISTON PIN:—**Diameter**— .8554-.8557" **Length** 2 31/32". Pin locked in one piston boss by lockscrew (opposite end slotted). Pin bosses are plated and must not be reamed Standard size pins only serviced. **Pin Fit in Piston**— .0001" loose to .0002" tight (plain boss end), .0002-.0005" tight (lock boss end). **Pin Fit in Rod Bushing**— .0003-.0006" clearance. *See Oldsmobile Shop Notes for Pin Fitting directions.*

CONNECTING ROD:—**Length**—7 13/16". **Weight**—28 0 ozs (complete except less bearing inserts). **Crankpin Journal Diameter**—2.123-2.124". **Lower Bearing**—Removable steel-backed, babbitt. Tangs on shells seat in notches on rod and cap. **Clearance**— .0005-.0025" **Sideplay**— .0055-.0105". **Bearing Adjustment:**—None Replace bearings **Installing Rods:**—Oil spit hole at lower end toward valves and grooves on rod and cap bolt bosses (part number side) matched Special ground bolts used *See Oldsmobile Shop Notes for Connecting Rod Bolt Nut change and installation data.*

CRANKSHAFT:—5 bearing, 8 integral counterweights **Journal Diameters:**—#1, 2.478-2.479"; #2, 2.5405-2.5415"; #3, 2.603-2.604"; #4, 2.6655-2.6665"; #5, 2.6855-2.6865" **Bearings**—Removable, steel-backed, babbitt Upper and lower halves interchangeable except #1 (front). **Clearance**—.0005-.002" (rear), .001-.003" (all others). **Bearing Adjustment:**—None (no shims). Replace bearings Do not file caps **Endplay**—.004-.008". *See Oldsmobile Shop Notes for Main Bearing Removal, End Thrust and Oil Seal data.*

CAMSHAFT:—5 bearing. Non-adjustable chain drive. **Journal Diameters**—#1, 2.0600-2.0595", #2, 1.9975-1.9970"; #3, 1.9350-1.9345"; #4, 1.8725-1.8720"; #5, 1.8100-1.8095". **Bearings**—Bronze bushings. **Clearance** .0015-.0035". **End Thrust:**—Spring-loaded steel plunger in front end of camshaft bears against steel plate on chain cover. **Camshaft Setting:**—Mesh chain with sprocket marks adjacent and in line with a straightedge across the shaft centers (or use Tool HM-408-0) **Timing Chain:**—Link Belt No. 365. Width 1". Pitch .500". Length 47 links or 23½".

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1 9/16"	.3415-.3425"	5 51/64"
Exhaust	1 27/64"	.3410-.3418"	5 61/64"
	Seat Angle	**Lift**	**Stem Clearance**
Intake	30°	.286"	.00175-.00375"
Exhaust	45°	.313"	.00245-.00425"

Tappet Clearance:—.008"Int , .011"Exh. Engine warm NOTE—Self-locking tappet screws are used. *See Oldsmobile Shop Notes for Fender Plate removal.* **Valve Guides:**—Intake and exhaust guides same. Press guides in so top end ⅞" below top of block (Tool J-1042 positions guide correctly in block). Ream to .34425-.34525" inside diam. (no taper).

Valve Springs:—Same spring used on both valves and on Six and Eight engines Damper used in top of each spring

	Spring Pressure	Spring Length
Valve Closed	50½ lbs	2¼"
Valve Open	95½ lbs	1 15/16"

Valve Lifters:—Mushroom type Lifter holes in block Body Diam. .6235-.6240". Furnished .001", .0015", .002", .005", .010" oversize **Clearance**— .0003-.0007". NOTE—Lifter holes have bearing-ized finish. Fit lifters without reaming holes wherever possible **Valve Timing:**—See Camshaft Setting above **Intake Valves**—Open at TDC Close 35° ALDC. **Exhaust Valves**—Open 45° BLDC Close 10° ATDC. **Valve Timing Check**—With .0124" tappet clearance #1 intake valve should open with piston at top dead center (.000") when flywheel mark 'TDC/' (NOT steel ball insert) lines up with pointer (inspection left face of housing). Reset tappet clear. .008" hot.

LUBRICATION:—Pressure (gear type pump on right of engine) *See Oldsmobile Shop Notes for Oil Pump data.* **Normal Oil Pressure:**—28-33 lbs **Oil Pressure Regulator:**—On pump, opens at 27 lbs Non-adjustable type. **Crankcase Capacity:**—6 quarts

COOLING SYSTEM:—**Capacity**—21 quarts. **Water Pump:**—Packless, sealed ball-bearing type. *See article in Mechanical Equipment Section for data.* **Removal**—Remove fan belt, 3 pump mounting cap-screws, and lower radiator hose Lift pump out. **Thermostat:**—Harrison In cylinder head outlet. **Setting**—Starts to open at 152°F. Fully open 173°. **Temperature Gauge:**—AC Electric #1510918 (dash), #1510772 (engine unit) *See article in Mechanical Equipment Section for data.*

CLUTCH (STD. TRANS.):—**Borg & Beck 10A7 with 'Borglite' driven member.** Marked #927 on cover Single plate, dry disc type with sheet metal pressure plate baffle **Hydra-matic Drive Car Note**—No clutch used. *See article in Mechanical Equipment Section for data.* **Facings**—Spiral wound (spirally grooved) molded woven, 2 used. Inside Diam. 7". O D. 10". ⅛" thick. **Pedal Adjustment:**—Free travel 1-1½" (adjusting clevis and locknut on link at clutch fork). **Removal:**—Remove transmission (see following), clutch underpan and reinforcing plate. Take out 6 mounting screws in clutch cover. NOTE—Use 2 long shank mounting screws in second hole on each side of locating dowel. *See Oldsmobile Shop Notes for Clutch Housing Reinforcing Plate data.*

TRANSMISSION (STD.):—**Own Make.** All helical gear, constant-mesh, synchro-mesh (second & high), sliding gear (low & reverse) with new remote shift. *See article in Mechanical Equipment Section for data.* **Transmission Control:**—Oldsmobile 'Handi-shift' type. *See article in Mechanical Equipment Section for data.* **Removal:**—Disconnect shift and selector rods and speedometer cable at transmission. Disconnect rear universal and slide propeller shaft and slip yoke to rear Remove 4 transmission mounting bolts, pull transmission straight back and lift out.

HYDRA-MATIC DRIVE (OPTL.):—**Own Make**—Consists of fluid coupling & automatic transmission. *See article in Mechanical Equipment Section for data.*

UNIVERSAL JOINTS:—**Mechanics 2C.** Roller bearing. *See article in Mechanical Equipment Section for data.* NOTE—Slip joint formed at rear of transmission ahead of front universal (driveshaft solid type).

REAR AXLE:—**Own Make.** Semi-floating, hypoid gear type with torque taken through 2 support arms. *See article in Mechanical Equipment Section for data.* **Ratio**—4 3-1 Std 4.55-1 Optl. Ring and pinion gear ratio stamped on upper outside of carrier. **Backlash**— .004-.008". Screw adjustment. **Removal:**—Disconnect drive shaft at rear universal, (do not disengage spline joint at transmission), remove axle shafts (see below), remove capscrews on carrier flange, pull carrier assembly out. **Axle Shaft Removal:**—Hoist rear end, remove wheel, brake drum, backing plate mounting nuts, static collector and loosen bearing retainer (do not allow backing plate to shift to damage brake line). Pull shaft and bearing with puller J-942 (do not allow shaft to drag on oil seal), replace one backing plate nut **Wheel Bearing Adjustment**—None. **Rear Suspension:**—Quadri-coil type (support arms). *See article in Mechanical Equipment Section for data.*

SHOCK ABSORBERS:—**Delco. Front**—Model 1947-C (right), 1947-D (left). **Rear**—1754-L (right), 1754-M (left) Double acting, hydraulic types. *See article in Mechanical Equipment Section for data.*

STEERING:—**Steering Gear**—Saginaw Worm-and-Double roller type. *See article in Mechanical Equipment Section for data.* **Front Suspension:**—Independent, linked parallelogram type with coil springs. *See article in Mechanical Equipment Section for data.* **Kingpin Inclination**—4°51'10". **Caster**—0-¾° negative. Adjustable. **Camber**—Negative ¼° to Pos. ¾°. Adjustable. **Toe In**—1/16-⅛". Adjust each tie rod. **Steering Geometry (Toe-out on Turns)**—Inner wheel turned 23° ± ½°. Outer wheel 20°.

BRAKES:—**Service.** Bendix hydraulic, duo-servo, single anchor type without eccentric adjustment. Hand lever applies rear wheel service brakes. *See article in Mechanical Equipment Section for data.* **Wheel Cylinder Bore**—Front wheel 1 3/32". Rear 1". **Drums**—Cast-iron. Diameter—11". NOTE—Drum turn down limit .030" cut. **Lining**—Molded. Width 1¾" Thickness 3/16". Length—Primary Shoe 9 11/32", Secondary 11 31/32". **Clearance**—.015" both ends of secondary shoe (with primary shoe forced out against drum) **Braking Power**—54½% front, 45½% rear. **Hand Brake:**—See Service Brakes above.

TORQUE WRENCH SPECIFICATIONS:—*See Torque Wrench article in Mechanical Equipment Section for tightening specifications for Cylinder Head, Main & Connecting Rod Bolts, etc.*

FRONT END REMOVAL:—For work on front of engine, remove radiator and fender assembly as a unit as follows: drain cooling system, remove fender-to-body bolts, fender-to-running board bolts, fender to brace bolts, disconnect radiator hoses, free radiator tie rods, free radiator anchor bolt on frame remove running board molding from fender and lift entire assembly off.

ORIGINAL BORE & PISTON SIZES:—Piston size indicated by mark stamped on head of each piston. Cylinder bore size indicated by mark stamped on top left face of cylinder block at Cylinder #4 (Six), #8 ('120' Eight), #1 (Super Eight). Piston and cylinder marks should correspond (AA piston in AA bore, etc.) as shown in following tables:

'110' SIX, '160' AND '180' SUPER EIGHT

Mark	Piston Size	Cylinder Size
AA	3.49825-3.49850"	3.49950-3.49975"
A	3.49850-3.49875"	3.49975-3.50000"
BB	3.49875-3.49900"	3.50000-3.50025"
B	3.49900-3.49925"	3.50025-3.50050"
CC	3.49925-3.49950"	3.50050-3.50075"
C	3.49950-3.49975"	3.50075-3.50100"
DD	3.49975-3.50000"	3.50100-3.50125"
D	3.50000-3.50025"	3.50125-3.50150"

'120' EIGHT

Mark	Piston Size	Cylinder Size
AA	3.24825-3.24850"	3.24950-3.24975"
A	3.24850-3.24875"	3.24975-3.25000"
BB	3.24875-3.24900"	3.25000-3.25025"
B	3.24900-3.24925"	3.25025-3.25050"
CC	3.24925-3.24950"	3.25050-3.25075"
C	3.24950-3.24975"	3.25075-3.25100"
DD	3.24975-3.25000"	3.25100-3.25125"
D	3.25000-3.25025"	3.25125-3.25150"

CYLINDER HEADS (ALL MODELS):—Cast iron heads used on all models. Each head marked by part number on front end (and letters 'HC' for optional high compression heads).

Car	Standard	High Compression
Six	354122	354675
Eight	348200	351243
Super 8	341586	351254

Head Installation—Coat both sides of gasket with good grade of gasket paste (not necessary on Packard service gaskets which are supplied coated). See Cylinder Head Tightening data pages in Mechanical Equipment Section for tightening order and tension. Coat studs with grease and tighten stud nuts cold. Recheck tension figures when warm.

REPLACEMENT PISTONS:—Finished Autothermic, Cam-ground, Tin-plated type pistons (as furnished for installation on 1940 and previous car models) are stamped on head with decimal figure (.005, .010, etc.) indicating nominal oversize and one or two letters (AA, A, BB, B, CC, C, DD, D) which indicates the actual variation of the piston (in .00025" steps) from indicated nominal oversize. See oversizes listed below and size variations for each letter (in table).

This system of marking makes it possible to order a finished piston (using number and letter) for any particular finished bore size within these limits.

Piston Oversizes (Figures Stamped on Piston Head)—Standard size and .005", .010", .020", .030", .040" oversize. See Piston Variation in table below for size variation indicated by letter.

Piston Variation
(Letters Stamped on Piston Head)
For All Models and Piston Oversizes

AA—.00025" Under marked size.
A—Same as marked size.
BB—.00025" Over marked size.
B—.0005" Over marked size.
CC—.00075" Over marked size.
C—.001" Over marked size.
DD—.00125" Over marked size.
D—.0015" Over marked size.

PISTON PIN BUSHING (ALL MODELS):—Formed by two split type bushings pressed in rod eye from opposite sides so as to form oil groove in center. Rifle-drilled oil passage in rod must open into this groove. New bushings should be burnished (Packard Tool ST-5008)—(grind pilot end of tool to diameter of .861" so that it will enter 1939-40 type bushings) and then ream bushing to size for correct fit.

CONNECTING ROD 'PALNUTS' (SIX & EIGHT):—Special patented self-locking locknuts are used on connecting rod bolt nuts in place of cotter pins. To install, turn regular connecting rod bolt up to desired point (see Tightening Specifications in Mechanical Equipment Section). Turn 'Palnut' on bolt (smooth side toward regular nut) until it contacts nut, then tighten Palnut ¼-⅓ additional turn to lock it in place.

OIL PUMP INSTALLATION (ALL MODELS):—Install pump with driving slot as near parallel as possible to center-line of camshaft with distributor rotor in line with #1 segment in cap. Punch mark on pump gear should be at the bottom (Six), at the top (Eight and Super 8). Recheck ignition timing.

SERIAL NUMBER:—On left side of cowl (use Eng No.).

ENGINE NUMBER:—First number C-1501. On left side of block between #1 & #2 cylinders.

ENGINE SPECIFICATIONS:—6 cylinder, 'L' head type. **Bore**—3½". **Stroke**—4¼".
Displacement—245 3 cu ins **Rated HP**—29 4.
Developed Horsepower—100 HP (Std. 6 39-1 head), 103-105 HP (Optl 6 71-1 head) at 3200 RPM.
Compression Ratio and Pressure:—As follows: 6 39-1 Std cast-iron head—110 lbs. at 125 RPM
6 71-1 Optl. HC cast-iron hd —118 lbs. at 125 RPM.
Vacuum Reading—Steady 18-21" idling at 6 MPH.
See Packard Shop Notes for Cylinder Head data.

PISTONS:—Nelson Bohnalite, aluminum alloy, autothermic, strut type, tin plated, cam ground type.
Weight—20¼ ozs (stripped), 26½ (with rings & pin).
Length—3⅞".
Removal—Pistons and rods removed from above
Clearance— 0005- 001" See Fitting Pistons
Original Bore & Piston Sizes, Replacement Pistons:—*See Packard Shop Notes for complete data.*
Fitting New Pistons:—Insert 0015" feeler ½" wide between piston and cylinder wall on side opposite slot. Pull to withdraw feeler should be 12-18 lbs.
Installing Pistons:—Slot toward valves

PISTON RINGS:—2 coated compression (Perfect Circle #200, No 1 upper inner edge beveled, #70 No 2), 1 oil cont. (X90-85 expander type), all above pin.

Ring	Width	End Gap	Side Clearance
Comp (#1)	0930- 0935"	007- 017"	0025-.003"
Comp (#2)	.1240- 1235"	007.-017"	0025-.003"
Oil Cont.	1860- 1865"	007- 015"	0015-.002"

Replacement Rings:—Furnished standard size and 005", 010", 020", 030", 040" oversize

PISTON PIN:—**Diameter**—⅞". **Length**—3 1/64".
Pin floats in piston and rod, held by locking rings
Pins furnished Std and 003", 006" oversize
Pin Fit in Piston—Finger push fit with piston heated to 160° F.
Pin Fit in Rod Bushing—Finger push fit at 70° F.

CONNECTING ROD:—**Length** 7 11/16". **Weight** 31 60 ozs
Upper Bearing (Piston Pin Bushing)—Split type.
See Packard Shop Notes for complete data.
Crankpin Journal Diameter—2 3/32"
Lower Bearing—Interchangeable steel-backed, babbitt-lined Bearings furnished standard and 001", 002", 003", .015" undersize
Clearance— 0005- 0015" **Endplay**— 004- 010".
Bearing Adjustment:—None (no shims). Replace bearings Do not file rods or caps *See Packard Shop Notes for 'Palnut' installation data.*
Installing Rods:—Oil squirt hole toward camshaft

CRANKSHAFT:—4 bearings, 6 integral counterweights and rubber friction disc vibration damper.
Journal Diameters—2¾"
Bearings—Interchangeable steel-backed, babbitt-lined Furnished std , 001", 002" undersize
Clearance— 001- 003".
Bearing Adjustment:—None (no shims). Replace bearings (upper half can be 'rotated' in or out). Do not file caps
End Thrust:—Taken by front (#1) bearing
Endplay— 003- 008"

CAMSHAFT:—4 bearing Non-adjustable chain drive
Bearing Type—Steel-backed, babbitt-lined
Clearance— 001- 003"
End Thrust:—Taken by thrust plate in back of camshaft sprocket **Endplay**— 002- 004"
Timing Chain:—Morse Type C-3682R (#1525) or Ramsey Width 1¼" Pitch 375" Length 21¾" or 58 links Same as 1939
Camshaft Setting:—Install chain and sprockets together with '0' marks on sprockets adjacent and in line with a straightedge across the shaft centers
See Packard Shop Notes for Radiator & Fender (unit) removal for work on front end of engine.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1 17/32"	34025"	5⅝"
Exhaust	1⅜"	34025"	5⅝"

	Seat Angle	Lift	Stem Clearance
Intake	30°	318"	001- 003"
Exhaust	45°	3175"	.003- 005"

Tappet Clearance:— 007" Int , 010" Exh. (hot & idling) NOTE—Self-locking tappet screw used Remove right front fender plate for access to valves.
Valve Guides:—Pressed in block from above with upper end 31/32" below valve seat Exhaust guides counter-bored on upper inner diameter
Valve Springs:—Intake and exhaust springs interchangeable

	Spring Pressure	Length
Valve Closed	47-52 lbs	1⅝"
Valve Open	114-124 lbs	1 5/16"

NOTE—Serrated washer installed on top of spring.
Valve Lifters:—New larger (diameter ⅝") mushroom type Remove from below with camshaft out Service by reaming (work through valve guide using ST-5144—23/32") and installing oversize lifters furnished 001", 002", 005" oversize
Diameter— 6235- 6240" **Clearance**— 0003- 0012".
NOTE—1939 tool (ST-5101) cannot be used
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 1° BTDC Close 39° ALDC
Exhaust Valves—Open 45° BLDC Close 5° ATDC.
To Check Timing—With 0125" tappet clearance #1 intake valve should open with #1 piston 1° or 0004" BTDC when 1° point on flywheel (½ graduation before '1 UP DC' mark) lines up with pointer in inspection hole in flywheel housing below starter (left side) Permissible variation plus or minus 2 graduations Reset tappet cl at 007" (hot & idling).

LUBRICATION:—Gear type pump on right of engine
See Packard Shop Notes for Oil Pump installation.
Normal Oil Pressure:—45 lbs at 45 MPH
Oil Pressure Relief Valve:—Mounted on pump cover Not adjustable Spring pressure should be 14 lbs plus or minus 2 ounces at 1⅞"
Crankcase Capacity:—5 quarts (refill)

COOLING SYSTEM:—**Capacity**—17 quarts
Water Pump:—Packless type with ball-bearing shaft
See article in Mechanical Equipment Section for data.
Removal—Remove fan belt, disconnect pump hose, take out pump mounting screws, lift out pump
Thermostat:—Harrison In cylinder head outlet Starts to open at 145° F

CLUTCH:—**Long Model 9½ CF-CS.** Semi-centrifugal, single plate, dry disc type
NOTE—Borg & Beck Model 10A7 (marked #948) Single plate, dry disc type with 'Borglite' driven member used on early cars
See article in Mechanical Equipment Section for data.
Facings (Long)—Spiral or chevron wound woven, US Asbestos No 1133G 2 used Inside Diam 6". Outside Diam 9½" Thickness 125"
Adjustment:—Adjust nut on pedal rod (at clutch fork) for 1½-2" pedal free movement
Removal:—Remove transmission (see Transmission Removal following) and flywheel housing lower cover Disconnect and remove pedal rod, clutch throw-out bearing Remove clutch cover screws and remove assembly from below

TRANSMISSION:—**Own Make.** Constant-mesh helical, ball-bearing mounted low speed gear (sliding spur gear for reverse) Synchro-mesh (second and high)
See article in Mechanical Equipment Section for data.
Econo-Drive Transmission:—New Warner-Packard type (Warner model AS1-R9) overdrive unit with electrical control Optional equipment on all cars
See article in Mechanical Equipment Section for data.
Transmission Control:—Own Remote Control type.
See article in Mechanical Equipment Section for data.
Removal:—Disconnect shifter rods, speedometer cable, hand brake cable at equalizer, engine ground strap, overdrive cable and solenoid wires (if used), front universal (block drive shaft up against floor pan) and rubber bearing at rear of overdrive. Support rear of engine with jack and unbolt cross member (at frame ends and flywheel housing lower cover). Disconnect clutch retractor spring and fore and aft restraint rod Take out transmission-to-flywheel housing mounting screws and remove assembly from car.

UNIVERSAL JOINTS:—**Mechanics.** Model 2C (Std.), 3C (with Econo-Drive). Needle bearing type. 2 used.
See article in Mechanical Equipment Section for data.
CAUTION—Rear universal flange controls pinion bearing pre-load. See Packard Rear Axle article in Mechanical Equipment Section for data.

REAR AXLE:—**Own Make.** Semi-floating, hypoid gear type with Hotchkiss drive Cover welded.
NOTE—Axle bearings not interchangeable with 1700 cars.
See article in Mechanical Equipment Section for data.
Ratio—4 36-1 Std , 4 55-1 with Econo-Drive trans'm.
Backlash— 003- 005". Screw adjustment.
Removal:—Remove wheel, hub, and brake backing plate assembly. Withdraw axle shafts. Disconnect rear universal joint and drop drive shaft Remove carrier-to-housing bolt nuts, withdraw carrier.
Wheel Bearing Adjustment—Endplay controlled by shims between flanged end of housing and brake backing plate Unbolt backing plate and clips holding brake tube to housing. Add or remove shims (endplay up to 050" can be adjusted at one wheel).
Endplay— 004- 007".

SHOCK ABSORBERS:—

	Front	Rear
Domestic	Delco 2206-A,B	Monroe 347416
Exp & Spec	Delco 2206-A,B	Delco 1130-W

Front shocks are parallel cylinder type Rear shocks are direct acting (adjustable type Delco).
See articles in Mechanical Equipment Section for data.
NOTE—No Fifth Shock Absorber used.

STEERING:—**Steering Gear**—Packard (Gemmer design) Worm-and-Roller type with center steering
See article in Mechanical Equipment Section for data.
Front Suspension:—Independent 'Safe-T-fleX' type with coil springs
See article in Mechanical Equipment Section for data.
NOTE—Frame height must be set first before checking Caster and Camber.
Frame Height—With car on level floor, distance from floor to top of frame side rail at front wheel center-line 18⅝" (load car until figure correct).
Kingpin Inclination—1°54' crosswise.
Camber—Pos. ½° (plus ¾°, minus 0°). Adjustable.
Caster—Pos. 1½° ± ½° Shim adjustment
Toe In—0" (+1/16", —0") at hub height Turn both tie rods equally (must be equal after adjusting).
Steering Geometry (Toe-out on Turns)—Inner wheel turned 23° Outer wheel 20°.

BRAKES:—**Service.** Bendix hydraulic, duo-servo, single anchor type without eccentric adjustment. Hand lever applies rear wheel service brakes.
See article in Mechanical Equipment Section for data.
Drums—Centrifuse Diameter—11"
Lining—Moulded Width 1¾". Thickness 3/16". Length per shoe 10⅝" (primary), 12" (secondary).
Clearance—.015" at both ends of secondary shoe with primary shoe forced out against drum.
Hand Brake:—See Service Brakes (above).

SERIAL NUMBER:—On left side of cowl (use Eng. No.).
ENGINE NUMBER:—First number C-300001. On left side of block between #1 & #2 cylinders.
ENGINE SPECIFICATIONS:—8 cylinder, 'L' head type.
Bore—3¼". **Stroke**—4¼".
Displacement—282.04 cu. ins. **Rated HP**—33.8.
Developed Horsepower—120 (Std. hd.) at 3600 RPM.
Compression Ratio—6.41-1 Std., 6.85-1 Optl. CI hds.
Compression Pressure—110 lbs. (Standard 6.41-1 hd.), 118 lbs. (Optl. 6.85-1 head) at 125 RPM.
Vacuum Reading—Steady 18-21" idling at 6 MPH.
See Packard Shop Notes for Cylinder Head data.

PISTONS:—Nelson Bohnalite, aluminum alloy, autothermic, strut type, tin plated, cam ground type.
Weight—17¼ ozs. stripped, 23⅛ with rings & pin.
Length—3⅞".
Removal—Pistons and rods removed from above.
Clearance—.0005-.001". See Fitting Pistons.
Original Bore & Piston Sizes, Replacement Pistons:—***See Packard Shop Notes for complete data.***
Fitting New Pistons:—Insert .0015" feeler ½" wide between piston and cylinder wall on side opposite slot. Pull to withdraw feeler should be 12-18 lbs.
Installing Pistons:—Slot toward valves.

PISTON RINGS:—2 coated compression (Perfect Circle #200, No. 1 upper inner edge beveled, #70 No. 2), 1 oil cont. (X90-85 expander type), all above pin.

Ring	Width	End Gap	Side Clearance
Comp. (#1)	.0930-.0935"	.007-.017"	.0025-.003"
Comp. (#2)	.1240-.1235"	.007-.017"	.0025-.003"
Oil Cont.	.1860-.1865"	.007-.015"	.0015-.002"

Replacement Rings:—Furnished standard size and .005", .010", .020", .030", .040" oversize.

PISTON PIN:—**Diameter**—⅞". **Length**—2 51/64".
Pin floats in piston and rod, held by locking rings. Pins furnished Std. and .003", .006" oversize.
Pin Fit in Piston—Finger push fit with piston heated to 160° F.
Pin Fit in Rod Bushing—Finger push fit at 70° F.

CONNECTING ROD:—**Length** 7 11/16". **Weight** 31.60 ozs.
Upper Bearing (Piston Pin Bushing)—Split type.
See Packard Shop Notes for complete data.
Crankpin Journal Diameter—2 3/32".
Lower Bearing—Interchangeable steel-backed, babbitt-lined. Bearings furnished standard and .001", .002", .003", .015" undersize.
Clearance—.0005-.0015". **Endplay**—.004-.010".
Bearing Adjustment:—None (no shims). Replace bearings. Do not file rods or caps. ***See Packard Shop Notes for 'Palnut' installation data.***
Installing Rods:—Oil squirt hole toward camshaft.

CRANKSHAFT:—5 bearings, 8 integral counterweights and rubber friction disc vibration dampener.
Journal Diameters—2¾".
Bearings—Interchangeable steel-backed, babbitt-lined. Furnished std., .001", .002" undersize.
Clearance—.001-.003".
Bearing Adjustment:—None (no shims). Replace bearing (upper half can be 'rotated' in or out).
End Thrust:—By #3 bearing. **Endplay**—.003-.008".

CAMSHAFT:—5 bearing. Non-adjustable chain drive.
Bearing Type—Steel-backed, babbitt-lined.
Clearance—.001-.003".
End Thrust:—Taken by thrust plate in back of camshaft sprocket. **Endplay**—.002-.004".
Timing Chain:—Morse Type C-3682R (#1525) or Ramsey. Width 1¼". Pitch .375". Length 21¾" or 58 links. Same as 1939.
Camshaft Setting:—Install chain and sprockets together with '0' marks on sprockets adjacent and in line with a straightedge across shaft centers with #1 piston on top dead center.
See Packard Shop Notes for Radiator & Fender (unit) removal for work on front of engine.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1 31/64"	.34025"	5⅝"
Exhaust	1⅜"	.34025"	5⅝"

	Seat Angle	Lift	Stem Clearance
Intake	30°	.318"	.001-.003"
Exhaust	45°	.3175"	.003-.005"

Tappet Clearance:—.007" Int., .010" Exh. (hot & idling). NOTE—Self-locking tappet screw used. Remove right front fender plate for access to valves.
Valve Guides:—Pressed in block from above with upper end 31/32" below valve seat. Exhaust guides counter-bored on upper inner diameter.
Valve Springs:—Intake and exhaust springs interchangeable.

	Spring Pressure	Length
Valve Closed	47-52 lbs.	1⅝"
Valve Open	114-124 lbs.	1 5/16"

NOTE—Serrated washer installed on top of spring.
Valve Lifters:—New larger (diameter ⅝") mushroom type. Remove from below with camshaft out. Service by reaming (work through valve guide using ST-5144—23/32") and installing oversize lifters furnished .001", .002", .005" oversize.
Diameter—.6235-.6240". **Clearance**—.0003-.0012".
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 1° BTDC. Close 39° ALDC.
Exhaust Valves—Open 45° BLDC. Close 5° ATDC.
To Check Timing—With .0125" tappet clearance #1 intake valve should open with #1 piston 1° or .0004" BTDC when 1° point on flywheel (½ graduation before '1 UP DC' mark) lines up with pointer in inspection hole in flywheel housing below starter (left side). Permissible variation plus or minus 2 graduations. Reset tappet cl. at .007" (hot & idling).

LUBRICATION:—Gear type pump on right of engine.
See Packard Shop Notes for Oil Pump installation.
Normal Oil Pressure:—45 lbs. at 45 MPH.
Oil Pressure Relief Valve:—Mounted on pump cover. Not adjustable. Spring pressure should be 14 lbs. plus or minus 2 ounces at 1⅞".
Crankcase Capacity:—6 quarts (refill).

COOLING SYSTEM:—**Capacity**—18 quarts.
Water Pump:—Packless type with ball-bearing shaft.
See article in Mechanical Equipment Section for data.
Removal—Remove fan belt, disconnect pump hose, take out pump mounting screws, lift out pump.
Thermostat:—Harrison. In cylinder head outlet (1801) in radiator top tank controlling shutters (1801A). Starts to open at 145° F.

CLUTCH:—**Long Model 10CF-CI.** Semi-centrifugal, single plate, dry disc type.
NOTE—Borg & Beck Model 10A7 (marked #922) Single plate, dry disc type with 'Borglite' driven member used in early cars.
See article in Mechanical Equipment Section for data.
Facings (Long)—Spiral or chevron wound woven, US Asbestos No. 1133G, 2 used. Inside Diam. 6". Outside Diam. 10". Thickness .125".
Adjustment:—Adjust nut on pedal rod (at clutch fork) for 1½-2" pedal free movement.
Removal:—Remove transmission (see Transmission Removal following) and flywheel housing lower cover. Disconnect and remove pedal rod, clutch throw-out bearing. Remove clutch cover screws and remove assembly from below.

TRANSMISSION:—**Own Make.** Constant-mesh, helical, ball-bearing mounted low speed gear (sliding spur gear for reverse). Synchro-mesh (second and high). ***See article in Mechanical Equipment Section.***
Econo-Drive Transmission:—New Warner-Packard type (Warner model AS1-R9) overdrive unit with electrical control. Optional equipment on all cars.
See article in Mechanical Equipment Section for data.
Transmission Control:—Own Remote Control type.
See article in Mechanical Equipment Section for data.
Removal:—Disconnect shifter rods, speedometer cable, hand brake cable at equalizer, engine ground strap, overdrive cable and solenoid wires (if used), front universal (block drive shaft up against floor pan) and rubber bearing at rear of overdrive. Support rear of engine with jack and unbolt cross member (at frame ends and flywheel housing lower cover). Disconnect clutch retractor spring and fore and aft restraint rod. Take out transmission-to-flywheel housing screws, remove assembly.

UNIVERSAL JOINTS:—**Mechanics Model 3C.** Needle bearing type. Two used.
See article in Mechanical Equipment Section for data.
CAUTION—Rear universal flange controls pinion bearing pre-load. See Packard Rear Axle article in Mechanical Equipment Section for data.

REAR AXLE:—**Own Make.** Semi-floating, hypoid gear type with Hotchkiss drive. Cover welded.
See article in Mechanical Equipment Section for data.
Ratio—1801—4.09-1 Std., 4.36-1 with Econo-Drive transmission. 1801A Comm'l—4.7-1 Std.
Backlash—.003-.005". Screw adjustment.
Removal:—Remove wheel, hub, and brake backing plate assembly. Withdraw axle shafts. Disconnect rear universal joint and drop drive shaft. Remove carrier-to-housing bolt nuts, withdraw carrier.
Wheel Bearing Adjustment—Endplay controlled by shims between flanged end of housing and brake backing plate. Unbolt backing plate and clips holding brake tube to housing. Add or remove shims **Endplay**—.004-.007".

SHOCK ABSORBERS:—

	Delco Front	Rear
1801 Domestic	2206-A,B	1001-V
1801 Exp. & Spec.	2206-A,B	1130-W
1801A Comm'l	1966-C,D	1751-M,Z

Parallel cylinder type (2206-A,B), Direct Acting (1001-V). Direct Acting Adjustable (1130-W), Double Acting (1966-C,D & 1751-M,Z).
Fifth Shock Absorber (Stabilizer):—Houdaille Model NFT. Double acting, hydraulic, adjustable type.
See articles in Mechanical Equipment Section for data.

STEERING:—**Steering Gear**—Packard (Gemmer design) Worm-and-Roller type with center steering.
See article in Mechanical Equipment Section for data.
Front Suspension:—Independent 'Safe-T-fleX' type with coil springs.
See article in Mechanical Equipment Section for data.
NOTE—Frame height must be set first before checking Caster and Camber.
Frame Height—With car on level floor, distance from floor to top of frame side rail at front wheel center-line should be 18¾" (1801), 19¼" (1801A). Load car until this figure correct.
Kingpin Inclination—1°54' crosswise.
Camber—Pos. ½° (plus ¾°, minus 0°). Adjustable.
Caster—Pos. 1½° ± ½°. Shim adjustment.
Toe In—0" (+1/16", —0") at hub height. Turn both tie rods equally (must be equal after adjusting).
Steering Geometry (Toe-out on Turns)—Inner wheel turned 22°50'. Outer wheel 20°.

BRAKES:—**Service.** Bendix hydraulic, duo-servo, single anchor type (no eccentric adjustment on 1801). Hand lever applies rear wheel service brakes.
NOTE—Brakes on 1801A Heavy Duty Ambulance same as on Model 1803A (see next page).
See article in Mechanical Equipment Section for data.
Drums—Centrifuse. Diameter—12".
Lining—Moulded. Width 1¾" (1801), 2¼" (1801A). Thickness 3/16". Length per shoe—13" (except 1801 primary), 11½" (1801 primary).
Clearance—1801—.015" at both end of secondary shoe with primary shoe forced out against drum.
1801A—.010" at heel and toe of each shoe.
Hand Brake:—See Service brakes (above).

SERIAL NUMBER:—On left side of cowl (use Eng. No.).

ENGINE NUMBER:—First number C-500,051 (1803,4,5), CC-500,051 (1806,7,8). Stamped on left side of cylinder block between #3 and #4 cylinders.

ENGINE SPECIFICATIONS:—8 cylinder, 'L' head type. **Bore**—3½". **Stroke**—4⅝". **Displacement**—356 cu. ins. **Rated HP**—39.2. **Developed Horsepower**—160 at 3600 RPM (Std. hd.). **Compression Ratio**—6.45-1 Std. 6.85-1 Optl. CI hds. **Compression Pressure**—118 lbs. at cranking speed for standard head. **Vacuum Reading**—18½" steady idling at 6 MPH.

PISTONS:—Nelson Bohnalite, aluminum alloy, autothermic, strut type, tin plated, cam ground. **Weight**—20¼ ozs. (stripped), 26½ (with rings & pin). **Length**—3⅞". **Removal**—Pistons and rods removed from above. **Clearance**—.0005-.001". See Fitting Pistons.

Original Bore & Piston Sizes, Replacement Pistons:—*See Packard Shop Notes for complete data.*

Fitting New Pistons:—Insert .0015" feeler ½" wide between piston and cylinder wall on side opposite slot. Pull to withdraw feeler should be 12-18 lbs.

Installing Pistons:—Slot toward valves.

PISTON RINGS:—2 coated compression (Perfect Circle #200, No. 1 upper inner edge beveled, #70 No. 2), 1 oil cont. (X90-85 expander type), all above pin.

Ring	Width	End Gap	Side Clearance
Comp. (#1)	.0930-.0935"	.007-.017"	.0025-.003"
Comp. (#2)	.1240-.1235"	.007.-017"	.0025-.003"
Oil Cont.	.1860-.1865"	.007-.015"	.0015-.002"

Replacement Rings:—Furnished standard and .005", .010", .020", .030" and .040" oversize.

PISTON PIN:—**Diameter**—⅞. **Length**—3 1/64". Pin floats in piston and rod, held by locking rings. Furnished standard and .003", .006" oversize. **Pin Fit in Piston**—Finger push fit with piston heated to 160°F. **Pin Fit in Rod Bushing**—Finger push fit at 70°F.

CONNECTING ROD:—**Length**—9¼". **Weight**—42.0 ozs. **Upper Bearing (Piston Pin Bushing)**—Split type. *See Packard Shop Notes for complete data.* **Crankpin Journal Diameter**—2¼". **Lower Bearing**—Interchangeable steel-backed, babbitt lined type. Bearings furnished std. and .001", .002", .003", .015" undersize. **Clearance**—.0005-.0015". **Sideplay**—.004-.010".

Bearing Adjustment:—None (no shims). Replace bearings. Do not file rods or caps.

Installing Rods:—Oil squirt hole to camshaft.

CRANKSHAFT:—9 bearing type with 8 bolted-on counter-weights. Vibration dampener on front end. **Journal Diameters**—2¾". **Bearings**—Interchangeable steel-backed, babbitt-lined. Furnished std., .001", .002" undersize. **Clearance**—.001-.003".

Bearing Adjustment:—None (no shims). Replace bearings (upper half can be 'rotated' in or out). Do not file caps.

End Thrust:—Taken by #5 bearing. **Endplay** .003-.008".

CAMSHAFT:—8 bearing. Non-adjustable chain drive. **Bearing Type**—Steel-backed, babbitt-lined. **Clearance**—.001-.003".

End Thrust:—Taken by thrust plate behind camshaft sprocket. **Endplay**—.002-.004".

Timing Chain:—Morse Type C-3682R (#765) or Ramsey. Width 1¼". Pitch ⅜". Length 62 links or 23¼".

Camshaft Setting:—Install chain and sprockets together with '0' marks on sprockets adjacent and in line with a straightedge across the shaft centers. *See Packard Shop Notes for Radiator & Fender (unit) removal for work on front end of engine.*

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1 43/64"	.34025"	6 3/16"
Exhaust	1 7/16"	.34025"	6 3/16"

	Seat Angle	Lift	Side Clearance
Intake	30°	.340"	.001-.003"
Exhaust	45°	.340"	.003-.005"

Tappet Clearance:—None (automatic take-up used).

Valve Guides:—Straight reamed type pressed in block from above. Install with stepped end up (Intake), down (Exh) & top of guide 31/32" below valve seat.

Valve Springs:—Washer used on top of each spring.

	Spring Pressure	Length
Valve Open	147-157 lbs.	1 13/32"

Valve Lifters:—Wilcox-Rich 'Zero-lash' type hydraulic lifters (mushroom type). Remove from below with camshaft out. Service by reaming (use tool ST-5101, work through valve guide hole) and installing lifters furnished .001", .002", .005" oversize. **Diameter** .7177-.7182". **Clearance** .0002" selective. *See article in Mechanical Equipment Section for data.*

Valve Timing:—See Camshaft Setting above. **Intake Valves**—Open 4° BTDC. Close 51° ALDC. **Exhaust Valves**—Open 49° BLDC. Close 10° ATDC. **To Check Timing**—#1 exhaust valve closes 10° or .0438" after top dead center with hydraulic lifter dry (oil drained) and built up with shim stock for zero tappet clearance.

LUBRICATION:—Pressure system with gear type oil pump mounted on right side of engine. *See Packard Shop Notes for Oil Pump installation.* **Normal Oil Pressure:**—50 lbs. at 45 MPH.

Oil Pressure Relief Valve:—Mounted on pump cover. Not adjustable. Spring pressure should be 17½-18½ lbs. at 1⅞".

Crankcase Capacity:—7 quarts.

COOLING SYSTEM:—**Capacity**—20 quarts.

Water Pump:—Packless type with ball-bearing shaft. *See article in Mechanical Equipment Section for data.* **Removal**—Remove fan belt, disconnect pump hose, take out pump mounting screws, lift out pump.

Thermostat:—Harrison. In radiator top tank. Operates radiator shutters.

CLUTCH:—**Long Model 11CFS-CI.** Semi-centrifugal, single plate, dry disc type (riveted assembly). NOTE—Borg & Beck Model 11A6 (marked #944) Single plate dry disc type with 'Borglite' driven member used on early cars. *See article in Mechanical Equipment Section for data.* **Facings (Long)**—Ammco No. 8263M1, 2 used. Inside Diam. 6½". Outside Diam. 11". Thickness .125".

Adjustment:—Adjust nut on pedal rod (at clutch fork) for 1¾-2¼" pedal free movement.

Removal:—Remove transmission (see Transmission Removal following) and flywheel housing lower cover. Disconnect and remove pedal rod, clutch throw-out bearing. Remove clutch cover screws and remove assembly from below.

TRANSMISSION:—**Own Make.** Constant-mesh, helical, ball-bearing mounted low speed gear (sliding spur gear for reverse). Synchro-mesh (second and high). *See article in Mechanical Equipment Section.*

Econo-Drive Transmission:—New Warner-Packard type (Warner Model AS1-R9A) overdrive unit with electrical control. Optional. *See article in Mechanical Equipment Section for data.*

Transmission Control:—Own Remote Control type. *See article in Mechanical Equipment Section for data.*

Removal:—Disconnect shifter rods, speedometer cable, hand brake cable at equalizer, engine ground strap, overdrive cable and solenoid wires (if used), front universal (block drive shaft up against floor pan) and rubber bearing at rear of overdrive. Support rear of engine with jack and unbolt cross member (at frame ends and flywheel housing lower cover). Disconnect clutch retractor spring and fore and aft restraint rod. Take out transmission-to-flywheel housing screws, remove assembly.

UNIVERSAL JOINTS:—**Mechanics Model 3C.** Needle bearing type. 2 used. *See article in Mechanical Equipment Section for data.* CAUTION—Rear universal flange controls pinion bearing pre-load. See Packard Rear Axle article in Mechanical Equipment Section for data.

REAR AXLE:—**Own Make.** Semi-floating, hypoid gear type with Hotchkiss drive and special Ring Gear Support Roller. Cover is welded in place. *See article in Mechanical Equipment Section for data.*

Model	Ratios:— Std.	Econ-Dr.	Optl.
1803, 1806	3.92-1	4.36-1	4.09-1
1804, 1807	4.09-1	4.36-1	4.36-1
1805, 1808	4.36-1	4.54-1	4.54-1
1803A	4.54-1	4.7-1	4.7-1

Backlash—.003-.005". Screw adjustment.

Removal:—Remove wheel, hub, and brake backing plate assembly. Withdraw axle shafts. Disconnect rear universal joint and drop drive shaft. Remove carrier-to-housing bolt nuts, withdraw carrier. **Wheel Bearing Adjustment**—Endplay controlled by shims between flanged end of housing and brake backing plate. Unbolt backing plate and clips holding brake tube to housing. Add or remove shims (endplay up to .050" can be adjusted at one wheel). **Endplay**—.004-.007".

SHOCK ABSORBERS:—

	Front	Rear
1803,6	Delco 2206-A,B	Monroe 351194
" " Export	Delco 2206-A,B	Delco 1130-W
1804,5,7,8	Delco 1966-C,D	Delco 2007-G,H
1803A Comm'l	Delco 1966-C,D	Delco 1751-M,Z

Parallel cylinder type (2206-A,B). Double acting type (1966-C,D; 2007-G,H; 1751-M,Z). Direct acting type (Monroe 351194). Direct acting adjustable type (Delco 1130-W).

Fifth Shock Absorber (Stabilizer):—Houdaille Model NFT. Double acting, hydraulic, adjustable type. *See articles in Mechanical Equipment Section for data.*

STEERING:—**Steering Gear**—Packard (Gemmer design) Worm-and-Roller type with center steering. *See article in Mechanical Equipment Section for data.*

Front Suspension:—Independent 'Safe-T-fleX' type with coil springs. *See article in Mechanical Equipment Section for data.* NOTE—Frame height must be set first before checking Caster and Camber. **Frame Height**—With car on level floor, distance from floor to top of frame side rail at front wheel center-line 19¼" (load car until figure correct). **Kingpin Inclination**—1°54' crosswise. **Camber**—Pos. ½° (plus ¾°, minus 0°). Adjustable. **Caster**—Neg. 1° ± ½° (except 1803A). Pos. 2½° ± ½° (1803A Comm'l). **Toe In**—0" (+1/16", —0") at hub height. Turn both tie rods equally (must be equal after adjusting). **Steering Geometry**—Inner wheel turned 22°50' 1803,6), 22°30' (1804,7), 22°20' (1805,8). Outer 20°.

BRAKES:—**Service.** Bendix hydraulic, duo-servo, single anchor type with eccentric adjustment (except 1803,6). Hand lever applies rear service brakes. *See article in Mechanical Equipment Section for data.* **Drums**—Centrifuse. Diameter 12". **Lining**—Moulded. Width 2" (1803,6), 2¼" (1804,5,7, 8), 2½" (1803A). Thickness 3/16". Length per shoe 13" (except 1803,6 primary shoe which is 11½"). **Clearance**—All except 1803,6—.010" at heel and toe of each shoe. 1803,6—.015" at both ends of secondary shoe with primary shoe forced out against drum.

Hand Brake:—See Service brakes (above).

FRONT END ASSEMBLY (UNIT) REMOVAL:—Should be removed as a unit for work on front of engine. *See Chrysler Shop Notes for directions.*

SERIAL NUMBER:—On right front door hinge post.

	Detroit	Los Angeles	Evansville	Canada
P9	1,378,001	3,114,801	9,062,201	9,368,516
P10	10,883,001	3,242,501	20,063,001	9,607,611

ENGINE NUMBER:—P9-1001 Up (P9), P10-1001 Up (P10). Left side of block between #1 and #2 cylinders. *See Chrysler Shop Notes for Engine Number Lettering ('Special Standard' bore and bearing sizes).*

ENGINE SPECIFICATIONS:—6 cylinder, 'L' head type. **Bore**—3⅛". **Stroke**—4⅜".
Displacement—201.3 cu. ins. **Rated HP**—23.44.
Developed Horsepower—84 at 3600 RPM (Std. hd.).
Compression Ratio and Pressure—As follows:

Ratio	Pressure at 1000 RPM	At 100 RPM
6.7-1 cast-iron hd.	145-155 lbs.	Approx. 115 lbs.
7.0-1 aluminum hd.	150-160 lbs.	Approx. 120 lbs.

Vacuum Reading—Steady 18-21" idling at 6 MPH. *See Chrysler Shop Notes for Engine Removal data.*

PISTONS:—Aluminum alloy, U-slot, cam ground, tin coated. **Length** 3 11/16". **Weight** 14.4 ozs. (stripped). **Removal**—Pistons and rods removed from above.
Clearance—Top .011". Skirt .0001-.0011".
Original Bore & Piston Sizes, Replacement Pistons:—*See Chrysler Shop Notes for sizes and markings.*
Fitting New Pistons:—Use micrometers. Check piston at bottom of skirt at right angles to pin bosses. With piston and wall dry, piston should pass through bore of own weight with slight drag (pin out). **Installing Pistons**—Slot away from camshaft.

PISTON RINGS:—4 rings, all above pin—#1 Compression (upper inner edge beveled), #2 Comp. (lower outer edge stepped), #3 & 4 (slotted oil rings).

Ring	Width	End Gap	Side Clearance
Comp. (Top)	⅛"	.007-.015"	.002-.004"
Comp. (#2)	⅛"	.007-.015"	.0015-.0035"
Oil Control	5/32"	.007-.015"	.001-.0025"

Replacement Rings:—Std. & .003", .005", .010", .015", .020", .023", .025", .030", .040", .050", .060" oversize.

PISTON PIN:—**Diameter**—55/64". **Length**—2⅝". Floating type. Pin hole in rod bronze bushed.
Pit Fit in Piston—Thumb push fit with piston heated to 100°F.
Pin Fit in Rod Bushing—Thumb push fit at 70°F.
Replacement Pins:—Std. & .003", .005", .008" oversize.

CONNECTING ROD:—**Weight**—30.7 ozs. (with bearings and bolts). **Length**—7 15/16".
Crankpin Journal Diameter—1 15/16".
Lower Bearing—Removable, precision type, steel-backed babbitt. *See Chrysler Shop Notes for undersizes.* **Clearance** .0005-.0025". **Sideplay** .0055-.0115".
Bearing Adjustment:—None (no shims). Install bearings with boss engaging groove in rod and cap.
Installing Rods:—Wide portion of bearing to rear (#1, 3, 5), to front (#2, 4, 6). Oil hole to camshaft.

CRANKSHAFT:—4 bearing type with 7 counterweights. *See Chrysler Shop Notes for Replacement Main Bearing Caps and Crankshaft Front and Rear Oil Seals.*
Journal Diameters—2¼" all bearings.
Bearing Type—Removable, precision type, steel-backed, babbitt-lined. **Clearance**—.001-.002".
Bearing Adjustment:—*See Chrysler Shop Notes for bearing removal, front main bearing cap removal, replacement bearing sizes and adjustment data.*
End Thrust:—Taken by flange faces on rear (#4) main bearing. **Endplay**—.003-.007".

CAMSHAFT:—4 bearing. Non-adjustable chain drive. *See Chrysler Shop Notes for camshaft removal.*
Journal Diameters—#1, 2"; #2, 1 31/32"; #3, 1 15/16"; #4, 1¼".
Bearing Type—Removable steel-backed, babbitt-lined bushings (except #4 machined in block).
Clearance—.001-.003" (#1), .0015-.0035" (all others).
End Thrust:—Taken by thrust plate behind camshaft sprocket hub. **Endplay**—.002-.006".

Timing Chain:—Morse Type 1883-N, No. 2661. Width 1". Pitch .500" (½"). Length 24" or 48 links.

Camshaft Setting:—Sprockets marked. Mesh chain with sprockets turned so that '0' marks are adjacent and in line with a straightedge across shaft centers.

VALVES:—

	Head Diameter	Stem Diameter	Length
All valves	1 15/32"	.340-.341"	4 25/32"

	Seat Angle	Lift	Stem Clearance
Intake	45°	5/16"	.001-.003"
Exhaust	45°	5/16"	.003-.005"

See Chrysler Shop Notes for Exh. valve seat insert data.

Tappet Clearance:—.006" Int., .008" Exh. (hot & idling). .002" addt'l exh. clearance desirable for sustained high speeds. NOTE—Tappet screws self-locking (no locknuts). Remove right front wheel, lower housing panel and pump shield for access.

Valve Guides:—Remove from above. Press new guides in (stepped end down) with upper end ⅞" below top of block, then finish ream (Tool CM-83) to .342-.343" Intake, .344-.345" Exhaust.

Valve Springs:—Install with closely coiled ends to top.

Free length 2 3/32".	Spring Pressure	Length
Valve Closed	34-38 lbs.	1¾"
Valve Open	77-83 lbs.	1 7/16"

Valve Lifters:—Mushroom type (remove from below). Stem diam. ⅝". Ream holes from above (pilot in valve stem guide). Oversizes .001", .008", .030", .060". **Clearance in block**—.000-.001".

Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 6° ATDC. Close 46° ALDC.
Exhaust Valves—Open 42° BLDC. Close 8° ATDC.
Valve Timing Check—With .011" (cold) tappet clearance, #6 intake valve should open with #6 piston 6° or .0153" ATDC with 6th graduation after DC mark on crankshaft pulley aligned with pointer on chain cover. Reset tappet clearance .006" (hot).

LUBRICATION:—Pressure (pump on right of engine). *See Chrysler Shop Notes for oil pump removal.*
Normal Oil Pressure:—30-45 lbs. @ 30 MPH, 15 idling.
Oil Pressure Relief Valve:—Under plug below starter. Opens at 40-45 lbs. To increase pressure use heavy (green)spring, to decrease use light (red) spring.
Crankcase Capacity:—5 quarts (refill).

COOLING SYSTEM:—**Capacity**—14 quarts. *See Chrysler Shop Notes for radiator core removal.*
Water Pump:—Packless type with belt drive. *See article in Mechanical Equipment Section for data.*
Removal—Drain water. Remove fan belt. Disconnect pump inlet hose. Remove pump mounting stud nuts and lockwashers and move pump and fan assembly against radiator core. Remove 3 pump mounting studs (use pipe wrench or stud pliers between pump and block). Lift pump and fan out.
Thermostat:—Bishop & Babcock or Fulton (Fulton only on P9). Starts to open 157-162°F. Fully open 183°.

CLUTCH:—**Borg & Beck Model 9A7, 11A6 (Taxi) with 'Borglite' driven member.** #926 (9A7), #931 (11A6) stamped on cover. Single plate dry disc type with spiral grooved facings, pressure plate oil baffle & pedal over-center return spring. *See article in Mechanical Equipment Section for data.*
Facings—Spiral wound moulded woven, 2 used. Inside Diam. 6" (9A7), 6½" (11A6). Outside Diam, 9¼" (9A7), 11" (11A6). Thickness ⅛" (all).
Adjustment:—Pedal should just clear toeboard (adjust stopscrew on lower end) and have 1" free movement (adjusting nut on link rod at clutch fork).
Removal:—Remove release fork pull-back spring, Transmission (see following) and housing underpan. Disconnect release fork from pivot and pull out as far as possible. Mark cover and flywheel, remove clutch cover screws evenly, lower assembly out.

TRANSMISSION:—**Own Make.** All helical gear, constant-mesh, synchro-mesh (second & high), sliding gear (low & reverse) with remote shift. *See article in Mechanical Equipment Section for data.*
Transmission Control:—Steering column shift Std. *See article in Mechanical Equipment Section for data.*
Removal:—Remove propeller shaft (loosen comp. flange nut if transmission to be disassembled—See Chrysler Shop Notes for Propeller Shaft Center Bearing Removal on 7 pass.). Disconnect speedometer cable, battery ground cable, hand brake cable, and gear shift rod and cable at transmission. Remove mounting stud nuts and lockwashers. Pull unit back, lower and remove from under car.

UNIVERSAL JOINTS:—**Detroit-Universal Series 4200 (3 & 5 pass.), Series 7200 (7 pass.).** Roller bearings with ball & trunnion (4200), cross type (7200). *See articles in Mechanical Equipment Section for data.*
Propeller Shaft Center Bearing:—Used on 7 passenger sedans. *See Chrysler Shop Notes for servicing.*

REAR AXLE:—**Own Make.** Semi-floating, hypoid gear type with Hotchkiss drive. *See article in Mechanical Equpiment Section for data.*
Ratio—3.54-1 (P9 Econ.). 3.73-1 (P9 Spec., P10 Econ.). 3.9-1 (P9 Std., P10 Coupe). 4.1-1 (P10 Sedan). 4.3-1 (P9, 10—18 or 20" whls.; P10 7 Pass.).
Backlash—.006-.010". Screw adjustment.
Removal:—Disconnect drive shaft at rear universal. Remove axle shafts (see below) and capscrews on carrier flange. Pull carrier assembly out.
Axle Shaft Removal—Remove wheel, hub, and drum assembly (use screw type hub puller—Tool C-319), block brake pedal, disconnect brake line at wheel cylinder, take off backing plate with oil seal, pull shaft and bearing (Tool C-158). NOTE—Use Tool C-358 to pull oil washer, C-201, 2 to install.
Wheel Bearing Adjustment:—Shims between backing plate and axle housing. With wheel and hub removed, check endplay with dial indicator. To adjust, remove backing plate, add or remove shims at both wheels equally. **Endplay**—.003-.008".

SHOCK ABSORBERS:—**Domestic**—Delco Direct Acting. **Export**—Delco Direct Acting or Delco Adjustable Direct Acting (Special Equip. Dom. also). *See article in Mechanical Equipment Section for data.*

STEERING:—**Steering Gear**—Chrysler (Gemmer design Model 300) standard. Gemmer Model 305 'push-pull' adjustment (7 pass.). Worm-and-roller types. *See articles in Mechanical Equipment Section for data.*
Front Suspension:—Independent, linked parallelogram type with coil springs. *See article in Mechanical Equipment Section for data.*
Kingpin Inclination—4¾° to 6°.
Camber—Pos. ¼°. Limits 0° to Pos. ¾°.
Caster—Neg. 1° to Pos. 1°. Not adjustable.
Toe In—1/16" (0-⅛"). Turn both rods equally.
Steering Geometry—Outer wheel 20°, Inner 22°.

BRAKES:—**Service.** Lockheed hydraulic, double anchor type. Hand brake applies independent shaft brake. *See article in Mechanical Equipment Section for data.*
Wheel Cylinders—Stepped or two-stage bore type.
Drums—Centrifuse. Diameter—10", 11" (7 pass.).
Lining—Molded. Width 2". Thickness 13/64". Length per shoe: Front—10 5/16", 11 15/32" (7 pass.); Rear—7 11/16", 7 13/32" (7 pass.).
Clearance—.012" toe, .006" heel, for each shoe.
Hand Brake:—On drum at rear of transmission.
Adjustment—*See Chrysler Shop Notes for data.*
Drum—Cast-iron. Diameter—6".
Lining—Width 2". Thick. 5/32". Length 17 1/16".

TORQUE WRENCH SPECIFICATIONS:—*See Torque Wrench article in Mechanical Equipment Section for tightening specifications for Cylinder Head, Main & Connecting Rod Bolts, etc.*

HOOD LOCK ADJUSTMENT:—Should be made whenever considerable force necessary to lock or unlock hood. Remove hand hole cover for access to stud nuts. Height correct when distance between hood and front of locking ornament (in released position) is 1⅝". Only light hand pressure should be necessary to snap locking ornament in place.

FITTING HOOD PANELS:—Hoods that are slightly loose at cowl can be fitted snugly by inserting 7/16" flat washer between flange of hood and hinge at each of three attaching bolts located on lower edge of hood at each hinge. This will place more tension on hood when in closed position.

FRONT FENDER AND RADIATOR REMOVAL:—To facilitate work on front of engine remove front end assembly as follows: Remove hood side panels, front bumper assembly, hex head fender-to-body bolts, Fender-to-frame brace bolts, headlamp wires from top side of fender apron and headlamp terminal at body side of terminal, right headlamp wires from back of terminal on right fender side apron, wire harness from radiator, and 2 nuts from beneath radiator support. Lift front end assembly off

FRONT ENGINE INSULATOR REMOVAL:—Remove hood side panels, disconnect exhaust pipe, remove 2 front engine-to-mounting bolts, raise engine with jack until insulator accessible, remove dirt on mounting from below, take out 2 mounting-to-frame screws, lift off mounting together with 'U' shaped shield. When re-installing, reverse procedure and tighten mounting bolts securely.

RADIATOR CORE REMOVAL:—Drain cooling system, disconnect radiator hoses, take out 3 capscrews at each side of radiator and lift core out (rotate fan to clear radiator water outlet).

ENGINE REAR SUPPORT INSULATOR REINFORCEMENT PLATE:—On some cars engine rear support insulators loosen from frame (insulator-to-frame bolt self-locking nuts gouge into washers). New hardened reinforcement plate #504992 (replacing washers) and longer bolts #120758 used in production starting with following serial numbers:
Special Six—P6HA-5026, L6HA-1976, C6HA-1467.
Deluxe Six—P6HB-17109, L6HB-4067, C6HB-3165.
Deluxe 8—P8HA-8047, L8HA-2425, C8HA-1863.
Torpedo 8—P8HB-5440, L8HB-1969, C8HB-1541.
NOTE—This plate can be installed on early cars.

ORIGINAL BORE & PISTON SIZES:—Original bore sizes, and size of pistons installed in each cylinder bore, may be determined by letter stamped on piston head and on top face of cylinder block. Piston sizes graduated in .0005" steps as follows:

Piston & Engine Mark	Six	Eight
'A'	3.4355"	3.247"
'B'	3.436"	3.2475"
'C'	3.4365"	3.248"
'D'	3.437"	3.2485"
'E'	3.4375"	3.249"

REPLACEMENT PISTONS:—**Standard.** Pistons furnished in following sizes for replacement of Standard Production Pistons listed above. Sizes and part numbers for each model as follows:

Part No. (6)	Size	Part No. (8)	Size
503045	3.4355"	503048	3.247"
503046	3.4365"	503049	3.248"
503047	3.4375"	503050	3.249"

First size covers 'A' and low limit 'B'. Second size covers high limit 'B', 'C' and low limit 'D'. Third size covers high limit 'D' and 'E' pistons

Oversize Replacement Pistons:—Finished pistons furnished in following oversizes: .005", .010", .020", .030". NOTE—Factory replacement pistons up to .030" oversize held to 1/16 oz. max. weight variation.

PISTON PIN FITTING:—Case harden, ground pins used (out-of-round .0002" max.). To install pins, coat inside of piston bosses with graphite grease, insert slotted end of pin in lockscrew boss and press in place. Pressure to install pin in piston should be 200-300 lbs. Car manufacturer recommends use of following tools (in conjunction with arbor press): hydraulic cylinder & gauge (J-1325-SA-1), piston rest block (J-1325-1), piston pin remover (J-1325-2), piston skirt plug (J-1325-3).

PISTON PIN BUSHING:—Consists of two hard rolled bronze bushings assembled in connecting rod.
Installation—Press bushings in place, making sure that 3/32" groove between bushings aligned with oil hole in rod. Then burnish bushings securely in place with burnishing bar. Finally ream or hone bushing for .0003-.0005" clearance on pin. Car manufacturer recommends use of following tools for servicing pin bushings: J-540-1—Bushing Remover. J-540-2—Bushing Replacer (tool fitted with shoulder which prevents bushings from being pressed through too far in rod boss). HMJ-516 Burnishing Bar. NOTE—Bushing Remover and Replacer used in conjunction with an arbor press.

CONNECTING ROD LOWER BEARING:—Removable type. No adjustment. Shims should not be used or bearing caps filed. When replacing bearings check crankpins. If scored or out-of-round and taper exceeds .001" crankshaft should be replaced.
Fitting—Use .0015" brass shim ½" wide and ⅞" long. Remove cap and lay shim across bearing. Tighten cap (with shim in place). Check bearing fit as follows:—Rod should be locked when testing end movement by hand but should slide on crankpin when tapped lightly with hammer (if rod can be moved by hand, install .001" undersize bearing). Rod should move freely on pin with shim removed.
Installation—Bearing shells fitted with tangs (Six—one to each edge of bearing, Eight—two on each edge). Install cap with tangs on opposite sides of rod (Six), on opposite ends of crankpin (Eight).

MAIN BEARINGS:—**Removal.** Bearings can be removed with caps removed and crankshaft in place by inserting suitable tool (see NOTE following) in oil hole in shaft and rotating shaft in usual direction. NOTE—Bearing Removal Tool can be made from ⅛"x1½" cotter key. Bend each end of key up 5/16" to make ⅝" long base. With this as a base, bend key to form 59° angle. With this tool inserted in place end will just protrude far enough to engage bearing.
Installation—Insert plain edge of bearing in indented side of bearing support, slowly rotate crankshaft until bearing seated.

FITTING MAIN BEARINGS:—If the crankshaft is badly scored manufacturer recommends that it be replaced. To check bearing fit, use .002" brass shim ½" wide and 1" long. With cap removed place shim across bearing. Tighten cap (with shim in place). Test bearing fit by rocking flywheel by hand. **Do not rock flywheel more than 1" in either direction** or bearing may be damaged by shim. If crankshaft locks with shim in place and rotates freely with shim removed bearing size correct. If shaft moves with shim in place use .001" undersize bearing.
IMPORTANT—Do not file main bearing caps. These caps are not furnished separately.

REAR MAIN BEARING OIL SEAL (Six only):—Consists of oil slinger on crankshaft to rear of rear main bearing operating in groove formed in block and cap (drain hole in cap returns oil to crankcase) with asbestos seal fitted in separate groove at rear.
Installation—With crankshaft out of engine and bearing shells removed, press packing in rear groove in block, seat packing using Tool J-1045 (large diameter to front of engine) by tapping tool with lead or rawhide hammer. With tool in place, cut each end of seal flush with bearing cap seat. Repeat operation for cap. Install crankshaft & bearings.

HARMONIC BALANCER:—Replace for service.
Removal & Installation—Can be removed from under car without removing front assembly. Use 13/16" (6), 1" (8) socket wrench to remove retaining screw, remove balancer. NOTE—If balancer corroded on crankshaft, remove Front Assembly and use Puller J-496.

CAMSHAFT:—All bearing sizes, removal and installation directions same as for 1939 models. *See 1939 Pontiac Shop Notes for data.*

TIMING COVER NOISE:—Timing cover oil seal noise may develop in some cases due to insufficient clearance between hub of crankshaft balancer and timing cover cork seal. Crankshaft balancer hub diameter has been reduced .006-.007" during production to overcome this condition. This change can be made in the field by removing balancer (without removing radiator and other front end parts) and turning hub down to diameter of 1.866-1.868". NOTE—Balancer removal on Torpedo can be facilitated by using a socket on balancer retaining screw and turning socket with small wrench.

OIL PUMP:—**Removal & Installation**—Same as for 1939 models. *See 1939 Pontiac Shop Notes.*

OIL PUMP CLEARANCES:—Shaft bearing .0005-.002". Idler gear bearing .0005-.002". Driving gear backlash .003-.004". Backlash between pump gears .006-.008". Pump Gear end clearance .002-.006".

OIL PAN REMOVAL:—**Deluxe Eight 40-28.** For access to front oil pan screws, remove Front Engine Insulator (see above) and rest front of engine on steel block (5¼" long, 1½" wide, 15/16" high).
Torpedo Eight 40-29—For access to front oil pan screws, take out Front Engine Insulator-to-Radiator Support Bracket screws, jack up engine and allow it to rest on 1" board.

CLUTCH PILOT BUSHING:—New clutch pilot bushing #412562 (oilless type) available for 1935 to 1940 cars. This can be used in place of regular production roller bearing where hole in crankshaft worn. Bushing can be driven into worn hole to give snug fit and provides a smooth running surface for shaft.
Installation—Soak bushing in light engine oil, place bushing on end of driver (Tool J-1329-P), insert tool through hole in flywheel housing and drive bushing in place making certain that it bottoms in hole. Manipulate driver out of bushing. NOTE—Clutch pilot bushing remover (Tool J-1448-1) available for bushing removal.

EIGHT CYLINDER CLUTCH NOTE:—Starting with engine number 8-217982 clutch cover spring tension has been increased from 1200 to 1400 lbs. to overcome clutch slippage and consequent damage to facings due to regularly starting car in second gear with excessive throttle opening. Car manufacturer recommends that new style clutch cover and pressure plate (Part No. 753615) be installed whenever clutch damage found due to this condition.

REAR AXLE OIL SEAL LEAKS:—Rear axle oil leaks may develop due to oil passing by axle shaft oil seal outer edge and working through between rear wheel bearing retainer and flange of axle housing and down onto brake lining. To correct this condition, coat axle housing shaft oil seal seat with sealing material (Permatex or Permagasket) before installing seal and also coat both sides of rear brake oil deflector gasket.

HOOD FITTING, HOOD LOCK ADJUSTMENT, AND FRONT FENDER & RADIATOR (UNIT) REMOVAL:—*See Pontiac Shop Notes for data.*

SERIAL NUMBER:—First number 6HA-1001 (Special), 6HB-1001 (Deluxe) with prefixes indicating factory as follows: P—Pontiac, Mich., C—South Gate, Calif., L—Linden, N. J. On plate fastened to left end of frame front cross member under hood.

ENGINE NUMBER:—First number 6-595801. Stamped on boss on top left front corner of engine block.

ENGINE SPECIFICATIONS:—6 cylinder, 'L' head.
Bore—3 7/16". **Stroke**—4".
Displacement—222.7 cu. ins. **Rated HP**—28.3.
Developed Horsepower—87 at 3520 RPM (Std. hd.).
Compression Ratio—6.5-1 Std., 7.2-1 HC. Optl.
Compression Pressure—155-158 lbs. at 1000 RPM or approx. 118-120 lbs. at cranking speed (Std. head).
Vacuum Reading—Steady 18-20" idling at 7 MPH.
See Pontiac Shop Notes for Front Engine Insulator Removal and Engine Rear Support Reinforcement Plate.

PISTONS:—Electro-plated, chrome nickel alloy type with rib under head. Cannot be ground.
Length—3 37/64". **Weight**—27⅛ ozs. (stripped). Piston and pin weight variation 1/16 oz. max.
Removal—Pistons and rods removed from above.
Clearance—Top land .0175-.0295". Skirt .002".
Original Bore & Piston Sizes, Replacement Pistons:—*See Pontiac Shop Notes for complete data.*
Fitting New Pistons:—Insert .0015" x ½" feeler between piston and cylinder wall. Pull to withdraw feeler must be 10-25 lbs. Piston taper or out-of-round .0005". Cylinder bore out-of-round or taper .001" max. (new).

PISTON RINGS:—Two taper faced compression rings above pin, 1 oil control ring below pin. **NOTE**—Install compression rings with mark TOP up.

Ring	Width	End Gap	Side Clearance
Compression	.0930-.0935"	.009-.014"	.0015-.003"
Oil Control	.1860-.1865"	.007-.017"	.001-.0025"

Replacement Rings:—Oversizes .005", .010", .020", .030".

PISTON PIN:—**Diameter** 15/16". **Length** 3 1/16". Pin locked in one piston boss. Free end slotted.
Pin Fit in Piston—*See Pontiac Shop Notes.*
Pin Fit in Rod Bushing—.0003-.0005".
Replacement Pins:—.001" (red & brown), .003" (red), .005" (blue) oversize. Paint marked on end of pin.

CONNECTING ROD:—**Weight** 2.31 lbs. **Length** 7 9/16".
Piston Pin Bushing (Upper Bearing)—Split bronze bushings. *See Pontiac Shop Notes for servicing.*
Crankpin Journal Diameter—2⅛".
Lower Bearing—Removable steel-backed, babbitt-lined type. Furnished standard & .001" undersize.
Clearance—.0005-.0015". **Endplay**—.005-.010".
Bearing Adjustment:—None (no shims). *See Pontiac Shop Notes for Fitting and Installing Bearings.*
Installing Rods:—Not offset (install either way). NOTE—Self-locking rod bolt nuts used.

CRANKSHAFT:—4 bearing, integral counterweights. *See Pontiac Shop Notes for Balancer Removal and Rear Main Bearing Oil Seal Renewal.*
Journal Diameters—#1, 2½"; #2, 2 17/32"; #3, 2 19/32"; #4, 2⅝".
Bearings—Interchangeable (upper and lower) steel-backed, babbitt-lined type. Furnished std. & .001" undersize. **Clearance**—.001-.003".
Bearing Adjustment:—None (no shims). Replace bearings. Do not file caps. *See Pontiac Shop Notes.*
End Thrust:—At #3 bearing. **Endplay**—.003-.008".

CAMSHAFT:—4 bearing. Non-adjustable chain drive. *See Pontiac Shop Notes for Camshaft Removal, Bearing Finished Sizes and Timing Cover Oil Seal data.*
Journal Diameters—#1, 2"; #2, 1 31/32; #3, 1 15/16"; #4, 1 29/32".
Bearing Type—Steel-backed, babbitt-lined.
Clearance—.0015-.0025".
End Thrust:—Steel thrust plate behind camshaft sprocket. Replace if worn. **Endplay** .002-.005".
Timing Chain:—Morse No. 1532, Type C-1882-K. Width 1". Pitch ⅜". Length 21" or 56 links.
Camshaft Setting:—Sprockets marked. Mesh chain with sprockets turned so that '0' marks are adjacent and in line with a straightedge across shaft centers.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1 19/32"	.310-.311"	5.718"
Exhaust	1 15/32"	.310-.311"	5.718"

	Seat Angle	Lift	Stem Clearance
Intake	30°	19/64"	Free fit to .0006"
Exhaust	45°	19/64"	Free fit to .0006"

NOTE—Valve heads not slotted.
Tappet Clearance:—.011-.013" all valves (engine warm). Use .011" feeler as 'go' gauge, .013" as 'no go'. NOTE—Car manufacturer recommends .013" exhaust clearance for sustained high speed driving.
Valve Guides:—Removable, tapered guides (.001" taper to the inch with greatest clearance at top). IMPORTANT—Measure clearance at bottom end. Valve should just fall through guide of own weight when started in guide. NOTE—Guides should be cleaned with wire brush or taper reamer Tool P.R. 131. Replacement guides straight cut, ream to fit valve stem after installing with reamer P.R. 131.
Valve Springs:—Intake and exhaust springs identical. Install with two closed coils at top and dampener on top of each spring. Use new dampeners whenever springs installed. **Free Length**—2 9/16".

	Spring Pressure	Spring Length
Valve Closed	56-63 lbs.	1 29/32"
Valve Open	97-105 lbs.	1 19/32"

Valve Lifters:—Barrel type, cast-iron. Guides holes reamed in block. Lifters furnished .005" oversize (use special pilot reamer J-706-P when installing to obtain proper alignment). **Clearance**—Free fit. Lifter should just move freely with finger touch.
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 5° BTDC. Close 39° ALDC.
Exhaust Valves—Open 45° BLDC. Close 5° ATDC.
Valve Timing Check—With .015" tappet clearance #6 intake valve should open with piston 5° or .0096" before top dead center with first straight line of flywheel mark '/IGN.ONE/' slightly past indicator in left front face of flywheel housing.

LUBRICATION:—Pressure type (gear type pump on right side). *See Pontiac Shop Notes for Oil Pump data.*
Normal Oil Pressure:—35-40 lbs. above 40 MPH.
Oil Pressure Regulator:—On pump. Opens at 40 lbs. Non-adjustable type.
Crankcase Capacity:—6 qts. (refill).

COOLING SYSTEM:—**Capacity**—17 quarts.
See Pontiac Shop Notes for Radiator Core Removal.
Water Pump:—Packless, sealed ball-bearing shaft. *See article in Mechanical Equipment Section for data.*
Removal—Remove fan belt, pump mounting bolts and lower hose. Lift off pump and fan assembly.
Thermostat:—Harrison. In cylinder head outlet.
Setting—Closed 140°F. Starts 145°. Fully open 172°.
Temperature Gauge:—AC #1510916 (dash), #1510772 (engine unit). Electric type.
See article in Mechanical Equipment Section for data.

CLUTCH:—**Inland.** 'Diaphragm' type, single plate, dry disc type with Long 9CF-CS, 10CF-CS (Taxi) driven member. *See Mechanical Equipment Section for data.*
Facings—Moulded (Ammco), 2 used. Inside Diam. 5¾", 6" (Taxi). O.D. 9", 10" (Taxi). Thickness .125". *See Pontiac Shop Notes for Clutch Pilot Bushing.*
Pedal Adjustment:—Free travel ⅞-1⅛" (adjusting nut on link at clutch fork). Pedal height above toe board (engaged) 5⅛" (Special), 4¾" (Deluxe), stop screw at lower end of pedal arm.
Removal:—Remove transmission (see below), take off bottom housing cover, unlock pedal pull-back spring, remove fork ball support, fork and throwout bearing. Remove cover screws evenly until tension relieved. Move clutch away from flywheel at bottom to remove disc, then lower cover assembly out.

TRANSMISSION:—**Own.** All helical gear, constant-mesh, synchro-mesh (second & high), sliding gear (low & reverse) with remote steering col. shift.
See article in Mechanical Equipment Section for data.
Transmission Control:—Pontiac 'Safety-Shift' type.
See article in Mechanical Equipment Section for data.
Removal:—Remove floor mat and center panel. Disconnect speedometer cable, gearshift selector and control rods at transmission. Disconnect rear universal (wire trunnions) and pull propeller shaft to rear to disengage U-joint front yoke from transmission main shaft at slip joint. Remove upper transmission mounting screws, install guide pins (J-851), remove lower screws, pull unit to rear to free main drive gear, then up and forward at front,

UNIVERSAL JOINTS:—**Mechanics 2C.** Roller bearing. 2 used. *See article in Mechanical Equipment Section.*
NOTE—Solid propeller shaft used. Slip joint formed at rear of transmission mainshaft ahead of front universal (front yoke of universal splined directly to mainshaft—no front companion flange used).

REAR AXLE:—**Own Make.** Semi-floating, hypoid gear type with Hotchkiss drive.
See article in Mechanical Equipment Section for data.
Ratio—4.3-1 Std. (white), 4.55-1 Mount. (yellow), 4.1-1 Plains (green), 3.9-1 Economy (red). NOTE—Color marked on end of right or left axle shaft.
Backlash—.003-.012" (new).
See Pontiac Shop Notes for Axle Oil Leak correction.
Removal:—Disconnect rear universal and wire trunnions (do not disengage spline joint at front end of shaft), remove axle shafts (below), remove carrier flange capscrews, pull carrier assembly out.
Axle Shaft Removal:—Hoist rear of car, remove wheel, brake drum, 4 backing plate mounting bolt nuts and loosen bearing retainer (do not allow backing plate to shift to damage brake line). Pull shaft (Puller J-942) taking care not to drag shaft on oil seal. **Wheel Bearing Adjustment**—None.

SHOCK ABSORBERS:—**Delco. Front**—1947-C,D. **Rear**—1000-V (Domestic), 1754-E,F (Export 25), 1754-A,B (Export 26). Double acting, hydraulic (1000-V direct acting). *See articles in Mechanical Equipment Section.*

STEERING:—**Steering Gear.** Saginaw Worm-and-Double roller type.
See article in Mechanical Equipment Section for data.
Front Suspension:—Independent, linked parallelogram type with coil springs.
See article in Mechanical Equipment Section for data.
Kingpin Inclination—4⅝° to 5¼°.
Caster—Negative ¾°. Limits Neg. ½° to Neg. 1°.
Camber—Positive ⅜°. Limits 0° to ⅝° positive.
Toe In—0-1/16". Adjust tie rod tubes equally.
Steering Geometry—Inner wh'l 23° ± ½°. Outer 20°.

BRAKES:—**Service.** Bendix hydraulic, duo-servo, single anchor type without eccentric adjustment. Hand lever applies rear service brakes.
See article in Mechanical Equipment Section for data.
Drums—Chrome nickel iron. Diameter—11".
Wheel Cylinder Bore—Front wheel 1". Rear 15/16".
Lining—Moulded. Width 1¾". Thickness 3/16". Length 9 11/32" (Primary—D-R Multibestos), 11 31/32" (Secondary—L-8 Multibestos).
Clearance—.015" at both ends of secondary shoe (with primary shoe forced out against drum).
Braking Power—53% front wheels, 47% rear.
Hand Brake:—See Service Brakes above.

HOOD FITTING, HOOD LOCK ADJUSTMENT, AND FRONT FENDER & RADIATOR (UNIT) REMOVAL:—*See Pontiac Shop Notes for data.*

SERIAL NUMBER:—First number 8HA-1001 (Deluxe), 8HB-1001 (Torpedo) with prefixes indicating factory as follows: P—Pontiac, Mich., C—Southgate, Calif., L—Linden, N. J. On plate fastened to left end of frame front cross member under hood.

ENGINE NUMBER:—First number 8-194401. Stamped on boss on top left front corner of engine block.

ENGINE SPECFICATIONS:—8 cylinder, 'L' head.
Bore—3¼". **Stroke**—3¾".
Displacement—248.9 cu. ins. **Rated HP**—33.8.
Developed Horsepower—100 (Deluxe), 103 (Torpedo), 110 (Deluxe HC head) at 3700 RPM.
Compression Ratio—6.5-1 Std., 7.2-1 HC. Optl.
Compression Pressure—155-158 lbs. at 1000 RPM or approx. 118-120 lbs. at cranking speed (Std. head).
Vacuum Reading—18-20" steady idling at 7 MPH.
See Pontiac Shop Notes for Oil Pan Removal, Front Engine Insulator Removal, and Engine Rear Support Reinforcement Plate data.

PISTONS:—Electro-plated, chrome nickel alloy type with rib under head. Cannot be ground.
Length—3 19/32". **Weight**—24⅝ ozs. (stripped). Piston & pin and rod weight variation 1/16 oz. max.
Removal—Pistons and rods removed from above.
Clearance—Top land .0175-.0295". Skirt .002".
Original Bore & Piston Sizes, Replacement Pistons:—*See Pontiac Shop Notes for complete data.*
Fitting New Pistons:—Insert .0015" x ½" feeler between piston and cylinder wall. Pull to withdraw feeler must be 10-25 lbs. Taper and out-of-round limits—Piston .0005", Cylinder—.001" max. new.

PISTON RINGS:—Two taper faced compression rings above pin, 1 oil control ring below pin. NOTE—Install compression rings with mark TOP up.

Ring	Width	End Gap	Side Clearance
Compression	.0930-.0935"	.009-.014"	.0015-.003"
Oil Control	.1860-.1865"	.007-.017"	.001-.0025"

Replacement Rings:—Oversizes .005", .010", .020", .030".

PISTON PIN:—**Diameter**—15/16". **Length**—2⅞". Pin locked in one piston boss. Free end slotted.
Pin Fit in Piston—*See Pontiac Shop Notes.*
Pin Fit in Rod Bushing—.0003-.0005".
Replacement Pins:—.001" (red & brown), .003" (red), .005" (blue) oversize. Paint marked on end of pin.

CONNECTING ROD:—**Weight** 1.98 lbs. **Length** 7 9/16".
Piston Pin Bushing (Upper Bearing)—Split bronze bushings. *See Pontiac Shop Notes for servicing.*
Crankpin Journal Diameter—2".
Lower Bearing—Removable steel-backed, babbitt-lined type. Furnished standard & .001" undersize. **Clearance**—.0005-.0015". **Endplay**—.005-.010".
Bearing Adjustment:—None (no shims). *See Pontiac Shop Notes for Fitting and Installing Bearings.*
Installing Rods:—Not offset (install either way). NOTE—Self-locking rod bolt nuts used.

CRANKSHAFT:—5 bearing, integral counterweights.
See Pontiac Shop Notes for Balancer Removal.
Journal Diameters—#1, 2¼"; #2, 2 13/32"; #3, 2 7/16"; #4, 2 15/32"; #5, 2½".
Bearings—Interchangeable (upper and lower) steel-backed, babbitt-lined type. Furnished std. & .001" undersize. **Clearance**—.001-.003".
Bearing Adjustment:—None (no shims). Replace bearings. Do not file caps. *See Pontiac Shop Notes.*
End Thrust:—At #4 bearing. **Endplay**—.003-.008".

CAMSHAFT:—5 bearing. Non-adjustable chain drive.
See Pontiac Shop Notes for Camshaft Removal, Bearing Finished Sizes and Timing Cover Oil Seal data.
Journal Diameters—#1, 2"; #2, 1 31/32"; #3, 1 15/16"; #4, 1 29/32"; #5, 1⅞".
Bearing Type—Steel-backed, babbitt-lined. **Clearance**—.0015-.0025".
End Thrust:—Steel thrust plate behind camshaft sprocket. Replace if worn. **Endplay**—.002-.005".
Timing Chain:—Morse No. 2660, Type 766-T. Width ⅞". Pitch ⅜". Length 21" or 56 links.
Camshaft Setting:—Sprockets marked. Mesh chain with sprockets turned so that '0' marks are adjacent and in line with a straightedge across shaft centers.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1 15/32"	.310-.311"	5.53"
Exhaust	1 11/32"	.310-.311"	5.53"

	Seat Angle	Lift	Stem Clearance
Intake	30°	19/64"	Free fit to .0006"
Exhaust	45°	19/64"	Free fit to .0006"

NOTE—Valve heads not slotted.
Tappet Clearance:—.011-.013" all valves (engine warm). Use .011" feeler as 'go' gauge, .013" as 'no go'. NOTE—Car manufacturer recommends .013" exhaust clearance for sustained high speed driving.
Valve Guides:—Removable, tapered guides (.001" taper to the inch with greatest clearance at top). IMPORTANT—Measure clearance at bottom end. Valve should just fall through guide of own weight when started in guide. NOTE—Guides should be cleaned with wire brush or taper reamer Tool P.R. 131. Replacement guides straight cut, ream to fit valve stem after installing with reamer P.R. 131.
Valve Springs:—Intake and exhaust springs identical. Install with two closed coils at top and dampener on top of each spring. Use new dampeners whenever springs installed. **Free Length**—2 9/16".

	Spring Pressure	Spring Length
Valve Closed	56-63 lbs.	1 29/32"
Valve Open	97-105 lbs.	1 19/32"

Valve Lifters:—Barrel type, cast-iron. Guides holes reamed in block. Lifters furnished .005" oversize (use special pilot reamer J-706-P when installing to obtain proper alignment). **Clearance**—Free fit. Lifter should just move freely with finger touch.
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 5° BTDC. Close 39° ALDC.
Exhaust Valves—Open 45° BLDC. Close 5° ATDC.
Valve Timing Check—With .015" tappet clearance #8 intake valve should open with piston 5° or .0089" before top dead center with first straight line of flywheel mark '/IGN.ONE/' slightly past indicator in left front face of flywheel housing.

LUBRICATION:—Pressure type (gear type pump on right side). *See Pontiac Shop Notes for Oil Pump data.*
Normal Oil Pressure:—35-40 lbs. above 40 MPH.
Oil Pressure Regulator:—On pump. Opens at 40 lbs. Non-adjustable type.
Crankcase Capacity:—6 qts. (refill).

COOLING SYSTEM:—**Capacity**—19 quarts.
See Pontiac Shop Notes for Radiator Core Removal.
Water Pump:—Packless, sealed ball-bearing shaft.
See article in Mechanical Equipment Section for data.
Removal—Remove fan belt, pump mounting bolts and lower hose. Lift off pump and fan assembly.
Thermostat:—Harrison. In cylinder head outlet.
Setting—Closed 140°F. Starts 145°. Fully open 172°.
Temperature Gauge:—AC #1510916 (dash), #1510772 (engine unit). Electric type.
See article in Mechanical Equipment Section for data.

CLUTCH:—**Inland.** 'Diaphragm' type, single plate, dry disc type with Long 9¼CF-CS driven member.
See article in Mechanical Equipment Section for data.
Facings—Moulded (Ammco), 2 used. Inside Diam. 5¾". Outside Diam. 9¼". Thickness .125".
See Pontiac Shop Notes for Clutch change and Pilot Bushing data.
Pedal Adjustment:—Pedal free travel ⅞-1⅛" (adjusting nut and locknut on link at clutch fork). Pedal height above toeboard (engaged) 4¾" (Deluxe), 5" (Torpedo). Adjusting screw on pedal.
Removal:—Remove transmission (see below), take off bottom housing cover, unlock pedal pull-back spring, remove fork ball support, fork and throwout bearing. Remove cover screws evenly until tension relieved. Move clutch away from flywheel at bottom to remove disc, then lower cover assembly out.

TRANSMISSION:—**Own.** All helical gear, constant-mesh, synchro-mesh (second & high), sliding gear (low & reverse) with remote steering col. shift.
Transmission Control:—Pontiac 'Safety-Shift' type.
See articles in Mechanical Equipment Section for data.
Removal:—Remove floor mat and center panel. Disconnect speedometer cable, gearshift selector and control rods at transmission. Disconnect rear universal (wire trunnions) and pull propeller shaft to rear to disengage U-joint front yoke from transmission main shaft at slip joint. Remove upper transmission mounting screws, install guide pins (J-851), remove lower screws, pull unit to rear to free main drive gear, then up and forward at front.

UNIVERSAL JOINTS:—**Mechanics 2C.** Roller bearing. 2 used. *See article in Mechanical Equipment Section.* NOTE—Solid propeller shaft used. Slip joint formed at rear of transmission ahead of front universal.

REAR AXLE:—**Own Make.** Semi-floating, hypoid gear type with Hotchkiss drive.
See article in Mechanical Equipment Section for data.
Ratio—4.3-1 Std. (white), 4.55-1 Mount. (yellow), 4.1-1 Plains (green), 3.9-1 Economy (red). NOTE—Color marks on end of right or left axle shaft (Torpedo carries additional blue mark on end of shaft).
Backlash—.003-.012" (new).
See Pontiac Shop Notes for Axle Oil Leak correction.
Removal:—Disconnect rear universal and wire trunnions (do not disengage spline joint at front end of shaft), remove axle shafts (below), remove carrier flange capscrews, pull carrier assembly out.
Axle Shaft Removal:—Hoist rear of car, remove wheel, brake drum, 4 backing plate mounting bolt nuts and loosen bearing retainer (do not allow backing plate to shift to damage brake line). Pull shaft (Puller J-942) taking care not to drag shaft on oil seal. **Wheel Bearing Adjustment**—None.

SHOCK ABSORBERS:—**Delco. Front**—1947-C, D. **Rear**—1000-V (Domestic), 1754-A, B (Deluxe Export), 1754-G, H (Torpedo Export). Double acting, hydraulic (1000-V direct acting). *See articles in Mechanical Equipment Section.*

STEERING:—**Steering Gear.** Saginaw Worm-and-Double roller type.
See article in Mechanical Equipment Section for data.
Front Suspension:—Independent, linked parallelogram type with coil springs.
See article in Mechanical Equipment Section for data.
Kingpin Inclination—4⅝° to 5¼°.
Caster—Negative ¾°. Limits Neg. ½° to Neg. 1°.
Camber—Positive ⅜°. Limits 0° to ⅝° positive.
Toe In—0-1/16". Adjust tie rod tubes equally.
Steering Geometry—Inner wh'l 23° ± ½°. Outer 20°.

BRAKES:—**Service.** Bendix hydraulic, duo-servo, single anchor type without eccentric adjustment. Hand lever applies rear service brakes.
See article in Mechanical Equipment Section for data.
Drums—Chrome nickel iron. Diameter—11".
Wheel Cylinder Bore—Front wheel 1". Rear 15/16".
Lining—Moulded. Width 1¾". Thickness 3/16". Length 9 11/32" (Primary—D-R Multibestos 40-28 all wheels, 40-29 front wheels, 1236A Multibestos 40-29 rear wheels). 11 31/32" (Secondary—L-8 Multibestos 40-28, 2320K Hycoe 40-29).
Clearance—.015" at both ends of secondary shoe (with primary shoe forced out against drum).
Hand Brake:—See Service Brakes above.

TORQUE WRENCH SPECIFICATIONS:—*See Torque Wrench article in Mechanical Equipment Section for tightening specifications for Cylinder Head, Main & Connecting Rod Bolts, etc.*

HOOD LOCK FOR ALL 1940 MODELS:—These cars use an Alligator type hood with lock handle in driver's compartment and separate side panels. To raise hood, press down on lock handle at right of steering column (Champion), left of steering column (Commander & President). Hood will raise slightly, allowing safety latch on Commander & President models (located directly behind latch bolt and spring) to be pressed back which will release hood.

HOOD SIDE PANEL REMOVAL:—To remove the separate hood side panels, take out two screws on top side of panel and two wing screws on bottom side, lift panel out.

RADIATOR REMOVAL:—To remove radiator, remove brace rods, uncouple hose connections, free radiator from shell and lift straight up.

ORIGINAL BORE SIZE:—May be determined by marks stamped on top of block opposite each cylinder bore as follows:

Cylinder Bore Sizes

Commander		President	
Mark	Size	Mark	Size
25	3.3125"	25	3.0625"
3	3.313"	2	3.0620"
35	3.3135"	15	3.0615"
4	3.314"	1	3.061"
45	3.3145"	5	3.0605"

Champion Model

Mark	Size
0	3.000"
05	3.0005"
1	3.001"
15	3.0015"
2	3.002"
25	3.0025"

NOTE—Variation in any one engine is held to .001" maximum difference between individual bores.

CYLINDER HEAD INSTALLATION:—Coat both bottom of head gasket and lower face of cylinder head with Perfect Seal Gasket Cement (use sparingly), coat head capscrews with white lead. Tighten head screws to tension of 600-650 in. lbs. (Champion), 1000 in. lbs. (Commander & President) and recheck before starting engine.

CONNECTING ROD 'PALNUT' INSTALLATION:—Used on all 1940 cars. Consists of special patented locknut installed on top of regular nut instead of cotterpin. To install Palnut, tighten regular nut to tension of 650 in. lbs., turn up Palnut until it contacts regular nut (open face of Palnut out), then tighten Palnut ¼-⅓ turn additional to lock it in place.
NOTE—On Champion tighten regular nut to 300-325 in. lbs. tension.

PISTON PIN REMOVAL & INSTALLATION:—Champion—Tapered pin and nut secures pin in rod. To remove pin, place rod and piston on assembling fixture No. J1293, take nut off and install on opposite end of pin and turn nut down pulling pin out. To install, place pin on fixture, slip piston and rod on pin, tighten pin nut (rock rod to insure lock pin seats properly). One nut only used on tapered lock pin.

SELF-LOCKING TAPPETS:—Champion—Tappet screws slotted on upper end and require no locknuts. When tappet screws replaced, car manufacturer recommends that screws must check as follows: Pull required to move tappet screw must be 25 in. lbs. minimum (4 lbs. pull on 6" wrench).

VIBRATION DAMPENER:—President—Consists of a spring-loaded flywheel mounted on four tapered rubber cushions between a friction facing on the fan pulley and a damper plate on the front end of the crankshaft. The flywheel oscillation is controlled by the friction of the friction facing and the compression of the rubber cushions. Flywheel radial movement is controlled by a fibre ring on the fan pulley hub. Spring tension is adjusted by shims under spring in flywheel, compression of rubber cushions adjusted by shims on bolt sleeve between cushion and damper plate.

Servicing—Damper can be removed from crankshaft as an assembly. If disassembled, note position of all parts and reassemble in same order. Fibre ring should be press fit on pan pulley hub and should have .004-.006" clearance in flywheel. Install shims under springs, as required, to secure 50 lbs. pressure per spring or 200 lbs. total with damper bolts tightened. Install shims on rubber cushions so that cushions compressed .015" (.020" for 1936) with bolts tightened (plate against spacers).

NOTE—When installing crankshaft nut, make certain that copper-asbestos gasket in place under nut (necessary to prevent oil leaks at this point).

Commander Model:—Consists of a flywheel mounted on two rubber rings on forward end of crankshaft. Compression of rubber rings is limited by length of vibration damper and fan pulley hub and does not require checking or adjusting.

TIMING GEARS:—Removal and Installation—Holes provided in gears (on Champion and Commander), gear hub recess threaded (President) for gear puller to remove gears. Use tool HM-925 (Champ.&Comm.), HM-865 (President). See Replacement Camshaft Gear Sizes (below) for size selection when replacing gears. Use gear pusher tool HM-861X (all models) to install gears. CAUTION—Do not drive gears on with a hammer which will loosen gear at hub.

Replacement Camshaft Gear Sizes:—Furnished in three sizes: 'S'—Standard, 'H'—High Limit, 'L'—Low Limit. When replacing gear on engine with considerable service, install next largest camshaft gear size. For reconditioned engine with new camshaft and main bearings use same size gear. Crankshaft gear furnished in standard size only.

VALVE SPRING SERVICING:—Commander—Valve springs will not clear lifter and tappet adjusting screw when in extended position and should be installed as follows: Place spring seat in place on bottom of spring, use 'C' type valve lifter to compress spring slightly so that it will clear tappet adjusting screw as it is pressed up into place, install valves, compress spring, install valve spring seat locks. NOTE—Make certain that valve lifter tension spring installed on top of each valve lifter.

OIL PUMP INSTALLATION:—Commander. To insure correct rotor position of distributor when pump installed, install pump as follows: Remove distributor, crank engine over (with piston #1 on compression) until vibration damper mark 'UDC/1-6' lines up with pointer on gear case, sight down distributor shaft hole and mesh oil pump drive gear so that drive tongue on shaft is 30° from the horizontal and offset toward the top.

Champion:—Install oil pump as follows: Turn engine over until #1 piston at TDC. entering power stroke (flywheel mark U.D.C.1-6 in line with pointer on left rear engine plate). Engage pump shaft with camshaft gear with key-way pointing down (key-way will rotate to rear when gears meshed), assemble pump to engine. Check distributor drive tongue position by sighting down distributor shaft hole (distributor out). With #1 cylinder in firing position, tongue should be parallel with camshaft and offset (narrow half of shaft) toward camshaft.

President:—Install oil pump as follows: Turn engine over until piston #1 is on TDC entering power stroke with vibration damper mark 'UDC/1-8' lined up with pointer on gear case, turn pump shaft so that distributor drive slot is two teeth clockwise (viewed from below) from correct installed position with slot parallel to camshaft (wide side of shaft toward camshaft). Shaft will be rotated into position as gears are meshed. Check by sighting down distributor shaft hole (distributor out) to see that shaft slot parallel to camshaft and wide halve of shaft toward camshaft.

REAR SUPPORT INSTALLATION (OVERDRIVE TRANSMISSION):—On cars with Overdrive, rear support (must be removed to remove transmission) should be installed with original shims in same location in order to maintain alignment. These shims located between support and frame at each end. If shims lost or readjustment necessary, install support as follows: Hold support in place under transmission case, install sufficient shims at each end to take up all except 1/16" clearance between support and frame, install frame bolts, tighten bolts securely with shims in place. This clearance will provide correct compression of the support rubber cushions.

HILL HOLDER ADJUSTMENT:—On cars with Hill-Holder (optional equipment), check action whenever clutch adjusted to make certain that brakes release just before clutch engages.

Adjustment—Loosen locknut on end of Hill-holder control rod, shorten rod for earlier brake release, lengthen rod for later release, tighten locknut.

NOTE—On Champion, adjusting sleeve and locknut provided on rod.

HOOD LOCK & SIDE PANEL:—*See Studebaker Shop Notes for data.*

SERIAL NUMBER:—First number G-30501 (South Bend), G-803701 (Los Angeles). Stamped on right hand body front hinge pillar.

ENGINE NUMBER:—First number 34101. Stamped on pad on upper left front corner of engine block.

ENGINE SPECIFICATIONS:—6 cylinder, 'L' head.
Bore—3". **Stroke**—3⅞".
Displacement—164.3 cu. in. **Rated HP.**—21.6.
Developed Horsepower—78 at 4000 RPM.
Compression Ratio—6.5-1 Std. cast-iron hd.
Compression Pressure—105 lbs. at 150 RPM.
Vacuum Reading—Steady 17-18" at 8 MPH. idle speed.
See Studebaker Shop Notes for Head installation.

PISTONS:—Aluminum alloy, tin-plated, T-slot, cam ground type.
Length—2⅝". **Weight**—.53 lbs.
Removal—Pistons and rods removed from above.
Clearance—.0005" new. See Fitting New Pistons.
Original Bore Size:—*See Studebaker Shop Notes.*
Replacement Pistons:—Finished pistons (pins fitted) furnished standard and .002", .004", .010", .015", .020", .030" oversize. Exact size stamped on piston head.
Fitting New Pistons:—Insert .002"x1" feeler between piston and wall on camshaft side (pin parallel to crankshaft, T-slot away from camshaft). Pull to withdraw feeler must be between 16 to 22 lbs. NOTE—Cylinder bore out-of-round and taper .002" maximum.
Installing Pistons:—T-slot away from camshaft.

PISTON RINGS:—3 rings, all above pin—#1 Comp. P-C 200 (with step up), #2 Comp. P-C 70 (with step down), #3 Oil P-C 85 (slotted type). Oil ring groove drilled with drain holes. Heat-dam groove (no ring) above #1 ring groove.

Ring	Width	End Gap	Side Clearance
Comp. (Top)	3/32"	.007-.017"	.0015-.002"
Comp. (#2)	⅛"	.007-.017"	.0015-.002"
Oil Control	3/16"	.007-.017"	.0015-.002"

Replacement Rings:—.010", .020", .030" oversize.

PISTON PIN:—**Diameter** .7491-.7495". **Length** 2⅝". Pin locked in rod by tapered lockscrew and nut (small end of connnecting rod not split).
Pin Fit in Piston—.0001-.0003" clearance or light push fit. Replacement pistons have fitted pins.
See Studebaker Shop Notes for Pin removal and installation instructions.

CONNECTING ROD:—**Length** 6 7/16". **Weight** 1.28 lbs.
Crankpin Journal Diameter—1.81175-1.81275".
Lower Bearing—Spun babbitt. Exchange rods furnished std. and .010" and .020" undersize.
Clearance—.0005-.002". **Sideplay**—.005-.009".
Bearing Adjustment:—None. Replace rods. *See Studebaker Shop Notes for 'Palnut' installation.*
Installing Rods:—Narrow portion of bearing to front (#1,3,5), to rear (#2,4,6). Side marked with number and oil spray hole toward camshaft.

CRANKSHAFT:—4 bearing, integral counterweights.
Journal Diameters—2.437-2.4375".
Bearing Type—Removable steel-backed, babbitt-lined type. **Clearance**—.0005-.0025".
Bearing Adjustment:—None (no shims). Replace bearings. Furnished Std., .010", .020" undersize. Tighten bearing cap screws to 1100 in. lbs.
NOTE—Front oil pan seal block may be removed for access to front main bearing cap by removing lower timing gear cover screws (on front face).
End Thrust:—Thrust plate assembled between front bearing and crankshaft gear. Controlled by shims between plate & journal face. **Endplay .003-.006".**

CAMSHAFT:—Four bearing with helical gear drive.
Journal Dieameters—#1, 1.74750-1.74800"; #2, 1.71625-1.71700"; #3, 1.68575-1.68650; #4, 1.62325-1.62400".
Bearings—Steel-backed, babbitt-lined bushings. Align oil hole in block and bushing.
Clearance—.00075-.00225" (#1), .001-.00275" (others).
End Thrust:—Steel thrust washer and spacer assembled between gear hub and front bushing.
Timing Gears:—Crankshaft (cast-iron), Camshaft (Celeron Fabric). *See Studebaker Shop Notes for Gear Removal & Replacement Gear size selection.*
Backlash—.001-.003".
Camshaft Setting:—Mesh marked camshaft gear tooth between two marked teeth on crankshaft gear.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1 11/32"	.310-.311"	4 11/32"
Exhaust	1 9/32"	.310-.311"	4 11/32"

	Seat Angle	Lift	Stem Clearance
All Valves	45°	5/16"	.001-.0035"

Tappet Clearance:—.016" (cold) all valves. *See Studebaker Shop Notes for Hood Side Panel removal and Self-Locking tappet data.*
Valve Guides:—Pressed in block from above 1 3/16" below top of block. Finish ream to .312-.3135".
Valve Springs:—Install with closed coils at top. Replace if springs 10% weak.

	Spring Pressure	Spring Length
Valve Closed	49-53 lbs.	1 21/32"
Valve Open	90-94 lbs.	1 11/32"

Valve Lifters:—Mushroom type. Lifter clearance in block .0005-.0015".
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 15° BTDC. Close 49° ALDC.
Exhaust Valves—Open 54° BLDC. Close 10° ATDC.
To Check Timing—Set tappet clearance #1 intake valve at .020". This valve should open with piston 15° or .0835" before top dead center when flywheel mark 'IN.OP.1-6/' lines up with pointer on left rear engine plate. Reset tappet clearance at .016" (cold).

LUBRICATION:—Pressure system with oil pump mounted on right side of engine. *See Studebaker Shop Notes for Oil Pump installation instructions.*
Normal Oil Pressure:—40 lbs. at 40-60 M.P.H.
Oil Pressure Regulator:—Opens with 40 lbs. pressure. On right front corner of block. Not adjustable.
Crankcase Capacity:—5 quarts.

COOLING SYSTEM:—**Capacity**—10½ quarts.
Water Pump:—Packless, sealed ball-bearing shaft.
See article in Mechanical Equipment Section for data.
Removal—Drain water, remove fan belt, fan blades and pulley, hose, 3 pump mounting screws.
Thermostat:—Bishop & Babcock. In cyl. head outlet.
Setting—Starts to open 156° F. to 160° F.
Temperature Gauge:—Auto-Lite (Motometer) Vapor tension type. Part No. H-9210.
See article in Mechanical Equipment Section for data.

CLUTCH:—**Borg & Beck Model 8A7.** Single plate, dry disc type. Identified by #925 stamped on cover.
See article in Mechanical Equipment Section for data.
Facings—Molded (flywheel side), woven (pressure plate side), Inside Diam. 5⅛". Outside Diam. 7⅞". Thickness .125". NOTE—Grooved facing used on pressure plate side (After '39 Engine No. 17804).
Adjustment—Free travel 1" (min.). Turn clutch adjusting sleeve on connector link. Check Hill-holder.
Removal:—Remove transmission (see below), take off clutch housing, take out mounting screws in clutch cover flange, remove clutch cover assembly.

TRANSMISSION:—**Warner.** Model AS2-T84F. (Std.), AS2-T84F-R7A (overdrive with electrical 'kick-down' control, optl.). Helical gear and synchro-mesh (second & high), sliding spur (low & reverse).
Std. Transmission Note—Companion flange and rear extension discontinued. Solid propeller shaft used and slip joint formed ahead of front universal (transmission mainshaft splined with front yoke of front universal). Not used on cars with overdrive.
See Transmission, Overdrive, and Overdrive Control articles in Mechanical Equipment Section.
Transmission Control:—Remote steering col. shift Std.
See articles in Mechanical Equipment Section for data.
Removal (Std.):—Disconnect shift rods and speedometer cable, disconnect rear universal and withdraw propeller shaft from transmission. Place jack under engine rear plate, free rear engine mountings. Take out transmission mounting bolts, pull transmission out.
Overdrive Model—Same as Std. (above) except that top radiator hose must be disconnected, exhaust pipe loosened at manifold and engine rear plate, clutch shaft pulled free of engine, overdrive shift lever and solenoid leads disconnected, engine rear support cross-member removed, and rear of engine lowered so that transmission clears underside of frame X-member when removed. Also propeller shaft disconnect at front universal by removing U-bolts.

UNIVERSAL JOINTS:—**Spicer.** Model 1268-102 (all except front on cars with Overdrive). 1261-101 (front on cars with Overdrive). Needle bearing type. 2 used.
See article in Mechanical Equipment Section for data.

REAR AXLE:—**Spicer Model 23.** Semi-floating, hypoid gear type with Hotchkiss drive.
See article in Mechanical Equipment Section for data.
Ratio—4.56-1 standard. 4.1-1 optional.
Backlash—.003-.005". Shim adjustment.
Removal:—Hoist rear of car, disconnect propeller shaft at rear universal, hydraulic brake lines, brake cables, and shock absorbers. Remove spring U-bolts, disconnect rear spring shackles, and withdraw axle
Wheel Bearing Adjustment—Shims provided between flanged end of axle housing and brake backing plate. To adjust, remove wheel, hub and drum assembly (Puller J-446), and backing plate. Remove shims to decrease endplay, add shims to increase. Shims furnished .003", .005", .010", .030" thick.
Endplay—.001-.005". Measure with dial indicator.

SHOCK ABSORBERS:—**Houdaille.** Model BBFSS (front), BBDS (rear). Double acting, hydraulic.
See article in Mechanical Equipment Section for data.

STEERING:—**Steering Gear**—Ross Model T-12. Cam-and-Twin Lever type.
See article in Mechanical Equipment Section for data.
Front Suspension:—Planar type independent suspension with transverse spring.
See article in Mechanical Equipment Section for data.
Kingpin Inclination—5½°.
Caster—1° to 2°.
Camber—¼-¾°. Shim adjustment.
Toe In—⅛-7/32". Adjust right reach rod only for toe-in (left rod should be adjusted for left wheel straight-ahead position only).
Steering Geometry (Toe-out on Turns)—Inner wheel turned 22½°, Outer wheel 20°.

BRAKES:—**Service.** Lockheed hydraulic, single anchor type. Hand lever applies rear service brakes.
See article in Mechanical Equipment Section for data.
Drums—Diameter 9".
Lining—Front shoe (U.S. #714) 10 3/16". Rear shoe (Man. DV-2921) 7 13/16". Width 1¾". Thickness 3/16".
Clearance—.010" toe, .006" heel, for each shoe.
Braking Power—43% rear.
Hand Brake Adjustment:—See Service Brakes.
Hill-Holder:—Optional equipment.
See article in Mechanical Equipment Section for data.

HOOD LOCK:—*See Studebaker Shop Notes for data.*

SERIAL NUMBER:—First number 4148501 (South Bend), 4807601 (Los Angeles). Stamped on left hand body front hinge pillar.

ENGINE NUMBER:—On left side of cylinder block. First Number—H-87601.

ENGINE SPECIFICATIONS:—Model 10A. 6 cylinder, 'L' head. **Bore**—3 5/16". **Stroke**—4⅜".
Displacement—226 cu. ins. **Rated HP**—26.35.
Developed Horsepower—90 HP (Std. head), 94 HP (Optl. high altitude head) at 3400 RPM.
Compression Ratio—6.0-1 Standard cast-iron head. 7.0-1 aluminum head Optl. (high altitude only).
Compression Pressure—105 lbs. @ 150 RPM (Std. head).
See Studebaker Shop Notes for Cyl. Head Installation.
Vacuum Reading—18-20" at 450 RPM or 8 MPH.

PISTONS:—Lynite, aluminum alloy, tin-plated, T-slot, cam ground type. **Length** 3¾". **Weight** 14.4 ozs. (stripped).
Removal—Pistons and rods removed from above.
Clearance—.0005" new. Measure ¼" up on skirt 90° from pin bosses. See Fitting New Pistons.
Original Bore Sizes:—*See Studebaker Shop Notes.*
Replacement Pistons:—Finished pistons (pins fitted) furnished standard and .002", .004", .010", .015", .020", .030" oversize. Exact size stamped on piston head.
Fitting New Pistons:—Insert .002" x 1" feeler between piston and wall on camshaft side (pin parallel to crankshaft, T-slot away from camshaft). Pull to withdraw feeler must be between 7-15 lbs.
Installing Pistons:—T-slot away from camshaft.

PISTON RINGS:—New sealed power type compression rings (2 used) with upper inner edge beveled, 1 oil control ring, all above pin. Narrow heat-dam groove (no ring fitted) above top ring. Oil ring groove drilled with oil drain holes. NOTE—New type ring used on 1939 Commander starting with Eng. #H-81539.

Ring	Width	End Gap	Side Clearance
Compression	3/32"	.013-.018"	.0015-.002"
Oil Control	3/16"	.013-.018"	.0015-.002"

NOTE—Install compr. rings with bevel edge up.
Replacement Rings:—Oversizes .010", .020", .030".

PISTON PIN:—Diameter—⅞". **Length**—2⅞".
Pin locked in connecting rod.
Pin Fit in Piston—Light push fit (rod should rock in piston of own weight. Clearance .0001-.0003".
NOTE—Replacement pistons have pins fitted.

CONNECTING ROD:—Weight—33.2 ozs. **Length**—8⅛".
Crankpin Journal Diameter—2.18675-2.18775".
Lower Bearing—Spun babbitt. Rods exchanged.
Clearance—.0005-.002". **Sideplay**—.005-.009".
Bearing Adjustment:—None. Replace rods. Rods furnished std. and .010", .020" undersize. Ream to give clearance of .0005-.002". *See Studebaker Shop Notes for 'Palnut' installation instructions.*
Installing Rods:—Install rods with narrow half of bearing toward front in cylinders #1, 3, 5, toward rear in #2, 4, 6. Marks on rods and caps must be together and oil hole toward camshaft.

CRANKSHAFT:—4 bearing, 5 integral counterweights with vibration dampener mounted at forward end.
Journal Diameters—2.4995-2.500" all bearings.
Bearing Type—Removable steel-backed, babbitt-lined type. **Clearance**—.0005-.0025".
Bearing Adjustment:—None (no shims). Replace bearings. Furnished Std., .010", .020" undersize.
End Thrust:—Thrust plate assembled between front bearing and crankshaft gear. Controlled by shims between plate and bearing. **Endplay**—.003-.006".

CAMSHAFT:—Four bearing. Helical gear drive.
Bearings—Steel-backed, babbitt-lined, split type bushings. When replacing bushings, oil holes in block and bushing must be in alignment.
Clearance—.00075-.00225"(#1), .002-.00375"(others).
End Thrust:—Steel thrust washer and spacer between gear hub and front bushing.
Timing Gears:—Crankshaft (cast-iron). Camshaft (Celeron fabric with steel hub). Two threaded holes in gears provided for puller for gear removal. *See Studebaker Shop Notes for Gear Removal & Replacement Gear size selection.*
Camshaft Setting:—Mesh marked camshaft gear tooth with two marked teeth on crankshaft gear.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1 15/32"	11/32"	5 7/32"
Exhaust	1 9/32"	11/32"	5 7/32"

	Seat Angle	Lift	Stem Clearance
All valves	45°	11/32"	.001-.003"

Tappet Clearance:—.016" all valves (cold). Remove right hood side panel for work on valves. *See Studebaker Shop Notes for Hood Side Panel Removal.*
Valve Guides:—Pressed in block from above (1 5/32" below upper edge of valve seat) with stepped end down. Ream to inside diameter of .3425-.3445".
Valve Springs:—Install with closed coil at top. Damper on top of spring. Replace spring if 10% weak. *See Studebaker Shop Notes for Valve Spring Installation instructions.*

	Spring Pressure	Spring Length
Valve Closed	54-60 lbs.	2 3/32"
Valve Open	125-135 lbs.	1¾"

Valve Lifters:—Barrel type (no separate guides). Can be removed from top. Furnished .0005", .001" ov'size.
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 15° BTDC. Close 49° ALDC.
Exhaust Valves—Open 54° BLDC. Close 10° ATDC.
Valve Timing Check—Set tappet clearance #1 intake valve at .020". This valve should open with piston 15° or .0942" before top dead center when mark 'IN-OP.1-6/' on vibration damper at front of engine lines up with pointer on gear case cover at front of engine. Reset tappet clearance at .016" (cold).
Motor Gauge—Weidenhoff Adapter #104, Rod #2.

LUBRICATION:—Pressure system with oil pump mounted on right side of engine. *See Studebaker Shop Notes for Oil Pump installation instructions.*
Normal Oil Pressure:—40 lbs. at 25-30 MPH.
Oil Pressure Regulator:—Located on right front corner of engine. Operates at 40 lbs. Non-adjustable.
Crankcase Capacity:—6 quarts.

COOLING SYSTEM:—Capacity—14½ quarts.
Water Pump:—Centrifugal with adjustable packing. *See article in Mechanical Equipment Section for data.*
Removal—Drain water, remove fan belt, disconnect pump inlet hose, take out pump mounting bolts, lift fan and pump assembly out.
Thermostat:—Bishop & Babcock or Fulton. In Cylinder head water outlet. Install with bellows down.
Setting—Starts to open at 156-160°F.
Drain Valves:—Left side of radiator lower tank and plug on left side of block at rear.

CLUTCH:—Borg & Beck Model 9A7 with 'Borglite' driven member. Model #943 stamped on cover. Single plate, dry disc type.
See article in Mechanical Equipment Section for data.
Facings—Spiral wound molded woven, 2 used. Inside Diam. 6". Outside Diam. 9¼". Thickness ⅛".
Pedal Adjustment:—Free travel 1". min. (sleeve on pedal connecting rod, turn out for greater travel, in for less). Check Hill-Holder after clutch adjustment.
Removal:—Disconnect clutch linkage, remove transmission (see Transmission Removal following), support engine at rear, remove rear engine mountings and clutch housing. Take out mounting screws in clutch cover flange (turn screws out evenly) and remove clutch.

TRANSMISSION:—Warner. Synchro-mesh, all helical gear type with remote control shift. Overdrive with electrical control 'kick-down' Optl. (adjust control whenever accelerator linkage disturbed). *See Transmission, Overdrive, and Overdrive Control articles in Mechanical Equipment Section.*
Transmission Control:—New type remote shift.
See article in Mechanical Equipment Section for data.
Removal:—Disconnect shift rods from levers and speedometer cable at transmission, take out U-bolts in front universal and lower propeller shaft (on cars with Overdrive disconnect rear support at frame ends and wires at solenoid). Remove transmission mounting screws at clutch housing, pull transmission back and lift out. *See Studebaker Shop Notes for Overdrive Rear Support Installation data.*

UNIVERSAL JOINTS:—Spicer—1271-101 (front), 1278-101 (rear). Needle bearing type. 2 used.
See article in Mechanical Equipment Section for data.

REAR AXLE:—Spicer Model 41-2. Semi-floating, hypoid gear type with Hotchkiss drive.
See article in Mechanical Equipment Section for data.
Ratio—4.55-1 Std., 4.82-1 Optl.
Backlash—.005-.007". Shim adjustment.
Removal:—Hoist rear of car, disconnect propeller shaft at rear universal, brake line, and shock absorbers, remove spring U-bolts, disconnect rear spring shackles, withdraw axle assembly from car.
Wheel Bearing Adjustment—Shims provided between flanged end of axle housing and brake backing plate. To adjust, remove wheel, hub, drum, and backing plate (retained by 6 nuts). Remove shims to decrease endplay, add shims to increase. Shim thickness at both wheels must be equal within .005".
Endplay—.001-.005". Measure with dial indicator.

SHOCK ABSORBERS:—Houdaille, Type BBFS (front), ACHS (rear). Double acting, hydraulic, adjustable type with thermostatic control (rear only).
See article in Mechanical Equipment Section for data.

STEERING:—Steering Gear. Ross Cam-and-Twin-Lever type. Model T-14.
See article in Mechanical Equipment Section for data.
Front Suspension:—Planar type independent suspension with transverse spring. Specifications below apply with car unloaded on level floor.
See article in Mechanical Equipment Section for data.
Kingpin Inclination—5½°.
Caster—Negative ¼° to Positive ¾°. Not adjustable.
Camber—¼° to ¾°. Adjustable.
Toe In—1/16-⅛". Adjust right reach rod for toe-in.
Steering Geometry (Toe-out on Turns)—Inner wheel turned 22°, Outer wheel 20°.

BRAKES:—Service—Lockheed hydraulic, double anchor type. Hand lever applies rear wheel service brakes.
See article in Mechanical Equipment Section for data.
Wheel Cylinders—Stepped or two-stage bore type: Front Wheels—Front shoe cylinder 1⅜", Rear 1". Rear Wheels—Front shoe cylinder 1¼". Rear 1".
NOTE—Wheel cylinder bore size marked on casting.
Drum—Budd composite. Diameter 11".
Lining—Front shoe—woven. Rear—moulded. Width 2". Thickness 3/16". Length per wheel 19 11/16".
Clearance—.010" toe, .005" heel, for each shoe.
Braking Power—45% rear.
Hand Brake Adjustment:—See Service Brakes
Hill-Holder:—Optl. *See Mechanical Equipment Section.*

HOOD LOCK:—*See Studebaker Shop Notes for data.*

SERIAL NUMBER:—First number 7133101 (South Bend), 7803301 (Los Angeles). Stamped on left hand body front hinge pillar.

ENGINE NUMBER:—On left rear of cylinder block. First Number—B-38501.

ENGINE SPECIFICATIONS:—**Model 6C.** 8 cylinder, 'L' head type. **Bore**—3 1/16". **Stroke**—4¼". **Displacement**—250.4 cu. ins. **Rated HP**—30. **Developed Horsepower**—110 at 3600 RPM. **Compression Ratio**—6.0-1 standard cast-iron head. 6.5-1 high compression head optional. **Compression Pressure**—105 lbs. at 150 RPM (std. head). **Vacuum Reading**—18" at 450 RPM or 8 MPH. *See Studebaker Shop Notes for cyl. head installation.*

PISTONS:—Lynite, aluminum alloy, T-slot, Cam ground, tin-plated type. **Length**—3¾". **Weight**—13.6 ozs. (stripped). **Removal**—Pistons and rods removed from above. **Clearance**—.0015" (¼" up on skirt 90° from pin).

Original Bore Sizes:—*See Studebaker Shop Notes.*

Replacement Pistons:—Finished pistons (with pins fitted) furnished .002", .004", .010", .015", .020",. 030" oversize. Exact size stamped on piston head.

Fitting New Pistons:—Install .003" x 1" hardened feeler between piston and cylinder wall on camshaft side (T-slot away from camshaft, pin bosses parallel to crankshaft). Pull to withdraw feeler must be 7-15 lbs.

Installing Pistons:—T-slot away from camshaft.

PISTON RINGS:—Two compression, 1 oil control ring, all above pin with narrow heat-dam groove (no ring) above top ring groove. Oil ring groove drilled with oil drain holes.

Ring	Width	End Gap	Side Clearance
Compression	⅛"	.013-.018"	.0015-.002"
Oil Control	3/16"	.013-.018"	.0015-.002"

NOTE—Install compression rings with step down. Inner ring used with oil ring only.

Replacement Rings:—Oversizes .010", .020", .030".

PISTON PIN:—**Diameter**—⅞. **Length**—2⅝". Pin locked in rod by clampscrew. **Pin Fit in Piston**—Light push fit (rod should rock in piston of own weight). Clearance .0001-.0003". NOTE—Replacement Pistons have pins fitted.

CONNECTING ROD:—**Weight**—32 ozs. **Length**—8". **Crankpin Journal Diameter**—1.87425-1.87525". **Lower Bearing**—Removable, steel-backed, lead-bronze lined type. **Clearance**—.00075-.00275". **Sideplay**—.005-.010".

Bearing Adjustment:—None. Replace bearings. Furnished Std. and .005", .010", .020" undersize. Crankpin must be turned down to size (bearings should not be reamed). See that tongues on bearings engage slots and that oil holes are aligned. *See Studebaker Shop Notes for 'Palnut' installation.*

Installing Rods:—Oil hole in rod toward camshaft.

CRANKSHAFT:—9 bearing, 12 bolted counterweights. Vibration dampener mounted on forward end. *See Studebaker Shop Notes on Vibration Dampener installation.* **Journal Diameters**—2 3435-2.3440" all bearings. **Bearing Type**—Removable steel-backed, babbitt-lined type. **Clearance**—.001-.003".

Bearing Adjustment:—None (no shims). Replace bearings. Do not file bearing caps. Bearings furnished .010" and .015" undersize.

End Thrust:—Thrust plate between front main bearing and crankshaft gear with shim adjustment. **Endplay**—.003-.006".

CAMSHAFT:—Six bearing. Helical gear drive. **Bearings**—Split steel-backed, babbitted bushings. NOTE—Oil holes in bushing & block must line up. **Clearance**—.00075-.00225" (#1), .002-.00375" (others).

End Thrust:—Steel thrust washer and spacer between gear hub and bearing. **Endplay**—.003-.006".

Timing Gears:—Cast-iron (crankshaft). Celeron Fabric (camshaft). *See Studebaker Shop Notes for Gear Removal and Replacement Gear Size Selection.*

Camshaft Setting:—Mesh marked tooth on camshaft gear between two marked teeth on crankshaft gear.

VALVES:—	Head Diameter	Stem Diameter	Length
Intake	1 13/32"	11/32"	5 7/32"
Exhaust	1 9/32"	11/32"	5 7/32"

	Seat Angle	Lift	Stem Clearance
All Valves	45°	11/32"	.001-.003"

Tappet Clearance:—.016" all valves—engine cold. Remove right hood side panel for work on valves. *See Studebaker Shop Notes for Side Panel Removal.*

Valve Guides:—Pressed in block from above (1 5/16" below top of block) with stepped end down. Ream to inside diameter of .343-.344".

Valve Springs:—Install with closed-coil up and dampener on top of spring. Replace springs if 10% weak.

	Spring Pressure	Spring Length
Valve Closed.	49-53 lbs.	2 3/32"
Valve Open	125-135 lbs.	1¾"

Valve Lifters:—Mushroom type in bolted-on guide brackets (clusters of four). Assemblies may be removed through valve opening on side of engine.

Valve Timing:—See Camshaft Setting above. **Intake Valves**—Open 15° BTDC. Close 49° ALDC. **Exhaust Valves**—Open 54° BLDC. Close 10° ATDC. **Valve Timing Check**—Set tappet clearance for #1 intake valve at .020". This valve should open with piston 15° or .0915" before top dead center when 'IN.OP/1-8' mark on vibration dampener at front of engine lines up with pointer on gear cover. Reset tappet clearance at .016" cold. **Motor Gauge**—Weidenhoff Adapter #104, Rod #40.

LUBRICATION:—Pressure type. Gear type oil pump in crankcase. *See Studebaker Shop Notes for Oil Pump Installation directions.*

Normal Oil Pressure:—60 lbs. (min.) at 25-30 MPH.

Oil Pressure Regulator:—Located at right front corner of engine. Opens at 60 lbs. Non-adjustable.

Crankcase Capacity—8 quarts.

COOLING SYSTEM:—**Capacity**—17 quarts.

Water Pump:—Centrifugal with adjustable packing. *See article in Mechanical Equipment Section for data.* **Removal**—With water drained and fan belt removed, disconnect hose, take out mounting bolts, lift off pump and fan assembly.

Thermostat:—Bishop & Babcock or Fulton. In cylinder head outlet. Install with bellows down. **Setting**—Starts to open 156-160°F.

Drain Valves:—On left side of radiator lower tank and plug at left rear of engine block.

CLUTCH:—**Inland.** 'Diaphragm' type, single plate, dry disc type with Long 9½CF-CS driven member. *See article in Mechanical Equipment Section for data.* **Facings**—Molded (spiral or chevron wound), 2 used. Inside Diam. 6". Outside Diam. 9½". Thickness .125".

Pedal Adjustment:—Free travel 1" min. Sleeve adjustment on pedal connecting rod. Check Hill-Holder after adjusting clutch.

Removal:—Disconnect clutch pedal linkage, remove transmission (see Transmission Removal following), support engine at rear, remove rear engine mountings and clutch housing, take out mounting screws in clutch cover flange (turn all screws out evenly), remove clutch assembly. CAUTION—Support pressure plate by hand to avoid distorting pressure plate tension springs.

TRANSMISSION:—**Warner.** Synchro-mesh, all helical gear type with remote control shift. Overdrive with electrical control 'kick-down' Optl. (adjust control whenever accelerator linkage disturbed). *See Transmission, Overdrive, and Overdrive Control articles in Mechanical Equipment Section.*

Transmission Control:—New type remote shift. *See article in Mechanical Equipment Section for data.*

Removal:—Disconnect shift rods from levers and speedometer cable at transmission, disconnect front universal by removing U-bolts and lower propeller shaft (on cars with Overdrive disconnect rear support at frame ends and wires at solenoid). Remove transmission mounting screws at clutch housing, pull transmission straight back and lift out. *See Studebaker Shop Notes for Overdrive Rear Support Installation instructions.*

UNIVERSAL JOINTS:—**Spicer**—1271-101 (front), 1278-101 (rear). Needle bearing type. 2 used. *See article in Mechanical Equipment Section for data.*

REAR AXLE:—**Spicer Model 41-2.** Semi-floating, hypoid gear type with Hotchkiss drive. *See article in Mechanical Equipment Section for data.* **Ratio**—4.55-1 Std., 4.82-1 Optl. (Std. with Overdrive). **Backlash**—.005-.007". Shim adjustment.

Removal:—Hoist rear of car, disconnect brake line, shock absorbers, drive shaft at rear universal, rear spring U bolts and rear spring shackles, withdraw axle assembly from car. NOTE—Bleed brake lines when axle installed.

Wheel Bearing Adjustment:—Shims located between flanged end of axle housing and brake backing plate. To adjust, remove wheel, hub, brake drum, and backing plate (retained by 6 bolts). Remove shims to decrease endplay, add shims to increase. Shim thickness at both wheels must be equal within .005". **Endplay**—.001-.005". Measure with dial indicator.

SHOCK ABSORBERS:—Houdaille, Type BBFS (front), ACHS (rear). Double acting, hydraulic, adjustable type with thermostatic control (rear only). *See article in Mechanical Equipment Section for data.*

STEERING:—**Steering Gear**—Ross Model T-14. Cam-and-Twin Lever type. *See article in Mechanical Equipment Section for data.*

Front Suspension:—Planar type independent suspension with transverse spring. Specifications below apply with car weight on wheels but without load. *See article in Mechanical Equipment Section for data.* **Caster**—Negative ¼° to Pos. ¾°. Not adjustable. **Camber**—¼° to ¾°. Adjustable. **Toe In**—1/16-⅛". Adjust right reach rod for toe-in. **Steering Geometry (Toe-out on Turns)**—Inner wheel turned 22°, Outer wheel 20°.

BRAKES:—**Service**—Lockheed hydraulic, double anchor type. Hand lever applies rear wheel service brakes. *See article in Mechanical Equipment Section for data.* **Wheel Cylinders**—Stepped or two-stage bore type: Front—Front Shoe Cylinder 1⅜". Rear 1". Rear—Front Shoe Cylinder 1¼". Rear 1". NOTE—Wheel cylinder bore size marked on casting. **Drum**—Budd Composite. Diameter 11". **Lining**—Front shoe—woven. Rear—moulded. Width 2¼". Thick. 3/16". Length per wheel 19 11/16". **Clearance**—.010" toe, .005" heel, for each shoe. **Braking Power**—45% rear, 55% front.

Hand Brake:—See Service Brakes above.

Hill-Holder:—Optl. *See Mechanical Equipment Section.*

PANEL DELIVERY NOTE:—Engine data given below applies to later cars beginning with Engine No. 35129 which have the Model 440 Engine (same as Pick-up model). First Panel Delivery cars (before Engine No. 35129) have the Model 440P Engine which is similar to that used on Willys 48 (1939). *See next page for Engine data on first Panel Delivery model.*

SERIAL NUMBER:—First No. 440-17001 (all models). Stamped on plate on frame front cross-member and on right side of cowl under engine hood (Pass. cars & Pick-up), or on right front floor riser at door (Panel Delivery).

ENGINE NUMBER:—First No. 17001 (all models). Stamped on right front upper corner of engine block.

ENGINE:—Own Model 440. 4 cylinder, 'L' head type.
Bore—3.125" (3⅛"). **Stroke**—4.375 (4⅜").
Displacement—134.2 cubic inches.
Rated Horsepower—15.63.
Developed Horsepower—61 (Pass. Car), 58 (Pick-up & Panel Delivery) at 3600 RPM. with Std. Heads.
Compression Ratio & Pressure—For each model as follows (All heads Cast Iron except H. C. (7.0-1) head which is Aluminum.

Model	Ratio	Pressure (Crk. Speed)
Pass. Car Std.	6.48-1	111 lbs., 185 RPM.
Pass. Car High Alt.	6.81-1	111 lbs., 185 RPM.
Pass. Car Optl. H.C.	7.0-1	111 lbs., 185 RPM.
Pick-up & Panel Dlvry	6.1-1	107 lbs., 185 RPM.

Vacuum Reading—Steady 21-23" idling at 8 MPH.
NOTE—Cylinders offset ⅛" from center-line of crankshaft toward camshaft side of engine.

PISTONS:—Lynite Lo-Ex aluminum alloy, 'T' slot, Cam ground, Tin-plated type with narrow 'heat-dam' groove above top piston ring.
Weight—12 ozs. (stripped). **Length**—3¾".
Removal—Pistons and rods removed from above.
Clearance—.014-.019" top, .003" skirt.
Original Bore & Piston Sizes:—Engines and pistons graded in four .0005" steps as shown in table below and marked as follows: **Piston**—Letter stamped on head, **Cylinder Bore**—Letter stamped on top of block between valve ports and bore at center.

Grade Letter	Cylinder Bore Size	Piston Size
A	3.1255-3.1250"	3.1235-3.1230"
B	3.1260-3.1255"	3.1240-3.1235"
C	3.1265-3.1260"	3.1245-3.1240"
D	3.1270-3.1265"	3.1250-3.1245"

Replacement Pistons:—Finished pistons furnished Std. (see Original Piston size table) and .002", .005", .010" oversize.
Fitting New Pistons:—Use .0025" feeler stock ¾" wide inserted between piston and cylinder wall on side opposite slot to check clearance. Pull required to withdraw feeler must be within 5-10 lbs.
Installing Pistons:—Slot toward left (valve) side.

PISTON RINGS:—Two compression, one oil control ring per piston, all above pin (narrow heat-dam groove above top ring). Oil ring groove drilled for drainage.

Ring	Width	End Gap	Side Clearance
Compr.	3/32"	.008-.013"	.0015-.002"
Oil Cont.	3/16"	.008-.013"	.0015-.002"

Wall Thickness—.130-.140" (Compr.—same as 1939), .090-.103" (oil ring with inner ring), .135-.145" (later oil ring without inner ring).
NOTE—Install taper-faced compression ring with mark 'TOP' up toward head of piston.
Replacement Rings:—Furnished Standard and .005", .010", .020", .030" oversize.

PISTON PIN:—Diameter .8117-.8127". **Length** 2 25/32".
Pin is locked in connecting rod by clampscrew.
Pin Fit in Piston—.0001-.0009" clearance or light push fit at 60° F.
Replacement Pins:—Furnished Standard and .001", .002", .003" oversize.

CONNECTING ROD:—Weight 34 ozs. **Length** 9 3/16".
Crankpin Journal Diameter—1.9395" (1 15/16").
Lower Bearing—Spun babbitt-lined type.
Clearance—.0008-.0023". **Sideplay**—.005-.009".
Bearing Adjustment:—None (no shims). Replace or rebabbitt rods. Do not file rods or bearing caps. Rods furnished Standard and .010" undersize.
Installing Rods:—Lower bearings offset. Install rods with short side of bearing toward nearest main bearing (toward front of engine for #1 and #3, toward rear for #2 and #4) with oil squirt hole in rod toward right (away from camshaft) on all rods.

CRANKSHAFT:—Three bearing, counterweighted type.
Journal Diameters—2.334" all bearings.
Bearing Type—Removable slip-in steel-backed, babbitt-lined type. Bearings furnished Standard and .010" undersize.
Clearance—.001-.0025".
Bearing Adjustment:—None (no shims). Replace bearings. Do not file bearing caps.
End Thrust:—Taken by #1 front bearing. Adjustable by adding or removing shims between crankshaft thrust washer and shaft. **Endplay**—.004-.006".

CAMSHAFT:—4 bearing. Non-adjustable chain drive.
Bearing Type—Removable bushing (front), machined in crankcase (all others).
Bearing Clearance—.002-.0035".
End Thrust:—Taken by thrust plate behind camshaft sprocket and spring-loaded plunger in forward end of camshaft bearing against thrust stud on chain case cover. NOTE—Make certain that plunger and spring in place when replacing chain case cover.
Timing Chain:—Link-Belt #82, 1¼" (Before Engine No. 34266); #S-40936, 1" (After Engine No. 34266). Pitch ½". Length 47 links or 23½".
Camshaft Setting:—With #1 piston on top dead center, mesh chain so that timing marks on sprockets are adjacent and in line with straightedge across shaft centers.

VALVES:—	Head Diam.	Stem Diam.	Length
Intake	1 17/32"	.373"	5¾" (overall)
Exhaust	1 15/32"	.3725"	5¾" (overall)

	Seat Angle	Lift	Stem Clearance
Intake	45°	23/64"	.0015-.00325"
Exhaust	45°	23/64"	.002-.00375"

NOTE—Separate valve seat inserts not used.
Tappet Clearance:—.014" all valves, engine cold.
NOTE—Remove hand hole in left front fender splash shield by taking out screws for valve adjustment.
Valve Guides:—Installed with taper end up. Remove old guides from above, press new guides in until lower end extends ¾" below valve spring seat recess in block.
Valve Springs:—Free length 2 11/16". Damper installed within each spring at upper end.

	Spring Pressure	Length
Valve Closed	46 lbs.	2¼"
Valve Open	85½ lbs.	1 15/16"

Valve Lifters:—Mushroom type. Guide holes reamed directly in block. Serviced by reaming guide hole and installing lifters furnished .004" oversize.
Lifter Clearance—.0005-.002".
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 9° BTDC. Close 50° ALDC.
Exhaust Valves—Open 47° BLDC. Close 12° ATDC.
To Check Timing—Set tappet clearance #1 intake valve at .020". This valve should open with piston 9° or .039" before top dead center when flywheel mark 'I.O.' centered in inspection hole in right front face of rear motor support (¼" variation permissible. Reset tappet clearance at .014" Cold.

LUBRICATION:—Pressure system. Gear type oil pump mounted on outer left side of crankcase.
Oil Pump Installation Note—Turn engine over until 'IGN' mark on flywheel lines up with indicator (inspection hole in top left surface of flywheel housing) with #1 piston on compression stroke, turn distributor shaft so that rotor is at #1 segment in distributor cap, mesh oil pump gear so that distributor not disturbed when tongue-and-slot drive coupling engaged.
Normal Oil Pressure:—75 lbs. (on gauge) at 30 MPH.
Oil Pressure Regulator:—Under plug on oil pump cover. Opens at 40 lbs. Adjustable by adding or removing shims within plug above spring.
Oil Pressure Gauge:—King-Seeley Electric. K-S No. 7860—first, 8115—later (Dash Units), No. 6425 (Engine Unit). NOTE—Dial on first dash unit has ivory lines, later unit has ivory dots.
See article in Mechanical Equipment Section for data.
Crankcase Capacity—4 quarts.

COOLING SYSTEM:—Water Capacity—11¾ quarts.
Water Pump:—Ball-bearing, packless type.
See article in Mechanical Equipment Section for data.
Removal—Drain water, remove fan belt and fan blades, loosen radiator mounting nuts, take out mounting bolts and lift pump out.
Thermostat:—Harrison. In outlet elbow on head. Starts to open 148-155°. Fully open at 173° F. NOTE—Thermostat not used on first Pick-up & Panel Delivery.
Temperature Gauge:—King-Seeley Electric. K-S No. 7850—first, 8110—later (Dash Units), No. 7000 (Engine Unit). NOTE—First dash unit has ivory lines, later dash unit has ivory dots.
See article in Mechanical Equipment Section for data.

CLUTCH:—Atwood Model TP 28-7 (Pass. Cars), Rockford UCLA-13-1098 (Pick-up & Panel Delivery). Single plate, dry disc type. No adjustment for wear required. NOTE—Borg & Beck driven member used with both clutches.
See article in Mechanical Equipment Section for data.
Facings—Molded type (Pass. Car). Molded & Woven type (Pick-up & Panel Delivery). Inside Diam. 5⅛". Outside Diam. 7⅞". Thickness .125".
Adjustment:—Pedal free travel must be ¾-1" (providing 1/16" clearance between release bearing and release levers). To adjust, loosen locknut, turn clutch fork connecting cable.
Removal:—Remove Transmission (see Transmission Removal below) and flywheel bell housing, take out mounting screws in clutch cover rim, lift clutch assembly and driven member out.

TRANSMISSION:—Warner Model AS3-T84D (Speedway Pass. Cars, Pick-up & Panel Delivery), AS4-T84F (Deluxe Pass. Cars with Steering Column Gearshift). Constant-mesh, synchro-mesh, helical gears (Second & High), sliding spur gears (Low & Reverse).
See article in Mechanical Equipment Section for data.
Transmission Control:—Own remote control type mounted on steering column. Std. on Deluxe Pass. Cars only.
See article in Mechanical Equipment Section for data.

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Removal:—Cover front seat cushion and door trim. On Deluxe Pass. Cars, disconnect control rods at transmission. On all other models, disconnect gearshift lever at retaining collar. Disconnect accelerator pedal from rubber socket, remove toeboards, disconnect propeller shaft at front universal, remove bell housing hand hole cover and disconnect clutch throw-out bearing retracting spring. Remove lower nuts on engine mounting bolts at rear of transmission, jack up rear of engine (Caution—see that fan blades do not damage radiator) to clear frame cross-member, remove transmission mounting bracket, remove bell housing-to-transmission case bolts, pull transmission straight back and lift out.

UNIVERSAL JOINTS:—Detroit Series 4100. Needle bearing, Ball-and-trunnion type. Two used.
See article in Mechanical Equipment Section for data.

REAR AXLE:—Own Model 440 (Pass. Cars), Spicer (Salisbury) Model 21-1 (Pick-up & Panel Delivery). Semi-floating, spiral bevel gear type with Hotchkiss drive. *See article in Mechanical Equipment Section.*
Ratio—4.3-1 (Speedway), 4.55-1 (Deluxe), 4.7-1 (Pick-up), 5.1-1 (Panel Delivery).
Backlash—.004-.008". Shim adjustment.
Removal:—Hoist rear of car. Disconnect drive shaft at rear universal, brake tube and cables, shock absorbers, spring U-bolts, rear spring shackles. Pull axle assembly out toward rear.

SHOCK ABSORBERS:—Monroe or Gabriel (Pass. Cars), Monroe (Pick-up & Panel Delivery). Direct acting type.
See article in Mechanical Equipment Section for data.

STEERING:—Steering Gear—Gemmer Model 250 Worm and-Roller type (Pass. Cars), Model 120 Worm-and-Sector type (Pick-up & Panel Delivery).
See article in Mechanical Equipment Section for data.
Front Suspension:—Own Model 440 Front Axle. Conventional type with 'I' beam section and Reverse-Elliott ends.
Kingpin Inclination—7½° crosswise.
Caster—3°. Adjustable by installing wedge shims between spring and spring pad on axle.
Camber—2°. Not adjustable.
Toe-In—1/16-⅛". Adjustable by loosening tie rod clamp bolts and turning tie rod.
Steering Geometry (toe-out on turns)—With outer wheel turned 20°, inner wheel should turn 23°15'. Not adjustable (check for bent steering arms).

BRAKES (PASS. CARS):—Service—Bendix (Lockheed) Hydraulic, double anchor type. Hand lever applies rear wheel service brakes. *See 'Lockheed Double Anchor' Brake article in Mechanical Equipment Section.*
Drums—Alloy cast iron. Diameter 9".
Lining—Molded type. Width 1¾". Thickness 3/16". Length 18⅝" per wheel.
Clearance—.010" toe, .005" heel for each shoe.
Braking Power—55% front, 45% rear.
Hand Brake:—See Service Brakes above.

BRAKES (PICK-UP & PANEL DELIVERY):—Service. Bendix Mechanical, Duo-servo, Single Anchor. Hand lever applies all service brakes.
See article in Mechanical Equipment Section for data.
Drums—9" Pressed Steel (Pick-up), 11" alloy iron (Panel Delivery).
Lining—Molded & Woven type (Pick-up), Molded (Panel Delivery). Width 1¾". Thickness 3/16". Length per wheel 19 3/16" (Pick-up), 23 15/16" (Panel Delivery).
Clearance—.010" at heel and toe of each shoe.
Hand Brake:—See Service Brakes above.

PANEL DELIVERY 440P
BEFORE ENGINE NUMBER 35129

LATER PANEL DELIVERY NOTE:—Engine data below applies to first cars only (from Engine No. 17001 to 35129). After Engine No. 35129, these models equipped with Model 440 Engine (same as used on Passenger Cars and Pick-up models). *See preceding page for data on this later engine and for data on Clutch, Transmission, Universal Joints, Rear Axle, Steering, and Brakes on all Panel Delivery cars.*

SERIAL NUMBER:—First number 440-17001. Stamped on plate on front center of frame front cross-member and on right front floor riser at door.

ENGINE NUMBER:—First number 17001. Stamped on right front upper corner of engine block.

ENGINE:—Own Model 440P. 4 cylinder, 'L' head type.
Bore—3⅛". **Stroke**—4⅜".
Displacement—134.2 cubic inches.
Rated Horsepower—15.63 (A.M.A.).
Developed Horsepower—48 HP at 3200 RPM.
Compression Ratio—5.7-1 cast-iron hd.
Compression Pressure—87 lbs. at 216 RPM.
Vacuum Reading—Steady 18½" idling at 8 MPH.
NOTE—Cylinder bore offset ⅛" from center line of crankshaft toward valve side of engine.

PISTONS:—Full skirt, hard grey iron, light weight type.
Weight—21-23 ozs. (stripped). **Length**—3¾".
Removal—Pistons and rods removed from above.
Clearance—Top .0165-.017". Skirt .0025-.003".
Replacement Pistons:—Finished pistons furnished Std. and .003", .005", .010", .015", .020", .025", .030" oversize.
Fitting New Pistons:—Use .0025" feeler stock ¼" wide inserted between piston and cylinder wall to check clearance. Pull required to withdraw feeler must be 4 lbs. plus or minus 2 lbs.

PISTON RINGS:—Three compression, one oil control ring per piston, all above pin.

Ring	Width	End Gap	Side Clearance
Compression	3/32"	.008-.013"	.0015"
Oil Control	3/16"	.008-.013"	.0015"

Wall Thickness—.130-.140" (Comp.), .098-.103" (oil).
Replacement Rings:—Furnished Std. and .003", .005", .010", .015", .020", .025", .030", .040" oversize.

PISTON PIN:—Diameter—15/16" (.9375"). **Length**—2.682". Pin floats in piston and rod. Retained by locking rings. Furnished .001", .003" oversize.
Pin Fit in Piston—.0002-.0004" clearance or hand push fit with piston dry.
Pin Fit in Rod Bushing—.0002-.0004" clearance or thumb press fit.

CONNECTING ROD:—Weight 34 ozs. **Length** 9 3/16".
Upper Bearing (Piston Pin Bushing)—Bronze.
Crankpin Journal Diameter—1.9395" (1 15/16").
Lower Bearing—Spun-babbitt-lined type.
Clearance—.001-.0025". **Sideplay**—.004-.009".
Bearing Adjustment:—None (no shims). Replace or rebabbitt rods. Do not file rods or bearing caps. Rods furnished Standard and .010" undersize.
Installing Rods:—Lower bearings offset. Install rods with short side of bearing toward nearest main bearing (toward front of engine for #1 & 3, toward rear for #2 & 4) with oil squirt hole in rod toward right (away from camshaft) on all rods.

CRANKSHAFT:—Three main bearing type.
Journal Diameters—2.334" all bearings.
Bearing Type—Removable slip-in steel-backed, babbitt-lined type. Bearings furnished Standard and .010" undersize. **Clearance**—.001-.0025".
Bearing Adjustment:—None (no shims). Replace bearings. Do not file caps.
End Thrust:—Taken by #1 front bearing. Adjustable by adding or removing shims between crankshaft thrust washer and shaft. **Endplay**—.004-.006".

CAMSHAFT:—4 bearing. Non-adjustable chain drive.
Bearing Type—Removable bushing (front), machined in crankcase (all others).
Bearing Clearance—.002-.0035".
End Thrust:—Taken by thrust plate behind camshaft sprocket and spring-loaded plunger in forward end of camshaft bearing against thrust stud on cover.
Timing Chain:—Link-Belt #82 (Willys #S-40936). Width 1". Pitch ½". Length 23½" or 47 links.
Camshaft Setting:—With #1 piston on top dead center, mesh chain so that timing marks on sprockets are adjacent and in line with a straightedge across the shaft centers.

VALVES:	Head Diam.	Stem Diam.	Length
Intake	1 17/32"	.372"	5 13/64" (5¾" overall)
Exhaust	1 15/32"	.371"	5 13/64" (5¾" overall)

	Seat Angle	Lift	Stem Clearance
Intake	45°	21/64"	.002-.004"
Exhaust	45°	21/64"	.003-.005"

NOTE—Exhaust valve seat inserts are used.
Tappet Clearance:—.004" Int., .006" Exh., engine warm
Valve Guides:—Removable. Installed with taper end up. Remove old guides from above and press in new guides until lower end extends ¾" below valve spring seat recess in block. Exhaust guide longer than intake guide.
Valve Springs:—Free length 2 11/16".

	Spring Pressure	Length
Valve Closed	46½ lbs.	2¼"
Valve Open	85½ lbs.	1 15/16"

Valve Lifters:—Mushroom type. Guide holes reamed directly in block. Serviced by reaming guide hole and installing lifters furnished .005", .010", .020" oversize. **Clearance**—.0007-.001".
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open TDC. Close 45° ALDC.
Exhaust Valves—Open 40° BLDC. Close 5° ATDC.
To Check Timing—Set tappet clearance #1 intake valve at .010" (cold). This valve should open with piston on top dead center when flywheel mark 'T.C. I.O.1-4' lines up with pointed end of inspection plate screw in inspection hole on left top face of flywheel housing (permissible variation ¼" either way from mark). Reset tappet clearance at .004" warm.

LUBRICATION:—Pressure system. Gear type oil pump mounted on outer left side of crankcase.
Oil Pump Installation Note—Turn engine over until 'IGN' mark on flywheel lines up with indicator (inspection hole in top left surface of flywheel housing) with #1 piston on compression stroke, turn distributor shaft so that rotor is at #1 segment in distributor cap, mesh oil pump gear so that distributor not disturbed when tongue-and-slot drive coupling engaged.
Normal Oil Pressure:—75 lbs. (gauge) at 30 MPH.
Oil Pressure Regulator:—Located under plug on oil pump cover. Opens at 40 lbs. Adjustable by adding or removing shims within plug above spring.
Oil Pressure Gauge:—King-Seeley Electric. K-S No. 6275 (dash unit), No. 6425 (engine unit).
See article in Mechanical Equipment Section for data.
Crankcase Capacity:—4 quarts.

COOLING SYSTEM:—Capacity—11 quarts.
Water Pump—Ball bearing, packless type.
See article in Mechanical Equipment Section for data.
Temperature Gauge:—King-Seeley Electric. K-S No. 6632 (first), 7140 (later) Dash Units; No. 5700 (first), 7000 (later) Engine Units.
See article in Mechanical Equipment Section for data.

For all other Data, see Later Panel Delivery Model on preceding page.

MECHANICAL EQUIPMENT SECTION

'ME' PAGES

The MECHANICAL EQUIPMENT SECTION contains the *Complete Separate Treatment* of the Illustrations, Operation, Performance, Adjustment, Overhaul and Trouble Shooting of the various MECHANICAL UNITS AND SYSTEMS.

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Used On:
SUPERCHARGER MODELS 67 & 69 (1934), 75 (1935), 110 (1936), 116 & 120 (1937), 97 (1938-39)

NOTE:—Supercharger is separate unit mounted on the side of engine and driven through a flexible coupling by an extension of the water pump shaft (1934-35), special shaft driven by separate chain (1936), twin 'Vee' belts (1937 on). All units are similar except that on 1934 model generator was flange-mounted on rear face of supercharger housing and driven through tongue-and-slot coupling by supercharger cross-shaft. On later models, generator is independently mounted and belt driven.

TYPE:—Centrifugal type. Consists of a blower vane or rotor mounted at the upper end of a vertical shaft and driven by worm-and-wheel gearing from a horizontal cross-shaft. Carburetor is mounted directly on upper cover so that fuel mixture is sucked into supercharger by rotor and delivered to manifold under pressure. Supercharger cover and cross-tube connection to manifold are water-jacketed for temperature control. Worm gear ratio is 4.8-1 and total drive ratio 5.75-1 so that rotor speed is 23,000 RPM. at 4000 RPM. of engine. Gears are special 'cone' type worm and worm gear designed for long life and quiet operation. All bearings are bronze-backed babbitt lined and pressure lubricated from engine oiling system by external oil line.

ADJUSTMENT:—No adjustment required (see car model page for drive chain adjustment on first models). Vertical shaft endplay can be adjusted (required only after long service) and oil retainer at top of vertical shaft and on drive or cross-shaft can be renewed without dismantling supercharger or removing unit from car. All other service work requires complete dismantling of the unit (see Service Caution below).

Vertical Shaft Endplay Adjustment:—Remove cover at lower end of vertical shaft, mount dial indicator on housing with pin against end of shaft. Pry shaft up and down and read endplay on indicator. If endplay more than .002", remove nut and first thrust washer, install thicker washer (this washer furnished from .140" to .160" thick in .001" steps) so that endplay is .002", replace nut and cover. Use micrometer to measure washer thickness and be certain that endplay is between .001-.002".

Vertical Shaft Oil Retainer:—On upper end of shaft under rotor. Worn or loose retainer will allow air leak into manifold (may cause high-pitched whistle or make it impossible to adjust carburetor) or cause oil to be drawn into engine (engine will smoke badly). To renew oil retainer, disconnect throttle linkage, choke, gasoline line and vacuum advance tube at carburetor, take out supercharger cover screws and remove cover and carburetor as a unit. Remove nut on top of vertical shaft, pull rotor **(use special puller)** or hold rotor up by gripping two opposite rotor blades with large pliers, place wooden block on end of shaft and tap sharply with small hammer. **Do not use bar to pry up on edge of rotor or shaft will be bent.** Remove old retainer. Use new gasket with new retainer, center retainer carefully on shaft before tightening screws (retainer hole is .808-.809" and will provide .0005-.001" clearance on shaft—**retainer must not touch shaft**). Install rotor, being careful that both keys are in place, and tighten nut securely.

Cross-shaft Oil Retainer:—Renew retainer if oil leaks out around shaft. Remove drive shaft between couplings, take off nut on end of shaft and remove drive flange, take out screws in retainer cover, remove cover and old retainer. Install new oil retainer, replace drive flange before tightening retainer cover screws (to center retainer on shaft). NOTE—When installing flexible coupling nuts, tighten nuts only so that distance from edge of coupling flange to edge of washer against opposite flange is 5/8" (excessive tightening will crush rubber bushings).

SERVICING:—Caution. Because of precision design and high speed at which supercharger operates, manufacturer strongly recommends that unit not be dismantled for servicing unless all special tools are used and extreme care taken that all clearances held to exact specifications. Use new worm and worm gear (matched set) whenever unit is rebuilt. Follow directions below carefully to insure correct fitting of each part.

Installing New Bushings:—Drive out old bushings (except cross-shaft rear bushing held by two screws), drive in new bushings (use special drivers) in following order: 1. Vertical shaft lower bushing (see that oil groove is at end of housing), 2. Intermediate bushing, 3. Upper bushing, 4. Cross-shaft front bushing in cover (press new bushing into cover from inside, see that cover fits squarely against housing and install in place), 5. Cross-shaft rear bushing (slip fit in housing and held in place by two machine screws). Line-ream upper and lower vertical shaft bushings in one operation (use special tandem reamer), then ream intermediate bushing (use special reamer). Set special adjustable reamer to cut hole size of exactly .751", ream both cross-shaft bushings. Remove side cover and rear bushing so that worm gear position can be checked.

Worm Gear Setting:—Assemble parts on cross-shaft (from rear or gear flange end forward) as follows: .032" shim thickness against shoulder, thrust washer (see that it engages dowel pins on flange). Install this assembly in side cover and continue assembly at outer end of shaft as follows: Thrust washer (see that it engages dowel pins on cover), .022" shim thickness, thrust washer (plain), drive flange and nut. Tighten nut securely and check endplay. Add or remove shims (outer .022" group) until there is no endplay. Bolt special gauge on cross-shaft flange (worm gear not installed), install cover assembly on supercharger housing making certain that lead gasket is in place under cover flange, install rear bushing to locate shaft. Install vertical shaft, check gap between gauge and vertical shaft (use feelers). This gap must be exactly .010". If gap not correct, remove vertical shaft and cross shaft assembly, dismantle cross-shaft assembly and add or remove shims from first (.032") shim pack located on shaft against worm gear flange. Recheck shaft endplay (adjust by adding or removing shims from outer (.022") shim pack, assemble and recheck gap. With gap exactly .010", add shims at outer shim pack to provide .002" endplay in shaft (check with two .002" feelers, placing one on each side of shaft between outer thrust washers). Remove nut and driving flange, install oil retainer assembly on cover, replace driving flange and tighten nut securely. Complete cross-shaft assembly by installing worm gear.

Worm Gear Installation:—Clean worm gear and mounting flange thoroughly, heat gear in hot water (will not clear flange unless heated), bolt gear on flange using special mounting screws and lockwashers (tighten all screws evenly and securely), wire screws together in pairs. Check gear runout on centers with dial indicator. Runout must not exceed .001".

Worm Setting & Installation:—Mount rotor on vertical shaft (not necessary to install keys) and tighten nut securely. Install shaft in housing, threading shaft down through special gauge at lower end (turn shaft until gauge is against shoulder on shaft —cross-shaft assembly must be out of housing to permit gauge installation). Place special plate gauge on housing cover flange and install rear cross-shaft bushing to locate gauge plug (gauge must be held firmly in place). Hold vertical shaft down, check clearance between two gauges with feelers. This must be determined accurately—incorrect measurement will cause noisy operation. Remove gauge, install shim thickness exactly equal to clearance (as measured above) on shaft against shoulder, install worm, special lockwasher and nut, tighten nut securely and turn down lockwasher ears against nut. Use dial indicator to check concentricity at each end of worm. Must check within .0005". Install special thrust washer (furnished from .122" to .128" thick in .001" steps) making certain that it engages dowel pins in housing, floating or plain thrust washer, second special thrust washer (furnished from .140" to .160" thick in .001" steps), castellated nut. Tighten nut securely. Mount dial indicator on housing and check vertical shaft endplay. Must be between .001-.002". Adjust by changing thickness of special thrust washer. Install cotter pin on nut, install lower cover and gasket. Pull rotor and install gasket and oil retainer at upper end (see Adjustment section for complete directions).

Final Assembly:—When installing worm gear and cross-shaft assembly in housing, see that screw with slotted head is used opposite worm (other screws will strike worm). Lead gasket must be in place under cover flange. On first type with mounting flange, line up flange with straightedge before tightening cover screws. Make certain that oil tube for upper bushing is in place and that entire assembly turns freely.

TORQUE WRENCH READINGS:—All torque wrenches are calibrated to read directly in Foot Pounds (Ft. Lbs.) or Inch Pounds (In. Lbs.) as noted in the following table, or are calibrated in accordance with a special table which may be converted into Ft. Lbs. or In. Lbs. as directed below.

Torque Indicating Wrenches

Wrench Manufacturer	Wrench Reading
Ammco	Special
Blackhawk Torqflash	Ft.Lbs. & In.Lbs.
Bonney #56 & #66	Ft. Lbs.
Duro-Chrome	Ft. Lbs.
Kwik-Way	In. Lbs.
Snap-On Torqometer (First Type)	Special
Snap-On Torqometer (Later Type)	Ft. Lbs.
Sunnen	In. Lbs.
Williams Measurrench	Ft. Lbs.

Special Wrench Types:—For both Ammco and first type Snap-On Torqometer wrenches, which are calibrated to a special scale, the Ft. Lbs and In. Lbs. tables given below must be converted into this special scale by dividing the Ft. Lbs. figure by .35 and the In. Lbs. figure by 4.2. NOTE—If the tables given below are used for these wrenches, it will be simpler to multiply the wrench reading by .35 (for Ft. Lbs.) or by 4.2 (for In. Lbs.) and compare the resulting wrench reading (which will be in Ft. Lbs. or In. Lbs.) with the table below.

Ft. Lbs. & In. Lbs. Special Note:—Ft. Lbs. figures are a measure of the force applied multiplied by the distance or leverage in feet (10 lb. force on end of 12" or 1' wrench equals 10 ft. lbs.). In. Lbs. figures are the same except that distance is measured in inches (10 lb. force on end of 12" wrench equals 120 In. Lbs.). Any figure can be changed from one system to the other as follows:

To Change In. Lbs. to Ft. Lbs.—Divide by 12.

To Change Ft. Lbs. to In. Lbs.—Multiply by 12.

CYLINDER HEAD TIGHTENING DATA:—It is not only important to tighten cylinder head screws or stud nuts to the correct tension as shown in table below, but they should be tightened in correct order as shown in diagrams on following page. Cast iron and Aluminum heads are tightened differently as follows:

Cast Iron Heads—With engine cold, tighten screws or nuts to correct tension as shown in table below. Run engine until thoroughly warm, then check and retighten nuts (additional tightening necessary to bring them back to correct tension).

Aluminum Heads—With engine cold, tighten screws or nuts to correct tension as shown in table below. Run engine until thoroughly warm, then allow engine to cool off, check and retighten nuts after engine has become cool—do not tighten aluminum heads hot.

Cylinder Head Tightening Order—See following page for cylinder head diagrams for each model. NOTE—Where head bolts are not numbered, no particular order is recommended by manufacturer. In general, these models should be tightened from center outward.

AUBURN—CORD

	Ft. Lbs.	In. Lbs.
Cylinder Head	50	600

BUICK

	Ft. Lbs.	In. Lbs.
Cylinder Head Bolts	65-70	780-840
Main Bearing Cap Screws	115-120	1380-1440
Connecting Rod Bolts (40)	45-50	540-600
Connecting Rod Bolts (60,80,90)	60-65	720-780
Rocker Arm Cap Screws	30-35	360-420

CADILLAC—LA SALLE

	Ft. Lbs.	In. Lbs.
Cylinder Head Bolts	70-75	840-900
Main Bearing Caps (V8)	130-140	1560-1680
Main Bearing Caps (V16)	100-110	1200-1320
Connecting Rod Bolts	55-60	660-720
Wrist Pin Clamp Screw (V16)	20-25	240-300
Intake & Exhaust Manifold	25-30	300-360
Flywheel to Crankshaft	65-70	780-840
Fan Support to Bracket	85-95	1020-1140
Spark Plugs	7-10	84-120
Front Suspension:		
Shock Absorber Bolts	100-115	1200-1380
Shock Absorber Links	40-48	480-576
Susp'n Arms to Frame (50, 61, 60S)	60-70	720-840
Susp'n Arms to Frame (75, 90)	85-100	1020-1200
Stabilizer to Frame	50-60	600-720
Knuckle to brake backing plate and steering arm (50,61,60S)	60-70	720-840
Knuckle to brake backing plate and steering arm (75, 90)	90-100	1080-1200
Diff'tial Carrier to Housing	30-35	360-420
Rear Shock Absorbers to Frame	120-140	1440-1680
Rear Shock Absorber Links	40-48	480-576
Rear Stabilizer (60S, 75, 90):		
Frame and Axle ends	120-130	1440-1560
Lower End Bolts	80-90	960-1080
Universal Joint Screws	15-20	180-240

CHEVROLET

	Ft. Lbs.	In. Lbs.
Cylinder Head Bolts	65-70	780-840
Main Bearing Bolts	105-110	1260-1320
Rocker Arm Support Bolts	25-30	300-360

CHRYSLER—DE SOTO—DODGE

	Ft. Lbs.	In. Lbs.
Cylinder Head Nuts	50-55	600-660
Cylinder Head Cap Screws	60-65	720-780
Main Bearing Nuts & Cap Screws	75-80	900-960
Connecting Rod Cap Bolts	55	660
Lower Control Pin & Bar Bush'gs	200	2400

FORD

	Ft. Lbs.	In. Lbs.
All Aluminum Heads (except 60)	40	480
60 H.P. Aluminum Heads	30	360
All Cast Iron Heads	50	600
Spark Plugs:		
7/8-18 Cast Iron Head	34-38	408-456
18 MM. Cast Iron Head	28-32	336-384
14 MM. Cast Iron Head	24-28	288-336
14 MM. Aluminum Head	20-24	240-288
18 MM. Aluminum Head	24-28	288-336

GRAHAM

	Ft. Lbs.	In. Lbs.
Aluminum Heads	40-45	480-540
Cast Iron Heads	55-60	660-720

HUDSON—TERRAPLANE

	Ft. Lbs.	In. Lbs.
Cylinder Head Stud Nuts (6)	45	540
Cylinder Head Stud Nuts (8)	55	660
Main Bearing Stud Nuts	90	1080
Connecting Rod Bolt Nuts	52½	630

LINCOLN—LINCOLN-ZEPHYR—MERCURY

	Ft. Lbs.	In. Lbs.
All Aluminum Heads	40	480
All Cast Iron Heads	50	600
Spark Plugs:		
7/8-18 Cast Iron Head	34-38	408-456
14 MM. Cast Iron Head	24-28	288-336
14 MM. Aluminum Head	20-24	240-288
18 MM. Aluminum Head	24-28	288-336

NASH—NASH-LAFAYETTE

	Ft. Lbs.	In. Lbs.
Cylinder Head Bolts	60-64	720-768
Main Bearing Cap Screws (3810, 20)	65-70	780-840
Main Bearing Cap Screws (3880)	70-75	840-900
Connecting Rod Bolts	50-55	600-660

OLDSMOBILE

	Ft. Lbs.	In. Lbs.
Cylinder Head Bolts	65-70	780-840
Main Bearing Bolts	135-145	1620-1740
Connecting Rod Bolts	30-35	360-420
Flywheel Nuts	30-35	360-420

PACKARD

	Ft. Lbs.	In. Lbs.
Cylinder Head Nuts (6-8-12)	61⅔-63⅓	740-760
Cylinder Head Nuts (Super 8)	58⅓-60	700-720
Main Bearing Nuts (6 & 8)	81⅔-85	980-1020
Connecting Rod Nuts (6 & 8)	59½-60½	715-725
Tappet Lock Nuts (6 & 8)	23⅓-25	280-300
Spark Plugs	4	50

PLYMOUTH

	Ft. Lbs.	In. Lbs.
Cylinder Head Nuts	50-55	600-660
Cylinder Head Cap Screws	60-65	720-780
Main Bearing Nuts & Cap Screws	75-80	900-960
Connecting Rod Cap Bolts	55	660
Lower Control Pin & Bar Bush'gs	200	2400

PONTIAC

	Ft. Lbs.	In. Lbs.
Cylinder Head Bolts	60	720
Main Bearing Cap Screws	85	1020
Connecting Rod Bolts	45	540
Flywheel to Crankshaft Bolts (6)	105	1260
Flywheel to Crankshaft Bolts (8)	70	840
Lower Control Arm Pin & Bar Bushings	200	2400

STUDEBAKER CHAMPION

	Ft. Lbs.	In. Lbs.
Cylinder Head Cap Screws	50-54	600-650
Main Bearing Cap Screws	91⅔	1100
Connecting Rod Cap Bolts	25-27	300-325

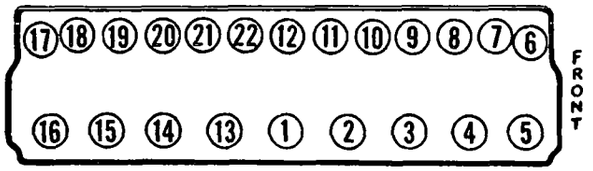
STUDEBAKER (EXCEPT CHAMPION)

	Ft. Lbs.	In. Lbs.
Cylinder Head Cap Screws	83⅓	1000
Main Bearing Cap Screws	91⅔	1100
Connecting Rod Bolt Nuts	54	650

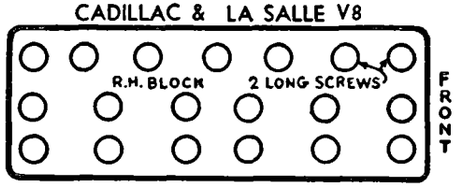
WILLYS

	Ft. Lbs.	In. Lbs.
Cast Iron Cylinder Heads	60-65	720-780
Aluminum Cylinder Heads	40	480

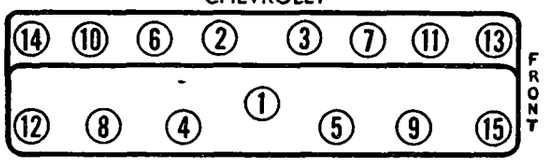
BUICK



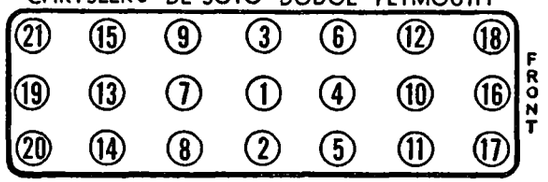
CADILLAC & LA SALLE V8



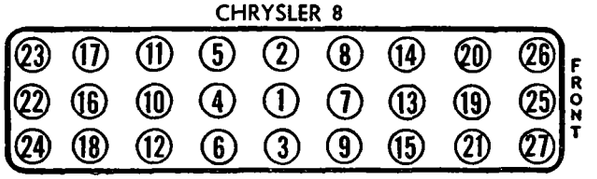
CHEVROLET



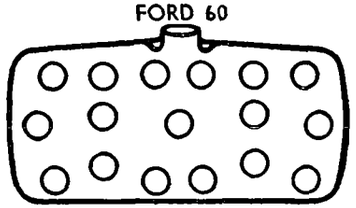
CHRYSLER 6 - DE SOTO - DODGE - PLYMOUTH



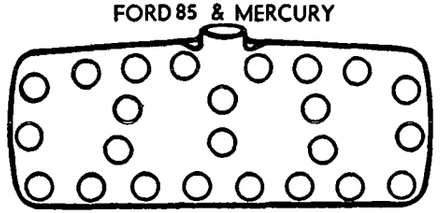
CHRYSLER 8



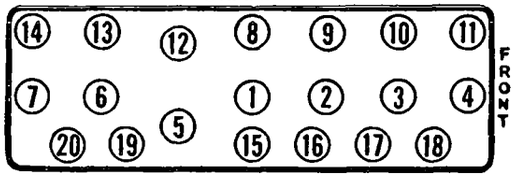
FORD 60



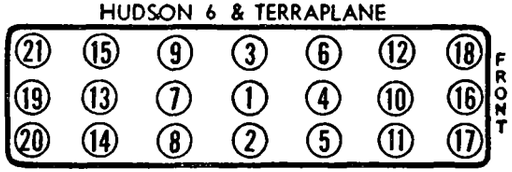
FORD 85 & MERCURY



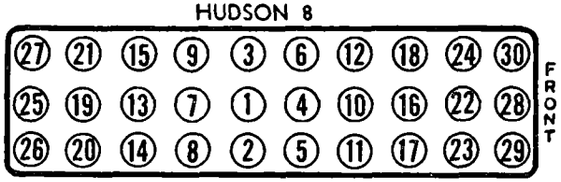
GRAHAM



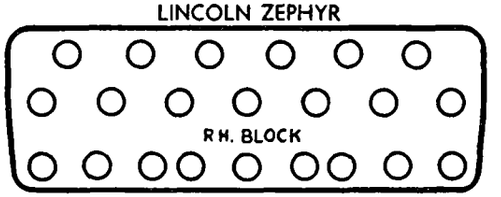
HUDSON 6 & TERRAPLANE



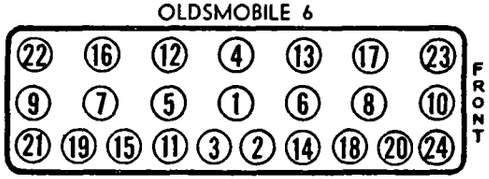
HUDSON 8



LINCOLN ZEPHYR



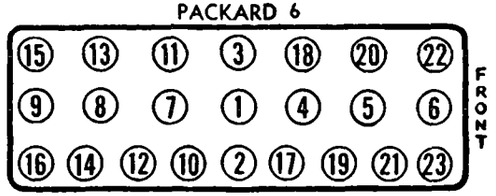
OLDSMOBILE 6



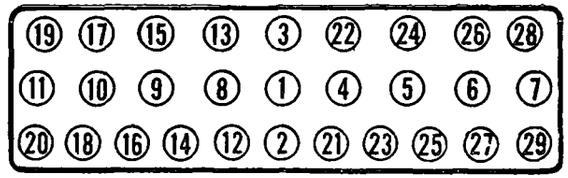
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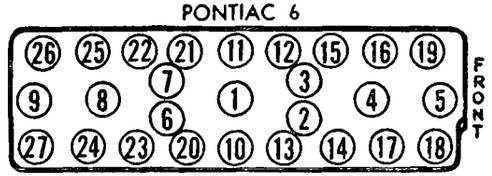
PACKARD 6



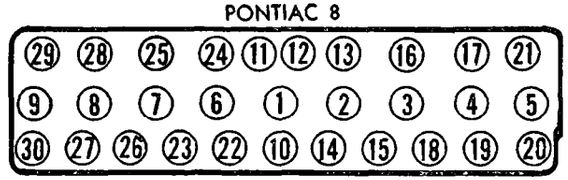
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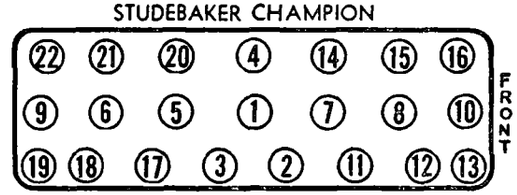
PONTIAC 6



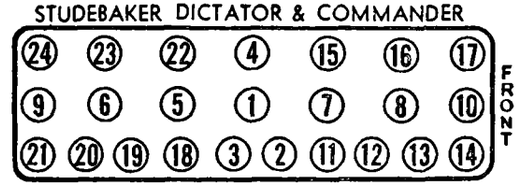
PONTIAC 8



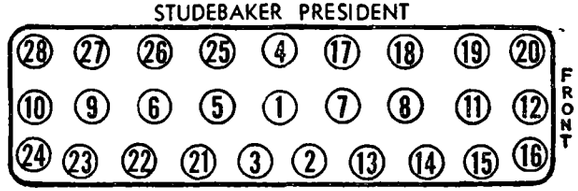
STUDEBAKER CHAMPION



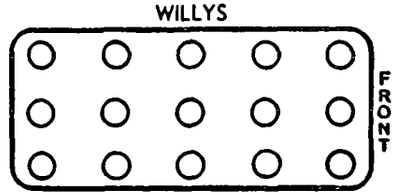
STUDEBAKER DICTATOR & COMMANDER



STUDEBAKER PRESIDENT



WILLYS



These units standard equipment on the following car models:

Car Model	Year	Windshield Wiper No.
Chrysler Royal C22	1939	EW-5001, 5101
Chrysler Imperial C23	1939	EW-5001, 5101
Chrysler Cust. Imp. C24	1939	EW-5001, 5101
DeSoto S6, Dodge D11	1939	EW-5001, 5101
Studebaker Comm. 9A	1939	EW-5003
Studebaker Pres. 5C	1939	EW-5003

MODEL NUMBERING NOTATION:—Model numbers given above are assembly numbers and include Links, Pivots, Wiper Arms, etc. Model numbers of Motors used on each assembly are as follows:

Assembly No.	Motor No.
EW-5001, EW-5002	EW-4001, EW-4101 (See Note).
EW-5003	EW-4002, EW-4102 (See Note).

NOTE—EW-4001 and EW-4002 motors were original design and have been superseded by improved design Models EW-4101 and EW-4102.

IMPORTANT CHRYSLER, DE SOTO, AND DODGE CHANGES:—See Special Servicing Notes below for production changes and corrections which should be made on first cars.

WIPER FUSE:—14 ampere (Chrysler, De Soto, Dodge), 20 ampere (Studebaker) in lead between ignition switch and wiper control switch (on switch on later Chrysler, De Soto, Dodge cars). Do not substitute any other capacity fuse.

DESCRIPTION:—Windshield wiper consists of a two-pole shunt wound motor driving a crank arm through worm gearing. Crank arm is linked to left hand windshield wiper pivot arm (right and left pivot arms connected in tandem by additional link) so that rotation of the crank arm imparts the usual wiping action to the blade attached to each pivot arm. The motor is controlled by a two-position switch on the instrument panel with special circuits so that relay and cam-operated contacts in control box on motor housing return the wiper blades to the off or parking position when the control switch is turned off. A friction clutch is incorporated in each pivot assembly to allow blades to be moved by hand when cleaning windshield and to prevent stalling of motor when blades blocked by heavy snow or sleet (motor will operate independently). Clutches will slip with pull of 1¾-2¾ lbs. at end of wiper arm.

OPERATION:—***'On' or Running.*** When control switch button is pulled out to the 'on' position, circuit is completed through the motor armature and also through the relay winding '2' (see illustration). Relay contacts then close which completes the motor field circuit so that the motor runs as a shunt wound machine to operate the windshield wiper blades. With motor running, contacts '3' and '4' (see illustration) are alternately opened and closed by the cam on the motor crank arm but this has no effect on the motor operation since the contact circuits are not in use.

'Off' or Parked. When control switch button is pushed in to the 'off' position, motor continues to run until the parking position is reached when cam 'D' on crank arm opens contacts '4' and closes contacts '3' (motor circuit is completed through contacts '4' from terminal 'B' to terminal 'C' even though switch is in the off position). Closing of contacts '3' ground the armature through relay winding '1'. This action causes the motor to operate as a dynamic brake and retards the opening of the relay contacts (which breaks the field circuit) so that the motor is brought to a positive stop in the park position. This park position is adjustable by changing the relation of the crank arm cam 'D' and the movable contact arm 'E'.

ADJUSTMENT:—**Park Position.** Angle between motor crank arm and line parallel to armature shaft with motor stopped under load (control switch pushed in to 'off' position) is shown in table below. This angle must be correctly set to insure proper position of wiper blades on windshield when not operating.

Windshield Wiper Model	Park Angle
EW-4001, EW-4101	21°
EW-4002, EW-4102	14°
EWA-4001, EWA-4101	21°
EWA-4002, EWA-4102	14°

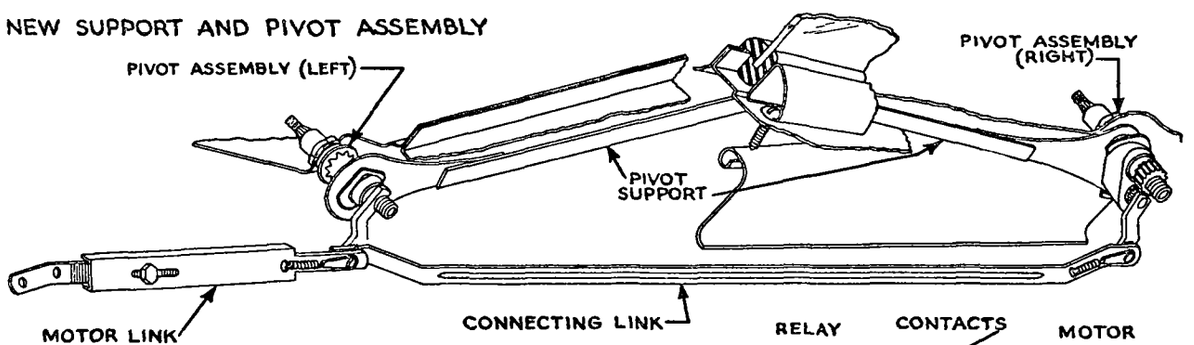
To adjust Park position, remove relay cover, loosen lockscrew 'F' (see illustration), turn eccentric adjusting screw 'G' to secure correct angle. After making this adjustment, check contact gap '4' (.025" minimum with motor stopped in park position), and contact pressure (2 ozs. minimum).

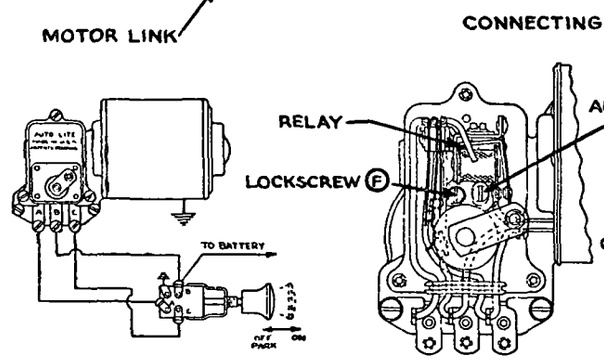
SERVICING:—**Motor.** Bearings (commutator and drive end) do not require lubrication in service and no oilers provided. Gear box should be filled ¾ full with special Auto-Lite ST-294 gear grease before assembly and crank arm cross shaft should be coated for entire length with this same grease before assembly in housing. Use extreme care to prevent grease getting on commutator and contact points.

Bearing Alignment—After motor completely assembled (but before running) strike frame several sharp blows with rawhide hammer to align bearings at commutator and drive end of armature shaft.

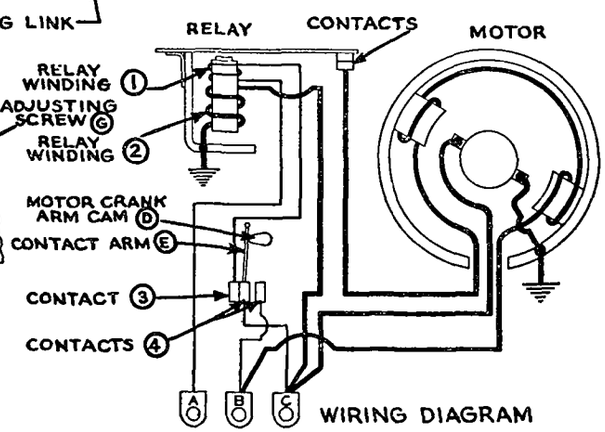
Armature Endplay—Must not be less than 1/32" (measure by removing gear case cover and moving crank arm back and forth. If necessary to reduce endplay to eliminate noise caused by excessive end motion, install thrust washers but make certain that endplay not less than 1/32".

NEW SUPPORT AND PIVOT ASSEMBLY





SWITCH CONNECTIONS (EARLY CHRYSLER CARS)



WIRING DIAGRAM

Motor Specifications

Starting (Under Load)—4 volts min. (all 6 volt units), 8 volts min. (all 12 volt units).

Running (Light)—3.0-4.5 amperes at 5.8 volts (all 6 volt units), 1.5-2.25 amperes at 11.6 volts (all 12 volt units).

Field Current—1.5-1.7 amperes at 6.0 volts (all 6 volt units), .7-.9 amperes at 12.0 volts (all 12 volt units).

Relay Specifications

Closing Voltage—4 volts max. (all 6 volt units), 8 volts max. (all 12 volt units).

Opening Voltage—.2 volt min., .5 volt max. (all 6 volt units), .25 volt min., 1.0 volt max. (all 12 volt units).

Contact Gap—.020" min., .025" max. Adjust by bending stop 'H' as required. Do not disturb relay armature hinge lug.

Air Gap—Armature should be sealed flat against top of core with contacts closed.

TROUBLE SHOOTING:—If operation not satisfactory, check as directed below (see Chrysler Special Servicing directions for corrections on first cars).

Motor will not Start or Run

1. Fuse Blown. Check following possible causes before replacing fuse. Use only correct capacity fuse for replacement—14 ampere (Chrysler, De Soto, Dodge), 20 ampere (Studebaker).

(a) Examine relay contacts and resurface or clean if dirty. Use strip of clean linen tape and carbon-tetrachloride, finishing with clean dry tape to remove all residue. If filing necessary, use ST-290 file.

(b) Check connections. Resolder connections and tighten all terminals.

(c) Check motor ground. Tighten ground strap and mounting screws.

(d) Low battery voltage. Check battery and recharge if necessary.

(e) Grounded motor leads. Check leads at point where wires go through drive end head into motor. Insulate wires and install sleeve to protect wires from sharp edge of motor frame casting.

2. Loose Connections in Wiper Circuit. Check all wiring. Tighten connections at Windshield Wiper, Control Switch, and Ignition Switch.

3. Crank Arm Shaft Binding. If necessary, replace drive end head. Make certain that cross shaft greased for entire length with special ST-294 grease before installing and that all wire connections are clean and tight.

4. Linkage Binding. Make certain that linkage between crank arm and pivot arms is not binding and that wiper blades and pivot arms operate freely.

Motor Stops with Blades in Wrong Position

1. Park angle incorrectly set. See adjustment section above.

Motor Will Not Stop

1. Loose connections at switch. Examine and tighten connections at Control Switch 'A' terminal and ground connection.

2. Parking mechanism out of adjustment. Check Park adjustment (see Adjustment section above) and particularly contact gap (contacts '4').

3. Relay Operation Incorrect. Check relay and adjust to specifications given in Service section above. Replace relay if satisfactory performance cannot be secured by adjustment.

NOTE—On units manufactured before December 1, 1938, complete motor should be replaced.

Overtravel of Right hand Blade.

1. Pivot Assembly defective. See that right hand pivot assembly does not move in mounting and that bearing clearance of pivot assembly is not excessive. See special servicing notes below for new pivot installation directions.

2. Insufficient Wiper Blade Tension. Check wiper blade tension on glass (measure with spring scale at instant wiper blade leaves the glass). Increase tension to 5-6 ozs. by bending lower spring holding lug.

3. Excessive sideplay between arm and blade. Wiper blade should be press fit in arm. Adjust by pressing the two blade holding fingers together.

CHRYSLER, DE SOTO, DODGE SPECIAL SERVICING NOTES:—Improved pivot assemblies and special support assembly welded to body designed to correct excessive motor movement on bracket or pivot assemblies moving in mountings were put in production on all cars beginning with the following serial numbers:

Chrysler Royal Model C22	7574866
Chrysler Royal Windsor Model C22	6948303
Chrysler Imperial Model C23	6742485
Chrysler New Yorker Model C23	6609905
**De Soto Model S6	5634616
Dodge Special Model D11	4278375
Dodge Deluxe Model D11	30105170

**Service Pivot Support Assembly installed on all cars before this Serial Number.

On all cars before these serial numbers, if windshield wiper fails to operate, if blade travel is incorrect, or if cowl panel flexes and motor moves excessively on bracket when operating, check following table for possible causes and install new pivot assemblies (Part No. EW-1089B—left hand, EW-2172—right hand) and special Service Pivot Support (Chrysler Part No. 837954) as directed below. NOTE—Service Pivot Support installed on all De Soto cars, new pivot assemblies only need be installed on these cars.

Motor Stalls Causing Fuse to Blow

1. Inoperative Pivot Clutches. Clutches should slip with pull of 1¾-2¾ lbs. applied at end of wiper arm. If clutches do not slip, any obstruction preventing wiper blade movement will stall motor.

2 Binding or Seizure of Pivot Shafts. May be caused by improper lubrication, incorrect assembly (square sleeve not properly entered in washers when assembled), improper adjustment of motor and pivot link, stiff pivot clutches, bent pivot shafts. NOTE—Binding or sticking of pivot shafts may cause distortion of linkage as well as motor stalling.

3. Connecting Links Binding. May cause erratic operation or complete failure.

Incorrect Wiper Blade Travel

1. Pivot Shaft Bearing Clearance Excessive. Excessive bearing clearance at right hand pivot will cause under or overtravel of the wiper blade.

2. Pivot Shaft Assembly Moving in Mounting. Movement of right hand pivot assembly will cause incorrect travel and may allow blades to strike lower edge of windshield or center dividing strip.

NOTE—Check connecting link binding complaints by disconnecting motor link (between motor and left hand pivot assembly) and operating wiper by hand. If binding caused by incorrect pivot alignment or linkage distortion, new pivot assemblies, or new linkage should be installed as follows:

New Support & Pivot Assembly Installation: Remove windshield wiper blades, pivots, and connecting links (On cars with radio, remove glove compartment box to facilitate assembly). Cut off end of center instrument panel-to-belt bar screw flush with bar. Place new support assembly (Chrysler No. 837954) over pivot and arm assembly (EW-2172—R.H., EW-1089B—L.H.) by removing cotter pin from left hand pivot assembly. Connect pivot link assembly (EW-100) with pivot arm pointing toward right. Install lockwasher over square shank of each pivot and arm assembly and install in position in car with bowed section of support toward front, filing cowl ventilator hinge flange if required to provide clearance for connecting link. Install fiber washer (EW-160), plain washer (EW-159), and nut (EW-81) on pivot support. Tighten nut securely and make certain that square holes on washers are properly engaged on square shank of each pivot shank. This is very important for correct wiper operation. See that motor and crank arm are in parked position (motor will stop in this position automatically if operated with regular control switch), connect motor to pivot link and to left hand pivot and arm assembly. Adjust motor to pivot assembly connecting link (loosen adjusting nut and slide connector end in link) so that end of link slips freely over pin on crank arm. With correct adjustment, gap between left hand pivot clutch spring and motor connecting link should be 1/16" with pivot arm at end of travel away from motor. Install windshield wiper blades.

NOTE—This installation made on no-charge basis on cars with motor code date previous to 1T provided car mileage is less than 10000 miles.

Used On:
CUSTOM IMPERIAL MODEL C24 (1939)

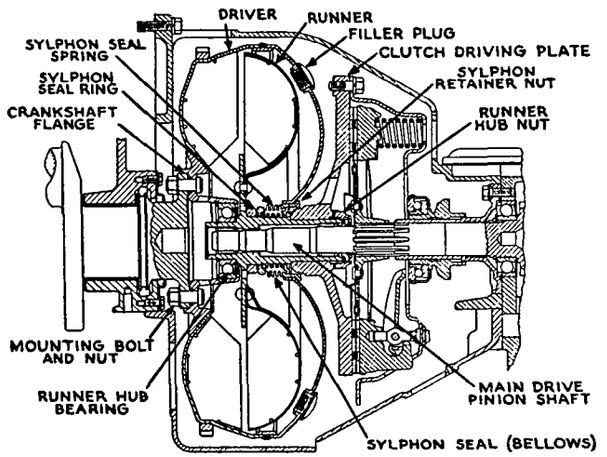
DESCRIPTION & OPERATION:—The Fluid Drive (Fluid Coupling) Assembly consists of a self-contained, factory-sealed assembly which is mounted on the rear end of the crankshaft in place of the conventional flywheel (unit has ring gear for starter mesh on outer rim and separate clutch driving plate for clutch mounting bolted on end of runner shaft at rear end). The case and integral 'driver' vanes rotate with the crankshaft and transmit power to the 'runner' or free vane assembly within the case without any mechanical connection through the oil with which the case is filled. The 'Runner' is integral with the hub (short hollow shaft extending through rear of case with clutch driving shaft mounted on rear end) and is mounted on a large ball bearing within the fluid drive case at the forward end and piloted on the clutch shaft at the rear end (clutch shaft mounted on needle bearings within runner hub at each end). Oil leakage is prevented by spring-loaded Sylphon Assembly or bellows and Sealing Ring (on runner hub within case at rear), leather oil seal (at rear end of runner hub on clutch shaft), rubber grommets on mounting bolts (fitted in recess on front face of case) and thin gasket installed between fluid drive case and crankshaft flange.

SERVICING:—Unit is sealed and no adjustment required. Service operations are restricted to filling unit with oil (15,000 mile intervals or when drained) and renewing sylphon assembly and sealing ring (to correct oil leakage). See Removal & Installation directions below if Fluid Drive Assembly is being removed from engine.

Checking Oil Level & Adding Oil:—Recommended at 15,000 mile intervals. Take out removable screen on upper right side of clutch housing, turn fluid drive assembly until one filler plug visible through this opening (2 plugs—180° apart). Use Allen wrench to remove plug, fill case to level of filler plug hole with special Chrysler Fluid Drive Oil, replace plug and tighten securely to prevent oil leakage.

Sylphon Assembly & Seal Ring Renewal:—Remove Transmission and Clutch (see Chrysler C24 'M' page for instructions). Bend down tab on lockwasher and remove runner hub nut (in center of clutch driving plate). Mark spline on runner hub and mating spline on clutch driving plate (to insure correct installation), use special puller to remove clutch driving plate being careful to line up two points on the plate horizontally (plate is hexagonal) so that two top points on plate line up with recesses in clutch housing which will permit plate to be withdrawn from housing. Rotate fluid drive unit until one filler plug is at bottom, remove filler plug with Allen wrench and drain unit. Use special Sylphon Spring Compressor to compress sylphon spring, remove retainer snap ring from sylphon nut, withdraw spring retainer and spring. Use special spanner wrench to unscrew sylphon nut, withdraw sylphon assembly. If Sealing Ring to be replaced, use special puller to remove ring from runner hub. NOTE—Mating surfaces on Sylphon and Sealing Ring must be smooth and show continuous line of contact over entire 360° of circumference. Replace both parts if surfaces are scored or show poor contact.

Installation. To install Sealing Ring, screw ring in special installing tool, heat ring in boiling water, shake free of water and quickly push ring snugly in



place against ground face of runner hub, then unscrew tool and remove. Install sylphon bellows assembly, tighten sylphon nut securely, install sylphon spring, retainer, and snap ring. Fill unit with oil as directed above and install new gasket under filler plug. See that filler plug securely tightened. When installing clutch driving plate on runner hub, coat splines on hub and in driving plate with white lead, use special assembling tool to install plate on hub and see that marks on splines are lined up. Clean surfaces of driving plate and clutch pressure plate thoroughly of all oil and white lead before installing clutch. A special clutch aligning tool is available to line up driven member when installing clutch (extra clutch shaft can be used for this purpose if desired).

Correction for Oil Leaks at Crankshaft Mounting Flange:—If oil leakage occurs at mounting bolts, tighten nuts on eight bolts (nuts are on forward end of bolts, accessible by removing oil pan and rear main bearing cap) evenly and securely. If this does not correct leakage, it will be necessary to replace mounting gasket or mounting bolt grommets (see Removal & Installation directions below).

FLUID DRIVE ASSEMBLY REMOVAL & INSTALLATION:—**Removal.** Remove Transmission & Clutch (See Chrysler C24 'M' page for instructions), rotate fluid drive unit until one filler plug is at bottom, use Allen wrench to remove filler plug, drain unit. Remove engine oil pan and rear main bearing cap. Take off nuts on mounting bolts (on front face of crankshaft flange), pull fluid drive unit back to free bolts from crankshaft flange, remove unit from below.

Installation. Install new grommets on mounting bolts, seating grommets in recess in front face of fluid drive case. Carefully clean face of crankshaft flange and fluid drive unit case (remove all traces of old gasket and any burrs which might prevent flat, even contact of mounting faces). Coat both sides of new .010" thick gasket with shellac, install gasket on fluid drive case (one bolt hole 4° out of line to insure installation in correct position), install fluid drive assembly on crankshaft flange threading mounting bolts through holes in flange, install nuts on mounting bolts, tighten nuts evenly and securely.

CADILLAC
ALL V12 & V16 MODELS (1930-37)

DESCRIPTION:—Automatic take-up is a spring-loaded plunger in a dashpot at the pushrod end of the rocker arm which bears against a cam on the eccentric sleeve. The double springs below the plunger (single spring used on first models) force the plunger up and rotate the eccentric, shifting the rocker arm to take up all clearance. The dashpot is filled with oil and resists the downward movement of the plunger when the valve is opened (the slow escape of oil around the plunger is sufficient to allow the plunger to move down enough to compensate for expansion of the valve gear as the engine warms up).

SERVICING:—The Automatic Take-up mechanism does not require any service operations. A spring-loaded check valve within the plunger allows the free passage of oil into the dashpot below the plunger and prevents the escape of oil when the engine is running. Plungers are a selective fit in the dashpot and should not be interchanged (plungers have a stamped identification mark on the top shoulder and should be installed in cylinders stamped with this same mark on the top). Complete assemblies consisting of plungers, springs, and plunger cylinder or dashpot are furnished for service only (assembly consists of take-up mechanism for two adjacent cylinders as dashpot cylinders are cast in pairs). The initial clearance for the take-up mechanism must be set whenever valves are ground or replaced.

ADJUSTMENT:—First Models. With camslide on heel of cam, use special plunger releasing tool (#109624) to release oil pressure under plunger and hold plunger down at end of stroke with spring compressed (plunger must be held in this position while making the adjustment). Rotate eccentric sleeve so that cam rests on top of plunger. Use special combination screwdriver and wrench (#109627-T) and turn adjusting setscrew on pushrod end of rocker arm until clearance between rocker arm and valve stem is .030". This adjustment can be made with engine running or, if engine is not running, turn engine over until piston is at firing position to make certain that camslide is on heel of cam. Lock adjustment with adjusting setscrew locknut. Check to see that plunger is down at bottom of stroke with eccentric sleeve cam in contact with top of plunger. This is important to provide sufficient plunger stroke to take up clearance when engine is operated.

Later Models. On models with a shoulder just below the hole in the top of the plunger, adjustment can be made by releasing oil pressure in dashpot cylinder (by pressing down on check valve) and pushing plunger down in cylinder until the bottom of the hole in the upper end is below the top edge of dashpot. Use special combination screw driver and wrench #109627T and turn adjusting screw on pushrod end of rocker arm down until all clearance taken up. Release plunger and back adjusting screw off until top of shoulder on plunger is even with top edge of dashpot (see illustration), tighten adjusting screw locknut.

PACKARD
ALL V12 MODELS

DESCRIPTION:—On these models, valve actuating mechanism consists of a rocker arm mounted above the camshaft with a cam follower on the lower end of the arm and upper end of arm contacting the valve stem. Rocker arm is mounted on an eccentric sleeve which is rotated by the Automatic Take-Up mechanism so that all clearance is taken up between the rocker arm and the valve stem under ordinary running conditions. Pressure is not sufficient to hold the valve off its seat and take-up mechanism backs off enough to compensate for expansion of valve mechanism as the engine warms up (permitted by slight leakage of oil from plunger cylinder). Rocker arm and cam follower are mounted on needle bearings and no provision is made for manual adjustment of the tappet clearance (see Checking Clearance directions below). The automatic take-up consists of a spring loaded plunger in a cylinder above the rocker arm which bears on a cam on the eccentric sleeve. A spring above the plunger forces the plunger down and rotates the eccentric sleeve to take up all clearance between the rocker arm and the valve stem. The dashpot within the plunger is filled with oil and resists the upward movement of the plunger when the valve opens (slow escape of oil around piston allows plunger to move up enough to compensate for expansion of valve gear as engine warms up).

A spring-loaded check-valve on the dashpot piston stem allows the free passage of oil into the dashpot and prevents the escape of oil when the engine is running.

SERVICING:—The Automatic Take-up does not require any servicing operations. All parts are a selective fit and should not be disturbed or interchanged. Whenever valves are ground it will be necessary to bleed the take-up to allow valves to seat with valve springs removed, and the valve clearance or stroke of the mechanism must be checked when valves reassembled.

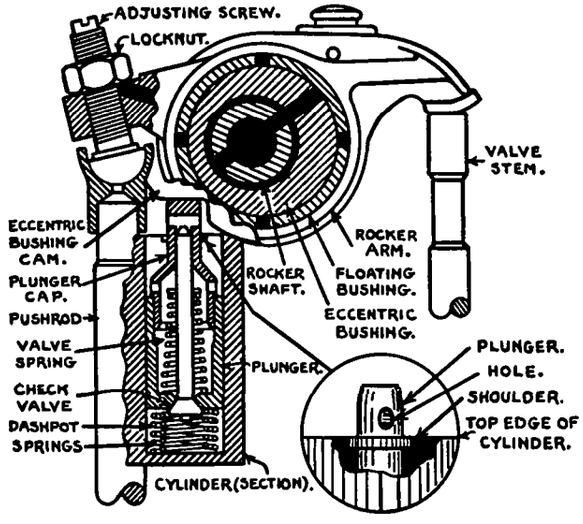
Bleeding Take-up Mechanism (Grinding Valves)—With valve springs removed, valve should be held approximately .028" off seat by rocker arm. Bleed Automatic Take-up mechanism by inserting ⅛" round rod in bleeder hole in top and pressing down on rod to open check valve. Press rocker arm lever back away from valve stem (do not force lever) and hold in this position by installing wedge (#ST-879) between lever and crankcase while valve is being ground. Do not crank engine with these wedges in place.

Checking Clearance (Installing Valves)—With valve refaced and reseated ready for installation, check clearance by installing valve in engine with clearance gauge (#ST-865) in place between valve and cylinder and centered on valve. Make certain that rocker lever roller or cam follower is on low side of cam by cranking engine over until valve is fully open, and then turning engine over one additional revolution. **Do not crank engine with wedges in place.** Remove wedges and hold rocker arm as far away from valve stem as possible by hand while engine is being turned over. Use feeler gauge and check clearance between valve stem and rocker arm. Clearance must be .002" minimum (providing .040" automatic take-up) to .015" maximum (providing .025" automatic take-up). If clearance is not within these limits, the end of the valve stem can be ground off to provide .015" clearance. The plunger is designed for a stroke of ⅛" downward, 3/32" upward to provide an average automatic take-up of .040" plus or minus .010" on new engines.

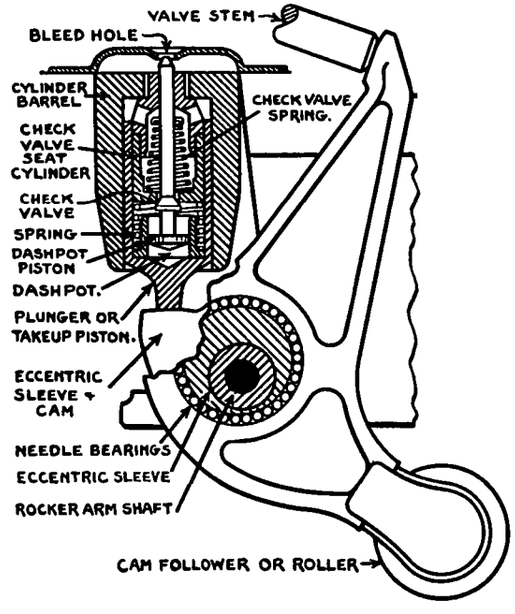
SPECIFICATIONS:—The take-up plunger clearance within the cylinder barrel is held to .0015-.0025". Clearance of check-valve seat cylinder and inner wall of plunger is .0007" plus or minus .0001". Clearance between dashpot piston and dashpot is .006-.008". The check-valve seat is ground and the check valve burnished to provide an oil-tight seat.

NOTE ON VALVE GRINDING:—A split type valve retaining key was used on the first cars and care should be taken in removing them to prevent them dropping into the crankcase. Valve springs should be installed with the japanned end down toward rocker arm. The spring has a closer-spaced first coil at the upper end.

CADILLAC.



PACKARD.



AUTOMATIC VALVE TAPPET TAKE-UP

WILCOX-RICH ZERO-LASH HYDRAULIC TYPE

Std. Equipment On:
CADILLAC V8, ALL SERIES (1936-37-38-39)
CADILLAC V16, SERIES 90 (1938-39)
LA SALLE V8, SERIES 50 (1937-38-39)
LINCOLN, V12 MODEL (1937-38-39)
LINCOLN-ZEPHYR, MODEL 86H ('38), 96H ('39)
PIERCE ARROW 8, ALL MODELS (1932-38)
PIERCE ARROW 12, ALL MODELS (1932-38)

DESCRIPTION:—This type automatic take-up is hydraulically operated and is built inthe valve lifter or tappet (engines are 'L' head type). The conventional tappet clearance adjusting screw is not used and the lifter plunger contacts the end of the valve stem directly. The lifter is made in two parts; a lower or lifter section (mushroom or barrel type) which contacts the camshaft cam, and an upper or plunger section which contacts the end of the valve stem. The plunger fits into a cylinder in the head of the lifter body and is raised to contact the valve stem end by a spring under the plunger head. Oil from the pressure lubricating system of the engine flows through the oil reservoir in the lifter bracket and the oil passage in the lifter body to fill the cylinder below the lifter plunger. When the lifter is raised by the cam to open the valve, the ball check valve in the bottom of the cylinder closes, preventing the escape of oil from the cylinder and the cam motion is transmitted directly through the lifter to open the valve. The combination of plunger spring (to take up any clearance between lifter and valve stem end) and oil trapped in the plunger cylinder by the check valve (so that cam pressure is transmitted solidly through the lifter assembly) result in an entirely automatic take-up with positive valve opening action.

Pierce Arrow Note—Lifters are of different design with ball check valve retained by pin in lower end of plunger and coil spring mounted on lower end of plunger and engaging counterbore in plunger body. On 1935 and previous models, lifters interchangeable on 8 and 12 cylinder models with exception of plunger cap (see Service Note below on Plunger Caps).

SERVICING:—Removal. On mushroom lifter types with removable brackets, disconnect oil supply tube (when external oil line used), take out capscrews in each lifter bracket, lift bracket out taking care that lifters do not fall out of bracket (on some installations, lifters prevented from falling through bracket by locking ring at upper end of cylinder). On barrel type lifters which operate in guide holes in block (no guide brackets), lifters may be removed from upper end after valves and springs removed.

Disassembly. On mushroom types, remove locking ring at top of cylinder, withdraw lifter unit from below. Pull plunger and cylinder assembly out of lifter body. Unlock plunger spring by twisting plunger, pull plunger and spring out of cylinder (plunger is selective fit in cylinder and must be re-installed in same cylinder). Ball check valve in bottom of cylinder may be unseated if necessary by using small blunt tool.

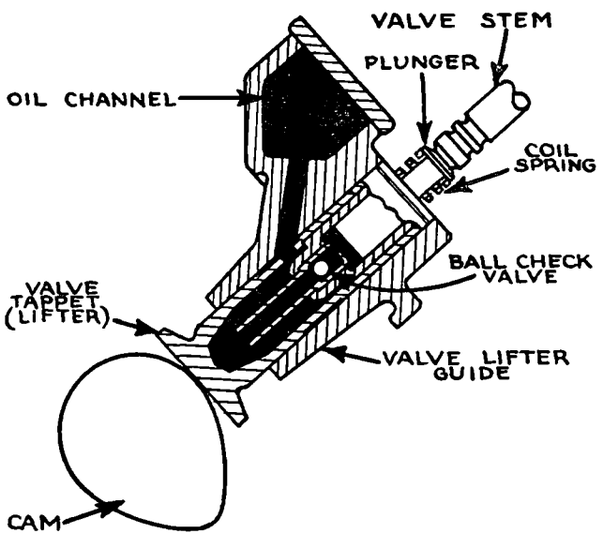
Servicing—Wash all parts in gasoline, wipe with soft cloth or dry with air (air hose must not be held closer than 2"). If plunger or cylinder scored or clearance excessive, replace as a unit (old lifter body may be used if clearance in bracket or block guide holes not excessive). Check ball check valve tightness (see Testing). Ball should rattle when unit is shaken. Clean out oil reservoir and oil passages in brackets and engine block.

Reassembly—Place plunger spring on plunger, insert plunger in cylinder, lock spring in cylinder by twisting plunger. Make certain that same plunger and cylinder used together (plungers must not be interchanged). Install plunger and cylinder assembly in lifter, insert lifter assembly in bracket and install locking ring at upper end of lifter body above bracket (when used).

Pierce Arrow Plunger Cap Note—On 1935 and earlier cars, lifters interchangeable between 8 and 12 cylinder cars by installing correct plunger cap (longer cap on 8). To exchange caps, clamp cap (not plunger) in vise, use pin inserted in plunger holes and pull plunger off cap, press correct cap in place. Use extreme care not to distort or mar plunger body.

Installation—Valve lifters should be installed without oil in the cylinder (mechanical clearance must be checked if new parts installed or valves serviced) and engine should be run to quiet valve action (may require running for as long as an hour, if oil seals off air escape between plunger and cylinder before all air expelled, valve may not quiet until oil is warm).

Pierce Arrow Note—After installing lifter bracket assemblies on engine, see that lifters spin in brackets when engine is running. If they do not, loosen bracket mounting bolts, shift bracket to front or rear slightly, tighten bolts. Do not overtighten bolts which will distort brackets and cause lifters to bind. See that gasket projects evenly above and below lifter bracket (gasket is 1/16" wider) to insure oil holes being in line and open.



Checking Clearance—When new parts installed or valves reseated, check clearance between plunger and valve stem with plunger held down at bottom of stroke (no oil in cylinder). Clearance must be .030-.070". If clearance less than .030", grind off lower end of valve stem slightly.

Cadillac V8 Note—Use tool J-1055 to check valve stem length before installing lifters (measures distance from heel of cam to valve stem). Grind off end of valve stem until tool slides into place. Use tool J-827 to compress plunger springs when installing lifter bracket assemblies.

Pierce Arrow Note—Clearance between plunger cap and valve stem must be .015" with lifter dry. If clearance less than this amount, remove plunger from plunger body, grind off lower end of plunger slightly using care not to grind into ball check retaining pin.

TESTING:—Plunger Fit in Cylinder. With all oil washed out and unit dry, pull plunger up to release spring from counterbore in cylinder, raise plunger as high as possible while still guided in cylinder, push plunger down into cylinder quickly and release. If unit holds air to extent that plunger tends to bounce back when released, clearance is satisfactory. **Plungers are selective fit in cylinders and must not be interchanged** (clearances cannot be measured directly).

Check Valve Tightness. Check by filling cylinder with kerosene and noting rate at which this leaks past the ball check valve. Maximum allowable leakage is 1 drop per second.

Engine Oil Pressure. Oil pressure at lifters not ordinarily indicated by instrument panel oil pressure gauge (reduced by metering restriction, etc. in oil lead to lifters). Pressure at lifters should be 4 lbs. minimum at idling speed, 12 lbs. minimum at high speed. Pressure in excess of 55 lbs. may cause noisy valve operation. Check by connecting pressure gauge in lifter oil line (where external oil lines to lifters used, disconnect line; on Lincoln Zephyr remove plug between banks at **rear** of engine directly above lifter metering hole.

TROUBLE SHOOTING:—If operation not satisfactory, check as follows:

All Valves are Noisy.

NOTE—Hydraulic lifters should be installed without oil and operation will not be quiet until engine has been run for a short time. Oil in lifters when installed will hinder this quieting operation.

1. Oil Level Low—Oil level in crankcase must not be allowed to become excessively low which may permit air to enter pump inlet.

2. Oil Level High—Oil level in crankcase should not be above 'Full' line on indicator. Higher level may cause foaming.

3. Oil Pressure Low—Oil supply to lifters will be inadequate. Must be sufficient to replace normal relief leakage between plunger and cylinder. Check oil pressure (See Testing above).

4. Oil Pressure High—High pressure may lift entire hydraulic unit against plunger spring tension causing excessive wear. If noise particularly noticeable when oil is hot, check pressure in oil supply line at lifter assembly (See Testing above).

One or More Valves Noisy.

1. Incorrect Clearance—Check mechanical clearance for particular unit (see directions above). Check clearance between plunger and cylinder (if parts interchanged, replace as a unit), check clearance between cylinder and lifter body.
2. Sticking Caused by Dirt or Grit—Disassemble and clean units as directed above. Drain crankcase, clean oil pan, flush engine, refill crankcase with new oil to prevent repetition of trouble.

DESCRIPTION:—Link-Belt Timing Chains used on automobile engines are of three types: 1) Middle Guide with guide link at center of chain which engages groove in sprocket teeth, 2) Side Flange with flanged or guide links at each side of chain which fit over edges of sprocket teeth, 3) Duplex or back type which is a double faced chain designed to engage tooth type sprockets on either side (used with automatic take-up idler sprocket which engages back face of chain).

NOTE—All chains used for two-sprocket drives, and some three-sprocket drive chains are fitted with no-back-bend or check links which permit the chain to bend only in the direction of the sprockets. This prevents all 'whipping' action of the chain in service.

Link Construction. The Link-Belt Patented Liner Joint is used in all chains for two and three-sprocket drives. Liners are built with .004" spring (ends spring back .004" from center—see illustration). As installed in new chains, the liners are straight. However, as wear occurs, the spring in the liners tends to compensate for any slack which develops so that the chain is kept tight throughout its life.

INSTALLATION:—Chains should be installed 'endless' (with sprockets removed from engine) whenever possible. Whenever chain disassembly is necessary, split the washer under the riveted head of the pin, push the pin out, remove liners. To assemble chain, mesh chain links, install both liners, then push pin in place between liners, install washer on pin and rivet end of pin securely.

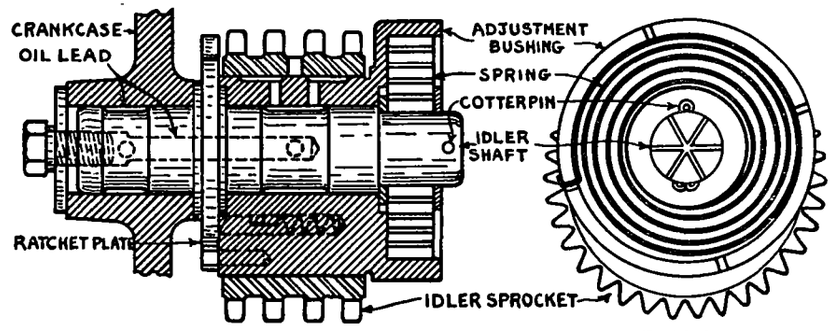
ADJUSTMENT TYPES:—Link Belt Chains are used with the various types of adjustments listed on the previous page. In addition a special type of eccentric manual adjustment and a special automatic adjustment idler sprocket have been developed.

Eccentric Manual Adjustment. On this type the sprocket revolves on an eccentric stub shaft which is mounted in the crankcase and which can be rotated by hand to take up the timing chain. The accessory drive shaft passes through the center of the chain (its center does not shift). A toothed flange is bolted on the end of the accessory shaft and corresponds with teeth on the forward end of the drive sprocket. The two are held together by a small chain which is assembled around them directly in front of the timing chain. This type of mounting permits the removal of the accessory shaft or generator (where the generator shaft extends through the eccentric mounting) without disturbing the timing chain simply by removing the nut on the end of the shaft which holds the drive flange in place. Any desired relation between the crankshaft and accessory shaft can be secured (where this is necessary for timing, etc.) by removing the small coupling chain and rotating the accessory shaft.

***Automatic Adjustment* Idler Sprocket.** This type sprocket is designed in two types which differ in construction principally in the manner of mounting the take-up spring (see illustration). It is used with a duplex type chain and is ordinarily mounted between the accessory drive sprocket and the crankshaft sprocket and engages the back of the chain (where the chain is wrapped around the crankshaft sprocket), or inside the chain (where the chain passes over the crankshaft sprocket). The sprocket revolves on an eccentric sleeve which is mounted on a short stub shaft mounted in the crankcase. A spiral spring is placed under tension in such a manner as to tend to revolve the eccentric sleeve (one end of the spring is engaged in the slotted end of the stub shaft and the other end is fastened to the eccentric sleeve) thus forcing the sprocket toward the chain and taking up the slack. The sprocket is designed to take up all slack developed during the life of the chain and no adjustment is necessary.

To Remove Automatic Idler Sprocket. First take out the cotter pin in the end of the stub shaft. Then take hold of the adjustment bushing (eccentric sleeve) and pull out by hand. The washer, adjustment bushing and spring will come out together. The chain can then be lifted up and the sprocket wheel lifted off.

To Install Automatic Idler Sprocket. Place the sprocket wheel on the shaft and mesh it in the chain. Push the adjustment bushing or eccentric bushing on the shaft until the spring is close to the slotted end of the shaft and rotate the bushing by hand until the spring slack is all taken up. Wind up the spring one and one quarter turns (not more than one and one half turns) and push the end of the spring into the nearest slot of the shaft. A special spring winder should be used in winding up the spring. Press the spring back into the spring box, place the washer on the shaft and insert the cotter pin. The assembly can be checked by turning the eccentric bushing in a direction opposite to the winding direction. The spring should return it to the initial position when it is released.



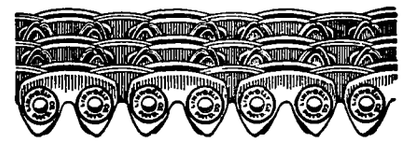
LINK BELT AUTOMATIC IDLER SPROCKET

TYPE A.

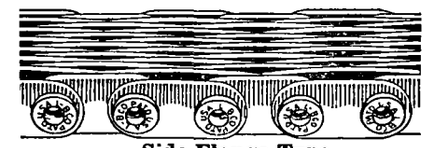
TYPE B.

DISASSEMBLY.
1. TAKE OUT COTTER PIN AND REMOVE WASHER
2. PULL OUT THE ADJUSTMENT BUSHING AND WASHER
3. LIFT UP CHAIN AND REMOVE SPROCKET WHEEL

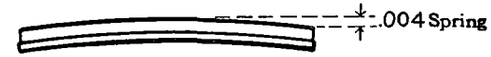
ASSEMBLY.
1. MESH SPROCKET IN CHAIN.
2. PUSH ADJUSTMENT BUSHING ON SHAFT AND WIND UP UNTIL SLACK IS TAKEN UP.
3. WIND UP SPRING 1 ¼ TURNS AND SLIP END OF SPRING IN NEAREST SLOT.
4. PLACE WASHER ON SHAFT AND INSERT COTTER.



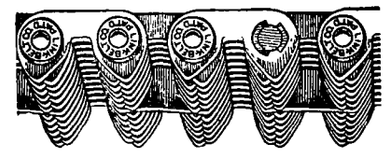
Duplex Type



Side Flange Type

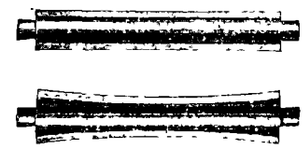


Bushing straight at time of installation. Spring in bushing takes up eye wear in link gradually, as wear occurs.



Middle Guide Type

The Effect:



Link-Belt Spring Liner Construction

MORSE CHAIN TYPES & AUTOMATIC TAKE-UP SPROCKET

CHAIN TYPES:—Morse Silent Timing Chains are furnished in center guide and duplex types. Three types of joint construction will be found in service. These are Rocker Joint, Bushed Joint, and Oscillating Joint types

1. Rocker Joint. The Rocker Joint link assembly consists of two pins, a ribbed seat pin, and a plain rocker pin. The chain is designed to operate in one direction which is indicated by an arrow stamped on the face of the outside links. The seat pin is the leading pin and is assembled with the rib pointing in the direction of the arrow. This rib engages in a slot cut in the end of the links and prevents the seat pin from turning. The rocker pin is free to oscillate in the link. In assembly the two pins are slipped in place in the link and a retaining washer is slipped over the end of the seat pin. The seat pin is then riveted over the washer. To disassemble the chain, first turn the chain until the link which is to be taken out is directly over one of the sprockets, then split the washers at each end of the link with a cold chisel and push out the pins. The chain can then be removed and the link will fall from place.

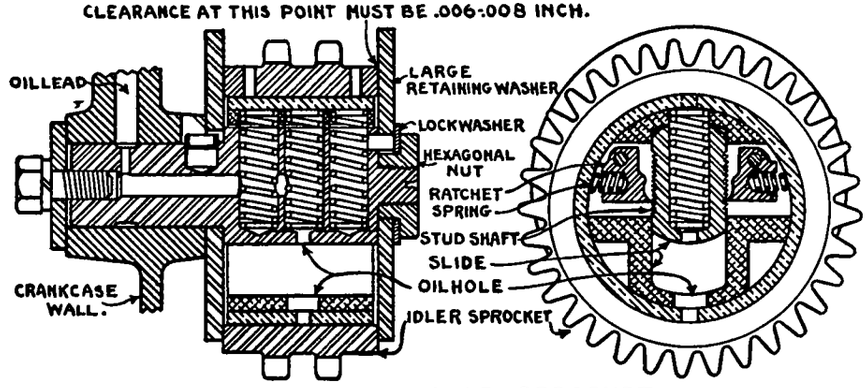
2. Bushed Joint. In Bushed Joint construction, the links are held in place by a round pin and two half round bushings. The bushing is held rigidly in the end of the link but is free to turn in the intermediate links, permitting the chain to adapt itself to the sprockets. In assembling the chains the bushings are slipped in place and the outer link assembled with the 'D' shaped end of the pin projecting through the link. The pin is then riveted over the link. To disassemble the chain, turn chain until the hunting link is on the sprocket. Then drive out the pin at each end of the link and take out the pin and bushings. Chains of this type without direction arrows are designed to run in either direction. Certain chains are marked with direction arrows on the outside links. The chain should be assembled so as to run in the direction of the arrow.

3. Single Pin Joint. The single pin joint consists of a special shaped hardened pin with the ends riveted in the outside links. Pins are securely held in one row of links with clearance provided in the other row to permit the links to turn on the pin. Links are symmetrical in shape and chains may be run in either direction. Chains with this type joint are supplied in flexible types and also in anti-whip or non-back bend types which have a special shaped pin hole in one row of links which prevent any back bend in the chain. Chains are furnished with one coupling pin (headed pin with cotter pin fastener on opposite end) which may be taken out to permit the chain to be installed without removing the sprockets.

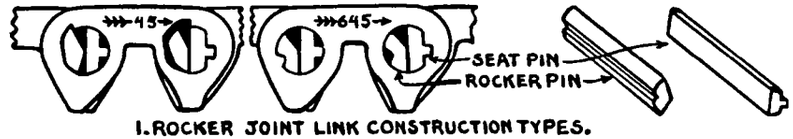
ADJUSTMENT TYPES:—Morse Chains are used with the various types of adjustment detailed on the preceding page. In addition a special Morse type eccentric manual adjustment drive and automatic adjustment have been developed. Details concerning these types are given below.

1. Eccentric Manual Adjustment. This installation incorporates a special accessory drive sprocket which is carried on an eccentric sleeve. The accessory drive shaft passes through the eccentric shaft on which the sprocket revolves and has a fixed center which is not disturbed when the timing chain is adjusted. The eccentric sleeve is carried in a sleeve in the rear of the timing chain case and extends through to an adjustment clamp arm on the rear face. The adjustment consists of loosening the clamp screw and turning the clamp arm. This revolves the eccentric sleeve within the accessory sprocket, causing the sprocket to move outward thus taking up the chain slack. The full range of adjustment is 180 degrees or 5/16 inch. When this point is reached the hunting link should be removed from the chain and the adjustment clamp returned to its original position.

2. Morse Automatic Adjustment. The Morse Automatic Adjustment consists of an idler sprocket engaging the rear face of a Duplex type timing chain. The idler sprocket revolves on a bushing which is mounted eccentrically on a stationary shaft. Three coil springs in the shaft maintain a constant pressure on the bushing tending to move the sprocket toward the chain and thus take up the chain slack. Two dogs or ratchets are held in engagement with serrations in the sides of the shaft. These provide stops for the adjustment and prevent reverse action. Provision is made for force lubrication. The adjustment range is sufficient to take up all allowable wear in the chain. When the sprocket reaches the point of maximum adjustment the chain should be replaced. Shortening the chain will cause excessive wear on the sprockets since the chain teeth will not mesh properly.



MORSE AUTOMATIC IDLER SPROCKET.



1. ROCKER JOINT LINK CONSTRUCTION TYPES.



To replace the chain, take off the hexagon nut, lock washer and large retaining washer. This will expose the sprocket mounting on the stud shaft. Insert a small flattened pin in the two slots in the slide adjacent to the shaft. This will release the ratchets. Then press down on the sprocket compressing the springs and insert a hardwood plug in the slide opening under the stud shaft to hold the sprocket in place. The chain can then be replaced. If it is desired to disassemble the automatic sprocket this can be done after the chain has been removed by sliding the sprocket off and then forcing the bushing outward. After the bushing has been removed the slide can be removed and disassembled. Be careful to save the five springs used in the assembly. In reassembling, the large retaining washer must not be clamped tight against the face of the sprocket. The clearance at this point should be .006-.008 inch.

DESCRIPTION:—Whitney chains are furnished for original or replacement equipment on car models in both the conventional internal engagement and the Duplex or back-laced types (for use with automatic idler take-up sprockets). The internal engagement type is fitted with the Whitney patented 'Inside Face Link and Sprocket Tooth Engagement' by which the sprocket tooth is engaged in the recess at the center of the link while clearance is provided at the ends of the link so that they do not contact the sprocket tooth. The "Anti-Whip' guide links may be fitted at the center (Center Guide) or at either side (Side Guide) of the chain. These Anti-Whip guide links consist of wedge shaped pieces which replace the usual guide links. They are cut away on the lower edge to permit the chain to wrap around the sprocket but the straight upper edges contact when the chain is drawn out straight between the sprockets so that no whip is possible (see illustration). The two types of link construction are as follows:

Double Bearing Pin and Bushing Type. In this type the links are joined by a pin on which a row of bushings are assembled. The bushings are free to turn on the pin so that a double bearing surface is provided, an inner bearing between the pin and the bushing, and an outer bearing between the bushing and the link ends. See Installation Directions below for details of assembly.

Single Floating Pin and Link. In this type the links are joined by a single pin which is inserted through the link ends and the end then riveted over a washer installed on the end of the link. The bearing surface is between the pin and the link.

INSTALLATION:—Chains are ordinarily furnished 'endless' and should be installed in this condition whenever possible. On 'two-sprocket' drives where no adjustment is furnished, the camshaft sprocket is usually mounted on a flange or hub and can be removed in order to permit the chain to be meshed on the sprockets. On three-sprocket drives, where an adjustment is provided, the adjustment should be backed off as much as possible and if necessary the camshaft sprocket or accessory sprocket removed. If it is necessary to split the chain so that it may be wrapped around the sprockets, proceed as directed below:

To Install Double Bearing Pin and Bushing Types. File off the heads of two rivets and drive out the assembly of two pins and outside link. Drive out one row of bushings. Use a punch and be careful not to damage bushings or links. Install chain on sprockets and mesh end links in proper order. Insert connecting link assembly (see illustration), which has one row of bushings assembled on pin, install loose outside plate or guide link, install cotter pins in pins. Check to see that connecting link and cotter pins do not strike any part of chain case.

To Install Single Floating Pin and Link Types. Grind or file off the riveted end of any link pin, drive out pin. Install chain on sprockets and mesh end links in proper order. Use special connecting pin and washer to join chain. Insert connecting pin, install open washer on end of pin, pinch washer shut. Check to see that end of connecting pin does not strike any part of chain case.

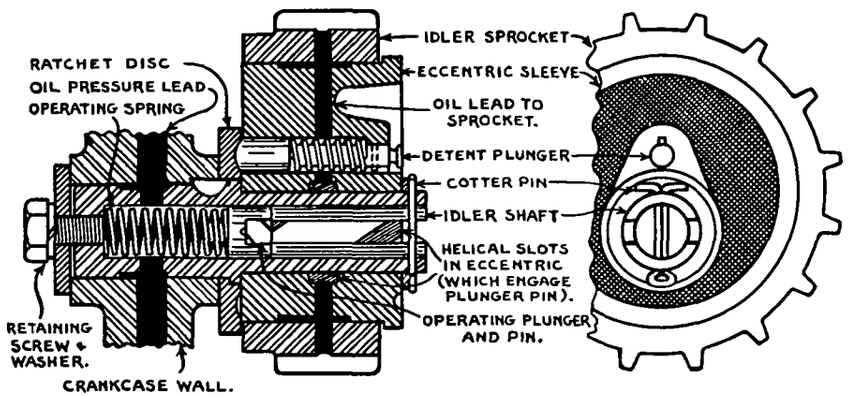
NOTE:—Duplex or back-laced chains and chains equipped with Anti-Whip guide links must be installed endless and should never be split or opened. Whitney chains will run in either direction and direction need not be considered when chains are installed.

ADJUSTMENT:—See individual car pages for chain adjustment directions where this is required (no adjustment possible on two-sprocket type drives).

WHITNEY AUTOMATIC TAKE-UP IDLER SPROCKET

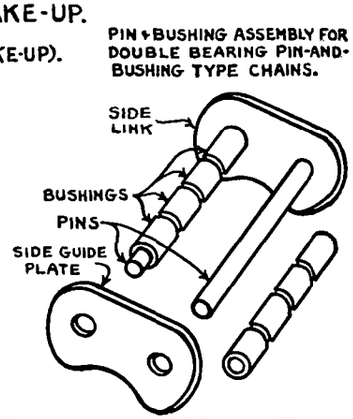
DESCRIPTION:—This type take-up is designed to be used with Duplex or back-laced chains and with Roller chains. The design and operation of the idler is the same in either case (sprocket tooth form differs only).

OPERATION:—The automatic take-up consists of an idler sprocket mounted on an eccentric which is rotated around a stationary hub or shaft so as to maintain a uniform tension on the timing chain. The range of adjustment is sufficient to take up all play developed during the life of the chain and the chain should be replaced when the sprocket reaches 'maximum' position. The eccentric is rotated by a spring plunger within the stationary hub which engages helical slots on the inner surface of the eccentric and is pushed forward by the spring behind it. A detent plunger located at the side of the stationary hub engages successive slots in the hub flange as the eccentric is turned and prevents any backward motion. The take-up should be locked in 'minimum' position when chain is installed (if camshaft sprocket is removed) or may be disassembled (if camshaft sprocket cannot be removed). See directions below.

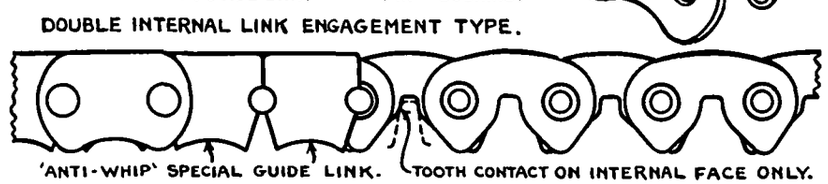


WHITNEY AUTOMATIC TAKE-UP.

REVERSIBLE TYPE (USED WITH AUTOMATIC TAKE-UP).







SERVICING:—**To lock Take-up in Minimum Position.** Pull out detent pins until released (one pin only used on first type idler, several pins on later types), turn take up sprocket to minimum position by pushing plunger tool and lock tool. When chain is installed, release tool and release detent pins (pins locked out of engagement when withdrawn).

To assemble Take-up Idler. Insert plunger spring and plunger in recess in hub, use special assembly tool and compress spring, rotate assembly tool slightly until it locks. Install idler sprocket and mesh sprocket in chain. Insert eccentric in sprocket, place plunger retaining washer on shaft and insert cotter pin. Press on assembly tool until released, withdraw assembly tool and release detent pins.

AC TYPE

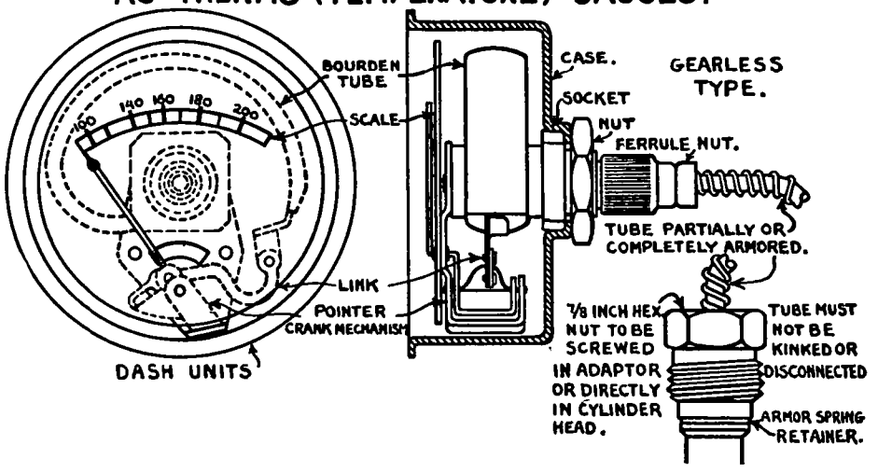
DESCRIPTION:—A.C. Temperature Gauges are of the Bourden tube type and consist of a dash unit in which the Bourden tube is mounted, together with the gauge pointer and connecting mechanism, and an engine unit or bulb. The units are connected by a hermetically sealed copper tube and the entire assembly is filled with a special liquid. The engine unit is mounted on the cylinder head and is immersed in the cooling water. As the temperature of the water increases the liquid in the bulb is vaporized causing a pressure to be exerted in the Bourden tube. The Bourden tube consists of a curved tube mounted rigidly at one end and connected to the gauge pointer through a crank mechanism or gear system at the other. The pressure within the Bourden tube results in a movement of the free end causing the pointer to move across gauge dial which is calibrated in degrees.

INSTALLATION:—Gauges are made in three types: Gearless, in which the gauge pointer is connected to the Bourden tube through a simple crank mechanism; Gear Type,, employing a smaller Bourden tube which is connected to the pointer through a sector and pinion gear system to amplify the tube movement, and a Gear Type Heavy Duty design.

Engine unit bulbs are designed in three sizes although for automotive use with a capillary tube length of less than 8 feet the smallest size, .365 inch in diameter and 1⅜ inches long, is used. Capillary tubing between the two units is completely armored or partially armored (at each unit). The engine bulb plug has a ⅝-18 N.F.-3 thread and may be screwed directly into a tapped hole in the cylinder head although it is recommended that an adapter be used in the hole in the cylinder head.

SERVICING:—The entire gauge—dash unit, engine bulb, and capillary tubing—are assembled at the factory as one unit and no attempt should ever be made to disconnect the units or cut the tubing as this will render the gauge inoperative. Gauge must be replaced when found to be defective.

AC THERMO (TEMPERATURE) GAUGES.



AC ELECTRIC TYPE

DESCRIPTION:—This is an Electric gauge of the 'balanced coil' type and consists of a Dash Unit or recording gauge and an Engine Unit or temperature reacting unit mounted in the cylinder head or engine block in contact with the cooling water in the engine. Dash unit is connected to the 'Gauge' side of the ignition switch (controlled by switch and operative only with switch on) and to the engine unit and each unit is grounded (see wiring diagram). Dash unit consists of two coils at a 90° angle with an armature (on which the pointer is mounted) at the intersection of the coil axis. One coil is connected directly between the 'IGN' (feed) terminal and ground on the gauge case, the other coil being connected between the two gauge terminals (in series with the engine unit). Engine unit consists of a fixed resistance unit which has a high resistance value Cold and a relatively low resistance value Hot (gauge operated by this change in resistance due to temperature changes in the engine—gauge engine unit has no moving parts).

OPERATION:—When the ignition switch is turned on with the engine cold, current flows directly through coil 'A' to ground. The high resistance of the engine unit causes a relatively smaller current to flow through coil 'B' (which is connected in series with this resistance) so that the pointer is deflected toward the 'Low' or coil 'A' side of the scale. As the engine warms up, the resistance of the engine unit decreases, allowing an increasingly greater current flow through coil 'B' so that the pointer is drawn over toward the 'High' end of the scale. The balanced action of the two coils compensates for battery voltage variations and in addition an inertia dampener is built in the armature assembly to prevent pointer vibration on rough roads, etc.

SERVICING:—All defective units should be replaced.

TROUBLE SHOOTING:—If gauge operation not satisfactory, check as directed under correct heading in following table, being careful to turn ignition switch off when disconnecting or re-connecting leads on terminals and using extreme care not to reverse connections at dash unit terminals. Do not allow dash unit to be placed in strong electric field which will affect magnetic armature.

CONNECTION NOTE—Left hand (small diameter) terminal on dash unit should be connected to ignition switch, right hand (large diameter) terminal connected to engine unit. Terminals marked for identification.

Gauge does not register with Ignition Switch turned on:

1. Lead between Ignition Switch and Dash Unit broken or grounded (open or short-circuit). Check by connecting test lead between these two points with regular lead disconnected at both ends.

Gauge register 'Cold' under all conditions:

1. Lead between Dash Unit and Engine Unit broken (open-circuit). Check by connecting test lead between these two units.
2. Coil 'B' (right hand coil) in dash unit defective or lead to coil broken.

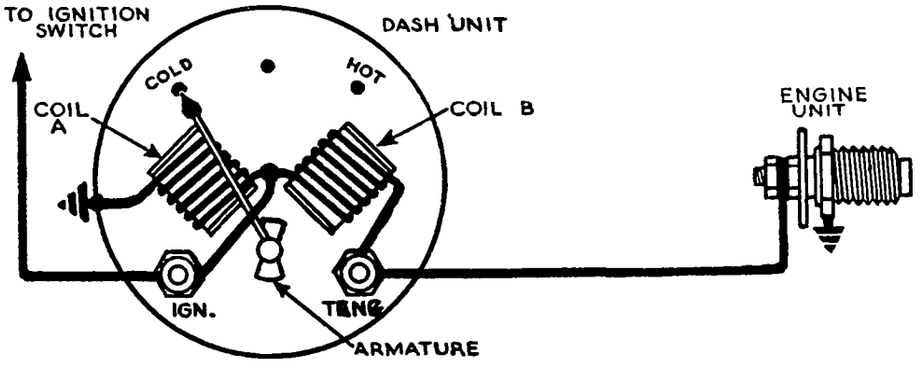
Gauge registers 'Hot' under all conditions:

1. Lead between Dash Unit and Engine Unit short-circuited. Check by disconnecting this lead at engine unit terminal and noting gauge reading. If gauge still reads high, this lead is shorted. If gauge reads low, engine unit is shorted and must be replaced.
2. Dash Unit not grounded. Clean all paint from under dash unit mounting flange, tighten mounting screws.
3. Engine Unit burned out. See check under (1) above or install replacement engine unit and note operation.
4. Coil 'A' (left hand coil) in dash unit defective or lead to coil broken.

Gauge registers Inaccurately:

To check, disconnect lead at engine unit terminal, remove engine unit, ground engine unit shell to car frame with test lead, re-connect engine unit, immerse inner end of unit in pan of water at known temperature (use reliable thermometer and heat water as required), note gauge reading.

CAUTION—When making this test, do not completely immerse engine unit in water which may allow leakage within shell or short-circuit lead on terminal.



OIL PRESSURE GAUGE

DESCRIPTION:—This is an electric oil pressure gauge comprising an engine unit, and a dash or recording unit connected by a wire. The dash unit is also connected to the ignition switch (gauge operative only with engine turned on) and the gauge circuit is completed to ground through the engine unit contacts. The dash unit consists of a thermostatic bi-metal arm linked to the instrument pointer around which is wound a heating coil. The engine unit has a similar bi-metal arm and heating coil. One of the engine unit contacts is mounted on this bi-metal arm and the other contact is mounted on a diaphragm which is deflected when oil pressure is built up in the engine so as to increase the contact pressure and lengthen the time period over which the contacts are closed. The diaphragm contact completes the gauge circuit to ground.

OPERATION:—When the engine is operated and oil pressure is built up, the pressure deflects the diaphragm in the engine unit and, with the contacts closed, a current flows through the heating coils of the dash and engine unit. The heating effect of the coil in the dash unit tends to bend the bi-metal arm which is linked to the pointer and record a reading on the gauge. At the same time, the heating coil in the engine unit causes the bi-metal arm to flex to a point where the contacts open and the current is interrupted. When this occurs the bi-metal arm in the engine unit flexes in the opposite direction and again closes the contacts. Contact pressure and length of time (amount of flexing necessary to open contacts) is directly proportionate to the oil pressure in the engine, and as this determines the amount of current flowing in the gauge circuit and the deflection of the bi-metal arm in the dash unit, the dash unit indicates the oil pressure. The opening and closing of the contacts is extremely rapid (approximately 120 cycles per minute with engine oil pressure of 25 lbs.). The dash unit is calibrated in pounds and the accuracy of the gauge is established at the time of assembly by the use of calibrating shunts.

SERVICING:—No service operations are necessary other than to see that connections are tight and that lead is properly connected to engine unit. If gauge operation is unsatisfactory, check Trouble Shooting Table and make tests outlined below. Repair or calibration of units is not practical and manufacturer recommends replacement of Receiver or Sender units which are defective.

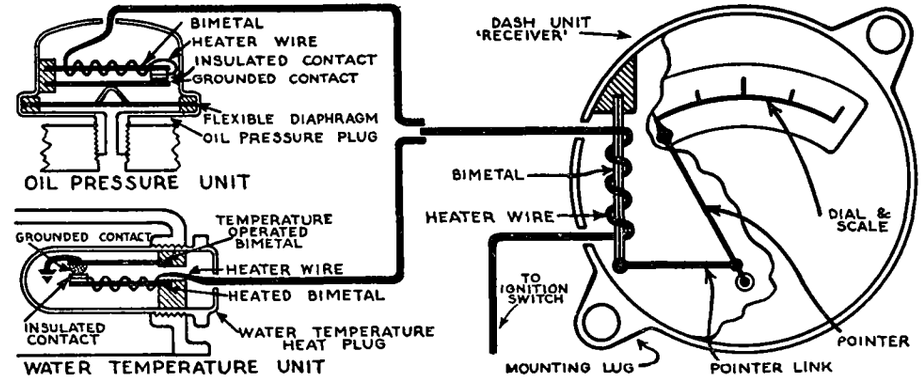
Trouble Shooting Table

1. **Gauge pointer is erratic.** Engine unit probably defective.
2. **Gauge reading inaccurate.** Engine unit probably defective.
3. **Gauge does not register.** Engine unit defective or dash unit burnt out as result of short-circuit in lead between units.
4. **Gauge registers with engine not running (ignition on).** Short-circuit in lead between dash unit and engine unit or short-circuit in dash unit (a short-circuit of this type will usually result in dash unit burning out, resulting in no reading).

TESTING (ALL UNITS):—Use a gasoline gauge tank unit which is known to be OK. for test purposes. Connect flexible test lead to terminal on this test unit and second lead to test unit mounting flange (for ground circuit). Make tests in order as given below before removing units from car.

Testing Dash Unit Receiver. Disconnect engine unit Sender, connect test unit terminal lead to this wire, ground test unit to engine block. Turn on ignition switch. With float of test unit at bottom (tank empty) position, dash unit receiver pointer should be even with lowest mark on dial. Move test unit float rod up to top position. Dash unit receiver pointer should move to top mark on dial (allow one minute for pointer to come to rest). If dash unit receiver does not operate satisfactorily, see that connections at receiver and ignition switch are tight, check line to ignition switch and line to engine unit, then replace receiver. NOTE—When testing temperature gauges, readings will be reversed (Hot reading with test unit float at bottom, Cold reading with test unit float at top).

Testing Engine Unit Sender. If receiver tests OK. (above), see that motor unit is well grounded, disconnect and check radio condenser (shorted condenser will cause high reading on dash unit). Then replace engine unit sender, connect to dash unit receiver and note performance.



TEMPERATURE GAUGE

IMPORTANT NOTE:—**All Models.** Temperature gauges will read 'Hot' or 212° with the ignition switch turned off (engine not running). This reading does not mean that gauge is defective and is caused by the linkage design which is designed to conserve current (less current consumed when engine is at normal running temperatures). Gauge readings should only be taken with the ignition switch turned on.

Willys 48 1939. Temperature gauge on this model consists of a tell-tale light on the instrument panel which is controlled by a thermostatic type engine unit similar in appearance to those used on other King-Seeley gauges. This engine unit must never be used with regular thermostatic type dash units (as used on Willys Overland Model 39) as it will result in the dash unit burning out. NOTE—These engine units may be identified by groove around hexagonal head of the engine unit plug. Regular type engine unit for Willys-Overland Model 39 is not marked by these grooves.

DESCRIPTION:—Dash unit or Receiver same design as for Oil Pressure Gauge. Engine Unit or Sender consists of two bi-metal arms within a heat bulb which is designed to be screwed in the engine block so that cooling water temperature is transmitted to the arms. Heating coil (connected to dash unit) is wound on one arm and connected to insulated contact at free end of arm. Ground contact is mounted on free end of second bi-metal arm which is so located that contacts are normally closed (with arms not flexed) and gauge circuit is completed through heating coil and contacts to ground when ignition is turned on.

OPERATION:—When heating coil on bi-metal arm in engine unit is energized, the temperature rise tends to flex the arm and open the contacts. This interrupts current flow, allows bi-metal arm to cool off and flex back so that contacts are again closed. This action is extremely rapid and arm has a vibrating motion. Second bi-metal arm is longer and thinner than heater arm so that flexing action, as engine temperature increases, is greater and tends to increase contact pressure and length of time contacts are closed. Consequently current flow in gauge circuit increases in proportion to the rise in engine temperature and this increased current produces a greater deflection of the dash unit bi-metal arm so that a higher reading is indicated on the dial.

TESTING & SERVICING:—Same as for Oil Pressure Gauges (above). See Note for reversed readings secured on temperature gauges when using special gas gauge tank unit as a test sender.

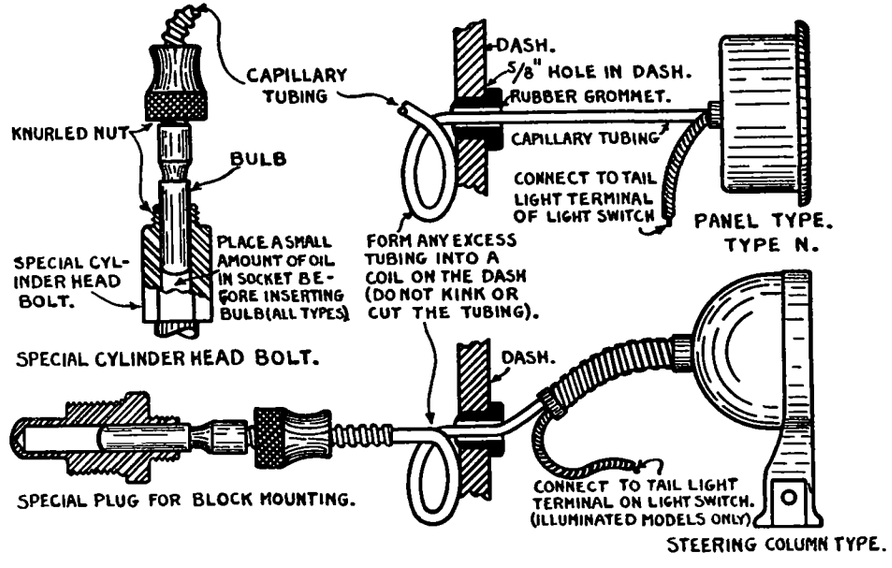
MOTOMETER (AUTO-LITE TYPES)

DESCRIPTION:—These Motometer Temperature Gauges are of the Vapor Tension type. They consist of a dash unit calibrated to read in degrees of engine temperature, an operating bulb or engine unit, and a capillary tube connecting the dash unit with the engine unit. The Types US, UL, and NS are designed for steering column or dash mounting with the engine unit mounted in a special cylinder head nut or screwed into the engine block in place of the special half inch plug which is provided for this purpose on some engines. The bulb of the engine unit is filled with a liquid and the remainder of the system (capillary tubing and dash instrument) is evacuated. For this reason the capillary tubing must never be disconnected from the bulb or the dash unit and must not be cut or kinked.

OPERATION:—The bulb is exposed to the heat of the engine block (or the water in the cooling system in the Type N and L gauge) and the liquid in the system is raised to the same temperature. The pressure which results from this increase in temperature causes the dash unit to indicate a reading which is calibrated in degrees. All these models are of the illuminated 'Red Ball' type and must be connected to the lighting system of the car. See Mounting.

MOUNTING:—**Types US, UL NS.** These gauges are of the 'Distance Type' and are designed to be mounted on the steering column or on the dash with the engine unit or operating bulb mounted on the engine block. They are furnished with a special cylinder head bolt and with a special plug which is screwed in the engine block on engines where provision is made for this mounting (these engines are equipped with a half inch plug which should de taken out and the special mounting plug screwed in the opening). To mount the gauge, first mount the dash unit on the steering column or drill a 2 1/16 inch hole in the dash for dash mounting. The securing clamp on the dash mounting type is adjustable for mounting on dash boards of various thicknesses. Then drill 5/8 inch hole in the partition at the left of the engine and pass the engine bulb, capillary tubing and knurled nut through this hole. A special rubber plug or grommet is supplied for this opening to prevent the capillary tubing chafing on the edge of the hole. Then remove the nut from the second cylinder head stud at the left of the engine and take out the stud with a Stillson wrench. Screw the special cylinder head bolt in place. Put a small quantity of oil in the bulb socket, insert the bulb and tighten the knurled nut.

Types L and S. The engine unit or bulb on these types is designed to be inserted in the water outlet hose connection at the front of the engine. Mount the dash instrument as directed above, connect the lead to the tail light terminal of the switch and pass the capillary tubing and bulb through to the engine compartment. Drain the water from the engine, and with the special cutter cut a half inch hole in the hose midway between the ends. Force the bulb socket through this opening, place the reinforcement plate on the outside of the hose and tighten the lock nut. This will make a water tight connection. Form a one inch coil in the tubing and insert the bulb in the socket and tighten the knurled nut. This coil will take up any strain and allow for vibration. Form the surplus tubing into a coil and fasten to the dash. Support the tubing on the radiator tie rod so there is no strain on the tubing at any point. Under no circumstances should any attempt be made to remove surplus tubing by cutting the tube or disconnecting it from the dash gauge or operating bulb as this will destroy the instrument.



If it is necessary to replace the lamp in these instruments, remove the two screws holding the bottom case at the rear of the gauge and insert a 6-8 volt, 2 cp. single contact bulb. If this provides too much light, a 12 volt bulb can be used.

SERVICING:—It is not possible to repair these instruments and they must be replaced whenever they are found to be defective.

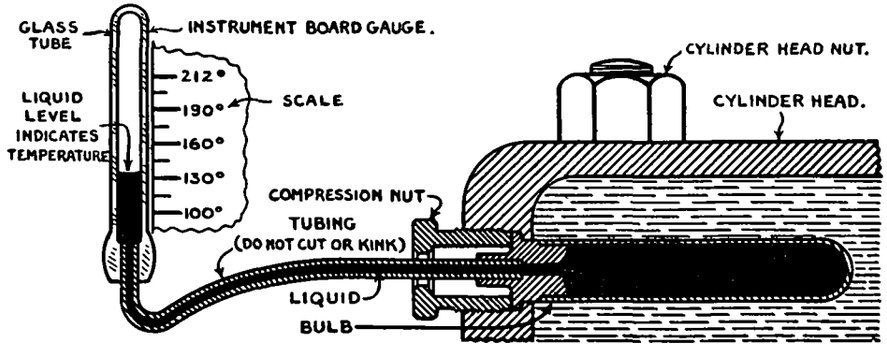
K-S HEAT INDICATOR

DESCRIPTION:—The K-S Heat Indicator or temperature gauge is a thermometer in which the glass tube or indicator (dash unit) and the bulb (engine unit) are connected by a sealed copper tube. The entire device is assembled as a unit and the copper tubing must not be cut or the joints broken.

OPERATION:—The liquid with which the bulb and tubing are filled expands evenly with temperature increases and rises into the glass tube so that a reading is obtained when the engine warms up. The location of the bulb in the cylinder head is selected to accurately indicate the cooling water temperature and should not be changed.

SERVICING:—No service operations are necessary. The entire unit must be replaced if found to be defective as a result of mutilation or breakage.

Removal of Bulb from Engine—To disconnect gauge when removing cylinder head, loosen corrosion or sediment around bulb by tapping on cylinder head with a ball-pein hammer, take out compression nut, withdraw bulb. If bulb cannot be withdrawn without great effort, pry gently with a screwdriver. Bulb must not be distorted and must retain its original round shape in order to read correctly.



Used On:
1940 CONVERTIBLE CAR MODELS.

NOTE:—Power tops on all cars are of similar design with differences in power cylinder mounting, linkage design and control hook-up as noted below.

DESCRIPTION:—Convertible tops used on cars with power actuation have the conventional top bows and braces modified for connection of the vacuum power cylinders and are equipped with counterbalancing springs. Two vacuum power cylinders are mounted at sides of car behind seat trim (one on each side) and are linked to the top frame. Each cylinder is double acting type, with vacuum line hose connection to upper and lower end, and operate when control valve button on dash is manipulated to connect either end of cylinder to engine manifold vacuum line (both strokes of cylinder piston rod are positive and top is both raised and lowered by vacuum power). Control valve is double acting type and is normally centered in the 'off' position by a spring within the valve. When the control valve button is pushed in, or pulled out, vacuum connection is made through the valve to one end or the other of both power cylinders. Button must be held in or out during entire time cylinders are operating to raise or lower top.

OPERATION:—Engine should be running (idle engine with closed throttle) and car should be stopped when top control is operated. CAUTION—Top should never be raised or lowered when car is in motion.

Lowering Top—Unlatch top from widshield header on both sides, raise top slightly so that locating dowels or pins are free of header, press in or pull out on control valve button (pull out on button on Buick, Cadillac, Chevrolet, La Salle, Oldsmobile, Pontiac, Packard; press in on button on Chrysler, De Soto, Dodge, Plymouth) and **hold button in this position** until top is completely lowered. In this position, control valve connects lower end of each cylinder to engine manifold vacuum line and opens upper end of each cylinder to atmospheric pressure.

Raising Top—See that top straps or boots are removed so that top is free. Press in on control valve button (Buick, Cadillac, Chevrolet, La Salle, Oldsmobile, Pontiac, Packard), or pull out on button (Chrysler, De Soto, Dodge, Plymouth) and **hold in this position** until top is completely raised. Top should come to rest within 1-2" of windshield header and side rail should be straight (see Adjustment section below). Top must then be pulled down and fastened in place by hand.

ADJUSTMENT:—Chevrolet—If top does not come to rest within 1-2" of windshield header and side rails do not straighten out when top is raised, or if top travel is excessive so that it comes to rest on windshield header, adjust as follows: Lower top, remove mounting screws and take out rear quarter trim panels. Loosen two nuts anchoring adjustment plate on control link bracket (directly above and forward of top of vacuum power cylinder on each side of car), tap adjustment plate down ⅛" (if travel insufficient), up ⅛" (if travel excessive), tighten anchor nuts. **Adjust both sides of car exactly alike.** Check performance, repeat adjustment until correct operation secured.

Top Alignment—Top alignment to insure correct registering of locating dowels or pins and sockets on top and windshield header can be adjusted by shimming body at mounting bolts.

SERVICING:—Vacuum Cylinder—To remove vacuum cylinder, remove rear quarter trim panel, take out bolt linking piston rod to top, disconnect both connections, remove bolt mounting cylinder on body bracket at lower end (on General Motors cars, remove locknut on end of bolt, then remove bolt with a 5/16" Allen setscrew wrench), lift cylinder out. When replacing cylinder, use care not to bend or distort piston rod or cylinder, make certain that cylinder and piston rod lined up between mounting bolt and top connector bolt (if cylinder out of alignment, piston rod will bind and operation will be faulty). See that vacuum line hoses are properly connected to top and bottom of cylinder.
NOTE—Use care not to reverse hose connections.

Lubricating Cylinder (Chrysler Models)—If piston is tight in cylinder, lubricate with half-and-half mixture of Neatsfoot Oil and Kerosene by submerging hose connection at upper end of cylinder (hose removed) in 1 oz. glass of lubricant and operating piston downward which will draw lubricant into cylinder. Work piston up and down several times.

Control Valve—To remove valve, disconnect and tag hose connections (to insure correct reassembly), remove mounting nut and withdraw valve assembly. To disassemble valve, remove large nut on stem end of valve and withdraw plunger. On General Motors cars, an air cleaner is mounted under the perforated plate on the end of the valve and is retained by a locking ring.

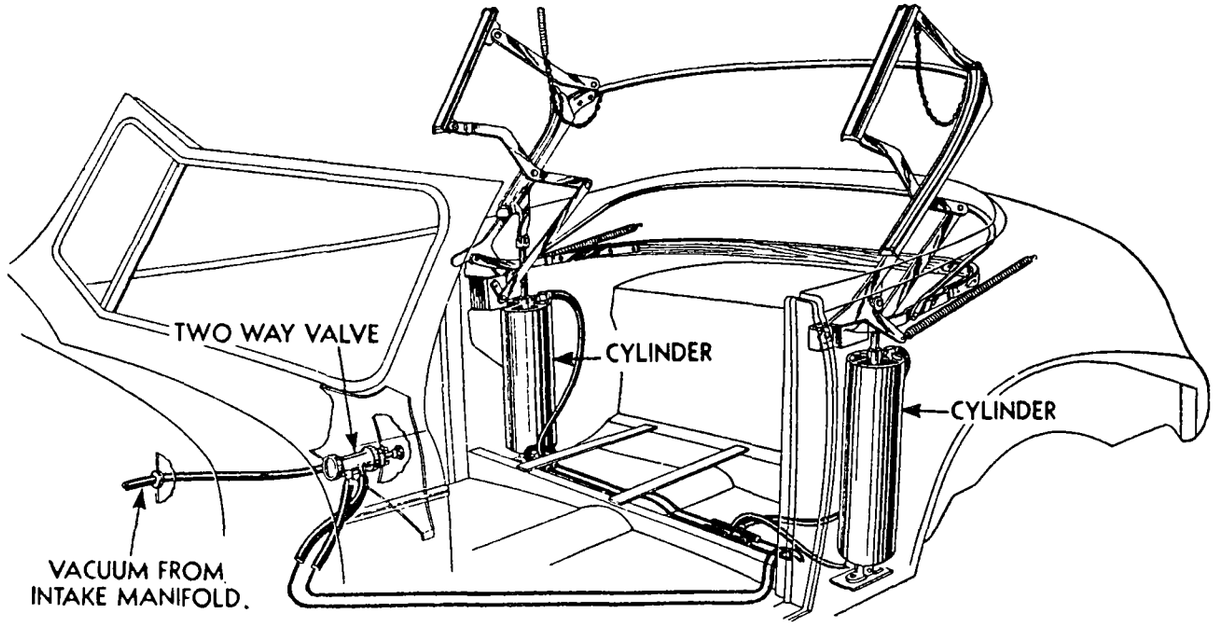
Vacuum Line Connections (Buick, Cadillac, Chevrolet, La Salle, Oldsmobile, Pontiac)—Rubber tubing should extend over ends of metal tubing connections 1" or more (except at control valve which should be ½"). Joints should be cemented tight with rubber cement such as Fisher F.S. 621.

TROUBLE SHOOTING:—If top does not operate satisfactorily, check the following points:

Vacuum Lines—Check all connections for leaks, see that hose connections and metal tubing are not kinked or broken. NOTE—Lines can be checked with vacuum gauge by noting gauge reading at engine manifold, and then connecting gauge to each hose connection at cylinder (hose to opposite cylinder must be plugged, and control valve button must be operated to open valve in order to secure gauge reading). See Vacuum Line connections in Servicing section above.

Vacuum Power Cylinder—Check piston rod for binding or tightness caused by lack of lubrication (see Cylinder Lubrication in Servicing section above). To check cylinder, disconnect bolt linking piston rod to top, see that piston moves freely in cylinder. Check alignment by raising top in stages, and checking piston rod in each position. IMPORTANT NOTE—Cylinder rocks on lower mounting bolt as top is raised and lowered. Any mis-alignment caused by top and bottom mounting bolts not being in same plane (so that cylinder or piston rod cocked sideways) will cause binding and faulty operation.

Top Mechanism—See that top folding arm assembly operates freely without binding. This can be checked by operating top with vacuum cylinders disconnected, or by operating top manually with engine not running (operate control valve in usual manner so as to permit piston to move up or down in vacuum cylinder).



TORQUE WRENCH READINGS:—All torque wrenches are calibrated to read directly in Foot Pounds (Ft. Lbs.) or Inch Pounds (In. Lbs.) as noted in the following table, or are calibrated in accordance with a special table which may be converted into Ft. Lbs. or In. Lbs. as directed below.

Torque Indicating Wrenches

Wrench Manufacturer	Wrench Reading
Ammco	Special
Blackhawk Torqflash	Ft.Lbs. & In.Lbs.
Bonney #56 & #66	Ft. Lbs.
Duro-Chrome	Ft. Lbs.
Kwik-Way	In. Lbs.
Snap-On Torqometer (First Type)	Special
Snap-On Torqometer (Later Type)	Ft. Lbs.
Sunnen	In. Lbs.
Williams Measurrench	Ft. Lbs.

Special Wrench Types:—For both Ammco and first type Snap-On Torqometer wrenches, which are calibrated to a special scale, the Ft. Lbs and In. Lbs. tables given below must be converted into this special scale by dividing the Ft. Lbs. figure by .35 and the In. Lbs. figure by 4.2. NOTE—If the tables given below are used for these wrenches, it will be simpler to multiply the wrench reading by .35 (for Ft. Lbs.) or by 4.2 (for In. Lbs.).

Ft. Lbs. & In. Lbs. Special Note:—Ft. Lbs. figures are a measure of the force applied multiplied by the distance or leverage in feet (10 lb. force on end of 12" or 1' wrench equals 10 ft. lbs.). In. Lbs. figures are the same except that distance is measured in inches (10 lb. force on end of 12" wrench equals 120 In. Lbs.). Any figure can be changed from one system to the other as follows:

To Change In. Lbs. to Ft. Lbs.—Divide by 12.

To Change Ft. Lbs. to In. Lbs.—Multiply by 12.

CYLINDER HEAD TIGHTENING DATA:—It is not only important to tighten cylinder head screws or stud nuts to the correct tension as shown in table below, but they should be tightened in correct order as shown in diagrams on following page. Cast iron and Aluminum heads are tightened differently as follows:

Cast Iron Heads—With engine cold, tighten screws or nuts to correct tension as shown in table below. Run engine until thoroughly warm, then check and retighten nuts (additional tightening necessary to bring them back to correct tension).

Aluminum Heads—With engine cold, tighten screws or nuts to correct tension as shown in table below. Run engine until thoroughly warm, then allow engine to cool off, check and retighten nuts after engine has become cool—do not tighten aluminum heads hot.

Cylinder Head Tightening Order—See following page for cylinder head diagrams for each model. NOTE—Where head bolts are not numbered, no particular order is recommended by manufacturer. In general, these models should be tightened from center outward.

AUBURN—CORD

	Ft. Lbs.	In. Lbs.
Cylinder Head	50	600

BUICK

	Ft. Lbs.	In. Lbs.
Cylinder Head Bolts	65-70	780-840
Main Bearing Cap Screws	115-120	1380-1440
Connecting Rod Bolts (40,50)	45-50	540-600
" " " (60,70,80,90)	60-65	720-780
Rocker Arm Cap Screws	30-35	360-420

CADILLAC—LA SALLE

	Ft. Lbs.	In. Lbs.
Cylinder Head Bolts	70-75	840-900
Main Bearing Caps (V8)	130-140	1560-1680
Main Bearing Caps (V16)	100-110	1200-1320
Connecting Rod Bolts	55-60	660-720
Wrist Pin Clamp Screw (V16)	20-25	240-300
Intake & Exhaust Manifold	25-30	300-360
Flywheel to Crankshaft	65-70	780-840
Spark Plugs (10 MM. Type)	7-10	84-120
Spark Plugs (14 MM. Type)	35-40	420-480
Front Suspension:		
Susp'n Arms to Frame (V8 except 75)	60-70	720-840
Susp'n Arms to Frame (75, 90)	85-100	1020-1200
Diff'tial Carrier to Housing	30-35	360-420

CHEVROLET

	Ft. Lbs.	In. Lbs.
Cylinder Head Bolts	75-80	900-960
Main Bearing Bolts	105-110	1260-1320
Rocker Arm Support Bolts	25-30	300-360

CHRYSLER—DE SOTO—DODGE

	Ft. Lbs.	In. Lbs.
Cylinder Head Nuts	52½-57½	630-690
" " Plain Capscrews	65-70	780-840
" " Cupped Hd. "	67½-72½	810-870
Main Bearing Nuts & Capscrews	75-80	900-960
Connecting Rod Nuts	52½-57½	630-690
Camshaft Sprocket Screws	15-20	180-240
Clutch to Flywheel Capscrews	15-20	180-240
Spark Plugs (14 MM. Type)	26-32	312-384
Lower Control Pin & Bar Bush'gs	180	2160
Rear Spring Clip Nuts	75-80	900-960

FORD

	Ft. Lbs.	In. Lbs.
All Aluminum Heads (except 60)	40	480
60 H.P. Aluminum Heads	30	360
All Cast Iron Heads	50	600
Spark Plugs:		
⅞-18 Cast Iron Head	34-38	408-456
18 MM. Cast Iron Head	28-32	336-384
14 MM. Cast Iron Head	24-28	288-336
14 MM. Aluminum Head	20-24	240-288
18 MM. Aluminum Head	24-28	288-336

GRAHAM

	Ft. Lbs.	In. Lbs.
Aluminum Heads	40-45	480-540
Cast Iron Heads	55-60	660-720

HUDSON—TERRAPLANE

	Ft. Lbs.	In. Lbs.
Cylinder Head Stud Nuts (6)	45	540
Cylinder Head Stud Nuts (8)	55	660
Main Bearing Stud Nuts	91⅔	1100
Connecting Rod Bolt Nuts	52½	630

LINCOLN—LINCOLN-ZEPHYR—MERCURY

	Ft. Lbs.	In. Lbs.
All Aluminum Heads	40	480
All Cast Iron Heads	50	600
Spark Plugs:		
⅞-18 Cast Iron Head	34-38	408-456
14 MM. Cast Iron Head	24-28	288-336
14 MM. Aluminum Head	20-24	240-288
18 MM. Aluminum Head	24-28	288-336

NASH—NASH-LAFAYETTE

	Ft. Lbs.	In. Lbs.
Cylinder Head Bolts	60-64	720-768
Main Bearing Capscrews (Sixes)	65-70	780-840
Main Bearing Capscrews (Eight)	70-75	840-900
Connecting Rod Bolts	50-55	600-660

OLDSMOBILE

	Ft. Lbs.	In. Lbs.
Cylinder Head Bolts	60-70	720-840
Piston Pin Lockscrews	9-11	108-132
Main Bearing Bolts:		
#2 and #3	120	1440
#1 and #4 (#5 on Eight)	140	1680
Spark Plugs (14 MM. Type)	28-35	336-420
Con Rod Nuts (regular type)	30-35	360-420
" " " (self-locking type)	50-55	600-660

PACKARD

	Ft. Lbs.	In. Lbs.
Cylinder Head Nuts:		
6, 8, Super 8 '40, 12	61⅔-63⅓	740-760
Super 8 before 1940	58⅓-60	700-720
Main Bearing Nuts (6 & 8)	81⅔-85	980-1020
Connecting Rod Nuts (6 & 8)	59½-60½	715-725
Tappet Lock Nuts (6 & 8)	23⅓-25	280-300
Spark Plugs (10 MM. Type)	4	50

PLYMOUTH

	Ft. Lbs.	In. Lbs.
Cylinder Head Nuts	52½-57½	630-690
" " Plain Capscrews	65-70	780-840
" " Cupped Hd. "	67½-72½	810-870
Main Bearing Nuts & Capscrews	75-80	900-960
Connecting Rod Nuts	52½-57½	630-690
Camshaft Sprocket Screws	15-20	180-240
Clutch to Flywheel Capscrews	15-20	180-240
Spark Plugs (14 MM. Type)	26-32	312-384
Lower Control Pin & Bar Bush'gs	180	2160
Rear Spring Clip Nuts	75-80	900-960

PONTIAC

	Ft. Lbs.	In. Lbs.
Cylinder Head Bolts	60	720
Main Bearing Cap Screws	85	1020
Connecting Rod Bolts	45	540
Flywheel to Crankshaft Bolts (6)	105	1260
Flywheel to Crankshaft Bolts (8)	70	840
Lower Control Arm Pin & Bar Bushings	200	2400

STUDEBAKER CHAMPION

	Ft. Lbs.	In. Lbs.
Cylinder Head Cap Screws	50-54	600-650
Main Bearing Cap Screws	91⅔	1100
Connecting Rod Cap Bolts	25-27	300-325

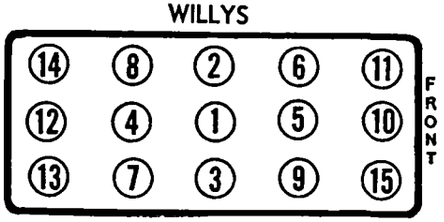
STUDEBAKER (EXCEPT CHAMPION)

	Ft. Lbs.	In. Lbs.
Cylinder Head Cap Screws	83⅓	1000
Main Bearing Cap Screws	91⅔	1100
Connecting Rod Bolt Nuts	54	650

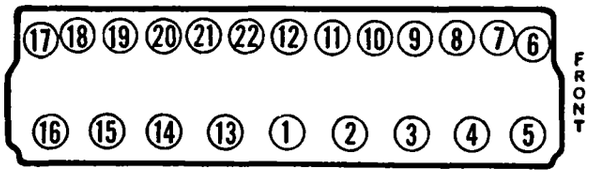
WILLYS

	Ft. Lbs.	In. Lbs.
Cast Iron Cylinder Heads	60-65	720-780
Aluminum Cylinder Heads	40	480
Connecting Rod Cap Bolts	50-55	600-660
Main Bearing Cap Bolts	65-70	780-840

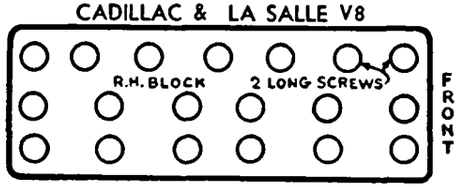
WILLYS



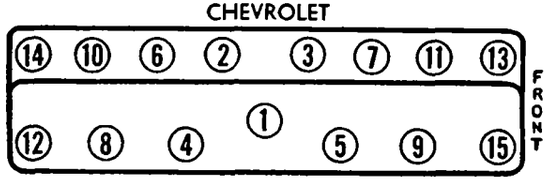
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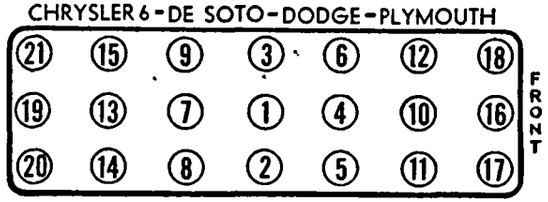
CADILLAC & LA SALLE V8



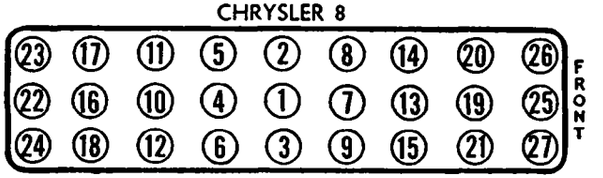
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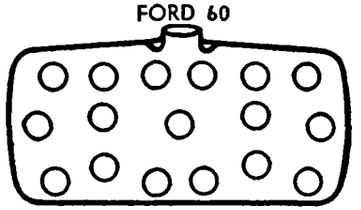
CHRYSLER 6 - DE SOTO - DODGE - PLYMOUTH



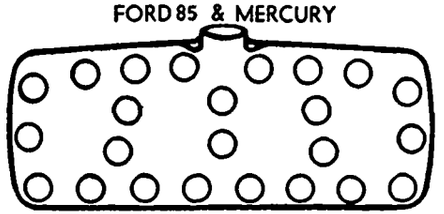
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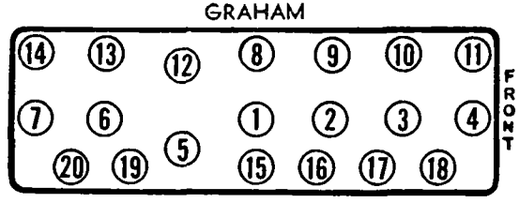
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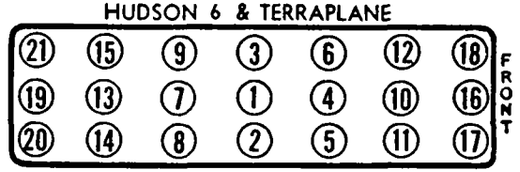
FORD 85 & MERCURY



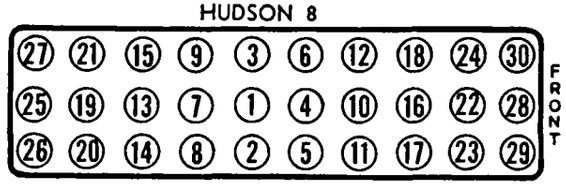
GRAHAM



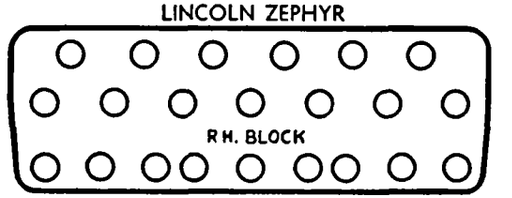
HUDSON 6 & TERRAPLANE



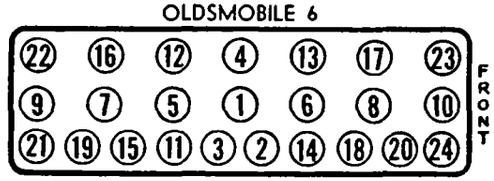
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LINCOLN ZEPHYR



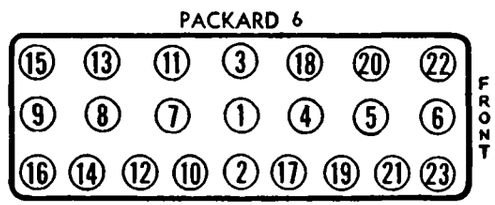
OLDSMOBILE 6



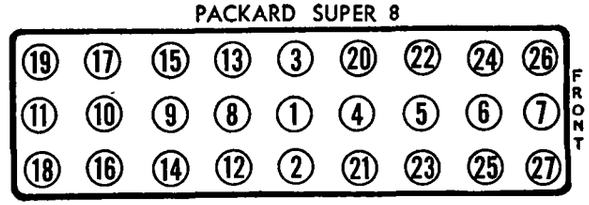
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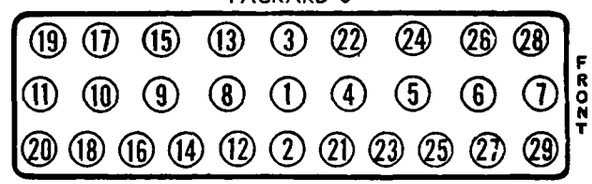
PACKARD 6



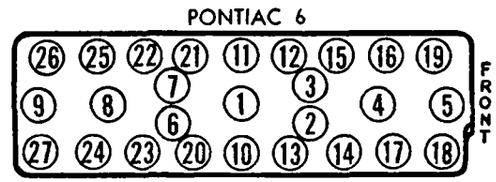
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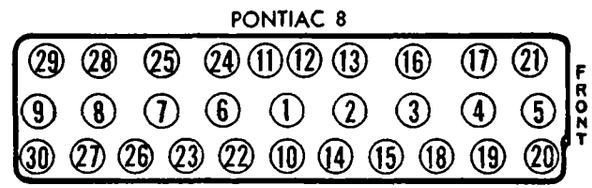
PACKARD 8



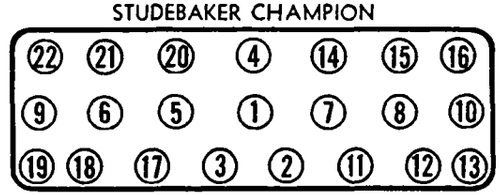
PONTIAC 6



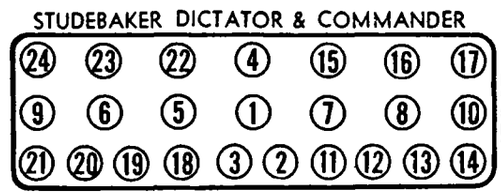
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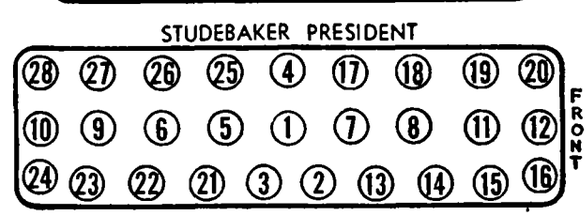
STUDEBAKER CHAMPION



STUDEBAKER DICTATOR & COMMANDER



STUDEBAKER PRESIDENT



CHRYSLER TYPE

Used On:

CHRYSLER C26, TRAVELER, SARATOGA & NEW YORKER (1940) OPTL.

CHRYSLER, C27 CROWN IMPERIAL (1940)

This Fluid Drive same design as used on 1939 Model C24 except as noted below.

1940 CHANGES:—Design changed from 1939 type as follows:

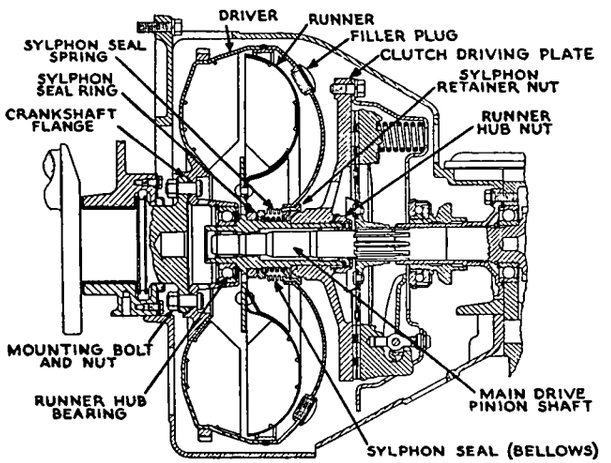
Fluid Drive Housing & Mounting—Fins have been added on front and rear face of fluid drive housing to circulate air within housing for cooling. Fluid drive mounting on crankshaft flange has been modified by installing oil seal and bearing retaining plug in forward end of driver hub (mounting flange). Mounting studs are screwed in flange with nuts located on front face of crankshaft flange (same as 1939 except studs used instead of bolts). Grommets on mounting bolts and oil seal gasket (between crankshaft and fluid drive flanges) are not used. Filler plug now has 1⅛" hexagonal head (use 1⅛" socket wrench instead of Allen setscrew wrench used on 1939 plugs).

Sylphon Seal Assembly—Floating seal ring now used between inner seal ring (on runner hub) and sylphon seal ring. Manufacturer recommends that inner seal ring not be removed and that Fluid Drive assembly be replaced if this ring requires renewal.

SERVICING:—Unit is sealed and no adjustment required. Service operations are restricted to filling unit with oil (15,000 mile intervals or when drained) and renewing sylphon assembly and sealing ring (to correct oil leakage). See Removal & Installation directions below if Fluid Drive Assembly is being removed from engine.

Checking Oil Level & Adding Oil:—Recommended at 15,000 mile intervals. Take out removable screen on upper right side of clutch housing, turn fluid drive assembly until one filler plug visible through this opening (2 plugs—180° apart). Use 1⅛" wrench to remove plug, fill case to level of filler plug hole with special Chrysler Fluid Drive Oil, replace plug and tighten securely to prevent oil leakage.

Sylphon Assembly & Seal Ring Renewal:—Remove Transmission and Clutch (See Chrysler 'M' pages for instructions). Bend down tab on lockwasher and remove runner hub nut (in center of clutch driving plate). Mark spline on runner hub and mating spline on clutch driving plate (to insure correct installation), use special puller to remove clutch driving plate being careful to line up two points on the plate horizontally (plate is hexagonal) so that two top points on plate line up with recesses in clutch housing which will permit plate to be withdrawn from housing. Rotate fluid drive unit until one filler plug is at bottom, remove filler plug with 1⅛" wrench and drain unit. Use special Sylphon Spring Compressor to compress sylphon spring, remove retainer snap ring from sylphon nut, withdraw spring retainer and spring. Use special spanner wrench to unscrew sylphon nut, withdraw sylphon assembly.



Remove floating seal ring. Inner seal ring (on runner hub) should not be disturbed and Fluid Drive should be replaced if this ring requires renewal.

NOTE—Mating surfaces on Sylphon, floating seal ring, and inner seal ring must be smooth and show continuous line of contact over entire 360° of circumference. Replace sylphon and floating seal ring if surfaces are scored, scratched, or show poor contact.

Installation—Install floating ring and sylphon assembly and tighten nut securely, install sylphon spring, retainer, and snap ring. Fill unit with oil as directed above and install new gasket under filler plug. See that filler plug securely tightened. When installing clutch driving plate on runner hub, coat splines on hub and in driving plate with white lead, use special assembling tool to install plate on hub and see that marks on splines are lined up. Clean surfaces of driving plate and clutch pressure plate thoroughly of all oil and white lead before installing clutch. A special clutch aligning tool is available to line up driven member when installing clutch (extra clutch shaft can be used for this purpose if desired).

FLUID DRIVE ASSEMBLY REMOVAL & INSTALLATION:—Removal—Remove Transmission & Clutch (see Chrysler 'M' pages for instructions), rotate fluid drive unit until one filler plug is at bottom, use 1⅛" socket wrench to remove filler plug, drain unit (NOTE—Unit need not be drained unless it is to be dismantled). Remove engine oil pan and rear main bearing cap. Take off nuts on mounting studs (on front of crankshaft flange), pull fluid drive unit back to free mounting studs from crankshaft flange, remove unit from below.

Installation—Carefully clean face of crankshaft flange and fluid drive housing mounting flange to remove all dirt and burrs which might prevent flat even contact of mounting faces. Install fluid drive assembly and thread mounting studs through holes in crankshaft flange, install nuts on studs, tighten nuts evenly and securely.

OLDSMOBILE HYDRA-MATIC TYPE

Used On:

ALL CARS WITH HYDRA-MATIC DRIVE (1940)

DESCRIPTION:—This Fluid Coupling replaces the conventional clutch on cars with Hydra-matic drive (no clutch used and clutch pedal omitted). Design is unlike other Fluid Drives in that, although the assembly is mounted in a case bolted on the engine flywheel, the drive is not direct from the engine crankshaft through the fluid drive (see Operation below). Fluid drive case is kept filled with same oil used in transmission case and oil is pumped into case by the transmission front oil pump. A return line and control valve allows the oil to circulate between the fluid drive and transmission so that temperatures are equalized and overheating is prevented.

OPERATION:—The engine drives the fluid coupling case which is bolted on the flywheel. The case is splined on a sleeve integral with the ring gear (drive gear) of the front planetary gear unit so that this gear is driven positively by the engine. This gear drives the planetary gear pinions and pinion plate (which is keyed on tubular intermediate shaft) and the rear unit or driver of the fluid coupling which is bolted on a mounting flange splined on the forward end of this tubular shaft. At idling speed, the driver rotates freely and does not transmit engine torque to the forward unit or runner of the fluid coupling. As soon as the engine speed is increased slightly (when accelerator pedal depressed to start car in motion), the fluid coupling driver causes the runner to rotate (driving through the oil with which the case is filled). The runner is bolted on a mounting flange which is splined on the forward end of the intermediate shaft (within the tubular shaft) and the engine torque is transmitted back through this shaft through the transmission to the rear wheels. NOTE—See separate Oldsmobile Hydra-matic Transmission article for complete description of transmission operation in each of the four forward speeds.

SERVICING:—Lubrication—Fluid Coupling case is kept filled with oil, and oil is automatically circulated, by pump in transmission case. Fluid coupling case is sealed and requires no attention.

Disassembly & Servicing—See Oldsmobile Hydra-matic Transmission article for complete instructions.

Std. Equipment On:

Car Model	Year	Model No.
Chrysler C25, C26, C27	1940	EWB-4001
De Soto S7, Dodge D14	1940	EBW-4001
Studebaker 10A, 6C	1940	EWB-4002

MODEL NOTATION:—Model number given above Windshield Wiper Motor. Wiper Pivots, Links, and Arms are serviced separately and have separate part numbers.

DESCRIPTION & OPERATION:—Same as for 1939 type (see 1939 Supplement) except for new Two-speed motor and control circuit, and independent drive crank for each wiper arm as follows:

Two-speed Motor Control—Wiper motor is two pole shunt wound type (new armature & field windings but same design as used on 1939 types) with a field resistance mounted on the control switch (Chrysler), or on motor frame (Studebaker). This resistance is cut in or out of the field circuit by the switch and provides low speed operation (resistance cut out) or high speed operation (with resistance cut in series with field). See wiring diagram for circuits.

Wiper Drive Cranks—Second crank arm has been added so that each wiper arm is driven independently by a separate gear and crank. Drive gear for each crank is driven by worm gear on motor shaft.

CIRCUIT BREAKER:—Chrysler Models—Wiper is protected by a thermostatic type circuit breaker mounted on the control switch. Circuit breaker operates when current reaches 12 amperes.

Studebaker Models—No circuit breaker used. Wiper is protected by regular 20 ampere accessory fuse on fuse block.

ADJUSTMENT:—Park Angle—Crank arms must stop at correct parking angle to insure wiper blades being parked in proper position on windshield (see illustration for 'park angle' measurement).

Car Model	Parking Angle
Chrysler, De Soto, Dodge	26°
Studebaker	12½°

To adjust, remove relay cover, loosen parking angle lockscrew, and turn parking angle adjusting screw (see illustration), with correct adjustment, contact gap of right hand control contacts should be .025" minimum and contact pressure of left hand control contacts should be 2 ozs. minimum (contacts closed) with wiper motor stopped in park position.

SERVICING:—Motor Lubrication—No oilers provided and motor bearings do not require lubrication in service. Gear box should be filled ¾ full with special Auto-Lite ST-295 gear grease (do not use any other type) before assembly and both crank cross-shafts should be coated for entire length with this same grease before installed in housing. Use care not to get grease on motor commutator or control contacts. CAUTION—See that both crank arms are installed in correct position so that parking angle is correct (parking angle controlled by left hand crank only, right hand crank operates independently).

Bearing Alignment—After motor completely assembled (but before running), strike frame several sharp blows with rawhide hammer to insure correct alignment of bearings with armature shaft.

Armature Endplay—Must be .005" minimum, .010" maximum. To adjust endplay, remove gear housing cover, expand or contract armature stop button support arms (in housing at end of armature shaft).

Motor Specifications

Starting (Under Load)—4.0 volts (6 volt units), 8.0 volts (12 volt units) with control switch in High Speed position.

Current Draw—Depends on motor speed (less at high speed) as follows:

	Voltage	Amperes Low Speed	Amperes High Speed
6 Volt Units	5.8 volts	4.5 max.	4.0 max.
12 Volt Units	11.6 volts	2.25 max.	2.0 max.

Field Current—2.4-2.75 amperes at 6 volts (6 Volt Units), 1.2-1.4 amperes at 12 volts (12 Volt Units).

Relay Specifications

Closing Voltage—4 volts maximum (6 Volt Units), 8 volts maximum (12 Volt Units). Armature should be sealed flat against top of core with contacts closed.

Opening Voltage—.2 volt min., .5 volt max. (6 Volt Units), .25 volt min., 1.0 volt max. (12 Volt Units). **Contact Gap**—.020" min., .025" max. Adjust by bending armature stop. CAUTION—Do not bend relay armature hinge lug.

Air Gap—Armature should be sealed flat against top of core with contacts closed.

Relay Windings—At 80°F., relay winding resistances should be as follows: Shunt Coil—21-25 ohms (6 Volt Units), 42-50 ohms (12 Volt Units). Series Coil —.035 ohm (6 & 12 Volt Units).

TROUBLE SHOOTING:—If wiper action not satisfactory, check as follows:

Motor Will Not Start or Run

1. Fuse Blown (Studebaker only). Before replacing blown fuse, check following possible causes: Check all connections, examine relay contacts and clean if dirty, check motor ground, check all motor leads for grounds.

2. Loose Connections in Wiper Circuit. Check all wiring. Tighten connections at Windshield Wiper, Control Switch, and Ignition Switch.

3. Crank Arm Shafts Binding. Make certain that cross shafts greased for entire length with special ST-295 grease before installing and that all wire connections are clean and tight.

4. Linkage Binding. Make certain that linkage between crank arm and pivot arms is not binding and that wiper blades and pivot arms operate freely.

Motor Stops with Blades in Wrong Position

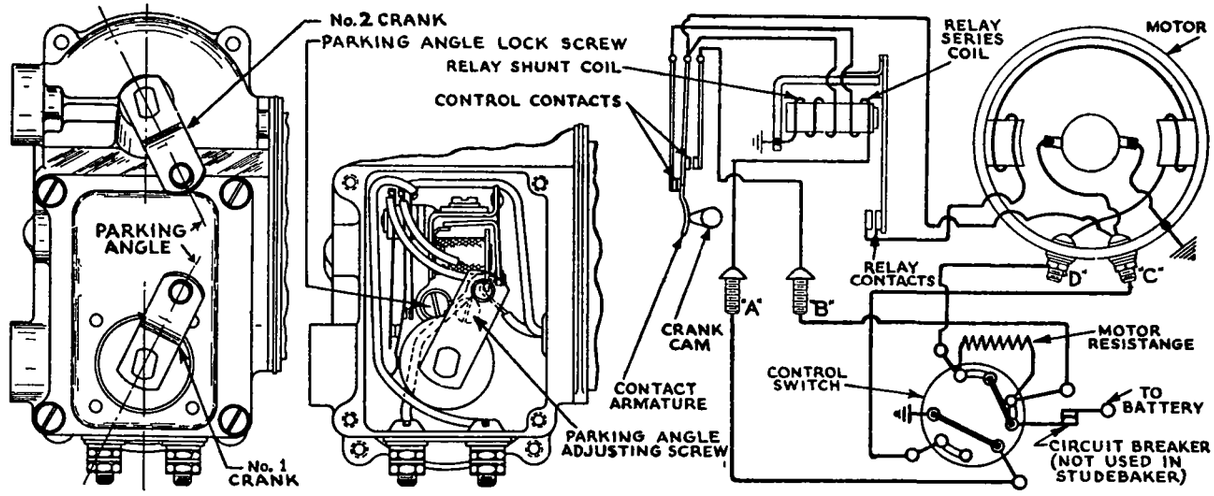
1. Park angle incorrectly set. See adjustment section above.

Motor Will Not Stop

1. Loose connections at switch. Examine and tighten connections at Control Switch 'A' terminal and ground connection.

2. Parking mechanism out of adjustment. Check Park adjustment (see Adjustment section above).

3. Relay Operation Incorrect. Check relay and adjust to specifications given in Service section above. Replace relay if satisfactory performance cannot be secured by adjustment.



Series 645
Standard Equipment On:
Packard Six, '110' Model 1800 (1940)
Packard Eight, '120' Model 1801 (1940)

DESCRIPTION:—Windshield wiper consists of an electric motor and gear driven crank arm linked to two wiper arm assemblies mounted on cowl at lower edge of windshield. Each wiper arm assembly consists of a wiper arm and a transmission assembly which transmits the reciprocating motion of the motor driven-link to the wiper arm and blade. Motor assembly includes an off-on switch and a Dynamic Breaker which causes the motor to stop in the correct 'parking' position when switch is turned off so that blades are moved down to the edge of the windshield and out of the way.

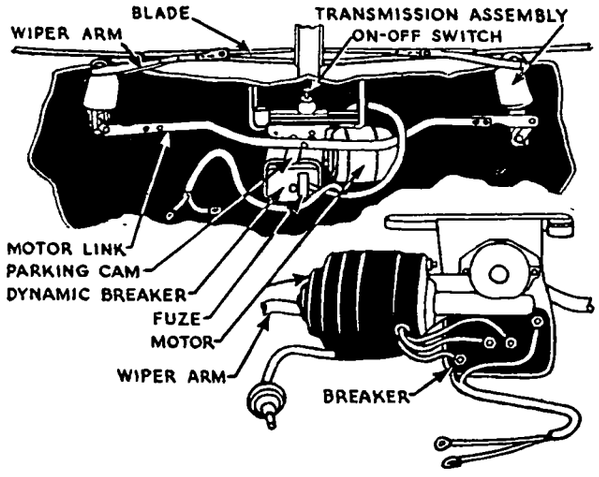
Wiper throw-out Safety Clutches—Wiper arms are connected through safety clutches which will prevent damage to mechanism if arms frozen or operation is interrupted.

NOTE—First models equipped with 8¼" wiper blade, later models have 9" blade.

WINDSHIELD WIPER FUSE:—A 14 ampere fuse is mounted in a holder on the Dynamic Breaker housing of the motor assembly. Do not use any other than 14 ampere fuse at this point.

ADJUSTMENT:—**Parking Position**—Both blades should park evenly at base of windshield when switch is turned off (within several strokes after switch turned off). If blades do not park properly or if blades are not synchronized, adjust linkage as follows:

Linkage Adjustment—Remove both wiper blades and arms (see Removal Note below), loosen two adjusting screws clamping wiper arm transmission link to motor link at each wiper arm assembly. Adjust right unit by pressing transmission link toward motor (center of car) as far as possible, then pull link back 1/16" and lock adjusting screws. Adjust left hand unit by pulling transmission link out or away from motor as far as possible, then push link back 1/16" and tighten adjusting screws. Reassemble wiper arms and blades.



Transmission Connector Slack Adjustment—To remove slack from connectors in each wiper arm transmission housing, disconnect adjusting screws clamping transmission link to motor link, make certain that rods are hooked into connectors. Loosen adjusting nut on lower end of transmission housing, press down on link or press down on connectors on both sides of housing until all slack removed, tighten adjusting nut before releasing link. NOTE—Transmission housing need not be removed to make this adjustment.

Wiper Blade Installation—Use care not to damage spring within wiper arm when replacing blades. To remove blade, hold arm away from windshield glass and pull blade out toward end.

SERVICING:—**Lubrication**—No lubrication required in service. Motor bearings are oilless type and gears are lubricated for life when assembled.

Dynamic Breaker—Can not be adjusted or repaired in the field and should be serviced by replacement only. Do not dismantle Dynamic Breaker assembly.

Transmission Housing Gear Renewal—Gears can be renewed as an assembly as follows: Remove wiper blade and arm, take out adjusting screws and free transmission link from motor link, remove upper mounting screw on transmission housing (do not disturb lower slack adjusting nut), remove assembly. When new assembly installed, adjust to remove slack from internal connectors as directed above.

Motor—Motor can be disconnected from gear housing by disconnecting lead and taking off nuts on mounting studs. Average motor current consumption is 4 amperes.

KING-SEELEY ELECTRIC TEMPERATURE GAUGE

1940 CAR MODEL TYPE:—King-Seeley Electric Temperature Gauges installed on 1940 car models are similar to design used on previous cars except for new smaller Engine Unit as follows:

No. 7000 Engine Unit—This new unit has ⅜" pipe thread for mounting in engine block and over all length is 2⅝". It can be distinguished from earlier No. 5700 or 6450 types by smaller size and mounting thread (old units were 3⅜" long and had ½" pipe thread).

TESTING & SERVICING:—All operations same as for previous types. ***See 'King-Seeley Temperature Gauge' in Mechanical Equipment Section of manual for complete instructions.***

1939 & EARLIER CAR MODEL REPLACEMENT UNITS:—Original No. 5700 & 6450 type Motor Units have been superseded by new type No. 7000 and this new No. 7000 type unit only is furnished for service. Whenever Engine Unit requires replacement, install special #7113 ½"-⅜" adapter bushing in engine block, and install new type Engine Unit and new Dash Unit as an assembly. All of these parts—Adapter Bushing, Engine Unit, and Dash Unit furnished in a Service Kit for each car model as listed in table below. CAUTION—New Dash Unit must be installed whenever new type Engine Unit installed (dash unit furnished in each service kit).

Dash Unit Replacement—If original Dash Unit only is being replaced (original Engine Unit retained in use), new Dash Unit of same type as originally installed should be used (see 'Original Dash Unit Part No.' in table below). If Dash Unit supplied in Service Kit (for use with new type Engine Unit) is being replaced, see 'New Dash Unit Part No.' in table below for correct type for each car model.

Replacement Service Kits & Dash Units

Car Model	Service Kit Part No.	New Dash Unit Part No.	Original Dash Unit Part No.
Graham—all (1937)	7647	7646	6110
Graham—all (1938)	7640	7490	6923
Hudson & Terraplane ('36)	7627	7626	5819
Hudson & Terraplane ('37)①	7631	7630	6190
Hudson & Terraplane ('37)②	7629	7628	6570
Hudson 112 (1938)	7133	7111	7080
Hudson—others (1938)	7131	7116	6756
Hudson-Terraplane ('38)	7132	7121	6783
Lincoln V12 (1936)	7544	7543	5768
Lincoln V12 ('37-38-39)	7547	7546	6245
Lincoln-Zephyr (1936)	7544	7543	5768
Lincoln-Zephyr ('37) 1st 5500	7549	7548	6160
Lincoln-Zephyr ('37) next 10000	7553	7552	6480
Lincoln-Zephyr ('37) After 15500	7591	7590	6594
Lincoln-Zephyr ('38)	7593	7592	6692
Nash & Nash-Lafayette ('38)	7645	7295	6730, 7070
Willys exc. Deluxe ('38)	7643	7142	6628
Willys Deluxe ('38)	7642	7140	6632
Willys Comm'l. ('39)	7642	7140	6632

①—Black dial. ②—Brown dial.

BENDIX MECHANICAL TYPE. SINGLE ANCHOR.

Used On:

BUICK MODEL 40 (1934-35).
HUDSON SIX (1933, 1935).
HUDSON EIGHT (1932-1935).
LA FAYETTE MODELS 110 (1934), 3510 (1935).
LINCOLN, V12 MODEL (1934 to 1939)
LINCOLN ZEPHYR, MODEL H (1936).
LINCOLN ZEPHYR, MODEL HB (1937)
LINCOLN ZEPHYR, MODEL 86H (1938)
NASH SIX, MODEL 1220 (1934).
NASH 8, MODELS 1180, 1190 ('33), 1280, 1290 ('34).
OLDSMOBILE 6, MODELS F-32 ('32), F-33 ('33).
OLDSMOBILE 8, MODELS L-32 ('32), L-33 ('33).
PACKARD EIGHT (1933-34-35-36).
PACKARD SUPER EIGHT (1933-34-35-36).
PACKARD TWELVE (1933-34-35-36).
PONTIAC EIGHT, MODEL 603 (1934).
TERRAPLANE SIX (1932-33-34-35).
TERRAPLANE EIGHT, MODEL KT (1933).
WILLYS, MODEL 77 (1933-34-35-36)
WILLYS, 37 ('37), 38 ('38), 48 ('39)
WILLYS, TRUCK MODELS (1938-39)

NOTE—Bendix Vacuum Power operation used on Lincoln V-12 and all Packard Models. See separate article on this unit and note under adjustment below.

DESCRIPTION AND OPERATION:—Wheel Brakes—Two shoes per wheel, connected together by turn buckle type adjusting screw at one end and bearing against single anchor pin at other end. Cable actuated lever concentric with anchor pin forces anchor end of primary shoe against drum when brakes applied. Primary shoe applies secondary. Shoes returned to off position by independent spring hooked to lever and brake shoe. Shoes held in position by coiled springs and clips hooked to backing plate. Adjustments consist of eccentric screw (brake shoe stop) to centralize shoes, and adjusting screw (between shoes) to control clearance between shoes and drum.

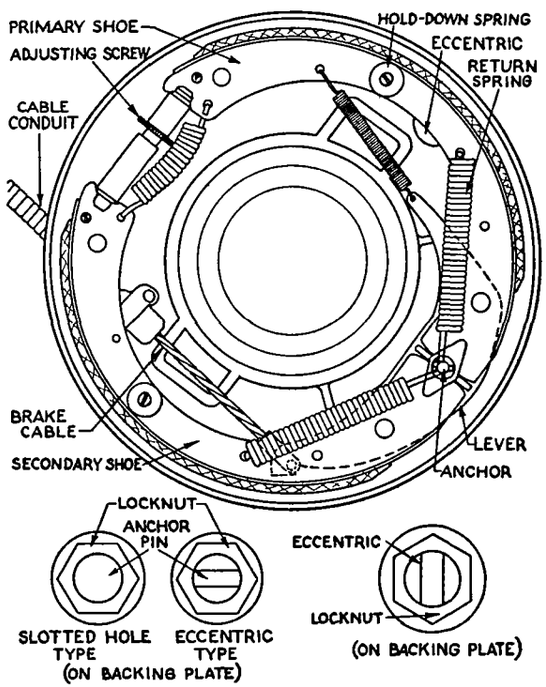
Brake Linkage:—Wheel brakes actuated by cables from single cross-shaft or rotary plate or equalizer mounted at center of frame 'X' member (Hudson & Terraplane 1935 models, La Fayette 1934-35). Brake cables protected by flexible conduits between frame and wheel. Brake pedal linked to cross-shaft with Vacuum Power Cylinder Control Valve (when used) incorporated in pedal linkage.

Hand Brake:—Hand Brake lever linked to cross-shaft or equalizer plate applies all four service brakes.

ADJUSTMENT:—Jack up all four wheels, disconnect cables at cross-shaft, remove adjusting screw hole covers on backing plates and inspection hole covers on drums (remove wheels if disc type). Check pedal position with cross-shaft levers against stops. Pedal should clear underside of toeboard by ½". Adjust by disconnecting pedal link and changing length. Then proceed as follows:

Minor Adjustment (For Wear):—1—At each wheel—loosen eccentric locknut, turn eccentric in direction of forward wheel rotation until .010" feeler is snug at both ends of this shoe. Hold eccentric from turning, tighten locknut. Clearance at both ends must be the same within .003" with smaller clearance preferably at anchor end. If variation greater than .003", anchor pin must be relocated (see Major Adjustment below). NOTE—If feeler gauge not used, turn eccentric up until slight drag felt when wheel turned by hand, then back eccentric off until wheel is just free.

2—At each wheel—insert tool or screwdriver in adjusting screw hole, turn notched adjusting screw toward backing plate rim (move outer end of tool up toward center of wheel) until shoes are expanded so that drum can just be turned, pull brake cables toward cross-shaft to remove all slack, adjust clevis position (loosen locknut, turn clevis, tighten locknut) until pins just enter clevises at cross-shaft lever freely, reconnect brake cables.



3—Back off adjusting screws same number of notches at each wheel until wheels are free. Apply brakes with hand lever or use pedal jack until wheel with least drag can just be turned, equalize brakes by backing off adjusting screws on tight wheels not more than two or three notches. Do not tighten loose wheels.

4—Check pedal reserve (distance from pedal to floorboard with brakes applied). This should be one half total travel (minimum). Recheck adjustment if less than this amount. Then check hand lever position (below).

NOTE—On Packard Models, brake lining for left front wheel is of narrower width (see Car Specifications) so that if brakes checked on tester, difference in pull should be in ratio of 6.5-6.75 (right front wheel) to 5.0 (all other wheels).

Major Adjustment (New Shoes or Relined Brakes):—1—At each wheel loosen anchor pin nut one turn, tap anchor pin out toward drum (slotted hole type with plain end) or turn anchor pin in direction of forward wheel rotation (eccentric type with slotted end). Loosen locknut, turn eccentric in direction f forward wheel rotation until .010" feeler snug at both ends of this shoe, hold anchor pin, tighten locknut securely with 16" wrench, hold eccentric from turning, tighten eccentric locknut. Then proceed with (2) and (3) under Wear Adjustment above.

NOTE—On Packard 8 & Super 8 ('35-36), vacuum unit control valve, mounted on brake pedal, adjustable to provide more or less vacuum booster action. Brake pedal vertical lever is connected to vertical arm through link engaged in one of three holes in lever. On new cars or with new lining requiring minimum booster action, engage link in lower hole in lever (factory setting on new cars). Engage link in center hole for softer pedal after linings are run in. Upper hole used only for very soft pedal action. This adjustment not provided on Packard Twelve.

Hand Lever Adjustment:—With hand lever in released position, and cross-shaft levers against stops adjust length of hand lever cable or rod to eliminate all slack (see note on Lincoln Zephyr).

Lincoln Zephyr—On this model, hand lever adjusted by moving cable conduit forward or backward at support bracket at cross-shaft until free movement or lash at extreme end of hand brake lever is ¼-½". Conduit end is threaded and positioned by adjusting nut on each side of support bracket. Loosen locknuts. back off front adjusting nut (to decrease lash) or rear nut (to increase lash), turn up second adjusting nut until conduit clamped in support, tighten locknuts.

Willys ('37-39). Hand brake lever linked to intermediate lever on left frame side member by cable with adjustable clevis at lower end. Lower end of intermediate lever is connected to lever on cross-shaft by slotted link (slot provides 'overrun' for foot brake operation). Left hand lever on cross-shaft (to which cables for left front and left rear wheels attached) serves as stop for entire brake system and must contact bracket when brakes are released.

RELINING BRAKES:—Manufacturer recommends use of replacement shoes furnished with new linings installed and ground concentrically. If shoes relined, use same type lining as fitted originally (see Car Model article). Lining on primary and secondary shoes may be of different types (woven on primary, moulded on secondary, etc.), or of different lengths. Shoes may be identified by 'P' (primary) 'S' (secondary) stamped on rib at adjusting screw end.

Lining Specifications—See car model 'M' page for complete lining data.

SERVICING:—Brake Linkage—Whenever adjustment made, lubricate brake pedal hand lever, cross-shaft. overrunning linkage and all clevis pins. See that linkage operates freely and returns sharply to stops when pedal and hand lever released.

Cable Conduits:—Lubricate cable and conduit assemblies through fittings (when so equipped) or disconnect cable at both ends, clean thoroughly, pull cable out at wheel end to expose portion normally in conduit, clean and coat with Bendix Cable Lubricant, or graphite grease such as Gredag #213½, pull cable back and forth to spread lubricant in conduit. See that conduit is bottomed firmly in abutment brackets and that bracket bolts are tight.

Wheel Brakes:—With shoes removed, coat brake cam, anchor pin, cable ramps, eccentric, backing plate shoe edges and all other contact points with Bendix Lubriplate. Examine shoe return springs and see that heavier spring it attached to shoe which covers cable end of brake lever.

BENDIX MECHANICAL TYPE DUO-SERVO, DOUBLE ANCHOR

Used on:

LINCOLN, V12 MODEL (1932).
LINCOLN, MODEL V-12-136 (1933).
LINCOLN, MODEL V-12-145 (1933).

DESCRIPTION & OPERATION:—Wheel Brakes—Two shoes per wheel, connected together by turn-buckle type adjusting screw at one end and bearing against individual anchor bolts at opposite (cam) end. Floating cam on brake lever shaft between shoes applies primary shoe and primary applies secondary shoe. Shoes returned to off position by large return spring hooked between shoes at each end and a small return spring hooked to each shoe and the backing plate at a point near the adjusting screw end.

Brake Linkage:—Wheel brakes actuated by rods (cable from frame to wheel at front wheels only) from a single cross-shaft on frame. Cables protected by flexible conduit terminating at bracket on backing plate adjacent to brake levers. Brake pedal linked to cross-shaft by rod in which Vacuum Power cylinder control valve (external type) incorporated.

Hand Lever:—Linked to cross-shaft by rod and applies all four service brakes.

ADJUSTMENT:—Minor Adjustment for Wear—Jack up all four wheels. Place hand lever in released position. Make following adjustments in order.

1. At each wheel—Loosen eccentric locknut, turn eccentric in direction of forward wheel rotation until slight drag evident when wheel is turned, back off eccentric until wheel is just free, hold eccentric from turning, tighten locknut.
2. At each wheel—Remove cover plate on outside of brake drum, insert screwdriver or adjusting tool, turn notched adjusting screw toward rim of backing plate until slight drag felt, back off adjusting screw until wheel is just free.
3. Apply brakes by depressing pedal approximately 3" (use hand lever to hold pedal in this position). Check equalization. Equalize wheels by backing off adjusting screw on tight wheel slightly. Do not tighten loose wheels.

Major Adjustment (New Shoes or Relined Brakes):—Jack up all four wheels. At each wheel, loosen nuts on anchor bolts (one on each side of brake lever shaft) so that nuts are completely free from lock washers and bolt is free to move in slotted hole. Remove cover plate on outside of brake drum, turn notched adjusting screw up until wheel can just be turned by hand. Use soft hammer and tap anchor bolts on threaded end to insure their assuming correct position, tighten anchor bolt nuts securely using 16" wrench. Back adjusting screw off until wheel is free. Adjust at each wheel as directed for wear (1, 2, 3) above.

NOTE—Inspection hole (closed by cover plate) provided on backing plate for use of feeler gauge in setting shoe clearance. If feeler gauges used, clearance between shoe and drum should be .008" at anchor end, and .014" at adjusting screw end.

Brake Linkage:—No adjustment required for wear Inspect linkage for play or lost motion when major adjustment is made. Adjust by loosening locknut and turning clevis on cross-shaft end of brake rods. Do not shorten rods sufficiently to expand shoes away from anchor pins with brake released.

RELINING BRAKES:—Manufacturer recommends installation of factory replacement linings. Woven lining used on primary shoe and molded lining on secondary. Lining should be ground concentrically after installation. First type primary lining (brass wire insert) changed to later type (zinc wire insert) to eliminate brake noise.

SERVICING:—Removal of Shoes—Unhook return springs, take out cotter pins in anchor bolts, lift off anchor bolt plate, take out cotter pins in spacer or hold-down nuts, take off nuts, lift shoes out.

Brake Cable Lubrication:—Special lubrication fitting required (conduit can not be moved to expose cable).

Brake Lever Lubrication:—Remove plugs on inner end of levers, install lubrication fitting, inject approximately ½ teaspoonful gear lubricant at 5000 mile intervals. Excess grease at this point will be forced out on linings.

BENDIX MECHANICAL TYPE DUO-POWER, DOUBLE ANCHOR

Used on:

STUDEBAKER SIX, MODEL 56 (1933).
STUDEBAKER COMMANDER, MODEL 73 (1933).
STUDEBAKER PRESIDENT, MODEL 82 (1933).
STUDEBAKER SPDWY. PRES. MODEL 92 (1933).
STUDEBAKER COMMANDER, MODEL B (1934).
STUDEBAKER PRESIDENT, MODEL C (1934).

DESCRIPTION AND OPERATION:—Wheel Brakes—Double anchor, two shoe type. Design not similar to previous double anchor brakes and adjustments are entirely different. Shoes are connected together by turn-buckle type adjusting screws at both ends (upper adjusting screw combined with brake operating lever strut). The shoe on which the brake lever is mounted (front shoe, front brakes; rear shoe, rear brakes) is positioned by eccentrics at both ends. Each shoe is anchored by non-adjustable anchor pin which engages slot in shoe near lever end. Shoes are actuated by short lever pivoted on one shoe and linked to second shoe by an adjustable strut (upper adjusting screw). Shoes returned to off position by return spring hooked to shoe and backing plate so that shoe is held against anchor.

Brake Linkage:—Brakes operated through flexible cable control from cross-shaft on frame. Brake pedal linked to cross-shaft by rod.

Hand Brake:—Hand lever applies all four service brakes.

ADJUSTMENT:—Anchor pins not adjustable and anchor pin nuts should be kept tight at all times. All adjustments made by means of eccentrics (clearance for one shoe) and upper and lower adjusting screws (clearance for second shoe). To adjust brakes, jack up all four wheels, disconnect brake cables at cross-shaft, push cables firmly through conduit toward wheels to insure shoes being in 'off' position. Make adjustments in following order:

1. At each wheel, remove inspection hole covers, loosen eccentric locknuts, turn each eccentric toward drum until clearance at each end of shoe is .008-.010" as measured by feeler gauge inserted through inspection hole (eccentrics control front shoe in front brakes and rear shoe in rear brakes), hold eccentrics from turning, tighten locknuts.
2. At each wheel, remove adjusting screw covers, insert screwdriver or adjusting tool, turn screws by moving outer end of tool toward axle until clearance at both ends of second shoe is .008-.010".
3. Adjust cable lengths by loosening locknut and turning clevis on cross-shaft end of cable until clevis pins can just be inserted with cross-shaft against stops and all slack removed from cables Cables must not be under tension as this will pull shoes away from anchors and cause erratic brake action.
4. Apply brakes by using pedal jack to depress pedal until heavy drag secured on all wheels. Equalize brakes by backing off both adjusting screws on tight wheel equal amount. Do not tighten loose wheels.

Studebaker Special Instructions:—Simplified wear adjustment recommended by car manufacturer as follows:

At each wheel, remove adjusting screw covers, insert tool, turn lower adjusting screw (move handle of tool toward axle) until shoes are tight against anchor pin and drum at bottom, turn upper adjusting screw until shoes are tight against drum at top. Loosen eccentric locknuts, turn each eccentric out until it contacts shoe. Adjust cable lengths by loosening locknut and turning clevis until pins can just be inserted with cross-shaft in released position against stops, connect cables. Back off lower adjusting screw exactly 12 notches and upper adjusting screw exactly 4 notches. Centralize shoes by turning each eccentric back an equal amount until no drag is evident, hold eccentrics in this position, tighten locknuts. Apply brakes by depressing pedal with pedal jack, equalize brakes by backing off lower adjusting screw in tight wheels slightly. Do not change setting of upper adjusting screw and do not tighten loose wheels.

SERVICING:—Same as for other types of Bendix mechanical brakes. See article on Bendix Mechanical, Single anchor type.

POWER UNIT:—Vacuum suspended, internal valve type. See special article following for adjustment instructions.

BENDIX VACUUM CYLINDER. PLAIN TYPE—EXTERNAL VALVE.

Used On:

BUICK, ALL MODELS (1934-35).
CHRYSLER, CUST. IMPERIAL MODEL CL* (1933).
LINCOLN, V12 MODEL (1932 to 1939)
PACKARD, ALL EIGHTS (1933-36).
PACKARD, ALL SUPER EIGHTS (1933-36)
PACKARD, ALL TWELVES (1933-36).
PIERCE ARROW, ALL MODELS (1936).
PIERCE ARROW 8, 1701 ('37), 1801 ('38)
PIERCE ARROW 12, 1702,3 ('37), 1802,3 ('38)
STUTZ, ALL MODELS (1932-34)

NOTE:—Lincoln. This model has dash-controlled regulating valve which supplements standard control valve so that operator may select amount of power application.

Pierce Arrow. Reserve vacuum tank used so that brakes may be applied with engine not running.

DESCRIPTION:—Consists of vacuum cylinder mounted on frame with piston rod linked to brake cross-shaft or pedal. Rod or boot end of piston chamber open to atmosphere (through air cleaner in cover) and opposite chamber behind piston connected to engine manifold through control valve. Piston normally held in outer position against boot end by brake linkage return springs with brakes 'off' when both chambers are open to atmosphere.

OPERATION:—Control valve connected in pedal linkage is two-way diaphragm type. With brakes 'off' and no tension on valve rods, atmospheric valve is bottomed in chamber so that air is admitted through cleaner in cover is free to flow to power unit balancing pressure on both sides of piston. Vacuum connection to manifold is cut off by seating of diaphragm. When brakes are applied, atmospheric valve moves forward and contacts diaphragm, cutting off air intake. Further movement unseats diaphragm opening manifold vacuum connection, and makes connection with power unit line so that air in chamber in exhausted. Air pressure on boot face of piston forces piston in, applying brakes. Vacuum, and consequently booster action of power unit, is directly proportional to pedal application. When atmospheric valve stop bottoms in housing (total travel approximately 3/32"), pedal pressure is transmitted directly through control valve housing to brake cross-shaft so that brakes are applied both by pedal and vacuum power unit. When pedal is released, movement of atmospheric valve first seats diaphragm cutting off vacuum, and then admits air to cylinder allowing power unit piston to move off position.

ADJUSTMENT:—Control Valve Setting—Pedal linkage should be adjusted so that there is no load on control valve (atmospheric valve should be bottomed in chamber) with pedal released and against its stop, and cross-shaft levers against stops. Any tension on control valve in this position will cause dragging brakes.

Buick Models—Special diaphragm type control valve used on these models. Plunger type valve floats between tension spring and spring-loaded diaphragm which forms vacuum chamber. Vacuum acting on valve diaphragm is always equal to vacuum in brake power cylinder so that braking action proportional to pedal pressure.

Lincoln Models—Regulating valve with control knob located on front compartment floor (1932), or on instrument panel (1933 on) used to supplement standard type control valve.

Packard Models—On 1933-34 models, regulating valve with control knob on instrument panel provides four settings (minimum to maximum vacuum power). On 1935-36 Eights, control valve linkage adjustable to provide more or less vacuum power (see brake adjustment instructions). On these models, control valve is adjusted by taking out clevis pin in link under control valve, loosening locknut and turning link in or out to relieve load on valve when brakes released.

Power Unit:—With brakes 'off', and cross-shaft levers against stop, disconnect piston cable, pull piston all the way out (against boot end stop) adjust cable length to remove all slack, reconnect cable.

TROUBLE SHOOTING:—Engine misses and stalls when brakes applied:—

1—Loose hose connection between control valve and power unit. Check connections. Replace hose.

2—Dry Piston Seal in Power Unit cylinder. Check by disconnecting piston cable and hose connection at cylinder. Push piston all the way in. Hold finger over hose nipple on end of cylinder, pull on piston rod. If piston can be pulled out, piston seal is leaking. Lubricate as directed in Servicing below, repeat test. If operation still unsatisfactory piston seal should be replaced.

3—Cracked Diaphragm in Control Valve or dirt between valve and diaphragm seat. To check, disconnect all connections and remove valve from car. Apply suction to nipple from which manifold connection removed. If air can be drawn through valve, diaphragm does not seat or is cracked. Disassemble and inspect unit.

Engine misses or stalls when idling:—

1—Loose connections or leaky hose between control valve and manifold. Examine connections, replace hose.

SERVICING:—Piston Seal Lubrication—Remove Power Unit from car, hold unit vertical with piston rod down, inject approximately 2 ounces Bendix Vacuum Oil through hose nipple in upper end of cylinder, work piston up and down and around to spread oil.

BENDIX VACUUM CYLINDER. INTERNAL VALVE TYPE.

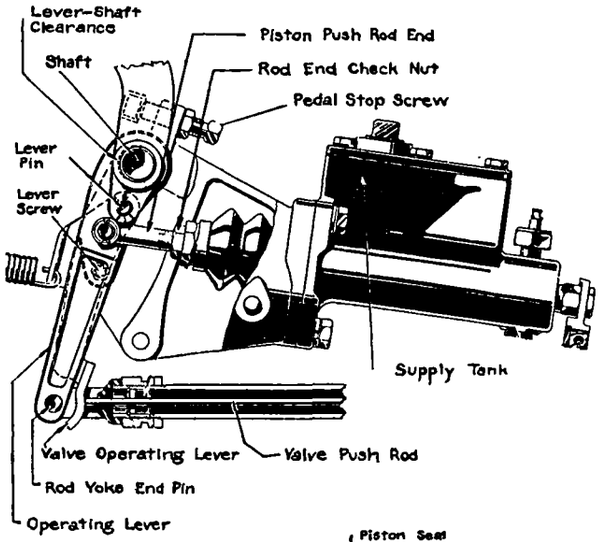
Used On:

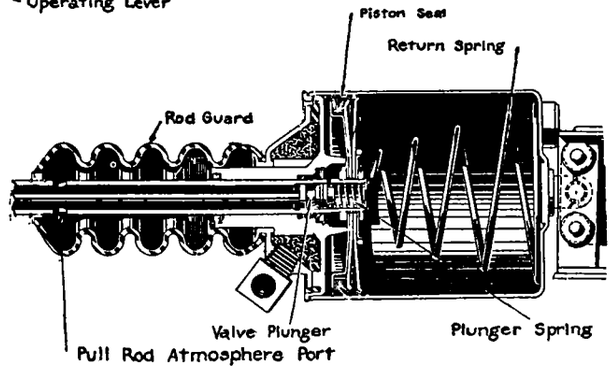
AUBURN, MODEL 850Y (1934) FIRST 1597 CARS.
CADILLAC V8 & V12, ALL MODELS (1932-35).
CADILLAC V16, ALL MODELS (1932-36).
CADILLAC V16, SERIES 37-90 (1937)
CHRYSER IMP., CQ, CV, C3, C10 (1933-36).
CHRYSLER CUST. IMP., CW,CW*,C3,C11 (1934-36).
CHRYSLER CST. IMP. C-15 (1937)
CHRYSLER AIRFLOW C-17 (1937)
CHRYSLER CUSTOM IMP., MODEL C20 (1938)
CHRYSLER CUSTOM IMP. MODEL C24 (1939)
DUESENBERG, ALL MODELS (1932-36).
DUESENBERG, MODELS J, SJ (1937)
HUDSON EIGHT (1933).
LA SALLE V8, MODELS 345B, C (1932-33).
PACKARD TWELVE, 1506, 7, 8 (1937)
PACKARD TWELVE, 1607,8 (1938), 1707,8 (1939)
STUDEBAKER, ALL MODELS (1933-34).

NOTE:—Packard Models. Individual vacuum power unit used for both Brake operation and Clutch operation. See Clutch Section for Clutch Power cylinder adjustment.

DESCRIPTION:—Vacuum cylinder mounted on frame with hollow pull rod connected directly to brake pedal extension lever. Spring loaded piston type control valve located within hollow pull rod and operated by push-rod which extends out through pull rod to pedal lever. Vacuum line from manifold connected directly to rear end of cylinder so that vacuum always present in rear chamber behind piston. Front chamber controlled by control valve.

OPERATION:—Control valve push-rod setting provides slight clearance at brake pedal lever with brakes 'off' so that valve is seated in forward position by spring. This cuts off air passage (air inlet is through air cleaner in cover and boot to hole in piston pull rod and through pull rod to atmospheric valve). Vacuum passage from rear chamber through push-





rod stem and front chamber port in side of pull rod uncovered by valve is open so that both piston chambers are evacuated (pressure equal) and piston will be held in 'off' position (forward against boot end) by spring in cylinder. When brake pedal depressed, pull rod clevis pin contacts valve push-rod, moving valve to rear, cutting off vacuum and connecting front chamber port to atmosphere so that air pressure forces piston to rear applying brakes. When pedal travel is stopped, control valve cuts off air so that no further movement of piston takes place, and when pedal is released, further travel of control valve forward opens vacuum connection to front chamber, balancing pressure and piston is returned to 'off' position by spring.

BENDIX VACUUM CYLINDER CONT.

ADJUSTMENT:—On all models, see that brake pedal position is correct (clearance at toeboard) and that cross-shaft is in released position against stops. Disconnect power cylinder piston rod by taking out clevis pin, adjust piston rod length so that clevis pin can just be inserted with piston pulled all the way out at the end of its stroke and power lever pressed forward so that clearance in hole is at opposite side of shaft. Then adjust valve rod length so that valve rod yoke just contacts yoke pin in valve lever with valve rod pulled all the way out. Special instructions on individual models given below.

Cadillac & La Salle V8:—Disconnect brake pedal from pull rod, see that vacuum cylinder fully released, both cross-shafts against stops and equalizer link all the way forward so that cross-shaft lever pin is against rear end of slot in link. Loosen locknut and turn up adjusting nut on forward end of spring-loaded rod (nut is in flange of cross-member) to eliminate all backlash in brake connections. Disconnect power cylinder piston rod clevis at power lever, replace clevis pin, loosen locknut and adjust clevis so that clevis pin is ⅛" from end of valve rod, connect power cylinder.

Cadillac V8 (Series 20, 30 '34-35) V12, V16 Models:—NOTE—Cadillac V16 (1937) fitted with hydraulic brakes and push rod (to master cylinder) used instead of pull rod. Adjust as follows:

1—Disconnect brake pedal pull rod and vacuum power unit from pedal lever, reinstall clevis pin in upper end of valve lever, loosen locking screw in upper end of pedal lever and turn eccentric bushing clockwise to bring rear edge of hole in lower end of pedal lever in line with rear edge of hole in valve lever bushing, tighten locking screw.

2—Loosen locknut, adjust brake pedal stopscrew so that clearance between pedal and underside of toeboard is ¼-⅜", tighten locknut.

3—See that spring between valve lever and pedal lever has sufficient tension to separate levers as far as clevis pin at top of levers permits. Spring cotter pin should have ⅛" clearance at valve lever.

4—Check length of Power Unit pull rod. Distance from face of boot and flange to center of clevis pin must be 8 3/16" (1932-36), 13⅞" (1937) with pull rod pulled out to end of stroke.

1937 Model. Adjust master cylinder push rod length (loosen locknut, turn turnbuckle at master cylinder) so that clevis pin end of vacuum cylinder pull rod just fits on lever pin with vacuum cylinder piston in released (forward) position and master cylinder piston against its stop.

5—Adjust length of control valve clevis or fork by loosening locknut and turning fork out until it contacts clevis pin, then turn fork in 1½ turns and tighten locknut.

6—Connect Power Unit, readjusting pedal stopscrew if necessary to allow Power Unit pull rod clevis to enter levers without disturbing piston.

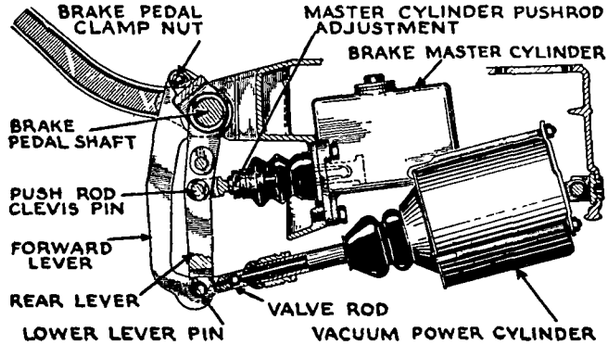
7—Connect brake pedal pull rod and see that clearance between front end of clevis and clevis pin is 1/32" with pedal and cross-shafts against stops. (Mechanical brake type—before 1937).

Chrysler Model CQ (1933):—Vacuum power cylinder mounted in front of pedal shaft under brake master cylinder. Check brake pedal position and adjust by turning pedal stopscrew. Push vacuum cylinder piston forward against its stop, adjust piston rod length so that it can be connected to power lever without disturbing position of pedal. Push valve rod forward against its stop and adjust length of rod so that it can be connected without disturbing position of pedal lever.

Chrysler (1934 and later):—See illustration for vacuum cylinder mounting location and linkage.

1. Adjust brake pedal stopscrew so that pedal just clears underside of floor board when released.
2. Remove clevis pin linking vacuum cylinder pullrod and operating lever. Loosen two studs holding valve operating lever to pedal so that pedal is free. Hold operating lever so that clearance between lever and brake pedal shaft is all on forward side of shaft (shaft is smaller than hole in lever), disconnect master cylinder pushrod and adjust pushrod length so that clevis pin can just be inserted with master cylinder piston against its stop (do not allow operating lever to shift from position while making this adjustment).
3. With operating lever still held so that clearance between lever and pedal shaft is on forward side of shaft, loosen vacuum cylinder frame bracket mounting bolt, shift bracket and vacuum cylinder on frame until clevis pin can just be inserted in pullrod and operating lever with vacuum cylinder piston pulled out against its stop. Make certain that clevis pin goes through ferrule on end of valve operating rod and that forked valve operating lever is hooked over ferrule (do not adjust valve operating rod).
4. With studs holding valve operating lever to pedal loosened so that pedal is free, allow valve operating rod to assume correct position (ferrule against clevis pin), tighten studs.
5. Make certain that entire power unit is in alignment and that links line up so that parts do not require springing to install clevis pins.

Packard Twelve:—Remove front floor boards, depress brake pedal at least 10 times (to exhaust vacuum supply tank), see that pedal is against toeboard with brakes released. Loosen clamp nut at top of brake pedal levers (above pedal shaft), press lower



end of rear lever toward rear and front lever toward front until all clearance at pedal shaft (upper end of levers) and clevis pin (lower end of levers) is all on forward side, hold levers in this position and tighten clamp nut. Remove master cylinder push rod clevis pin in rear lever, move brake pedal down until all clearance at pedal shaft and clevis pin at lower end of levers is on rear side, adjust master cylinder pushrod length so that clevis pin can just be inserted with master cylinder piston against stop and pushrod just contacting piston.

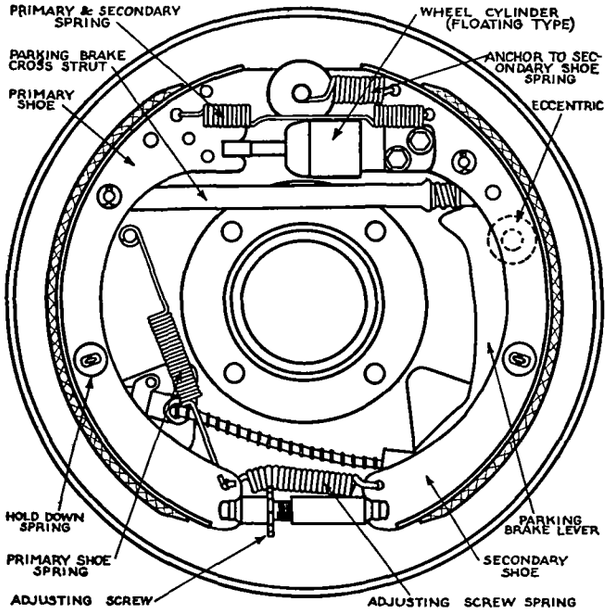
SERVICING:—**Power Unit**—At 6000 mile intervals, remove plug on boot end of cylinder, inject 2 ounces of Bendix Vacuum Cylinder Oil, work piston around and up and down to spread il in cylinder.

BENDIX HYDRAULIC TYPE SINGLE ANCHOR, FLOATING CYLINDER

Used on:
LA SALLE, MODEL 350, SERIES 50 (1934-35).
OLDSMOBILE SIX, MODEL F-34 (1934).
OLDSMOBILE EIGHT, MODEL L-34 (1934).

DESCRIPTION & OPERATION:—**Wheel Brakes**—Two shoe, single anchor type similar to other Bendix designs except for number and location of return springs. Single return spring hooked between shoes at anchor end above hydraulic cylinder. Additional short return spring hooked between anchor pin and upper end of secondary shoe on which hydraulic cylinder is mounted. Return spring also hooked to backing plate and primary shoe at adjusting screw end.

NOTE—The small return spring must be attached to the secondary shoe. Operation will not be satisfactory if this spring is attached in any other manner.



Wheel Cylinder:—Single acting floating type mounted on secondary shoe with piston linked to primary shoe. Same design as Rigid type cylinders except that conical piston return spring has locating cap and stop lug on piston end.

Master Cylinder:—Compensating type same as for other Bendix Hydraulic brake systems.

Hand Brake:—Hand lever applies rear wheel service brakes through cable linked to lever pivoted on one shoe and connected to other shoe by non-adjustable strut.

ADJUSTMENT:—All adjustments for service brakes same as for Bendix Hydraulic type with rigid cylinder. See following article for complete data.

Hand Brake (La Salle):—Adjust hand brake cable lengths by loosening locknut and turning clevis at cross-shaft end until brake lever strut just begins to operate brake shoe with hand lever in released position. Equalize by slacking off on cable attached to tight wheel.

BENDIX HYDRAULIC FLOATING CYLINDER TYPE CONT.

SERVICING:—Brake Shoe Removal—Remove wheels and brake drums (use clamp to retain wheel cylinder piston and do not apply brakes with drum off to avoid necessity of bleeding line when brakes reassembled). Disconnect hand brake cables at cross-shaft clevises. Remove shoe hold-down cups and spring, remove all return springs, disconnect secondary shoe from wheel cylinder by taking out two screws in mounting flange. Remove shoes. Disconnect hand brake cables at levers on rear wheels.

Wheel Cylinder:—With shoes removed (above), disconnect hose coupling, withdraw cylinder, remove piston boot, withdraw piston and return spring. Cylinders serviced in same manner as rigid type. See separate Hydraulic Brake Servicing article for data.

NOTE—Cylinders for front and rear wheels are of different size and must not be interchanged.

Master Cylinder:—See complete servicing directions in separate Hydraulic Brake Servicing article.

BENDIX HYDRAULIC TYPE DOUBLE ANCHOR

Used On:

HUDSON '112', MODELS 89 (1938), 90 (1939)

HUDSON MODEL 90 UTILITY COACH & COUPE (1939)

DESCRIPTION:—Wheel Brakes. Two shoes linked together by strut and star adjusting wheel in same manner as on other Bendix Duo-Servo designs. Hydraulic cylinder is mounted on backing plate and has been moved up between shoes at anchor end so that pistons bear directly on ends of brake shoes. Anchor design is new and consists of a short anchor link (for each shoe) pivoted at lower end on anchor bolt (on backing plate) with short stud at opposite end engaging slot in brake shoe web (shoe held against stud when brakes released by short spring hooked between stud and shoe). Shoes are positioned on backing plate by eccentrics (one for each shoe, adjacent to anchor links) and are held against eccentrics by retracting spring hooked between shoes.

Master Cylinder:—Compensating type. Same design as used on other Bendix hydraulic brake systems.

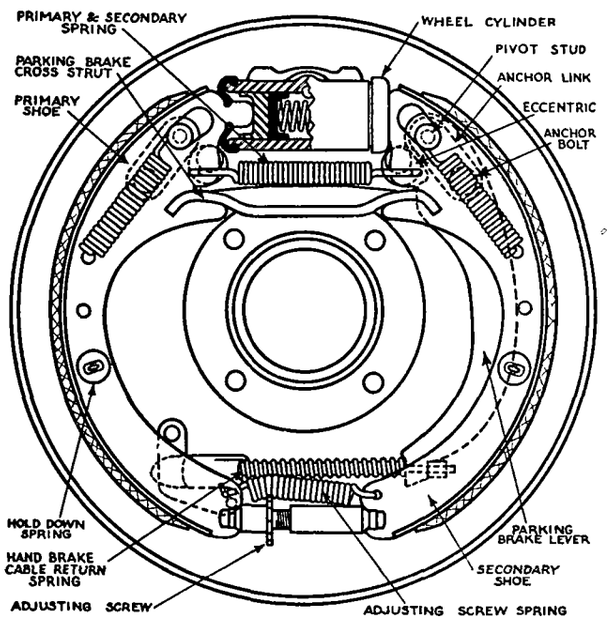
Hand Brake:—Incorporated in rear wheel brakes. Consists of cable actuated lever pivoted on secondary brake shoe anchor link stud and linked to primary shoe by strut. Applies brake shoes mechanically for parking.

OPERATION:—When brake pedal depressed and fluid in wheel cylinder forces piston and shoe out against drum, anchor link stud slides freely in slot in shoe until shoes contact drum. Primary shoe then applies secondary shoe which moves to bring anchor link stud against end of shoe slot and this link serves as anchor for both shoes. Links are mounted so that this braking thrust is in line with link axis so that shoes and anchors are free to swing within limit of eccentric adjustment (shoes follow drum and high spots due to irregular drums are eliminated). When brakes are applied with car in reverse motion, the application is exactly the same except that the opposite anchor link comes into use (only one anchor acts at a time).

ADJUSTMENT:—Hydraulic system (Bleeding lines, pedal clearance etc.). These operations performed in same manner as on other hydraulic brake systems. See Bendix Single Anchor Brake article (following) for data.

Minor Adjustment (For Wear):—Jack up all four wheels. Make certain hand brake released and that cables are free enough so that brake shoes rest against eccentrics or disconnect cables at equalizer. Remove wheels. Make following adjustments in order at each wheel.

1. Loosen locknut on primary brake shoe (forward shoe) eccentric, turn eccentric in direction of forward wheel rotation until wheel can just be turned by hand, then turn eccentric slowly in opposite direction until wheel is just free of drag, hold eccentric in this position and tighten locknut. If



feeler gauge used, insert .010" feeler between shoe and drum at anchor (upper) end of shoe, adjust eccentric until feeler gauge is snug, hold eccentric from turning and tighten locknut.

2. Adjust secondary shoe eccentric in same manner as primary shoe (above).

3. Remove adjusting hole cover on backing plate, use Tool HM-13985 (or screwdriver) and turn star wheel until brake shoes are expanded tightly against drum (move outer end of tool toward axle to expand shoes, in opposite direction to release shoes). Back off star wheel exactly 12 notches (both rear wheels must be backed off same amount to maintain hand brake balance). Check all wheels to make certain that they are entirely free of drag.

Complete Adjustment (For Wear or when New Shoes or Linings Installed):—Whenever new shoes or linings installed, or if adjustment does not give satisfactory operation, wheel brakes and cables should be cleaned and lubricated (see Servicing directions below). Jack up all four wheels, disconnect parking brake cable to each rear wheel at equalizer bar. Make following adjustments in order, repeating adjustment at each wheel as noted.

CAUTION—If hand brake cables not disconnected, shoes may be held away from eccentrics (if cables adjusted too short) so that correct brake adjustment cannot be secured.

1. At each wheel, remove inspection hole cover on brake drum, insert .010" feeler between drum and primary shoe (front shoe) near anchor end. Loosen eccentric locknut, turn eccentric in direction of forward wheel rotation until feeler is just snug, hold eccentric in this position, tighten locknut.

2. At each wheel, adjust secondary shoe (rear shoe) eccentric in same manner as primary shoe (above) using same .010" feeler.

3. At each wheel, remove adjusting hole cover on backing plate, use tool HM-13985 (or screwdriver), turn star wheel until brake shoes are expanded tightly against drums (move outer end of tool toward axle to expand shoes, in opposite direction to release shoes). Set parking brake hand lever two notches from released position (⅛" clearance between equalizer plate and stop), pull cables toward equalizer bar to remove all slack, adjust clevis at equalizer end of each cable so that clevis pins can just be inserted, tighten clevis locknuts, connect cables. Release hand lever.

4. At each wheel, back off star adjusting wheel until wheel is just free of any drag with parking brake lever in released position. Check parking brake equalization by pulling on lever until wheels can just be turned by hand and noting if drag on rear wheels is equal. Check brakes for balance.

Mechanical Follow-up Adjustment:—Turn adjusting nut on pushrod until clearance between face of nut and end of pushrod tube is 1 7/16", tighten locknut. See separate article for complete Follow-up data.

SERVICING:—Brake Shoes. To remove shoes, install clamp (HMO-145) on wheel cylinder (this will make it unnecessary to bleed lines when shoes installed if brakes not applied with shoes off). Remove retracting spring and shoe anchor link springs, release hold-down springs and remove shoe retaining washers, pull anchor end of shoes free from wheel cylinder, lift shoe assembly out. Install shoes in same manner making certain that eccentrics are turned so that high side is away from anchor links.

NOTE—Beginning with 90906, heavier (25 lbs.) spring used on secondary shoe. Lighter (20 lbs.) spring continued for primary shoes.

Backing Plate and Linkage. Remove anchor links by removing anchor bolt nuts on backing plate. Apply thin film of Bendix Lubri-plate to backing plate side of anchor links, shoe support ledges on backing plate, eccentrics, parking brake cable ramp, and all other moving or sliding parts. When installing anchor links, tighten anchor bolt nuts so that all sideplay removed but make certain that anchor links move freely.

Parking Brake Linkage. Disconnect brake cables at equalizer bar, clean exposed portion of cable, pull cable through conduit at wheel end until portion in conduit is exposed, clean and lubricate this part of cable with Bendix Cable Lubricant, push cable back into conduit. To connect cable (after shoes installed), move cable return spring away from cable end, place cable end in groove in end of brake operating lever, allow return spring to come back against lever to hold cable in place. Lubricate cable ramp with Bendix Lubri-plate. Adjust brakes and connect cables to equalizer bar.

BENDIX HYDRAULIC TYPE. DUO-SERVO, SINGLE ANCHOR (WITH ECCENTRIC ADJUSTMENT)

Used On:

AUBURN 6, 652-X, Y ('34), 653 ('35), 654 ('36-37)
AUBURN 8, 8-101, 105 ('33), 850-X, Y ('34), 851 ('35),
AUBURN 8, 852 (1936-37)
AUBURN SCHGD. 8, 851 ('35), 852 (1936-37)
BUICK, ALL MODELS (1936-37-38)
CADILLAC V8, ALL SERIES (1936-37-38)
CADILLAC V8, SERIES 39-75 (1939)
CADILLAC V12, SERIES 80, 85 (1936-37)
CADILLAC V 16, SERIES 90 (1936 TO 1939)
HUDSON 6, ALL MODELS (1936-37-38)
HUDSON 6, 91, 92, 93 (1939)
HUDSON 8, ALL MODELS (1936 TO 1939)
HUDSON BUSINESS CARS 90, 98 (1939)
LA SALLE, SERIES 50 (1935 TO 1938)
LAFAYETTE, MODEL 3610 (1936)
LINCOLN-ZEPHYR, MODEL 96H (1939)
NASH, ALL MODELS (1935 TO 1939)
NASH-LAFAYETTE, ALL MODELS (1937-38-39)
OLDSMOBILE 6, ALL MODELS (1935 TO 1938)
OLDSMOBILE 8, ALL MODELS (1935 TO 1939)
PACKARD 6, ALL MODELS (1937-38-39)
PACKARD '120' 8, ALL MODELS (1935 TO 1939)
PACKARD SUPER 8, ALL MODELS (1937-38-39)
PACKARD TWELVE, ALL MODELS (1937-38-39)
PONTIAC 6, ALL MODELS (1935 TO 1938)
PONTIAC 8, ALL MODELS (1935 TO 1938)
TERRAPLANE, ALL MODELS (1936-37-38)

NOTE:—Buick 1938. New type hand brake cable design. Individual brake cable adjusting clevises have been discontinued and single cable now used for both wheels (cable runs through equalizer at hand lever cable connection and all adjustments now made on hand brake lever cable).

Buick, Cadillac, Oldsmobile, Pontiac 1939 Models. All models not listed above use Bendix Hydraulic Brakes without eccentric adjustment. See following article for complete data on this type.

Cadillac 1937 Models. Special metal brake seals installed on drums of all wheels. Must be removed before drums can be removed. To remove seal, take off nut on clampscrew between seal ends, expand seal, lift off.

Cadillac V16 1937. Bendix Internal Valve type Vacuum Cylinder used. See separate article for complete adjusting directions.

Cadillac 1938. Brake seals (installed on drums to keep out dirt and water) have been discontinued. Vacuum Power unit (used on former V16 models) not used on new 38-90.

Hudson & Terraplane Models. Mechanical follow-up used by which rear wheel brakes are applied by pedal, after hydraulic action, as a reserve. Check setting when brakes adjusted—see section at end. Hill Holder is optional equipment. See separate article for adjustment to insure synchronization of release with clutch engagement.

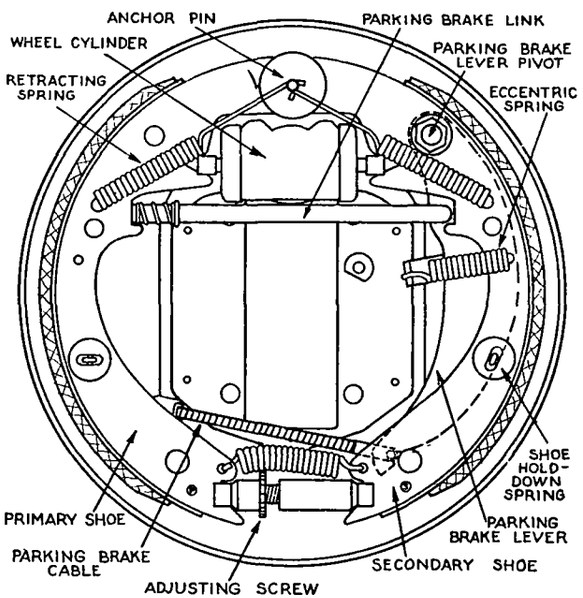
Hudson & Terraplane 1938. Master cylinder operating lever now has two holes for brake pedal link engagement. For standard adjustment, link is connected to outer hole on lever. Link can be shifted to inner hole on lever for harder brake pedal and less sensitive brakes.

Hudson '112' Models. All Hudson 112 models and Model 90 Utility Coach and Coupe use Bendix Double Anchor Type Hydraulic Brakes. See preceding article for complete data on this type.

Lincoln-Zephyr. These brakes do not have eccentric to centralize shoes and retracting springs for both shoes now of equal weight. Except for these points and new hydraulic actuation, wheel brakes similar to 1938 design.

Nash Models. Lockheed (Wagner) Hydraulic brakes used on some cars. See Lockheed Brake article for data.

Packard Twelve. Bendix internal valve type Vacuum Power Cylinder linked to brake pedal lever. Check setting whenever brakes adjusted. See separate article.



DESCRIPTION AND OPERATION:—Wheel Brakes— Brake shoes used in this type are entirely similar to those used in mechanically operated brakes (see previous article). A rigid type hydraulic cylinder with double opposed pistons is mounted on the backing plate below the anchor bolt. The opposed pistons are connected to the brake shoes through short struts or studs and force the anchor ends of the brake shoes against the drum when the brake fluid, displaced from the master cylinder by depressing the pedal, flows through the lines to the wheel cylinders. The primary shoe applies the secondary shoe in the usual manner. Shoes are returned to the 'off' position by retracting springs hooked to the shoes and the anchor pin in the same manner as mechanical brakes. Adjustments are the same as on mechanical brakes.

Hand Brake:—When incorporated in wheel brakes (rear wheels only), consists of cable actuated lever pivoted on one shoe and linked to other shoe by a strut so that the shoes are expanded against drums at anchor ends when brake is applied. Hand brake adjustment is part of service brake adjustment (see directions below).

Master Cylinder:—Compensating type. See separate article on Hydraulic Brake Servicing for complete master cylinder servicing data.
NOTE—Wheel cylinder must be 'bled' whenever brake line to that particular wheel is disconnected, and entire system (all four wheels) must be bled whenever brake lines are disconnected at master cylinder to remove all air in system and correct springy brake action.

ADJUSTMENT:—Before adjusting, jack up all four wheels, disconnect parking brake (hand lever) cables at intermediate lever, remove adjusting screw hole cover on backing plate and feeler gauge hole cover on drum (remove wheels for access to this hole). Adjust as directed below. CAUTION—If hand brake cables not disconnected, shoes may be held 'on' by cables (if adjusted too tight) so that correct brake adjustment cannot be secured.

Bleeding Brake System. See separate article on Hydraulic Brake Servicing for complete bleeding directions (required when lines disconnected, to remove wrong type fluid which has been used in system, or to remove air from lines caused by allowing master cylinder supply tank to become dry).

Brake Pedal Clearance:—Brake pedal must have 3/8" free travel before master cylinder piston begins to move. To adjust, loosen locknut at outer end of master cylinder boot, change length of brake pedal rod, tighten locknut. By-pass port between master cylinder and supply tank must be uncovered when piston is in 'off' position to provide compensating action.

Buick 1938. Clearance between pedal and underside of toe board should be 1 1/8" (40, 60), 7/8" (80, 90) with master cylinder piston against its stop in the released position. To adjust, loosen locknut and turn master cylinder pushrod (hold pushrod from turning while tightening locknut). Check to see that pedal does not bind and that master cylinder piston is against stop when released. Pedal free travel must be 1/4-1/2".

Hudson & Terraplane 1938. After adjusting brake pedal link for required 1/4" pedal free travel, make certain that link connected in outer hole on master cylinder operating lever. When connected in inner hole, less sensitive brakes are secured but with harder pedal action.

Oldsmobile 1939. Sponge rubber bumper on underside of toeboard must be compressed not more than 1/16" with pedal released and master cylinder piston against its stop. Adjusted in same manner as other cars (above).

Packard Twelve. Vacuum power cylinder and master cylinder linkage must be adjusted together. See preceding article on Bendix Vacuum Cylinder for complete data.

Pontiac Models. Pedal clearance between pedal and underside of felt retainer should be 3/8-5/8" with pedal released and master cylinder piston against its stop.

Minor Adjustment (For Wear):—Adjust at each wheel as follows:
1. (All Models except Lincoln-Zephyr). Loosen eccentric locknut, turn eccentric in direction of forward wheel rotation until .010" feeler is snug between lining and drum at each end of this secondary shoe, hold eccentric from turning, tighten locknut. Clearance at both ends of shoe must be alike within .002" (Cadillac), .003" (all others) with

BENDIX HYDRAULIC SINGLE ANCHOR (WITH ECCENTRIC) Cont.

smaller clearance preferably at anchor end. If variation greater than this amount, anchor must be re-located (See Major Adjustment below). If feeler gauge not used, turn eccentric up until heavy brake drag secured, then back eccentric off until wheel is just free of drag.

Lincoln-Zephyr Note. No eccentric provided and this adjustment not required. Begin adjustment with (2).

2. **(All Models).** Insert special tool, or screwdriver, in adjusting screw hole on backing plate, turn adjusting screw by moving outer end of tool up toward center of wheel to expand shoes until wheel can just be turned (if necessary to turn adjusting screw more than 50 notches or clicks, examine linings for wear and replace if necessary). Adjust and connect hand lever cables (see Hand Brake Adjustment below). Then back off adjusting screw until wheel is just free of drag (approximately 20 notches except Lincoln-Zephyr—see Note following). Check equalization by depressing brake pedal (use pedal jack) until wheel with least drag can just be turned by hand, equalize by backing off adjusting screws on tight wheels not more than 2-3 notches. Do not tighten loose wheels.

Hudson Note. Check mechanical 'follow-up' setting after adjusting brakes (see separate article following).

Lincoln-Zephyr Note. Adjusting screw should be backed off exactly 14 notches which will give .010" clearance.

3. **Hand Brake Adjustment (All Models).** Adjust hand brake cables for each model as follows:

Buick (1937). Disconnect all cables on equalizer bar, take up each wheel cable until clevis pins can just be inserted in plate with tension spring play taken up, hold in this position, insert hand brake cable in center hole, take up nut at rear end until all slack removed from wheel cables with hand lever against stop in off position. Attach releasing springs. Equalize wheels by backing off adjusting screw in tight wheel not more than 2 notches.

Buick 1938. After brake shoes adjusted, jack up rear wheels, see that brake lever released and against stop, expand shoes in both rear drums until wheels can just be turned by hand, tighten adjusting nut at rear end of hand brake cable (at wheel cable equalizer) until cables are taut. Back off adjusting star screw in each rear brake 17-20 notches so that wheels are free of brake drag. Check equalization by pulling hand brake lever on until wheels can just be turned by hand. If rear wheels not balanced, back off adjusting star screw on tight wheel not more than 2 notches. If wheels still not balanced, center equalizer on rear wheel cables.

Cadillac. With rear brake shoes expanded so that rear wheels can just be turned by hand, make certain that hand lever in 'off' position, pull cables taut and adjust clevises so that clevis pins can just be inserted. Connect cables and back off adjustment at shoes 15-20 notches until wheels are just free. Check equalization.

Hudson & Terraplane Models. With brake shoes in rear wheels expanded so that wheels can just be turned by hand, pull hand brake lever on until equalizer bar is ⅛" from stop, adjust clevises at forward ends of cables so that clevis pins just enter holes in equalizer bar with cables pulled tight, connect cables and make certain that rear face of equalizer plate is parallel with face of stop. Release hand brake, back off adjusting screw at each wheel until brakes are just free of any drag. Check equalization. Adjusting screw on tight wheel can be backed off not more than 2-3 notches to balance wheels.

La Fayette-Nash ('36)—Cables cannot be disconnected (equalized by pulley coupling on lever). Loosen bracket-to-frame screws, place hand lever in third notch, move bracket forward until cables are tight, tighten mounting screws, release lever.

Lincoln-Zephyr. Do not expand rear wheel brake shoes. Pull hand lever 'on' one notch, apply brakes by depressing brake pedal with 30 lbs. pressure (use pedal jack, hold pedal in this position while adjusting). Remove slack in cable by adjusting conduit clamp. Release hand lever and brake pedal, see that brakes are free.

Nash. With rear brake shoes expanded tightly against drum, pull hand lever 'on' 2 notches, loosen two bolts on adjusting clamp (connecting lever and wheel cables), pull cables tight and tighten bolts. Return lever to 'off' position. Back off adjusting screw in each wheel to free brakes and check equalization as directed in (2) above. See that hand brake lever on each wheel backing plate has ⅛" free travel with hand lever in off position. Equalize hand brakes by loosening rear bolt in cable adjusting clamp and applying hand brakes (this will allow cable to shift on adjusting clamp). Check position of hand brake cable guide on rear spring. Guide should be exactly 19¾" (Nash 6, Nash-Lafayette), 18¼" (Nash 8).

Oldsmobile Models. With rear wheel brake shoes expanded until heavy drag secured on wheels, pull parking brake cable toward equalizer to remove all slack, adjust clevis at forward end of each cable so that clevis pin can just be inserted through both clevises and hole in equalizer bar link with link held parallel to drive shaft. Install clevis pin with head to top. Back off adjusting screw in each wheel approximately 20 notches until wheel is free of any brake drag. Equalize brakes by backing off adjusting screw in tight wheel slightly.

Packard 120 ('35), 120-B ('36)—With lever in 'off' position, remove all slack in cable connecting lever to cross-shaft (120) or equalizer bar (120-B). Set lever in first notch (on 120-B equalizer bar must be at right angles to propellor shaft and clamped in this position while adjusting cables). Adjust and reconnect cables with all slack removed.

Packard 1937-39. Adjust clevis at equalizer end hand brake lever cable to remove all slack with lever released and equalizer against stop. With rear wheel brake shoes expanded so that wheels can just be turned by hand, place hand lever in first notch, adjust clevis at forward end of each wheel cable so that clevis pin can just be inserted with all slack removed and equalizer bar held at right angles to frame. Back off adjusting screw in each wheel until wheels are just free of any brake drag, equalize brakes by backing off adjusting screw on tight wheel slightly.

Pontiac Models. With brake shoes in rear wheels expanded so that wheels can just be turned by hand, place hand lever in first notch, adjust clevis at forward end of each wheel cable until clevis pin can just be inserted with approximately 25 lbs. pull on cable. Back off adjusting screw at each wheel until wheel is just free of any brake drag, equalize brakes by backing off adjusting screw at tight wheel slightly.

Major Adjustment (For New Shoes or Relined Brakes):—If shoes with new linings being installed, adjusting screw and eccentric adjustment must be backed off to allow drums to be installed. Disconnect parking brake cables, remove adjusting screw cover on backing plate and inspection hole cover on drums. Adjust brakes at each wheel as follows:

1. **Anchor Pin & Eccentric Adjustment (All Models).** Loosen eccentric locknut, turn eccentric in direction of forward wheel rotation until .010" feeler is just snug at adjusting screw end of this secondary shoe, hold eccentric from turning and tighten locknut. Check clearance at anchor pin end (opposite end) of this same shoe. If clearance not .010", adjust anchor pin as follows: Loosen anchor pin locknut one turn, turn anchor pin in direction of forward wheel rotation (eccentric type with slotted end) or tap anchor pin out toward drum (slotted hole type with plain end) until clearance at anchor pin end of shoe is exactly .010", hold anchor pin from moving and tighten locknut securely with 16" wrench. Recheck clearance at adjusting screw end of shoe. Make any necessary readjustments at eccentric and anchor pin until .010" clearance secured at both ends of this shoe. Then proceed with adjustments (2) and (3) as given under Minor (Wear) adjustment above.

RELINING BRAKES:—Manufacturer recommends use of replacement shoes furnished with new linings installed and ground concentrically. If shoes relined, use same type lining as fitted originally (see Car Model article). Lining on primary and secondary shoes may be of different types (woven on primary, moulded on secondary, etc.), or of different lengths. Shoes may be identified by 'P' (primary), 'S' (secondary) stamped on rib at adjusting screw end.

SERVICING:—Linkage—Lubrication of cables same as for mechanical brakes. See previous article on Bendix Mechanical Brakes.

Master Cylinders & Wheel Cylinders:—See separate article on Hydraulic Brake Servicing for complete data.

Brake Drum Grinding. On all Buick, Cadillac, Oldsmobile models, not more than .030" should be removed from drum. Removing of greater amount will weaken drum and may cause distortion. On Pontiac models, manufacturer recommends that drum be replaced if seriously scored (drum may be sanded to remove slight irregularities).

HUDSON MECHANICAL FOLLOW-UP.

Used On:

HUDSON, ALL MODELS (1936 TO 1939)
TERRAPLANE, ALL MODELS (1936-37-38)

DESCRIPTION AND OPERATION:—Consists of overrunning mechanical linkage between brake pedal and hand lever equalizer bar plate by which wheel brakes are set mechanically through hand lever or parking linkage after movement of pedal sufficient to operate brakes hydraulically has taken place. Acts as reserve if hydraulic application fails or when pedal travel excessive.

ADJUSTMENT:—See that master cylinder operating lever is against stop (brake pedal stop) and that rear brake cable equalizer bar plate is against stop on bracket, loosen locknut on threaded follow-up rod below brake pedal, turn adjusting nut until clearance between face of nut and front end of pushrod tube is 1 29/32" (all 1936-37 models), 1 7/16" (1938-39 models), tighten locknut. This will provide correct lag between hydraulic application and mechanical follow-up.

BENDIX HYDRAULIC TYPE DUO-SERVO, SINGLE ANCHOR (WITHOUT ECCENTRIC ADJUSTMENT)

Used On:

BUICK, MODELS 39-40, 60, 80, 90 (1939)
CADILLAC V8, MODELS 39-60S, 61 (1939)
LA SALLE V8, MODEL 39-50 (1939)
OLDSMOBILE SIX '60', MODEL F-39 (1939)
OLDSMOBILE SIX '70', MODEL G-39 (1939)
PONTIAC DELUXE 115 SIX, MODEL 39-25 (1939)
PONTIAC DELUXE 120 SIX, MODEL 39-26 (1939)
PONTIAC DELUXE EIGHT, 39-28 (1939)

NOTE:—Buick Models. First cars provided with eccentric adjustment but eccentric is turned and locked in position so that it is inoperative and short secondary shoe spring (hooked between center of secondary shoe and backing plate—normally used with eccentric adjustment) is not used.

CAUTION—On these models, eccentric must not be disturbed and brakes must be adjusted in special manner as directed below.

Cadillac, Oldsmobile (other Models). These other models have eccentric adjustment and are adjusted differently. See preceding article for data.

DESCRIPTION:—These brakes similar to other Bendix single anchor designs except that secondary shoe eccentric not used (see Buick Note & Caution above) and short spring between secondary shoe and backing plate (used normally to hold shoe against eccentric) is omitted. This design requires special adjustment instructions as given below.

ADJUSTMENT:—Before adjusting, jack up all four wheels, loosen or disconnect parking brake cables at intermediate lever or equalizer, remove adjusting screw hole cover on backing plate. Check brake pedal clearance (see Brake Pedal Adjustment below). Adjust each wheel brake as directed below. CAUTION—If hand brake cables not disconnected, shoes may be held on by cables (if adjusted too tight) so that correct brake adjustment cannot be secured.

Minor Adjustment (For Wear):—At each wheel, make certain that anchor pin nuts are tight, insert special tool or screwdriver through adjusting hole on backing plate, turn notched adjusting screw by moving tool handle up toward center of wheel until brake drum can just be turned by hand. Adjust and connect hand brake cables (see Parking brake adjustment below). Back off adjusting screw approximately 17 notches or 'clicks' (Buick), 14 (Pontiac), 20 (others) until shoes are just free and drum revolves without any brake drag (tapping backing plate may assist in centralizing shoes and eliminating drag). If brakes are not free after making this adjustment, or if shoes drag at anchor pin end, adjust anchor pin as directed in Major Adjustment below.

Parking Brake Adjustment—Before connecting hand brake cables, adjust cable lengths on each model as follows:

Buick. With rear wheel brake shoes expanded so that drums can just be turned, tighten adjuster nut on rear end of hand lever cable (at wheel cable equalizer on torque tube near rear axle) until cables are taut with hand lever in released position, back off adjusting screw in each wheel 15 notches so that wheels free of any brake drag, check equalization by applying brakes with hand lever until drums can just be turned. Equalize wheels by backing off adjusting screw in tight wheel not more than 2 notches (if this does not equalize wheels, check centering of wheel cables in equalizer).

Cadillac, LaSalle. With rear brake shoes expanded so that rear wheels can just be turned by hand, make certain that hand lever in 'off' position, pull cables taut and adjust clevises so that clevis pins can just be inserted. Connect cables and back off adjustment at shoes 15-20 notches until wheels are just free. Check equalization.

Oldsmobile. With rear wheel brake shoes expanded so that drums can just be turned, pull wheel cables forward to eliminate all slack, adjust clevises on forward ends of cables so that clevis pins can just be inserted with equalizer link held parallel to propeller shaft, connect cables (insert clevis pins with head toward top), back off adjusting screw in each wheel approximately 20 notches until wheels are free, check equalization.

Pontiac. Check hand brake cable tension by moving clevis pin at cross lever wheel cable spreader, pin should move up and down with thumb and finger pressure (hand lever in released position, rear wheel brake shoes not expanded), and both rear wheels should lock with hand lever in third notch. To adjust, remove cross lever clevis pin and engage pin in another of the several holes in the cable spreader (approximate setting), remove hand lever clevis pin and turn clevis on cable (exact setting) using extreme care not to twist the cable. To equalize wheel cables after adjusting, loosen clampscrews on wheel cable spreader at cross lever (if necessary pry clamp ears apart with a screwdriver so that cable free in spreader), apply brakes hard by pulling back on hand lever, tighten spreader clampscrews before releasing hand lever.

Brake Pedal Adjustment—On all models, pedal must be adjusted to insure master cylinder piston being back against its stop (within master cylinder) for correct compensating action when brakes released. To adjust, loosen locknut on piston connector rod, turn clevis on rod to secure clearances specified below with master cylinder piston against the stop.

Buick. Clearance between pedal and underside of toeboard should be ⅞" (all models) with brakes released.

Cadillac, LaSalle. Rubber grommet on pedal under toeboard should be compressed to ¾" with brakes released.

Oldsmobile. Spong rubber pedal bumper on underside of toeboard should be compressed not more than 1/16" with brakes released.

Pontiac. Clearance between pedal and lower surface of felt retainer on underside of toeboard should be ¾-1¼" with brakes released.

Major Adjustment (For New Shoes, Relined Brakes or when Minor Adjustment not satisfactory):—Jack up all four wheels, loosen or disconnect parking brake cables at equalizer or intermediate lever, remove adjusting screw hole cover on backing plate and inspection hole cover on drums (remove wheels for access). Check pedal clearance (see Brake Pedal Adjustment above). Adjust each wheel brake as follows. CAUTION—If hand brake cables not disconnected or loosened, shoes may be held on by cables (if adjusted too tight) so that correct brake adjustment cannot be secured.

Anchor Pin & Adjusting Screw Adjustment—Turn drum so that inspection hole is at center of secondary shoe (rear shoe on each wheel), insert screwdriver and pry secondary shoe away from drum so that primary shoe (other shoe) is seated solidly against drum. Insert screwdriver or special adjusting tool in hole on backing plate and turn notched adjusting screw by moving handle of tool up toward center of wheel until .015" feeler is snug between lining and drum at adjusting screw end of secondary (rear) shoe. Check clearance at anchor pin (opposite) end of this same shoe. If clearance not .015", adjust anchor pin by loosening locknut and tapping anchor out toward drum (slotted hole type with plain end) or turn anchor pin in direction of forward wheel rotation (eccentric type with slotted end) until .015" clearance secured, hold anchor pin from shifting and tighten locknut securely with 16" wrench. Recheck clearance at adjusting srew end of shoe. Make any necessary re-adjustments at adjusting screw and anchor pin to secure clearance of .015" at both ends. It is very important that primary shoe be out in solid contact with drum while this adjustment being made. Adjust hand brake cables as directed in Parking Brake Adjustment under Minor Adjustment above.

SERVICING:—All servicing operations including Bleeding of Lines, Brake Shoe Removal & Installation (except eccentric and short secondary shoe spring data which should be disregarded), Master Cylinder & Wheel Cylinder Overhaul are same as on other Bendix brake installations. See preceding article on Bendix Duo-Servo, Single Anchor Type With Eccentric and separate article on Hydraulic Brake Servicing for complete data.

Pontiac Wheel Cylinders—Wheel cylinders of two different lengths are installed at factory and special backing plates (with narrow or wide piston stops to fit each type wheel cylinder) are used with each cylinder. Backing plate with narrow stop dimension only is furnished for service and stops must be filed out 1/16" on each side when service backing plate used with longer wheel cylinder.

LOCKHEED HYDRAULIC DOUBLE ANCHOR TYPE

Used On:

CHRYSLER, ALL MODELS (1932 TO 1939)
DE SOTO, ALL MODELS (1932 TO 1939)
DODGE, ALL MODELS (1932 TO 1939)
GRAHAM, ALL MODELS (1933 TO 1939)
HUPMOBILE SIX, 518-D ('35), 618-G ('36)
HUPMOBILE EIGHT, 521-O ('35), 621-N ('36)
HUPMOBILE SIX, 822-E ('38), 922-E ('39)
HUPMOBILE EIGHT, 825-H ('38), 925-H ('39)
HUPMOBILE SKYLARK, MODEL R (1939)
NASH, ALL MODELS (1935-39)
NASH-LAFAYETTE, ALL MODELS (1937-38-39)
PLYMOUTH, ALL MODELS (1933 TO 1939)
REO SIX, S-2, 3 ('33), S-4 ('34), S-7 ('35)
REO FLYING CLOUD, 6-A ('35), 6-D ('36)
STUDEBAKER, DICTATOR MODELS (1935-36-37)
STUDEBAKER, COMMANDER MODELS ('35 to '39)
STUDEBAKER, PRESIDENT MODELS ('35 to '39)

NOTE:—Chrysler Models. Bendix Internal Valve type Vacuum Power Cylinder standard equipment on Imperial & Custom Imperial models (1933-36), Custom Imperial Models C15 ('37), C20 ('38), C24 '39). Optional equipment on Airflow and Imperial models. See separate article for complete data.

Chrysler, DeSoto, Dodge, Plymouth 1939. Anchor pins are marked with an arrow on inner ends (visible with drums removed) so that position of minimum adjustment can be readily secured by turning pins so that arrow heads point toward each other. See special anchor pin adjustment directions below.

Nash Models. Bendix Hydraulic Brakes, Single Anchor type, used on some cars. See Bendix Hydraulic Brake article for data on these cars.

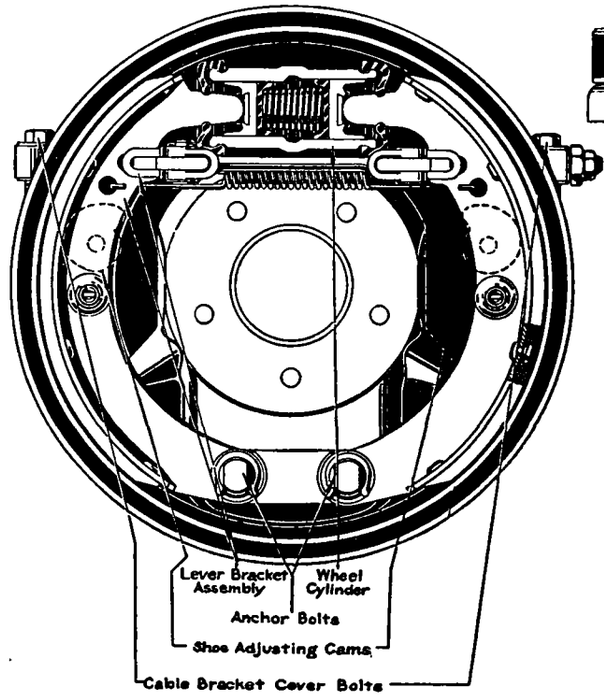
Studebaker Models. Model 7A was called 'Six' in early 1938, 'Commander' for later cars. Model 8A was called 'Commander' in early 1938, 'State Commander' model for later cars.

DESCRIPTION AND OPERATION:—Wheel Brakes— Two shoes per wheel, mounted on independent eccentric anchor pins at the lower or "heel" end and bear directly against the opposed pistons of stationary wheel cylinder at the upper or 'toe' end. Shoes are forced out against drum at toe end by fluid displaced from master cylinder and flowing through brake lines to wheel cylinder when brake pedal is depressed. No self-energizing action is employed and self-energizing effect of forward brake shoe ordinarily offset by using shorter length lining on this shoe or by using 'stepped' wheel cylinders with smaller diameter forward shoe piston and larger diameter piston for rear shoe. Brakes are returned to 'off' position against eccentric stops by retracting spring connected between shoes at toe end.

Wheel Cylinder:—Rigid type mounted on backing plate with opposed pistons bearing directly on toe ends of brake shoes. Pistons sealed by rubber caps held against piston head by central spring.

Master Cylinder:—Compensating type with integral supply tank. Supply tank is directly above master cylinder and is connected to it by two ports (1) by-pass port uncovered when piston is in 'off' position so that fluid may flow freely in or out of master cylinder to compensate for any loss, and to prevent back-pressure due to expansion of fluid in system and (2) supply port by which additional fluid is drawn down and through holes in the piston and past the lip of the piston packing cup when brake pedal is released so that cylinder is always full of fluid and ready for repeated brake action even before fluid in system is returned to master cylinder by retracting wheel cylinder pistons caused by shoe springs. Master cylinder requires no attention other than keeping supply tank more than one half full of fluid at all times. Brake pedal clearance should be checked (see directions below) but will not change in service.

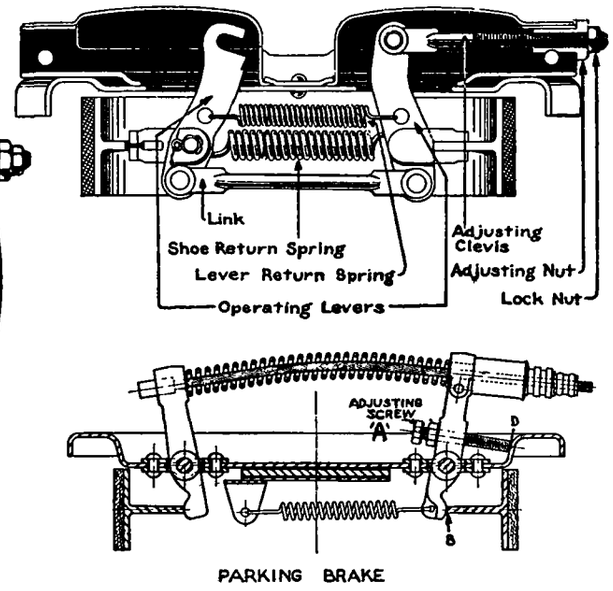
NOTE—Wheel cylinder must be 'bled' whenever brake line to that particular wheel is disconnected, and entire system (all four wheels) must be 'bled' whenever brake lines are disconnected at master cylinder to remove all air in system and correct springy brake action.



Hand Brake:—When incorporated in rear wheels consists of cable operated lever pivoted on one brake shoe and connected to other shoe through link or strut so that toes of both shoes are forced out against drum when hand lever is applied. Adjustment should be checked whenever brake adjustments are made.

ADJUSTMENT:—Before making adjustments, jack up all four wheels, check brake pedal clearance or free travel (See Brake Pedal Adjustment below), release hand brake and see that rear wheels are free. Then adjust brakes at each wheel as directed below.

Bleeding Brake System. Remove cap, fill master cylinder supply tank with genuine brake fluid, remove bleeder capscrew on backing plate directly above hose coupling, screw in standard bleeder drain tube (combination valve wrench and tube connection), allow tube to hang in clear jar, unscrew bleeder connection ¾ turn, depress brake pedal slowly ½ of travel, return slowly to off position, repeat operation until flow of fluid from wheel cylinder is free from all air bubbles, usually six strokes. Keep supply tank filled with fluid (entire system must be 'bled' if supply tank drained). Do not use fluid bled from system. Remove bleeder connection and replace capscrew. Repeat at other wheels to bleed entire system.



PARKING BRAKE

Brake Pedal Clearance:—Pedal clearance or free travel before master cylinder piston begins to move should be aproximately ⅜" to insure piston return to extreme 'off' position with by-pass port uncovered when pedal released. To adjust, hold master cylinder push rod from turning with wrench on hexagonal end, loosen locknut, screw push rod extension pedal link in (to increase free travel), tighten locknut.

NOTE—See article on Bendix Power Unit for lever position when making adjustments on Chrysler Models with Vacuum Power assister.

Minor Adjustment (For Wear):—Jack up all four wheels, release hand lever, see that rear wheels are free. At each wheel, turn up eccentric on each shoe (move wrench toward wheel rim when installed on eccentric nut upward) until shoe contacts drum, then back off eccentric slightly until wheel rotates freely in both directions with no drag. Eccentric held in position by spring tension. Check hand brake setting and adjust if necessary.

LOCKHEED HYDRAULIC—CONT.

Major Adjustment (For New Linings):—Dummy drum with cut-away section, ring gauge or other type adjusting tool must be used. Release hand lever and check hand brake clearance or disconnect hand brake cables, install dummy drum or ring gauge, turn so that gauging point is at heel (anchor pin end of shoe), loosen anchor pin locknut on backing plate and turn anchor pin (see special directions below for Chrysler, DeSoto, Dodge, Plymouth 1939 models) until clearance between lining and gauge is .005-.006" (see car model 'M' page for specified clearance for each model) at point 1½" back from heel of shoe, tighten anchor pin locknut. Turn gauge to toe (opposite end of shoe), adjust eccentric cam as directed under Minor Adjustment above until clearance between lining and gauge is .010-.012" (see car model 'M' page). Adjust each shoe in all wheels in same manner, adjust hand brake cables as directed in Hand Brake section following.

1939 Chrysler, DeSoto, Dodge, Plymouth. Inner ends of anchor pins are marked by an arrow and flattened so that adjusting wrench can be applied at this end of pins. Before making adjustment, loosen anchor pin bolt nuts on backing plates, turn each anchor pin so that arrows line up with arrow heads together. Then adjust anchor pins by turning right hand pin counter-clockwise, left hand pin clockwise (pins turned toward each other at top) to secure correct clearance. CAUTION—Shoes will not be centralized in drum (even though set for correct clearance) unless anchor pin arrows lined up first and adjustment made exactly as specified above.

Hand Brake:—Adjust whenever service brakes adjusted or new shoes installed. For all models except as noted below, pull hand lever up three notches. Shorten each brake cable by turning turnbuckle at forward end until slight drag felt on rear wheels. Release hand lever, check to see that wheels rotate freely without drag. Brakes can be equalized by pulling up lever until wheel with least drag can just be turned and then slacking off on cable to tight wheel.

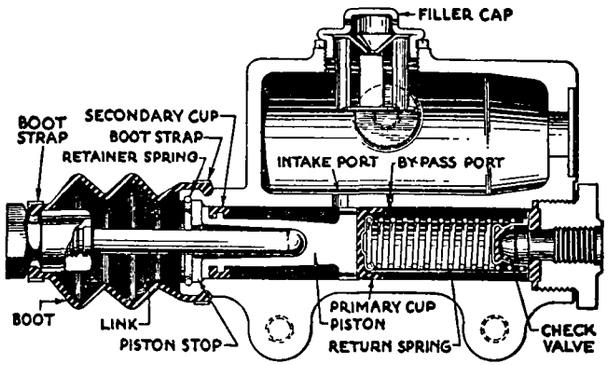
All Chrysler, De Soto, Dodge and Plymouth Models—On these models, when hand lever applies rear wheel service brakes, adjust at each wheel as follows: Place hand lever in released position, loosen support cable bracket cover bolt nut, and adjusting clevis locknut, turn up adjusting nut on clevis (under locknut) until slight drag felt when wheel turned, back off adjusting nut until wheel is free, tighten locknut and support cable bracket cover bolt nut, equalize by setting hand brake so that wheel with least drag can just be turned, slack off adjustment on tight wheeel slightly. With correct adjustment wheels should be free with hand lever released and should have slight drag with lever in second notch.

Graham 80, 80A, 85:—Adjust forward lever at each wheel with hand lever released and cables slack. Loosen locknut and turn adjusting screw 'A' up until clearance between inner end of lever and shoe at 'B' is barely perceptible. Tighten locknut. Then adjust rear levers with hand lever placed in first notch. Loosen locknut and turn up turnbuckle at forward end of cable conduit until all slack is taken up and tension in cable is sufficient to move backing plate end of adjusting screw 'A' away from backing plate at point 'D' slightly. Tension must be same on both rear wheel cables to insure equalization. Release hand lever and check rear wheels.

Hupmobile Models. With the hand brake lever in released position, remove all slack in cable between hand lever and intermediate lever by adjusting turnbuckle at rear end of cable. Then pull hand lever 'on' to second notch, adjust each wheel cable by adjusting turnbuckle at forward end of cable to remove all slack. Release hand lever and check to see that rear wheels rotate freely without any brake drag. Equalize wheels by making slight re-adjustment at wheel cable turnbuckle for tight wheel.

Nash Models. Pull hand lever 'on' to second notch, loosen two bolts on adjusting clamp (connecting hand lever cable and wheel cables), pull cables tight and tighten clamp bolts. Release hand lever and check rear wheels to see that they rotate freely without brake drag. To equalize hand brakes, loosen rear bolt in cable adjusting clamp and apply brakes by pulling on hand lever (this will allow wheel cable to shift in adjusting clamp), tighten adjusting clamp bolt. Check position of hand brake cable guide on each rear spring. Guide should be exactly 19¾" (Nash 6, Nash-Lafayette), 18¼" (Nash 8).

Studebaker Models. With hand lever released, take up slack in hand lever cable by turning turnbuckle brake lever end. Pull hand lever 'on' to second notch. Adjust turn-buckle at forward end of each wheel cable so that slight drag felt at each wheel. Release hand lever and make certain that wheels are free of any brake drag. Equalize brakes by slacking off cable to tight wheel slightly (equalizer link used on former six cylinder models has been discontinued).



RELINING BRAKES:—See car model page for lining type and length and instructions where lining of unequal lengths used on forward and rear shoes in same wheel. Linings should be faced or ground concentrically after installation.

Shoe Removal:—Shoes held in place by coil spring retained by plain washer and 'C' type washer on each shoe. To remove shoes, pull out 'C' washer, disassemble plain washer and spring, take off return spring freeing shoes at toe end (use piston clamp on wheel cylinder and do not depress pedal with shoes disconnected). Remove 'C' washers on anchor pins, slide shoes off.

SERVICING:—**Master Cylinders & Wheel Cylinders.** See separate article on Hydraulic Brake Servicing for complete data.

DUESENBERG (LOCKHEED) TYPE

Used On:
MODELS J AND SJ (1931-37)

DESCRIPTION AND OPERATION:—**Wheel Brakes**—Two shoes per wheel, mounted on anchor pins on lower support bracket at lower end and operated through reducing lever or toggle (linked by toggles to each shoe) by single piston in wheel cylinder. Adjustment provided on toggle lever at toe of shoe. Shoes returned to 'off' position by single retracting spring hooked between shoes.

Wheel Cylinder:—Cylinder mounted vertically (integral with steering knuckle pivot pin casting in front wheels) with single acting piston which is forced up when brake fluid, displaced from master cylinder by pedal operation, flows through lines. Toggle arm lever contacts piston directly.

Master Cylinder:—Compensating type mounted within supply tank and operated through crank on shaft linked to brake pedal. Similar to other Lockheed designs (see Lockheed article) except that secondary piston cup and bleeder holes in piston not used. Compensating action secured by free flow of fluid between master cylinder and supply tank through by-pass port with piston in 'off' position.

Hand Brake:—Independent type mounted at rear of transmission. See adjustment instructions below.

ADJUSTMENT:—**Bleeding Lines**—See Lockheed article for complete instructions.

Pedal Clearance:—With pedal released and against toeboard, disconnect pedal linkage by taking out clevis pins and see that master cylinder piston is in fully returned position. Adjust by shifting position of master cylinder lever (attached to adjusting plate to which pedal links are connected).

Brake Shoe Clearance:—Jack up all four wheels. Remove plates on inside dust cover on front wheels marked 'Adjust Brakes Here', remove upper section of inside dust cover on rear wheels by taking off 2 nuts and removing 2 capscrews for each section.
1—At each wheel, loosen locknut on long toggle link, turn adjusting screw in opposite direction to expand shoes until brake drags slightly. With all wheels set for slight drag, depress foot pedal firmly. This will centralize shoes and wheels should be free. Repeat this operation until slight drag remains after pedal is released. Then back off adjusting nut exactly ½ turn at each wheel, tighten locknut.

Hand Brake Adjustment:—Loosen screw in equalizer sleeve at center of cross-shaft above brake at rear of transmission. Tighten adjusting nut until hand lever locks brakes when placed in fifth notch, tighten equalizer screw before releasing brake.

SERVICING:—**Removing Brake Shoes**—Remove brake drums (rear drums removed as unit with axles), remove inside dust covers, removing toggle pins at both ends of each shoe, disconnect retracting spring.

Wheel Cylinders:—Remove brake drums, use lever and lift toggle arm up and to rear shifting brake assembly slightly. Piston may then be withdrawn from cylinder (removal will be easier if bleed screw opened). Bleed lines when wheel cylinder reassembled.

RELINING BRAKES:—If ring gauge or dummy shoe used to check clearance when shoes with new lining installed, shoe clearance should be .005-.008" at toes.

LOCKHEED HYDRAULIC TYPE SINGLE ANCHOR

Used On:

CORD, MODELS 810 (1936), 812 (1937)
STUDEBAKER CHAMPION, MODEL G (1939)
WILLYS-OVERLAND, MODEL 39 (1939)

DESCRIPTION:—These brakes similar in design to other Lockheed Hydraulic types except for Anchor Pin.

Anchor Pin—Single anchor pin used with both brake shoes pivoting on this same pin. Anchor pin has double eccentric section so that both shoes are moved out toward drum when pin is turned for major brake adjustment.

ADJUSTMENT:—Before making adjustments, jack up all four wheels, check pedal clearance or free travel (see Brake Pedal Adjustment below), release hand brake. Then adjust brakes at each wheel as follows:

Minor Adjustment (For Wear):—Install wrench on eccentric adjusting cam on backing plate with wrench handle up, turn cam by moving wrench handle out toward wheel until shoe contacts drum (brakes drag when wheel revolved), then turn cam in opposite direction until wheel is just free of any brake drag. Adjust all eccentric cams in this manner (one cam for each shoe, two cams on each backing plate). Cams are held in position by spring tension and no locking nuts are used.

Major Adjustment (For new linings, etc.):—With wheels removed, rotate brake drums so that inspection hole in drum is at heel (anchor pin end) of shoe, loosen eccentric anchor pin locknut, turn anchor pin until clearance between lining and drum is exactly .006" (measured with feeler gauge 1½" from end of lining). Check to see that heel clearance on opposite shoe is likewise .006", tighten anchor pin locknut. Turn drum so that slot is 1½" from end of lining at toe end of shoe, adjust eccentric cam (as directed under Minor Adjustment above) so that clearance is exactly .010". Recheck clearance at anchor pin end and make any necessary re-adjustments to secure correct clearance at both ends of shoe. Adjust eccentric cam on opposite shoe, then repeat adjustment at other wheels.

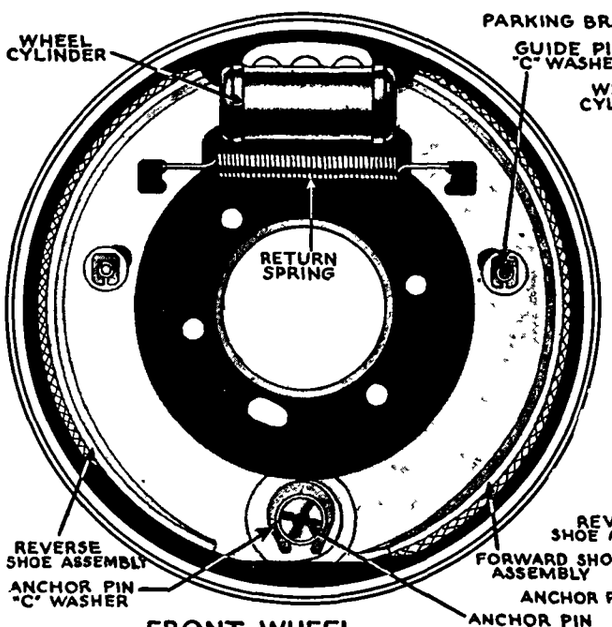
Brake Pedal Adjustment:—Pedal must have ¼" min., ½" max. free travel to insure master cylinder piston being back against its stop (in cylinder) for correct compensating action when brakes released. To adadjust, loosen locknut and turn large adjusting nut on master cylinder end of connector rod.

Parking Brake Adjustment:—Adjust whenever brakes adjusted for wear or new shoes installed. To adjust, pull hand lever 'on' three notches. Adjust yoke on forward end of each wheel cable to eliminate all slack, re-connect cables, release hand brake lever, check rear wheels to see that they rotate freely without any drag. Equalize wheels by making slight re-adjustment at wheel cable yoke for tight wheel.

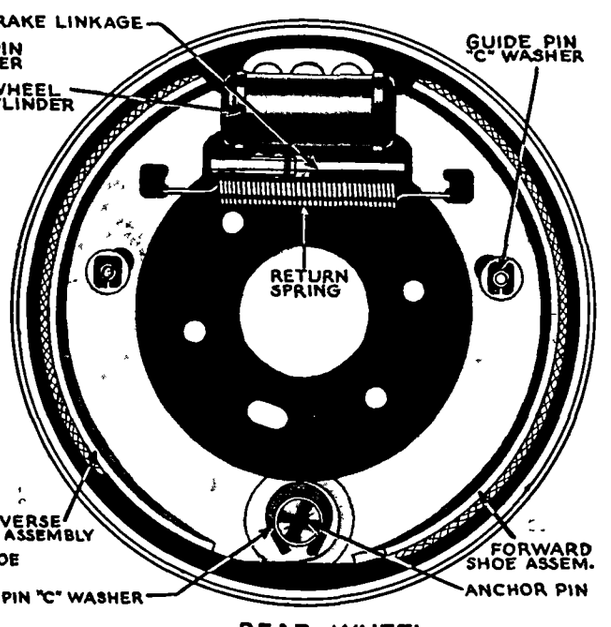
SERVICING:—Except for shoe removal and installation, all service operations including Bleeding of Lines, Master Cylinder & Wheel Cylinder Overhaul are same as for other Lockheed Brakes. See preceding article on Lockheed Double Anchor Type Hydraulic Brakes and separate article on Hydraulic Brake Servicing for complete data.

Brake Shoe Removal & Installation. To remove brake shoes for relining or servicing, remove anchor pin locknut on backing plate, free 'C' washer and remove plain washer on guide pin at center of each shoe, pull toe end of shoe free of wheel cylinder piston slot and boot. Remove 'C' washer on anchor pin, remove shoe. Reassemble shoes in same manner.

Wheel Cylinder Installation. Wheel cylinder on front wheels has greater diameter than rear wheel cylinder. Use extreme care not to interchange cylinders which would cause badly unbalanced brake action.



FRONT WHEEL



REAR WHEEL

HYDRAULIC BRAKE TROUBLE SHOOTING

TROUBLE SHOOTING:—Brake Pedal goes down to floor.

1—Excessive shoe clearance due to wear—Adjust brakes. If adjusting screw must be turned up more than 50 clicks or notches, examine lining for replacement.

2—Leaks in system. Minor leaks evident by gradual slacking off of brakes when applied with pedal depressor. Examine lines and wheel cylinders. When caused by contraction of piston cups due to extreme cold, correct by installing special expanders (between cup and spring) and special springs (shorter than standard).

3—Air in Brake System—when present in considerable quantity (smaller amount evidenced as 'springy' pedal). Bleed system.

4—No fluid in supply tank. Lines must be bled if supply tank allowed to become empty.

Brakes drag at all wheels:—

1—Mineral oil in system—causes rubber piston cups to expand. Wash out master cylinder, lines and wheel cylinders with alcohol, replace rubber piston cups, refill with genuine brake fluid.

2—By-Pass port in master cylinder clogged or covered by piston. See that port is uncovered with piston in extreme off or outer position to allow fluid return to supply tank (see brake pedal adjustment directions in each brake article

Brakes drag at one wheel:—

1—Weak or broken return spring. Replace springs. See that stronger spring is attached to secondard shoe.

2—Improper adjustment (shoe clearance too small).

3—Cylinder cups distorted or incorrectly installed. Lip of cup must point in.

4—Loose front wheel bearings.

Car pulls to one side:—

1—Oily linings. Replace shoes or reline.

2—Improper adjustment (shoe clearance too small).

3—Loose backing plate, loose front spring U bolts.

4—Incorrect lining type or length. See specifications in Car articles.

5—Incorrect or uneven tire inflation pressures.

6—Brake drums out-of-round or scored.

7—Brake lines kinked, hose plugged.

Brake Pedal Springy:—

1—Air in system. Bleed lines.
2—Brakes shoes incorrectly adjusted.

Brake Pedal 'Hard':—

1—Improper adjustment.
2—Incorrect lining type.
3—Oily linings—replace or install new shoes.
4—Partial contact—high spots. Linings should be ground concentrically.

Brake Pedal 'Soft':—

1—Improper adjustment.
2—Dust shield or backing plate loose.
3—Oily linings.

SERVICING NOTE:—See following article for directions for bleeding lines and servicing of master and wheel cylinders. See separate brake articles for brake shoe and brake pedal adjustment directions.

HYDRAULIC BRAKE SERVICING

BLEEDING BRAKE LINES:—Remove master cylinder supply tank filler cap, fill tank with genuine brake fluid, keep tank filled with fluid during entire bleeding operation (air will be drawn into brake lines if tank allowed to become dry). Remove screw in bleeder valve on wheel backing plate, install special fitting and hose connection. Submerge free end of hose in brake fluid in clean glass container. Unscrew bleeder valve ½-¾ turn, press brake pedal down by hand approximately half of travel, allow pedal to return slowly. Repeat operation until fluid flow from tube is completely free from any air bubbles, then close bleeder valve, remove hose connection and replace dustscrew. Bleed lines at each wheel in same manner.

CAUTION—Use extreme care not to allow supply tank to become dry during bleeding operation. If automatic refiller unit not used, supply tank should be filled after every 6-10 strokes of the brake pedal (automatic refiller will maintain level in supply tank without attention during bleeding operation).

SERVICING:—Wheel Cylinders—To disassemble wheel cylinders, remove brake shoes, take out wheel cylinder mounting screws, withdraw cylinder through backing plate. Disconnect brake line, remove piston boots, withdraw pistons. Examine cylinder bore. If corroded or scored, cylinders can be lapped or honed and oversize pistons fitted. Piston clearance (metal piston) in cylinder should be .001-.003" and must never exceed .005". In assembling wheel cylinder, wash all parts in alcohol, dip rubber piston cups in Brake Fluid, and insert ahead of piston with lip in. Central return spring in stepped cylinders is tapered and should be installed with small end toward piston in smaller bore. Reconditioned cylinders should be tested for leakage in fixture under alcohol with 8 lbs. and 80 lbs. air pressure. Wheel must be bled when wheel cylinder reinstalled.

Piston Cup Expanders—Can be used with special return spring in wheel cylinders to correct leakage caused by piston cup contraction in extreme cold temperatures. Expander should have .005" clearance in cylinder and should fit into open end of piston cup with slight clearance. Install expanders with cupped face in and use special return spring which is ½ turn shorter than standard spring.

Master Cylinder:—To disassemble master cylinder, remove rubber boot and push rod or link, take out retainer spring and piston stop, withdraw piston. Examine cylinder. If corroded or scored, cylinder can be lapped or honed and oversize piston fitted. Clearance should be .001-.003". In reassembling, wash all parts in alcohol, dip in Brake Fluid, see that check valve is installed correctly and that thin washer is in place between piston and primary piston cup. Insert piston with lips on both primary and secondary cups in. Test for leaks in same manner as for wheel cylinders and bleed entire system when installed on car.

By-pass Port Note—By-pass or compensating port connecting supply tank and master cylinder must be uncovered with the master cylinder piston against its stop. When installing master cylinder piston assembly, hold piston against stop and make certain that this port is not covered by lip of primary cup.

CAUTION—When master cylinder installed on car, brake pedal must be adjusted for correct pedal clearance or free-travel to insure this by-pass port being uncovered with pedal released and master cylinder piston against its stop. Brakes will drag if this port is not open.

HILL-HOLDER

Std. or Optl. Equipment On:

HUDSON, STUDEBAKER, TERRAPLANE & OTHER CARS

DESCRIPTION:—Hill-holder consists of a ball check valve connected in the brake line at the master cylinder and controlled by the clutch pedal.

OPERATION:—The valve cage with the rubber seal orifice is normally held away from the valve seat by the clutch pedal controlled camshaft (with the clutch engaged) so that the valve is open and brake operation is conventional. When the clutch is disengaged, the rotation of the camshaft permits the spring behind the valve cage to force the cage back so that the rubber seal seats against the valve seat. If the car is pointed uphill, the ball within the valve cage rolls down against the rubber seal, closing the orifice within the seal so that the brake fluid in the lines is prevented from returning to the master cylinder and brakes are held 'on' even though brake pedal is released. When the clutch is engaged, the valve cage is pulled away from the valve seat uncovering the return passage to the master cylinder and releasing the brakes. If the car is on a level road or pointing downhill, the ball will not close the rubber seal orifice.

ADJUSTMENT:—Operating lever position must be checked (to insure correct timing of brake release when clutch is engaged) whenever clutch pedal is adjusted. See Clutch pedal adjustment instructions on car model 'M' pages or adjust as follows:

Adjustment:—Check setting by applying brake on slight incline with clutch disengaged, then shift into low gear, engage clutch slowly and note point at which brakes release. If brakes release too soon and car has tendency to roll backward, loosen locknut and turn adjusting nut on end of control rod away from pedal to lengthen rod. If brakes release late and engine has tendency to stall, turn nut in to shorten rod. Tighten locknut and check setting.

Mounting:—Hill Holder must be mounted in level position on car frame. **To check, place spirit level on bosses on top of hill-holder body casting with car** standing on level floor. Unit must be leveled lengthwise (place spirit level on two bosses on top of unit), and crosswise (place spirit level crosswise on one boss).

Hudson & Terraplane 1937 Model. When leveling the unit on these models, place .052" shim stock between spirit level and boss on forward end of Hill Holder unit (no shim used at rear end), adjust unit until spirit level is horizontal. Level unit crosswise by placing spirit level on forward boss.

NOTE—Do not use this shim when leveling unit on 1938 Hudson and Terraplane models.

SERVICING:—Before dismantling unit mark shaft and lever and replace in same position. Remove ball chamber head plug and spring, withdraw camshaft being careful not to lose camshaft spring, withdraw ball cage assembly. In reassembling unit, see that ball cage is installed with two large ball rail rods underneath camshaft, and that camshaft spring is in place at inner end of camshaft.

NOROL

Optional Equipment On:

BUICK, CHEVROLET, NASH & OTHER CARS.

DESCRIPTION & OPERATION:—Similar to Hill Holder (see following article). NoRol unit is mounted on brake master cylinder and controlled by lever linked to clutch pedal.

INSTALLATION:—Disconnect tubes from outlet connection on master cylinder, remove bolt and outlet fitting, assemble bolt and fitting to outlet connection on NoRol valve housing (use new gaskets). Attach unit to master cylinder using new bolt and gaskets. Attach NoRol lever to clutch pedal lever using rod and fittings supplied with unit. Adjust as directed below.

ADJUSTMENT:—NoRol unit position must be checked (see below) when installed, and lever setting must be checked whenever clutch pedal adjusted (see instructions on car model 'M' pages or adjust as follows:

Adjustment:—Check setting by applying brake on slight incline with clutch disengaged, then shift into low gear, engage clutch slowly and note point at which brakes release. If brakes release too soon and car has tendency to roll backward, loosen locknut and turn adjusting nut on end of control rod away from pedal to lengthen rod. If brakes release late and engine has tendency to stall, turn nut in to shorten rod. Tighten locknut and check setting.

NoRol Mounting:—Unit must be level (crosswise and lengthwise of car) when installed. Check with spirit level on bosses provided on top of NoRol housing. Adjust by loosening mounting bolts and shifting unit slightly. Car must be placed on level floor and all tires inflated to correct pressure when making this check.

SERVICING:—Mark shaft and lever to insure replacement in same relative positions. Remove plug on head of unit, and withdraw spring, valve cage assembly, shaft and spring. Assemble in same positions and check lever setting.

MIDLAND STEELDRAULIC TYPE

Used on:

AUBURN, MODELS 8-100, 8-100A (1932).
HUPMOBILE, MODELS 216, 222, 226 (1932).
HUPMOBILE, MODELS 321 (1933), 421, A (1934).
HUPMOBILE, MODELS 322 (1933), 422 (1934).
HUPMOBILE, MODELS 326 (1933), 426 (1934).
HUPMOBILE, MODELS 417-W (1934), 517-W (1935).
HUPMOBILE, MODELS 421-J (1934), 521-J (1935).
HUPMOBILE, MODELS 427-T (1934), 527-T (1935).
NASH, BIG SIX MODEL 1120 (1933).
NASH, EIGHTS STD. 1130, SPEC. 1170 (1933).
STUDEBAKER, DICTATOR MODEL A (1934).

NOTE:—Bendix Vacuum Power Unit on Studebaker Dictator Yr. Ahead model (after June 26, 1934). Midland Vacuum Power Unit used on Hupmobile 521-J, 527-T (1935). See separate articles for data on these units.

DESCRIPTION & OPERATION:—One shoe per wheel. Shoe is semi-flexible type extending in complete circle around drum with both ends bearing against single anchor pin at top. Forward end of shoe is flexible and contacts drum first when brakes applied, furnishing self-energizing action to apply remainder of band. Rear end of shoe is strengthened by web forming 'T' section and this end of shoe bears against anchor pin for brake application when car moving forward. Brake actuated by toggle type levers linked between shoes at anchor pin end operated by cable control from cross-shaft on frame. Shoes returned to off position by return spring connected between ends of shoe at anchor pin end and additional return spring hooked to backing plate and shoe web near centralizing cam.

Brake Linkage:—Cable control from cross-shaft on frame. Cables adjustable at cross-shaft clevises.

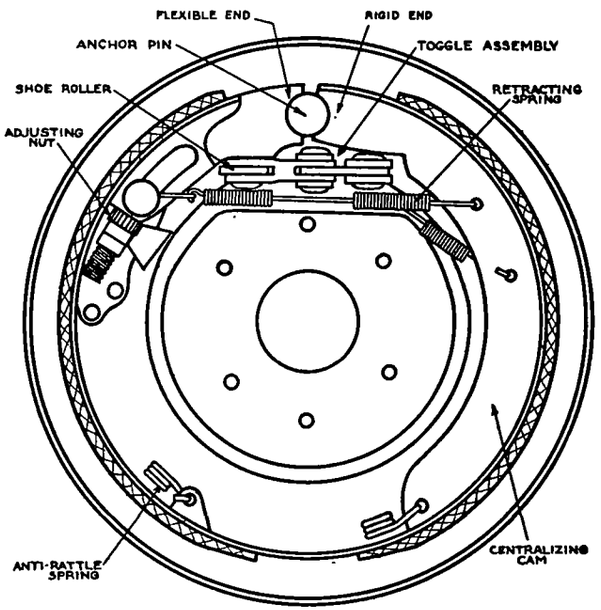
Hand Brake:—Hand lever linked to cross-shaft and applies all four service brakes.

ADJUSTMENT:—Jack up all four wheels. Check brake pedal to cross-shaft linkage, see that cross-shaft against stop with brakes released (see special instructions for Studebaker pedal linkage adjustment below), lubricate all parts of brake linkage. Make following adjustment in order.

1. With hand lever and brake pedal in released position and cross-shaft against stops, loosen locknut on adjusting rod at cross-shaft end of each cable, hold ferrule from turning and adjust cable length by turning rod in or out of ferrule until clearance between anchor pin and flexible end of brake shoe is 1/16" (check through inspection hole in brake drum). This clearance must be uniform at each wheel.

2. At each wheel, loosen centralizing cam locknut on backing plate, turn cam until slight drag evident, back off cam until wheel is free, tighten locknut. More exact adjustment can be made by turning wheel until inspection hole in drum is opposite cam, and turning cam until clearance as measured by feeler gauge is approximately .020". Hold cam from turning while tightening locknut.

3. Apply brakes, by depressing pedal with pedal jack halfway to floor. At each wheel, remove adjusting screw cover on backing plate, turn adjusting screw until heavy drag felt when wheel rotated by hand in forward direction. Drag must be equal on all wheels. Equalize by backing off adjusting screw on tight wheel slightly. Release pedal and check for drag. Wheels should revolve freely without drag.



Studebaker Pedal Linkage Adjustment:—On this model brake pedal is connected to cross-shaft lever by double links (non-adjustable link at rear, adjustable link at front). Pedal travel should be 6" and is controlled by length of rear non-adjustable link. Three types used: Part No. 182526—3 5/64", 182527—3 9/64", 511403—3 13/64". Shortest link provides greatest pedal travel. On first cars with less than 6" pedal travel, new shorter link may be substituted for original link. To adjust links, depress pedal slightly until tension placed on clevis pins in rear link. Loosen locknut and turn clevis at lower end of forward link until slight compression placed on clevis pins in this link when connected.

NOTE—Two sets of holes provided in pedal and cross-shaft for link connection. These holes marked '1' (inner or short radius), '2' (outer or long radius) in pedal and lever. Both links must be connected to same numbered holes at top and bottom. No. 2 provides standard pedal pressure. No. 1 will provide softer action and lower pedal pressures.

RELINING BRAKES:—Molded lining used on all brakes. Lining applied in two pieces with cutaway section diametrically opposite anchor pin.

NOTE—On Studebaker model, different type lining used on each end of shoe. Factory recommendations are Manhatten DV-2320 for rigid end of shoe, Raybestos 453-R for flexible end of shoe.

SERVICING:—When replacing brake shoe assemblies, see that long end of toggle (attached to rigid end of shoe) is assembled next to the backing plate and that the toggle attached to the brake cable is assembled with the yoke away from the backing plate.

MIDLAND BRAKE BOOSTER VACUUM POWER TYPE

Used on:

HUPMOBILE, MODEL 521-J (1935).

HUPMOBILE, MODEL 527-T (1935).

DESCRIPTION & OPERATION:—Vacuum cylinder mounted on left frame side rail and connected to linkage between right and left brake levers on frame 'X' member center plate. Piston type vacuum control valve mounted on bracket built in forward end of brake pedal pull rod with valve lever pivoted on bracket and linked to pedal pull rod clevis pin. Clevis pin hole in pull rod provided with slight clearance to permit valve operation when brakes applied (movement of pedal to take up free play before brakes applied operates valve).

ADJUSTMENT:—Brake pedal linkage must be adjusted so that clearance between pull rod clevis hole and clevis pin is ahead of the pin with brakes released and pedal and brake levers against stops. Adjust valve by loosening locknut and turning valve piston rod until valve piston is all the way forward (out) and against stop with brakes released. Adjust vacuum cylinder piston rod length so that piston is bottomed in cylinder with brakes released.

TROUBLE SHOOTING:—Control Valve—To check control valve for leaks, first check setting and see that valve piston is against its stop with brakes released (heavy pedal return spring may hold brake pedal away from stop and move valve piston from off position), connect vacuum gauge to control valve outlet or vacuum cylinder end of hose. Gauge should register '0' with brakes released and register approximately 18" when brakes applied (engine must be idling when making this test). Oil valve piston by injecting one or two drops light engine oil in cylinder.

Vacuum Cylinder—To check vacuum cylinder for leaks, disconnect hose coupling, pull piston all the way out, seal vacuum inlet, push piston back into cylinder. Piston should hold out. If piston can be moved, piston seal is leaking. Inject one ounce light oil, work piston back and forth to distribute oil on piston and walls, repeat test.

Used On:

PIERCE ARROW EIGHTS, MODELS 836, 39 ('33), 836A, 40A ('34), 845 ('35), 1601 ('36).
PIERCE ARROW TWELVES, MODELS 1236, 42, 47 ('33), 1240A, 48A ('34), 1245, 55 ('35), 1602, 3 ('36).
PIERCE ARROW 8, 1701 ('37), 1801 ('38)
PIERCE ARROW 12, 1702, 3 ('37), 1802, 3 ('38)

NOTE:—Stewart-Warner Power Unit (mechanical servo or power take-off mounted at rear of transmission) used on 1933-34-35 models but superseded by Bendix Vacuum Power Unit on 1936 and later models. See separate article for data on Bendix unit.

DESCRIPTION AND OPERATION:—Wheel Brakes—Two shoes per wheel anchored at adjusting screw end (heel) and operated by floating cam on brake shaft at opposite end (toe). Front brake shoes released proportionally to turning angle when turned from straight-ahead position. Shoes held in off position by short retracting spring hooked to shoe at center. Adjustments consist of centralizing screw (set angularly on backing plate so that tapered head contacts web of one shoe) and adjusting nut at anchor end which expands shoe.

Linkage:—Consists of single cable in conduit from brake lever forward to front brake cross-shaft and rearward to rear brake cross-shaft. Brake operating cams float on ends of cross-shafts. Cables require adjustment only when chassis units serviced.

Hand Lever:—Applies all four service brakes. Provided with 'overrun' which provides automatic take-up in service. Overrun must be reset in lower position when brakes are adjusted.

ADJUSTMENT:—For Wear—Set hand lever in off position, see that pin is engaged in lower slot of brake rod overrun and that pin does not contact forward end of slot. Set front wheels in straight-ahead position (important). Jack up all 4 wheels, at each wheel, turn hexagonal adjusting screw clockwise until wheel can just be turned by hand, then back off adjusting nut 9 notches (front wheels), and 12 notches (rear wheels), tap nut snugly toward backing plate. One notch on nut moves shoe .001" (measured at center) and there are 6 notches per revolution of the nut. If wheel does not turn freely after adjusting, turn centralizing screw on backing plate in or clockwise until brake drags appreciably, then back screw off until wheel is free. Road test car and equalize wheels. Braking force is 54% front wheels, 46% rear wheels.

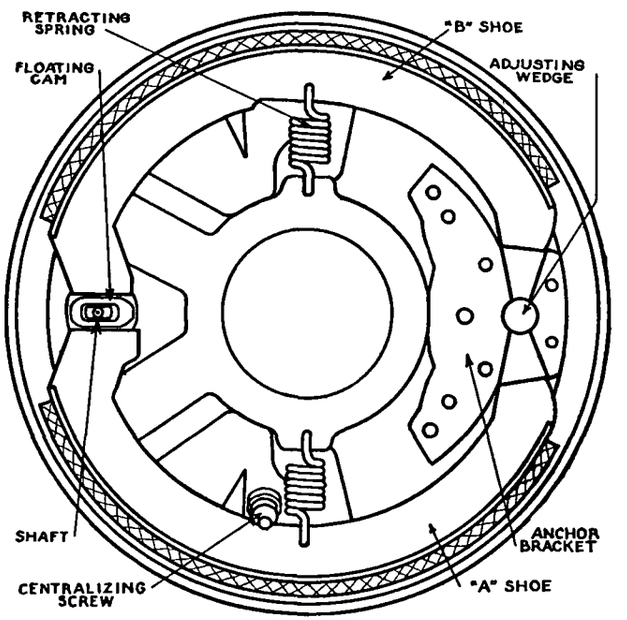
Treadle Adjustment (Stewart-Warner Power Unit Only):—Treadle height adjustable by removing clevis pin under toe of treadle and turning clevis up or down on rod as desired. Treadle pressure adjustable by changing location of clevis pin in pedal shank and in input yoke shaft lever on power unit. Holes marked as follows: 'A' pedal upper hole, 'B' pedal lower hole, 'C' power unit lever upper hole, 'D' power unit lever lower hole. Use combination A-D for highest, A-C medium, B-D low, B-C lowest treadle pressure. Readjust power unit when treadle rod changed.

Stewart-Warner Power Unit Adjustment:—Turnbuckle at rear end of treadle-to-power unit rod should be adjusted to maintain treadle free movement of 1½" (measured at toe of treadle from extreme off position to point where definite resistance felt when treadle depressed). To adjust, loosen locknuts at end of turn-buckle and turn turn-buckle (rod threads are right and left handed).

NOTE—If treadle free movement is insufficient or heavy lubricant is used in transmission and power unit in cold weather, brakes may drag when car is first started cold. Correct by checking power unit adjustment and by draining transmission and power unit case and filling with correct lubricant.

Hand Lever Adjustment:—After adjusting brakes (above), loosen locknut and adjust clevis at rear of hand lever brake rod until only slight clearance remains between lever pin and end of lower slot in overrun at forward end of brake rod.

Linkage Adjustment:—When cable adjustment required, see that cable conduit support springs are in place and fastened so that cable does not sag, place hand lever in 'off' position with pin engaging lower slot of rod overrun, set front wheels in straight-ahead position, loosen both cable adjustment locknuts and adjusting nuts at brake lever, turn up adjusting nut at each wheel until wheel can just be turned by hand, back off nut 2 notches, tap nut against backing plate. Tighten cable adjustment nuts until wheel can just be turned, tighten cable



adjustment locknuts. Adjust wheel brakes as directed above.

RELINING BRAKES:—Manufacturer recommends installation of factory-lined shoes which are accurately ground. Shoes interchangeable in pairs.

SERVICING:—Removing and Installing Shoes—Use special spring tool to extend retracting spring permitting removal of shoe. If tool not used, pull 'A' shoe out radially until it hooks over two embossed shoe rests on backing plate, repeat with 'B' shoe, slide cam off shaft. Pull 'B' shoe away from backing plate to free it from rests, pull anchor end out of anchor bracket, holding cam end out so that it is free to overlap 'A' shoe, swing cam end against spindle, unhook spring, remove 'B' shoe.

Pull adjusting nut and wedge assembly out of anchor bracket, wipe all parts clean, lubricate bearing surfaces with graphite grease. See that tapered grooves in adjusting wedge assembly lines up with openings in anchor bracket when reassembling.

STEWART-WARNER POWER UNIT

DESCRIPTION & OPERATION:—Power unit consists of a small single plate disc clutch controlled by the input yoke and mounted on the splines on the actuator unit. Actuator unit consists of two sleeves threaded together so that either sleeve is free to move endwise by rotating on the other. Outer or forward actuator is splined in clutch disc and inner or reverse actuator is splined on shaft. Output yoke on which levers for front and rear brakes are located is mounted directly in front of actuator unit on shaft. Treadle pressure to apply brakes moves clutch pressure plate backward causing clutch or friction disc (which rotates with shaft) to drag between pressure plate and machined face at rear of housing. This slowing down of the friction disc causes one actuator (outer if car moving forward, inner if car moving backward) to screw forward applying pressure to the output yoke and rotating the output shaft to apply the brakes.

SERVICING:—Replacement of friction disc should be only service operation required and unit need not be dismantled further than required to remove disc. Manufacturer recommends installation of new disc.

Disassembling Power Unit:—Disconnect brake rods on levers, take out cotter pin and pull conduit and cable out of power unit cover, disconnect front universal joint, drop propellor shaft, remove universal joint companion flange. Take out power unit housing cover screws, remove cover, remove three presure plate springs, splined spacer, thrust washer assembly, friction disc, actuators, pressure plate, and actuator thrust bearing. Remove screw and spring washer on output shaft lever at left side, remove lever and washer on cork seal, hold output yoke and pull shaft out of housing. Remove input lever clamp screw, remove input lever and key, take out two screws in oil seal cap, remove cap and cork oil seal, tap out flanged bushing from inside of case.

Servicing:—Wash all parts in gasoline. Thoroughly oil thrust bearings, actuators, input yoke, output yoke shaft and brake lever hub before reassembling.

Reassembling Power Unit:—Install input yoke and lever assembly (use new cork oil seal if necessary). Place steel washer on output shaft against brake lever, use new oil seals in housing, hold output yoke in position and install shaft, engaging splines so that yoke and brake lever are both vertical when lever rotated back on shaft (slot in yoke positions it over guide pin in housing). Assemble washer on oil seal and return spring lever on end of output shaft. Install actuator thrust bearing so that lettering on face **"Important—Worm Actuators must bear against this face"** can be read with bearing in place. Damage will result if this bearing is reversed. Install inner and outer actuator assembly on splined shaft **with shouldered end to rear (visible after assembly).** Install pressure plate on guide pins with machined surface to rear, install friction disc **with spokes of disc to rear (visible after assembly).** Place thrust washer in position on shoulder of actuator with flanged edge of thrust washer casing to rear so that assembly fits over shoulder on actuator. Assemble splined spacer on shaft, install pressure plate springs, replace cover. Adjust power unit.

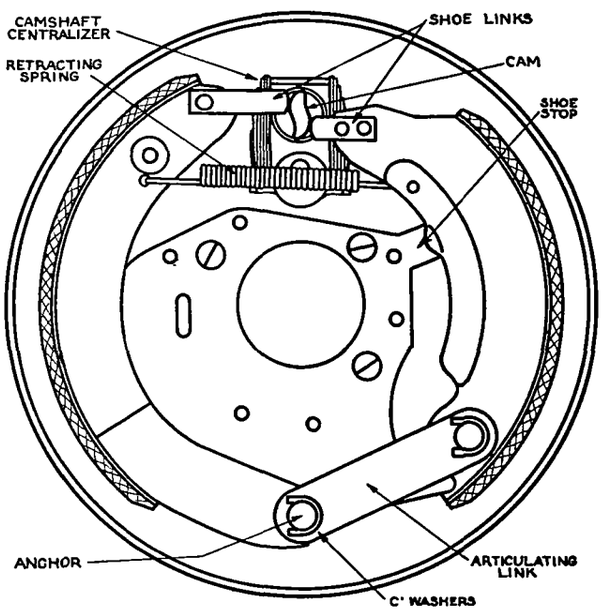
Adjustment:—With output yoke in extreme off position (normal position with return spring connected) and treadle rod connected, tighten turn-buckle until slight drag felt when universal joint flange turned by hand, back off turn-buckle until drag eliminated, then back off one-half turn additional.

BUICK (OWN) MECHANICAL TYPE

Used on:
BUICK, MODELS 50, 60, 90 (1932-33-34-35).
BUICK, MODEL 80 (1932-33).

DESCRIPTION & OPERATION:—Wheel Brakes—Two shoes per wheel. Shoes are self-energizing with upper shoe mounted on articulated link at anchor pin end. Shoes actuated through segmental links by cam at opposite end. Shoes returned to off position by single retracting spring linked between shoes at cam end.

Brake Linkage:—Brakes operated by pull rods from single cross-shaft on frame. Flexible cables used at wheel ends of pull rods (except for rear wheels on 1932-33 models with rods connected directly to brake levers on backing plates). Brake pedal connected to cross-shaft by adjustable pull rod with optional connection at pedal to provide hard or soft pedal.



Hand Lever:—Connected to cross-shaft by adjustable pull rod and operates all four service brakes. Adjusted as part of service brake adjustment.

Power Unit:—Vacuum power unit used on 1934-35 models. Plain type vacuum cylinder mounted on frame and linked to cross-shaft. Control valve connected in brake pedal linkage. See separate article on Bendix Vacuum Power cylinder for complete adjustment data.

ADJUSTMENT:—Adjust brakes when pedal reserve (distance to floor with brakes on) decreases to 2" or 3" for high speed driving. Adjustments must be made with drums cold. Make adjustments in following order.

Linkage—Adjust pedal stopscrew so that pedal is against rubber pad on under side of toeboard (50 '32-33; 60, 80, 90 '33), or pedal clearance is 3/16" (60, 80, 90 '32), 3/8" (all models '34-35). See that pedal pullrod is connected to lower hole in pedal (50 '32-33-34-35; 60, 80, 90 '32) or upper hole (60, 80, 90 '33-34-35). With cross-shaft in released position against stop pin, adjust length of pedal pullrod by loosening locknut and turning pedal end clevis until clevis pin can just be entered (on 1934-35 models vacuum cylinder valve must be in fully released position). See that hand lever is fully released, adjust length of hand lever pull rod to remove all slack. Disconnect all wheel pull rods at cross-shaft levers, see that each wheel brake operates freely and is in off position (levers against stops on backing plates). Adjust each pull rod to remove all slack. On 1934-35 models with vacuum power, pull power cylinder piston back to released position and adjust power cylinder pull rod to remove slack.

Brake Shoes—Jack up all four wheels. Loosen cam centralizer clamp bolt nuts on backing plate at each wheel (nuts must be free on lockwashers to allow cam to centralize). Turn up adjusting nut on adjusting levers at each wheel so that heavy drag secured and wheel can just be turned by hand. Tighten centralizer clamp bolt nuts. Back off adjusting nut at each wheel exactly 14 flats (for new lining), or 12 flats (after lining has been run in). Slight drag permissible with new lining. Apply brakes firmly to seat adjusting nuts against adjusting levers and see that spring locks engage adjusting nuts so that they will not loosen in service. Equalize brakes by slacking off adjusting nut on tight wheel slightly. This setting equal to approximately 1¾" pedal travel.

NOTE—Slightly harder pedal pressure is secured with pedal pull rod connected in upper hole on pedal. See linkage adjustment above for standard connection on each model.

SERVICING:—Brake Shoes—To remove brake shoes, unhook retracting spring and take out 'C' washers on anchor pin and articulating link pin. When replacing shoes see that washers clinched to prevent their dropping out into drum. Friction spring at end of articulated shoe must have 50 lbs. pressure when assembled to prevent movement of shoe due to road shock. Guides on shoe and anchor plate must not bind but must prevent shoe play. See that centralizer springs are parallel so that they bear on both the centralizer casting and stamping.

Brake Linkage—Lubricate brake cables twice each year using SAE. #160 lubricant. Special fittings necessary to inject lubricant into cable conduits.

CADILLAC (OWN) MECHANICAL TYPE

Used on:
LA SALLE V8, 345-B ('32), 345-C ('33).
CADILLAC V8, 355-B ('32), 355-C ('33), 355-D ('34-35).
CADILLAC V12, 370-B ('32), 370-C ('33), 370-D ('34-35).
CADILLAC V16, 452-B ('32), 452-C ('33), 452-D ('34-35).
CADILLAC V16, SERIES 90 (1936).

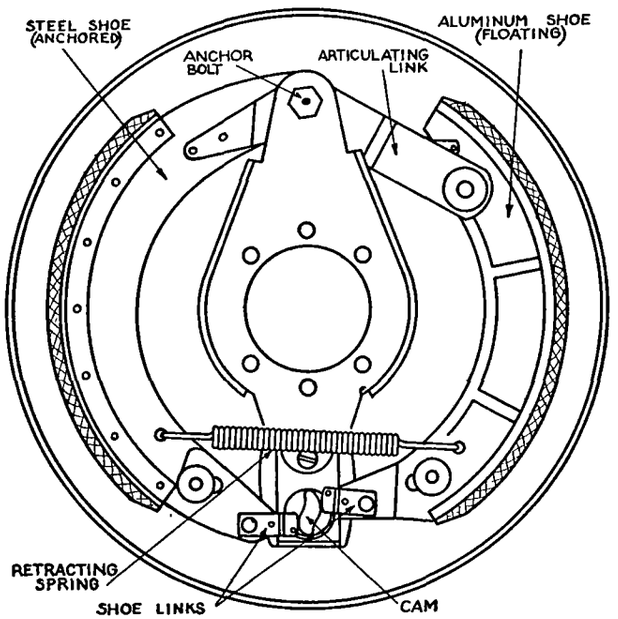
DESCRIPTION:—Wheel Brakes—Two shoes per wheel, Shoes mounted on articulating links at anchor (forward) end and actuated by cam through links pivoted on shoes at rear end. Upper (self-energizing) shoe does major portion of forward car braking and is aluminum with thicker lining than lower (steel) shoe. Shoes returned to 'off' position by single retracting spring hooked between shoes. Adjustment provided at cam lever on backing plate at each wheel.

Linkage (All Models 1932-33):—Front brakes operated by pull rods and cables (cable at wheel end protected by armored conduit) from one cross-shaft. Rear brakes operated by pull rods connected between second cross-shaft and short individual shaft for each wheel on rear axle housing. Brake pedal linked to equalizer between cross-shafts for 60% front, 40% rear braking.

Linkage (All Models 1934-36):—Front and rear brakes operated by pull rods and cables (cables at wheel end in conduit). Front wheel pull rods connected to rear cross-shaft, rear pull rods to front cross-shaft with pedal linked to equalizer between shafts for 60% front, 40% rear braking.

Hand Brake:—Hand brake lever linked to front cross-shaft and applies rear service brakes.

Power Unit:—Bendix internal valve type linked to brake pedal lever. See separate article for complete adjustment data (adjustments on La Salle and Cadillac V8 not the same as on other models due to differences in linkage).



ADJUSTMENT:—Check linkage if not known to be OK. before adjusting brakes at each wheel.

Linkage Adjustment (1932-33 Models):—See separate article on Bendix internal valve type Vacuum Power Unit for adjustment of brake pedal lever and valve lever. With cross-shafts against stops, see that clearance between pedal and underside of toeboard is 3/8-5/8". Adjust by loosening locknut and turning pedal stopscrew under pedal shaft. Adjust length of pedal pull rod so that clevis pin at pedal end of rod is at forward end of slot. Check cam lever positions by measuring distance from nearest face of cable clamp bracket to center of cable link pin in auxiliary lever (front wheels) or lever spring length from spring hole in lever to hole in backing plate (rear wheels). Adjust by changing length of pull rods so that these distances are 3 5/8" (front wheels), 4 15/16" (rear wheels).

(1934-36 Models):—See separate article on Bendix self-contained type Vacuum Power Unit for adjustment of brake pedal and lever, and valve lever. With pedal position correct and 1/32" clearance between end of clevis and pin at forward end of pedal pull-rod, and cross-shaft levers against stops, check

CADILLAC (OWN) MECHANICAL CONT.

cam lever position on each wheel by measuring distance from nearest face of cable clamp bracket to center of cable link pin in cam lever (rear wheels) or auxiliary lever (front wheels). Adjust clevises at cross-shaft ends of cables so that these distances are 3⅝" (front), 3 13/16" (rear).

Brake Adjustment:—
1—At each wheel, loosen cam bracket locking nut, apply brakes firmly to centralize cam bracket, tighten nuts before releasing brakes.

2—Check brake equalization between wheels. If braking action equal in all wheels, turn down all 4 cam lever adjusting nuts equal number of turns until pedal travel to apply brakes is 2¼"(1 1/6 turns of adjusting screw equal to 1" pedal travel). If braking action not equal, turn down each cam lever adjusting nuts until brakes drag, then back off all nuts same number of turns for correct pedal travel of 2¼". Recheck equalization.

Hand Brake Adjustment:—With hand lever in 'off' position, brakes released, and cross-shaft levers against stops, adjust length of hand brake cable at hand lever to allow 1/16-⅛" free travel of lever (1932-33 models) or adjust at cross-shaft end to eliminate all slack (1934-36 models).

RELINING BRAKES:—See Car Model article for special lining specifications for each shoe. New linings should be chamfered 1/32" for distance of ¾" back at each end of shoe and rivet hole burrs removed.

SERVICING:—Brake Cables—Fittings provided for lubrication of cable conduits.
Brake Cams:—Lubricated by removing cotter pin in cam lever, withdrawing cam, packing the bearing behind cam with grease.

CHEVROLET (OWN) MECHANICAL TYPE

Used on:

STANDARD MODEL CC ('33), DC ('34), EC ('35).
MASTER MODEL CA ('33), DA ('34), EA, ED ('35).
TRUCK MODELS CB,O ('33), DB,P ('34), EB,Q ('35).

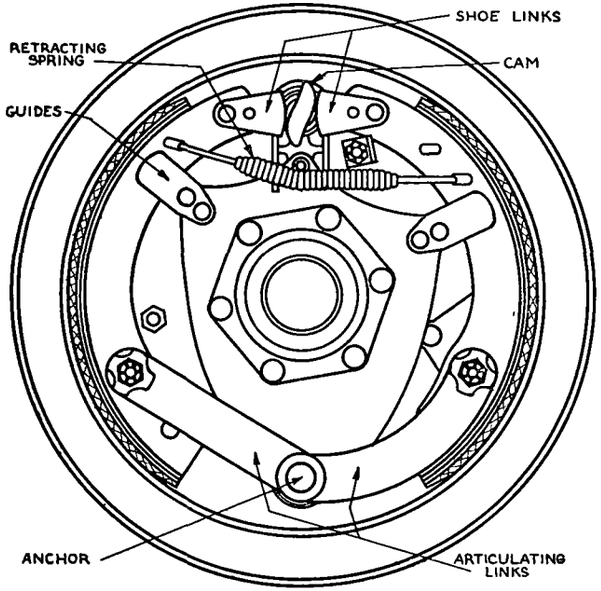
DESCRIPTION & OPERATION:—Wheel Brakes—Two shoes per wheel. Shoes are self-energizing type mounted on articulating links at anchor end and operated through segmental links by cam at opposite end. Guides for each shoe are mounted on mounting plate. Shoes returned to off position by retracting spring between shoes at cam end.
NOTE—Two additional shoes used in rear wheels on 1½ ton truck models. These shoes operated by hand lever which also applies all service brakes through cut-in linkage at cross-shaft.

Brake Linkage:—Brakes operated by rods, with flexible cable ends at wheels, from cross-shaft on frame. On all models (1933) and 1½ ton truck models (1934-35) cables not used for rear wheels and rods connected directly to cam levers on backing plate. Cross-shaft and linkage must be adjusted when brakes adjusted.

Hand Brake:—Hand lever linked to cross-shaft and operates all service brakes. On 1½ ton truck, hand lever also operates two additional shoes in each rear wheel. See separate section below for adjustment of this model.

ADJUSTMENT:—Service Brakes—Adjustments on all models must be made in the following order: 1. Linkage, 2. Centralizing Shoes, 3. Shoe Clearance, 4. Hand Brake (1½ ton truck only).

Linkage Adjustment (all cars 1933, 1½ ton trucks 1933-34-35)—Disconnect pedal return spring and all pull rods on cross-shaft, loosen cross-shaft bracket nuts (passenger cars only), adjust cross-shaft to pedal brace so that cross-shaft is free (trucks only). Install brake gauge on cross-shaft (special type for each model), see that pedal is against stop, adjust pedal pull rod by loosening locknut and turning rod until clevis pin at pedal end of rod is in extreme forward position. Place hand lever in off (forward) position, adjust pull rod length by loosening locknut and turning clevis until rod end pin is in extreme forward position (passenger cars) or at extreme rear end of slot (trucks). Adjust pull rods to front and rear wheels to remove all slack with cam levers on backing plate against stops. On front wheel pull rods, remove slack from cables by pulling on cable until cam lever on backing plate does not quite move (lever must remain against stop), and adjust by loosening locknut and turning rod into



cable end connector. Remove gauge, see that shaft is in center of hand lever cross-shaft bracket, tighten cross-shaft bracket nuts (pass. cars only).

Linkage Adjustment (all 1934-35 models except 1½ ton truck)—Disconnect all pull rods and return spring on cross-shaft. Set hand lever in extreme forward position, adjust pull rod by loosening locknut and turning rod until length from rear of hole at forward end to rear end of slot at back is 15¾" (DA), 15⅝" (EA, ED), 11½" (DB, EB), 9⅜" (DC, EC), assemble pull rod. Adjust brake pedal stop so that pedal clears floor board by ¼". With brake pedal against stop, adjust pedal pull rod by loosening locknut and turning rod until clevis pin can just be inserted in cross-shaft lever, connect pull rod. Adjust pull rods to front and rear wheels to remove all slack by pulling on cables until cam levers on backing plate do not quite move (levers must be against stops), loosening locknut and turning rod in cable end connector until pull rod clevis pins can just be inserted in cross-shaft levers, connect pull rods.

Centralizing Brake Cams—See that front wheel bearings properly adjusted, loosen cam centralizer clamp bolts on each wheel, make sure that centralizers are free by tapping adjuster lever hub nut. Apply brakes with quick hand pressure on pedal, hold brakes on, tighten all centralizer clamp bolts.

Brake Shoe Clearance—Jack up all four wheels, loosen adjusting screw locknuts on brake adjuster lever at each wheel, turn adjusting screw clockwise until shoes drag very lightly on drums, tighten locknuts. Equalize brakes by backing off screw on tight wheel. If slight pull to right or left develops when new linings installed, make final equalization after linings have worn in.

Hand Brake Adjustment (1½ ton truck):—Adjusted in same manner as service brakes. Disconnect all pull rods and return spring on cross-shaft, place hand lever in extreme forward position, install special brake gauge on right hand end of cross-shaft. Adjust length of hand lever pull rod by loosening locknut and turning rod until clevis pin can just be inserted in lever, connect pull rod and remove brake gauge. Adjust length of each rear wheel pull rod so that eyes of cam operating levers are exactly 3 5/16" from front face of rear axle banjo housing, connect pull rods and return spring. Loosen centralizer clamp bolts (directly to rear of cam operating shaft), apply hand brake firmly, then place lever in normal braking position and tighten centralizer clamp bolts. Release hand lever, loosen locknuts on brake adjuster lever at inner end of each cam operating shaft, turn adjusting screw clockwise until shoes drag very lightly on drums, tighten locknuts. Equalize by slacking off on tight wheel slightly. Adjust length of pull rod connecting hand lever to service brake cross-shaft so that clevis pin at cross-shaft end is at extreme rear end (this rod not used on 1933 model).

RELINING BRAKES:—Factory replacement lining furnished in sets (different type lining for upper and lower shoes for Master and half ton truck). Lining for upper shoe Dark Gray (1934), Yellow (1935), lower shoe Light Gray (1934-35).
NOTE—At Buffalo, Tarrytown and Bloomfield plants (serial number prefix 12, 2, or 27) special type lining (black) used on Master model.

CHEVROLET (OWN) HYDRAULIC TYPE

Used On:

ALL PASS. CAR & TRUCK MODELS (1936 to 1939)

NOTE:—Brake design for 1939 models changed from previous models as follows:
Hand Brake (Passenger Car Models). Hand brake lever is mounted under cowl and is linked to bell-crank lever on left frame side-rail by non-adjustable rod. Bell-crank is linked to idler lever on second frame cross-member by non-adjustable rod with anti-rattle clip on rod at engine tie bar. This idler lever is linked to rear wheel hand brake cables by rods with adjusting clevises at cable connections. Free end of lever is guided by slotted guide plate.
Master Cylinder Piston Primary Cup (all Models). New type rubber primary cup used which has brass support ring vulcanized in base to prevent cup imbedding in bleeder holes in piston. This new type primary cup can be used on previous car and truck models. NOTE—Old design truck primary cups cannot be used on 1939 truck models.

DESCRIPTION AND OPERATION:—Wheel Brakes—Two shoes per wheel similar to previous design in that shoes are mounted on articulating links at anchor pin end with upper end bearing directly on wheel cylinder piston adjusting screws. Rigid type hydraulic wheel cylinder mounted on backing plate between shoes Shoes are forced out in contact with drum by piston movement when fluid displaced from master cylinder by pedal application flows through lines to wheel cylinder. Articulating links result in uniform shoe contact with drum and only one adjustment (at piston) provided. Shoes returned to off position when pedal released by single retracting spring linked between shoes.

Hand Brake:—Hand lever applies rear wheel service shoes through cable actuated lever pivoted on one shoe and linked to other shoe by strut (passenger cars) or lever and link (1½ ton truck).

Master Cylinder:—Compensating type similar in design to type used on Lockheed Brakes See Lockheed Brake article.

ADJUSTMENT:—Jack up all four wheels, remove front wheels on Passenger Cars, ½ Ton, ¾ Ton & ¾ Ton Special, 1 Ton, and rear wheels also on ¾ Ton Special & 1 Ton Models. Disconnect hand brake rods at cable connectors, remove adjusting hole covers on backing plate at each end of master cylinder (except rear wheels on 1½ Ton truck) Adjust each wheel as directed below. If brake drums have been removed previously, articulating pins should be aligned by applying brakes firmly before adjustments are made

Bleeding Brake System. See separate article on Hydraulic Brake Servicing for complete bleeding directions (required when lines disconnected, to remove wrong type fluid whenever it has been used in system, or to remove air from lines caused by allowing master cylinder supply tank to become dry or by disconnecting lines

CAUTION—Hand brake rods must be disconnected to eliminate any possibility of shoes being held on by cables which would make it impossible to secure satisfactory brake adjustment.

Brake Pedal Clearance:—Clearance between pedal and underside of toeboard must be ¼" to insure master cylinder piston being back against its stop for correct compensating action when brakes released. Adjust each model as follows:

Passenger Cars. Loosen locknut on eccentric bolt (linking pedal and master cylinder piston rod), turn bolt until correct toeboard clearance secured, tighten locknut.

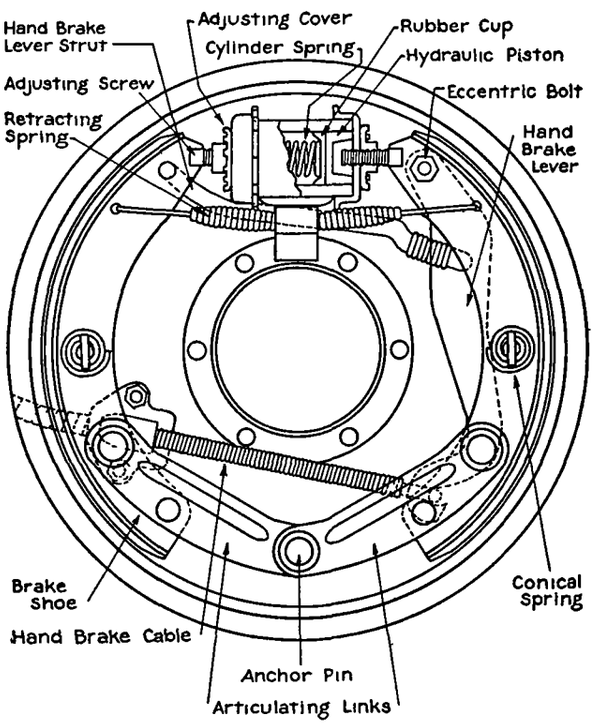
Truck Models. Loosen locknut at clevis on rear end of master cylinder pushrod, turn pushrod until correct toeboard clearance secured, tighten locknut.

Adjustment (Except 1½ Ton Rear Wheels):—Insert screwdriver in slot on backing plate at each end of wheel cylinder so as to engage notched adjusting covers on cylinder (adjusting cover on each end of cylinder controls one shoe), turn adjusting covers until shoe has slight drag on drum, then back cover off exactly 4 notches (all models except 1½ Ton Truck front wheels), 5 notches (1½ Ton Truck front wheels) to provide correct clearance. Adjust all wheels in this manner, then adjust parking brake (see below) and check brake pedal clearance.

Adjustment (1½ Ton Truck Rear Wheels). Wheel cylinder adjusting covers turned by means of hexagonal-headed pinion shafts on backing plates. Turn each pinion shaft clockwise until shoe has slight drag on drum, then turn pinion shaft back ¾ turn for correct clearance, adjusting parking brake (see below) and check brake pedal clearance.

Parking Brake Adjustment (Passenger Cars):—Place hand lever in fully released position. Pull on forward end of each wheel cable to remove all slack, turn adjusting clevis on rear end of each brake rod until holes in clevis and end of cable line up, install clevis pins (hold clevis while tightening locknuts to prevent twisting of rods and cables. Check equalization and make any necessary re-adjustment by loosening adjusting clevis on rod to tight wheel (do not change wheel cylinder adjusting cover setting).

Adjustment (Truck Models). Place hand lever in fully released position. Pull wheel cable end fitting (at front of rear frame cross-member) forward until a definite stop is felt, hold cable in this position, turn nut on forward rod down until it contacts (turn by hand only, do not use wrench), lock cable by turning rear nut up securely. Check equalization and make any necessary re-adjustment by loosening wheel cable to tight wheel slightly (do not change wheel cylinder adjusting cover setting).



Toggle Lever Adjustment—This adjustment must be made whenever new rear brake shoes installed. After adjusting service (hydraulic) brakes, remove brake drum, loosen eccentric bolt locknut (lever pivot on shoe web below right end of hydraulic cylinder), hold toggle lever against shoe, turn eccentric bolt until only slight clearance between lever and bottom of slot in hand brake extension link, tighten locknut, recheck clearance. Adjust hand brake as directed above.

NOTE—Whenever brake drums removed, see that drain hole in drum is lined up with notch in axle flange when drums replaced.

RELINING BRAKES:—Manufacturer recommends installation of new replacement shoes furnished with linings. Hard (semi-moulded or moulded) lining used which will have glazed appearance when burnished. See Car Model page for specifications for each model. Wheel cylinder piston clamp should be installed on piston when shoes removed.

To Remove Shoes:—Remove brake shoe return spring and conical hold-down springs. On rear brakes only remove toggle lever eccentric bolt and nut from rear brake shoe. Remove articulating link friction spring pin lock, pin and spring. Take out pin lock and pin on each shoe and remove articulating links.

NOTE—In assembling toggle lever on new shoes, see that high side of eccentric bolt is toward shoe in minimum adjustment position (high side indicated by flat ground in bolt head). Toggle lever adjusted as directed above under Hand Brake.

1½ Ton Truck Models. The wheels and brake drums with wheel hubs must be removed to get at brake shoes. Wheel bearings must be adjusted when wheels replaced (see car model page). Brake shoes on rear wheels have individual anchors.

Brake Shoe Installation. When installing shoes, see that they contact all pads on anchor plate (3 pads for each shoe) by checking clearance at each pad with .002" feeler gauge. If shoes do not touch all pads, bend anchor plate.

SERVICING:—Brake Linkage—Brake cables on passenger cars and 1½ ton truck must not be lubricated. Rear brake cables on Master Model identical (left and right. Cables on the ton-and-a-half truck not interchangeable and identified by string tracer woven under cable wire shield in left hand cable. Cables should be set for tire clearance as follows:

1½ Ton Truck—Wind up cables ½ turn (counter-clockwise for left hand, clockwise right hand) before clamping cable in frame bracket.

Standard Model—Each rear brake cable should have spring, Part No. 592681 with clip installed 1 7/8" from front of flange plate bracket to hold cable away from wheel. Install spring on cars not equipped.

Brake Drum Removal—Rear brake drums held on axle shaft flange by wheel mounting nuts and two screws. To remove drums, remove wheel and then take out screws. Extra hole in drum and gaskets should be lined up with notch in axle shaft flange for oil drain from deflector.

Hand Brake Lever (1938 Models). Double tooth pawl and sector plate pivoted on hand brake lever and linked to mounting bracket so that sector plate moves in opposite direction when hand lever pulled to apply brakes (allows finer lever setting)

Master Cylinder:—Piston clearance in cylinder must be .001-.005". When reassembled clearance between lip on primary piston cup and center of compensating by-pass port should be .035".

Master Cylinder (HD, HE, T Only):—Special 'Vee' shaped ring installed on face of piston under primary cup to prevent cup imbedding in bleeder holes when brakes applied. See that this ring installed when assembling master cylinder.

Wheel Cylinders:—To disassemble wheel cylinders, with brake line disconnected and return spring on shoes removed, take out two mounting screws on backing plate. Remove cylinder, lift off adjusting cover and screw assemblies, withdraw pistons, piston cups and return spring. Examine bore. Piston clearance in cylinder should be .002-.004". Line must be bled when reinstalled.

NOTE—Wheel cylinders for front and rear wheels are of different bore and must be replaced in same wheel. No part of assembly interchangeable (see Car Model page for specifications).

HAWLEY TYPE

Used On:

CROSLEY, MODEL A (1939-40)

TYPE:—Hawley Neutral Shoe type with floating brake lining. Lining consists of a single piece of sufficient length to reach entirely around shoes with gap of 1/16" at ends. Lining is centered on shoes by rib on backing plate and conical retainer on wheel side.

DESCRIPTION & OPERATION:—Wheel Brakes. Two shoes per wheel, anchored at adjusting screw end and operated by cam at opposite end. Shoes are held against adjusting screw and cam by small coiled spring hooked between shoes at each end.

Linkage:—Wheel brakes operated by cables from main cross-shaft on frame. Cables enclosed in conduits at wheel ends and provided with adjusting clevises at cross-shaft.

Hand Brake:—Hand lever is linked to main cross-shaft on frame. Cables enclosed in conduits at wheel ends and provided with adjusting clevises at cross-shaft.

Hand Brake:—Hand lever is linked to main cross-shaft and applies all four wheel service brakes.

ADJUSTMENT:—Jack up all four wheels, remove clevis pins and disconnect all four wheel cables at cross-shaft. At each wheel, loosen locknut and tighten brake adjusting screw on backing plate (turn screw counter-clockwise) until slight drag noticed when wheel turned by hand, then back adjusting screw off (turn screw clockwise) until wheel is just free, tighten locknut.

Linkage Adjustment—Depress brake pedal 1" and hold in this position. Adjust clevis on cross-shaft end of each wheel cable so that brakes barely drag when cable connected to cross-shaft. Release pedal. Road test car and equalize brakes by turning adjusting screw on tight wheel slightly (turn screw clockwise to loosen brakes).

SERVICING:—Brake Lining Replacement—To remove and renew brake linings, jack up wheel, remove hub cap, wheel, and hub assembly. Remove conical brake lining retainer. Take out old lining. Insert new lining and re-install wheel.

Brake Lining Note—Use only genuine Crosley lining—furnished in correct length to fit around shoe with 1/16" gap at ends. Lining is not riveted on shoes and is installed loosely in drum.

Brake Cable Lubrication:—Whenever brake cables adjusted, fill cable conduits with grease. When connecting cables use care not to twist or buckle cables excessively.

FORD (OWN) MECHANICAL TYPE

USED ON ALL MODELS (1932-33-34-35-36).

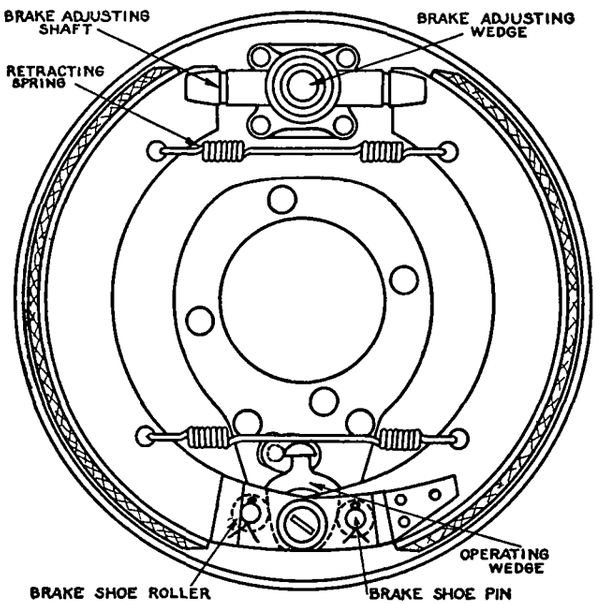
DESCRIPTION & OPERATION:—Wheel Brakes—Two shoes per wheel, anchored at adjusting wedge end and actuated by brake operating wedge at other end (front brakes for all models, rear brakes on 1935-36 models) or brake cam (rear brakes on 1932-33-34 models). Shoe wedges or cams actuated by cranklevers on backing plate (rear wheels) or by lever on spring hanger through operating pin extending down through hollow kingpin (front wheels). Shoes returned to off position by retracting springs hooked between shoes at both ends.

Linkage:—Rod to each wheel from cross-shaft mounted on rear of 'X' member center connector. Linkage adjustment (clevis and locknut) at wheel end of each rod.

Hand Brake:—Hand lever connected to cross-shaft and actuates all service brakes (passenger and commercial cars) or connected to second cross-shaft and actuates independent internal expanding brake bands in each rear wheel (trucks). Hand brake must be adjusted separately on trucks (instructions below).

ADJUSTMENT:—For Wear—Jack up all four wheels, check front wheel bearings, spindle bearings, spring shackle studs, shock absorber links, and radius mountings for looseness. Release hand lever, disconnect brake rods by taking out clevis pins at each wheel.

1—At each wheel, screw in adjusting screw all the way then back off until wheels are just free of drag. Brakes must be cold.



2—See that hand lever is full released. Cross-shaft levers on 1932-34 models should be vertical (passenger cars) or 1" behind vertical (trucks). Disconnect brake pedal rod, adjust length of rod by turning clevis until pedal rests against rubber stop on floor (1932-34 models), or until clearance between rear end of hand lever rod clevis slot and rear face of cross-shaft lever pin is 1/8" (1935-36 passenger cars), or rear face of pedal rod lever on service brake cross-shaft is 1 29/32" in front of cross-member (1935-36 trucks). Reconnect pedal.

3—Adjust length of each brake rod at wheel so that rods are 1/32" short (levers must be pulled in 1/32" to insert clevis pins). Reconnect brake rods.

4—Set hand lever in first notch (passenger and commercial cars) or apply brakes with pedal jack (trucks). Turn each wheel at least one revolution and equalize by backing off adjusting screw on tight wheels. When brakes equalized, back off adjusting screw on each rear wheel exactly 2 notches on 1932-33-34 models (to equalize action on front wheel wedge-operated brakes and rear wheel cam-operated brakes). On 1935-36 models with all brakes operated by wedges this setting not necessary and all screws should be backed off evenly.

New Shoes or Relined Brakes:—When installing shoes, use brake gauge to check shoe clearance. Clearance at all points (except chamfered ends) must be .010" minimum and must not exceed .030" at any point. Turn up adjusting screws until clearance at adjusting screw end is .010". Check wedge end clearance. If less than .020", install new brake shoe pins with oversize heads which raise shoe .010" and increase clearance by this amount. Adjust brakes as directed above.

Hand Brake (Trucks):—Take up brake rods to rear wheels equal amount so that wheels are just free of drag with hand lever released. Equalize by applying brakes and slacking off rod to tight wheel

RELINING BRAKES:—New lining should be ground concentrically on special fixture and linings should be chamfered for distance of 1¼" back from each end.

FORD (OWN) MECHANICAL TYPE

Used On:

FORD V8 '60', MODELS 73, 74, 75 (1937)
FORD V8 '85', MODELS 77, 78, 79 (1937)
'60' MODELS 82A, 82C, 82Y (1938)
'85' MODELS 81A, 81C, 81Y, 81T, 81U, 817T (1938)

NOTE:—75, 79, 81T, U, 817T Trucks. Hand brakes on these models are entirely independent, hand lever applying separate internal-expanding brake band in each rear wheel brake drum.

DESCRIPTION & OPERATION:—Wheel Brakes—Two shoes per wheel, anchored at adjusting screw end and actuated by wedge at opposite end. Shoes returned to off position by retracting spring at either end (see illustration).

Linkage:—Wheel brakes operated by cable from cross-shaft at rear of 'X' member on frame. Cables enclosed in conduit between frame and wheel. Hand lever linked to cross-shaft by conduit enclosed cable, brake pedal by adjustable rod.

Hand Brake:—Hand lever, under the instrument panel linked to cross-shaft by cable in conduit and applies all four service brakes.

ADJUSTMENT:—For Wear—Jack up all four wheels, check front wheel bearings, spindle bearings, spring shackle studs, shock absorber links, and radius rod mountings for looseness. Release hand lever. See that lower or front brake cable lever is against bottom of cross-shaft bracket (cars), operating lever against frame cross-member (trucks); if not, Major Adjustment required. At each wheel, turn adjusting screw in until shoes are tight in drum, then back screw off until all drag just removed. Hold brake pedal 'on' with pedal jack, check wheels for even drag. Equalize by backing off tightest wheels. Check tire inflation. Test brake action on Brake Tester or by road testing car.

Major Adjustment (New Shoes, Relined Brakes etc):—Jack up all four wheels, check for looseness (see Wear Adjustment above). Remove clevis pins in front and rear brake cables at cross-shaft, remove wheel and hub assemblies. Adjust as follows:

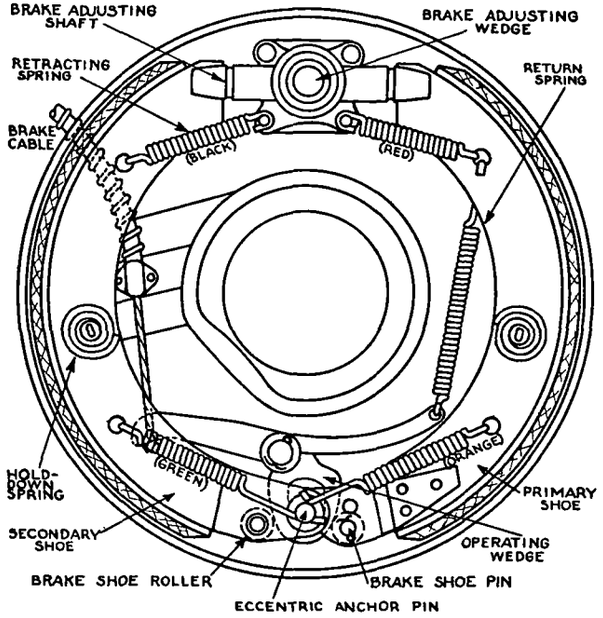
1—At each wheel, install concentricity gauge and check shoes for distortion (clearance should be uniform around shoe, if not shoes should be replaced—See Overhaul data below). Re-install wheel and hub assemblies.

FORD MECHANICAL TYPE CONT.

2—Check cross-shaft lever position. Front brake cable lever (lower) must be against bottom of cross-shaft bracket (cars), operating lever against cross-member (trucks). To adjust, remove pedal rod clevis pin at cross-shaft, loosen locknut and turn clevis until pin can be installed with lever against stop (pin must be at rear end of pedal rod slot).

3—Check hand lever cable length. Cable must not hold cross-shaft lever away from stop with hand lever released. To adjust, place hand lever in released position, loosen locknut and clevis pin at hand lever end of cable, turn clevis until pin can be inserted without disturbing levers.

4—At each wheel, turn up adjusting screws until shoes are tight in drums. Adjust each wheel brake cable clevis at cross-shaft end so that pin can just be installed with 25 lbs. pull on cable (use special



Ford SV-207 brake cable puller to apply tension to cables). NOTE—On trucks (81Y, 82Y rear brakes; 75, 79, 81T, U, 817T all brakes), eccentric anchor should be adjusted at same time by loosening anchor pin locknut and turning anchor pin slightly in both directions, while adjusting screws are being tightened, until shoes have been expanded to maximum. Then hold anchor pin from turning and tighten locknut securely using wrench with 20" handle. On all other models, new Carrier Plate Assemblies should be installed if eccentric anchor pin requires adjustment.

5—At each wheel, back off adjusting screw until wheel is just free of drag. Hold brake pedal on with pedal jack and check wheels for even drag. Equalize by backing off tightest wheels. Check tire inflation. Test brake action on Brake Tester or by road testing.

SERVICING:—Brake Shoes—To remove shoes, disconnect retracting spring at each end of each shoe. Take out pin, remove plain washer on hold-down spring at center of shoe web. Pull shoes free at adjusting wedge end, lift off.

Cable Conduits—Whenever cable conduit clamps are loosened, to replace conduits, tighten clamp capscrews and then back off one half turn. Turn up adjusting screw until brake shoes are tight in drum. Use brake cable puller SV-207 and apply 300 lb. pull on cable, maintain this pull by tightening adjusting screw on tool, shake conduit vigorously to insure its seating in clamps, tighten clamp screws at carrier plate and frame. Readjust wheel brake.

CARRIER PLATE ASSEMBLIES:—When installing new carrier plate assemblies, disconnect all brake cables at cross-shaft, check spindle bearings, spring shackles, shock absorber links, and front radius rod mountings. Replace if looseness caused by wear is excessive. Examine brake drums and replace if scored or eccentric (maximum runout .010"). Check brake cross-shaft lever position. Adjust pedal rod if front brake cable lever not against bottom of cross-shaft bracket (see above). Install new brake carrier assembly and connect ball end of cable to lever. Tighten conduit clamp on backing plate securely then loosen both screws one half turn. Loosen conduit clamp screw at frame bracket one half turn. Adjust conduits as directed above (Servicing Cable Conduits). Then adjust brakes.

FORD-LOCKHEED TYPE

Used On:

FORD, ALL PASS. CAR & TRUCK MODELS (1939)
MERCURY, MODEL 99-A (1939)

LINCOLN-ZEPHYR NOTE:—Hydraulic brakes on this model are Bendix Single Anchor type. See Bendix Brake article for data on Lincoln-Zephyr brakes.

DESCRIPTION & OPERATION:—Lockheed two-shoe, double anchor type. Two shoes per wheel, each mounted on individual eccentric anchor pin at lower or 'heel' end and bearing directly against opposed pistons of stationary wheel cylinder at upper or 'toe' end. Shoes are held against eccentric adjusting cams (wear adjustment) in 'off' position by a single retracting spring hooked between the two shoes at the toe end.

Wheel Cylinders:—Rigid type mounted on backing plate with opposed pistons which bear directly against toes of brake shoes. Pistons are sealed by rubber cups held against piston heads by central spring and dirt is excluded from cylinder by rubber boot fitting over end of cylinder and brake shoe.

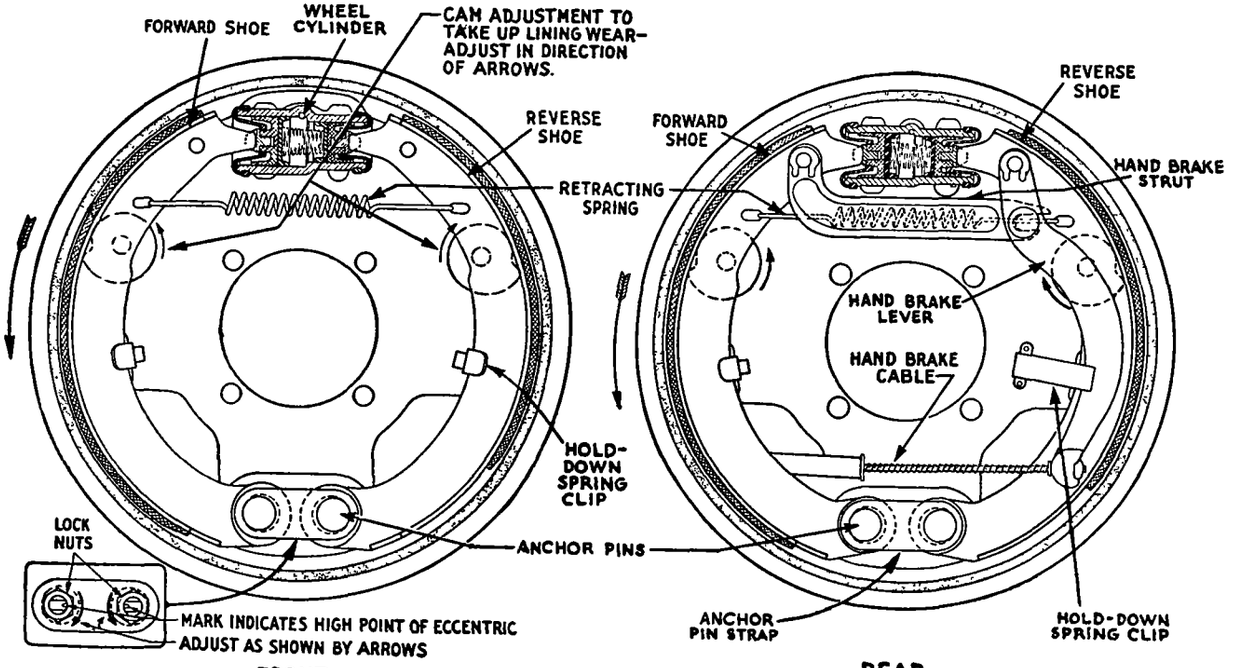
Passenger Car & 1 Ton Truck—Cylinders are stepped or two-stage bore type with larger end of cylinder toward front and actuating forward shoe. Front wheel cylinders larger than rear wheel.

Truck Models. Cylinders not stepped (both ends same size). Larger cylinders used on rear wheels.

NOTE—Wheel cylinder not interchangeable from right to left sides of car or from front to rear wheels.

Master Cylinder:—Compensating type with integral supply tank. Similar in design to type used on other Lockheed Hydraulic Brake applications.

Parking (Hand) Brake:—On Passenger Cars & 1 Ton models, hand lever applies rear service brakes through cables connected to a strut and lever linkage on the brake shoes. On other truck models, hand lever applies an independent internal-expanding brake band in the rear wheel brake drums.



SERVICING:—Bleeding Brake Lines. Fill master cylinder supply tank with genuine Ford Brake Fluid (keep tank filled during bleeding operation, bleeding must be repeated if fluid level low enough so that air enters cylinder and lines). Remove dustscrew on bleeder valve at wheel cylinder, install rubber tubing in bleeder valve and immerse other end of tubing in brake fluid in a container. Open bleeder valve and pump brake pedal with slow even strokes until only clean fluid flows from wheel cylinder (no trace of air or bubbles) being careful that fluid level maintained in master cylinder supply tank. Close bleeder valve, remove tubing, replace dustscrew. Bleed other wheels in same manner.

ADJUSTMENT:—Before adjusting, jack up all four wheels, remove one front wheel and inspect lining (to determine if new linings required), re-install wheel. Check front wheel bearing adjustment, spring shackles, shock absorber links, and radius rod mountings, tighten steering connections. Place hand lever in released position. Adjust each wheel as follows:

Minor Adjustment (For Wear):—Install wrench on eccentric adjusting cam on backing plate with wrench handle upward, turn cam by moving wrench handle out toward wheel rim until shoe is tight in drum, then turn cam back until wheel just turns freely without drag (do not turn cam back more than enough to free wheel, desired setting is with least possible amount of clearance). After adjusting forward shoe, repeat adjustment on rear shoe, then adjust all other wheels in same manner. Check pedal reserve, if reserve less than half total travel, repeat adjustment (if pedal is 'spongy', bleed lines). Check brake pedal clearance and adjust hand brake (see instructions below).

Major Adjustment (For relined brakes, etc.):—NOTE—Before installing brake drums, loosen eccentric anchor pin locknuts and turn each anchor pin so that marks on flatted ends of pins are together (marks indicate 'high' side of eccentric and in this minimum position will allow drums to be installed over new linings). Adjust eccentric adjusting cam for each shoe (see Minor Adjustment above), then adjust anchor pins as follows: Depress brake pedal with 25-35 lbs. pressure (hold in this position while making adjustments), use wrench with 3" handle and turn eccentric anchor pin so that mark moves down until brake shoe is felt to contact drum, hold anchor pin from turning and tighten locknut securely. Release brake pedal, check wheel to see that it turns freely without any drag, repeat adjustment if wheel drags. This setting designed to secure less clearance at anchor pin or heel end of shoe than at toe with only slight clearance for entire shoe. Adjust both shoes in each wheel in this manner, check brake pedal clearance and adjust hand brake as directed below.

Brake Pedal Adjustment:—Brake pedal must have **¼-½" free movement (measured at pedal pad) to** insure master cylinder piston being against its stop for correct compensating action when brakes released. To adjust, loosen locknut on pedal rod, turn rear section of rod (integral with large adjusting nut—not necessary to disconnect clevis pins), tighten locknut.

Parking (Hand) Brake Adjustment (Passenger Cars & 1 Ton Truck):—Place hand brake lever in first notch 'on'. Depress brake pedal with 30 lbs. pressure and hold in this position while adjustment being made. Pull cables to remove all slack, adjust conduit so that cables are exactly right length. Release hand lever and brake pedal, check rear wheels to see that they are free.

Trucks (others). Hand lever linked to cross-shaft by non-adjustable rod, cross-shaft linked to hand brake lever on each rear wheel backing plate by adjustable rods. To adjust, remove clevis pin in forward end of each rod at cross-shaft, loosen locknut, turn clevis on rod.

OVERHAUL:—Note—Factory recommends installation of factory reconditioned brake shoes (with new lining installed) whenever lining worn so that replacement required. Before removing brake shoes, install clamp on wheel cylinders (to retain wheel cylinder pistons) and be careful not to depress brake pedal with shoes off. This will eliminate necessity of bleeding lines when shoes installed.

Brake Shoe Installation:—Assemble retracting spring to shoes (and hand brake lever and link parts for rear wheels). Turn eccentric adjusting cams to minimum position. Hold shoes so that anchor pin ends overlap and upper ends spread sufficiently to enter wheel cylinder pistons, engage shoes in piston slots, spread lower ends of shoes until they are engaged under flat lip of hold-down springs. Install anchor pins making certain that eccentric is in place in hole in brake shoe and that anchor pin engages eccentric. Turn anchor pins so that notch in flatted end of each pin is lined up with notch in opposite pin, install anchor pin locknuts, connect hand brake cable to lever. Adjust shoes as directed in Major Adjustment above.

***Master Cylinder & Wheel Cylinder* Disassembly and Overhaul:**—All service operations same as on other Lockheed Brakes. See article on Lockheed Double Anchor Hydraulic Brakes and separate article on Hydraulic Brake Servicing for complete data.

BENDIX MECHANICAL TYPE SINGLE ANCHOR

Used On:

LINCOLN, V12 MODEL (1940)

WILLYS, 440 PICK-UP, 440P PANEL DELIVERY (1940)

This Brake same design as used on preceding models.

NOTE:—Lincoln Brake Power Cylinder—Bendix plain type vacuum cylinder (with separate control valve) used on all cars. See Bendix Vacuum Cylinder in manual for complete data.

Willys Passenger Cars—These cars equipped with Lockheed Hydraulic, Double Anchor brakes. See separate article for data on Lockheed brakes.

ADJUSTMENT & SERVICING:—Adjustments same as for corresponding preceding models. See 'Bendix Mechanical—Duo-Servo, Single Anchor Type' brake article in Mechanical Equipment Section of manual for complete data.

BENDIX HYDRAULIC, SINGLE ANCHOR (WITH ECCENTRIC ADJUSTMENT)

Used On:

CADILLAC V8, SERIES 40-75 (1940)

CADILLAC V16, SERIES 40-90 (1940)

HUDSON SIX, MODELS 41, 43 (1940)

HUDSON EIGHT, MODELS 44, 47 (1940)

NASH EIGHT, MODEL 4080 (1940)

PACKARD COMM'L., 1801A, 1803A (1940)

PACKARD SUPER 8, '160' 1804, 5 (1940)

PACKARD CUST. SUPER 8, '180' 1807,8 ('40)

These brakes same design as used on corresponding 1939 car models.

NOTE:—Cadillac, Nash, Packard (other models)—These other models with Bendix Hydraulic Brakes do not have eccentric adjustment and are adjusted differently. See preceding article for data.

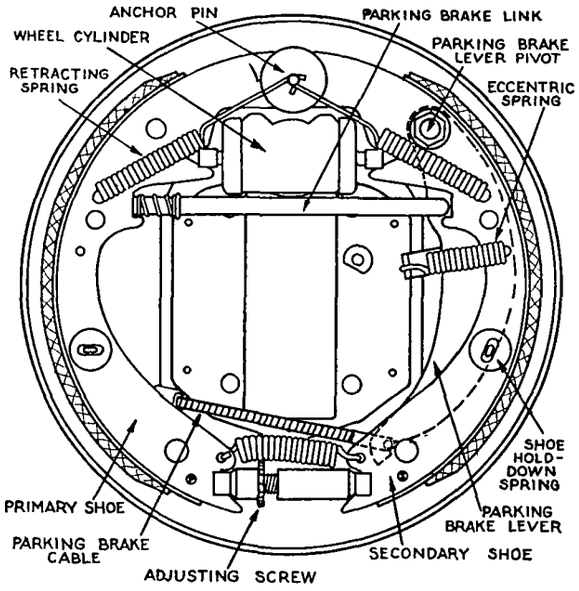
Hudson (other Models)—Hudson Models 40P & 40T have Bendix Hydraulic Double anchor brakes. See separate article for data on this type.

ADJUSTMENT:—Before making adjustments, jack up all four wheels, loosen or disconnect parking brake (hand lever) cables at intermediate lever, remove adjusting screw hole covers on backing plates and feeler gauge hole cover on drum (remove wheels for access). Check brake pedal clearance (see Brake Pedal Adjustment below), then adjust at each wheel as follows. CAUTION—If hand brake cables not disconnected, shoes may be held 'on' by cables (if adjusted too tight) so that correct brake adjustment cannot be secured.

Minor Adjustment (For Wear):—Adjust at each wheel as follows:

1. (All Models). Loosen eccentric locknut, turn eccentric in direction of forward wheel rotation until .010" feeler is snug between lining and drum at each end of this secondary shoe, hold eccentric from turning, tighten locknut. Clearance at both ends of shoe must be alike within .002" (Cadillac), .003" (all others) with smaller clearance preferably at anchor end. If variation greater than this amount, anchor must be re-located (See Major Adjustment below). If feeler gauge not used, turn eccentric up until heavy brake drag secured, then back eccentric off until wheel is just free of drag.

2. (All Models). Insert special tool, or screwdriver, in adjusting screw hole on backing plate, turn adjusting screw by moving outer end of tool up toward center of wheel to expand shoes until wheel can just be turned (if necessary to turn adjusting screw more than 50 notches or clicks, examine linings for wear and replace if necessary). Adjust and connect hand lever cables (see Hand Brake Adjustment below). Then back off adjusting screw until wheel is just free of drag (approximately 20 notches). Check equalization by depressing brake pedal (use pedal jack) until wheel with least drag can just be turned by hand, equalize by backing off adjusting screws on tight wheels not more than 2-3 notches. Do not tighten loose wheels.



Hudson Note. Check mechanical 'follow-up' setting after adjusting brakes (see separate article following).

3. Hand Brake Adjustment (All Models). Adjust hand brake cables for each model as follows:

Cadillac. With rear brake shoes expanded so that rear wheels can just be turned by hand, make certain that hand lever in 'off' position, pull cables taut and adjust clevises so that clevis pins can just be inserted. Connect cables and back off adjustment at shoes 15-20 notches until wheels are just free. Check equalization.

Hudson—With rear brake shoes expanded tightly against drum, pull hand lever 'on' two notches so that clearance between hand brake cable lever and end of slot in guide plate is ⅛", pull cables tight, adjust clevis at forward end of each cable so that clevis pins just enter holes in toggle on lever, connect cables, back off adjusting screw in each wheel until wheels are free, check equalization.

Nash. With rear brake shoes expanded tightly against drum, pull hand lever 'on' 2 notches, loosen two bolts on adjusting clamp (connecting lever and wheel cables), pull cables tight and tighten bolts. Return lever to 'off' position. Back off adjusting screw in each wheel to free brakes and check equalization as directed in (2) above. See that hand brake lever on each wheel backing plate has ⅛" free travel with hand lever in off position. Equalize hand brakes by loosening rear bolt in cable adjusting clamp and applying hand brakes (this will allow cable to shift on adjusting clamp). Check position of hand brake cable guide on rear spring. Guide should be exactly 18¼" to rear of center-line of spring front eye bolt.

Packard. Expand rear wheel brake shoes tightly against drums. Eliminate slack in cable linking hand lever to equalizer by turning clevis at equalizer end of cable. Pull hand lever 'on' one notch, pull cables forward to eliminate slack, adjust clevises at equalizer link end of cables so that clevis pins can just be inserted, connect cables. Back off adjusting screw in each wheel and check equalization as directed in (2) above.

4. Brake Pedal Adjustment. Brake pedal must have ¼" minimum free travel or play in released position to insure master cylinder piston being back against its stop for correct compensating action with brakes released. To adjust, loosen locknut on piston rod, turn rod or clevis making certain that piston is against the stop.

Cadillac Models—Rubber grommet on pedal under toeboard should be compressed to overall length of ¾" with brakes released.

Hudson Models—Clearance between pedal shank and underside of toeboard should be ¼" with brakes released. To adjust, remove clevis pin at forward end of connecting link (between pedal and master cylinder bellcrank), loosen locknut and turn link.

Major Adjustment (For New Shoes or Relined Brakes):—If shoes with new linings being installed, adjusting screw and eccentric adjustment must be backed off to allow drums to be installed. Disconnect parking brake cables, remove adjusting screw cover on backing plate and inspection hole cover on drums. Adjust brakes at each wheel as follows:

1. Anchor Pin & Eccentric Adjustment (All Models). Loosen eccentric locknut, turn eccentric in direction of forward wheel rotation until .010" feeler is just snug at adjusting screw end of this secondary shoe, hold eccentric from turning and tighten locknut. Check clearance at anchor pin end (opposite end) of this same shoe. If clearance not .010", adjust anchor pin as follows: Loosen anchor pin locknut one turn, turn anchor pin in direction of forward wheel rotation (eccentric type with slotted end) or tap anchor pin out toward drum (slotted hole type with plain end) until clearance at anchor pin end of shoe is exactly .010", hold anchor pin from moving and tighten locknut securely with 16" wrench. Recheck clearance at adjusting screw end of shoe. Make any necessary readjustments at eccentric and anchor pin until .010" clearance secured at both ends of this shoe. Then proceed with adjustments (2), (3), and (4) as given under Minor (Wear) adjustment above.

SERVICING:—All servicing operations including Bleeding of Lines, Brake Shoe Removal & Installation, Master Cylinder and Wheel Cylinder Overhaul are same as previous models. *See 'Bendix Hydraulic Type, Single Anchor, Rigid Cylinder' brake article in Mechanical Equipment Section of manual for complete data.*

BENDIX HYDRAULIC, SINGLE ANCHOR (WITHOUT ECCENTRIC ADJUSTMENT)

Used On:

BUICK, SERIES 40-40, 50, 60, 70, 80, 90 (1940)
CADILLAC V8, SERIES 40-60S, 62, 72 (1940)
LA SALLE V8, SERIES 40-50, 52 (1940)
LINCOLN-ZEPHYR, MODEL 06H (1940)
NASH-LAFAYETTE, MODEL 4010 (1940)
NASH SIX, MODEL 4020 (1940)
OLDSMOBILE 6, '60' F-40, '70' G-40 (1940)
OLDSMOBILE 8, '90' MODEL L-40 (1940)
PACKARD SIX, '110' MODEL 1800 (1940)
PACKARD EIGHT, '120' MODEL 1801 (1940)
PACKARD SUPER 8, '160' 1803, '180' 1806 (1940)
PONTIAC 6, MODELS 40-25, 40-26 (1940)
PONTIAC 8, 40-28, TORPEDO 40-29 (1940)

These brakes same design as used on corresponding 1939 car models.

NOTE:—Cadillac (other models)—V8 Model 75 and V16 Model 90 have Bendix hydraulic brakes with Eccentric Adjustment and are adjusted differently (see following article for data).

Nash (other models)—Model 4080 Eight has Bendix hydraulic brakes with Eccentric Adjustment (see following article for data).

Packard Super Eight—Models 1804, 5 (160) and 1807, 8 (180) have Bendix Hydraulic brakes with Eccentric Adjustment (see following article).

DESCRIPTION:—These brakes same design as used on 1939 cars and are similar to other Bendix single-anchor brakes except that the eccentric adjustment is omitted and all adjustments are made at the adjusting screw and the anchor pin as given below.

ADJUSTMENT:—Before making adjustments, jack up all four wheels, loosen or disconnect parking brake cables at intermediate lever or equalizer bar, remove adjusting hole screw covers on backing plate (see Pontiac Note below), check brake pedal clearance (See Brake Pedal Adjustment below), adjust brakes at each wheel as follows. CAUTION—If hand brake cables not disconnected, shoes may be held 'on' by cables (if adjusted too tight) so that correct brake adjustment cannot be secured.

Pontiac Adjusting Hole Covers—Covers are rubber and have lip on inner edge to engage slot in backing plate. To remove, insert screwdriver under lip of cover and pry out. To install, moisten cover with water or brake fluid, start one end in adjusting hole slot, strike cover with hammer to seat it in slot.

Minor Adjustment—For Wear (Except Cadillac, La Salle, Packard):—At each wheel, make certain that anchor pins are tightened (check with 16" wrench, if anchor pins loose, adjust as directed under Major Adjustment below). Insert special tool or screwdriver through adjusting hole in backing plate, turn notched adjusting screw by moving tool handle up toward center of wheel until brake drum can just be turned by hand. Adjust and connect hand brake cables (see Parking Brake Adjustment below), then back off adjusting screw 17 notches or 'clicks' (Buick), 14 notches (Lincoln-Zephyr, Nash, Pontiac), 20 notches (others) until shoes are just free and drum revolves without any drag. If brakes are not free after making this adjustment, or if shoes drag at anchor pin end, adjust anchor pin as directed under Major Adjustment below.

Parking Brake Adjustment—Before connecting hand brake cables, adjust cable lengths on each model as follows:

Buick. With rear wheel brake shoes expanded so that drums can just be turned, tighten adjuster nut on rear end of hand lever cable (at wheel cable equalizer on torque tube near rear axle) until cables are taut with hand lever in released position, back off adjusting screw in each wheel 15 notches so that wheels free of any brake drag, check equalization by applying brakes with hand lever until drums can just be turned. Equalize wheels by backing off adjusting screw in tight wheel not more than 2 notches (if this does not equalize wheels, check centering of wheel cables in equalizer).

NOTE—Parking brake lever has two holes for attachment of brake cable. Standard setting is with cable attached to upper hole but cable can be attached to lower hole for less lever movement (results in harder operating brake).

Lincoln-Zephyr. Do not expand rear wheel brake shoes. Pull hand lever 'on' one notch, apply brakes by depressing brake pedal with 30 lbs. pressure (use pedal jack, hold pedal in this position while adjusting). Remove slack in cable by adjusting conduit clamp. Release hand lever and brake pedal, see that brakes are free.

Nash. With rear brake shoes expanded tightly against drum, pull hand lever 'on' 2 notches, loosen two bolts on adjusting clamp (connecting lever and wheel cables), pull cables tight and tighten bolts. Return lever to 'off' position. Back off adjusting screw in each wheel to free brakes and check equalization. See that hand brake lever on each wheel backing plate has ⅛" free travel with hand lever in off position. Equalize hand brakes by loosening rear bolt in cable adjusting clamp and applying hand brakes (this will allow cable to shift on adjusting clamp). Check position of hand brake cable guide on rear spring. Guide should be exactly 19¾" to rear of center-line of spring front eye bolt.

Oldsmobile. With rear wheel brake shoes expanded so that drums can just be turned, pull wheel cables forward to eliminate all slack, adjust clevises on forward ends of cables so that clevis pins can just be inserted with equalizer link held parallel to propeller shaft, connect cables (insert clevis pins with head toward top), back off adjusting screw in each wheel approximately 20 notches until wheels are free, check equalization.

Pontiac. Check hand brake cable tension by moving clevis pin at cross lever wheel cable spreader, pin should move up and down with thumb and finger pressure (hand lever in released position, rear wheel brake shoes not expanded), and both rear wheels should lock with hand lever in third notch. To adjust, remove cross lever clevis pin and engage pin in another of the several holes in the cable spreader (approximate setting), remove hand lever clevis pin and turn clevis on cable (exact setting) using extreme care not to twist the cable. To equalize wheel cables after adjusting, loosen clampscrews on wheel cable spreader at cross lever (if necessary pry clamp ears apart with a screwdriver so that cable free in spreader), apply brakes hard by pulling back on hand lever, tighten spreader clampscrews before releasing hand lever.

Minor Adjustment—For Wear (Cadillac, LaSalle, Packard Models):—Manufacturer recommends that adjusting screw and anchor pin be adjusted as directed in 'Major Adjustment' below. Then adjust parking brake as follows:

Cadillac, LaSalle. With rear brake shoes expanded so that rear wheels can just be turned by hand, make certain that hand lever in 'off' position, pull cables taut and adjust clevises so that clevis pins can just be inserted. Connect cables and back off adjustment at shoes 15-20 notches until wheels are just free. Check equalization.

Packard. Expand rear wheel brake shoes tightly against drums. Eliminate slack in cable linking hand lever to equalizer by turning clevis at equalizer end of cable. Pull hand lever 'on' one notch, pull cables forward to eliminate slack, adjust clevises at equalizer link end of cables so that clevis pins can just be inserted, connect cables. Back off adjusting screw in each wheel and check equalization.

Major Adjustment (For New Shoes, Relined Brakes or when Minor Adjustment not satisfactory):—Jack up all four wheels, loosen or disconnect parking brake cables at equalizer or intermedate lever, remove adjusting screw hole cover on backing plate and inspection hole cover on drums (remove wheels for access). Check pedal clearance (see Brake Pedal Adjustment below). Adjust each wheel brake as follows. CAUTION—If hand brake cables not disconnected or loosened, shoes may be held on by cables (if adjusted too tight) so that correct brake adjustment cannot be secured.

Anchor Pin & Adjusting Screw Adjustment—Turn drum so that inspection hole is at center of secondary shoe (rear shoe on each wheel), insert screwdriver and pry secondary shoe away from drum so that primary shoe (other shoe) is seated solidly against drum. Insert screwdriver or special adjusting tool in hole on backing plate and turn notched adjusting screw by moving handle of tool up toward center of wheel until .015" feeler is snug between lining and drum at adjusting screw end of secondary (rear) shoe. Check clearance at anchor pin (opposite) end of this same shoe. If clearance not .015", adjust anchor pin by loosening locknut and tapping anchor out toward drum (slotted hole type with plain end) or turn anchor pin in direction of forward wheel rotation (eccentric type with slotted end) until .015" clearance secured, hold anchor pin from shifting and tighten locknut securely with 16" wrench. Recheck clearance at adjusting screw end of shoe. Make any necessary readjustments at adjusting screw and anchor pin to secure clearance of .015" at both ends. It is very important that primary shoe be out in solid contact with drum while this adjustment being made. Adjust hand brake cables as directed in Parking Brake Adjustment under Minor Adjustment above.

Brake Pedal Adjustment:—On all models, brake pedal must be checked and adjusted to insure master cylinder piston being back against its stop in the master cylinder for correct compensating action with brakes released. To adjust, loosen locknut on piston connector rod, turn clevis or rod to secure clearances specified below with master cylinder piston against the stop.

Buick—Clearance between pedal and underside of toeboard should be 1 1/16" (40,60), ⅞" (50,70,80, 90).

Cadillac & LaSalle—Rubber grommet on pedal under toeboard should be compressed to overall length of ¾" with brakes released.

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Nash—Brake pedal should have ¼-½" free movement or play in released position.

Oldsmobile—Sponge rubber pedal seal on underside of toeboard should be compressed not more than 1/16" with brakes released.

Packard—Brake pedal should have ¼-½" free movement or play in released position.

Pontiac—Pedal height should be adjusted so that brake pedal is even with clutch pedal. Distance from floor to top of pedal should be 5⅛" (Special 6), 4¾" (Deluxe 6 & 8), 5" (Torpedo 8).

SERVICING:—All service operations (Bleeding Brake Lines, Brake Shoe Removal & Installation—except eccentric and short secondary shoe spring data which should be disregarded, Master Cylinder and Wheel Cylinder Overhaul) are same as for other Bendix Hydraulic Brakes except as noted below. *See 'Bendix Hydraulic Rigid Cylinder Type' brake article in Mechanical Equipment Section of manual for complete instructions and note following new data:*

Lincoln-Zephyr Springs—Brake shoe retracting springs are now same weight on both primary and secondary brake shoes.

Oldsmobile Wheel Cylinder Stops—Stops are formed on backing plate which prevent pistons being forced out of wheel cylinder for any reason. These stops make it unnecessary to use piston clamps to retain pistons when brake drums and shoes are removed but wheel cylinder must be removed from backing plate before it can be dismantled or pistons taken out.

Packard Springs—Brake shoe retracting springs on Model 1800 are same for both shoes (Blue color). On Models 1801, 1A, spring on primary shoe (front) is Aluminum, spring on secondary (rear shoe) is heavier and is Yellow.

HILL-HOLDER & NOROL

Optl. Equipment On:

CAR MODELS WITH HYDRAULIC BRAKES (1940)

These units same design as used on 1939 car models.

DESCRIPTION:—Same design as units used on previous car models. Both units consist of a gravity and clutch pedal controlled check valve in the hydraulic brake line so that brakes are held 'on' with car heading uphill on grade and clutch disengaged. Brakes are released through clutch pedal connection when clutch is engaged.

ADJUSTMENT:—Adjust whenever clutch pedal adjusted or when linkage disconnected. Mounting of unit should be checked whenever unit removed or disturbed in any manner.

Adjustment:—Check adjustment by operating car and noting point at which brakes release (brakes should release just before clutch engages). To adjust, loosen locknut on operating rod (linking unit and clutch pedal), turn adjustment so as to shorten rod for earlier release, lengthen rod for later release, tighten locknut after adjusting and check operation.

Mounting:—Unit must be level (crosswise and lengthwise of car) when installed for correct operation. To check mounting, use spirit level placed on bosses on top of housing with car standing on level floor and all tires inflated to correct pressure. Adjust by loosening mounting bolts and shifting entire unit slightly (this adjustment not provided on all models).

BENDIX HYDRAULIC, DOUBLE ANCHOR

Used On:

HUDSON 6, 40T TRAVELER, 40P DELUXE (1940)

These brakes same design as used on previous '112' models.

NOTE:—Hudson (other models)—Bendix Hydraulic Single Anchor Brakes (with eccentric adjustment) used on other models. See separate article for data.

ADJUSTMENT:—Jack up all four wheels, remove wheels, take off adjusting hole covers on backing plates and inspection hole covers on drums. Disconnect hand brake cables from cable lever toggle by taking out clevis pins at forward ends of cables. CAUTION—If hand brake cables not disconnected, brake shoes may be held 'on' by cables (if adjusted too tight) so that correct brake adjustment cannot be secured.

Adjustment (For Wear):—Adjust at each wheel as follows:

1. Insert .010" feeler between brake drum and lining at upper (anchor end) of primary or forward shoe, loosen eccentric locknut, turn eccentric on this shoe in direction of forward wheel rotation until feeler gauge is just snug, hold eccentric in this position and tighten locknut securely.
2. Adjust secondary shoe (rear shoe) in same manner as primary shoe using same .010" feeler.
3. Use special adjusting tool or screwdriver inserted through hole in backing plate and turn notched adjusting screw (move outer end of tool up toward center of wheel) to expand shoes until drum can just be turned by hand, adjust and connect parking brake cables (see Parking Brake Adjustment below), back off adjusting screw until drum is free of any drag. Install wheels and road test car to check equalization.

Mechanical Follow-up Note—Setting should be checked after brakes adjusted. See separate article for adjustment instructions.

Parking Brake Adjustment:—With brake shoes expanded so that drums can just be turned, pull hand brake lever 'on' two notches so that clearance between hand brake cable lever and end of slot in guide plate is ⅛", pull cables tight and adjust clevis at forward end of each cable so that clevis pins just enter holes in toogle on lever, connect cables, back off adjusting screws until wheels are free, check equalization.

Brake Pedal Clearance:—Clearance between pedal shank and toeboard must be ¼" to insure master cylinder piston being against its stop in released position for correct compensating action. To adjust, remove clevis pin at forward end of connecting link (between pedal and master cylinder bellcrank), loosen locknut and turn link.

SERVICING:—All service operations same as for previous models. See 'Bendix Hydraulic Double Anchor' brake article in Mechanical Equipment Section of manual (or 1938 Supplement) for complete instructions.

HUDSON MECHANICAL FOLLOW-UP

Used On:

ALL MODELS (1940)

DESCRIPTION:—Same design as used on previous models. Consists of linkage connecting brake pedal and hand brake cable lever so that rear wheel brakes applied mechanically by brake pedal with additional pedal travel (beyond point where brakes applied by hydraulic system).

ADJUSTMENT:—See that brake pedal properly adjusted and that hand brake cable lever is against its stop (end of slot in guide plate). Loosen locknut on brake pedal pushrod (linking pedal and idler lever), turn rod until distance from rear face of lug on rod to forward end of pushrod tube is exactly 1¼", tighten locknut.

BENDIX VACUUM CYLINDER INTERNAL VALVE TYPE

Std. Equipment On:

CHRYSLER CROWN IMPERIAL, MODEL C27 (1940)

This Vacuum Cylinder same design as used on 1939 and previous Chrysler Custom Imperial Models.

ADJUSTMENT:—**Note**—Adjustment required only when master cylinder or vacuum power cylinder removed from car or disassembled (setting not disturbed by minor brake adjustment). CAUTION—Do not readjust vacuum cylinder linkage to compensate for normal brake wear—see Lockheed brake articles for brake adjustment instructions.

Adjustment:—Make following adjustments in order:

1. Adjust brake pedal stopscrew so that pedal shank just clears underside of toeboard.
2. Remove clevis pin connecting power cylinder operating lever and pullrod, disconnect power unit at point where it attaches to base of lever, loosen two studs holding valve operating lever to pedal so that pedal is free.
3. Hold operating lever so that clearance between lever and brake pedal shaft is at front side of shaft (hole in lever larger than shaft and clearance must be at front with brakes released to balance power cylinder against brake pedal), check master cylinder pushrod length to make certain that piston is against its stop. To adjust, disconnect master cylinder pushrod at point where it is connected to power lever (piston will then come back against stop), adjust pushrod length so that clevis pin enters hole in lever without disturbing piston or lever position, re-connect pushrod.
4. Without disturbing position of operating lever (clearance at front of pedal shaft), pull on power cylinder pullrod to make certain that piston against its stop, loosen frame bracket mounting bolt and shift bracket until pullrod clevis pin can be entered in operating lever without disturbing position of lever or piston pullrod. Connect pullrod and lever making certain that pin goes through ferrule on end of power cylinder valve operating rod (do not adjust this valve operating rod, rod is correctly adjusted at factory and setting does not change in service). See that hooked valve operating lever is hooked over ferrule.
5. Make certain that valve operating rod in correct position (rod will be pushed out of cylinder by spring so that ferrule will be against clevis pin), tighten two studs holding valve operating lever on pedal.

SERVICING:—**Lubrication**—At 6000 mile intervals, lubricate power cylinder by removing plug on front of cylinder and inserting one ounce of shock absorber fluid, transformer oil, or ice machine oil. At the same time, disconnect vacuum line connection at rear end of cylinder and insert an additional ounce of oil at this point.

LOCKHEED HYDRAULIC DOUBLE ANCHOR TYPE

Used On:

CHRYSLER 6, C25 ROYAL & WINDSOR (1940)
CHRYSLER 8, C26 & C27 ('40)—SEE NOTE
DE SOTO, S7 CUSTOM & DELUXE (1940)
DODGE, D14 DELUXE, D17 SPECIAL (1940)
GRAHAM, 107 SPECIAL, 108 SUPERCHARGER ('40)
HUPMOBILE, SKYLARK MODEL (1940)
PLYMOUTH, P9 ROADKING, P10 DELUXE (1940)
STUDEBAKER COMMANDER, MODEL 10A (1940)
STUDEBAKER PRESIDENT, MODEL 6C (1940)
WILLYS, MODEL 440 PASS. CARS (1940)

These brakes same design as used on corresponding 1939 car models except as noted below.

NOTE:—**Chrysler C26 & C27**—Rear brakes are double anchor type with new type wheel cylinder. Front wheel brakes are new Two-cylinder type (see following article for data on this type).

Willys—Brakes on this model are double anchor type (not same as Single Anchor brake used on 1939 Willys-Overland). Brakes on 440 Pick-up and 440P Panel Delivery are Bendix Single Anchor mechanical type (see separate article for data).

DESCRIPTION:—Same design as used on previous models except as follows:

Chrysler C26, C27 Wheel Cylinders—Wheel cylinder pistons have rubber 'piston ring' installed in groove in each piston. Separate piston cups are not used and no piston cup spring is required.

Chrysler, De Soto, Dodge, Plymouth Brake Anchor Pins—Marked by arrow on inner end to indicate point of minimum adjustment (same as for 1939). See special anchor pin adjustment under Major Adjustment below.

ADJUSTMENT:—Before making adjustments, jack up all four wheels, check brake pedal clearance or free travel (See Brake Pedal Adjustment below), check pedal travel (Chrysler—see below), release hand brake and make certain that rear wheels are free. Then adjust at each wheel (see following article for adjustment of Chrysler C26, C27 front wheels) as follows.

Chrysler, De Soto, Dodge, Plymouth Note—Total pedal travel on these models should be 1⅞-2¼" (except C26, C27), 1⅝-2" (Chrysler C26, C27). If Minor Adjustment does not correct pedal travel, check Brake Pedal Adjustment also.

Minor Adjustment (For Wear):—On Willys only, loosen eccentric cam locknut, on all models turn eccentric cam adjustment on backing plate out until brake shoe contacts drum solidly (install wrench on cam adjuster with handle up, move wrench handle toward rim of wheel), then back eccentric cam off until wheel is just free of any drag, tighten locknut (Willys only). Adjust all eccentric cams in this manner (one cam for each shoe, two cam adjusters on each wheel backing plate. On all models except Willys, cams are held in position by spring tension and no locking nuts are used.

Major Adjustment (For New Linings, etc.):—On Willys model slot provided in brake drum so that feelers can be inserted to check shoe clearance. On all other models special adjusting fixture or gauge (or cutaway drum) must be used to check setting. With gauge installed in place of brake drum and turned so that gauging is at heel (anchor pin end) of shoe approximately 1½" back from end of lining (do not gauge relieved or chamfered end of lining), loosen anchor pin locknut on backing plate, turn anchor pin (see special directions for Chrysler, De Soto, Dodge, Plymouth models below) until clearance between lining and drum is correct (see table below), tighten anchor pin locknut. Turn gauge to toe (wheel cylinder end) of shoe, adjust eccentric cam as directed in Minor Adjustment above until clearance is correct (see table below). Adjust each shoe in all wheels in same manner. Check Parking Brake Adjustment as directed below.

Brake Shoe Clearances

Car Model	Heel (Anchor end)	Toe (Cyl. end)
Chrysler C25	.006"	.012"
Chrysler C26, 27 (frt. shoe)	.006"	.007"
Chrysler C26, 27 (rear shoe)	.007"	.007"
De Soto, Dodge	.006"	.012"
Graham	.006"	.010"
Hupmobile	.005"	.010"
Plymouth	.006"	.012"
Studebaker 10A, 6C	.005"	.010"
Willys 440	.005"	.010"

Chrysler, De Soto, Dodge, Plymouth Note—Inner ends of anchor pins are marked by an arrow and flattened so that adjusting wrench can be applied at this end of pins. Before making adjustment, loosen anchor pin bolt nuts on backing plates, turn each anchor pin so that arrows line up with arrow heads together. Then adjust anchor pins by turning right hand pin counter-clockwise, left hand pin clockwise (pins turned toward each other at top) to secure correct clearance. CAUTION—Shoes will not be centralized in drum (even though set for correct clearance) unless anchor pin arrows lined up first and adjustment made exactly as specified above.

Brake Pedal Adjustment:—Brake pedal must have sufficient free travel or play to insure master cylinder piston being back against its stop with brakes released so as to provide correct compensating action. To adjust, loosen locknut on master cylinder end of pedal rod, turn large adjusting nut until pedal free travel is ¾-1 1/16" (Chrysler, De Soto, Dodge, Plymouth), ¼-⅜" (Studebaker), ½" (others), tighten locknut.

Chrysler C27 Note—See Bendix Vacuum Power Cylinder article for master cylinder pushrod adjustment (power cylinder adjustment will be disturbed unless adjustments made exactly as directed).

Parking Brake Adjustment:—Adjust hand brake cables on models where hand lever applies rear wheel service brakes as follows (On Chrysler, De Soto, Dodge, Graham, Plymouth models, independent hand brake located on propeller shaft at rear of transmission. See car model 'M' page for adjustment).

Hupmobile, Studebaker, Willys Models—With hand lever in released position, remove all slack in cable between hand lever and intermediate lever by adjusting turnbuckle at rear end of cable (on Willys, cross-shaft levers to which wheel cables are attached should be 23½° to rear of vertical with brakes released). Then pull hand lever 'on' to second notch (Hupmobile, Studebaker), third notch (Willys), adjust each wheel cable by turning turnbuckle or adjusting clevis at forward end of cable until slight drag felt at rear wheels, connect cables and release hand lever. Wheels should be free of any brake drag. Equalize by making slight adjustment on wheel cable for tight wheel.

SERVICING:—All servicing operations (Bleeding of lines, brake shoe removal and installation, master cylinder and wheel cylinder overhaul) same as for previous models except as noted below. *See 'Lockhead Hydraulic Type' brake article in Mechanical Equipment Section of manual for complete instructions and note following new data:*

Chrysler C26, C27 Wheel Cylinders—No piston cup spring used and pistons will not spring out of wheel cylinder when released as on other models. To remove pistons, blow through brake tube connection. With pistons out, rubber piston ring can be removed by rolling it off the end of the piston. Install piston ring with lip toward inner end of piston.

LOCKHEED HYDRAULIC SINGLE ANCHOR TYPE

Used On:

STUDEBAKER CHAMPION, MODEL 2G (1940)

This brake same design as used on 1939 Champion.

ADJUSTMENT:—Before making adjustments, jack up all four wheels, check pedal clearance or free travel (see Brake Pedal Adjustment below), release hand brake. Then adjust brakes at each wheel as follows:

Minor Adjustment (For Wear):—Install wrench on eccentric adjusting cam on backing plate with wrench handle up, turn cam by moving wrench handle out toward wheel until shoe contacts drum (brakes drag when wheel revolved), then turn cam in opposite direction until wheel is just free of any brake drag. Adjust all eccentric cams in this manner (one cam for each shoe, two cams on each backing plate). Cams are held in position by spring tension and no locking nuts are used.

Major Adjustment (For new linings, etc):—With wheels removed, rotate brake drums so that inspection hole in drum is at heel (anchor pin end) of shoe, loosen eccentric anchor pin locknut, turn anchor pin until clearance between lining and drum is exactly .006" (measured with feeler gauge 1½" from end of lining). Check to see that heel clearance on opposite shoe is likewise .006", tighten anchor pin locknut. Turn drum so that slot is 1½" from end of lining at toe end of shoe, adjust eccentric cam (as directed under Minor Adjustment above) so that clearance is exactly .010". Recheck clearance at anchor pin end and make any necessary re-adjustments to secure correct clearance at both ends of shoe. Adjust eccentric cam on opposite shoe, then repeat adjustment at other wheels.

Brake Pedal Adjustment:—Pedal must have ¼" min., ½" max. free travel to insure master cylinder piston being back against its stop (in cylinder) for correct compensating action when brakes released. To adjust, loosen locknut and turn large adjusting nut on master cylinder end of connector rod.

Parking Brake Adjustment:—Adjust whenever brakes adjusted for wear or new shoes installed. To adjust, remove pin linking brake cable to parking brake lever on rear wheel backing plate, pull on cable to eliminate slack and press forward on lever to take up play, install pin through holes in lever and cable end which line up. Adjust both wheels in same manner, check for brake drag and equalization after adjustment completed.

SERVICING:—All service operations including Bleeding of Lines, Master Cylinder and Wheel Cylinder Overhaul are same as for other Lockheed Brakes. *See Lockheed Hydraulic Type brake article in Mechanical Equipment Section of manual for complete data.*

LOCKHEED HYDRAULIC TWO-CYLINDER TYPE

Used On:

CHRYSLER 8, C26, C27 ('40) FRONT WHEELS ONLY

NOTE:—These brakes used on front wheels only. Rear brakes are conventional Lockheed Double Anchor Type with single double-acting wheel cylinder (see preceding article for rear brake data).

Chrysler C27 Power Brake—This model has Bendix Vacuum Power Cylinder (internal valve type). See separate article for adjustment and servicing data.

DESCRIPTION:—Each brake shoe actuated by individual wheel cylinder with single acting piston (forward shoe anchored at lower end and operated by upper cylinder, rear shoe anchored at upper end and operated by lower cylinder) the effect being similar to that of two 'forward' shoes on other Lockheed brakes. Brake cylinders are connected in tandem with a connecting tube extending from one cylinder to the other within the brake drum (brake line is connected to upper cylinder in usual manner), the principal difference being an additional bleeder connection on the backing plate at the lower cylinder. Double retracting springs are used (hooked between shoes at each end).
CAUTION—When bleeding brake lines, **both** wheel cylinders must be bled—see directions below.

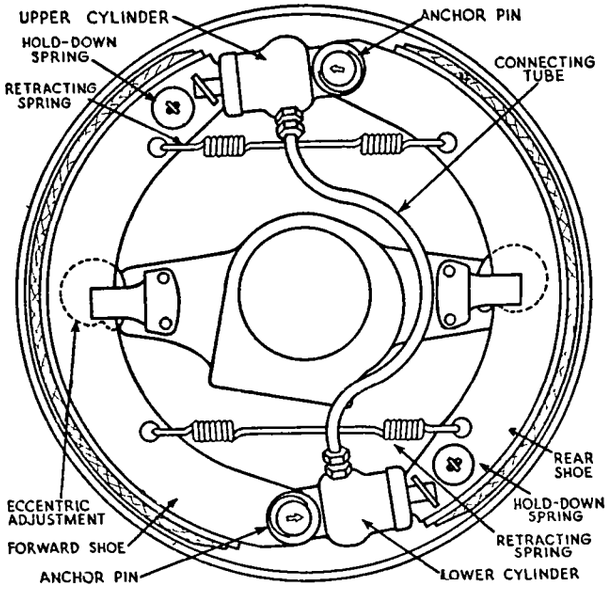
ADJUSTMENT:—Before making adjustments, jack up all wheels, check brake pedal free travel (should be ¾-1 1/16"—see Brake Pedal Adjustment below). Then adjust each front wheel as follows.

Pedal Travel Note—Total pedal travel should be 1⅝-2" and should be correct after Minor Adjustment if brake pedal free travel is correct.

Minor Adjustment (For Wear):—Turn eccentric cam adjuster on backing plate out until shoe is solid against drum and wheel is locked, then back eccentric off until wheel is free. Adjust each eccentric in this manner (one eccentric for each shoe, two on each wheel backing plate). Eccentric is held in position by spring tension and no locknuts are used. Adjustments should be made with brakes at room temperature (will drag when cold if adjusted hot).

Major Adjustment (For New Linings):—Special adjusting gauge (MT-19-C) or cutaway drum must be used to check shoe clearance. Before making adjustments, set both anchor pins in minimum position by loosening locknuts on backing plate and turning anchor pin until arrow on inner end points toward adjacent wheel cylinder. Install gauge and turn so that gauging point is at heel (lower end) of forward shoe. Turn anchor pin in clockwise direction (right hand side of car), counter-clockwise direction (left hand side of car) to move shoes out toward drum until clearance is exactly .006", tighten anchor pin locknut. Rotate gauge to toe (wheel cylinder end) of shoe, adjust eccentric cam adjuster on backing plate until clearance is exactly .007". Repeat these adjustments for rear shoe (keeping in mind that anchor pin end and wheel cylinder end of shoe reversed from those on forward shoe), then adjust wheel on opposite side of car in same manner (anchor pin must be turned in opposite direction as directed above).

CAUTION—Anchor pins must always be turned to minimum adjustment position (with arrow on inner end pointed toward adjacent wheel cylinder) before adjustments are made. If this is not done, shoes will not be centralized in drum even though clearances are correct. Anchor pin inner ends are flattened so that wrench can be applied at this point and arrows checked while pins are being turned.



Brake Pedal Adjustment:—Brake pedal must have ¾-1 1/16" free travel to insure master cylinder piston being back against its stop and compensating port uncovered when brakes released in order to provide for correct compensating action (brakes will drag if this port blocked). To adjust, loosen locknut on master cylinder end of pedal rod, turn large adjusting nut.

Chrysler C27 Note—See Bendix Vacuum Power Cylinder article for master cylinder pushrod adjustment (power cylinder adjustment will be disturbed unless adjustments made exactly as directed).

SERVICING:—Bleeding Brake Lines—Fill master cylinder supply tank with fresh fluid, attach bleeder hose to bleeder screw in center of **upper** wheel cylinder, submerge end of hose in fluid in clean glass container. Loosen bleeder screw ½-¾ turn, bleed line by pumping brake pedal slowly through one-half of pedal travel until fluid flow from hose is continuous and no air bubbles are evident. Then close upper bleeder screw. Connect hose to lower cylinder bleeder screw in center of **lower** wheel cylinder, open bleeder screw ½-¾ turn and bleed line between two brake cylinders in same manner. This is important.

Wheel Cylinders—Wheel cylinders (two per wheel) are single acting type with one piston. Pistons have rubber 'piston ring' in groove on piston and separate piston cups and piston cup spring are not used. To remove piston from cylinder, after wheel cylinder has been taken off car, blow through brake line connection. Remove piston ring from piston by rolling it off the end of the piston. When installing this rubber ring, make certain that lip is in toward inner end of cylinder.

Master Cylinder—Same as for other Lockheed types. See Lockheed Brake article in Mechanical Equipment Section of manual for servicing data.

HAWLEY TYPE

Used On:

CROSLEY, MODEL A (1939-40)

TYPE:—Hawley Neutral Shoe type with floating brake lining. Lining consists of a single piece of sufficient length to reach entirely around shoes with gap of 1/16" at ends. Lining is centered on shoes by rib on backing plate and conical retainer on wheel side.

DESCRIPTION & OPERATION:—Wheel Brakes. Two shoes per wheel, anchored at adjusting screw end and operated by cam at opposite end. Shoes are held against adjusting screw and cam by small coiled spring hooked between shoes at each end.

Linkage:—Wheel brakes operated by cables from main cross-shaft on frame. Cables enclosed in conduits at wheel ends and provided with adjusting clevises at cross-shaft.

Hand Brake:—Hand lever is linked to main cross-shaft on frame. Cables enclosed in conduits at wheel ends and provided with adjusting clevises at cross-shaft.

Hand Brake:—Hand lever is linked to main cross-shaft and applies all four wheel service brakes.

ADJUSTMENT:—Jack up all four wheels, remove clevis pins and disconnect all four wheel cables at cross-shaft. At each wheel, loosen locknut and tighten brake adjusting screw on backing plate (turn screw counter-clockwise) until slight drag noticed when wheel turned by hand, then back adjusting screw off (turn screw clockwise) until wheel is just free, tighten locknut.

Linkage Adjustment—Depress brake pedal 1" and hold in this position. Adjust clevis on cross-shaft end of each wheel cable so that brakes barely drag when cable connected to cross-shaft. Release pedal. Road test car and equalize brakes by turning adjusting screw on tight wheel slightly (turn screw clockwise to loosen brakes).

SERVICING:—Brake Lining Replacement—To remove and renew brake linings, jack up wheel, remove hub cap, wheel, and hub assembly. Remove conical brake lining retainer. Take out old lining. Insert new lining and re-install wheel.

Brake Lining Note—Use only genuine Crosley lining—furnished in correct length to fit around shoe with 1/16" gap at ends. Lining is not riveted on shoes and is installed loosely in drum.

Brake Cable Lubrication:—Whenever brake cables adjusted, fill cable conduits with grease. When connecting cables use care not to twist or buckle cables excessively.

FORD-LOCKHEED TYPE

Used On:

FORD, ALL '60', '85', '95' PASSENGER CAR & TRUCK MODELS (1940)

MERCURY, MODEL 09A (1940)

These brakes same design as used on 1939 models.

LINCOLN-ZEPHYR NOTE:—Lincoln-Zephyr brakes are Bendix Hydraulic Single Anchor Type (without eccentric adjustment). See separate article for data on Bendix brakes.

DESCRIPTION:—Same design as used on 1939 models except for new type parking brake on truck models as follows:

All Trucks except ¾ & 1 Ton—Parking brake consists of an independent drum and brake band on the propeller shaft directly back of the transmission. For hand brake adjustment on these models, see Ford Truck 'M' page.

¾ & 1 Ton—Hand lever actuates rear wheel service brakes (same as 1939). Adjustment instructions given below.

ADJUSTMENT:—Before adjusting, jack up all four wheels, remove one front wheel and inspect lining (to determine if new linings required), re-install wheel. Check front wheel bearing adjustment, spring shackles, shock absorber links, and radius rod mountings, tighten steering connections. Place hand lever in released position. Adjust each wheel as follows:

Minor Adjustment (For Wear):—Install wrench on eccentric adjusting cam on backing plate with wrench handle upward, turn cam by moving wrench handle out toward wheel rim until shoe is tight in drum, then turn cam back until wheel just turns freely without drag (do not turn cam back more than enough to free wheel, desired setting is with least possible amount of clearance). After adjusting forward shoe, repeat adjustment on rear shoe, then adjust all other wheels in same manner. Check pedal reserve, if reserve less than half total travel, repeat adjustment (if pedal is 'spongy', bleed lines). Check brake pedal clearance and adjust hand brake (see instructions below).

Major Adjustment (For relined brakes, etc.):—NOTE—Before installing brake drums, loosen eccentric anchor pin locknuts and turn each anchor pin so that marks on flatted ends of pins are together (marks indicate 'high' side of eccentric and in this minimum position will allow drums to be installed over new linings). Adjust eccentric adjusting cam for each shoe (see Minor Adjustment above), then adjust anchor pins as follows: Depress brake pedal with 25-35 lbs. pressure (hold in this position while making adjustments), use wrench with 3" handle and turn eccentric anchor pin so that mark moves down until brake shoe is felt to contact drum, hold anchor pin from turning and tighten locknut securely. Release brake pedal, check wheel to see that it turns freely without any drag, repeat adjustment if wheel drags. This setting designed to secure less clearance at anchor pin or heel end of shoe than at toe with only slight clearance for entire shoe. Adjust both shoes in each wheel in this manner, check brake pedal clearance and adjust hand brake as directed below.

Brake Pedal Adjustment:—Brake pedal must have ¼-½" free movement (measured at pedal pad) to insure master cylinder piston being against its stop for correct compensating action when brakes released. To adjust, loosen locknut on pedal rod, turn rear section of rod (integral with large adjusting nut—not necessary to disconnect clevis pins), tighten locknut.

Parking (Hand) Brake Adjustment (Passenger Cars):—Place hand lever in fully released position. Use pedal jack to depress brake pedal so that rear brake shoes applied firmly against drums (leave in this position while adjusting). Pull forward on cables to remove all slack, adjust clevis on end of hand brake cable. Release pedal jack and check adjustment. End of hand brake lever should move ½" before all slack in cable is taken up and wheels should be free with hand brake lever released.

¾ & 1 Ton Models—Place hand lever in fully released position, use pedal jack to depress brake pedal so that rear brake shoes applied firmly against drums (leave in this position while adjusting). Disconnect both wheel cables at intermediate lever on frame, loosen locknut and adjust clevis on forward end of each cable so that all slack removed when cables re-connected. Release pedal jack, adjust clevis at intermediate lever end of hand lever so that ½" movement of hand lever tip required to remove all slack from cables and that bolt on intermediate lever bracket is in center of slot with hand brake applied.

Other Trucks—These models have independent hand brake on propeller shaft. See Ford Truck 'M' page for data.

SERVICING & OVERHAUL:—Same as for 1939 models. ***See 'Ford-Lockheed Type' brake article in Mechanical Equipment Section of manual (or 1939 Supplement) for complete instructions.***

CHEVROLET (OWN) HYDRAULIC TYPE

Used On:

ALL PASSENGER CAR & TRUCK MODELS (1940)

These brakes same design as used on corresponding 1939 models except as noted below.

DESCRIPTION:—Same as 1939 types except as follows: **Front Brake Adjustment Slots**—Slots provided in front wheel backing plates (closed by snap covers) on Passenger Cars and Trucks so that brakes can be adjusted without removing front wheels (as was necessary on 1939 models).

Hand Brake (Passenger Cars)—New type idler lever mounted on bracket welded to second cross-member (at rear of transmission) and linked to each rear wheel by cable with adjustment on each cable at idler lever end (see adjustment data below).

ADJUSTMENT:—Jack up all four wheels (not necessary to remove front wheels as in 1939). Disconnect hand brake cables at idler lever (Pass. Cars), hand brake rods at cable connectors (Trucks). Adjust each wheel as follows.

CAUTION—Hand brake rods must be disconnected to eliminate any possibility of shoes being held on by cables which would make it impossible to secure satisfactory brake adjustment.

Adjustment (Except 1½ Ton Rear Wheels). Insert screwdriver in slot on backing plate at each end of wheel cylinder so as to engage notched adjusting covers on cylinder (adjusting cover on each end of cylinder controls one shoe), turn adjusting covers until shoe has slight drag on drum, then back cover off exactly 4 notches (all models except 1½ Ton Truck front wheels), 5 notches (1½ Ton Truck front wheels) to provide correct clearance. Adjust all wheels in this manner, then adjust parking brake (see below) and check brake pedal clearance.

Adjustment (1½ Ton Truck Rear Wheels). Wheel cylinder adjusting covers turned by means of hexagonal-headed pinion shafts on backing plates. Turn each pinion shaft clockwise until shoe has slight drag on drum, then turn pinion shaft back ¾ turn for correct clearance, adjusting parking brake (see below) and check brake pedal clearance.

Parking Brake Adjustment (Passenger Cars):—Place hand lever in fully released position. Loosen both check nuts on each wheel cable at idler lever on frame cross-member at forward end of cables, pull cables forward out of conduit until definite stop is felt, hold cable in this position and tighten both check nuts on each cable so that cable is locked to idler lever toggle. Check to make certain that rear wheels are free.

Adjustment (Truck Models). Place hand lever in fully released position. Pull wheel cable end fitting (at front of rear frame cross-member) forward until a definite stop is felt, hold cable in this position, turn nut on forward rod down until it contacts (turn by hand only, do not use wrench), lock cable by turning rear nut up securely. Check equalization and make any necessary re-adjustment by loosening wheel cable to tight wheel slightly (do not change wheel cylinder adjusting cover setting). **Cab-over-Engine Note**—Adjusted in same manner as other trucks but Front Cowling Assembly and Left Front Fender must be removed for access to hand lever mounting and pull rod clevis pin.

Toggle Lever Adjustment (When new Shoes Installed). With brake drum removed, loosen eccentric bolt locknut (on web of one shoe), hold toggle lever against shoe, turn eccentric bolt until there is only slight clearance between lever and bottom of slot in hand brake extension link, tighten eccentric bolt locknut and recheck clearance.

NOTE—This toggle arrangement not used on 1½ Ton truck models.

Brake Pedal Clearance:—Clearance between pedal and underside of toeboard must be ¼" to insure master cylinder piston being back against its stop for correct compensating action when brakes released (clearance between edge of master cylinder piston primary cup and center of compensating port must be .035" min.). Adjust each model as follows:

Passenger Cars. Loosen locknut on eccentric bolt (linking pedal and master cylinder piston rod), turn bolt until correct toeboard clearance secured, tighten locknut.

Truck Models. Loosen locknut at clevis on rear end of master cylinder pushrod, turn pushrod until correct toeboard clearance secured, tighten locknut.

SERVICING:—All service operations including Bleeding of Brake Lines, Brake Shoe Removal & Installation, Master Cylinder & Wheel Cylinder Overhaul same as for previous models. ***See 'Chevrolet (Own) Hydraulic Type' brake article in Mechanical Equipment Section of manual for complete instructions and note following data:***

Brake Shoe Installation (Pass. Cars, ½ & ¾ Ton Models)—When installing shoes, make certain that they contact pads on anchor plate (3 pads for each shoe) by checking clearance between shoe and each pad with .002" feeler gauge. If shoes do not contact all pads, bend anchor plate.

BENDIX VACUUM TYPE

Standard or Optional Equipment on:

BUICK, ALL MODELS (1933-34-35).
CADILLAC ,ALL MODELS (1932-33).
CHRYSLER, DE SOTO, DODGE, PLYMOUTH (1932-36).
HUDSON, ESSEX, TERRAPLANE MODELS ('33-36).
LA SALLE, ALL MODELS (1932-33).
PACKARD EIGHTS & TWELVE (1932-34)
STUTZ, ALL MODELS (1933-36).

NOTE:—Buick 'Wizard Control' used on 1932 models was same general design as on later models but used transmission-controlled valve assembly to control clutch engagement. See separate article on Buick Wizard Control following for data on this equipment.

DESCRIPTION & OPERATION:—Bendix Clutch Control consists of a Vacuum Power Cylinder linked to the clutch throw-out shaft lever so that clutch is drawn out of engagement whenever vacuum admitted to one end of cylinder, and clutch is engaged when the vacuum is cut off and air is admitted to the cylinder. Rate of engagement is controlled by inserting a check-valve in the air intake to the opposite end of the cylinder and controlling or 'bleeding' air from the cylinder as the clutch is engaged. Vacuum power cylinder operation is controlled by a two or three plunger valve assembly in the vacuum and bleeder lines as follows:

Accelerator Pedal Plunger—Linked to accelerator pedal so that groove near end of plunger lines up with vacuum passage in valve body opening vacuum line to cylinder when pedal is fully released. Vacuum port from manifold is cut off when pedal is depressed and air is admitted to cylinder through slot in plunger stem.

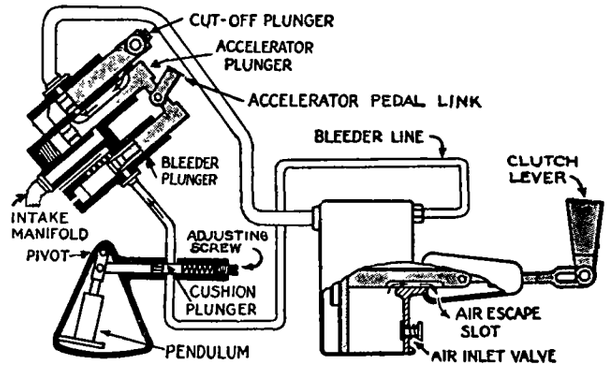
Bleeder Plunger—Linked to accelerator pedal plunger and moves in conjunction with it. Taper on plunger controls air escape from opposite end of vacuum cylinder when piston moves back during clutch engagement (clutch movement is rapid during first part of stroke while air is escaping through slot or valve in piston rod, this port being cut off at 'cushion point' so that air remaining in cylinder is forced to escape through bleeder line and bleeder plunger slot during final stage of clutch engagement). On some models separate bleeder plunger not used and bleeder action is controlled by additional slot in accelerator plunger stem.

Cut-Off Plunger—Used to cut out automatic clutch operation when desired. On Chrysler and Hudson models, cut-off plunger linked to free-wheeling control so that automatic clutch inoperative when free-wheeling locked out. On 1933 Buick and all Cadillac models, cut-off valve connected to 'Free-wheel' control button and operative only when button is depressed. On 1934-35 Buick models, separate control button on instrument panel is used. On Packard models, a control lever on the steering wheel is used.

Cushion Control—Not used on 1932 models. Consists of second control valve in vacuum cylinder bleeder line controlled by pendulum weight which prevents surging during high speed clutch engagement. Movement of pendulum when car surges causes plunger type valve to close momentarily delaying clutch engagement until car speed can be brought up to engine speed.

ADJUSTMENT:—Clutch pedal clearance and free movement, accelerator pedal linkage, and carburetor idling speed adjustments must be correctly made before automatic clutch is adjusted. Adjust automatic clutch whenever clutch pedal adjustment is made. Instructions for each model given below:

Buick (All Models):—On 1933 models, adjust trunnion on cut-off plunger rod so that plunger does not quite bottom in housing when control button fully depressed (determine bottoming point, then turn trunnion in two full turns). On 1934-35 models with cable control, push button in toward instrument panel, loosen cable control lockscrew on cut-off plunger, push plunger in until it bottoms in housing, tighten lockscrew. Adjust trunnion at forward end of accelerator rod so that tip of accelerator pedal is exactly 4⅛" (50 '33), 4⅜" (60 '33), 4⅝" (90 '33, 50 '34-35), 4⅞" (60, 90 '34-35) above the toeboard (measured at right angle to floor) with pedal fully released. Adjust trunnion on lower end of plunger connecting rod so that plungers are fully down in valve housing with accelerator pedal released. Ring on bleeder plunger must be in line with front edge of valve cover plate in this position. Adjust by turning plunger on stem. Adjust throttle lever adjusting screw (controlling over-run between



accelerator linkage lever and valve plunger rod lever) so that free play is taken up and ring on accelerator plunger is flush with cover plate just as carburetor throttle begins to open (operate engine to check throttle opening point). Operate engine to check settings and make final adjustments as follows: Use control button to engage clutch for low gear start. Car should start smoothly without jerking or excessive clutch slippage. Loosen locknut and turn compensator valve (piston rod valve) adjustment out as much as possible without interfering with smooth starting. If clutch engagement is rough, turn compensator in slightly. Then start car in low and reverse with small throttle opening. If engagement severe and rough, turn bleeder plunger out slightly. If engagement slow, turn bleeder in slightly. Plunger must not be turned more than 3 turns either way from initial setting. With final compensator or piston rod and bleeder plunger settings, clutch slippage should be normal with part throttle and engine speeds below 20 M.P.H. Check Cushion Control plunger setting by starting with wide open throttle in low gear. If car jerks or surges, back plunger adjusting screw off slightly. If clutch slippage is excessive, turn screw in slightly.

Cadillac and La Salle Models:—Adjust cut-off plunger linkage so that plunger contacts lever with button released and in outer position (plunger is spring-loaded). Adjust throttle linkage so that tip of accelerator pedal is ⅝" from top of toeboard with throttle wide open and against its stop. Check throttle linkage free movement. Groove on accelerator pedal plunger stem should be flush with face of valve housing cover plate when throttle begins to open (17/32" travel at tip of accelerator pedal). See that linkage does not bind. Adjust bleeder plunger by loosening locknut and turning stem out until center of hole in stem eye is 1-1 1/16" from face of plunger.

Operate engine to check final adjustments as follows: Start car in low gear by releasing control button to engage clutch without using accelerating pedal. Car should start immediately and engagement should be smooth. Lengthen vacuum cylinder piston rod if clutch engagement rough or jerky, shorten rod slightly if start is delayed. Check bleeder plunger setting by starting car in low gear in normal manner (keep control button pressed down, use accelerator pedal to engage clutch). If clutch engagement is rough or jerky, shorten length of bleeder plunger stem slightly; if clutch slippage excessive, lengthen arm slightly. Check high speed starting by operating engine at 25 M.P.H. speed, use accelerator pedal to disengage and engage clutch. If clutch slippage excessive, lengthen bleeder plunger stem slightly. Final setting should not be much greater than 1 1/16".

Chrysler, De Soto, Dodge, Plymouth Models:—Depress clutch pedal enough to take up pedal free movement (stop at point where throw-out bearing contacts release levers), check clearance between screw on power cylinder lever and operating lever on throw-out shaft. Loosen locknut and turn screw until clearance at this point ¼" (Dodge '33), ⅛" (all others). Check clearance between accelerator plunger linkage and throttle valve linkage and set so that plunger travel is ¼" (all '32 models and Dodge '33), 5/32" (all other '33 models), 3/16" ('34 and after) before throttle valve begins to open. Separate bleeder plunger not used on these models and bleeder adjustment not necessary. Check and adjust piston rod length on 1932 models so that distance from center of hole in rod to face of stem (locknut seat) is 3½" (Chrysler, De Soto, Dodge Sixes), 4½" (Chrysler Eight), 3⅝" (Chrysler Imperial and Custom Imperial). On 1933 models piston rod length checked by measuring from rod eye center to center of mounting hole on opposite end of cylinder with piston at outer end of stroke. Distances should be 13 3/16" (Chrysler, De Soto Six), 13½" (Chrysler Eights), 14 13/16" (Dodge), 14 3/16" (Plymouth). On 1934 and later models, compensator valve in piston rod used instead of slot and adjustment made by checking performance (see below). Check settings by road testing car using normal accelerator pedal operation. If engine stalls, decrease accelerator plunger travel or linkage clearance so that throttle valve opens sooner. If clutch engagement is delayed or engine speeds up, increase travel. If clutch engagement is rough or jerky with small throttle openings, shorten piston rod slightly (early models) or loosen locknut and turn compensator adjusting nut on piston rod in slightly (later models). If clutch engagement is delayed, lengthen piston rod or turn compensator adjusting nut out slightly. Check starting in low gear with wide open throttle. If engagement is rough or jerky, loosen

locknut and turn Cushion Control adjusting screw out. If clutch slippage excessive, turn adjusting screw in. Cushion Control not used on 1932 models.

Hudson, Essex, Terraplane Models:—Adjust accelerator plunger rod length so that plunger is out against its stop with ⅜" clearance between plunger rod lever and toe board. Depress accelerator pedal, pull vacuum cylinder piston out to end of stroke, adjust cable length by turning clevis out until pin will just enter hole in lever, then turn clevis out 7 additional turns (1932-33 models). On later models, clearance between back of slot in cable yoke and clevis pin hole in lever should be ½" (1934), ⅞" (1935). Operate engine and check setting by using control button to engage clutch without depressing accelerator pedal. If clutch engagement is rough or jerky, shorten piston cable slightly. If engagement is delayed, lengthen cable slightly. Use accelerator pedal to start car in normal manner. Clutch should begin to engage just as throttle valve begins to open. If clutch grabs, shorten accelerator plunger slightly. If clutch slips and engine speeds up before engagement, lengthen rod. On later models with Cushion Control, check operation by engaging and disengaging clutch with engine operating faster than normal. If engagement is rough or jerky, turn plunger adjusting screw out. If clutch slippage excessive, turn screw in.

Packard Models:—Accelerator plunger adjusted by changing position of unit on steering column. With tip of accelerator pedal 2½" above floor board and accelerator plunger connected to throttle shaft, locate unit on steering column so that accelerator and bleeder plungers are all the way out, clamp in this position. Check distance from hexagonal nut on bleeder plunger stem to face of housing cover plate. Adjust by turning nut until this distance is ¾". See that accelerator pedal operates freely and can be depressed sufficiently to open throttle wide after these adjustments. Play or lost motion in accelerator pedal linkage should be ¼" (⅜" maximum play provided for by elongating slot in link on end of connector rod). Adjust by loosening locknuts and turning rod. This adjustment determines idling speed at which clutch will be disengaged (car will idle at 10 M.P.H. without clutch disengagement with this setting). Check cut-off plunger setting by pulling control lever on steering wheel all the way down and noting if cut-off plunger all the way out. Adjust by disconnecting connecting rod and adjusting length of rod. Operate car to check settings. Start car in low gear by operating cut-off plunger control lever to engage clutch (do not depress accelerator pedal). Car should start immediately and smoothly. If engagement rough or jerky, shorten vacuum cylinder piston rod. If start is delayed, lengthen piston rod. Start car in low gear by manipulating accelerator pedal to engage clutch. If engagement is rough or jerky, shorten bleeder plunger stem length slightly. If clutch slips, lengthen plunger stem.

REO TYPE

Reo Models:—Vacuum cylinder on this model is diaphragm type mounted on the dash and connected directly to the clutch pedal by a cable. Valve assembly mounted directly on top of diaphragm cylinder. Consists of main valve (cut-off plunger) connected to control button on toe board, control valve (corresponds to accelerator plunger), and bleeder valve. Control valve and bleeder valve are spring-loaded and operated by manifold vacuum variations without external connections. Adjusting screw which controls spring tension provided for each of these valves. Adjust each valve in order as follows:

Control Valve Adjustment—Loosen locknut and back off bleeder valve adjusting screw so that all spring tension on bleeder valve removed while control valve being adjusted. This is important. Operate engine at 12-15 M.P.H. speed (hold at this speed by setting hand throttle while making adjustment). Shift into low gear and engage clutch by releasing control button (do not depress accelerator pedal). Clutch should move rapidly to point where engagement begins, slip momentarily and car should then start slowly and smoothly. If engagement too rapid or rough, loosen locknut and turn control valve adjusting screw in one turn at a time, repeating test after each adjustment. If engagement too slow, with excessive clutch slippage, turn screw out.

Bleeder Valve Adjustment—Operate engine at regular idling speed (5 M.P.H.) with throttle closed. Shift into low gear and start car in usual manner (release control button and depress accelerator pedal for desired acceleration). Start should be smooth but will be slow until bleeder valve adjusting screw turned in. Turn screw in enough to give desired performance, tighten locknut after adjustment completed.

Linkage Adjustment—Adjust vacuum cylinder cable length to remove slack. This adjustment has no effect on performance except that excessive slack may prevent complete clutch disengagement.

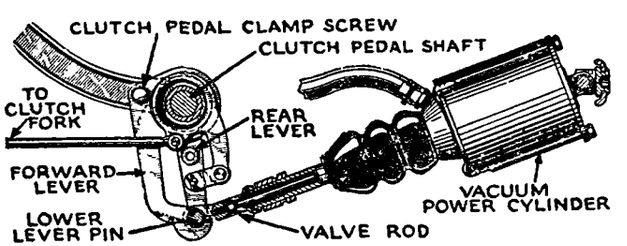
Servicing—Wire mesh type air cleaner under cover on top of valve assembly should be cleaned in gasoline and re-oiled occasionally (accessible by taking out four screws in pressed steel cover).

PACKARD CLUTCH CONTROL

Used On:

TWELVE, 1507,8 ('37), 1607,8 ('38), 1707,8 ('39)

DESCRIPTION:—Power cylinder is 'internal valve' type with control valve located within piston rod and actuated by pushrod extending out through piston rod to clutch lever clevis.



ADJUSTMENT:—Remove the front floor boards, depress clutch pedal several times, see that pedal is against toe board spring with clutch engaged. Loosen pedal clampscrew, press lower end of rear lever back and forward lever front at bottom until all clearance on pin at lower end of levers and on clutch pedal shaft at upper end of levers is at front, hold levers in this position, tighten clampscrew. Depress clutch pedal exactly 1 13/16", hold in this position, loosen locknut and turn adjusting nut on forward end of connecting rod at clutch fork until release bearing just contacts clutch release levers, tighten locknut. With correct adjustment, power cylinder valve will open just as release bearing contacts levers with pin at the lower end of the clutch pedal levers at front (clearance at rear).

BUICK WIZARD CONTROL

Used On:

MODELS 50, 60, 80, 90 (1932)

DESCRIPTION AND OPERATION:—Similar to other Bendix units in that Cut-off plunger linked to control button and accelerator plunger linked to accelerator pedal used to control vacuum line to cylinder. Additional valve assembly on transmission consisting of three bleeder plungers linked to clutch lever and barrel-type valve linked to transmission shift mechanism used to control rate of engagement for each gear ratio. The barrel type valve selects the correct bleeder plunger for each ratio. Bleeder plunger controls rate of air admission regulating speed of power cylinder return stroke and clutch engagement.

ADJUSTMENT:—Power Cylinder Travel—With clutch pedal properly adjusted, press pedal down to toeboard, loosen locknuts on power cylinder rod turnbuckle, adjust rod length so that piston just touches the back end of the cylinder. Locknut on cylinder end of turn-buckle must be loosened first and tightened last to avoid damaging piston diaphragm.

Control Valve Linkage—Adjust trunnion on rear end of control valve rod so that cut-off plunger is all the way out with shoulder on plunger against cover plate when control button is pressed all the way down to the floor. See that cotter pin at forward end of rod inserted from bottom to prevent interference with accelerator valve plunger.

Accelerator Valve—Close hand throttle, adjust throttle rod by turning trunnion at carburetor end of rod so that clearance between accelerator pedal lever and underside of toeboard is ⅜" (50, 80, 90), 3/16" (60) with spring loaded trunnion at rear end fully extended and accelerator plunger rod disconnected. Adjust trunnion on accelerator pedal rod so that spring loaded trunnion on throttle rod is 1/16" from shoulder on rod with accelerator plunger out all the way. Check adjustment by idling engine and noting whether clutch mechanism starts to move slowly just as throttle begins to open. Shorten accelerator plunger rod until this action secured.

Selector Valve—Depress clutch pedal to point where all free movement taken up, check distance from back face of valve body (cover removed) to slotted end of bleeder plungers. Should be ⅜". Adjust by turning wing nut on connector rod at clutch pedal. Check setting by noting clutch engagement when car started in all gears. If engagement too severe or rough, turn wing nut counter-clockwise. If clutch slips, turn nut clockwise. If clutch grabs or slips in one gear only, adjust bleeder plunger for that gear separately by removing cover plate, inserting screwdriver and turning plunger counter-clockwise to correct too severe engagement or clockwise to correct excessive slipping. Plungers and case marked '1'(low and reverse—lower plunger), '2'(second—middle plunger), '3' (high—upper plunger).

Optional Equipment On:

HUDSON SIX, MODEL 73 (1937).

HUDSON EIGHT, MODELS 74, 75, 76, 77 (1937).

TERRAPLANE, MODELS 70, 71, 72 (1937).

DESCRIPTION:—Bendix Vacuum Cylinder type with accelerator pedal control and Cushion (pendulum) Valve. Similar to type used previously except that Cut-off Plunger has been discontinued and a solenoid operated valve installed instead. Valve solenoid is controlled by 1) Dash Control Switch, 2) Governor switch (on speedometer take-off at transmission), 3) Electric Hand Selector Switch, and 4) High Gear Ground Switch (on transmission) to prevent clutch being disengaged by the release of the accelerator pedal at speeds above 15 M.P.H. with transmission in high gear. These controls operate as follows:

Dash Control Switch—Main switch for valve solenoind circuit. With switch button pulled out, solenoid circuit is broken and valve is closed (Clutch Control inoperative). Allows Automatic Clutch to be cut in or out as desired.

Governor Switch—This switch is closed with car standing or moving less than 15 M.P.H. completing solenoid circuit to ground so that Automatic Clutch is operative. At speeds above 15 M.P.H., this switch is held open so that solenoid circuit is broken and Automatic Clutch cannot operate unless circuit is completed by the Electric Hand Selector Switch or the High Gear Ground Switch.

High Gear Ground Switch—At forward end of transmission and operated by high gear shifter rail. Closed in all gear positions except high gear. Switch is opened when transmission shifted into high gear so that Automatic Clutch is inoperative and will not disengage clutch at speeds above 15 M.P.H.

Electric Hand Selector Switch—Consists of a ground strap which completes solenoid circuit to ground in all switch positions except high gear. With Selector switch in high gear, flat on switch shaft is directly under ground strap and bakelite button on strap holds it away from shaft so that solenoid circuit is open and Automatic Clutch inoperative. Moving Selector switch to neutral or any other position completes solenoid circuit to ground so that Automatic Clutch is operative and shifts can be made at any car speed.

ADJUSTMENT:—Adjustments similar to those for preceding model and must be made in order as directed below. Before adjusting, see that engine idles smoothly and idling speed is set for 7 M.P.H. (engine must be run to supply vacuum and operate clutch while adjustments being made).

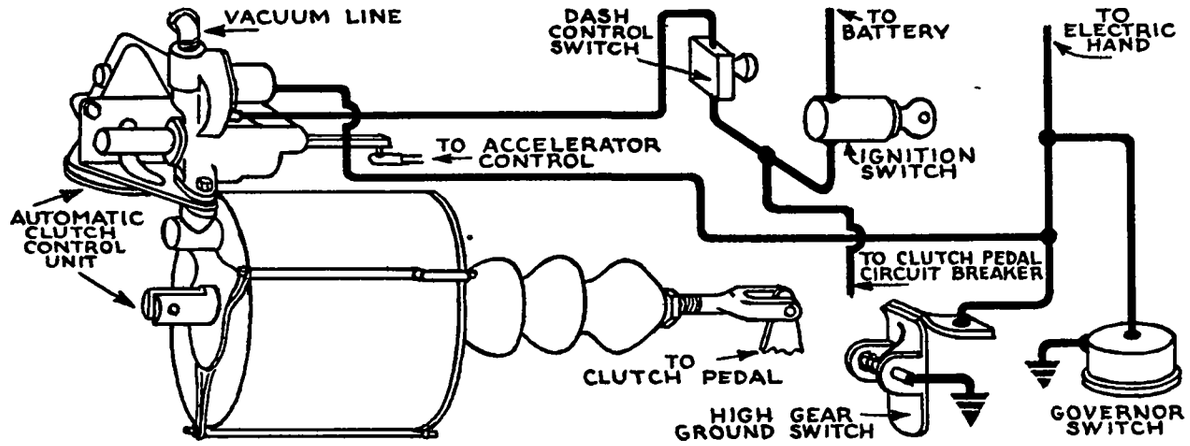
Accelerator Valve Plunger Adjustment:—See that accelerator valve plunger is back against its stop when accelerator pedal released. To check, disconnect throttle pull rod and check clearance between accelerator pedal bell-crank and toeboard. Adjust length of accelerator valve plunger rod (loosen locknut and turn clevis at rear end) so that bell-crank clearance is ½". NOTE—Cars not equipped with Clutch Control at factory have rubber bumper on accelerator pedal rod to act as stop for pedal lever. This bumper must be removed when Clutch Control installed (accelerator valve plunger must act as stop for pedal lever).

Piston Rod Adjustment:—Check distance from rear end of piston rod (not face of locknut) to center of piston rod clevis pin. Should be exactly 1⅞". To adjust, loosen locknut, turn clevis in or out of piston rod, tighten locknut.

Centering Piston Travel:—To check piston position in cylinder, push accelerator control valve plunger forward and pull piston rod backward to limit of travel with engine not running. Check clearance between front end of slot in piston rod lever and clevis pin of rod attached to this lever. Distance should be ⅛".

Throttle Rod Adjustment:—With engine idling and clutch disengaged by automatic control, pull back on carburetor throttle rod until piston rod begins to move backward, hold throttle rod in this position, turn clevis on forward end until clevis pin can just be inserted through clevis and extreme rear end of slot in throttle lever. With this setting, any additional throttle opening after piston rod begins to move will increase engine speed.

Cushion Valve Adjustment:—Remove fitting on right side of valve housing and check plunger position. With pendulum in extreme forward position, grooved section of plunger should be exactly in line with port in housing. To adjust (on first models with adjusting screw on forward face of pendulum housing), loosen locknut and turn screw. On later models with stop on forward face of housing which contacts rubber washer on bottom of pendulum, spring pendulum arm slightly. NOTE—Some first units not equipped with a stop (Install stop on these models by drilling through boss on housing and tapping hole for 10/32" by 1½" machine screw). Remove plunger spring and check free length, stretch spring to correct free length of 1⅝". Replace spring, turn spring adjusting screw in flush with face of locknut, tighten locknut.



Final Test & Adjustment:—Shift transmission into low gear, depress accelerator pedal ¼ or less (more than this throttle opening will bring cushion valve into action). If clutch engagement is harsh, piston rod should be shortened. If engine races before clutch engages, piston rod should be lengthened. When making these adjustments, change piston rod length by turning clevis ½ turn and repeat test until satisfactory operation secured. If satisfactory setting cannot be secured, see Trouble Shooting and special recommended changes to be made on early 1937 cars.

Early 1937 Cars. If engine races with half throttle before clutch engages, remove accelerator valve plunger, disconnect vacuum line from cushion valve to accelerator valve, file square port in accelerator valve body (in line with connection removed) 1/16" longer toward front of body. Use extreme care not to remove metal from the other three sides of the port and remove all burrs and filings. Increase width of tapered traverse slot located midway of plunger length by grinding off 1/16" of each of the tapered sides.

TROUBLE SHOOTING:—Clutch Disengagement slow when pedal released (at speeds below 15 MPH, in high gear, all speeds in other gears). Check accelerator pedal, throttle linkage, and accelerator valve plunger linkage for free movement and see that accelerator valve plunger snaps out against stop when pedal is released. Check carburetor throttle slow closing-device (carburetor throttle dashpot which prevents throttle closing until gasoline in cylinder escapes through check-valve in dashpot plunger), check for leaking or blocked vacuum lines and fittings, check solenoid valve for restriction caused by swollen head or sticking plunger. Check power cylinder for piston leakage by removing control valve assembly and holding finger over vacuum port on front of cylinder while piston rod is pulled out. If piston can be pulled out, cylinder must be dismantled and piston rebuilt.

Clutch Engagement too Rapid. Check for power cylinder piston leakage (see paragraph above), check cylinder head gasket for leaks. Check for leakage at atmospheric valve and around piston rod by placing finger over bleed line fitting in cylinder head and pulling out on piston rod. If piston moves out after 'dump slot' in piston rod reaches cushion point, leaks exist at one of these points. Check for leaks in bleed line from cylinder head to cushion valve, and from cushion valve to accelerator plunger valve housing.

ELECTRIC CONTROL TESTING:—On-Off Switch & Valve Solenoid. If clutch not disengaged with engine running and switch in 'on' position, connect jumper wire from hot terminal (relay or regulator 'B' terminal) to red-wire terminal on solenoid. If clutch operates, check wiring between ignition switch, On-Off switch, and solenoid; check switch

1937 TYPE CONT.

for poor contact. If clutch does not operate, leave jumper wire in place, ground the other (yellow-wire) terminal. If clutch operates, check all ground switches (Shift rail switch, Governor switch, Electric Hand ground switch). If clutch does not operate, check solenoid for open-circuit and see that valve is not sticking.

Shift Rail Switch:—Disconnect Electric Hand jack (at lower end of steering column), disconnect yellow-wire at Governor Switch. Operate clutch by idling engine and depressing accelerator pedal. Clutch should operate in all gears except High Gear. If clutch does not operate in any gear, ground shift rail switch terminal. If clutch operates, replace switch. If clutch does not operate check or replace wire. If clutch operates in high gear, replace switch.

Wiring Harness:—After checking Shift Rail Switch, and with Governor Switch wire and Electric Hand Jack disconnected, shift transmission into High Gear. Insert one test prod connected to voltmeter or ammeter (ground other meter lead) in center socket of lower harness jack. Meter reading should be 6 volts (voltmeter), 3 amperes (ammeter). No reading indicates open-circuit in yellow-wire from solenoid ground terminal to jack. Leave transmission in high gear, shift meter test prod to Shift Rail Switch terminal. If 6 volt (voltmeter), 3 ampere (ammeter) reading not obtained, check yellow-wire connection at jack center terminal and at shift rail switch. Repeat this test at Governor Switch terminal. If these tests do not give satisfactory results, lower wiring harness should be replaced.

Selector Ground Switch:—To check ground switch in Electric Hand Selector, connect voltmeter or test lamp lead to hot terminal ('B' terminal of relay or regulator), connect other lead to center prong of upper wiring harness jack (do not use ammeter for this test). Lamp should light or voltmeter show reading of 5-6 volts with selector in all positions except High Gear. If reading not obtained, check selector ground to steering post and contact between ground strap and selector shaft. If reading obtained in high gear, remove selector and check thickness of bakelite button on ground strap and shape of strap.

Governor Switch:—Check by road testing or with rear wheels jacked up. Place selector in high gear, see that transmission high gear engaged, connect yellow-wire to governor switch. Operate engine. Clutch should operate when accelerator pedal depressed and released. If not, replace Governor Switch. Depress accelerator pedal until speedometer reads 25 MPH., release pedal. Clutch should remain engaged with speedometer reading above 20 MPH. but should disengage before speedometer drops to 16 MPH. If disengagement does not occur within this speed range, replace Governor Switch.

SERVICING:—Piston Lubrication. At 15000 mile intervals, remove piston rod guard, and with engine running and accelerator pedal depressed so that clutch is engaged, use oil can to squirt 1 ounce of Hudson Shock Absorber fluid in piston rod slot. Release accelerator pedal at same time so that piston rod movement as clutch is disengaged will draw fluid into cylinder. Remove piston rod clevis pin, work piston back and forth and rotate piston at same time to distribute fluid evenly on piston seal. When reconnecting piston rod, rotate piston one-half turn so that wear on piston seal will be uniform.

1938-39 TYPE

Optional Equipment On:
HUDSON '112', MODELS 90, 98 (1939)
HUDSON SIX, 83 ('38), 91, 2, 3 ('39)
HUDSON EIGHT, 84,5,7 ('38), 95,7 ('39)
TERRAPLANE, MODELS 80, 81, 82, 88 (1938)

IMPORTANT NOTE:—Power Cylinder Tension Spring—Should be installed on first cars not equipped with this spring at the factory. Spring acts as support for part of power cylinder weight at rear end. To install, mount clip (Part No. 33539) under nut on lower tripod clamp bolt, hook small end of spring (Part No. 155839) in clamp, drill ⅛" hole ⅝" in from, and slightly below, adjusting screw on lug of bell crank bracket and hook other end of spring in this hole. Spring installed in this manner at factory on later cars.

TYPE:—New design not similar to type used on 1937 models. Vacuum Cylinder is Internal Valve Type (control valve located within piston rod, operated by lever on piston rod bell-crank). Solenoid valve mounted on forward end of cylinder controls High-Gear lock-out operation and special open-throttle rapid-engagement only (see description below) and does not have any effect on normal clutch control operation. When engine is started, vacuum line to forward end of cylinder will be open (solenoid valve open), control valve within piston rod will be drawn forward admitting air to rear end of cylinder and piston will move forward to disengage clutch. When accelerator pedal is depressed, first motion of linkage moves control valve lever forward (rapid motion permitted by clearance between cushion point stop-screw and valve lever cam) pulling control valve to rear so that vacuum admitted to rear end of cylinder, piston spring then engages clutch rapidly until cushion point is reached when piston overtakes control valve and seals off rear end of cylinder. Further movement then possible only as valve lever cam is rotated under cushion point stop-screw so that very soft cushioning action or initial clutch engagement is secured. As soon as accelerator linkage play is taken up and carburetor throttle begins to open, final clutch engagement takes place rapidly (valve lever cam has special contour to secure this action). Clutch control designed to modify this normal engagement for special conditions as follows:

Compensator (For Initial Engagement)—When clutch disengaged manually (necessary to start engine), the end of the bell-crank yoke strikes a pin on the end of the intermediate lever (on which valve lever is mounted) swinging lever so that valve lever pivot is moved forward permitting clutch to engage deeper at the cushion point to compensate for oil on clutch disc cork inserts. As soon as clutch engages automatically, trip lever on piston rod yoke rotates compensator lever back to normal driving position. No adjustment is required but compensator must be in normal driving position when other clutch control adjustments are made.

Accelerator Switch (For wide-open throttle Engagement)—Consists of a switch on the dash operated by the accelerator pedal which controls vacuum cylinder solenoid valve circuits. With throttle closed, circuit completed through switch to both Governor Switch (left hand terminal—RW wire) and to High Gear Shift Rail Switch and Selector switch (right hand terminal—Y wire). When throttle opened sufficiently to rotate accelerator switch lever 5-10°, circuit to Governor Switch is broken (eliminating Governor control). When throttle opened approximately 1/2, circuit to Shift Rail Switch and Selector ground switch is broken. With all solenoid circuits to ground broken, solenoid valve cuts off vacuum and admits air to vacuum cylinder so that clutch engages rapidly (which is desirable when car started with throttle more than half open).

High Gear Lock-out (At speeds above 20 MPH)—This devoce operates in same manner as on 1937 models and prevents clutch disengaging when accelerator pedal is released at speeds above 20 MPH. with transmission and selector lever in High Gear. Electrical circuits are new (Governor, Shift Rail Switch, and Selector ground contact connected through Accelerator Switch—see paragraph above).

ADJUSTMENT:—Before making adjustments, engine must be properly tuned and warmed up so it idles smoothly at correct idle speed with vacuum reading of 18-21" of mercury (see Tune-up data on car model 'T&E' page). Car should be driven sufficiently to bring clutch units to normal operating temperatures. See that Compensator is in normal running position (see Compensator above) and make all Clutch, Throttle, and Automatic Clutch linkage adjustments listed below in order before adjusting 'Cushion Point' which controls clutch performance.

Clutch Pedal Adjustment—Remove clevis pin at lower end of clutch pedal connecting link, loosen locknut and turn clevis so that center of pedal shank clamp bolt is 1½" from toeboard with clutch fully engaged.

Accelerator Linkage—See that all linkage operates freely without binding. Adjust clevis at upper end of throttle rod connected to accelerator pedal bell-crank so that upper arm on bell-crank is ¼" from toeboard with accelerator pedal released and accelerator switch lever against its stop (this switch lever must act as stop for accelerator linkage). NOTE—On cars not factory equipped with Automatic Clutch control (no Accelerator Switch), rubber bumper is installed on accelerator pedal rod to act as stop for pedal bell-crank. This bumper must be removed when Accelerator Switch installed so that switch lever controls accelerator pedal position. **Important—Valve Cam Linkage**—Connecting rod on accelerator pedal bell-crank which operates valve cam linkage must be connected in third hole from end of bell-crank lower arm. On early cars, this rod connected in second hole and should be changed before adjustments are made.

Vacuum Cylinder Bell-crank Yoke—With engine not running, and vacuum cylinder piston in extreme rear position, take out cotter pin in valve lever pivot and hairpin at valve-rod-and-lever link. remove valve lever, adjust yoke at bell-crank end of operating rod so that clearance between front edge of clevis pin on bell-crank and front end of slot in yoke is ⅛". This setting will provide clearance at clutch throw-out bearing (with clutch engaged) without excessive play in operating linkage.

Piston Travel (Valve Linkage)—Make certain that valve cam lever operating rod guide block is mounted in rear (end) hole of cam lever (see Note below), and compensator pin in extreme rear position, operate engine to provide vacuum. With clutch disengaged, screw threaded sleeve (on operating rod at valve cam lever guide block) toward dash until piston rod just reaches its extreme forward position, then screw threaded sleeve away from dash until piston moves ¼" toward rear.

HUDSON CLUTCH CONTROL CONT.

Important Note—On some early cars, guide block was located in center hole of cam lever. Guide block should be changed to rear hole during adjustment (allows for slightly faster throttle opening for same clutch engagement). On Models 84, 85, 87 it may be necessary to cut ⅛-¼" additional thread length on rod to permit sleeve adjustment (10-32 thread).

Cushion Point Adjustment:—With all linkage adjustments correctly made (above), block wheels and start engine (do not set brakes). Accelerate engine and manually engage and disengage clutch to dry clutch disc corks. Swing compensator lever to rear (normal running position), turn cushion point stopscrew clockwise or in until it contacts valve cam. With transmission in low gear, hold cam against stopscrew by pressing on back of cam lever, slowly turn stopscrew counter-clockwise or out until car tends to move forward (clutch beginning to drag against flywheel). Check carburetor throttle rod and then make final adjustment.

Throttle Rod Adjustment—See that accelerator rod engaged in correct hole in lever on dash (82, 83—Top Hole; 80, 81, 88—Bottom Hole; 84, 85, 87—Center Hole). Hold accelerator pedal down so that valve lever cam just touches cushion point stopscrew—**Important**—Use wedge behind accelerator pedal bell-crank at toeboard to secure this throttle opening, pressure applied to any other point of accelerator linkage will prevent correct adjustment being secured. Adjust clevis at carburetor end of accelerator rod so that all lost motion is taken up and any additional pedal travel will open throttle. Check this adjustment whenever governor removed or carburetor setting is changed.

Final Adjustment:—Shift transmission into second gear, depress accelerator pedal slowly with engine running. Car should begin to move slightly upon initial throttle opening. If clutch engagement slow and engine speed excessive, turn cushion point stopscrew counter-clockwise or out slightly. If clutch engagement too rapid (engine stalls), turn screw clockwise or in slightly. Do not turn screw more than 1/2 turn without rechecking performance.

TROUBLE SHOOTING:—If Automatic Clutch operation slow or erratic, check vacuum lines for leaks, tighten connections, check gaskets, solenoid for sticking plunger, all linkage for excessive friction or binding (operate accelerator and watch operation of entire linkage system). To check vacuum cylinder for piston leaks, slide piston rod guard forward until 4 ports in piston rod are exposed, start engine and allow clutch to disengage automatically, close off piston rod ports by covering with fingers, excessive leakage will cause a perceptible suction at the ports (see Piston Lubrication under Servicing below).

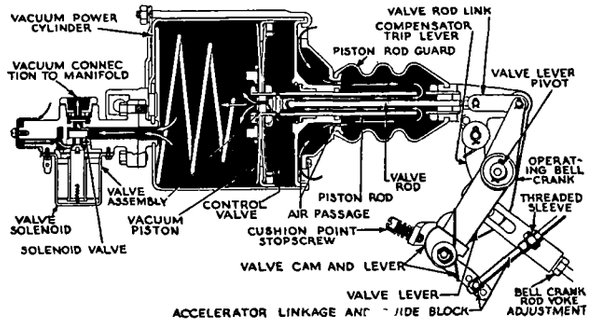
SERVICING:—Vacuum Cylinder Piston Lubrication—At 15000 mile intervals, remove pipe plug in end of cylinder, inject exactly one ounce of Hudson Shock Absorber fluid. Take out piston rod bolt at bell-crank and disconnect valve-rod-to-lever link, rotate piston to spread lubricant over entire piston and oil wick. Place 2-3 drops of oil in bell-crank bracket oil hole every 1000 miles.

Piston Rod Guard Replacement:—To remove rubber boot or guard on piston rod, take out cotter pin in valve lever pivot and hairpin in valve rod trunnion at upper end of valve lever, remove lever. Take out piston rod bolt in bell-crank, remove guard from groove in piston rod end, hold piston rod from turning with drift in bell-crank bolt hole, loosen locknut against rod end, remove piston rod end, remove guard. Install guard in same manner, adjust piston rod length, adjust cushion point stopscrew when valve lever reassembled (see Adjustment above).

Piston Rod Adjustment:—Whenever piston rod end removed or disturbed, position end on rod so that distance from center of tripod mounting hole to center of bell-crank bolt hole in rod end is exactly 13 11/16", lock setting with locknut.

TESTING:—Where test lamp required in making following tests, use 'Valve Solenoid' test lamp (H87 Lead, G87 Prod) of the 1938 Electric Hand Test Lamp Kit or make up test lamp using 15 cp. Mazda No. 87 bulb and suitable leads. Make tests in order given below.

Valve Solenoid:—Disconnect Blue-White (BLW) wire from valve solenoid terminal and connect this wire to one test lamp lead. Ground the other solenoid terminal to which Brown-White (B-W) wire attached. Touch the second test lamp lead to the solenoid terminal from which BLW wire removed. With ignition turned on and dash 'Off-On' switch on, lamp should show dull glow. If lamp does not light, solenoid is open. If lamp burns brightly, solenoid is shorted. If circuit is normal, remove vacuum pipe connection, bushing, and bakelite valve disc.



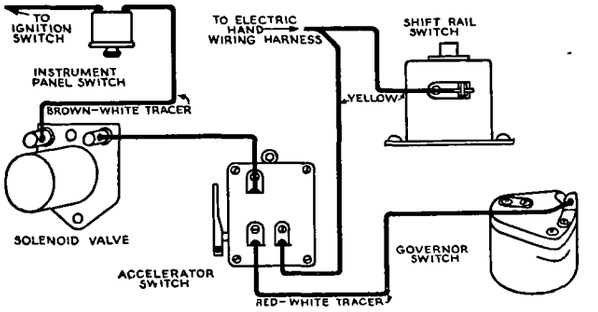
Insert narrow scale in opening and check plunger travel under light pressure. If plunger does not move 1/16-3/32" freely, check valve disc rubber and plunger interference. Tighten vacuum connections tightly.

Dash 'Off-On' Switch & Upper Wiring Harness:—If clutch does not disengage with fully closed throttle, valve lever rod in fully forward position, and dash switch 'on' (pushed in), connect jumper wire from battery cable terminal to solenoid BLW terminal. If clutch operates, check dash switch for poor contact, check wiring from dash switch to gas gauge to ignition switch for open-circuit.

Accelerator Switch:—Disconnect Governor Switch Red-White (RW) wire at accelerator switch terminal, shift transmission into High Gear (Electric Hand selector lever must also be in High Gear position), see that ignition switch and dash 'off-on' switch turned on and accelerator pedal in idle position. Ground one test lamp lead, touch other lead to accelerator switch terminal from which RW wire removed. With 5° step of No. J-1190 test gauge between switch lever and its stop, lamp should show red glow. When 10° step of gauge inserted between lever and stop, lamp should go out. Transfer test lamp lead from RW terminal to Y terminal on switch. Lamp should show red glow until throttle half open and then go out. Replace switch if defective.

Shift Rail Switch & Lower Wiring Harness:—Disconnect connector between Automatic Clutch lower harness and Electric Hand lower harness, disconnect Red-White wire from Governor Switch. Automatic Clutch should operate in all gears except High. If it does not, ground Second-and-High Shift Rail Switch (left hand switch on transmission). If operation satisfactory, check switch for sticking operating ball or replace switch. If Automatic Clutch does not operate, replace Yellow wire between Accelerator switch, Shift Rail Switch, and Electric Hand harness. If Automatic Clutch operates in High Gear replace Shift Rail Switch.

Testing Wiring Harness—After testing switch for correct operation, and with Red-White wire disconnected from Governor switch, and connector between Automatic Clutch and Electric Hand lower wiring harnesses disconnected, shift transmission to high gear, turn on ignition, ground one test lamp lead, connect other lead to lower harness connector. Test lamp should show red glow. If lamp does not light, wiring is defective. Repeat test at Shift Rail and Governor Switch terminals. Recheck Accelerator switch before replacing wiring harness.



Selector Ground Switch:—Connect voltmeter or test lamp clip to battery cable terminal (do not use ammeter), connect other test lead to 'Y' prong of Electric Hand upper harness jack. Test lamp should light, or voltmeter read 5-6 volts with selector in any gear position except high gear. If no light or reading secured, check selector for poor contact between ground finger and shaft or poor ground connection between selector and steering column. If lamp lights or reading obtained in high gear, dismantle selector and check for short-circuit between selector finger and shaft (check thickness and shape of bakelite insulating button).

Governor Switch:—Check by road-testing or operating car with rear wheels blocked up so that engine can be run with transmission in gear. See that Red-White wire connected to Governor switch, operate engine, engage high gear. Check to see that Automatic Clutch operates when accelerator pedal is depressed and released. If it does not, replace Governor Switch. With high gear engaged, increase engine speed until speedometer reading is 25 M.P.H., release accelerator and note when clutch disengages. Clutch should be engaged at 20 M.P.H. but should disengage before speed decreases to 15 M.P.H. If clutch disengagement is not within this 15-20 M.P.H. speed range, replace Governor Switch

MODELS 9A1, 10A1, 11A1, 11A2

Used On:

9A1—DE SOTO 6, MODEL SC (1932).
DODGE 6, MODEL DP (1933).
OLDSMOBILE 6, MODEL F-32 (1932).
PLYMOUTH 6, MODELS PC, PD (1933).
STUDEBAKER, DICT. A & Yr. Ah'd. A ('34)
10A1—CHRYSLER 6, MODEL CO (1933).
CHRYSLER, ROYAL 8 CT, IMPERIAL CQ ('33).
DE SOTO 6, MODEL SD (1933).
DODGE 6, MODEL DL (1932).
HUPMOBILE, 216 ('32), 321 ('33), 421, A ('34).
HUPMOBILE, 222 ('32), 322 ('33), 422 ('34).
NASH, BIG 6 1120, STD. 8 1130, SPEC. 8 1170, ADVANCED 8 1180 (1933).
OLDSMOBILE 6, MODEL F-33 (1933).
11A1—STUDEBAKER PRES. 91 (1932), 92 (1933).
11A2—CHRYSLER, CST. IMP, CH, CL ('32), CL* ('33).

NOTE:—Manufacturer recommends use of Borg-Warner UF-300 universal fixture in servicing clutch.

DESCRIPTION:—Single plate, dry disc type. Similar in design to other Borg & Beck models except that lever struts not used and release levers contact pressure plate lugs directly.

SERVICING:—All service directions same as for other Borg & Beck clutch models except that directions for removal and installation of release lever struts may be disregarded. Release lever design on Model 11A2 different (instructions below).

Clutch Springs (all models):—Release springs should check with table below. Replace springs if burned or weak.

Part No.	Color	Press. & Length
2958	Black or White	160 lbs. @ 1 11/16"
2994	Yellow or Brown	140 " " "
3031	Red or Blue	180 " " "
3534	Pink or Grey	200 " " "

Release Lever Adjustment (all models):—Special lands should be used under pressure plate when clutch mounted on fixture. Adjusting arm setting on sleeve should be 1 11/16" (all models).

RELEASE LEVERS (11A2):—Release levers mounted on roller bearings (loose rollers) in cover eye-bolt and pressure plate. Care must be taken in dismantling clutch not lose the loose rollers (14 at each point).

Disassembling Release Levers:—Take out locking pins (first type—pins are clinched at center and may need to be broken before they can be removed), or locking wires (later type) in each end of release lever pin in pressure plate lugs, remove washer, push pin out. Pin will carry out rollers at one end and rollers at opposite end will fall out. Lift out release lever and eye bolt assembly.

Assembling Release Lever Bearing in Eye Bolt:—Coat bearing race in eye bolt with high melting point grease, install lever pin, insert 14 rollers around pin, withdraw pin vertically so that rollers are retained in eye bolt by grease, insert eye bolt in release lever lug, insert pin being careful that rollers are not lost out. Pin is held in place by pressure plate lugs when lever installed. Assemble lever in position in pressure plate.

Assembling Release Lever Pin in Pressure Plate:—Roller outer race is press fit in pressure plate lugs and should be replaced only if worn or loose. To assemble bearings, coat race in lugs with high melting point grease, insert pin (pin must be above end of release lever), install lever pin, insert the 14 rollers at each end of pin, install washer on pin, insert locking pin or install hairpin type locking wire. Locking pins must be clinched by inserting punch through hollow end of lever pin and bending locking pin.

DRIVEN MEMBER:—Manufacturer recommends installation of new driven member with new clutch facings rather than relining clutch. Driven plate hub (Spring Dampener) cannot be serviced in the field. See following article on Borg & Beck Models 9A6, 10A6, 11A6 for complete driven member data.

MODELS 9A3; 10A3, 4; 11A3, 5

Used On:

9A3 —OLDSMOBILE 6 MODEL F-34 (1934).
LAFAYETTE, MODEL 110 (1934)
PLYMOUTH 6 PF, PG, PE (1934).
STUDEBAKER 6, A & YR. AH'D (1934).
10A3—CHRYSLER 6, AIRST'M CA, CB ('34).
DE SOTO AIRFLOW SE (1934).
DODGE 6 DR, DS (1934).
HUPMOBILE 417-W ('34), 517-W ('35); 421-J ('34), 521-J ('35).
NASH 1220 ('34), 1280 ('34).
OLDSMOBILE 8, L-32 ('32), L-33 ('33).
10A4—LA SALLE 350, SERIES 50 ('34-35), 35-50 ('35), 36-50 ('36).
OLDSMOBILE 8, L-34, 35, 36 (1934-36).
11A3—NASH AMB. 8, 1290 (1934).
11A5—CHRYSLER AIRFLOW CU, CV (1934).

NOTE:—LaSalle ('34-36). Long Type 10CF-CI driven plate used on this model. See article on Long Model 'CF' clutch for driven plate data.

NOTE—Manufacturer recommends use of Borg-Warner UF-300 fixture for servicing clutch. Fixture consists of surface plate, which duplicates driving surface of flywheel, clamp screws to clamp clutch cover against plate, arbor press to compress springs in dismantling clutch, and gauge standard for use in setting up release levers.

DESCRIPTION:—Single plate, dry disc type. Three release levers mounted on bolts piloted in pressure plate and held in clutch cover, actuate clutch through struts which provide 'knife-edge' action. Servicing directions below apply to pressure plate assembly. See Driven Member Section if pressure plate not to be dismantled and rebuilt.

SERVICING:—Mark all parts before dismantling clutch and reassemble in same position (necessary to maintain balance). Replace grooved, checked or warped pressure plates. Replace springs when pressure plate discolored from heat (test springs as directed below).

Dismantling:—Place clutch on fixture or arbor press support pressure plate under release levers), place block across cover resting on spring bosses, compress cover slightly, remove metal staking in adjusting nuts by running hacksaw blade through slot, remove nuts, release pressure slowly, remove cover and springs. Remove release levers by grasping lever and eyebolt between thumb and forefinger, so that inner end of lever and upper end of eyebolt are pressed together. Lift strut over ridge in end of lever (press lower end back against lug), lift lever and eyebolt out.

Clutch Springs:—Release springs should check with table below. Replace springs if weak or burned or if clutch has been subjected to excessive heat.

Part No.	Color	Pressure (at 1 11/16")
2958	Black or White	160 lbs.
2994	Yellow or Brown	140 lbs.
3031	Red or Blue	180 lbs.
3534	Pink or Gray	200 lbs.
3814	Purple	135 lbs.
3817	Green	110 lbs.
3951	No Color	155 lbs.

Assembling:—Place pressure plate on fixture or arbor press, supporting plate under release lever lugs. Install lever, eyebolt and strut assemblies by reversing removal procedure. Place pressure springs in seats on plate, install anti-rattler springs (see note) in cover, place cover on pressure plate. Make certain that pressure springs are seated and that anti-rattler springs are in place on release levers. Compress cover slowly guiding eyebolts through bolt holes in cover. If assembly made on fixture use clamps to clamp cover flange to plate at mounting holes. Assemble eyebolt nuts, turn nuts down until flush with head of bolt. Compress and release clutch levers several times to seat all working parts. Then adjust release lever heights.

Release Lever Adjustment (without Fixture):—Use Borg & Beck A1 type gauge plate, assemble plate in clutch on flywheel in place of driven plate, positioning gauge lugs under release levers. Place short scale or straightedge on edge on boss in center of gauge, adjust release levers by turning adjusting nuts on eyebolts in or out until release levers just contact edge of scale. All levers must be even within .005". Lock adjusting nuts by peening metal of nut into bolt slot. Recheck settings.

Release Lever Adjustment (On Fixture)—Install special lands (3J) on fixture under pressure plate, install lever indicating plate (3X) on levers (except Models 11A3, 5 where plate should not be used), set adjusting arm at correct figure as shown in table below, install arm and sleeve assembly on fixture, swing arm over each release lever in turn, turn release lever eyebolt nut until tip of lever just contacts indicating plate, lock nut by peening metal of nut into bolt slot, recheck setting.

Clutch Model	Lever Setting
9A3, 10A3	2 5/16"
10A4	2 5/32"
11A3, 11A5	1 13/16"

DRIVEN MEMBER:—Manufacturer recommends installation of new driven member with new clutch facings rather than relining clutch. Driven plate hub (Spring dampener) cannot be serviced in the field.

Two types of plates used: (1) cushioning secured by slotting plate into concave and convex segments, (2) Separate cushioning springs under one facing. Type used can be determined by inspection. See following article on Borg & Beck Models 9A6, 10A6, 11A6 for complete driven member data.

MODELS 8A7; 9A6, 7; 10A6, 7; 11A6

Assembly Number	Used On: MODEL 8A7
925	STUDEBAKER CHAMPION, MODEL G (1939)

MODEL 9A6

876—LAFAYETTE, 3510 ('35), 3610 ('36)
NASH '400', 3540, 3640 ('35), 3640A ('36)
906—NASH-LAFAYETTE, 3710 ('37), 3810 ('38)
932—NASH-LAFAYETTE, MODEL 3910 (1939)
873—OLDSMOBILE 6, F-35 ('35), F-36 ('36)
895—OLDSMOBILE 6, F-37 ('37), F-38 ('38)
OLDSMOBILE 6 '70' G-39 (1939) FIRST CARS
869—PLYMOUTH, PJ, PJE ('35), P1, ('36),
PLYMOUTH, P3, P4 (1937)
918—PLYMOUTH, P5, 6 ('38), P7, 8 ('39)
876—STUDEBAKER DICT., 1A, 2A (1935)
869—STUDEBAKER DICT., 3A, 4A ('36), 5A, 6A ('37)
STUDEBAKER COMM., 7A, 8A ('38), 9A ('39)

MODEL 9A7

924—OLDSMOBILE 6 '60', F-39 (1939)
OLDSMOBILE 6 '70', G-39 (1939) LATER CARS

MODEL 10A6

933—CHRYSLER CUST. IMP., C24 (1939)
874—CHRYSLER 6, C6 ('35), C7 ('36)
CHRYSLER 8, CZ ('35), C8 ('36)
CHRYSLER IMP., C14 (1937)
DE SOTO, SF ('35), S1, S2 ('36)
883—DE SOTO AIRFLOW, SG (1935)
870—DODGE, DU ('35), D2 ('36)
890—HUPMOBILE 6, 518-D ('35), 618-G ('36)
877—NASH 6, 1220 ('34), 3520 ('35), 3620 ('36)
880—NASH 8, 3580 ('35), 3680 ('36)
883—NASH 8, 3780 ('37), 3880 ('38)
878—REO FLYING CLOUD, 6A ('35), 6D ('36)

MODEL 10A7

899—CHRYSLER C16, DE SOTO S3, DODGE D5 ('37)
914—CHRYSLER, ROYAL C18 (1938)
930—CHRYSLER ROYAL, MODEL C22 (1939)
913—DE SOTO S5, DODGE D8 (1938)
928—DE SOTO, MODEL S6 (1939)
DODGE, MODEL D11 (1939)
898—HUPMOBILE SKYLARK, 915-R (1939)
HUPMOBILE 6, 822-E ('38), 922-E ('39)
902—NASH AMBASS. 6, 3720 ('37), 3820 ('38)
NASH AMBASS. 6, 3920 ('39), FIRST CARS
934—NASH AMBASS. 6, 3920 (1939) LATER CARS
919—NASH AMBASS. 8, MODEL 3980 (1939)
897—OLDSMOBILE 8, L-37 ('37), L-38 ('38)
OLDSMOBILE 8 '80' L-39 (1939) FIRST CARS
927—OLDSMOBILE 8 '80', L-39 (1939) LATER CARS

MODEL 11A6

871—CHRYSLER, C1,2,3 ('35), C9,10,11 ('36)
CHRYSLER, C15, C17 (1937)
915—CHRYSLER CUST. IMP. C20 (1938)
916—CHRYSLER IMPERIAL, C19 (1938)
929—CHRYSLER IMPERIAL, C23 (1939)
917—CHRYSLER, DE SOTO, DODGE, PLYMOUTH TAXICAB MODELS (1938)
931—CHRYSLER, DE SOTO, DODGE, PLYMOUTH TAXICAB MODELS (1939)

NOTE:—Assembly No. This number is stamped on each clutch cover and can be used to identify each installation.

Buick 40 (1934-36). Borg & Beck driven member used on this model (with Own Make clutch). Driven member data given below applies to this model.

Hupmobile 6 (1935-36). Clutch Assembly Nos. 877 and 878 also used on these models.

Nash 6 & 8 (1934-35-36). Clutch Assembly No. 878 also used on these models.

Oldsmobile (1937-38)—A special clutch release plate and steel spacer assembled on release levers as part of clutch assembly. Held in place by special release lever return springs (anti-rattler springs and separate bearing plate retainers not used). See special instructions, in Assembling section below, for spacer servicing and release plate assembly.

Oldsmobile 8 (1938)—Release lever spring ends hooked over cover rim and must be installed in cover before it is placed on pressure plate assembly. Release levers are guided on rectangular guide pins riveted to cover (see that guide pins enter lever slots when installing cover). Release levers on L-38 are ⅛" higher than F-38 (special lever setting). Special grooved facings used on models with Self-Shifting Transmission (not interchangeable with standard driven member).

Willys 77, 37. Driven plate on this model is Borg & Beck type. Driven plate data below applies. NOTE—Manufacturer recommends use of Borg-Warner UF-300 fixture for servicing clutch. Fixture consists of surface plate, which duplicates driving surface of flywheel, clamp screws to clamp clutch cover against plate, arbor press to compress springs in dismantling clutch, and gauge standard for use in setting up release levers.

DESCRIPTION:—Single plate, dry disc type. Three release levers mounted on bolts piloted in pressure plate and held in clutch cover, actuate clutch through struts which provide 'knife-edge' action. Servicing directions below apply to pressure plate assembly. See Driven Member Section if pressure plate not to be dismantled and rebuilt.

Pressure Plate Baffle. Used on 1938-39 Chrysler, DeSoto, Dodge, Plymouth, 1939 Oldsmobile. Consists of a thin cupped steel disc assembled on pressure plate to prevent oil working in on facings. When baffle plate used, release levers must be set 1/16" higher (9" & 10" clutches with Std. Driven Member, 11" Clutches with Borglite Driven Member), ⅛" higher (9" & 10" clutches with Borglite Driven Member). See Service data below for baffle plate installation.

Duckbill Type Release Levers. Used on 1939 Oldsmobile. Throw-out bearing ends of release levers are widened and flattened to increase bearing contact area so that no separate bearing plate required.

Borglite Driven Members. Used on 1939 Chrysler, DeSoto, Dodge, Oldsmobile models. New type light weight driven member (see description below). Release levers must be set ⅛" higher (9" & 10" clutches), 1/16" higher (11" clutches) when this new type driven member used in conjunction with pressure plate baffle. See Servicing data below for lever setting and gauge data.

SERVICING:—Mark all parts before dismantling clutch and reassamble in same position (necessary to maintain balance). Replace grooved, checked or warped pressure plates. Replace springs when pressure plate discolored from heat (test springs as directed below).

Dismantling:—Place clutch on fixture or arbor press support pressure plate under release levers), place block across cover resting on spring bosses, compress cover slightly, remove metal staking in adjusting nuts by running hacksaw blade through slot, remove nuts, release pressure slowly, remove cover and springs. Remove release levers by grasping lever and eyebolt between thumb and forefinger, so that inner end of lever and upper end of eyebolt are pressed together. Lift strut over ridge in end of lever (press lower end back against lug), lift lever and eyebolt out.

Clutch Springs:—Note spring color and install in same relative position (groups of two different springs used on some clutch models). Springs should check with table below. Replace springs if weak or burned or if clutch has been subjected to excessive heat.

Spring Specifications

Part No.	Pressure (@ 1 11/16")	Color
2994	140 lbs.	Yellow or Brown
3814	135 lbs.	Purple
3817	110 lbs.	Green
3951	155 lbs.	No Color
4039	165 lbs.	Light Blue
4190	160 lbs.	Tan
4211	170 lbs.	Orange
4214	175 lbs.	Light Green

Assembling:—Place pressure plate on fixture or arbor press supporting plate under release lever lugs. Install baffle plate (some models only—see Note below), install lever, eyebolt, and strut assemblies by reversing removal procedure. Place pressure plate springs on plate, install anti-rattler springs (see Note below) in cover, place cover on pressure plate. Make certain that springs are seated in cover recesses and anti-rattler springs in place on release levers. Compress cover slowly and guide eyebolts through holes in cover. If assembly made in fixture, use clamps to clamp cover flange to plate at mounting holes. Install eyebolt nuts and turn nuts down flush with head of bolt. Compress and release clutch several times to seat all working parts. Then adjust release lever heights.

NOTE—On Oldsmobile 1937 models where release lever springs used instead of anti-rattler springs, install these springs with cross-wire straddling lever tip and coils at either side of pressure plate lug. Free ends of springs will extend up so as to contact clutch cover when installed.

Oldsmobile (1937-38)—To replace the steel spacer on the cast-iron release plate, place plate face down on bench, install spacer engaging the 3 prongs in the release plate holes, place a wooden block on the spacer lugs, tap spacer down until it is firmly seated on release plate bosses. Use extreme care not to distort spacer or mar spacer lugs which engage release lever slots. To install this assembly, place assembly on release levers with spacer down and lugs engaging release lever slots, lift lever return spring cross-wires and snap in place in release plate lug grooves.

Baffle Plate Installation Note (9A6, 9A7, 10A6, 10A7 Clutches):—Place baffle plate on pressure plate with baffle plate ears on special low spring seat ribs (adjacent to release lever lug on plate in counter-clockwise direction) so that flanged edge of baffle fits depressions in pressure plate at base of each lug and baffle is retained by springs (which seat on ears) when installed. See that baffle plate ears are flat on spring seat ribs and that baffle seats fully in machined recess in plate (straighten ears if bent by handling).

(Model 11A6 Clutch)—Install baffle in same manner as above except that baffle ears must be seated on spring seats adjacent to lugs in clockwise direction.

MODELS 8A7; 9A6, 7; 10A6, 7; 11A6 CONT.

Release Lever Adjustment (Without Fixture):—Use Borg & Beck A1 type gauge plate, assembling gauge in clutch on flywheel in place of regular driven member so that lugs on gauge are under release levers. Place short scale or straightedge on edge on boss in center of gauge (see special directions below for types with baffle plate or new Borglite driven member which require special lever heights). Adjust levers by turning adjusting nuts on eyebolts until levers just contact edge of straightedge. Lever heights must be equal within .005". Lock adjusting nuts by peening metal into bolt slot and recheck settings.

Release Lever Adjustment (With Pressure Plate Baffle & Borglite Driven Member):—Use special gauge plate No. 4234 (Borglite driven member is thinner and requires special setting—do not use regular gauge plate No. 3525). Install gauge plate on flywheel in place of regular Borglite driven member, install clutch cover assembly. On Models 9A6, 9A7, 10A6, 10A7, adjust levers in usual manner by placing short straightedge on top of gauge plate hub and turning nuts on adjusting screws until lever tips contact edge of straightedge. Lock screws by peening nut into slot in adjusting screws (except 10A7), peening nut against flat notches on side of adjusting screws (8A7, 9A7). On Model 11A6, levers must be set 1/16" higher than hub of this #4234 gauge plate and straightedge with 1/16" step, 5/16" long, cut in one corner should be used. Set levers so that tips contact straightedge at bottom of this step.

Release Lever Adjustment (With Pressure Plate Baffle & Standard Driven Member):—Use regular gauge plate No. 3525 assembled on flywheel in place of regular driven member. On Models 9A6, 9A7, 10A6, 10A7 (except #897—Oldsmobile), release levers must be set 1/16" higher than hub of gauge and straightedge with 1/16" step, 5/16" long, cut in one corner should be used. Set levers so that lever tips contact straightedge at bottom of step. On Models 10A7 #897 (Oldsmobile) and all 11A6 clutches, levers must be set ⅛" higher than gauge hub. Adjust in same manner as above using straightedge with ⅛" step.

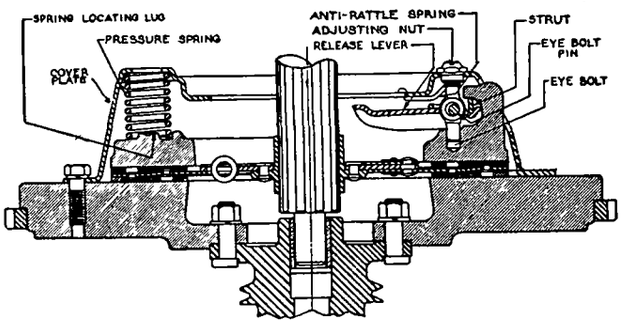
Release Lever Adjustment (Chrysler, DeSoto, Dodge, Plymouth Models) using Chrysler Clutch Fixture: If special Chrysler Clutch Fixture used to set levers on these models, adjust levers so that the special "A" feeler gauge (.005" thick) will just pass between lever tips and underside of gauge plate (all 1935-36-37 models).

1938 Chrysler, DeSoto, Dodge, Plymouth Models—These models require higher lever settings and special extension 'U' spacer must be installed under gauge plate as follows: 1/16" (Chrysler C18, DeSoto S5, Dodge D8, Plymouth P5, P6), 3/16" (Chrysler, DeSoto, Dodge, Plymouth Taxicabs; Chrysler C19). Do not use spacer on Chrysler C20. Adjust levers as directed above with .005" feeler "A".

1939 Chrysler, DeSoto, Dodge Models—These clutch models equipped with baffle plate and Borglite Driven Member and require new 'Y' shaped extension gauge and new thicker feeler gauge (Tool Part No C-411-37A) for release lever adjustment. Install 'Y' extension gauge directly over release lever, tighten extension gauge locknut. Use 'D' end of feeler gauge (Chrysler C22, C24, DeSoto, Dodge except Taxicabs), 'C' end of feeler gauge (Chrysler C23, and all Chrysler, DeSoto, Dodge, Plymouth Taxicabs). Turn release lever adjusting screw nut until feeler gauge is just snug between lever tip and extension gauge, lock adjusting screw nut by peening nut into adjusting screw slot. Check to make certain that clearances for all levers is uniform after completing adjustment.

1939 Plymouth—On all models except Taxicab (see Taxicab note below), use new 'Y' shaped extension gauge (part of C-411-37A tool—do not use new thicker feeler gauge furnished for use on other models). Install 1/16" spacer on clutch fixture, place 'Y' extension gauge on spacer, tighten gauge locknut. Adjust release levers so that the regular 'A' feeler gauge is snug between the lever tips and the 'Y' extension gauge.

1939 Plymouth Taxicab—Adjust in same manner as other Taxicabs using "D" end of new thicker feeler gauge. See 1939 Chrysler, DeSoto, Dodge above.



Release Lever Adjustment (On Borg-Warner Universal Clutch Fixture UF-300):—Special lands must be installed on fixture under pressure plate lever lugs (all models with 3 levers—space lands equally on 4 lever types). Set adjusting arm on adjusting sleeve so that height of lower side of arm above bottom of sleeve is correct for each model (see table below), install indicating plate on levers (see special note below on Models 9A7, 10A7 with new duckbill release levers). Adjust each lever so that it just contacts indicating plate or adjusting arm, lock lever adjusting nuts by peening metal of nut into slot of screw (on 8A7, 9A7 peen nut against screw flats). IMPORTANT NOTE—Indicating plate "3X" should not be used on some 11A6 models as noted in table below. Use indicating plate for all other clutches.

Number	Lever Height
Model 8A7	
925	2⅛"
Model 9A6	
869, 873, 876, 894, 895, 906, 911, 932	2 5/16"
918	2⅜"
Model 9A7	
924	See Note
Model 10A6	
870, 874, 877, 878, 880, 883, 886, 890	2 5/16"
901, 904, 907, 923	2 5/16"
933	2 3/16"
Model 10A7	
897	2 7/16"
898, 899, 902, 905, 922	2 5/16"
913, 914, 919, 920, 924	2⅜"
927	See Note
928, 930	2 5/32"
Model 11A6	
871, 879, 882, 884, 900 (See Note)	1 13/16"
908, 910, 915, 916, 917, 921	2 7/16"
929, 931	2¼"

9A7, 10A7 Note—These models with 'duckbill' type release levers must be adjusted in special manner (longer length of levers makes it impossible to install height sleeve on fixture). With clutch mounted on fixture, install three height blocks '3K10' touching spindle and equally spaced around it with part number on blocks up. Install '3V' sleeve on height blocks with flange down. Install calibrated adjusting sleeve on sleeve and set adjusting arm flush with bottom of sleeve, install indicating plate on levers with counterbored side up and adjust levers.

11A6 Note—Do not use indicating plate "3X" when adjusting levers on these models.

DRIVEN MEMBER:—Manufacturer recommends installation of new driven member with new clutch facings rather than relining clutch. Driven plate hub (Spring Dampener) cannot be serviced in the field. Two types of plates used: (1) Cushioning secured by slotting plate into concave and convex segments, (2) Separate cushioning springs under one facing. Type used can be determined by inspection. Servicing directions for each type are as follows:

New Borglite Type Driven Member:—New type composite plate consisting of a small diameter disc with separate clock-spring type cushion segments (to which facings are riveted) riveted to outer rim. Segments are dished to provide soft engagement. This type of construction results in less weight at rim of driven member (which reduces spinning and allows quiet, fast gear shifting) without loss of strength in plate. Plate is balanced by additional rivets placed at rim of disc. Facings are riveted individually on cushion segments by one or two rivets in each segment.

Segmented Type Plate:—Driven plate slotted radially and segments alternately convex and concave. Tongue formed in each section by 'U' shaped cutaway. Each facing riveted individually at outer holes on convex side of segments (alternate segments) and to inner point of tongue on intervening concave segments.

To Remove Facings—Drill out rivets to remove old facings. Do not punch out rivets as this will distort disc and damage tongues.

Installing Facings—Insert rivets on facing side (head in countersunk hole of facing). Roll rivets on plate side—do not use split rivets. Each facing must be riveted individually with facing drilled to permit working through facing to head rivets for facing in opposite side.

Installing Driven Member—Plate marked 'Flywheel side'. Install with this side toward flywheel.

Cushion Spring Type Plate:—Facing on pressure plate side riveted only to series of individual cushion springs by two short rivets at tongue end of each spring. Cushion springs riveted to plate together with facing for flywheel side with two long rivets.

To Remove Facings—Drill out rivets when removing old facings to avoid danger of distorting disc and damaging cushion springs.

Installing Facings—Use complete new set of cushion springs if necessary to replace any of the springs. Install lining of flywheel side, inserting long rivets with heads in countersunk holes in facing, place cushion springs on opposite side of plate concave side down lining up springs so that tongue of one spring enters notch in next, roll rivets on spring side. If properly installed, holes in spring for pressure plate facing will line up with slot in plate. Install facing on cushion springs inserting short rivets with head in countersunk holes in facing, roll rivets on cushion spring side (work through holes in flywheel facing).

Installing Driven Member—Plate marked 'Flywheel Side'. Install with this side toward flywheel.

ILLINOIS (GRAHAM).

Used on:

GRAHAM, STD. 6 MODEL 74 (1935).
GRAHAM, CRUS. MODELS 80, 80-A (1936).
GRAHAM, CAVAL. MODELS 90, 90-A (1936).
GRAHAM, SUPERCH'D MODEL 110 (1936).
GRAHAM CRUSADER, MODEL 85 (1937)

DESCRIPTION:—Single plate dry disc type. Three release levers pivoted on eccentric pins in pressure plate lugs at flywheel brackets actuate clutch. Single large spiral clutch spring located between release lever plate and pressure plate. Pressure plate is heavy ribbed casting and is mounted on flywheel by three lugs engaging brackets bolted on flywheel independently (no conventional clutch cover used). NOTE—Mounting bolts are special type and no other type bolt should be used for replacement. One 5/16" lockwasher 3/32" thick must be used under each bolt head.

ADJUSTMENT:—When range of clutch pedal engagement has been used up, bracket mounting bolts on flywheel should be loosened one or two turns and the bracket shim pulled out from between the bracket and the face of the flywheel (shim holes slotted, not necessary to completely remove bolts). Adjust one bracket at a time, tighten bracket bolts before loosening next bracket. Shims can be discarded (new shims furnished with new lined clutch plates).

SERVICING:—Disassembly. Drill out riveted end of each eccentric pin (at outer end of each release lever) using ¼" drill. **Important**—Any attempt to drive out pins without first drilling riveted end will break or distort pressure plate. Place assembly on arbor press, compress release lever plate and spring slightly, remove eccentric pins and release levers, back off press to release spring, lift off plate and spring.

Assembly:—New clutch spring and new eccentric pins must always be used. See that release levers and retaining plate are not worn and that ends of levers are free in plate Place pressure plate on arbor press, install spring and retaining plate, compress spring, install release levers and eccentric pins turning nuts on pins up loosely, remove assembly from press and adjust release levers.

Release Lever Adjustment:—Mount pressure plate assembly on standard flywheel with three pieces of 5/16" key stock 1½" long between plate and face of flywheel midway between release levers (these pieces must be exactly same thickness, do not install driven member). Turn eccentric pins so that release levers are thrown in toward center of assembly as far as possible. Install special gauge ('U' shaped metal bar which forms parallel surface above retaining plate) over retaining plate, turn each eccentric pin so that face of retaining plate is parallel with underside of gauge in all positions, tighten locknuts securely

Installation:—When installing clutch with new driven member or new facings, see that shims furnished with new plate are installed on flywheel under each mounting bracket (these shims are discarded to secure second range of adjustment as facings wear). NOTE—Long type driven member used on Model 90 after Eng. No 207437, 110 after Eng. No 109174, and furnished for replacement on these models and also Model 90A after May 15, 1936. See Long data below. When installing Long driven member on these cars, see that flywheel bolts are tight and do not extend beyond face of nuts, install driven member with dampener toward flywheel

DRIVEN MEMBER:—Spring dampening device incorporated in driving plate hub. Driving plate segmented and facings riveted to plate individually. Manufacturer recommends use of new driven member with lining selected to maintain even thickness at all points under pressure.

Illinois Type Driven Member:—Iron rivets used for one facing, copper or brass for other (facings riveted individually). Iron rivets must be drilled out, plate will be distorted if rivets driven out. See that new facings contact plate at all points, driven member must be of exact same thickness at all points.

Long Type Driven Member:—See article on Long Type 9CF clutches for complete driven member data Facings as furnished by manufacturer have cushion springs installed. Install plain facing on flywheel side (dampener side when used with Illinois clutch, on models with Long Clutch when dampener installed away from flywheel, plain facing is installed on opposite side) Use brass tubular rivets Install cushion spring facing last using soft iron rivets with heads in clearance holes in facing. Special riveting fixture available with locating pins to insure correct positioning.

INLAND MODELS

Used On:

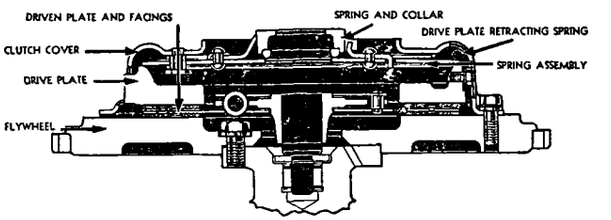
PONTIAC QUALITY SIX, MODEL 39-25 (1939)
PONTIAC DELUXE SIX, MODEL 39-26 (1939)
PONTIAC DELUXE EIGHT, MODEL 39-28 (1939)
STUDEBAKER PRESIDENT, MODEL 5C (1939)

DESCRIPTION:—Single plate dry disc type with diaphragm spring disc which takes the place of both pressure plate springs and release levers. Diaphragm spring is shaped like dished washer with inner rim slotted to form 18 segments or release fingers and is pivoted on inner and outer pivot rings assembled on inner surface of clutch cover by nine rivets. Diaphragm and pressure plate are linked by three tension or retracting springs mounted on edge of pressure plate by capscrews (springs and mounting screws visible through slots in cover). When diaphragm spring fingers depressed to release clutch, diaphragm pivots on inner pivot ring and resulting flexing action causes outer rim to move out relieving pressure on pressure plate and withdrawing plate from driven member. When diaphragm released to engage clutch, diaphragm flexs in opposite direction (pivoting on outer pivot ring). Pressure plate driving torque taken by three lugs on outer rim of plate which engage slots in clutch cover.

Pontiac Models. On all Pontiac models, an anti-rattle spring is installed between the cover and the rim of the pressure plate at one of the cover holes adjacent to the balance-marked lug hole and a release bearing plate (used with special graphite-composition release bearing) is mounted on the center of the clutch diaphragm.

SERVICING:—Caution. Do not allow pressure plate to hang on retracting springs in clutch cover. When handling clutch cover assembly, support pressure plate by hand or invert assembly so that pressure plate is up.

Disassembly. On Pontiac models, wire anti-rattle spring (flat tension spring in hole on side of clutch cover adjacent to balance marked pressure plate lug slot) to cover so that it will be retained when pressure plate is removed—**shifting spring to any other position will upset clutch balance.** Working through holes in clutch cover, take out retracting spring mounting screws, withdraw three retracting springs, lift pressure plate out. This completes disassembly (cover, diaphragm, and release bearing plate serviced as an assembly only and should not be dismantled).



Assembly. Place cover and diaphragm assembly over pressure plate making certain that pressure plate lug marked '0' is engaged in cover slot which is similarly marked (mark on cover will be found on mounting flange below slot), install retracting springs and tighten mounting screws. On Pontiac models, make certain that anti-rattle spring is in place in cover in hole adjacent to balance-marked slot and that it bears on pressure plate edge. No release lever setting etc. required.
NOTE—Manufacturer recommends that new retracting springs be used with clutch whenever a new or relined driven member is installed.

DRIVEN MEMBER:—Long 'CF" type driven members used on all models as follows:

Car Model	Driven Member Type
Pontiac Six 39-25, 26	9CF-CS
Pontiac Taxicab	10CF-CS
Pontiac Eight 39-28	9½CF-CS
Studebaker Pres. 5C .	9½CF-CS

See Long Model 9CF Clutch article for complete driven member data and note following points:

Pontiac Models—Special fixture available for facing installation (J-1043 riveting anvil, J-846-8 rivet set) on all models. When using this fixture, place guide pins in 'P6' holes for all six cylinder models (lower set of holes on rim near nameplate) and place rivet in center 'P' hole (diametrically across rim from nameplate) On eight cylinder models place guide pins in 'P8' holes (upper set of holes on rim near nameplate) and use same rivet hole as for six cylinder cars. On Taxicabs, place guide pins in 'A' holes (approx. 45° around rim from P6 & P8 holes), place rivets in center 'A' holes (directly below part no. of nameplate). Facing and driven member should be rotated on anvil as rivets are installed.

Studebaker—Reconditioned driven member assemblies (with facings installed) are available.

MODELS 9AB, 11A, 11AB

Type — Used On:

9AB —AUBURN 8, 8-100, 100A ('32), 8-101, 105 ('33).
FORD V-8 (1932-34).
GRAHAM 6, 65 ('33), 68 ('34).
GRAHAM 8, 57 ('32), 64, 57A ('33), 67 ('34).
STUDEBAKER, COMM 1-B, PRES. 1-C ('35).

9AB-CS —AUBURN 6, 652-X, Y ('34), 653 ('35), 654 ('36).
AUBURN SIX, MODEL 654 (1937)

9AB-M —GRAHAM 6, 73 ('35); 8, 72 ('35).
GRAHAM SUPERCH. 67, 69 ('34), 75 ('35).
HUPMOBILE 8, 226 ('32), 326 ('33), 426 ('34).
STUDEBAKER 6, 56 ('33), COMM. 73 ('33).
STUDEBAKER COMM. B & YR.AH'D ('34).
STUDEBAKER PRES. 82 ('33),
C & YR. AH'D ('34).

9AB-6CI —AUBURN 8, 850-X, Y ('34), 851 ('35), 852 ('36)
AUBURN SUPERCH. 851 ('35), 852 ('36).
AUBURN EIGHT, MODEL 852 (1937)
AUBURN SGD. EIGHT, MOD. 852 ('37)
HUPMOBILE 8, 427-T ('34), 527-T ('35).

9AB-10CI—STUDEBAKER PRES. 2C (1936).
STUDEBAKER PRES. MOD. 3C (1937)

11A —PACKARD 8, 901, 902 (1932).

NOTE:—Manufacturer recommends use of Borg-Warner UF-300 fixture for servicing clutch. Fixture consists of surface plate, which duplicates driving surface of flywheel, clamp screws to clamp clutch cover against plate, arbor press to compress springs in dismantling clutch, and gauge standard for use in setting up release levers.

DESCRIPTION:—Single plate, dry disc type. Six release levers pivoted on release bolts at rim of pressure plate with edge of cover at lever hole serving as fulcrum to actuate clutch. Servicing directions below apply to pressure plate assembly. See Driven Member Section if pressure plate not to be dismantled and rebuilt.

SERVICING:—Mark all parts before disassembling and reassemble in same position. Replace grooved, warped, or checked pressure plates. Replace springs when pressure plate discolored from heat (see Spring Testing below).

Dismantling:—Break release lever bolt nut locks by running hacksaw blade through bolt slots. Place clutch in fixture or arbor press, compress cover slightly, take off release lever bolt nuts, release pressure slowly, lift off cover plate. This will expose all parts of pressure plate assembly. Remove and test clutch springs.

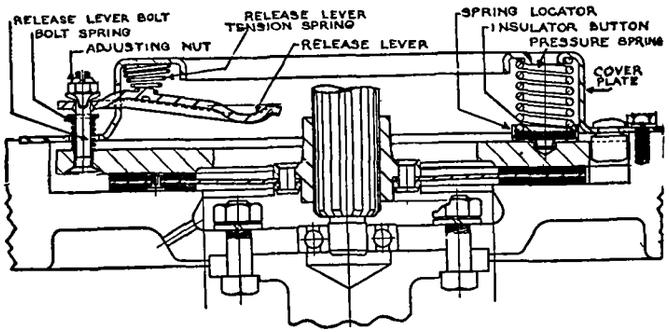
Clutch Springs:—Pressure springs should check with table below. Replace springs if weak or burned or if clutch has been subjected to excessive heat. Twelve springs used on all models.

Spring Specifications

Spring No.	Pressure @ 1 9/16"	Free Length	No. Coils
C-1965	90-100 lbs.	2¼"	8¾
C-2045	110-120 lbs.	2¼"	8¾
C-2096	120-130 lbs.	2½"	8½
C-2141	130-140 lbs.	2¾"	8½
C-3097	110-120 lbs.	2¼"	8¾
C-3098	110-120 lbs.	2¼"	8¾
C-3410	120-130 lbs.	2 15/32"	8½

Release Lever Assembly:—Place cover plate upside down on bench, place lever tension springs on cover, install levers forcing springs into place under lever. Make certain that springs are seated within cover and that small end of spring engages lug on lever. Cover assembly can then be installed on pressure plate.

Assembling:—Place pressure plate on fixture or arbor press, insert release lever bolts through plate, install springs on bolts, assemble spring locators, locator buttons and pressure springs on pressure plate. Install cover, compress cover about ½ until release bolts are just short of entering holes in levers, place flat washers on release lever bolt springs (washers must not be placed on springs before cover is installed or cover will bind and be distorted). Place #5 (9AB), #4 (11A), #8 (11AB) height sleeves on fixture under cover edge at levers, compress cover until it rests on height sleeves, guiding release lever bolts through holes in levers, use clamps to hold cover plate down on height sleeves. Assemble the washers and nuts in release lever bolts turning nuts down until they are flush with tops of bolts. Compress and release clutch several times to seat all parts (use weight on release levers). Then adjust release lever heights.



Release Lever Adjustment (on Fixture):—Assemble lever adjusting arm and sleeve setting bottom of of adjusting arm 1 17/32" (9AB except all Fords), 1 19/32" (Ford Pass. Cars), 1⅝" (Ford Truck and Coach), 1 17/32" (11A), 1 23/32" (11AB) above bottom of sleeves and lock with thumbnut. Swing arm over each lever in turn, set lever by turning release lever bolt until lever tip contacts arm. Lock adjustment by peening metal of nut into bolt slot.

Release Lever Adjustment (without Fixture):—Use aligning shaft and adjustment sleeve (Studebaker Parts HMJ-278, 278-2). Insert shaft in splined hub of driven member (clutch installed in flywheel) place sleeve on shaft so that it contacts hub, place straightedge across top edge of sleeve, turn adjusting screws up until they contact straightedge. Lever heights must be equal within .020". Lock adjusting screws by peening metal into slots.

DRIVEN MEMBER:—Manufacturer recommends installation of new driven member with new clutch facings rather than relining clutch. Driven plate hub (Spring dampener) cannot be serviced in the field. Cushioning springs are used under facing on pressure plate side of driven plate.

To Remove Facings:—Drill out twelve iron rivets mounting cushion springs on plate (two rivets radially at center of each spring), remove spring and facing assembly, drill out rivets to remove springs from facing (replace springs as complete set). Then drill out rivets mounting other facing on plate. Do not punch out rivets.

To Install Facings:—Install facing on flywheel side of driven plate, inserting brass rivets with heads in countersunk holes in facing and rolling rivets on plate side. Rivets are staggered in inner and outer rows around plate. Place cushion springs on second facing with clearance between spring and plate at center. Insert brass rivets with head in countersunk holes in facing, roll rivets on spring side (rivets installed in inner and outer holes alternately around plate in opposite order to those on other facing). Brass rivets must not extend through plate or springs more than 1/32" (plate end spring cutaway to provide clearance). Place facing and cushion spring assembly on plate, insert iron rivets through holes in plate and cushion springs, roll rivets (working through holes in facings). Driven member should be balanced after new facings installed.

Installing Driven Member:—Install with hub bolt nuts on flywheel side and cushioned facing toward transmission.

MODELS 8½CB, 11CB

Type — Used On:

8½CB-CS6—FORD '60' PASS. CAR, MODELS 74 (1937), 82A (1938), 922A (1939)
WILLYS-OVERLAND, MODEL 39 (1939)

11CB—PACKARD EIGHT, 1001, 2 (1933)

NOTE:—Manufacturer recommends use of Borg-Warner UF-300 fixture for servicing clutch. Fixture consists of surface plate, which duplicates driving surface of flywheel, clamp screws to clamp cover against plate, arbor press to compress springs in dismantling clutch, and gauge standard for use in setting up release levers.

DESCRIPTION:—Single plate, dry disc type. Release levers pivoted on studs in outer rim of pressure plate with edge of cover at lever holes serving as fulcrum to actuate clutch. Servicing directions below apply to Pressure Plate and Cover Assembly (need not be followed if driven member only being replaced).

SERVICING:—Mark all parts before disassembling (reassemble in same positions to preserve balance). Replace grooved, warped, or cracked pressure plates, replace springs if pressure plate discolored from excessive heating.

Dismantling:—Free release lever stud nut locks by running hacksaw blade through slots. Place assembly on fixture or in arbor press, compress cover slightly, remove lever stud nuts, release pressure slowly, lift off cover plate and lever assembly. Free release lever tension springs, lift out levers. Lever studs are pressed in pressure plate and pinned in place (need not be removed unless pressure plate or studs being replaced—see servicing directions below).

Release Lever Studs:—Replacement studs furnished without drilled hole for lock pin. To install studs, start stud in pressure plate hole, use vise jaws as press to force studs in until end of stud is 13/16" plus or minus 1/32" above finished surface of pressure plate, drill studs through pressure plate hole (use No. 22 drill), drive lockpins in from inside (rounded end first).

MODELS 8½CB, 11CB CONT.

Clutch Springs:—Replace springs if weak or burnt, or if pressure plate indicates clutch has heated excessively.

Model 8½CB Springs

Spring No.	Pressure & Length	Color
C-287 (Ford)	130-140 lbs. @ 1 9/32"	Blue
C-4784 (Overland)	140-150 lbs. @ 1 19/64"	White

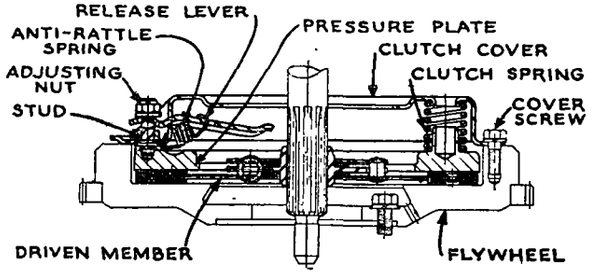
Model 11CB Springs

C-2096 (Packard) ....120-130 lbs. @ 1 9/16" .... Red

NOTE—Spring pressure for Model 8½CB was 120-130 lbs. @ 1 9/32" (spring with 7 coils).

Release Lever Assembly:—Invert cover, insert levers through slots in cover from inside, hook tension springs over levers and in spring holes in cover below lever slots. Cover is then ready to install on pressure plate.

Pressure Plate Assembly:—Place pressure plate and stud assembly on fixture (see release lever stud servicing above), install springs on spring bosses on pressure plate, place cover in position on springs, compress cover until it is tight against #2 (8½CB), #8 (11CB) height sleeves placed under cover edge at clamps, guide lever studs through holes at outer ends of levers, install lockwashers and tighten lever nuts flush with ends of studs. Use clamps at height sleeves to hold cover, compress and release clutch several times (use weight on levers) to seat all parts, adjust lever heights.



Release Lever Adjustment (On Fixture):—Use lever adjusting arm and sleeve, setting lower face of lever exactly 1¼" (8½CB—Ford 60), 1 7/16" (8½CB Overland—with "3J" lands under pressure plate), 1 23/32" (11CB—Packard) above the bottom of the sleeve, tighten thumbnut. Swing arm over each release lever in turn, turn release lever nut until lever tip just contacts arm. Lock adjustment by peening nut into stud slot, recheck lever setting.

Release Lever Adjustment (Dial Indicator):—If dial indicator used, install indicator plate on lever tips, set indicator bracket at 1¾" (8½CB), 1 23/32" (11CB), set all levers for zero reading on dial indicator.

DRIVEN MEMBER:—Manufacturer recommends installation of replacement driven member (clutch disc) with new facings installed. See car model Mechanical Page for facing specifications.

Driven Member (Willys Overland)—Borg & Beck type (same as Willys) used on some cars. See Borg & Beck clutch article for data.

CLUTCH INSTALLATION:—Manufacturer recommends that cover be compressed on clutch fixture or in arbor press and ¼" tapered wooden blocks be installed between inside edge of cover and levers to hold levers in released position while installing clutch on flywheel. This will prevent cover distortion when cover bolts are tightened (remove blocks after clutch installed).

MODEL 12CB.

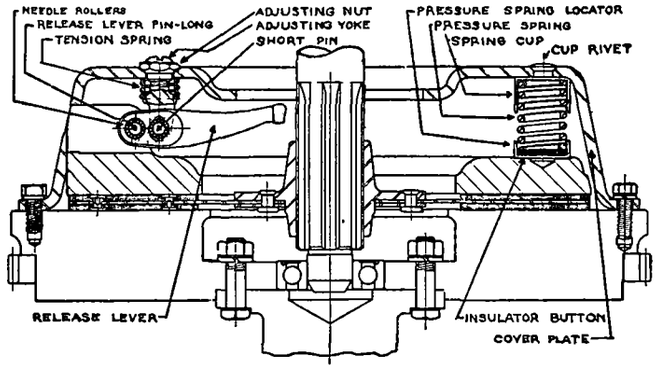
Type Used On:

12CB —CHRYSLER CST. IMPERIAL, CW ('34), CW* ('35).
LINCOLN V-12 (1934-35).
PACKARD EIGHT (1934-35).
PACKARD SUPER EIGHT (1933-35).
PACKARD TWELVE (1933-35).

12CB-CL—LINCOLN, V12 MODEL (1936-37-38-39)
PACKARD 8, MODELS 1400, 1, 2 (1936)
PACKARD SUPER 8, 1403, 4, 5 ('36), 1500, 1, 2 ('37)
PACKARD SUPER 8, 1603, 4, 5 (1938)
PACKARD 12, 1407, 8 ('36), 1506, 7, 8 ('37)
PACKARD 12, 1607, 8 ('38), 1707, 8 ('39)
PIERCE ARROW 8, 1601 ('36), 1701 ('37)
PIERCE ARROW 8, MODEL 1801 (1938)
PIERCE ARROW 12, 1602, 3 ('36), 1702, 3 ('37)
PIERCE ARROW 12, 1802, 3 (1938)

12CB-11½C—CADILLAC V16, SERIES 90 (1938-39)

NOTE—Manufacturer recommends use of Borg-Warner UF-300 fixture for servicing clutch.



DESCRIPTION:—Single plate, dry disc type. Six release levers pivoted on pressure plate lugs with fulcrum on yoke on cover. Needle bearings used at both pivot points. Servicing directions below apply to pressure plate assembly. See Driven Member Section if pressure plate not to be dismantled and rebuilt.

SERVICING:—Mark all parts before dismantling, and reassemble in same position. Replace grooved, warped, or checked pressure plates. Replace springs when pressure plate discolored from heat (see Spring Testing below).

Dismantling:—Break release lever yoke bolt nuts by running hacksaw blade through bolt slots. Place clutch in fixture or arbor press, supporting pressure plate on special lands under release levers, compress cover slightly, take off release lever yoke bolt nuts, release pressure slowly, lift off cover plate. This will expose all parts of assembly. Remove and test clutch springs.

Clutch Springs:—Double release springs used in some models (Type C-2727 springs inside heavier outer spring). Check springs separately, replace all springs which do not test up to figures below or which appear burned or warped.

Spring Specifications

Spring Number	Pressure @ 1 9/16"	No. of Coils	Color Markings
C-2727	50-54 lbs.	14	Dark Green
C-2096	120-130 lbs.	8½	Red
C-2972	100-105 lbs.	10¼	Dark Green
C-3347	112-118 lbs.	8¾	Purple
C-3431	150-160 lbs.	8½	Pink

Release Lever Assembly:—Use lever pin sawed off to lever width as a guide, install needle bearings in inner hole of lever, install adjusting yoke, insert short lever pin (pushing guide pin out as pin inserted) install pin locks. First type pins locked by hair-pin type lockwire at each end. Later type has head on one end and is held by cotter pin at other. First type pins should be replaced by later type whenever encountered. Repeat operation above at outer lever hole and install lever in pressure plate lugs using long lever pin.

Assembling:—Place pressure plate on fixture or arbor press supporting on special lands under release levers, assemble pressure spring locators, locator buttons and springs on plate, place cover on plate, compress slowly guiding lever yoke adjusting bolts through holes in cover, see that springs seat properly, clamp cover down placing clamps at cover clamp bolt holes. Assemble release lever bolt nuts and turn nuts down flush with tops of bolts. Compress and release clutch several times (using weight on release levers) to seat all parts. Then adjust release levers.

Release Lever Adjustment (on Fixture):—Assemble lever adjusting arm and sleeve, set bottom of arm 2 13/32" above bottom of sleeve, lock with thumbscrew. Swing arm over each release lever in turn, turn adjusting nut until lever just contacts arm, lock nuts by peening metal of nut into bolt slot.

Release Lever Adjustment (without Fixture):—If gauge plate or dial indicator used to set up release levers, lever heights must be equal within .005". Lock adjustment by peening metal of nut into bolt slot.

DRIVEN MEMBER:—Manufacturer recommends installation of new driven member with new clutch facings rather than relining clutch. Driven plate hub (Spring dampener) cannot be serviced in the field. Cushioning springs are used under facing on pressure plate side of driven plate.

To Remove Facings:—Drill out iron rivets mounting cushion springs on plate, remove spring and facing assembly, drill out rivets to remove springs from facing (replace springs as complete sets). Then drill out rivets mounting other facing on plate. Do not punch out rivets.

To Install Facings:—Install facing on flywheel side inserting brass rivets with heads in countersunk holes in facing and roll rivets on plate side. Place cushion springs on second facing with clearance at center between spring and facing, insert brass rivets with heads in countersunk holes in facing and roll on spring side. Brass rivets must not project more than 1/32" when rolled (plate and spring cutaway to provide clearance). Place cushion spring and facing assembly on plate, insert iron rivets through holes in plate and spring, roll rivets (work through holes in facing). Driven member should be balanced after new facings installed.

MODELS 9CF, 9½CF, 10CF, 11CF

Assembly Number — Used On:

BL-1441—FORD '85' PASS. & COMM'L. ('35-39)
FORD '60' COMM'L. & 1 TON ('37-39)
GRAHAM, ALL (1937) SEE NOTE
MERCURY, MODEL 99A (1939)

MODEL 9½CF-CS

BL-4114—GRAHAM, MODELS 96, 97 (1938-39)
PACKARD SIX, ALL MODELS (1937-38-39)
STUDEBAKER PRESIDENT, 4C (1938)

MODELS 10CF, 10CF-CI

BL-3555—HUPMOBILE 8, 621N('36),825H('38),935H('39)
PACKARD '120' 8, ALL MODELS ('35-39)
BL-3731—CORD, MODELS 810 ('36), 812 ('37)
BL-3817—LINCOLN-ZEPHYR, ALL MODELS (1936-39)
BL-4671—LA SALLE V8, SERIES 39-50 (1939)

MODELS 11CF, C, CI, CL, 10½CI

BL-3890—CADILLAC V8, ALL MODELS (1936-39)
CADILLAC V12, 80, 85 (1936-37)
LA SALLE V8, SERIES 50 (1937-38)
BL-1478—FORD '85' TRUCK MODELS (1936-39)

NOTE:—Assembly Number. This is the part number of the Cover Assembly which includes all clutch parts except driven member Clutch Model Number (9CF-CI, 9CF-CS, etc) indicates also the type of driven member used on each car model.

Driven Members (for other cars):—Long 'CF' type driven members used on cars with other clutch models as shown in table below. Driven member data as shown below applies to these car models also.

Car Model	Long Driven Member
Buick 40 (1937-38)	10CF-CI
LaSalle 350, 50 (1934-36)	10CF-CI
Pontiac 6 & 8 (1934-38)	10CF-CI
Buick 60, 80, 90 (1937)	11CF-CI
Pontiac 6 (1939)	CF-CS
Pontiac 8 (1939)	9½CF-CS
Pontiac Taxicab (1939)	10CF-CS
Studebaker Pres. (1939)	9½CF-CS

Clutch Fixture Note:—Manufacturer recommends use of Borg-Warner Universal Clutch Fixture UF-300 for all servicing and rebuilding operations

DESCRIPTION:—Single plate, dry disc type. Release levers formed with weight on outer end which increase pressure on driven member as engine speed increases. Levers pivoted on pressure plate on needle bearings with fulcrum located in yoke support on cover plate. Hardened-steel screw contact provided on lever tips. These screws staked in place and should be disturbed only when release lever adjustment (for new or relined driven plate) is to be made. Servicing directions below apply to pressure plate assembly. See Driven Member Section below if pressure plate not to be dismantled and rebuilt.

SERVICING:—Mark all parts before dismantling and reassemble in same position. Replace grooved, warped, or checked pressure plates. Replace springs when pressure plate discolored from heat (see Spring Testing below).

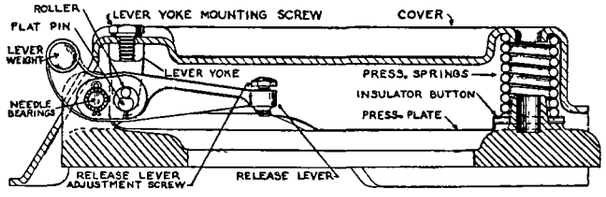
Dismantling:—Place clutch on fixture (supporting pressure plate on special lands under lugs) or arbor press. Compress cover plate slightly, take out assembly screws (lever yoke mounting screws) on cover, release pressure on cover plate slowly, lift off plate. Note whether washers used on yokes under assembly screws (these washers must be reinstalled if old pressure plate used again). See special directions below on removing and reinstalling release levers. Remove and test clutch springs.

Clutch Springs:—Pressure springs should check with table below. Replace springs if weak or burned or if clutch has been subjected to excessive heat. Six springs used on 9CF, nine springs on 10CF, 11CF.

Spring Specifications

Spring Number	Pressure @ 1 9/16"	No. of Coils	Color Marking
C-1445	130-140 lbs.	8¾	Green
C-1965	90-100 lbs.	8¾	Light Green
C-2045	110-120 lbs.	8¾	Gray
C-2096	120-130 lbs.	8½	Red
C-2141	130-140 lbs.	8½	Black
C-2686	145-150 lbs.	8¾	Yellow
C-2717	100-110 lbs.	8½	Dark Green
C-3431	150-160 lbs.	8½	Pink
C-4188	170-180 lbs.	7.4	Pink

Pressure Plate:—Pressure plate refacing by grinding or turning down on lathe will throw release levers



out of adjustment. If pressure plate being refinished, remove .020" from face and install spacer washer .015" thick on release lever yoke under cover. NOTE—If washers are found on release lever yokes under cover when clutch disassembled, replace these washers (if old pressure plate used) or discard washers (if new pressure plate installed).

Release Lever Assembly:—Mount lever yoke on release lever, fasten by inserting flat-sided lever pin (flat side out or toward cover) and roller (place roller on flat side of pin). Insert lever in pressure plate lug, use roller pin sawed off to length of lever width as a guide and insert needle bearings, insert roller pin, pushing guide pin out, lock both lever pins with cotter pins. Thread release lever adjusting screws in ends of levers, turning screws down completely.

Assembling:—Place pressure plate on fixture or arbor press. Assemble pressure springs, locator washers or insulator washers on plate, place washers on lever yokes (if washers used previously and old pressure plate being used). Place cover plate in position (lining up marks made before dismantling), compress cover slowly guiding lever weights through holes in cover and lining up yokes under cover plate holes. See that pressure springs are seated, insert cover screws in yokes, using lockwasher under screw head, tighten screws down securely. Compress and release clutch several times (using weight on release levers) to seat all parts. Then adjust release lever heights.

Release Lever Adjustment (on Fixture):—Place special lands on fixture under pressure plate lugs, assemble lever adjusting arm and sleeve setting bottom of adjusting arm correct distance as shown in table below (all figures plus or minus 1/32") above bottom of sleeve and lock the adjusting arm with the thumbscrew. Swing arm over each release lever in turn, back off adjusting screw on tip of lever until rounded screw head just contacts arm, lock screws by inverting clutch so that screw head is supported and stake or peen lever into adjusting screw slot. Do not disturb lever yoke screws when making this adjustment.

Clutch Model	Lever Setting Height
9CF	2 3/32"
9½CF	2"
10CF	2⅛"
11CF	2 7/32"

Release Lever Adjustment (without Fixture):—Assemble lever setting disc or gauge (Cadillac No. J-685) on flywheel in place of driven member, placing gauge so that lugs are under release levers and gauge is centered in clutch. Tighten all clutch cover bolts evenly. Place short straightedge on edge on top of gauge shoulder, turn adjusting screws at tips of release levers up or down until they contact straightedge, lock screws by peening metal of lever into screw slot. Lever heights must be equal within .005".

Release Lever Adjustment (Dial Indicator):—When using dial indicator to set release levers on Model 9½CF, special indicating plate must be installed on levers and lever setting with this plate in place should be 2½" (plus or minus 1/32") and lever heights equal within .005". This indicating plate is not used on other models.

DRIVEN MEMBER:—Manufacturer recommends installation of new driven member with new clutch facings rather than relining clutch. Driven plate hub (Spring dampener) cannot be serviced in the field. Cushioning springs used under facing on pressure plate side of disc only.

To Remove Facings:—Drill out 12 iron rivets mounting cushion springs on plate (two rivets radially at center of each spring), remove spring and facing assembly, drill out rivets to remove springs from facing (replace springs as complete sets). Then drill out rivets mounting other facing on plate. Do not punch out rivets.

To Install Facings:—Install facings on flywheel side inserting brass rivets with heads in countersunk holes in facing and roll rivets on plate side (rivets staggered in inner and outer holes alternately around facing or placed two in a row radially). Place cushion springs on second facing with clearance at center between spring and facing, insert brass rivets with head in countersunk holes in facing and roll on spring side. Rivet layout same as for first facing except that rivets staggered in opposite direction or radial rows offset from rivets for first facing. Brass rivets must not project more than 1/32" when rolled (plate and spring cutaway to provide clearance). Place cushion spring and facing assembly on plate, insert iron rivets through holes in plate and spring, roll rivets (work through holes in facing). Driven member should be balanced after new facings installed.

Installing Driven Member:—Install with hub nuts on flywheel side and cushioned facing toward transmission (plate on Cadillac V12 is solid hub type with no dampening device).

MODEL 11CFS SPECIAL TYPE

Type **Used On:**

11CFS-CI—PACKARD SUPER 8, 1703, 3A, 5 (1939)

NOTE:—This clutch is a special type of riveted construction and cannot be dismantled. See description and servicing directions below.

DESCRIPTION:—Single plate, dry disc type of same design as other Long 'CF' semi-centrifugal clutches except for added spring segments installed as follows:

Spring Segments—Consist of three flat springs located between release levers which are riveted to lugs on pressure plate at inner ends and clutch cover flange at outer ends so that all clutch parts are permanently joined in one assembly (one clutch spring of each group extends through clearance hole in center of each spring segment).

SERVICING:—Cover assembly cannot be dismantled without removing spring segments (riveted to pressure plate and cover) and is serviced on an exchange basis.

WARNING—Clutch will not operate satisfactorily with spring segments removed.

DRIVEN MEMBER:—Long 'CF' Type. See Long 'CF' Clutch article (preceding page) for data.

MODELS 29A, 31A

Type **Used On:**

29A—LINCOLN, V-12 (1932), V-12-136, 145 (1933).

PACKARD SUPER EIGHT, 903, 4 (1932).

PACKARD TWELVE, 905, 6 (1932).

PIERCE ARROW EIGHT, MODELS 53 ('32), 836, 9 ('33), 836-A, 840-A ('34), 845 ('35).

PIERCE ARROW TWELVE, MODELS 51, 2 ('32), 1236, 42, 47 ('33), 1240-A, 48-A ('34), 1245, 55 ('35),

STUTZ, MODELS SV-16, DV-32 (1932-34)

31A—DUESENBERG, MODELS J, SJ (1931-37)

NOTE:—Manufacturer recommends use of Borg-Warner UF-300 universal fixture for servicing clutch.

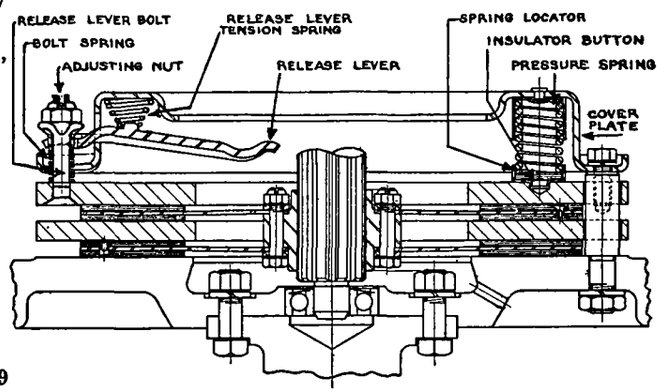
DESCRIPTION:—Double plate, dry disc type. Driven member consists of two discs bolted to hub on opposite sides of front driving plate so as to form an assembly. Driven discs clamped between flywheel and forward driving plate (front disc), between forward driving plate and rear driving plate or pressure plate (rear disc) when clutch engaged. Driving plates mounted loosely on studs in flywheel which serve as mounting posts for clutch cover plate. Six release levers pivoted on edge of slot in cover actuate pressure plate through bolts at outer end on which adjusting nuts located. Center plate actuated by three adjusting screws in rim of pressure plate. Twelve clutch springs used and mounted in groups of two between adjacent release levers.

SERVICING:—Mark all parts before dismantling so that clutch parts can be reassembled in same position. Driven member must be dismantled to remove driven discs for replacement or refacing. Pressure plate assembly need not be dismantled unless springs are to be checked or parts replaced (release levers will not require readjustment when clutch assembled unless pressure plate assembly disturbed).

Dismantling Driven Member:—Take off nuts on bolts in driven member hub holding driven discs, remove discs. On types with spring dampener in hub, be careful not to disturb dampener assembly. Nuts must be locked on bolts when driven member reassembled.

Dismantling Pressure Plate Assembly:—Take out three center plate adjusting screws in rim of pressure plate, break release lever bolt nut locks by running hacksaw blade through slot in nut. Place assembly in fixture or on arbor press, compress cover slightly, take off release lever bolt nuts, release pressure slowly, lift cover off. This will expose all parts of assembly.

Clutch Springs:—Check springs and replace if weak or if burned or warped. Replace springs if pressure plate warped or discolored indicating excessive heating.



Spring No.	Press. & Length	Free Length	No. Coils
C-1675	120-130# @ 1⅝"	2⅜"	8
"	130-140# @ 1 9/16"	2⅜"	8
C-1846	110-120# @ 1⅝"	2 13/32"	8¼
"	120-130# @ 1 9/16"	2 13/32"	8¼
C-1930	105-115# @ 1⅝"	2½"	9
C-1965	90-100# @ 1 9/16"	2¼"	8½
C-2141	130-140# @ 1 9/16"	2¾"	8½

Release Lever Assembly:—Place cover plate upside down on bench, install lever tension springs in cover with large end against cover (see illustration), install levers forcing springs into place under levers. Cover is then ready to install on pressure plate.

Pressure Plate Assembly:—Insert lever bolts through plate, place plate on fixture or arbor press, install springs on lever bolts, assemble spring locators, locator buttons and springs on plate. Install cover on pressure plate making certain that center plate adjusting screw holes (9/16") in rim of plate line up with holes in cover. Place #2 (29A), #4 (31A) height sleeves under edge of cover, compress cover about ½ until release lever bolts are just short of entering levers, install flat washers on top of lever bolt springs (washers must not be installed before cover assembled or cover will be distorted), compress cover all the way guiding lever bolts through holes in levers, install rockerwashers and nuts on lever bolts, turn nuts down until flush with tops of bolts. Compress and release clutch several times (use weight on release levers) to seat all parts. Then adjust lever heights.

Release Lever Adjustment (On Fixture):—Assemble lever adjusting arm and sleeve, setting bottom of arm exactly 1⅜" (29A), 1½" (31A) above bottom of sleeve, lock with thumbscrew. Swing arm over each release lever in turn, turn adjusting nut on release bolt until lever just contacts arm, lock nuts by peening metal of nut into slot in bolt.
NOTE—These settings correct with #2 (29A), #4 (31A) height sleeves under cover flange.

Release Lever Adjustment (Without Fixture):—If dial indicator used to set up release levers, lever heights must be equal within .005". Lock lever adjusting nuts by peening metal of nut into bolt slot.

DRIVEN MEMBER:—Manufacturer recommends installation of new driven member with new clutch facings rather than relining clutch. Driven plate hub (Spring Dampener) cannot be serviced in the field. Cushioning springs are used under facing on pressure plate side of driven plate.

INSTALLING CLUTCH:—Driving plates must be free sliding fit on mounting studs in flywheel. Center (front) driving plate must be installed with separator springs (small leaf springs on rim of plate) against flywheel. These springs release forward driven member by moving driving plate back when clutch disengaged. Center plate adjusting screws must be adjusted after clutch installed in flywheel.

Center Plate Adjusting Screw Setting:—Turn each screw in or clockwise until it bottoms on center driving plate, then back each screw off 3 or 4 notches (see car page for each model). Screws are assembled with springs under head and locking plates which hold the adjustment.

ROCKFORD (CROSLEY) TYPE

Used On:

CROSLEY, MODEL A (1939-40)

DESCRIPTION:—Single plate dry disc type. Clutch assembly consists of three fulcrum brackets (mounting brackets) which are bolted individually on the flywheel. Release levers are pivoted on pins in fulcrum brackets and engage lugs on pressure plate with pressure spring mounted on pressure plate under each lever (3 springs used).

SERVICING:—Disassembly. Take out cotter pin and remove pin linking release lever to fulcrum bracket, remove release lever and spring. Repeat this operation at each of the three fulcrum brackets.

Assembly—Install fulcrum bracket on pressure plate lug, install spring, place release lever in position with hole in lever and fulcrum bracket lined up, install pin and secure with cotter pin.

DRIVEN MEMBER:—Consists of a steel disc with slotted rim on which linings are riveted in four separate segments. Each lining segment retained by three rivets with rivet heads reversed on alternate segments (rivet heads toward flywheel on adjacent segments).

Servicing—Facings not furnished separately and driven member should be serviced by replacement.

ROCKFORD TYPE

Used On:

Assembly No. MODEL 8½ SP.
UCLA-2-1748—AMERICAN AUSTIN (1932-35)
UCLA-3-1748—BANTAM, MODEL 60 (1937-39)

MODEL 8 II

UCLA-5-1098 —WILLYS, MODEL 77 (1933-36)
UCLA-9-1098 —WILLYS, 37 ('37), 38 ('38), 48 ('39)
UCLA-13-1098—WILLYS, TRUCKS (1938-39)

NOTE:—Assembly Number—This is the part number of the Cover Assembly which consists of all parts except Driven Member. See Driven Member data below.

Willys 48 (1939)—Long Model 8½CB Clutch used on some cars. See article on Long Clutch for data on this type (same as used on Willys-Overland Model 39).

DESCRIPTION:—Willys—Single plate, dry disc type, mounted in recess in flywheel with flat cover bolted to flywheel rim. Actuated by three release levers pivoted on steel ball in lever post on cover plate and linked to lever stud mounted on pressure plate by pin (lever stud extends through hole in cover plate).

Bantam—Release levers have fulcrum lug which engages cover and are linked to studs inserted through pressure plate (facing riveted on face of pressure plate and must be removed to remove these studs). Twelve short springs (¾" working height) are mounted in pockets in pressure plate and cover.

SERVICING:—Pressure plate assembly need not be dismantled when replacing driven member unless pressure springs are to be tested or replaced or other service work performed.

Dismantling:—Place cover assembly in arbor press with pressure plate down, compress cover slightly, remove cotter pins, lever pins, unhook lever springs, remove levers, release pressure slowly, lift off cover.

Clutch Springs:—Check springs and replace if weak or burnt. Springs should check with following figures:

Clutch Model	Spring Pressure & Height
UCLA-2-1748 & 3-1748	23-27 lbs. @ ¾"
UCLA-5-1098 & 9-1098	140-150 lbs. @1 13/16"
UCLA-13-1098	160-170 lbs. @ 1 13/16"

Assembling (Willys):—Place pressure plate on press or fixture, install pressure springs on plate and place spring cups on springs. Install cover plate, guiding spring cups through holes in cover and making certain that stud holes are lined up. Compress cover slightly. See that steel balls on which levers pivot are in place in recess in end of each lever post. Hook lever springs on levers, then hook opposite end of springs under cover rim (springs must be engaged before levers installed, if springs installed later they may be stretched beyond limits and distorted). Force lever in position in slot in lever stud, insert lever pin and cotter pin. Check lever heights.

Bantam. Place pressure plate and release lever stud assembly on arbor press or clutch fixture (studs must be installed before facing riveted on pressure plate). Install clutch springs (12 used), install cover plate with lever studs extending through plate. With release lever springs in place, install levers and insert lever pins.

Release Lever Adjustment (Willys):—Levers adjusted by turning knurled adjusting screw which contacts steel post on lever post. Adjusting screws locked in position by end of lever spring which engages the serrations in the screw head. Levers must be equal so that all levers contact release bearing simultaneously and should be set so that lever tips are exactly 1 3/16" above top surface of clutch cover. Clearance between lever tips and release bearing should be 1/16" with clutch engaged.

Bantam. Levers not adjustable but lever tips should be exactly 1" above outer surface of facing on pressure plate (check with facing installed). Clearance between lever tips and face of release bearing should be 1/16" with clutch engaged.

DRIVEN MEMBER:—Bantam Models. Driven plate on this model consists of an unlined steel disc. Facings are riveted separately to face of flywheel and pressure plate.

Willys Models. Driven member is Borg and Beck type. See Borg & Beck Clutch article for data.

BUICK (OWN) SINGLE PLATE TYPE

Used On:

MODEL 40 (1934-35-36).
MODEL 50 (1932-33-34-35).
MODEL 60 (1932-33-34-35-36).
MODELS 80, 90 (1936).
MODEL 37-40 (1937), 38-40 (1938)
MODELS 37-60,80,90 ('37), 38-60,80,90 ('38)
MODELS 39-60,80,90 (1939)

NOTE:—Double plate clutch used on Models 80 (1932-33), 90 (1932-35). See separate article for data.

1938 Models. Heavier clutch spring pressures used (approximately 5 lbs. per spring) but pedal pressure less than on previous models due to use of new over-center return spring.

1939 Models. Pressure plate assembly may be installed on earlier car models provided release lever heights correctly set (adjusting nuts not locked on new assemblies, levers should be correctly set and nuts then locked). Lever height increased on 1939 models due to use of new Borglite driven member.

DESCRIPTION:—Single plate, dry disc type. Clutch mounted in slight recess in face of flywheel with pressure plate lugs in grooves cut in flywheel rim so that drive transmitted directly from flywheel to plate. Clutch is actuated by three release levers pivoted on adjusting bolts in cover plate and linked to pressure plate by pins in lugs on plate. Servicing directions below apply to pressure plate assembly and need not be followed unless pressure plate, springs, or release levers to be examined or replaced.

SERVICING:—Mark all parts before dismantling and replace in same position to maintain balance.

Dismantling:—Place pressure plate assembly on arbor press, place block on cover (clearing release lever adjusting nuts) to take pressure, compress cover slightly, remove adjusting nuts, release pressure slowly. Lift off cover. This will expose all parts for inspection. Replace worn parts, check clutch springs.

Clutch Springs:—Check pressure springs and replace if weak or burned. Nine springs (3 groups of 3) used on Model 40, 50 and 60 (1932-35); Twelve springs (4 groups of 3) used on Models 60, 80, 90 1936). Springs for 60 '32 marked by daub of red paint. Springs on 50 identical with 60 for 1933-34-35.

Spring Specifications

Model	Pressure	Length
All Models '32-35	140-150 lbs.	1 13/16"
40 1936-37	140-150 lbs.	1 13/16"
40 1938	152 lbs.	1 11/16"
60, 80, 90 1936-37	135-145 lbs.	1 3/4"
60, 80, 90 1938-39	139 lbs.	1 3/4"

Assembling:—Place pressure plate on arbor press. Install pressure springs on plate. Place cover in position on springs, install guide pins on release lever adjusting bolts. Compress cover slightly guiding adjusting bolts through holes in cover, install adjusting nuts on bolts, remove assembly from arbor press.

Release Lever Height Adjustment:—Assemble gauge plate (see table below for type for each model) in flywheel in place of driven member, centering gauge in clutch with lugs on plate under release levers. Place short straightedge on top of gauge hub, turn adjusting nut until release lever just contacts straightedge, lock adjusting nut by peening metal into slots. Remove gauge plate and install driven member. Release lever heights must be equal within .005". Check runout with clutch installed in flywheel and see that it does not exceed this figure.

NOTE—On 1938-39 models, lever screws flattened on one side and adjusting nuts should be locked by crimping flanged edge of nut against this flat.

Gauge Plate

Model	Gauge Plate No.
40 (1934-38)	J-285 (See Note).
50, 60 (1932-35)	J-285
60, 80, 90 (1936-38)	J-685
60, 80, 90 (1939)	J-1036

Model 40 Note—On 1934-35 models, use Adapter No. J-285-1 assembled on top of gauge plate. On 1938 model, use Adapter No. J-285-4. No adapter used on 1936-37 models.

DRIVEN MEMBER:—Spring dampener type hub used on all models. Drill out old rivets to avoid distorting clutch disc when removing facings. Install new facings as follows:

1932-33—Rivets installed with heads in opposite direction alternately around disc (rivet heads in outer row in one direction, inner row oposite). Driven member on 50 and 60 not interchangeable.

1934-35—Split type facing laced at joint. Two rivets installed on each side of joint. Rivets installed from one side for one half of disc, and from opposite side for other half (heads of rivets at facing joint).

40 1934-35—Single row of rivets around disc. Rivet heads alternated from one side to the other.

1936—Borg and Beck driven member (with separate cushioning springs) used on Model 40, Long type driven member on Models 60, 80, 90. See article on Borg and Beck or Long Clutches.

1937 Models:—Long type driven member used on all models (see list below). Type used on Model 40 may be used for replacement on earlier models but old type driven member must not be used on 1937 cars (greater torque on new models). Type used on Models 60, 80, 90 same as previous type except that plate weight has been reduced by stamping holes in the plate. New type driven member is interchangeable with 1936 Models 60, 80, 90.

Model	Long Driven Member
40	10CF-CI
60, 80, 90	11CF-CI

See article on Long Model 'CF' clutches for complete data on these driven members.

1938 Models. Long Model 10-CF-CS driven member used on Model 40 (see Long 10-CF article for data). On Models 60, 80, 90 driven member is new Borg & Beck type balanced by weights installed on disc. Parts not furnished separately for this driven member.

1939 Models. Driven Member is new Borglite type. See Borg & Beck Clutch article for complete data on this type driven member. NOTE—This new type driven member may be installed on 1938 cars if the release levers are set for the new 2" height (J-1036 gauge).

BUICK 40 (OWN MAKE) 1939 TYPE

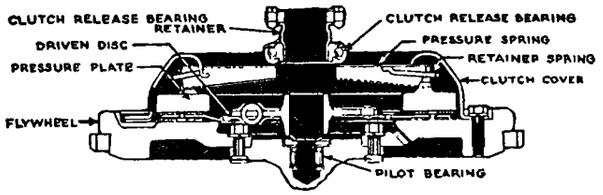
Used On:

MODEL 39-40 (1939)

TYPE:—Single plate, dry disc type of entirely new design with corrugated spring disc which replaces both pressure springs and release levers used on former clutch. Corrugations on disc engage ears on inner rim of clutch cover and lugs on pressure plate. Disc pivots on cover plate ears when it is flexed to release clutch, relieving pressure on pressure plate which is then pulled away from driven member by hairpin type retainer springs which pass through holes in pressure plate lugs and are hooked over cover ears.

SERVICING:—Mark pressure plate, spring disc and cover before disassembling clutch to insure reassembling in same positions (do not prick-punch spring disc, use paint or chalk for marking).

Disassembly. Use special tools J-1039-1 and J-1039-2 to unhook retainer springs from clutch cover ears working springs slightly toward center to permit tool engagement (do not hammer on tool which will distort cover), lift clutch cover off. Unhook retainer springs from spring disc by working one leg of each spring in through pressure plate lug toward center of clutch and other leg out, lift off spring disc, remove retainer springs from pressure plate lugs.



Assembly. Install retainer springs in pressure plate lugs with curved legs of springs up toward spring disc (push one leg of each spring in toward center of clutch and other leg out, lift off spring that it is just entered in hole in lug). Apply 'Lubriplate' lightly on spring disc at points where it contacts pressure plate and retainer springs (excess will ruin clutch facings), place spring disc on pressure plate, maneuver retainer spring loops over disc by turning springs so that they are properly aligned. Install cover, use special tools to engage retainer spring loops on cover ears. Make certain that marks on pressure plate, spring disc, and cover are lined up. This completes clutch assembly (no release lever adjustment, etc. required).

DRIVEN MEMBER:—New Borg & Beck 'Borglite' type with spiral grooved facings. Parts not furnished separately. Driven member assembly lighter than 1938 type and requires .005" additional release clearance. New type driven disc has nine separate cushion spring segments (to which facings are riveted) mounted individually on disc rim by two rivets each (center hole rivet found on some segments is balance weight).

Driven Member Installation on 1938 Cars. May be installed on 1938 Model 40 (without self-shifting transmission) provided that release levers are set higher than usual to secure additional release clearance (use J-285 gauge without adapter). **Do not install this type Driven Member on 1938 Model 40 cars with Self-shifting Transmission.**

BUICK—CADILLAC (OWN MAKE) DOUBLE PLATE TYPE

Used On:

BUICK MODELS

80, 90 (1932-33), 90 (1934-35).

CADILLAC MODELS

V8, 355-B ('32), 355-C ('33), 355-D ('34-35).

V12, 370-B ('32), 370-C ('33), 370-D ('34-35).

V16, 452-B ('32), 452-C ('33), 452-D ('34-35).

V16, SERIES 90 (1936). SERIES 37-90 (1937)

LA SALLE MODELS

V8, 345-B (1932), 345-C (1933).

DESCRIPTION:—Double plate, dry disc type. Three driving plates mounted as an assembly (center plate bolted on flywheel rim by 4 studs and nuts, front and rear plates mounted on 4 pins which are press-fit in center plate and free sliding fit on others). Driven member consists of two driven discs mounted on opposite ends of clutch hub so that each disc clamped between two pressure plates when engaged. Twelve pressure springs (mounted in 4 groups of 3 on rear driving plate) under spring pressure plate which is mounted on eight studs (one at each side of each release lever) extending through center driving plate to forward driving plate with nuts on front face of front plate. Release levers are single type (all Buick models, Cadillac 355-D, 370-D) or double type (all other Cadillac, La Salle models) and actuate clutch as follows:

Single Type Release Lever—Mounted on yoke bolt in spring pressure plate with outer end engaging bracket on rear driving plate. Pivots on lug which contacts driving pin in center driving plate so that rear driving plate drawn backward and front plate pushed forward (through spring pressure plate mounting studs) when clutch disengaged.

Double Type—Double type lever consists of short outer lever pivoted on yoke on rear end of driving plate pin (yoke bolt extends through pin with nut on forward end) and actuating spring pressure plate through yoke bolt extending through plate (forward motion of spring plate when clutch disengaged transmitted to front driving plate by stud at each side of each release lever) and an inner long lever which actuates rear pressure plate (lever contacts bracket bolted on plate). The two levers are pinned together at a point near the throw-out bearing end.

SERVICING:—No adjustment for wear required. On Cadillac models, condition of plates can be checked by measuring from spring pressure plate ridge to tip of release levers. Replace driven discs if less than 1 15/32" (355-D, 370-D), 1 13/32" (452-D, 90).

Driven Discs (Buick):—New facings can be installed. See car model page for specifications. Discs with new facings should be balanced within ¼ inch ounce by grinding at outer edge.

Driven Discs (Cadillac):—Manufacturer recommends that new driven discs be installed in matched pairs. Other parts not furnished separately. Driven discs thickness (with facings) and worn limit (when discs should be replaced) as follows:

Model	Thickness (new)	Worn Limit
355-D	.295"	.220"
370-D	.285"	.210"
452-D, 90	.335"	.260"

INSTALLING NEW DRIVEN DISCS:—Clutch Removal—Take off 4 nuts mounting center driving plate on flywheel rim (these nuts accessible through holes in rim of rear driving plate). Remove entire unit.

Dismantling Clutch (all models):—Place clutch assembly in arbor press, compress spring pressure plate slightly, take off nuts on spring pressure plate studs on front driving plate, release spring tension. Lift off front driving plate. Take off nuts on release lever pivot bolts at forward end of center plate driving pins (double release lever types only). Lift off rear driving plate. Take off 6 nuts on driven member hub bolts (on Buick models take out bolts carefully so that spring hub assembly does not come apart),

Assembling Driven Member:—Assemble discs on center driving plate entering hub bolts from flywheel side (Cadillac) or transmission side (Buick). Check clearance by supporting assembly on blocks on bench placing blocks under lower driven disc so that all clearance is between plate and upper disc. Clearance should be .030" and must be within .020-.045" (Buick), .025-.040" (Cadillac). Correct by installing spring washer, Cadillac Part No. 873860 (.010" thick) between disc and clutch hub. If more than one disc used, total should be divided between both discs and hub. On Buick models, if clearance not uniform around disc, install special shims .003" thick on hub bolts between disc and hub at low points. Lock hub bolts by punching nut down on bolt flat.

Assembling and Installing Clutch:—Clearance between driving pin and driving plates should be .001-.0025" (new) and must not exceed .008" (worn limit). Center plate driving pin heights at release lever end must be alike within .0005". Replace center driving plate if outside this limit. Install driven member with bevel on hub to rear (Buick models). On Cadillac V-12 models with curved disc spokes, spokes must lead out from hub in clockwise direction viewed from flywheel side. Balance marks on Cadillac driving plates (circle which may have letter inside) must be lined up on all plates.

Release Lever Adjustment (Buick Models):—Tighten all release lever yoke nuts until clearance between lever lug and top of driving pin is .001" (measure by inserting feeler gauge under lever bracket). Install release bearing on levers, use dial gauge to check runout. Must be less than .005". Correct by grinding off release lever clip slightly (lever ratio is 5:1 and .001" ground off clip will change lever height .005").

Cadillac Models—Manufacturer recommends that release lever yoke nuts not be disturbed when clutch dismantled.

CHEVROLET (OWN MAKE)

Used On:

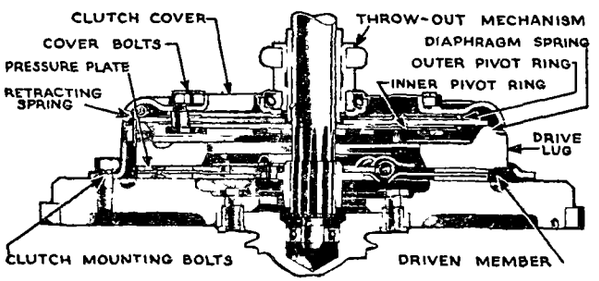
MASTER DELUXE, HA (1938), JA (1939)
MASTER, HB (1938), '85' JB (1939)
HALF-TON, HC (1938), JC (1939)
¾ TON, HD ('38), JD, SPECIAL JE ('39)
ONE TON, MODEL HE (1938)
1½ TON, T (1938), VA TO VH (1939)

IMPORTANT 1939 SERVICE NOTE:—On all 1939 clutches, Clutch Cover, Diaphragm Spring, and Pivot Rings are a permanent assembly (rivets used instead of bolts) and cannot be disassembled and serviced as separate parts. Disassembly directions given below apply only to 1938 type.

CLUTCH TYPES:—Two sizes used—9" on Passenger Cars and Half Ton, 11" on all other trucks. Both types are same design and serviced in same manner but must not be interchanged.

DESCRIPTION:—Single plate, dry disc type of entirely new design with diaphragm spring which serves as clutch spring and release levers. Diaphragm spring is shaped like dished washer with inner rim slotted to form 18 release fingers and is pivoted on inner and outer pivot rings mounted on 9 bolts in clutch cover. When clutch engaged, diaphragm spring pivots on outer pivot ring and exerts pressure on pressure plate rim. When diaphragm spring fingers are depressed to disengage clutch, spring pivots on inner pivot ring and this dishing action causes outer rim to move out, relieving pressure on plate and pulling plate away from driven member (pressure plate linked to diaphragm spring by three small retracting springs bolted to pressure plate rim). Pressure plate drive taken through three lugs on rim which engage slots in cover. Throw-out bearing is a sealed ball bearing (permanently lubricated) and throw-out mechanism is positively actuated by release fork so that no pull-back spring required.

SERVICING:—Manufacturer recommends use of Clutch Pilot Tool K-411, to support clutch during disassembly, and Clutch Assembling Fixture J-1113, to compress diaphragm spring when disassembling and assembling pressure plate and cover assembly.



Retracting Spring Replacement. Does not require dismantling clutch. Remove clutch housing underpan, crank engine over until retracting spring bolt appears in lower opening, remove bolt, withdraw retracting spring, install new spring in same manner. Replace other retracting springs (3 used) in same manner.

Clutch Fork Removal. Can be removed without disturbing transmission. Remove flywheel underpan, disconnect clutch fork from pedal, use ⅞" and ¾" wrench to remove fork mounting, withdraw fork, remove ball retainer spring, ball retainer, ball. Pack ball seat in fork with high-melting point grease. NOTE—Install ball retainer spring with upturned ends down in ball retainer opening (will not seat in machined groove in fork if incorrectly installed).

Disassembly:—Take out screws and remove three retracting springs through slots in cover (screws accessible through holes in side of cover), make certain that one pressure plate lug and cover marked to insure correct reassembly, remove pressure plate. Place assembly on Clutch Fixture J-1113 (make certain that pivot bolt heads seat in recesses in fixture), compress diaphragm spring until all pressure relieved from bolts. Remove nuts and lockwashers on nine cover bolts, tap cover lightly to free it and lift off, remove outer pivot ring and special washers on bolts, release diaphragm spring tension slowly, lift off diaphragm spring, second set of special washers and inner pivot ring.

Servicing:—Wash all parts except throw-out bearing in gasoline (see Caution below), examine pressure plate and flywheel face for scored or rough surface, check pressure plate drive lugs for burrs, see that lugs move freely in cover slots and that clearance in slots is .004-.010" (replace pressure plate or cover if clearance exceeds .010"). Check diaphragm spring and pivot rings for distortion or cracks. See that throw-out bearing is not rough and moves freely on clutch shaft sleeves, check transmission pilot hole in housing for runout (must be less than .008"). Check clutch fork ball seat and ball fit, check driven disc and clutch shaft splines (replace disc if splines worn).
CAUTION—Throw-out bearing permanently lubricated and must not be soaked in gasoline which may dissolve lubricant on balls.

Assembly:—Reverse disassembly directions. Coat special washers with graphite grease before installing. Make certain that lugs on pivot rings engage bolts (three pairs of lugs on each ring which must be placed at three of the bolts to prevent ring rotating). Install diaphragm spring with convex side up and compress spring so that it is flat while tightening bolt nuts on cover. Line up marks on pressure plate lug and cover when installing plate in cover assembly. See that cover plate nuts and retracting spring screws are tightened securely.

DRIVEN MEMBER:—Rivets must be drilled out from head side to remove old facings (driving out rivets will distort clutch disc). When riveting new facings, use special rivets, reverse rivets in pairs (install two each way). Special riveting fixture recommended and should be set to flatten rivets exactly 7/32".

INSTALLATION:—Remove and repack clutch bearing before installing clutch (see instructions below). Line up 'x' marks on flywheel and clutch cover, install cover bolts and tighten all bolts evenly, one turn at a time, to prevent distorting cover. Pack recess within clutch throw-out collar with high melting point lubricant and coat throw-out fork groove with lubricant before installing throw-out assembly. Make certain that throw-out fork ball is snug fit in fork without endplay (install new ball if scored or worn), pack seat with high melting point grease, make certain that upturned ends of ball seat retainer spring point down in ball retainer opening (retainer will not seat in groove in fork if spring installed incorrectly), install fork and tighten ball retainer securely.

Clutch Pilot Bearing—Special oil seal type. Use puller to remove bearing, clean and repack bearing with high temperature grease, use special driver (with centering collar which engages pilot hole) to install bearing to insure alignment with transmission mounting pilot hole.

TROUBLE SHOOTING:—To correct clutch rattles at idling speed with clutch released, replace retracting springs, check clearance between drive lugs on pressure plate and slots in cover (if clearance exceeds .010", replace pressure plate or cover), check throw-out fork for loose fulcrum ball. See Retracting Spring and Clutch Fork data under Servicing above.

CHEVROLET & PONTIAC (OWN MAKES)

Used On:

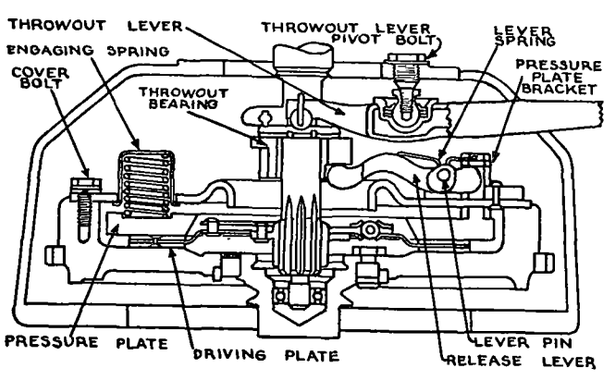
CHEVROLET MODELS

STANDARD, CC ('33), DC ('34), EC ('35), FC ('36).
MASTER, CA ('33), DA('34), EA,ED('35), FA,FD('36)
COMMERCIAL, CB('33), DB('34), EB('35), FB('36).
TRUCK, (1½ TON), O('33), P('34), Q('35), R('36).
MASTER DELUXE GA, MASTER GB (1937)
HALF TON TRUCK GC (1937)
TON AND A HALF TRUCK SA, SB, SC, SD (1937)

PONTIAC MODELS

EIGHT, MODEL 601 (1933). MODEL 603 (1934).

DESCRIPTION:—Single plate, dry disc type. Clutch assembled in flywheel recess with flat cover bolted to flywheel rim by 3 bolts at each release lever. Three release levers pivoted on cover plate actuate pressure plate by engaging brackets bolted on pressure plate bosses extending through holes in cover.



NOTE—On 1933 clutch, release levers mounted beneath cover plate (instead of on top) and pressure plate lever brackets do not extend through cover. Cover is cutaway at brackets so that lever plates can be installed from top as on later models. Pressure plate drive taken by three guide pins in flywheel rim which must engage slots in pressure plate when installed.

CHEVROLET-PONTIAC TYPE CONT.

SERVICING:—Mark all parts before disassembling clutch, replace in same position to maintain balance. Servicing directions below apply to pressure plate assembly when dismantled for inspection or overhaul.

Dismantling:—Take out six capscrews mounting lever plates on pressure plate bosses, turning all screws out evenly to relieve pressure spring tension. Lift off cover and lever assembly. This will expose all parts for inspection. To remove levers, take off lever springs, pull out lever pivot pins, lift levers out.

Clutch Springs:—Replace weak or burned springs. Special colored springs assembled in center of each spring group on Standard models. All center springs must be same color on this model.

Model	Pressure	Length
Chevrolet CA, CB, O ('33)	140-150 lbs.	1⅜"
Chevrolet CC ('33), DC ('34)	70- 80 lbs.	1 13/16"
Chevrolet (all others)	90-100 lbs.	1 13/16"
Pontiac '33-34	140-150 lbs.	1⅜"
Pontiac '34 (#993377 Up)	90-100 lbs.	1 13/16"

Release Lever Assembly:—Install levers in place in cover plate brackets, insert lever pivot pins. Install hairpin shaped lever spring with loop on lever, engage spring eyes in lever pin grooves (push pin through and loop spring under pin, repeat at opposite end).

Assembling:—Place pressure plate on arbor press, assemble nine pressure springs on plate (see Springs above), place spring cups on springs, place cover plate in position guiding spring cups through holes in plate and pressure plate bosses through holes in lever brackets. Compress cover slightly, place lever plates over levers and start plate screws in pressure plate bosses. Turn all screws up evenly.

Release Lever Adjustment:—After clutch assembled to flywheel with driven member in place (use pilot shaft to center plate), mount dial indicator on clutch housing and check lever and bearing plate runout. If runout exceeds .020", install shims under lever plate of high lever, using shim of equal thickness at mounting screw at each end of plate.

DRIVEN MEMBER:—On Chevrolet, different type facings used on 1933 Standard and Master. Driven members on these models should not be interchanged (both 9"). Driven member on 1½ ton truck is larger (10") and should not be interchanged with passenger car types.

To Remove Facings:—Drill out old rivets from head side. Do not punch out rivets or plate will be distorted.

To Install Facings:—Rivets must be reversed in pairs (install two each way). Use special rivets furnished by manufacturer.

HUDSON (OWN MAKE)

Used On:

HUDSON '112', MODEL 89 (1938)
HUDSON '112', MODEL 90 (1939)
HUDSON BUSINESS CARS, 90, 98 (1939)
HUDSON SIX, MODELS GH ('35), 63 ('36), 73 ('37)
HUDSON SIX, MODEL 83 (1938)
HUDSON SIX, MODELS 91, 92, 93 (1939)
HUDSON EIGHT, MODELS LL, LT, LTS (1934)
HUDSON EIGHT, MODELS HT, HH, HHU (1935)
HUDSON EIGHT, MODELS 64, 65, 66, 67 (1936)
HUDSON EIGHT, MODELS 74, 75, 76, 77 (1937).
HUDSON EIGHT, MODELS 84, 85, 87 (1938)
HUDSON EIGHT, MODELS 95, 97 (1939)
TERRAPLANE, MODELS K, KS, KU (1934)
TERRAPLANE, MODELS G, GU (1935), 61, 62 (1936)
TERRAPLANE, MODELS 70, 71, 72 (1937).
TERRAPLANE, MODELS 80, 81, 82, 88 (1938)

DESCRIPTION:—Single plate, cork insert type, operating in oil. Mounted on flywheel face by 16 capscrews in cover flange. Gasket used under cover flange to secure oil-tight joint and oil seal mounted on throwout collar to retain clutch lubricant. Clutch actuated by 3 clutch fingers pivoted on retainers bolted to cover and linked to pressure plate by pins at outer end.

SERVICING:—Clutch assembly need not be dismantled when replacing driven member unless springs are to be tested or replaced, pressure plate replaced, or other service work performed.

Dismantling:—Check punch marks near outer edge of pressure plate in line with mark on cover flange or make new marks to insure reassembly in same position. Place clutch assembly on special clutch fixture (#J-298-H) or in arbor press supporting pressure plate so that cover is free. Compress cover slightly, take off 3 nuts on clutch finger retainer bolts on cover, release pressure slowly, lift cover off.

Pressure Plate:—Examine plate, replace if scored. Check for warping (particularly if plate 'blued' due to overheating). Replace if warped more than .010".

Clutch Springs:—Twelve springs on Hudson models, nine large springs and six inner springs on Terraplanes. Replace springs if pressure plate 'blued' indicating overheating. Check springs and replace if pressure less than service limit shown below.

	Pressure (new)	Service Limit	Length
Large Springs	120 lbs.	110 lbs.	1⅝"
Small (inner)	75 lbs.	60 lbs.	1⅝"

1938 Clutch Springs. Two different types of main springs (#45148, #45149) and one type of inner spring (#155224) used in various combinations on different car models as follows:

Car Model	Inner Spr. No.	Inner Spr. Type	Main Spr. No.	Main Spr. Type
80 Utility Coach & Coupe	6	155224	9	45148
80 Cab Pick-up, Panel Delivery, Station Wagon			9	45149
81	6	155224	9	45148
82, 88			9	45149
83, 84, 85, 87	3	155224	9	45149
89 (112)	3	155224	9	45148

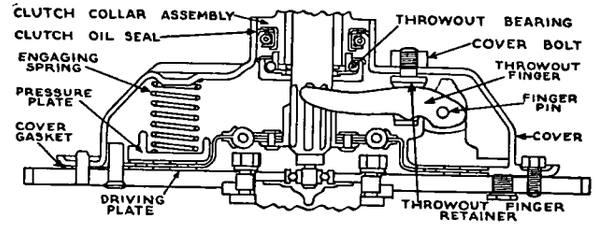
Spring No.	Pressure
45148	170 lbs.
45149	185 lbs.
155224	140 lbs.

1939 Springs. Combinations of outer (main) and inner (auxiliary) springs used on various models as follows:

Model	Inner Spring	Outer Spring
90 '112'	3	9
91, 92	6	9
93, 95, 97	3	12
98 (except Sedan)	3	12
98 Sedan	3	9

Spring Specifications

	Pressure	Length
Outer—90, 91, 92, 98 Sedan	170 lbs.	1¾"
Outer—93, 95, 97, 98 others	150 lbs.	1⅝"
Inner—All models	80 lbs.	1⅝"



Assembling:—Check clutch throw-out fingers, see that they are straight and do not show wear at tip or retainer lug. Replace retainer washers if necessary. Place pressure plate on fixture with face down. Assemble springs, clutch fingers, retainers and retainer washers on plate. Place cover on top of pressure plate assembly (lining up marks on cover and plate), compress cover slowly, guiding retainer bolts through holes in cover, install nuts on retainer bolts, tighten securely. Check clutch finger heights after clutch installed on flywheel.

INSTALLATION & ADJUSTMENT:—Shellac new gasket on face of cover flange, see that flywheel face smooth and clean, use clutch aligning arbor (#J-384) inserted through clutch cover and driven plate to align driven plate, mount clutch assembly on

HUDSON (OWN MAKE) CONT.

flywheel (engaging two locating dowel pins on flywheel), install 16 cover screws, tighten screws evenly and securely (draw down screws diametrically opposite together to avoid distorting cover). Then align clutch fingers.

Clutch Finger Alignment:—Use special clutch finger adjusting gauge (#J-774) resting gauge on clutch cover so that pin is directly above clutch finger tip. Turn thumbscrew down until pin contacts finger. Repeat at other clutch fingers to secure final gauge setting equal to lowest finger. Turn gauge to higher finger, strike end of retainer bolt with soft hammer until gauge bar rests squarely on cover hub. With final setting, gauge bar should rest squarely on hub over all fingers and clearance between pin and end of thumbscrew must be less than .005" (all fingers equal within this amount—check with feeler gauge).

Throw-out Bearing & Oil Seal:—Insert 1/3 pint Hudsonite through clutch hub before installing throw-out collar assembly. Oil seal is pressed on collar behind throw-out bearing. When installing new oil seal, press firmly near inner diameter (pressure at point near rim may distort outer stamping and allow inner stamping and oil seal leather to revolve with shaft, this will cause noise similar to noisy throw-out bearing). Use arbor press to install throw-out bearing (do not drive on). See that bearing revolves smoothly and that oil seal inner stamping is tight in outer stamping before installing collar in clutch cover.

DRIVEN PLATE:—Driven plate has spring-dampener type hub and facing consisting of cork inserts. Examine driven member, see that plate runs true and is not warped or distorted, and that springs in hub do not have appreciable free play. See that hub splines are not worn and are free from burrs. Corks must be in good condition. Black glaze indicates use of wrong lubricant. Soak driven plate in Hudsonite and clean corks, or replace driven member.

1938-39 **Driven Plate.** Heavier damper springs used on driven disc hub and disc is cupped. Two types of discs (with different number of cork inserts) used as follows:

Car Model	No. of Cork Inserts
80, 88 Sedan, Utility Coach & Coupe	90
Terraplane 81, Hudson '112' 89	90
Terraplane 82, Hudson 83, 84, 85, 87	108
Hudson '112', 90, 98 Sedan	90
Hudson 91, 92	90
Hudson 98 Bus. Cars (except Sedan)	108
Hudson 93, 95, 97	108

PONTIAC (OWN MAKE)

Used On:

SIX, MODELS 701A, B (1935), 36-26A, B (1936).
EIGHT, MODELS 605 (1935), 36-28 (1936).
SIX, MODEL 37-26CA (1937)
EIGHT, MODEL 37-28CA (1937)
SIX, MODEL 38-26DA (1938)
EIGHT, MODEL 38-28DA (1938)

NOTE:—Driven member on these models is Long Model 10CF-CI (1935-36), 10CF-CS (1937-38). See article on Long Model 'CF" clutches for driven plate data.

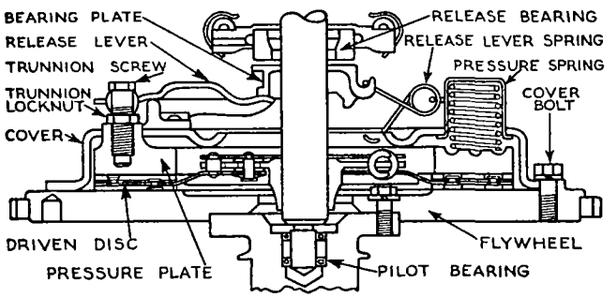
DESCRIPTION:—Single plate, dry disc type. Clutch mounted in recess in flywheel with cover bolted to flywheel rim. Clutch actuated by 3 release levers pivoted on lug or ridge on cover and linked to pressure plate by adjustable trunion screws (release lever height adjustment).

SERVICING:—Pressure plate assembly need not be dismantled when replacing driven member unless pressure springs are to be tested or replaced or other service work performed.

Dismantling:—Place pressure plate in arbor press, compress cover (not levers) slightly, unhook release lever springs, lift off bearing plate, loosen locknut, unscrew release lever trunion screw, lift off levers, release cover pressure slowly, lift off cover.

Clutch Springs:—Check springs and replace weak or burned. Spring pressure should be 145-150 lbs. compressed to 1 9/16".

Assembling:—With pressure plate on arbor press, place nine pressure springs in spring seats on plate, see that spring cups in place on cover, put cover on springs, compress cover slightly. Insert trunion screws in holes in ends of lever, thread locknut on screw, position levers on cover, turn screw into screw holes in pressure plate, turning all screws down evenly (do not tighten locknut) place release



lever plate on levers, engage center loop of release lever springs on lever plate lugs, hook free ends of springs in holes in rim of cover plate.
NOTE—Release lever springs are double coil type. Coils are held together by tie wire. Measurement along tie wire from outside of spring coils should be 1 13/16".

Release Lever Adjustment:—Use gauge plate J-285B and adapter, assembling gauge plate on flywheel in place of driven member with gauge plate centered so that adapter does not contact bearing plate and turned so that lugs are under release levers (in mounting clutch in flywheel, turn all cover screws down to avoid distorting cover). Loosen release lever trunion screw locknut, turn trunion screw until clearance between adapter lug and bearing plate is exactly .009-.011" ('35-36), .040" ('37-38). Hold adapter down while checking clearance with feeler gauge. Tighten locknut and recheck clearances (must be uniform for all levers).

MODELS 8A7; 9A6, 7; 10A6, 7; 11A6

Assembly Number — Used On:

MODEL 8A7

925—STUDEBAKER CHAMPION, MODEL 2G (1940)

MODEL 9A6

932—NASH-LAFAYETTE, 4010 (1940) FIRST CARS

MODEL 9A7

937—NASH-LAFAYETTE, 4010 (1940) 2ND. TYPE
951—NASH-LAFAYETTE, 4010 (1940) LATER CARS
924—OLDSMOBILE 6, '60' F-40, '70' G-40 (1940)
926—PLYMOUTH, MODELS P9, P10 (1940)
943—STUDEBAKER COMMANDER, MODEL 10A (1940)

MODEL 10A6

939—CHRYSLER, C26, C27 ('40) WITH FLUID DRIVE

MODEL 10A7

940—CHRYSLER, C25 ROYAL & WINDSOR (1940)
938—DE SOTO, S7 CUSTOM & DELUXE (1940)
928—DODGE, D14 DELUXE, D17 SPECIAL (1940)
938—DODGE, D14, D17 (1940) LATER CARS
898—HUPMOBILE, SKYLARK MODEL (1940)
934—NASH 6, MODEL 4020 (1940) FIRST CARS
950—NASH 6, MODEL 4020 (1940) LATER CARS
919—NASH 8, MODEL 4080 (1940) FIRST CARS
949—NASH 8, MODEL 4080 (1940) LATER CARS
927—OLDSMOBILE 8, '90' L-40 (1940) SEE NOTE
948—PACKARD 6, '110' MODEL 1800 (1940)
922—PACKARD 8, '120' MODEL 1801 (1940)

MODEL 11A6

945—CADILLAC V8, 60S,62,72,75 (1940) EARLY CARS
941—CHRYSLER 8, C26 ('40) WITHOUT FLUID DRIVE
CHRYSLER 6, TAXICAB MODEL (1940)
931—DE SOTO, DODGE, PLYMOUTH TAXICABS ('40)
946—LA SALLE V8, 40-50,52 (1940) EARLY CARS
944—PACKARD SUPER 8, 1803,4,5,6,7,8 (1940)

These Clutches same design as used on corresponding 1939 car models except as noted below.

NOTE:—Assembly Number—This number stamped on each clutch cover and may be used to identify each installation.

Borg & Beck Driven Members—Used with clutches of other makes on the following car models: Buick 40, 50 (part production only, other cars have Long 'CF' type); Buick 60, 70, 80, 90; and Willys (Cars & Commercial models). Buick driven members are Borglite type. See driven member data below.

PRODUCTION CHANGE NOTES:—Cadillac, LaSalle Models—These clutches used on first cars only. See Long 'CF' Clutch for later cars.

Nash & Nash-Lafayette—First type (1939 equipment) used on cars before December 15th. (4010, 4020), February 1st. (4080). Later type clutch with Borglite driven member used after these dates.

Oldsmobile 6 & 8—These clutches used only on cars with conventional transmission. No clutch used on cars with Hydra-matic Drive which has a Fluid Coupling.

Packard Models—These clutches used on first cars only. See Long 'CF' and 'CFS' Clutches for type used on later cars.

Studebaker Champion—*Driven member with grooved facings used on this model (used also on 1939 cars after Engine No. 17804).*

DESCRIPTION:—Same design as used on 1939 car models except as follows:

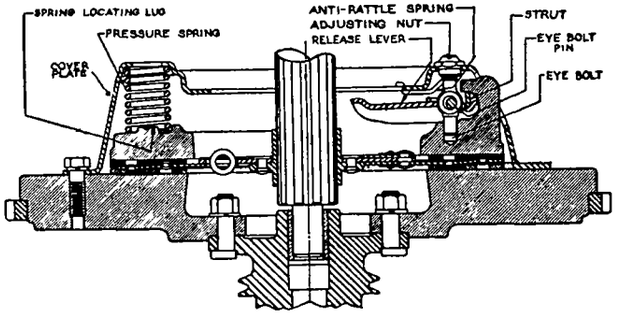
Chrysler C25, C26 (Without Fluid Drive), De Soto, Dodge, Plymouth & Taxicab Models—These clutches have Pressure Plate Baffle, and Borglite Driven Members. Baffle plate installation directions and special release lever settings given below. NOTE—Plymouth clutch is new type and release lever settings are not same as 1939.

Chrysler C26, C27 (With Fluid Drive)—Driven member has solid hub (no spring dampener) and has oil deflector discs on plate at inner rim of facings (baffle has inner rim cupped in deflector).

Nash & Nash-Lafayette—Later type clutches (see Production Change Note above) have Borglite driven members and require special release lever settings. Pressure plate baffle used on Nash clutches only.

Oldsmobile—These clutches same as 1939 types and have Pressure Plate Baffle, Borglite Driven Member, and special 'duck-bill' type release levers (lever ends flattened so that no release bearing plate required). Baffle plate installation directions and release lever settings are given below.

Studebaker Models—New type Driven Member used on Champion (see Production Change Note above). Commander clutch is new type and has Borglite driven member. This clutch requires special lever setting as given below.



SERVICING:—All service operations same as for previous Borg & Beck clutch models except as noted below.

See Borg & Beck clutch article in Mechanical Equipment Section of manual for complete data and note following new data:

Baffle Plate Installation (9A7, 10A7 Clutches):—Install baffle plate on pressure plate with baffle plate ears on special low spring seat ribs (adjacent to release lever lug on plate in counter-clockwise direction) so that flanged edge of baffle fits depressions in pressure plate at base of each lug and baffle is retained by springs when installed (spring seat on baffle plate ears). See that baffle plate ears are flat on spring seat ribs and that baffle seats fully in machined recess in plate (straighten baffle ears if bent by handling).

Model 11A6 Clutch—Install baffle in same manner as above except that baffle ears must be seated on spring seats adjacent to lugs in **clockwise** direction.

Release Lever Adjustment (On Borg-Warner Universal Clutch Fixture UF-300):—Except when rebuilding clutches, lever adjustment should not be changed unless levers are out of parallel more than .030". Place clutch on fixture with special lands under pressure plate lever lugs (all models with 3 levers, on models with 4 levers space lands equally). Set adjusting arm on sleeve so that height of lower face of arm above bottom of sleeve is correct for each model (see table below), install indicating plate on levers (except as noted), adjust each lever so that it just contacts indicating plate or adjusting arm, lock lever adjustment by peening nut into slot of adjusting screw (on 8A7 and 9A7, peen nut against two flats on screw).

Lever Settings

Clutch Model & No.	Lever Height
8A7—925	2⅛"
9A6—932	2 5/16"
9A7—924	See Note
9A7—926, 937, 943, 951	2 3/16"
10A6—939	2 3/16"
10A7—898, 922, 948	2 5/16"
10A7—919, 934	2⅜"
10A7—927	See Note
10A7—928, 938, 940, 949, 950	2 5/32"
11A6—931, 941	2¼"
11A6—944, 945, 946	2½"

9A7, 10A7 Note—These models have 'duck-bill' type release levers and must be adjusted in special manner (longer length of levers makes it impossible to install height sleeve on fixture). With clutch installed on fixture, place special extension sleeve '3Z' on spindle (this sleeve correct height for lever adjustment), place indicating plate on levers with counterbored side up. Set adjusting arm flush with bottom of calibrated adjusting sleeve, install sleeve on spindle and adjust release levers in usual manner.

Release Lever Adjustment (Chrysler, De Soto, Dodge, Plymouth Models—Using Chrysler Clutch Fixture) These models have baffle plate and Borglite driven members and require same C-411-37A gauge set used on 1939 cars ('Y' shaped extension gauge and double ended 'C' and 'D' feeler gauge). Install 'Y' extension gauge directly over release lever, tighten extension gauge locknut. Use 'D' end of feeler gauge (Chrysler C25, C26 with Fluid Drive, C27, De Soto, Dodge, Plymouth), 'C' end of feeler gauge (Chrysler C26 without Fluid Drive, and all Chrysler, De Soto, Dodge, Plymouth Taxicabs). Turn release lever adjusting screw nut until feeler gauge is just snug between lever tip and extension gauge, lock adjusting screw nut by peening nut into adjusting screw slot. Check levers for uniform setting after completing adjustment.

Release Lever Adjustment (Without Fixture)—Types with Borglite Driven Member:—Use special gauge plate, Borg-Warner #4234 (see note on car manufacturer's gauge nos. below), and install clutch on flywheel with gauge plate in place of regular driven member with machined lugs on gauge directly under release levers on 3 lever types (on 4 lever types, place lugs in any position). Use short straightedge placed on edge on gauge plate hub and adjust release lever adjusting screw nuts until levers just contact edge of straightedge for all models marked 'flush' in table below (if lever setting marked 'high', a cut-out or step must be made in the edge of the straightedge at one end so that levers can be set higher than hub; if lever setting marked 'low', recess or step should be cut in straightedge at gauge hub so that end of straightedge extends below hub), lock adjustment by peening nut into screw slot or against flat on screw.

Lever Settings

Clutch Model	Lever Height
8A7 (not Borglite)	⅛" Low
9A7 (except Oldsmobile)	1/16" Low
9A7 (Oldsmobile)	Flush
10A6, 10A7	Flush
11A6	1/16" High

Gauge Part No. Note—Gauge plates furnished by car manufacturers as follows: Nash—No. SE-505, Oldsmobile—No. J-1048, Studebaker—No. J-1307.

Release Lever Adjustment (Without Fixture)—Types with standard driven member (not Borglite):—The

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#4234 gauge plate can be used on these models and levers should be set ⅛" lower than gauge hub (8A7), 3/16" higher than gauge hub (9A6, 9A7, 10A7 models with pressure plate baffle), ¼" higher than gauge hub (11A6 model with pressure plate baffle). On models without baffle (except 8A7), use regular #3525 gauge plate and set levers flush with top of gauge hub.

CAUTION—This #3525 gauge plate should not be used on clutches with Borglite driven member or on Model 8A7.

Clutch Springs:—Spring type and pressure should agree with table below. NOTE—Number shown thus (8) indicates number of each type of spring used when several types used together.

Car Model	Spring Part No.
Cadillac V8	3814 (6) & 3951 (6)
Chrysler C25	4039 (9)
Chrysler C25 Taxicab	3951 (6) & 3814 (6)
Chrysler C26 (11A6)	3951 (6) & 3814 (6)
Chrysler C26, C27 (10A6)	4039 (12)
De Soto S7	3951 (9)
DeSoto Taxicab	3817 (4) & 3814 (8)
Dodge D14, D17 (928)	3951 (6) & 3814 (3)
Dodge D14, D17 (938)	3951 (9)
Dodge Taxicab	3817 (4) & 3814 (8)
Hupmobile	3814 (9)
LaSalle	3814 (12)
Nash-Lafayette (9A6)	3951 (9)
Nash-Lafayette (9A7-937)	4308 (9)
Nash-Lafayette (9A7-951)	4190 (9)
Nash 6 & 8 (First)	3951 (9)
Nash 6 & 8 (Later)	4039 (9)
Oldsmobile 6	4190 (9)
Oldsmobile 8	4214 (9)
Packard 6	4039 (9)
Packard 8	4039 (9)
Packard Super 8	4214 (12)
Plymouth P9, P10	4308 (9)
Plymouth Taxicab	3817 (4) & 3814 (8)
Studebaker Champ. 2G	4211 (6)
Studebaker Comm. 10A	4331 (9)

Spring Specifications

Part No.	Pressure (at 1 11/16")	Color
3814	130 lbs.	Purple
3817	105 lbs.	Green
3951	150 lbs.	No Color
4039	160 lbs.	Light Blue
4190	155 lbs.①	Tan
4211	165 lbs.①	Orange
4214	170 lbs.	Light Green
4308	145 lbs.①	Lavender
4331	135 lbs.①	Yellow

①—Spring length 1½".

Driven Member (Borglite Type):—New type composite plate consisting of a small diameter disc with separate clock-spring type cushion segments (to which facings are riveted) riveted to outer rim. Segments are dished to provide soft engagement. This type of construction results in less weight at rim of driven member (which reduces spinning and allows quiet, fast gear shifting) without loss of strength in plate. Plate is balanced by additional rivets placed at rim of disc. Facings are riveted individually on cushion segments by one or two rivets in each segment. **Manufacturer recommends that driven member not be relined and that replacement driven member (with new facings installed) be used.**

Driven Member (Other Types)—Same as used on previous models with separate cushioning springs or spring tabs on plate. See Borg & Beck Clutch article in manual for data on these types.

ATWOOD TYPE

Model TP 28-7

WILLYS, 440 SPEEDWAY & DELUXE PASS. CARS (1940)

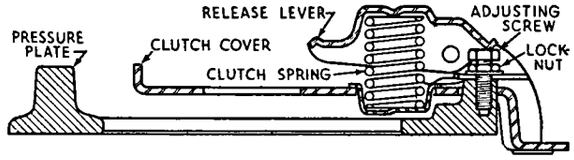
NOTE:—Pick-up & Panel Delivery Models. These models equipped with Rockford Clutch. See separate article for data on this type.

TYPE:—New design, single plate, dry disc type. Clutch cover consists of a three-legged spider with channel section legs in which the clutch springs and release levers are mounted. Release levers pivot on pins riveted in cover legs and actuate pressure plate through adjustable screws in pressure plate under outer end of each lever. Springs are mounted in cups on cover under each lever. Hairpin type retracting springs are mounted on each adjusting screw and are retained by the adjusting screw locknut.

SERVICING:—Disassembly—Release lever pivot pins need not be removed for pressure plate servicing. To remove pressure plate, back off adjusting screw under outer end of each release lever until screws are free from pressure plate, remove pressure plate from beneath clutch cover spider.

Clutch Springs:—Three springs used (one spring under each release lever). Spring pressure should be 195 lbs. compressed to 1 9/16".

Release Lever Adjustment:—Lever height should be checked with special ring gauge (hardened, ground ring .310"±.010" assembled in clutch (or under



pressure plate if clutch mounted on servicing fixture) in place of regular driven member. Loosen locknut on adjusting screw under outer end of each lever, and adjust each screw so that lever height (from face of flywheel or top face of servicing fixture to upper contact point on inner end of lever) is 1 15/16"±1/64". All levers must be set exactly alike.

Reassembly:—When reassembling pressure plate, thread adjusting screws through locknut and retracting spring, and into pressure plate hole. Adjust release levers (above) before tightening locknuts.

DRIVEN MEMBER:—Borg & Beck type. See Borg & Beck Clutch article for driven member data.

INLAND MODELS

Used On:

PONTIAC SIX, 40-25, 40-26 (1940)
PONTIAC EIGHT, MODEL 40-28 (1940)
PONTIAC TORPEDO EIGHT, 40-29 (1940)
STUDEBAKER, PRESIDENT MODEL 6C (1940)

These clutches same design as used on corresponding 1939 car models (see Pontiac Note).

PRODUCTION CHANGE NOTE:—Pontiac Eight—Beginning with Engine No. 8-217982, clutch with heavier 1400 lb. clutch spring was used (first type clutch spring was 1200 lb.). This new clutch, Part No. 753615 marked 'New Style', should be installed to correct damage resulting from slipping caused by starting in second gear and gunning engine.

SPECIAL SERVICE NOTE:—Poor Release Complaints—May be caused by anti-rattle spring wearing into plate and binding at end of spring. To correct this condition, examine pressure plate and spring for indication of interference. Smooth up pressure plate to provide good bearing surface for face of spring. See that spring does not have end thrust on pressure plate lug (shorten end of spring if necessary). Lubricate spring with Lubriplate when reassembling. CAUTION—Driving lug slots must not be widened to correct poor release. Clearance in excess of .005" at either side of lug will cause clutch noise and roughness. When installing clutch, make certain that dowel in flywheel engages hole in cover (cover will be distorted and clutch out-of-balance result from installation in any other position).

SERVICING:—Same as for 1939 car models. ***See 'Inland Model' clutch article in Mechanical Equipment Section of manual (or 1939 Supplement) for complete data and note following points:***

Pontiac Anti-Rattle Spring—Consists of a flat spring installed between the pressure plate and the clutch cover in one of the cover holes adjacent to the '0' balance marked lug hole. This anti-rattle spring should be wired in place before pressure plate is removed and must not be installed in any other position. CAUTION—Changing position of anti-rattle spring will upset clutch balance.

Driven Members—Driven members are Long 'CF' type. See Long 'CF' clutch article for driven plate data.

LONG MODEL 12CB

MODEL 12CB-11½C

CADILLAC V16, MODEL 40-90 (1940)

MODEL 12CB-CL

LINCOLN, V12 MODEL (1940)

These clutches same design as used on corresponding 1939 car models.

SERVICING:—All service operations same as for previous models. ***See 'Long Model 12CB' clutch article in Mechanical Equipment Section of manual for complete data and note following specifications:***

Clutch Springs—Twelve springs used on each model. Springs should check with specifications given below. Replace springs which do not test up to specifications or which appear burned or warped.

Spring Specifications

Car Model	Spring Part No.	Pressure @ 1 9/16"	Spring Color
Cadillac	C-2096	120-130 lbs.	Red
Lincoln	C-3431	150-160 lbs.	Pink

LONG MODEL 11CFS SPECIAL TYPE

MODEL 11CFS-CI

PACKARD SUPER 8, '160' 1803, 4, 5 (1940)

PACKARD SUPER 8, '180' 1806, 7, 8 (1940)

This clutch same design as used on 1939 models.

IMPORTANT NOTE:—This model has special riveted construction and cannot be dismantled.

Borg & Beck Clutch on Early Cars—See Borg & Beck Clutches for data on Model 11A6 used on early cars.

DESCRIPTION:—Same design as other Long 'CF' type semi-centrifugal clutches except for added spring segments as follows:

Spring Segments—Consists of three flat springs located between release levers. Springs are riveted

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to pressure plate at inner end and on clutch cover flange at outer end so that all clutch parts are permanently joined in one assembly (one clutch spring of each group extends through clearance hole in each spring segment).

SERVICING:—Cover assembly cannot be dismantled and is serviced on exchanged basis (spring segments must be removed first and will be damaged if any attempt made to remove clutch cover).

WARNING—Clutch will not operate satisfactorily with spring segments removed.

DRIVEN MEMBER:—Long 'CF' type. See Long 'CF' clutch article in Mechanical Equipment Section of manual for driven member data.

LONG 9CF, 9½CF, 10CF, 11CF MODELS

MODEL 9CF-CS

FORD '60' & '85', PASS. CARS & COMM'L. ('40)
FORD '60' TRUCK, ¾ & 1 TON MODELS (1940)
MERCURY, MODEL 09A (1940)

MODEL 9½CF-CS

GRAHAM, STD. & SPC. MODEL 107 (1940)
GRAHAM, SUPERCHARGER MODEL 108 (1940)
PACKARD SIX, '110' MODEL 1800 (1940)

MODEL 10CF-CI

PACKARD 8, '120' MODELS 1801 (1940)

MODEL 10CF-TI

LA SALLE V8, MODELS 40-50, 52 (1940)
LINCOLN-ZEPHYR, MODEL 06H (1940)

MODEL 11CF-CI

FORD '85' & '95', TRUCK MODELS (1940)

MODEL 11CF-10½CI

CADILLAC V8, MODELS 40-60S, 62 (1940)

MODEL 11CF-TI

CADILLAC V8, MODELS 40-72, 75 (1940)

These Clutches same design as used on corresponding 1939 car models except as noted below.

NOTE:—**Cadillac & LaSalle Early Cars**—See Borg & Beck Clutches for data on Model 11A6 Clutch used on early cars.

Ford '60'—Clutch used on this model is same as type used on Ford '85' in 1940 and previous years. Type used on 1937-39 Ford 60 (8½CB-CS) has been discontinued.

Packard 6 & 8 Early Cars—See Borg & Beck Clutches for data on Model 10A7 Clutch used on early cars.

Long Driven Members (on other cars)—Long driven members used with clutches of other makes on the following 1940 car models:

Car Model	Long Driven Member
Buick 40, 50 (Part Production)	10CS-7S
Pontiac 6, 40-25, 40-26	9CF-CS
Pontiac 8, 40-28, 40-29	9¼CF-CS
Studebaker Pres. 6C	9½CF-CS

See Driven Member data below. Borg & Beck 'Borglite' driven member also used on Buick 40, 50 (see Borg & Beck Clutch article for data).

DESCRIPTION:—Same design as used on previous car models except for new type driven member on some cars. See driven member data below.

SERVICING:—All service operations same as for previous models. ***See 'Long 9CF, 9½CF, 10CF, 11CF' Clutch article in Mechanical Equipment Section of manual for complete data and note following specifications for 1940 types:***

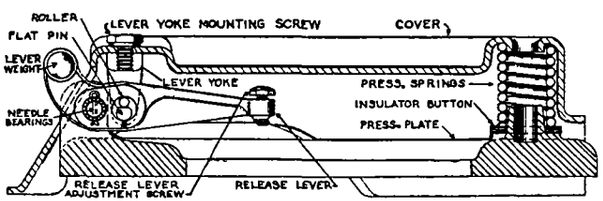
Release Lever Adjustment (On Borg-Warner Universal Clutch Fixture UF-300):—Install special lands on fixture under pressure plate, set lever adjusting arm on sleeve so that distance from bottom end of sleeve to bottom of arm is correct for each model (allowable variation plus or minus 1/32") as given in table below. Adjust levers by turning lever adjusting screw in each lever tip in or out, lock adjustment by peening lever into slot on screw.

CAUTION—Support screw on metal surface when peening lever to prevent distorting lever and screw.

Release Lever Settings

Clutch Model	Lever Height
9CF (all)	2 3/32"
9½CF (all)	2"
10CF (La Salle)	1 15/16"
10CF (Lincoln-Zephyr)	2"
10CF (Packard)	2⅛"
11CF (Cadillac)	1⅞"
11CF (Ford Truck)	2 7/32"

Release Lever Adjustment (without Fixture):—When using dial indicator to set release levers, on Model 9½CF install special Borg-Warner indicating plate on levers and lever setting should be 2½" plus or minus 1/32" with this plate in place. On other models this indicating plate is not used and lever settings are same as above. Lever heights must be equal within .005".



Pressure Plate Servicing:—Regrinding or resurfacing pressure plate will throw levers out of adjustment and this must be compensated for by installing washers between lever yoke and clutch cover. Manufacturer recommends that when .020" removed from plate, washer thickness of .015" be used (washers should be approximately same size as end of lever yoke). CAUTION—If washers are found installed at this point when clutch is disassembled, make certain that these washers re-installed when clutch is assembled (if old pressure plate re-used), or discarded (if new pressure plate installed).

Cadillac Models—Manufacturer recommends that adjusting gauge J-285-C be installed on flywheel in place of regular driven member and short straightedge used as guide on gauge boss. Release lever mounting clevis screw heads should be bumped lightly with 8 oz. hammer to bend cover slightly until lever tips contact edge of straightedge.

Clutch Springs:—Springs should check with table below. NOTE—Number shown thus (9) indicates number of springs used on each model.

Clutch Springs

Car Model	Spring Part No.
Cadillac V8 (all)	C-2686 (9)
Ford (9CF)	C-1445 (6)
Ford Truck (11CF)	C-1965 (9)
Graham	C-4905 (6)
La Salle	C-2686 (9)
Lincoln-Zephyr	C-2096 (9)
Mercury (9CF)	C-4873 (6)
Packard 6	C-4905 (6)
Packard 8	C-2045 (9)

Spring Specifications

Spring Number	Pressure @ 1 9/16"	No. of Coils	Color Marking
1445	130-140 lbs.	8¾	Green
1965	90-100 lbs.	8¾	Lgt. Green
2045	110-120 lbs.	8¾	Gray
2096	120-130 lbs.	8½	Red
2686	145-150 lbs.	8¾	Yellow
4873	147-153 lbs.	8¼	Brown
4905	158-168 lbs.	8¼	.....

DRIVEN MEMBER:—Manufacturer recommends that driven member not be relined and that replacement driven member (with new facings installed) be used. See Car Model 'M' Page for facing specifications and Long Clutch article in 'ME' section of manual for driven member and cushion spring data.

ROCKFORD MODELS

Assembly Number	Used On: MODEL 8½SP
UCLA-3-1748	BANTAM, 63 & SUPER FOUR 65 ('40)

MODEL 8II

UCLA-13-1098	WILLYS, 440 PICKUP, 440P PANEL DELIVERY (1940)

These clutches same design as used on 1939 cars.

NOTE:—**Bantam Production Change**—On engines before No. 65-500, front facing is riveted to flywheel, rear facing riveted to pressure plate. On Engines after No. 65-500, front facing is free and floats between driven disc and flywheel.

DESCRIPTION:—**Willys**—Single plate, dry disc type, mounted in recess in flywheel with flat cover bolted to flywheel rim. Actuated by three release levers pivoted on steel ball in lever post on cover plate and linked to lever stud mounted on pressure plate by pin (lever stud extends through hole in cover plate).

Bantam—Release levers have fulcrum lug which engages cover and are linked to studs inserted through pressure plate (facing riveted on face of pressure plate and must be removed to remove these studs). Twelve short springs (¾" working height) are mounted in pockets in pressure plate and cover.

SERVICING:—Pressure plate assembly need not be dismantled when replacing driven member unless pressure springs are to be tested or replaced or other service work performed.

Dismantling:—Place cover assembly in arbor press with pressure plate down, compress cover slightly, remove cotter pins, lever pins, unhook lever springs, remove levers, release pressure slowly, lift off cover.

Clutch Springs:—Check springs and replace if weak or burnt. Springs should check with following figures:

Spring Specifications

Car Model	Spring Pressure & Height
Bantam	23-27 lbs. at ¾"
Willys	160-170 lbs. at 1 13/16"

Assembling (Willys):—Place pressure plate on press or fixture, install pressure springs on plate and place spring cups on springs. Install cover plate, guiding spring cups through holes in cover and making certain that stud holes are lined up. Compress cover slightly. See that steel balls on which levers pivot are in place in recess in end of each lever post. Hook lever springs on levers, then hook opposite end of springs under cover rim (springs must be engaged

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before levers installed, if springs installed later they may be stretched beyond limits and distorted). Force lever in position in slot in lever stud, insert lever pin and cotter pin. Check lever heights.

Bantam. Place pressure plate and release lever stud assembly on arbor press or clutch fixture (studs must be installed before facing riveted on pressure plate). Install clutch springs (12 used), install cover plate with lever studs extending through plate. With release lever springs in place, install levers and insert lever pins.

Release Lever Adjustment (Willys):—Levers adjusted by turning knurled adjusting screw which contacts steel post on lever post. Adjusting screws locked in position by end of lever spring which engages the serrations in the screw head. Levers must be equal so that all levers contact release bearing simultaneously and should be set so that lever tips are exactly 1 3/16" above top surface of clutch cover. Clearance between lever tips and release bearing should be 1/16" with clutch engaged.

Bantam. Levers not adjustable but lever tips should be exactly 1" above outer surface of facing on pressure plate (check with facing installed). Clearance between lever tips and face of release bearing should be 1/16" with clutch engaged.

DRIVEN MEMBER:—Bantam Models. Driven plate on this model consists of an unlined steel disc. Facings are riveted separately to face of flywheel and pressure plate (see Production Change Note above for floating facing used on Eng. No. 65-500 up).

Willys Models. Driven member is Borg and Beck type. See Borg & Beck Clutch article for data.

ROCKFORD (CROSLEY) TYPE

Used On:

CROSLEY, MODEL A (1939-40)

DESCRIPTION:—Single plate dry disc type. Clutch assembly consists of three fulcrum brackets (mounting brackets) which are bolted individually on the flywheel. Release levers are pivoted on pins in fulcrum brackets and engage lugs on pressure plate with pressure spring mounted on pressure plate under each lever (3 springs used).

SERVICING:—Disassembly. Take out cotter pin and remove pin linking release lever to fulcrum bracket, remove release lever and spring. Repeat this operation at each of the three fulcrum brackets.

Assembly—Install fulcrum bracket on pressure plate lug, install spring, place release lever in position with hole in lever and fulcrum bracket lined up, install pin and secure with cotter pin.

DRIVEN MEMBER:—Consists of a steel disc with slotted rim on which linings are riveted in four separate segments. Each lining segment retained by three rivets with rivet heads reversed on alternate segments (rivet heads toward flywheel on adjacent segments).

Servicing—Facings not furnished separately and driven member should be serviced by replacement.

BUICK 40, 50 (OWN MAKE)

Used On:

BUICK, SERIES 40-40, 50 (1940)

This clutch same design as used on 1939 Series 40.

SERVICING:—Same as for 1939 type. *See 'Buick 40 Own Make' clutch article in Mechanical Equipment Section of manual (or 1939 Supplement) for complete data and note new driven member data as follows:*

Driven Member—Borglite type or Long Model 10CS-TS (each type used on part production). Parts not furnished separately and driven member should be replaced as an assembly. Grooved facings used on both types. CAUTION—Install driven member with large driving washer toward transmission.

BUICK 60, 70, 80, 90 (OWN MAKE)

Used On:

BUICK, SERIES 40-60, 70, 80, 90 (1940)

This clutch same design as used on corresponding 1939 models.

SERVICING:—Same as for previous models except as noted below. *See 'Buick (Own) Single Plate Type' clutch article in Mechanical Equipment Section of manual for complete data and note following new data:*

Release Lever Adjustment—Borglite driven member requires special lever setting and gauge plate J-1036 (same as for 1939) should be used. Assemble gauge plate in flywheel in place of regular driven member. Use service tool J-1013 and dial indicator, set all release levers equal within .005", lock adjustment by crimping flange on nut against flat on adjusting screw.

Driven Member—Borglite type (see Borg & Beck clutch article for data). Parts not furnished separately and driven member should be replaced as an assembly. Facings are grooved. CAUTION—Install driven member with large driving washer toward transmission.

CHEVROLET (OWN MAKE)

Used On:

ALL PASS. CAR & TRUCK MODELS (1940)

This clutch same design as used on 1938-39 models.

NOTE:—Clutch is same as 1939 type in that Clutch Cover, Diaphragm Spring, and Pivot Rings are riveted together in a permanent assembly. This assembly cannot be dismantled and parts are not furnished separately (furnished as an assembly only).

SERVICING:—All service data same as for previous models except that cover assembly cannot be dismantled. *See 'Chevrolet (Own Make)' clutch article in Mechanical Equipment Section of manual (or 1938 Supplement) for complete data and note following points:*

Clutch Balance Marks—When installing pressure plate make certain that '0' marks on one lug of plate and on clutch cover flange are lined up. When installing clutch in engine, line up 'X' marks on clutch cover and flywheel. This is necessary to maintain clutch balance.

Clutch Rattles at idling speed (released)—Can be corrected by renewing retracting spring without removing clutch from engine by removing clutch housing underpan and turning flywheel until retracting springs are at the bottom (3 springs used). Remove spring bolt, withdraw spring, install new spring in same manner. Renew all three springs in same way. If new springs do not correct rattles, check clearance between pressure plate lugs and edge of clutch cover slot. Clearance should be .002-.008" and clutch cover assembly or pressure plate should be replaced if clearance exceeds .010".

Clutch Fork Installation—If retainer in groove in fork is worn, install new retainer being certain that high side of retainer is up (away from bottom of ball opening), and open end of retainer on the horizontal.

Driven Member—Two types used—9⅛" diameter on Pass. Cars & ½ Ton, 10¾" on all other trucks. To install new facings, drill old rivets out from head side. Use riveting fixture to install new facings (fixture will flatten rivets exact correct amount of 7/32"), and reverse rivets in pairs (two each way). Facings are grooved type.

HUDSON (OWN MAKE)

Used On:

ALL MODELS (1940)—SEE NOTE

This clutch same design as used on 1939 models.

NOTE:—Cars with Overdrive—All cars with Overdrive are equipped with new heavier 10" clutch (cover is 10" type and is of new type welded construction has added strengthening ribs and thicker mounting bolt bosses). Driven member used with this clutch (spring dampener on this type has six heavy dampener springs instead of the eight smaller springs used on regular driven member). This clutch is serviced in same manner as other models (see special Clutch Spring data below).

SERVICING:—All service operations same as for previous types. *See 'Hudson (Own Make)' clutch article in Mechanical Equipment Section of manual for complete data and note new specifications as follows:*

Clutch Springs—Two types of outer (main) springs used and inner springs used on some models as shown in table below. Replace springs if pressure less than that shown in table.

Model	Inner Spring No. Used	Inner Spring Part No.	Outer Spring No. Used	Outer Spring Part No.
40	3	155224	9	45148
40 (41 Eng.)	6	155224	9	45148
41	6	155224	9	45148
48			12	45148
40, 41, 48 (O.D.)			12	45148
43			12	45149
44, 45, 47	3	155224	12	45149
43,44,45,47 (O.D.)	3	155224	12	45149

O.D.—Cars with Overdrive Transmission.

Spring Specifications

Spring No.	Pressure	Length
45148	155 lbs. ± 5 lbs.	1¾"
45149	135 lbs. ± 5 lbs.	1⅝"
155224	80 lbs. ± 5 lbs.	1⅝"

Clutch Aligning Arbor—Use J-449 arbor to center driven member when installing clutch on flywheel.

Driven Member—Cork insert type. See car model 'M' page for specifications. NOTE—Special driven member used on cars with Overdrive. May be identified by six larger dampener springs in hub assembly (standard driven member has 8 smaller springs).

HUDSON CLUTCH CONTROL

Optl. Equipment On:

ALL MODELS (1940)

This equipment same design as used on 1939 cars.

ADJUSTMENT, SERVICING, TESTING:—All data same as for 1938-39 cars. *See 'Hudson Automatic Clutch Control' article in Mechanical Equipment Section of manual (or 1938 Supplement) for complete data.*

BUICK FIRST TYPE

USED ON MODELS 50, 60, 90 (1934-35).

CHECKING & ADJUSTING:—Check following points first before changing settings:

Tire Inflation—26 lbs. (50), 24 lbs. (60), 28 lbs. (90).

Frame Height—Frame should be level crosswise of car. Check springs for sag and replace spring if necessary (see spring table below).

Toe In:—Check distance between center of tire tread at rear, roll car ahead ½ revolution, check distance between same marks. Should be 5/32-7/32" or ⅛-3/16" if measured on tire sidewall.

To Adjust—Change length of each tie rod equally. Intermediate steering arm must be on center line of car or midway between rear lower support arm bolts with wheels turned straight ahead. Correct by increasing length of one tie rod and decreasing length of second rod equally.

Caster:—Should be 1¾-2¼° (50), 1-1¼° (60, 90).

To Adjust—Jack up front wheels, loosen nuts on upper and lower support yokes one turn, tap nuts to free bolts in yoke, loosen knuckle support upper clamp bolt, turn upper support bolt (head of bolt at rear) clockwise to increase, or counter-clockwise to decrease caster. One complete turn of the bolt changes caster 1/3 degree.

Camber:—Should be ½-1¼° (all models). If camber checked by measuring from vertical line at wheel, felloe at top of wheel should be 9/64-23/64" outside felloe at bottom. Should be same for both wheels within ¼° or 1/16".

To Adjust—Jack up car so that weight is off wheel. Disconnect tie rod at wheel end. Remove nut on upper control arm yoke (if camber to be increased), or lower control arm yoke (if camber to be decreased, pull yoke out of arm, install special washer on yoke bolt between yoke and arm, reinstall yoke and tighten nut. Washers furnished 1/16" thick and change camber 1/3°.

CONTROL ARM ASSEMBLY:—Lower Knuckle Support—Pin is .0015-.0030" press fit in knuckle support and should be installed in an arbor press with 1-2 tons pressure. Pin locked by clamp bolt. Pin holes in lower support arm bronze-bushed and pin should have .0005-.002" clearance. End thrust taken by hard bronze washers fitted to .0015" end play.

Upper Knuckle Support:—Threaded pin screwed in upper end of knuckle support and carried in bronze bushings in upper support arm. Clearance in bushings .0005-.002" and endplay .0015" (steel thrust washer at front, bronze thrust washer at rear).

Lower Control Arm:—Mounted at inner end on individual threaded studs screwed in bushing in arms and bolted to anchor plate by special capscrews. Studs should be turned in or out of bushings until control arm bosses centered in clearance pockets in anchor plate with mounting bolt holes in studs and anchor plate lined up.

SPRINGS:—Springs are paired and same type must be installed on both sides of car. Standard types for each model as follows:

Car Model	(Spare at Rear)	(Fender Wells)
50	1284763	1284764
60	1284206	1284760
90	1284761	1284762

SHOCK ABSORBERS:—Front shocks mounted on frame by special heat treated bolts and located by reaming two bolt holes to provide .001-.0075" clearance.

BUICK 80, 90 TYPE

Used on:

MODEL 40 (1934-35-36), 60, 80, 90 (1936).

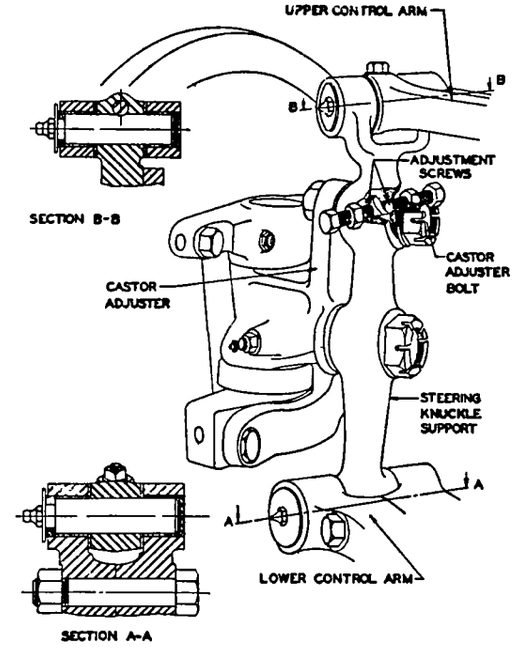
ROADMASTER, 37-80 ('37), 38-80 ('38), 39-80 ('39)

LIMITED, 37-90 ('37), 38-90 ('38), 39-90 ('39)

CHECKING AND ADJUSTMENT:—Check following points first:

Tire Inflation—26 lbs. (40), 28 lbs. (60, 80, 90).

Frame Height—Measured on each side of car from lower face of rubber bumper flange (40) or cross member at side of bumper flange (60, 80, 90) to top surface of lower control arm. Should be 4 9/16" (40), 4¾" (60), 4 9/16" (80,90 '36), 4 27/32" (80,90 '37-39). If difference greater than ¼", disconnect one stabilizer link. If this does not level car, remove and check front springs, install shims or replace springs (see Springs below).



Toe In:—Roll car on floor one full revolution, then check by measuring to marks in center of tire tread at rear, roll car ½ wheel revolution, reapeat measurement to same marks. Correct toe in determined by 'average' camber (½ sum of camber for both wheels) and should be 7/32" for camber of 2° decreasing 1/32" for each ¼° to 0" for 0° camber (except ½°-1/16" and ¼°-1/32" (1934-36) or 3/32" (1° camber), 1/16" (¾°-½° camber), 1/32" (¼° camber), 0" (0-Neg. ¼° camber) for 1937-39 models.

To Adjust—Turn each tie rod equally. Tie rod lengths should be equal and intermediate steering arm must be on center-line of car (equidistant from rear lower control arm inner brackets) when wheels straight-ahead (except 40 when steering arm thrown off center to correct steering wheel spoke location—see Steering Gear article). Correct steering arm position by increasing length of one tie rod and decreasing other.

Caster:—Machined bosses provided on each end of steering knuckle bosses (40) or caster adjuster (60, 80, 90) for protractor mounting when measuring caster. Should be 2¾-3¼° (40 '34-35), 3-3½° (40 '36), 1¾-2¼° (60, 80 '36), ¾-1¼° (90 '36), 0° (60, 80, 90 '37), **Negative** ⅞° (kingpin tilts forward at top) for 80, 90 '38-39. Allowable variation plus or minus ⅜°.

To Adjust—Jack up front end, loosen nuts on caster adjuster bolt and pivot bolt (on inner surface of steering knuckle support) one turn, loosen locknuts on adjusting screws which locate caster adjuster bolt in slotted hole. Back off one screw and turn up other screw an equal amount so that caster bolt is held tight (turn front screw in to increase or rear screw in to decrease caster). One turn of the screw changes caster 1°. Total range of adjustment 6° Tighten adjusting screw locknuts and caster adjuster bolt nuts securely, recheck caster with car weight on wheels.

Camber:—Can be checked with protractor held against machined surface of bearing hub (with hub cap and dustcap removed. Should be ½-1¼° (40 '34-35), negative ¼° to positive ¾° (all others).

NOTE—Camber for 1937-39 models can also be checked by measuring distance from mark on center of tire tread on each wheel at top and bottom (see table below).

Model	Camber	Top—Distance—Bottom
80	Neg. ¼°	59 59/64" — 60 11/64"
80	Pos 1°	60 37/64" — 59 9/16"
90	Neg. ¼°	59 59/64" — 60 11/64"
90	Pos. 1°	60 13/32" — 59 35/64"

CONTROL ARM ASSEMBLY:—Lower Knuckle Support—Pin is .0005-.002" (40), .0005-.0015" (60, 80, 90) press fit in knuckle support and is locked by clamp bolt. Use arbor press to remove and install pins—do not drive pins in or out. Pin clearance in control arm bushings should be .001-.0025". Side thrust of knuckle support taken by hardened bronze thrust washers on each side selected to give .000-.006" side clearance.

Upper Knuckle Support:—Pin clearance in support is .0015-.004" and pin should assemble easily by hand. Pin locked by clamp bolt. Pin clearance in control arm bushings should be .0015-.003" (40), .001-.0025" (60, 80, 90). Side thrust washers and clearance same as above.

Lower Control Arm:—Pivots on shaft bolted to cross member. Control arm carried on bushing threaded on shaft (front) and threaded on both shaft and in control arm end (rear). To assemble place control arm on shaft so that distance from center of shaft bracket bolt to outer face of rear control arm is 2 7/16" (40), 2 15/16" (60, 80, 90), thread rear bushing in arm and on shaft. Turn up tight and recheck distance. Thread front bushings on shaft, turn up until shoulder contacts face of arm, tighten clamp bolt.

NOTE—On Model 40 (1934-35), check control arm location by measuring from hole in center of shaft to rear face of rear boss on arm. Should be 6 3/16".

Entire assembly should move up and down freely (with spring not in place). Faulty alignment may be corrected by turning control arm shaft one turn in either direction to throw lower arm backward or forward. More than one turn will be in excess of caster adjustment.

SPRINGS:—Springs are paired and should have same free height. If not equal install ⅛" thick service washer and insulating washer on top of coil spring. Do not use more than two washers. If this does not correct car sag (unequal frame heights), check rear springs and frame alignment. Standard springs (identified by color) as follows:

	(Spare at rear)		(Fender wells)	
Car Model	**Part No.**	**Color**	**Part No.**	**Color**
41,46,46S '34-'35	1286634	Red	1286635	Yellow
47, 48 '34-'35	1286634	Red	1286635	Yellow
41 ('36)	1286635	Yellow	1292367	Green
46, C, S, 48 ('36)	1286635	Yellow	1293210	White
61, 66C, 66S, 68	1294664	Red	1294663	Yellow
81, 81C	1293553	Orange	1284760	Blue
90, 90L, 91			1293663	Green
80 ('37)	1298405	Orange	1298406	Blue
90 ('37)			1298407	Green

NOTE—Springs on 40 are smaller diameter and can be readily identified.

1938 Spring Specifications

	Spare at Rear		Fender Wells	
Model	**Color**	**Free Lgth.**	**Color**	**Free Lgth**
80 (All)	Orange	14¾"	Blue	14¾"
90 (All)	Blue	14⅝"	Green	14⅝"

1939 Spring Specifications.

	(Spare at Rear)		(Fender Wells)	
	Part No.	**Color**	**Part No.**	**Color**
80 (all)	1309916	Orange	1309917	Blue
90 (all)	1309917	Blue	1309918	Green

FRONT STABILIZER SHAFT (1939):—Serviced in same manner as Series 40 & 60 (see preceding article). **Stabilizer Links**—Same as Series 40 & 60 except that spacer not used on link bolt (grommet assem blies positioned by collars on bolt) and nut provided at each end of bolt for grommet assembly adjustment.

SHOCK ABSORBERS:—Front shocks mounted on frame by 4 special heat treated bolts and located by reaming out two bolt holes to close limits.

BUICK 40, 60 TYPE

Used On:

SPECIAL, 37-40 ('37), 38-40 ('38), 39-40 ('39)
CENTURY, 37-60 ('37), 38-60 ('38), 39-60 ('39)

NOTE:—This type suspension used on Models 40, 60 is the same for 1937-38 except as noted below:

1938 Type Lower Control Arms:—Hardened bushings are threaded in inner ends of lower control arms and on bracket shaft (arms broached so that threads are cut by bushing when first installed). Bushings will not ordinarily require removal.

1939 Type:—Design same as for 1938 except as follows:

Lower Control Arm—One piece rubber bushings used at inner ends of control arms (frame connection) and retained by extension of lower control arm shaft bracket (inner end), flat washer and self-locking nut (outer end). Spring seat riveted to control arms and rivets must be removed to dismantle assembly.

Upper Control Arm (Shock Absorber)—Interchangeable on right and left side of car. Caster adjustment located at rear of control arm (left side) front of arm (right side).

NOTE—Upper and lower control arms and shaft not interchangeable with 1938 because of these changes. Knuckle Support and Steering Knuckle are interchangeable with 1938 parts.

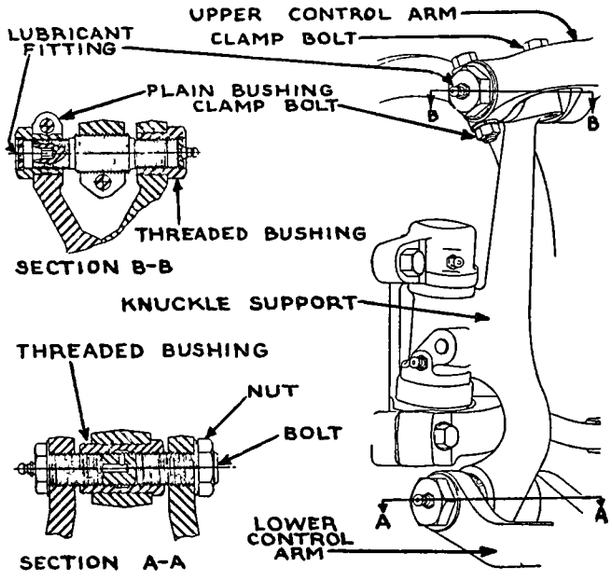
CHECKING & ADJUSTMENT:—Car weight must be on wheels. Adjust front wheel bearings and check following points first:

Tire Inflation—(40,60) 23 lbs. frt., 28 lbs. rear.

Kingpin Inclination—3½-4½° (40, 60).

Frame Height—4¾" ('37-38), 4" ('39) measured from lower face of frame cross-member to upper surface of lower control arm. Must be equal on both sides within ¼". If not correct, disconnect one stabilizer link. If this does not correct height differences, remove and check front springs (see spring data below), install special spacer washer #1310413 (⅛" thick) or replace springs.

Caster:—Machined surface provided on each end of steering knuckle bosses. Caster should be ¼° plus or minus ⅜° and equal within ¼° for both wheels (1937), **Negative** ⅞° (kingpin tilts forward at top) plus or minus ⅜° for 1938 models.



To Adjust (40, 60):—Jack up front wheels, loosen clamp bolt at upper end of knuckle support, remove lubricant fitting at forward end of top support pin bushing, insert Allen wrench No. J-720, turn support pin clockwise to increase, counter-clockwise to decrease caster, tighten clamp bolt, replace lubricant fitting, recheck caster. ¼ turn of wrench will change caster ¼°. If caster changed more than ¼°, check toe in.

1939 Adjusting Note. Adjusting socket (for Allen wrench) located at rear of control arm (left side), front of control arm (right side) under lubricant fitting (remove fitting for access).

Camber:—Can be checked by protractor held against machined edge of bearing hub with dust cap and hub cap removed. Camber should be negative ¼° to positive 1°.

NOTE—Camber can be checked by measuring distance from mark on center of tire tread on each wheel at top and bottom (see table below). No adjustment provided (see 40, 60 note).

Model	Camber	Top - Distance - Bottom
40	Neg. ¼°	58 37/64" — 58 13/16"
40	Pos. 1°	59 7/32" — 58 15/64"
60	Neg. ¼°	58 43/64" — 58 29/32"
60	Pos. 1°	59 5/16" — 58 5/16"

Model 40, 60. Standard upper control arm knuckle support pin can be replaced with special eccentric type (Group 6.178 Part No. 231760) to permit slight camber adjustments. Camber readings outside limits given above indicate bent parts which should be replaced.

Toe In:—Roll car ahead one revolution, then check by measuring to marks at center of tire tread at rear, roll car ½ wheel revolution, repeat measurement to same marks at front. Correct toe in determined by average camber (½ sum of camber for both wheels) and should be 3/32" (1° camber), 1/16" (¾-½° camber), 1/32" (¼° camber), 0" (0-Neg. ¼° camber).

To Adjust—Loosen clamp bolts at each end of each tie rod, turn rod tubes equally in direction of forward wheel rotation to increase, or opposite direction to decrease toe in. ½ turn of tubes changes toe in 5/16". Tie rods lengths must be equal and intermediate steering arm must be on center-line of car (equi-distant from rear lower control arm inner brackets) with wheels straight ahead. Correct by shortening one tie rod and lengthening other rod equal amount.

Model 40, 60 (1938-39). New type tie rods are used (no intermediate steering arm, short left hand tie rod ball seat located in longer right hand tie rod near pitman arm ball seat). Adjust by loosening clamp bolt at wheel end of each tie rod and turning threaded sleeve (between tie rod and ball seat stud) equally at each side. One half turn of each sleeve will change toe-in 5/32".

CONTROL ARM ASSEMBLY (40, 60):—Upper Knuckle Support. Consists of threaded bushing screwed in upper end of knuckle support and in bushings in forward and rear forks of upper control arm. To assemble, screw pin in knuckle support, hold support centered in upper control arm fork, install rear (threaded) bushing turning bushing in against arm. Then install front (plain) bushing being careful not to turn bushing in tight which will cause binding. Install clamp bolt on this bushing.

NOTE—Entire assembly (without spring) must move up and down freely without binding. Lower control arm shaft may be turned one full turn in either direction to correct binding but must not be turned more than this amount (caster adjustment insufficient for greater correction).

Lower Knuckle Support:—Consists of bolt threaded through lower control arm and bushing in lower end of knuckle support. To assemble, turn threaded bushing in lower end of knuckle support from rear until tight, position knuckle support in lower control arm fork, turn bolt in from front through forward arm, knuckle support bushing, rear arm, assemble washer and nut on rear end of bolt.

Lower Control Arm. Control arms threaded directly on ends of shaft bolted to cross-member. Must be installed separately with spring seat removed. Distance from center of bolt hole in shaft bracket to inner face of control arm at rear should be 1 7/32" (1937), 1⅜" (1938). On 1938 models, hardened bushings are installed in inner ends of control arms but will ordinarily not require removal.

BUICK TYPE CONT.

1939 Note. Lower control arms riveted to spring seat and rivets must be removed to dismantle arms for bushing renewal, etc. Use 1938 type control arm bolts to secure spring seat when reassembling.

SPRINGS:—Springs are paired and should have same free height. If not equal, install not more than two ⅛" thick service spring washers No. 1290142 on top coil of short spring. Spring number stamped on flat of first coil and marked with paint for identification as follows:

	(Spare at Rear)		(Fender Wells)	
Model	**Part No.**	**Color**	**Part No.**	**Color**
40 (all)	1297818	Yellow	1298801	White
60 (all)	1297819	Red	1298802	Brown

1938 Spring Specifications

	Spare at Rear		Fender Wells	
Model	**Color**	**Free Lgth.**	**Color**	**Free Lgth.**
40 (All)	Yellow	14⅛"	Red	14⅛"
60 (All)	Red	14¼"	Brown	14¼"

SPRINGS (1939):—Have special end coils. Must be installed as follows: **Upper End**—Coil pilots around cup attached to frame by shock absorber mounting bolt (cup will remain in place unless both spring and shock absorber removed) and has rubber insulator between frame and spring end. **Lower End**—End coil not ground flat and must be fitted in recess in spring seat.

1939 Spring Specifications

	(Spare at Rear)		(Fender Wells)	
Model	**Part No.**	**Color**	**Part No.**	**Color**
40 (all)	1310096	Yellow	1310360	Red
60 (all)	1310411	White	1310412	Brown

60 (all)....1310360 (Late cars with long frame).

NOTE—See Rear Suspension article for special springs to be installed with heavy duty rear springs

FRONT STABILIZER SHAFT (1939):—Disconnect links by removing nut on link bolt, take out frame bracket mounting bolts. To service frame bracket rubber bushings, break weld between bracket and backing plate, remove backing plate. If bushings being re-located (due to popping out of bracket caused by excessive soaping when installed), clean outside of bushings thoroughly with steam or gasoline. To install new bushings, cut old bushings off, apply weak solution of water and soap suds to shaft and new bushings, slide bushings on shaft (avoid excessive soaping, do not use strong soap or grease). Clamp assembly in vise and wire backing plate to bracket (not necessary to weld), remove wire after stabilizer installed on car.

Stabilizer Links—When installing links, make certain that retainer installed at ends of rubber grommets and spacer installed on bolt at center. Tighten bolt nut to limit of threads so that overall length of grommet assembly at each end of link (distance between outer faces of upper and lower grommet retainers) is exactly 1 11/16".

SHOCK ABSORBERS:—Delco Double acting type. Mounted on frame by four special heat treated bolts and positioned by reaming out two bolt holes to provide .002-.007" clearance. See separate article for complete data.

CADILLAC FIRST TYPE

Used on:

CADILLAC V8, MODEL 355-D (1934-35).
CADILLAC V12, MODEL 370-D (1934-35).
CADILLAC V16, MODEL 452-D (1934-35-36).
LA SALLE, MODEL 350 SERIES 50 (1934-35).

CHECKING & ADJUSTMENT:—Check these points first before checking or changing settings:

Tire Inflation—35 lbs. (Cadillac), 25 lbs. (La Salle—front), 30 lbs. (La Salle—rear).

Frame Height—Should be 3 13/16" (La Salle), 5 3/16" (Cadillac) measured between lower face of frame side rail and upper face of lower spring seat. Must be alike on both sides of car. Check spring length if car sags.

Wheel Runout—Must not exceed 3/32". Mark high spot on tire and turn wheel so that mark on top vertically (to check toe in), or at one side (to check caster and camber).

Toe In:—Should be 0-1/16" (all models). Adjust by changing length of both tie rods equally. Intermediate steering arm must be exactly at center with wheels straight ahead (correct by lengthening short rod and shortening long rod equal amounts).

Caster:—Should be 1½-2° (La Salle), 3° (Cadillac V8 Series 10, 20), 1° (Cadillac V8 Series 30, all V12, V16). Must be equal within ½° for both wheels.

Adjustment (La Salle)—Loosen upper and lower control arm yoke nuts, and clamp screw on upper end of knuckle support, remove lubrication fitting in front bushing of upper control arm yoke. Insert Allen wrench, turn threaded pin clockwise to increase caster, counter-clockwise to decrease caster.

Adjustment (Cadillac)—Loosen lower control arm yoke nut, and upper knuckle support lockscrew. Turn threaded pin in upper control arm yoke (head of pin to rear on right side, to front on left side) in following direction when facing head of pin: **Right Hand Pin**—Clockwise to increase, counter-clockwise to decrease caster; **Left Hand Pin**—Counter-clockwise to increase, or clockwise to decrease caster.

Camber:—Should be ¼-1° (La Salle), ¾-1½° (Cadillac). Must be equal within ½° for both wheels.

Adjustment—Camber corrected by adding shims between face of yoke and face of control arm. On Cadillac models shims may be added only at lower yoke to decrease camber, no adjustment to increase camber possible. On La Salle, shims should be installed on lower yoke to decrease camber, or on upper yoke to increase camber. Shims furnished 1/16" thick and change camber 1/3°.

CONTROL ARM ASSEMBLY:—Lower Control Arm—Mounted at inner end on threaded studs which are bolted individually to anchor plate. To install, screw threaded studs in control arm bosses so that bosses are centered in clearance pockets in anchor plate with mounting bolt holes in studs and anchor plate lined up.

Lower Knuckle Support (First Type on Cadillac Models):—To install first type yoke pins, turn threaded bushings in yoke ends against steering knuckle support, installing bushing with shoulder at rear and allowing ⅛" more clearance at this end. Outer ends of bushings should be flush with face of yoke. Install taper pin, assemble gasket and cover plate at each end, insert mounting screw and tighten nut just enough to prevent oil leakage.

Second Type—Install short bushing in front leg of lower control arm yoke, long bushing in rear, turn bushings in until flush with outer face of yoke, install small end of taper pin marked 'small end' from rear loosely, adjust bushing clearance between steering knuckle boss and inner face of yoke at front to 1/16", then press in taper pin until ends are flush with bushings (pin is press fit and should be installed on the bench).

Knuckle Support (LaSalle):—See Model 35-50 for installation of upper and lower yoke pins.

SPRINGS:—Springs should be replaced if sagged more than ¼".

Model	**Spring Diameter**	**Free Length**
Cadillac (all)	5½"	15⅛-15¾"
La Salle	5⅜"	14-14 5/16"

SHOCK ABSORBERS:—Shock absorbers used on Cadillac models fitted with ride control. Control linkage should be adjusted to eliminate all play so that each shock absorber lever is in fully closed position with ride control lever in 'firm' position or all the way up. Adjust linkage in following order: (1) Right front and right rear, (2) left rear, (3) left front, and check by operating lever several times between each setting.

CADILLAC LATER TYPE

Used on:

CADILLAC V8, ALL SERIES (1936-37-38-39)
CADILLAC V12, SERIES 80, 85 (1936-37)
CADILLAC V16, SERIES 90 (1937-38-39)
LA SALLE, SERIES 50 (1935-36-37-38-39)

NOTE:—First 36-60 Cadillac cars fitted with same type suspension as other Cadillac models. Later 36-60 and all 37-60, 38-60, 39-61 use same type as LaSalle 36-50 and later models. Changes in design have been made as follows:

Lower Control Arms on Models 38-50, 38-60:—Hardened bushings are threaded in inner ends of lower control arms and on frame bracket shaft (arms threaded directly on shaft on previous design). Synthetic rubber seals are installed between bracket shaft and inner ends of lower control arm and also at each side of knuckle support at outer end of lower control arm. Rubber rebound cushions for front end are softer to reduce rebound shock.

Lower Control Arm (La Salle & Cadillac 39-61 only)—New type straight arms with rubber bushings at inner end (on frame bracket shaft). Arms are riveted to spring seat and rivets must be removed to dismantle assembly (for bushing renewal, etc.). Use bolts and nuts to fasten spring seat on arms when reassembling. Arms and steering knuckle supports have been redesigned for greater strength.

Upper Control Arm (La Salle & Cadillac 39-61 only)—New type (shock absorbers unchanged from 1938). New springs and new rubber bumpers also used.

CHECKING AND ADJUSTMENT:—Check these points first:

Kingpin Inclination—4°51' (La Salle & Cadillac 60 '36-37), 5°44' (La Salle & Cadillac 60 '38), 5°38' (Cadillac 65, 70, 75, 80, 85 '36-37), 4°30' (90 '37), 5°1' (Cadillac 65, 75, 90, '38), 5°6' (LaSalle 39-50, Cadillac 39-61), 5°44' (Cadillac 39-60S), 5°1' (Cadillac 39-75, 90).

Tire Inflation—Minimum pressure 26 lbs. (50, 60), 28 lbs. (60S, 65, 70), 32 lbs. (75, 85, and 90 '38), 36 lbs. (90 '37), 24 lbs. (50, 61 '39), 28 lbs. (60S '39), 32 lbs. (75, 90 '39).

Frame Height—3 13/16" (35-50, 36-50, 36-60), 5 3/16" (36-70, 75, 80, 85) plus or minus ¼" measured between lower face of frame side rail and upper surface of lower spring seat. Must be same on both sides of car. Check spring length and suspension unit assembly if car sags.

CADILLAC TYPE CONT.

Wheel Runout—Must not exceed 3/32" with wheels in place on car. Mark high spot on tire and place wheel with mark at top vertically (to check toe in) or at one side (to check caster and camber).

Steering Geometry (Toe Out on Turns):—With outer wheel set at 20°, inner wheel should be 21¾-23¼° (La Salle 36-50, 37-50, Cadillac 36-60, 37-60), 22-23½° (Cadillac 65, 70, 75, 80, 85, 90 '36-37), 23½° (Cadillac 60, 75, 90; La Salle 50 '38), 23¾° (Cadillac 60S, 65 '38), 22¼-23¾° (50, 61 '39), 22¾-24¼° (60S, 75, 90 '39).

Front Wheel Stopscrew Adjustment (38-65, 75, 90):—With front wheels turned to straight ahead position, and steering gear roller on 'high point' of worm, mark steering wheel, then turn wheel exactly two full turns to the right, adjust right hand stopscrew so that it rests against stop. Adjust left hand stopscrew in same way with wheel turned two full turns to left.

NOTE—Stopscrews not installed on first 75 and 90 cars. May be installed by drilling .332" hole in web of steering knuckle support and tapping with ⅜-24 American thread tap.

Toe In:—Should be 0-1/16" (car in motion) or 1/32-3/32" (car at rest). Adjusted by changing length of both tie rods equally.

LaSalle 39-50, Cadillac 39-61 Note—The adjustment is new because of new type linkage (Cross type drag link connected between steering gear pitman arm and idler arm pivoted on right frame member with individual tie rods between drag link and each front wheel). To adjust, loosen two clamp bolts and turn adjusting sleeve at wheel end of each tie rod equally. Toe in should be 0-1/16" with car in motion, 1/32-3/32" with car at rest, (same as for 1938 models).

Caster (LaSalle 35-50, Cadillac including 36-60 first cars). Should be ¼-1° (La Salle 35-50, Cadillac 36-60 first cars), ¾-1¼° (36-75, 80, 85, 90), 0° plus or minus ¼° (65 '37-38, 70 '37, 75 '37-39, 85 '37, 90 '37-39). Must be equal within ¼° for both wheels.

To Adjust—Loosen nuts on knuckle support upper and lower yokes, loosen clamp screw in upper end of knuckle support, remove lubrication fitting from front bushing of knuckle support upper pivot pin, insert Allen wrench, turn wrench clockwise to increase or counter-clockwise to decrease caster, tighten clamp screw and yoke nuts.

Model 90. Remove locking bolts in outer end of upper suspension arm yoke, turn threaded pin with wrench to adjust caster (full turns only to permit locking bolts to enter when replaced).

Caster (LaSalle 36, 37, 38, 39-50; Cadillac 36-60 later cars; 37, 38, 39-60; 39-61):—Should be 1½-2° (1936), ¼-1° (1937), Neg. ¼ to Neg. 1¼° (1938), Neg. ¼ to Neg. 2¼° (50, 61 '39), Neg. ¼ to Neg. 1¼° (60S '39). Must be equal within ½° for both wheels. NOTE—Negative figures indicate Reverse Caster.

To Adjust—Loosen clamp bolt in upper end of knuckle support, take out lubrication fitting in front bushing, insert Allen wrench, turn wrench in complete revolutions only clockwise to increase or counter-clockwise to decrease caster, tighten clamp bolt. Camber will be affected unless wrench turned complete revolution. Check camber after making this adjustment.

Camber (LaSalle 35-50, Cadillac including 36-60 first cars). Should be ¼-1° (La Salle 35-50, Cadillac 36-60 first cars), 0-½° (all other Cadillacs). Must be equal within ¼° for both wheels.

To Adjust—Remove retaining nut and spacers from lower control arm yoke at knuckle support, pull out yoke and arrange spacers to secure correct camber (shift spacers to outer face of arm at yoke to decrease camber, or inner face of arm under nut to increase camber), re-install yoke and tighten nut.

Camber (LaSalle 36, 37, 38, 39-50; Cadillac 36-60 later cars; 37, 38, 39-60, 39-61):—Should be ¼-1° (1936-37), Neg. ¼ to Pos. ½° (50, 60 '38; 60S '39), Neg. ¼ to Pos. ¾° (50, 61 '39). Must be equal within ¼° for both wheels. If Camber not correct, check Kingpin Inclination.

To Adjust—Adjusted in same manner as Caster for these models except that wrench turned not more than ½ revolution. Knuckle support section of pivot pin eccentric and entire range of adjustment secured by ½ turn of wrench. Caster affected by camber adjustment but not outside limits if correctly set first.

CONTROL ARM ASSEMBLY:—La Salle 35-50, Cadillac including 36-60 first cars. On Model 90, a yoke is not used at outer end of upper control arm and knuckle support pin must be removed (as on 60 model below).

Lower Control Arm:—One piece type mounted on shaft on cross member by plain bushing threaded on shaft (front) and threaded bushing screwed on shaft and in control arm (rear). To assemble, place bracket shaft in position centered in control arm, thread rear bushing in arm and on shaft, turn in until tight with shoulder contacting arm, thread front bushing on shaft, turn up until tight, install clamp bolt in control arm. Arm should move freely on shaft without binding.

Knuckle Support Pivot Pins:—On these models, upper and lower control arm yoke nuts can be taken off, and knuckle support, pivot pins and yokes removed as an assembly. If disassembled further, mark position of pins and bushings, when reassembling turn pins and bushings in to same point to maintain front end alignment. Check caster and camber.

CONTROL ARM ASSEMBLY:—LaSalle 36, 37, 38, 39-50; Cadillac 36-60 later cars; 37, 38, 39-60, 39-61):—See Note below for 1939 lower control arm change.

Lower Control Arm:—Arms screwed on ends of mounting shaft directly (see note). Must be assembled separately with spring seat and jack pad removed. To assemble, screw arms on shaft equally until distance on shaft between inner faces of arm eyes is 11" (1936), 10 15/16" (1937). Assemble spring seat and jack pad, tightening nuts securely. Distance between inner faces of arms at outer end must be 2⅜". On 1938 models, make certain that rubber seals are in place on bracket shaft at inner face of lower control arm ends before screwing arms on shaft. NOTE—Hardened bushings used at inner ends of lower control arms on 1938 models only. **1939 LaSalle & Cadillac 39-61.** Lower control arms are riveted on spring seat and rivets must be removed to dismantle arms for bushing or bracket renewal. Use bolts and nuts to secure spring seat to control arms when reassembling.

Knuckle Support Lower Pivot Pin:—Note position of threaded bushing in lower end of knuckle support on threaded pin before disassembling so it can be assembled in same position. With knuckle support positioned in lower control arm, screw threaded pin in front through arm and knuckle support bushings until tight (locking washer gripped under head), assemble locking washer and nut on rear end.

NOTE—On 1938 models, make certain that rubber seals are in place between knuckle support and inner face of lower control arm outer ends when installing pivot pin.

Knuckle Support Upper Pivot Pin:—Note position of threaded pin in support before disassembling so that it can be reassembled in same position. With knuckle support positioned in upper control arm, screw threaded pin in from rear through support and in plain bushing in front upper control arm. Screw rear threaded bushing in on pin and in rear control arm. Insert clamp bolts in control arm and knuckle support. Entire assembly should move up and down freely without binding.

SPRINGS:—Part No. stamped on flat surface of end coil. Figure in table below following color indicates number of color markings. Replace springs if sagged more than ¼". See that insulator installed at top and bottom of each spring.

1936 Spring Specifications

Model	(Spare at Rear) Part No.	Length	(Fender wells) Part No.	Length
36-50	407558	13½"	407559	13¾"
36-60 (first 4008)	1413232	14⅛"	1413233	14⅛"
36-60 (after 4008)	1418331	14⅛"	1413232	14⅛"
36-70	1413788	14⅞"	1413789	14⅞"
36-75, 80	1413789	14⅞"	1413790	14⅞"
36-85	1413790	14⅞"	1413791	14⅞"

1937 Spring Specifications

Model	Part No.	Free Length	Color
37-50, 60 5W	1422058	14⅛"	Yellow
37-50, 60 6W	1297819	14¼"	Red
37-50, 60 Comm.	1420986	15"	Yellow
37-65, 70 5W	1420986	15"	Yellow
37-65, 70 6W	1413788	15"	Brown (2)
37-75 5W	1413789	14⅞"	White
37-75 6W	1413790	14⅞"	Red
37-75 Comm.	1413791	15"	Yellow (2)
37-75 Spec. Bus.	1420237	15"	Yellow (2)
37-85 5W	1413790	14⅞"	Red
37-85 6W	1413791	15"	Yellow (2)
37-90 5W	1404503	15⅛"	Tagged
37-90 6W	1404504	15⅛"	Tagged

1938 Spring Specifications

Model	Spring No.	Color Mark
50 5W (See Note)	1422058	Green
50 5W Later Cars	1427425	Yellow
50 6W (See Note)	1297819	Red
50 6W Later Cars	1427281	Aluminum
60 5W	1427425	Yellow
60 6W, 60S 5W	1427281	Aluminum
60S 6W	1427280	Orange
65 5W	1413788	Brown
65 6W, 75 5W	1413789	White
75 6W, 90 5W	1413790	Red
90 6W	1413791	Yellow
50, 60, 65 Comm. (See Note)	1420986	Blue
50, 60, 65 Comm. Later	1413788	Brown
75 Comm.	1413791	Yellow

NOTE—These springs used on first cars only with two ⅛" (No. 1290142) shims. Interchangeable with later springs providing shims used (first springs were ¼" shorter).

1939 Spring Specifications

Model	Part No.	Free Length	Color Mark
50, 61 5W	1428427	15⅞"	Green
50, 61 6W	1428428	15⅞"	White
50, 61 Com.	1428429	14⅝"	Yellow
60S 5W	1428426	15"	Red
60S 6W	1427280	15"	Orange
75, 90 5W	1413789	14⅞"	White
75, 90 6W	1413790	14⅞"	Red
75 Com.	1413791	15"	Yellow

5W—Spare at rear. 6W—Fenderwells.
Com.—Commercial Chassis.

SHOCK ABSORBERS:—Shock absorber valve number stamped on outside cap.

CHEVROLET KNEE-ACTION TYPE

Used On:
CHEVROLET MODELS.
MASTER, DA (1934), EA (1935), FA (1936).
MASTER DELUXE MODEL GA (1937)
MASTER DELUXE MODEL HA (1938)

NOTE:—Kingpin and Floating Bushing (special oversize) data applies to Master Deluxe Models GA, HA (floating bushings standard equipment), and to Models DA, EA, FA (when original needle bearings replaced by bushings).

DESCRIPTION:—Same design as on Pontiac models (see Pontiac article for complete description and assembling directions for suspension unit).
1937. Kingpin design is new. Needle bearings have been discontinued and new type floating bushings are used (bushings free to turn within kingpin support).

CHECKING:—Manufacturer recommends that front wheels be removed and car supported on jacks or horses under front spindle at inner bearing cone to permit use of approved Chevrolet checking tools. Car weight must be on spindles when checks are made.

Suspension Unit Height:—Measure from bottom of kingpin support to bottom of brake flange plate. See table under Adjustment below for directions. If correct adjustment cannot be secured, remove adjusting plug, housing cover and spring, install knee-action spring checking tool, Part No. J-764, reassemble housing cover and adjusting plug, recheck height. If height is correct, spring is defective and should be replaced. If height is not correct, suspension unit is defective and should be replaced.

Kingpin Inclination:—7° (1934), 7¾° (all others) crosswise. May be corrected by bending outer end of cross-member (kingpin support) if approved Chevrolet service tools used.

Camber:—1° (1934), ¼° (all others). Incorrect camber (after kingpin inclination checked and corrected) indicates that spindle is bent (replace Knee-action unit), or that kingpin bearings are worn (replace bearings).

Caster:—Kingpin caster 0°. Wheel caster effect secured by trailing wheel behind kingpin center. May be corrected by bending outer end of cross-member (kingpin support).

Toe In:—1/16-3/32". Check with car weight on wheels and roll car ahead at least one revolution before checking. Measure to chalk marks in center of tire tread, hub high, at rear, roll car ahead one half revolution, measure to same marks at front. Correct by loosening tie rod clamp bolts and changing length of rod.

Steering Geometry (Toe-out on Turns):—With outer wheel turned exactly 20°, inner wheel should be turned exactly 23°. Correct by replacing steering arms (no adjustment provided).

SERVICING:—To Remove Suspension Unit. Jack up car remove front wheel, remove two bolts and locking plate at bottom of front spring housing (radius rod bracket), turn unit outward, lift off brake assembly (hold radius rod to prevent it falling on floor). Remove steering arm nut, drive out steering arm with brass drift, remove kingpin lock pin. Remove dust caps and locking rings from kingpin support yokes (at upper and lower ends). Drill ¼" hole in center of upper kingpin plug, insert punch through this hole, drive kingpin down until lower plug is driven out. Then use soft steel drift against lower end of kingpin, drive kingpin up to remove upper plug, remove kingpin (lower bushing is loose and will fall out). Remove suspension unit. Remove upper kingpin bushing.

Servicing:—Manufacturer recommends that no attempt be made to disassemble unit or make repairs other than replacement of springs, spring guide, adjusting plug, or housing cover (accessible after removing adjusting plug and cover at top of unit), or shock absorber units (bolted individually on front of housing).

To Install Suspension Unit:—Insert kingpin from below making certain that longest end from slot is up and that locking pin slot lines up with hole. Tap thrust bearing in place between upper support yoke and suspension unit knuckle with dust shield side up. Check clearance or endplay and install steel shim if greater than .006". Install kingpin bushings lining up oil grooves on outside with lubrication fittings on steering knuckles (upper bushing groove down, lower bushing groove up). Coat cork gasket with heavy oil or grease before installing on spindle, see that bearing spacer engages slot in spindle when assembling inner bearing cone. When installing radius rod, first screw bracket up tight on rod, then bring radius rod straight up without side motion, loosen bracket just enough to line it up with boss on front spring housing, place it in position on boss, install lock plate and two bracket bolts, tighten bolts securely. Check suspension unit height and adjust if required.

KINGPIN AND BUSHING SERVICING:—Replacement bushings are finished to size and no reaming required. Bushings should be free on kingpin and may be somewhat snug in support yoke. If new standard bushings are loose in support yokes, yokes should be reamed and special oversize replacement bushings (Part No. 603076) installed. Use special reamer KMO-108 to ream support yokes, install smaller pilot in lower yoke, insert reamer through top yoke and pilot, ream top yoke, then install larger pilot in top yoke, reverse reamer and ream lower yoke. Reamer will finish yoke to correct size for oversize bushings.

ADJUSTMENT:—Suspension Unit Height. Remove adjusting plug lockscrew and lock, remove plug, clean out the groove and fill with Permatex (this should be done whenever plug is disturbed), install adjusting plug and turn plug in until suspension unit height is correct (see table below). Adjusting plug must not be more than ⅛" above or below top edge of housing cover (if outside these limits, check spring and replace either spring or unit).

Suspension Unit Height

Chevrolet '34 (Spare at rear)	5½"
Chevrolet '34 (Fender wells)	4½"
Chevrolet '35-36 (Spare at rear)	5⅜"
Chevrolet '35-36 (Fender wells)	4⅜"
Chevrolet 1937-38 Models	4⅞"

LUBRICATION:—Check level of lubricant in housing at 1000 mile intervals and keep housing full to lower edge of filler plug hole. Use only G.M. Shock Insulation Fluid.

CHEVROLET 1939 TYPE

Used On:
MASTER DELUXE, MODEL JA (1939)

NOTE:—Entire suspension unit assembly (Frame cross member and both control arm assemblies) may be removed from car as a unit for overhaul or replacement if desired. See Servicing data below for removal instructions.

TYPE:—New design 'S.L.A.' (short & long arm) or parallelogram type similar to design used on other car models. Shock absorbers are new 'parallel cylinder' type and are assembled as unit with upper control arms (arms permanently assembled on shaft and welded together). Neoprene seals are used at inner and outer ends of lower control arm and outer end of upper arm.

CHECKING & ADJUSTMENT:—Check the following points first before checking or adjusting front suspension unit.
Tire Inflation—26 lbs. (front), 28 lbs. (rear).
Wheel Runout—Check and adjust front wheel bearings. Check wheel for tire and rim runout and eccentricity. Mark tire midway between high and low spots (mean point) and place this mark at top (vertically) when checking Camber, at side (horizontally) when checking Toe In.
Steering Gear & Connections—Check mounting bolts and tighten if necessary. Check tie rod ball and socket joints for excessive looseness.
Frame Height—Install special gauges at front and rear ends of car to level frame when checking. Front gauge has holes to engage lower control arm shaft (inner end) and pivot pin (outer end) to hold control arms rigid in correct position. Rear gauge clamps axle housing and frame so that clearance between top of axle housing and lower face of frame side rail is 7 7/32".
NOTE—Make all checks with car weight on wheels (curb weight—car ready for road but no load).

Kingpin Inclination:—4¾° plus or minus ½°.

Caster:—0° plus or minus ½°. Adjusted by turning knuckle support eccentric upper pivot pin (same adjustment as for camber—See Camber Adjustment).

Camber:—Neg. ¼° (Wheel tilts in at top) plus or minus ½°.
Adjustment—Remove lubricant fitting on knuckle support upper pivot pin front bushing, loosen clamp bolt in upper end of knuckle support which clamps pivot pin. Insert ¼" Allen wrench through lubricant fitting hole in bushing to engage pivot pin, turn pivot pin clockwise to increase caster, counter-clockwise to decrease caster (pin is eccentric and this same movement will change Camber from minimum to maximum every half turn of the pin) until both caster and camber are correct within limits given above, tighten clamp bolt and replace lubricant fitting. One half-turn of pivot pin will change caster angle 39' and change camber angle from 0° to 1°2' (depending on initial position of pin).

Toe In:—0" to 1/16". **Adjustment**—Loosen clamp bolts and turn left hand (short) tie rod. When tightening clamp bolts, make certain that both tie rod ends are in alignment with the ball studs.
NOTE—Right hand (long) tie rod is not adjustable.

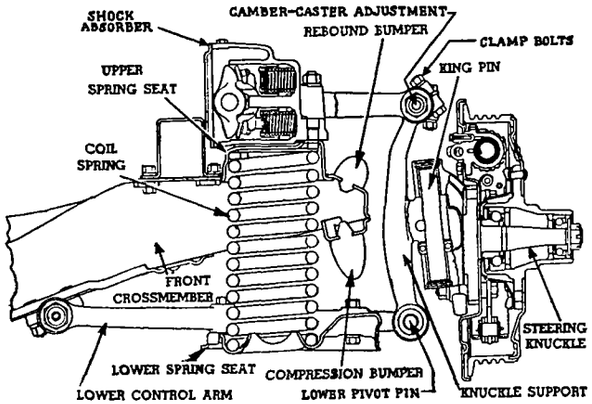
Steering Geometry (Toe out on Turns)—Outer wheel turned in 20°, Inner wheel turned 24° plus or minus 2°. Not adjustable (replace steering arm).

CHEVROLET TYPE CONT.

SERVICING:—Suspension Unit Assembly Removal—Remove front fender and radiator grille assembly as a unit (see Chevrolet Shop Notes for instructions). Remove front bumper, disconnect stabilizer from frame horns, remove pitman arm from steering gear, take out bolts holding front cross-member to frame side rails, slide suspension unit assembly off over frame side rails at forward end. Install in same manner.

Upper Control Arm Pivot Pin:—To remove pin, raise car with chain hoist, place jack under spring seat so that it takes weight of car, remove wheel and tire assembly. Unscrew rear (threaded) bushing, remove front bushing clamp bolt, remove bushing. Loosen clamp bolt in upper end of knuckle support, unscrew pivot pin (use Allen wrench).

Assembly—Place Neoprene seal over end of each upper control arm (so seals will be out of the way while installing pivot pin). With knuckle in upper arm yoke, enter pivot pin through eye in control arm and screw pin in knuckle support (with Allen wrench socket hole in pin toward front of car) until larger diameter center section is centered in



knuckle support. Hold knuckle support centered in control arm, thread rear bushing in control arm eye and on pivot pin, tighten bushing securely and make certain that support still centered in control arm yoke. Screw front bushing in on pivot pin until clearance between head of bushing and face of control arm is .020-.040". Use a wire hook to pull Neoprene bushings down over the ends of control arm so that they seat on pivot pin. Install front bushing clamp bolt. Adjust Caster and Camber (see instructions above).

Lower Control Arm Pivot Pin:—To remove, raise car install jack stand under inner side of lower spring seat, remove wheel and tire assembly, unscrew pivot pin (use socket wrench, remove pin through front arm), turn wheel to extreme outward position (will prevent knuckle support moving out at bottom), install block between upper control arm and cross-member to raise lower end of knuckle support clear of control arm yoke, unscrew bushing from support.

Assembly—Screw bushing securely in knuckle support from front end. Place new Neoprene seal on end of front lower control arm (so that it will be out of the way while installing pivot pin), place second seal on exposed end of bushing at rear of knuckle support. Thread pivot pin through front control arm, knuckle support bushing, and rear control arm while holding knuckle support centered in control arm yoke (if threads on pin and control arms do not index correctly, use 'C' clamp to compress arms slightly until pin enters rear control arm). Tighten pin securely. Use wire hook to pull Neoprene seal down over end of control arm so that it is seated on pivot pin between control arm and ahead of bushing, slip second seal off bushing so that it is seated on pivot pin.

Lower Control Arm Shaft (Frame Support):—To remove, disconnect stabilizer link at lower spring seat, remove front spring (see Spring Removal below), remove lower control arm pivot pin (see directions above), remove lower control arm assembly. Place assembly in vise, remove front and rear control arm shaft bushings. Take out two bolts mounting front control arm on spring seat, remove arm and shaft.

Assembly—Install steel retainer cup on each end of shaft with cupped shaped ends out, install new Neoprene seal on shaft next to each retainer, install shaft in control arm assembly with letter 'F' (forged on one bracket) toward front of car, bolt front control arm securely to spring seat (screw pivot pin through both control arm eyes first to maintain alignment while spring seat bolts are being tightened). Hold shaft centered between control arms, screw front and rear bushings on shaft and in control arms, tighten bushings securely, install assembly on car.

Front Stabilizer Shaft:—To remove, disconnect links by removing nut on upper end of link bolts and withdrawing bolts, then remove bolts from frame mounting brackets. To install stabilizer, make certain that steel spacer installed between frame and bracket, bolt bracket loosely to frame, install links, tighten bracket bolts only with links connected and car weight on wheels.

Stabilizer Links—Spacer must be installed on center of link bolt and steel retainer at outer end of bushings. Tighten link bolt nut to limit of threads.

SPRINGS:—Removal—Disconnect stabilizer link from lower spring seat, support weight of car on stand jack at inner side of lower spring seat, remove cotter pins and nuts from lower control arm shaft bracket bolts, drive out bolts and install long drift punch through bolt hole in bracket and cross-member to maintain alignment, raise care with chain hoist to remove spring pressure. Remove jack from beneath lower control arm allowing control arm and spring seat to drop down to free spring.

Assembly—Make certain that spring installed with ground end (flat surface) up and that lower end coil of spring fits in recess in spring seat. Reverse removal directions given above.

CHRYSLER 1934-35 TYPE

Used on:

CHRYSLER AIRSTRM. SIX, CA, CB ('34), C6 ('35).
CHRYSLER AIRSTRM. EIGHT, MODEL CZ (1935).
DE SOTO AIRSTRM. MODEL SF (1935).
DODGE SIX, MODELS DR, DS ('34).
PLYMOUTH DELUXE MODEL PE (1934).

CHECKING & ADJUSTMENT:—Check following points first before changing settings:

Tire Inflation—22 lbs. (front '34), 26 lbs. (rear '34 Coupes), 28 lbs, (rear '34 Sedans, all 1935).

Frame Height—Must be equal within ⅛" on both sides of car. Distance from top of lower control arm to underside of frame siderail should be 3½" (1934), distance from center line of lower control arm yoke pin to top of frame cross member should be 7¼-7⅜" without load (1935). See Springs below.

Toe In:—Measure to marks on center of tire tread. hub high, at rear, roll car ahead ½ revolution, repeat measurement at front. Should be 1/16-⅛".

To Adjust—Change length of each tie rod equally. Intermediate steering arm must coincide with center line of car with wheels straight ahead and tie rod lengths must be equal.

Caster:—Should be 1½° and must be within ½-2½° with car weight on wheels.

To Adjust—Loosen upper and lower control arm yoke nuts, remove lubrication fitting at front end of upper control yoke pin, loosen clamp bolts in upper end of knuckle support and yoke, insert special caster adjusting wrench through lubricant fitting hole, turn upper yoke pin so as to move upper end of support to rear to increase, or toward front to decrease caster.

Camber:—Should be ½° and must be within ¼-1°. with car weight on wheels. Camber affected by caster adjustment. Check when caster changed.

To Adjust—Jack up car with jack placed under lower control arm. Disconnect tie rod at wheel end. Remove upper control arm yoke nut, pull yoke out of upper control arm, remove spacer washer on yoke bolt to decrease camber, or transfer spacer from under nut to yoke bolt to increase camber. Extra spacers must be placed under nut on inner end of yoke bolt and must not be discarded.

CONTROL ARM ASSEMBLY:—Upper Control Arm Yoke Pin—Place yoke in position on upper end of knuckle support, screw threaded pin in support from front end (wrench recess toward front) until it is centered in support. Screw plain bushing in front end of yoke until clearance between bushing shoulder and front face of yoke is .040". Screw threaded bushing in rear end of yoke and tighten with 100 lb. force on 24" wrench. Tighten clamp bolt in yoke at front bushing. Set caster and then tighten clamp bolt in knuckle support.

Lower Control Arm Yoke Pin:—Center lower yoke on lower end of knuckle support, assemble plain bushing in rear end of yoke so that clearance between shoulder on bushing and face of yoke is .040". (inner end of bushing should be flush with inner face of yoke). Screw threaded pin in through knuckle support and into bushing keeping yoke centered. Install tapered locking pin in support and peen head. Screw threaded bushing into place in yoke and on pin and tighten with 100 lb. force on 24" wrench. Tighten clamp bolt in yoke holding plain bushing.

Lower Control Arms (1934 Models):—Mounted at inner end of individual threaded studs screwed in bushings in arms and bolted to anchor plate. Screw studs in or out of bushings until control arm bosses are centered in clearance pockets in anchor plate with bolt holes in stud and anchor plate lined up.

Lower Control Arms (1935 Models):—Mounted at inner end on shaft bolted to anchor plate by bracket at each end. To install, position control arm on bracket shaft so that clearance between inner face of arm and bracket equal at each end. Screw plain bushing in rear arm until clearance between head and face of control arm is .040". Screw threaded bushing in front arm and tighten securely with 100 lb. force on 24" wrench. Tighten clamp bolt on rear plain bushing.

SPRINGS:—Spacers installed in spring cup on lower control arm under metal bumper to level frame. On 1934 cars, one extra spacer installed on drivers side. If frame height not equal, install spacer #623114 (1934 models), #633295 (1935 models) on low side.

CHRYSLER 1936 TYPE

Used on:

CHRYSLER AIRSTREAM SIX, MODEL C7 (1936).
CHRYSLER AIRSTREAM EIGHT, MODEL C8 ('36).
DE SOTO AIRSTREAM SIX, MODEL S1 (1936).

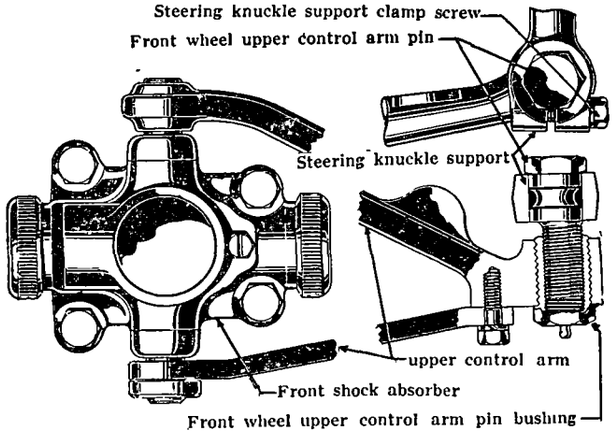
CHECKING AND ADJUSTMENT:—Check these points first:

Tire Inflation—28 lbs. (all models).

Frame Height—Should be 7¼-7⅜" measured from center of lower control arm yoke pin (knuckle support lower pivot pin) to top of frame cross-member. Allowable variation ⅛" plus or minus but both sides of car must be equal within ⅛". Adjusted by inserting spacer washer Part No. 657770 under spring on driver's side.

Toe In:—Measure to marks on center of tire tread hub high, at rear, roll car ahead ½ revolution, repeat measurement. Toe in should be 0-⅛".

To Adjust—Loosen tie rod end clamp bolts, set long tie rod at exactly 31 7/32", adjust length of shorter tie rod for toe in. Ball studs must be centered in tie rod slots when tightening clamp bolts to assure sufficient angular rotation of tie rod for extreme turns.



Caster:—Should be 1½°. Controlled by distance upper pivot pin screwed in bushing in upper (shock absorber) arm.

To Adjust—Loosen clamp bolt in knuckle support upper end, turn eccentric pin (hexagonal head at rear) in or out of bushing until clearance is exactly ⅜", tighten clamp bolt, check caster. This adjustment affects camber and should be made first.

Camber:—Should be +¼° and within limits of —¼° to +½°. Controlled by position of eccentric shoulder of upper pivot pin in knuckle support.

To Adjust—Loosen clamp bolt at upper end of knuckle support, and with correct Caster (⅜" clearance—see above), turn eccentric pin less than ½ revolution in either direction, recheck camber. Total adjustment obtained by ½ revolution of pin. Caster affected only slightly by this adjustment. Toe in is changed and must be checked after Camber adjustment made.

CONTROL ARM ASSEMBLY:—First screw knuckle support lower pin in support centrally (equal projection at each end), drive in taper lock pin and peen in place in support. Center support in lower control arms, screw threaded bushings on pivot pin and in control arm eyes loosely until shoulders contact outer faces of control arm. Center frame bracket shaft or bar in eyes on inner end of control arm. Screw threaded bushings on bar and in control arm eyes loosely until shoulders contact outer faces of control arm. Tighten all bushings with approximately 100 lbs. force on 24" lever. Tighten spring seat bolts securely, striking bolt heads with 2 lb. hammer to seat serrated washers. Check assembly to see that it moves up and down freely without binding.

SPRINGS:—See table below for type used on each car. If frame height not correct, or dimensions on right and left sides of car vary by more than ⅛", replace springs or install spacer between lower end of spring and silencer on low side.

Car Model	Spring Part Number Std.	With Fenderwells
Chrysler C7 ('36)	658462	658464
Chrysler C8 ('36) .	660722①	660724②
7 Pass. Cars	660724	660726
DeSoto S1 ('36)	658464	

①—Replaced by 658464 (Serial No. 6714558 Up).
②—Replaced by 663466 (Serial No. 6714360 Up).

CHRYSLER 1937-38 TYPE

Used On:

CHRYSLER ROYAL, MODEL C16 (1937)
CHRYSLER IMPERIAL, MODEL C14 (1937)
CHRYSLER CUSTOM IMPERIAL, MODEL C15 ('37)
CHRYSLER ROYAL, MODEL C18 (1938)
CHRYSLER IMPERIAL, MODEL C19 (1938)
CHRYSLER CUST. IMP., MODEL C20 (1938)
DE SOTO, MODEL S3 (1937)
DE SOTO, MODEL S5 (1938)

1937 TYPE:—Design changed so that Shock Absorber is not incorporated in upper control arm (Direct Acting type used). Threaded bushing at outer end of upper control arm has been discontinued and eccentric bushing is threaded on upper control arm outer end and seated in upper end of knuckle support (locked by clamp bolt).

1938 TYPE:—Design same as type used in 1937 except for the following points:

Control Arm Seals:—Rubber seals now used at all moving points on upper and lower control arms (see Control Arm Assembly below).

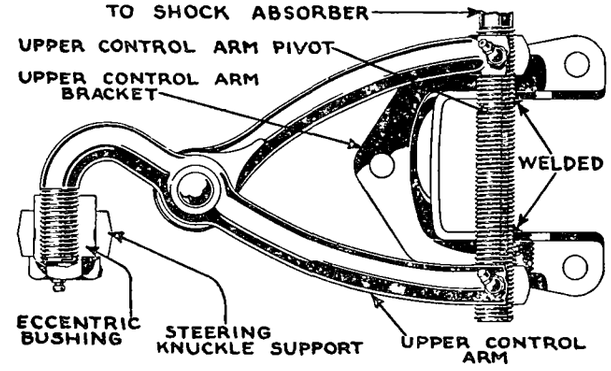
Shock Absorber Mounting:—Linked to bolt at midpoint of upper control arm at top, outer end of lower control arm at bottom, this mounting results in reduced shock absorber piston movement.

Upper Control Arm Mounting:—Pivot bar at inner end of upper control arm bolted directly to frame bracket (take out pivot bar bolts to remove control arm). Control arm mounted on bar by threaded bushing at rear, plain bushing (locked by clamp bolt in control arm) at front. Both bushings threaded on pivot bar and provided with lubricant fittings.

CHECKING & ADJUSTMENT:—Car weight must be on wheels. Adjust front bearings and check these points first:

Tire Inflation—Inflate evenly to correct pressure.
King Pin Inclination—4¾-6° crosswise (all mod'ls).
Frame Height—Measure from underside of lower spring seat to top surface of frame cross-member on center line of spring. Should be 9¾-9⅞" (S5, C14, C18), 9½-9⅝" (C19), 10¼-10⅜" (C20), 10½-10⅝" (C15), 9⅞-10" (C16, S3 except 7 Pass.), 10 1/16-10 3/16" (C16, S3, 7 Pass.) plus or minus ⅛" but must be equal within ⅛" on both sides. Correct by installing special spacer washer between spring and silencer in lower spring seat.

Toe In:—Measure to marks at center of tire tread at rear of wheel and hub high, roll car ahead ½ wheel revolution, repeat measurement to same marks at front. Toe in should be 1/16" and must be within limits of 0-⅛".



To Adjust (Except C15, C20). Loosen clamp bolts and first set longer tie rod so that length between ball end centers is exactly 30 15/16" (C14), 31 7/32" (C16, S3), 31⅝" (C18, S5), 30 25/32" (C19). Then adjust toe in by changing length of shorter tie rod in same manner.

To Adjust (C15, C20). Loosen tie rod bolts and turn both tie rods equally. Tie rod lengths must be equal after toe in adjustment completed. Correct by lengthening short rod and shortening long rod equal amounts.
NOTE—When tightening tie rod clamp bolts see that both ball studs centered in rod end slots to allow necessary angular rotation of the tie rod in operation. With wheels straight ahead, steering gear pitman arm must be approximately parallel to center-line of car and steering wheel center spoke must point straight down. Correct by removing steering wheel and engaging it on shaft in proper position.

Caster:—Should be 1½°. Controlled by distance knuckle support upper eccentric pin screwed on threaded end of upper control arm. Caster limits are ½-2½° (except C15, C20), 1-3° (C15, C20) and caster should not require adjustment unless control arm assembly has been dismantled.

To Adjust—Loosen clamp bolt in upper end of knuckle support, turn eccentric bushing (hexagonal head at rear) in or out. Bushing must not be turned in until it binds on control arm (at least one thread must be exposed) and caster must be set exactly with no variation. Tighten clamp bolt, check Camber.

CHRYSLER 1937-38 TYPE CONT.

Camber:—Should be +¼° and within limits of —¼° to +½°.

To Adjust—Adjusted in same manner as caster except that eccentric bushing must not be turned more than ½ revolution from point where correct caster setting secured (½ revolution provides entire range of adjustment) and greater movement will disturb caster setting. Recheck toe in.

Steering Geometry:—With outer wheel turned exactly 20°, inner wheel should be turned exactly 22°40′ (C18, S5 except 7 Pass.) 22°50′ (C18, S5 7 Pass. models), 22°0′ (C19), 22°15′ (C20). No adjustment provided. If not correct check for bent steering arms.

CONTROL ARM ASSEMBLY:—Lower Control Arm. Center lower control arm pin in lower end of knuckle support, drive in tapered locking pin, peen in place. Assemble complete lower assembly (knuckle support, control arms, spring seat, inner shaft) loosely. Hold knuckle support centered in control arms, turn bushings at front and rear in loosely, hold inner support shaft centered in control arm, turn bushing at each end in loosely, tighten all bushings with 100 lb. force on 24″ bar. Tighten spring seat bolts and seat serrated washers by srikking bolt heads with 2 lb. hammer. Check assembly to see that it moves freely without binding.

Upper Control Arm—Mounted at inner end on threaded pin which is spot welded in bracket. Should be removed by taking out bracket bolts. To assemble knuckle support on control arm, insert threaded outer end of control arm in knuckle support hole, turning bushing in on control arm end from rear, install clamp bolt in support.

CONTROL ARM ASSEMBLY (1938):—Serviced in same manner as above (except upper control arm frame mounting—see description above). See that seal is in place on outer end of upper control arm before installing eccentric bushing (seal fits over end of bushing), on knuckle support lower pin (at each side of support), and on each end of frame bracket shaft at inner ends of lower control arms before assembling the lower arms and spring seat.

SPRINGS:—See table below for type used on each car. If frame height not correct, or dimensions on right and left sides of car vary by more than ⅛″, replace springs or install spacer between lower end of spring and silencer on low side.

Car Model	Spring Part Number Std.	With Fenderwells
Chrysler C16 ('37)	670002	670004
7 Pass. Cars	660723	660725
Chrysler C14 ('37)	658465	660724
Chrysler C15 ('37)	674532	674534
Chrysler C18 ('38)	670002	.....
7 Pass. Cars	670004	.....
Chrysler C19 ('38)	670004	663466
Chrysler C20 ('38)	685553	674534
Extreme Duty	688753	688755
DeSoto S3 ('37)	670002	.....
7 Pass. & Limo.	660723①	.....
DeSoto S5 ('38)	670001	.....
7 Pass. & Limo.	670004	.....

①—Replaced by No. 660722.

SHOCK ABSORBERS:—Monroe Direct Acting type (not part of front suspension). See separate article for complete data.

CHRYSLER 1939 TYPE

Used On:

CHRYSLER ROYAL, MODEL C22 (1939)
CHRYSLER IMPERIAL, MODEL C23 (1939)
CHRYSLER CUSTOM IMPERIAL, C-24 (1939)
DE SOTO, MODEL S6 (1939)
DODGE LUXURY LINER, MODEL D11 (1939)
PLYMOUTH, STD. & DELUXE P7, P8 (1939)

TYPE:—Design used on Chrysler and DeSoto models is same as on corresponding 1938 cars (see preceding article). This design modified for Dodge and Plymouth models as follows:

Dodge, Plymouth Models (except 7 Pass.)—Lower coil of spring not ground flat and spring seat on lower control arm provided with recess to engage spring end (silencer formed to fit spring seat). Spacers cannot be installed to correct frame height on these models and springs must be replaced. Rubber bumpers mounted on control arms (upper bumper at shock absorber mounting stud, lower bumper on spring seat adjacent to spring.

Dodge, Plymouth (7 Pass.)—Design same as for other Chrysler models (spring lower coil ground and spacers may be installed).

CHECKING & ADJUSTMENT:—Car weight must be on wheels. Adjust front wheel bearings, inflate all tires evenly to correct pressure and check following points first:

Frame Height (Chrysler, De Soto, Dodge & Plymouth 7 Pass.):—Measure from underside of spring seat on lower control arm to top of frame cross-member on center-line of spring. Should be 9¾″ (Chrysler C22, C23, De Soto), 10¾″ (Chrysler C24), 9⅝-9⅞″ (Dodge 7 Pass.), 9⅝-9¾″ (Plymouth 7 Pass.). Allowable variation between right and left side of car is ⅛″. Adjust by installing spacers between lower end of spring and silencer.

Dodge, Plymouth (except 7 Pass.)—Frame height measurement not made in same manner as on other models. Measure from top of spring seat on lower control arm (near spring seat inner bolt) to lower plate of front cross-member at frame side rail. Should be 6-6¼″ (Dodge), 6-6⅛″ (Plymouth). Allowable variation between right and left sides of car is ⅛″. Adjust by replacing springs (not possible to install spacers).

Kingpin Inclination:—4¾-6° (Chrysler C22, C24, De Soto—Same as 1938), 5¾-7° (Chrysler C23), 5¼-6½° (Dodge, Plymouth except 7 Pass.), 4¾-6° (Dodge, Plymouth 7 Pass.).

Toe In:—1/16″ (0-⅛″) for all models—same as 1938. When checking toe in, measure to marks on center of tread at rear of wheel and hub high, roll car ahead ½ wheel revolution and repeat measurement to same marks at front.

Adjustment (except C24)—Set long tie rod first so that length between ball centers is 31⅝″ (Chrysler C22, De Soto S6), 30 25/32″ (Chrysler C23), 31 11/16″ (Dodge, Plymouth), then adjust short (left hand) tie rod for correct toe in.

Adjustment (Chrysler C24)—Center steering. Adjust both tie rods equally for toe in. See that tie rod lengths equal after adjusting. Correct by lengthening short rod and shortening long rod equal amounts.

NOTE—When tightening tie rod clamp bolts, see that both ball studs centered in rod end slots to allow for angular rotation of tie rod in operation.

Caster:—Limits are ½-2½° (Chrysler C22, De Soto S6), 1-3° (Chrysler C24), Neg. ½°-Pos. 1½° (Chrysler C23, Dodge & Plymouth except 7 Pass.), Pos. ½° —Pos. 2½° (Dodge & Plymouth 7 Pass.). Controlled by amount which knuckle support upper pivot bushing (eccentric camber adjustment) turned in on upper control arm. Not adjustable and should not require attention unless disassembled. See Camber Adjustment.

Camber:—Should be Pos. ¼° (Limits Neg. ¼° to Pos. ¾°) for Chrysler C22, C24, De Soto S6), 0° (Limits Neg. ¼° to Pos. ½°) for Chrysler C23, Dodge & Plymouth except 7 Pass. Plus ¼° (Limits Neg. ¼° to Pos. ¾°) for Dodge & Plymouth 7 Pass.

Adjustment—Same as for 1938 models. Turn eccentric bushing on knuckle support upper pivot pin not more than ½ revolution in either direction from point where correct caster secured (complete range of adjustment secured in ½ revolution).

NOTE—Eccentric bushing must not be turned up so that it binds on upper control arm (at least one or two threads on arm must be exposed beyond end of bushing).

CONTROL ARM ASSEMBLY:—Upper and lower control arms serviced in same manner as on 1938 car models (see preceding article) except as follows:

Dodge & Plymouth Models—When the upper and lower control arms are being assembled, check the distance from the front face of front lower control arm to center line of mounting holes in shaft bracket—should be 2 5/32″ (except 7 Pass.), 2¼″ (7 Pass.). Also check distance from rear face of rear upper control arm to center line of shaft mounting hole—should be 1 3/16″ (except 7 Pass.), 1 9/16″ (7 Pass.).

SPRINGS:—If frame height not correct and equal for both sides of car within ⅛″ (see above), install spacer between spring and silencer at lower end (types with lower coil ground flat only) or replace spring. Spacer #657770 installed at lower end of spring on drivers side of car (top of spring on types with lower coil not ground flat).

Car Model	Spring Number
Chrysler C22	670003
De Soto S6	670002
De Soto Taxicab	660722
Chrysler, De Soto 7 Pass	670004
Chrysler, De Soto 18″ Wheels	661381
Chrysler, De Soto 7 Pass. & 18″ W	661383
Chrysler C23	663466
Chrysler C23—Fender wells	660724
Chrysler C24	685553
Chrysler C24 Fender Wells (First)	674534
Chrysler C24 Fender Wells (Later)	852873
Dodge Spec. D11	695233
Dodge De Luxe D11	695234
Dodge 7 Pass	670003
Dodge 18″ or 20″ Wheels	695693
Plymouth P7, P8	695232
Plymouth 7 Pass	670003
Plymouth 18″ or 20″ Wheels	695692

OLDSMOBILE 1934-35 TYPE

Used on:

SIX, MODELS F-34 (1934), F-35 (1935).

EIGHT, MODELS L-34 (1934), L-35 (1935).

CHECKING & ADJUSTMENT:—Check the following points first before changing Front Suspension settings:

Tire Inflation—35 lbs. (F-34), 30 lbs. rear, 25 lbs. front (F-35), 25 lbs. (L-34, 35).

Frame Height—Bounce car up and down several times to allow frame to assume normal position (height should be equal on both sides of car).

Toe In:—Roll car ahead one revolution. Check between tires 10" up from floor. Should be 1/8-3/16". Adjust by changing length of each tie rod equally. Wheel distance from center gauge plate should be 26¼" (Six), 25¾" (Eight) right and left with wheels straight ahead. Correct by lengthening one tie rod and shortening second rod equal amounts.

Caster:—Machined bosses provided on front of knuckle support for protractor mounting. Caster should be 3° (F-34), 2° (L-34), 1½-2¼° (F-35, L-35). If measured from vertical line top boss should be 3/16-9/32" behind lower boss (1935 models).

To Adjust—Loosen yoke nuts in upper and lower control arms, loosen clamp bolt in upper end of knuckle support, remove lubrication fitting in front bushing of upper support arm yoke, insert Allen wrench, turn threaded pin clockwise to increase, or counter-clockwise to decrease caster.

Camber:—Should be 1/8-1°. If measured from vertical line, wheel felloe at top should be 3/16-9/32" outside felloe at bottom.

To Adjust—Jack up car so that weight is off wheel. Disconnect tie rod at wheel end. Remove nut on upper control arm yoke (if camber to be increased) or lower control arm yoke (if camber to be decreased), pull yoke out of arm, install special washer on yoke bolt between yoke and arm, reinstall yoke and tighten nut. Washers furnished 1/16" thick and change camber 1/3° or 3/32".

CONTROL ARM ASSEMBLY:—Knuckle Support Upper Pivot Pin—Hold control arm yoke in position on upper end of knuckle support, screw threaded pin into control arm until end of pin is flush with front face of yoke with 5/16" clearance between front face of support and inner face of yoke, tighten clamp screw. Screw in front bushing until clearance between yoke and support arm decreased to ¼", screw rear bushing on pin and in yoke until it is tight. Clearance between hexagonal portion of front bushing and front face of yoke should be 1/32" with rear bushing tight Tighten clamp bolt holding front bushing.

Knuckle Support Lower Pivot Pin:—To assemble, place yoke in position on knuckle support, screw threaded pin in support until centered, drive locking pin into place in support. Screw plain bushing on pin in clamp bolt side of yoke until clearance between hexagonal head of bushing and face of yoke is 1/32" with yoke centered on support. Screw threaded bushing in opposite end of yoke until tight, tighten clamp bolt in plain bushing.

Lower Control Arm:—To install, position control arm on bracket shaft so that distance from shaft bracket to inner face of arm boss is equal at each end. Screw threaded bushing in arm at front end (start threads in arm first), tighten securely. Screw plain bushing into arm at rear until clearance between head and face of arm bushing is 1/64", tighten clamp bolt.

SPRINGS:—Not interchangeable between models. The springs on 1935 models may be identified by length and color (2 daubs of paint on each spring) as follows:

Model	Free Length	Color
F-35 (Spare at rear)	14⅛"	Blue
F-35 (Fender Wells)	14⅜"	Green
L-35 (Spare at rear)	13 15/16"	Red
L-35 (Fender Wells)	14¼"	Yellow

SHOCK ABSORBERS:—Front shocks located on frame by close fitting bolts. Shims used between shock absorber and frame must be replaced when reinstalling units.

OLDSMOBILE-PONTIAC 1936-38 TYPE

Used On:

OLDSMOBILE SIX, MODEL F-36 (1936)
OLDSMOBILE EIGHT, MODEL L-36 (1936)
OLDSMOBILE SIX, MODEL F-37 (1937)
OLDSMOBILE EIGHT, MODEL L-37 (1937)
OLDSMOBILE SIX, MODEL F-38 (1938)
OLDSMOBILE EIGHT, MODEL L-38 (1938)
PONTIAC SIX, MODEL 37-26CA (1937)
PONTIAC EIGHT, MODEL 37-28CA (1937)
PONTIAC SIX, MODEL 38-26DA (1938)
PONTIAC EIGHT, MODEL 38-28DA (1938)

1938 TYPE:—Design changed from that used in 1937 as follows:

Control Arm Seals—Rubber seals installed at inner and outer ends of lower control arms.

Lower Control Arm Bushings—Hardened threaded bushings installed in inner ends of lower control arm on pivot shaft (arm formerly screwed directly on shaft).

CHECKING & ADJUSTMENT:—Car weight must be on wheels. Adjust front wheel bearings and check following points first:

Tire Inflation—Oldsmobile 24 lbs. (except rear tires on Six—28 lbs.). Pontiac 25 lbs. minimum (front), 30 lbs. minimum (rear).

Wheel Runout—Must not exceed 1/8". Mark high spot on tire and place wheel with mark at top vertically (to check toe in) or at side (to check caster and camber).

Kingpin Inclination—5°51' (Oldsmobile '36), 4°51' 10" (Oldsmobile '37-38), 4½-5° (Pontiac '37-38).

Frame Height—Car must be level crosswise of frame. Check by measuring distance from lower surface of frame siderail to top surface of lower spring seat on each side. Distances must be equal (replace spring if frame uneven due to spring sag). On Oldsmobile models, level frame while checking front end by inserting 2" wood blocks, Tool No. J-886 between upper control arm and frame flange.

Toe In:—Roll car forward one revolution with wheels straight ahead before checking (on Oldsmobile, use Centering gauge No. J-1023 to determine wheel position, distance to brake backing plate on each side should be 26¼" (F-36), 25¾" (L-36), 26 11/16" (all 1937-38 models). Measure toe in between tires 10" up from floor at front and rear (runout mark must be at top and wheel should not be disturbed while taking measurements). Toe in should be 1/8-3/16" (Oldsmobile), 0-1/16" (Pontiac).

To Adjust—Loosen clamp screws at each end of each tie rod, turn tie rods equally in direction of forward wheel revolution to decrease toe in, or opposite direction to increase toe in.

Caster:—Machined bosses provided on steering knuckle support front face for protractor mounting. Caster should be 1½-2¼° (Oldsmobile 1936), ¼-1° (Oldsmobile 1937), 0 to Neg. ¾° (Oldsmobile 1938), Neg. ¾ to Neg. 1¼° (Pontiac 1937-38). These negative figures are Reverse Caster (kingpin tilted forward at top). Caster must be equal for both wheels within ½°.

To Adjust—Loosen steering knuckle support clamp bolt, remove lubrication fitting in upper pivot pin front bushing, insert Allen wrench (J-720), turn pivot pin to thread support forward or backward on pin. Camber affected by this adjustment unless pin turned in complete revolutions only (start and stop at same point). Check camber.

Camber:—Should be 1/8 to 1° (Oldsmobile 1937-38), 3/8-¾° preferred (Service limits Neg. ½° to Pos. 1°) for Pontiac 1937-38 models. Must be equal for both wheels within ½°.

To Adjust—Same as Caster Adjustment (above) except that pin should be turned less than 180°. Pin is eccentric and maximum adjustment secured with one half turn. This adjustment changes Caster but not outside limits as given above if Caster set first at correct figure (see Caster adjustment above).

Steering Geometry (Toe out on Turns):—With outer wheel turned exactly 20°, inner wheel should be turned 22½-23½°. Replace steering arms to correct (no adjustment provided).

CONTROL ARM ASSEMBLY:—Lower Control Arm—Control arms threaded on ends of shaft bolted to cross-member. Spring seat and jack pad must be removed and arms turned on shaft separately until distance from inner face to center line of shaft bracket bolt holes is 1 23/32" (front arm—1936), 1 7/32" (rear arm—1936), 1 7/32" (both arms—Oldsmobile 1937-38, Pontiac 1937), 1⅜" (both arms—Pontiac 1938). With spring seat and jack pad in place, distance between eyes at outer end of control arm should be 2⅜" (all models).

1938 Service Note:—When installing new bushings in lower control arm (or tightening old bushings before assembling arms), tighten bushings with 150 lb. force on 16" wrench. With bushing tight there should be no clearance between bushing flange and arm. See that rubber seals are in place on pivot shaft and on knuckle support lower pivot pin (at each side of knuckle) before installing control arms.

New Spring Seats—Two holes must be drilled in seat after one arm is assembled. Bolt spring seat and bumper pad in place with two bolts, use bolt holes in control arms as pilot and drill two holes with 7/16" drill.

Knuckle Support Lower Pivot Pin:—Knuckle support threaded on bushing which is threaded on pivot pin. Pin threaded through control arm eyes and held by nut on rear end. To assemble, screw bushing in support lower end from rear until tight, hold support midway between lower control arms, thread pivot pin in from front through bushing and rear arm. Clearance in arms at either end of bushing must be 1/8" and exactly equal within 1 thread. Install lock washer and nut on pin.

1937 Knuckle Support Upper Pivot Pin—Eccentric upper pivot pin is threaded in support, in plain bushing in front shock absorber arm, and in threaded bushing in rear arm. Held by clamp bolt

OLDSMOBILE-PONTIAC 1936-38 TYPE CONT.

in knuckle support. To install, hold knuckle support in place in upper control arm, screw pivot pin in place in support (adjusting wrench hole end toward front) so that larger center section is centered in support, tighten clamp bolt. Start front bushing on pin until it engages front arm, center support in control arm yoke, thread rear bushing in on pin and in control arm, tighten securely. Turn front bushing in until clearance between head of bushing and front face of arm is 1/32", tighten clamp bolt.

NOTE—Clearance between threaded pins and bushings of front suspension should be .014-.018". Threaded construction requires this clearance for best performance and clearance must not be reduced.

SPRINGS:—Not interchangeable between models. If car is not level, check over-all length of springs and replace if sagged. When installing spring see that spring is centralized by four lugs in cross-member at top and spring seat at bottom.

Oldsmobile Spring Specifications

May be identified by 2 daubs of paint as indicated.

Model	Inside Diam.	Color Tracer
F-37(all)	4 3/64"	Blue
L-37 (Spare at rear)	4 3/64"	Red
L-37 (Fender wells)	4 3/64"	Yellow

1938 Oldsmobile Springs

Model	(Spare at Rear)	(Fender Wells)
F-38	Brown	
L-38	Orange	Green

Pontiac Spring Specifications

Model	Outside Diam.	Free Length
Six 1937-38	5 3/16"	14"
Eight 1937-38	5 3/16"	14⅜"

SHOCK ABSORBERS:—Delco, double acting type. Positioned on frame by close-fitting bolts. See separate article for complete data and valve calibration.

OLDSMOBILE-PONTIAC 1939 TYPE

Used On:

OLDSMOBILE MODELS
SERIES 60 SIX, MODEL F-39 (1939)
SERIES 70 SIX, MODEL G-39 (1939)
SERIES 80 EIGHT, MODEL L-39 (1939)

PONTIAC MODELS
QUALITY SIX, MODEL 39-25 (1939)
DELUXE SIX, MODEL 39-26 (1939)
DELUXE EIGHT, MODEL 39-28 (1939)

TYPE:—Design same as for 1938 except as follows: **Lower Control Arm Assembly**—New type channel-section type arms which are riveted to spring seat (assembly cannot be dismantled). Seals are used on control arm shaft at control arm bushings (inner end) and on pivot pin at arm (outer end). **Spring**—New type with top end only ground flat. Springs must be installed with this flat end up and end of lower coil fitted in recess in lower spring seat (coil end must register with hole in spring seat). **Steering Linkage**—New type linkage with center (non-adjustable) tie rod linked between steering gear pitman arm and idler arm mounted on right hand frame side rail with individual adjustable tie rods linked between the center tie rod and each wheel.

CHECKING & ADJUSTMENT:—Car weight must be on wheels. Adjust front wheel bearings and check following points first:

Tire Inflation—Inflate tires evenly as follows: Oldsmobile—24 lbs. (front), 26 lbs. (rear). Pontiac —27 lbs. (Quality Six 6.00x16), 30 lbs. (Others 6.00x 16), 25 lbs. (Others 6.50x16).

Wheel Runout—Check wheel and tire eccentricity or runout. Correct if in excess of ⅛". Mark high point on tire and turn tire so that mark at top (vertically) when checking toe in and toe out, or at side (midway between top and bottom) when checking Caster, Camber, and Kingpin Inclination.

Kingpin Inclination—4°51'10" (Oldsmobile), 4½-5° (Pontiac) crosswise.

Toe In Adjustment:—To adjust, loosen clamp bolts on adjuster near wheel end of each side tie rod, turn adjuster on each tie rod equally. Toe in should be ⅛-3/16" for Oldsmobile models, 0-⅛" for Pontiac models (same as for 1938).

NOTE—Make certain that tie rod end ball stud is properly aligned in seat before tightening clamp bolts.

Caster:—Should be 0° to Negative ¾° (all Oldsmobile and Pontiac models) and equal for both wheels within ½°. Adjusted in same manner as in 1938 (loosen clamp bolt at upper end of steering knuckle support, remove lubricant fitting on upper pivot pin front bushing, insert Allen wrench through lubricant fitting hole, turn eccentric pivot pin clockwise to increase caster, counter-clockwise to decrease caster, in complete turns only—camber adjustment will be disturbed if pin rotated in partial turns only).

Camber:—Should be ⅛-1° and equal within ½° for both sides of car. Pontiac preferred camber is ⅜-¾° with service limits of Neg ½° to Pos. 1°. Camber can also be checked by measuring distance from square placed on level floor to wheel felloe at top and bottom. Distance at top should be 1/32-9/32" less than at bottom (wheel should lean out at top) and both sides of car must be equal within 9/64". Adjust in same manner as for 1938 cars (turn upper pivot pin with Allen wrench in same manner as for Caster adjustment, do not turn pin more than 180° which provides entire range of adjustment—turning pivot pin more than this amount will change caster setting excessively).

Steering Geometry (toe out on turns):—With outer wheel turned exactly 20°, inner wheel should be turned 23° plus or minus ½° (all models). Correct by replacing steering arms (no adjustment).

CONTROL ARM ASSEMBLY:—Lower Control Arm—Serviced as an assembly and not interchangeable on right and left sides of car. Pivot shaft at inner ends of control arms can be removed by taking out bushing in each arm. To install shaft, install tool J-1052 or block between arms adjacent to shaft eyes so that distance between inner faces of arms at shaft eyes is exactly 11½" (necessary to prevent distortion of arms when bushings installed). Install shaft with seal on each end adjacent to mounting bracket, thread bushing in on shaft and in arm simultaneously (new bushings not threaded on outside and cut their own thread as they are turned in), tighten bushings with 150 lb. pull on 16" wrench (200 lbs. on 12" wrench) so that there is no clearance between bushing flange and control arm. See that distance between shaft bracket mounting holes and inner face of control arm is exactly 1½" at each end (turn shaft to centralize), and that seal ends lap over bushings.

Front Stabilizer Bar:—To remove, remove nut on upper end of link bolts, pull bolts out from below. Remove bracket bolts at stabilizer frame mounting, remove stabilizer bar. NOTE—On Oldsmobile L-39 Eight, radiator lower support (removable cross-member) must be removed with stabilizer (radiator need not be removed but must be supported while cross-member is out of car). Stabilizer bar rubber bearings (frame mounting) are serviced separately. When installing stabilizer links, make certain that spacer installed on bolt between arm and control arm mountings, place one rubber block and one steel retainer on both top and bottom of stabilizer arm and control arm bracket, tighten bolt nut to limit of threads and install locknut.

SPRINGS:—Removal & Installation—To remove springs, disconnect stabilizer link and tie rod, support car with chain hoist, install jack under spring seat on lower control arm, remove knuckle support lower pivot pin, raise car or lower jack under lower control arm to relieve tension on spring, remove spring. Install in same manner.

NOTE—Install spring with ground (flat) end up and centered on lugs on frame cross-member. Spring lower end (not ground flat) must be fitted in recess in spring seat on lower control arm.

Spring Identification—Oldsmobile springs have part number stamped on outside of one end coil and paint mark as follows:

Oldsmobile Springs

Model	Diameter of Wire	Color Mark
F-39 '60'	.594"	Red
G-39 '70'	.608"	Yellow
L-39 '80'	.635"	Brown

Pontiac Springs

Model	Diameter of Wire	Free Length
39-25 Qual. 6	.630"	13 31/32"
39-26 Deluxe 6	.630"	14 3/16"
39-28 Deluxe 8	.635"	14 7/16"

PONTIAC KNEE-ACTION

Used On:

DE LUXE SIX, 701-A (1935), 36-26A (1936).
EIGHT, 603 (1934), 605 (1935), 36-28 (1936).

DESCRIPTION:—Entire suspension unit (wheel support arm, coil springs, shock absorber) pivoted on kingpin at outer end of frame cross-member and turns with wheel. Wheel support arm mounted on support arm shaft carried on needle bearings in housing. Crank in inner end of shaft has a needle bearing mounted roller pin on end which engages spring guide. Two coil springs (outer main spring, inner control spring) mounted between guide and upper spring seat which is positioned in housing by adjusting plug at upper end. Shock absorber units (independent compression and rebound units) mounted in front of case act directly on support arm lever. Entire unit filled with oil. An additional radius rod linked to wheel and support housing used to guide wheel.

CHECKING:—Place car on level, with weight on wheels (roll ahead several revolutions if front wheels previously jacked up. Check following points first. **Tire Inflation**—Front wheels not less than 25 lbs. Rear wheels not less than 30 lbs.

Front Wheel Bearings—Adjust bearings, check king pins and tie rod ball ends for looseness.

Frame Leveling—Frame must be level from front to rear. On Pontiac, check height of front tubular cross-member lower face at center (15 11/16") and lower face of rear frame horns (19") level with jacks. If frame not level crosswise, see Suspension Unit Height Adjustment below.

Kingpin Inclination:—7° (1934-35), 8¾° (1936). No adjustment provided other than bending cross-member.

Camber:—1-2° (1934-35), —¼ to +¼° (1936). with car weight on wheels or wheel spindles. No adjustment provided other than bending cross-member.

Caster:—King-pin caster 0° with frame level. Caster effect obtained by trailing wheel behind center line of king-pin. No adjustment provided other than bending cross-member.

Toe In:—1/32-⅛" (1934), 0-1/16" (1935-36). Adjusted by changing length of tie rod in usual manner.

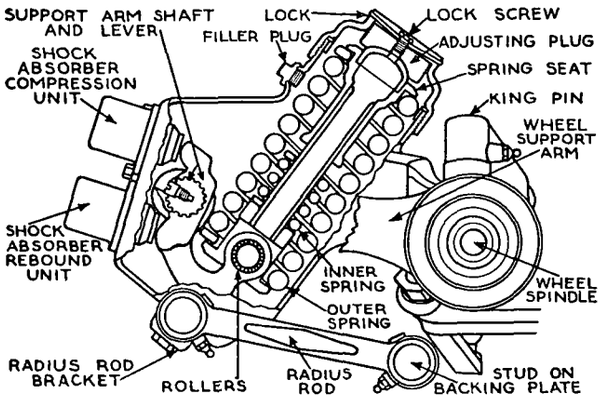
SERVICING:—To Remove Suspension Unit—Jack up car, remove wheel, disconnect brake hose at frame (wheel brake must be 'bled' when replaced), remove hub and brake assembly, disconnect radius rod bracket at lower end of suspension unit, turn suspension unit outward, lift off brake assembly supporting radius rod, remove steering arm nut, drive steering arm out using special brass drift, remove king-pin lockpin and plug lockrings, blow out upper plug using special plug remover J-746, drive king-pin and lower plug out through bottom using brass drift. Loose needle bearings will fall out at this point. On Pontiac 1936 models, needle bearings not used and conventional bronze bushings are installed at upper and lower ends.

Disassembly:—Clean outside of unit thoroughly and clamp in vise at radius rod bracket boss. Remove capscrew from adjusting plug, lift out plug lock, install special K-477 adjusting nut wrench in plug slot securing wrench with capscrew, remove adjusting plug (this relieves tension on outer spring), remove housing cover, lift spring upper seat assembly out, remove outer spring (if spacer forward under spring this must be reinstalled if old spring used again—spacer for new spring furnished attached to spring), lift out inner spring, drain fluid from case, back off shock absorber capscrews slowly and evenly and remove shock absorber units (shock absorber units matched pairs and must be reinstalled in same position in same unit). Remove lockscrew from support arm shaft cover, loosen hexagonal nut, pull shaft out of spring seat and shaft lever assembly catching loose needle bearings which will drop out at this point. Insert brass drift through housing, drive off shaft end packing cover, lift lower spring seat and shaft assembly out.

Servicing:—Clean all parts with gasoline, replace any worn parts.

Assembly:—Reverse disassembly directions above and note special points as follows: To assemble support arm shaft lever pin, place one spacer on pin, apply light film of grease, insert pin in lever, insert 32 loose rollers or needle bearings, place second spacer on pin. To assemble support arm shaft, place bearing spacer on shaft level side out, insert rubber packing in packing cover, then cork packing, use special support shaft seal and packing inserter to install this assembly on support arm shaft, apply light film of grease on shaft, assemble 49 rollers or needle bearings on shaft holding them in place with rubber band which can be removed after shaft started in housing, see that lockscrew hole in shaft lines up with hole in lever, tighten lockscrew securely and peen metal around screw hole to prevent screw working loose. When installing end cover (after 42 needle bearings and bearing retainer inserted at small end of shaft), use new cork packing, coat with Formagasket #1 (not Shellac), drive into place. To install shock absorber units, line up holes in piston and cylinder by compressing spring, insert cotter pin loosely, install capscrews loosely using new lead washers under screw head, raise support arm to relieve spring tension, pull out cotter pin, tighten capscrews evenly and securely. Coat housing cover gasket, adjusting plug threads and locking plate capscrew with gasket cement, coat threads in housing with white lead, coat bottom of adjusting plug with grease before installing these parts. Fill unit with shock absorber oil, turn adjusting plug down flush with top of housing (adjust after installation in car).

Installing:—King-pin ball thrust washer installed at top of support. If endplay more than .006" insert steel shim above bearing. See Adjustment for Radius Rod Bracket Installation.



ADJUSTMENT:—Radius Rod—Screw radius rod up tight against brake backing plate, then back off not more than ½-1 turn so that wheel moves freely. Screw radius rod bracket on rod until tight, then back off not more than ½-1 turn until free, mount bracket in suspension unit, turning screws in loosely, roll car ahead several revolutions and bounce frame up and down, tighten screws securely, note wheel action. If wheel action stiff, file bracket boss slightly so that bracket can be placed in position by hand, install shim #496974—.010", #496910—.025" under screws. Wheel action must be free throughout range with bracket screws tight. Lock screws by turning up edge of lockplate under screwhead.

Frame Leveling:—Turn adjusting plug in housing cover not more than 2 turns in or 5 turns out from flush position so that distance from bottom of cross-tube to bottom of brake drum is correct as shown in table below and equal on both sides of the car. Install lock and lock capscrew after adjustment completed.

Car Model.	Suspension Height
Pontiac '34-35	5⅛"
Pontiac '36	5⅜"

SHOCK ABSORBERS:—See separate article on "Special Knee-action Type" for complete data.

PACKARD SAFE-T-FLEX TYPE

USED ON MODEL 120 (1935), 120B (1936).

DESCRIPTION:—Consists of vertical wheel support arm pivoted at upper end on outer end of double shock absorber arm (shock absorber mounted on frame siderail at wheel), and at lower end on outer end of triangular arm mounted on frame cross member near center line of car (forward arm) and on frame side rail in front of cowl (rear or torque arm). Coil spring located between spring seat on lower control arm and upper seat on cross member. All control arm pivot points on frame are rubber bushed.

CHECKING AND ADJUSTMENT:—Check these points first:

Tire Inflation—22 lbs. (Conv.Coupe) 24 lbs. (others).

Frame Height—Load car so that top of frame side rail is 18" above floor and parallel to it.

Front Wheels—Check for runout, adjust bearings, turn wheels to straight ahead position.

Caster:—Should be 2° plus or minus ½°. Must be equal for both front wheels within ½°. Machined bosses provided on vertical wheel support for checking.

To Adjust—Jack up front end, take out 3 screws in torque arm rear socket, take off 2 nuts at forward end of torque arm freeing arm from forward or load carrying arm. Pull torque arm to rear until free, install wedge shim on torque arm studs, reinstall. Shims provided in two sizes; Part No. 0304699—½° taper, 0304698—1° taper. Install shims with thick end up to decrease, or down to increase caster. See that entire suspension unit moves up and down freely without binding after shims installed.

Camber:—Should be 1° plus or minus ¼°.

To Adjust—Jack up front end, support wheel, remove shock absorber link bushing bolt and pilot. Replace pilot with service pilot which throws top of wheel farther out to increase, or farther in to decrease, camber. Pilots furnished in four types with increasing offset as follows: Part No. 303075—0 offset, 303076—1/16 offset, 303077—⅛ offset, 303078—3/16 offset.

Toe In:—Should be 1/16-⅛". Check by measuring to center of tire tread at front and rear of wheels (spin wheel and chalk mark center of tread).

To Adjust—Loosen tie rod clamps, turn each tie rod equal amount. Check lengths after adjusting. If not equal, correct by shortening long rod and lengthening short rod to secure equal lengths with correct toe in. Clamp bolts should be vertical and at rear of tie rods.

SPRINGS:—Coiled helical type. All springs 5¼" diameter. Spring Rates as follows:

Model	Spring Rate (lbs. per in.)
120	90 lbs.
120-B Std.	75 lbs.
120-B Export	110 lbs.
120-BA (Comm.)	130 lbs.

PACKARD SAFE-T-FLEX TYPE

Used On:

SIX, ALL MODELS (1937-38-39)
'120' EIGHT, ALL MODELS (1937-38-39)
SUPER EIGHT, ALL MODELS (1937-38-39)
TWELVE, ALL MODELS (1937-38-39)

NOTE:—This design similar to type used on previous '120' models.

CHECKING & ADJUSTMENT:—Car weight must be on wheels. Adjust front wheel bearings and check following points first:

Tire Inflation—Inflate all tires evenly to correct pressure.

Frame Height—Load car as indicated in table below and check height (front and rear). If heights not correct (within limits of plus or minus ¼"), replace or shim front springs (see spring data below), replace rear springs.

Front Height—Measure from floor to top of frame side rail at center-line of front spring.

Rear Height—Measure from under side of frame side rail to top of axle housing at rear of car.

IMPORTANT NOTE—Frame Heights must be correct as shown in table below when checking Caster and Camber.

Car Loads (for Frame Height Check)

Body Type	Front Seat	Rear
Coupes	300 lbs.	225 lbs.
5 Pass. Sedans	300 lbs.	375 lbs.
7 Pass. Sedans	300 lbs.	675 lbs.
Comm'l Chassis	300 lbs.	500 lbs.

Frame Heights

Model	Front Height	Rear Height
Six '37	17⅝"	4⅞"
Six '38-39	18¾"	6¼"
Eight '37	18"	4⅞"
Eight 7 Pass. '37	18⅛"	4⅞"
Eight '38-39	19¼"	6¼"
Super 8 '37-38	20⅛"	4¾"
Super 8 '39	19¼"	6¼"
Twelve '37	20 7/16"	4¼"
Twelve '38-39	20½"	4¼"

Kingpin Inclination—1° 30' (Six & Eight '37, Super Eight '37-38, Twelve '37-38-39), 1° 54' (Six & Eight '38-39, Super Eight '39).

Front Wheels—Set in straight ahead position. Check by measuring from backing plate on each wheel to frame siderail at first rivet behind bumper (must be equal within ⅛" with intermediate steering arm on center line of car). Correct by equalizing tie rod lengths.

Toe In:—Should be 1/32"-1/16" (Six '37-38-39, 120 Eight '37-38), 0-1/16" (120 Eight '39), 1/32-⅛" (Super Eight '37-38-39, Twelve '37-38), 0-⅛" (Twelve '39).

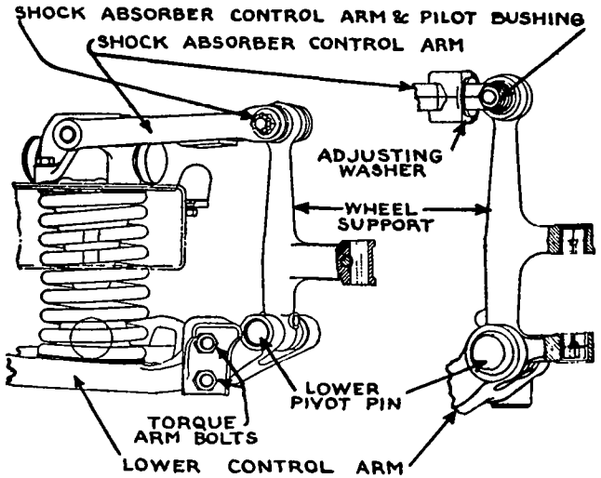
To Adjust—Loosen tie rod clamps and turn each tie rod equally. If tie rod lengths not equal within ⅛" with correct toe in, wheels straight ahead, and intermediate steering arm on center line of car (see wheel section above), check for bent steering arm.

Caster:—Should be 2½° (Six & Eight '37, Super Eight '37-38 and Comm'l. 1703A '39), 1½° (Six '38-39, Eight 1601 '38 and 1701 '39), 0° (Eight 1602 '38 and 1702 '39), ½° (Super Eight '39), 0° (Twelve '37-38-39). All specifications plus or minus ½° except Twelve which has allowable variation of Minus ½° only (Neg. ½° caster).

To Adjust—Jack up front end, take out three screws in torque arm rear socket, take off two nuts at forward end of torque arm on front face of lower control arm, pull torque arm to rear until free. Install wedge shim furnished in ½° and 1° taper on torque arm with thick end up to decrease or down to increase caster, re-install torque arm. Check upper control arm pivot pin for alignment (if necessary, elongate shock absorber mounting bolt holes to line up pin).

Camber:—1° plus or minus ¼° (Six & Eight '37, Super Eight '37-38, Twelve '37-38-39), ½° plus or minus ½° (Six & Eight '38), ½° plus ¾° or minus 0° (Six, Eight, Super Eight '39).

To Adjust (Six, Eight, Super 8)—Jack up front end, support wheel, remove shock absorber link bushing bolt and pilot bushing. Install proper offset pilot (furnished in four sizes—0, 1/16", ⅛", 3/16" offset to throw top of wheel out (increase camber), or in (decrease camber). Pilots may be installed with offset in either direction. 1/16" offset at pilot will change camber 1/3°.



To Adjust (Twelve)—Jack up front end, loosen shock absorber control arm yoke nut, install split washer between yoke and end of arm. Washers furnished ⅛", 3/16", ¼", 5/16" thick. 1/16" washer thickness will change camber 1/3°.

SERVICING:—**1939 Control Arm Damper**—To check, remove knuckle support upper pivot bolt at outer end of shock absorber arms and damper bolt at center of arms. Clearance between arms at damper friction disk should be .125-.135". If clearance not correct arms should be straightened or replaced. Damper tension spring pressure should be 105-115 lbs. compressed to 13/16". To assemble damper, install spring on bolt, insert bolt through arm which has larger hole, tighten nut securely so that opposite arm seated against shoulder on bolt. NOTE—This damper not used on Twelve.

Lower Control Arm Pivot Pin (Except Twelve)—Pivot pin is clamped in knuckle support and is mounted on special roller bearings in control arm ends with ball thrust bearing between knuckle support and rear arm. Bearing should be pre-loaded by installing thrust bearing shims (furnished in .001" thickness steps) between arm and support so that pull of 3-8 lbs. (1937), 1-6 lbs. ('38-39) required to move upper end of knuckle support with upper pivot bolt removed (use spring scale hooked to upper end of support to check this pre-load).

Lower Control Arm Pivot Pin (Twelve)—Pivot pin mounted on special roller bearing (rear end), adjustable tapered roller bearing (front end) with ball thrust bearing between knuckle support and front control arm. Front roller bearing should be adjusted by removing bearing cap and tightening bearing nut so that 5-6 lb. pull required to move upper end of support (upper pivot bolt removed). Make certain that bearing adjusting nut locknut securely tightened and lockplate ears turned up against nuts after making adjustments. Always use new bearing cap and install with special driver to seat cap in control arm.

Kingpin Bushings—Two types used, oil-impregnated bronze or split type steel-backed bronze bushings (later type superseding the solid bronze type). When installing new bushings, finish each type as directed below.

Oil-impregnated Bronze Bushings—Cannot be reamed and must be finished by burnishing to size with a burnishing bar (see table below). Use soap water to lubricate burnisher and install a long bolt between knuckle support yoke ends to prevent buckling while burnishing bar is being used.

Model	Burnishing Bar	Finished Diameter
Six & Eight '37-38-39	ST-5046	.866"
Super 8 '37 & '39	ST-5046	.866"
Super 8 '38	ST-2006	1.063"
Twelve '37-38-39	ST-990	1.054"

Steel-backed, Bronze Bushings—May be finished by reaming or burnishing. See table above for burnishing bar type and finished diameter of bushing for each model.

Lower Control Arm Inner Bushings—Lower arms mounted on rubber bushings at inner end. To renew bushings, press new bushings in place in an arbor press using special bushing drift ST-5021 (Six, Eight, Super Eight), ST-989 (Twelve). Protect bushing with special sleeve ST-5099 (Six, Eight, Super Eight), ST-2003 (Twelve) to prevent bushing collapse while it is being pressed into place. **Important**—Check bushing alignment.

Bushing Alignment—Bushing must be started in hole in control arm so that flatted end of bushing pin is in correct position to prevent binding or excessive distortion of bushing when control arm installed on car. To check bushing alignment, install special dummy bolt with flatted end ST-5030 (Six & Eight '37, Super Eight '37-38), ST-5102 (Six & Eight '38-39, Super Eight '39), ST-987 (Twelve '37-38-39) in bolt hole at outer end of control arm, use straightedge installed on top of flatted end of bushing pin at inner end of arm and check clearence between straight edge and flatted portion of dummy bolt at outer end of arm (dummy bolt flat will indicate center line of bolt hole). Clearance should be ⅛" (Six, Eight, Super Eight '37-38), Flush or no clearance (Six, Eight, Super Eight '39), 9/32" (Twelve '37-38-39).

Wheel Support Upper Bushing—Rubber bushing type. Bushing may be renewed without removing wheel support from car by using special puller and pusher ST-5049.

Torque Arm—Dip torque arm rubber end bushings in soap water before assembling.

PACKARD SAFE-T-FLEX CONT.

SPRINGS:—If frame height not correct (see above), install not more than two spacers #326836 (except Twelve), 341052 (Twelve) between upper spring cup and insulator on top of spring (if two spacers used, install insulator between spacers). Spacers are ¼" thick. If height cannot be corrected by this means, replace spring. Springs marked by 1, 2, or 3 color marks on center coils as follows:

1937 Spring Specifications

Model	Part No.	Free Lngth	Color
120C	304408	14.63"	Gray
120C Del.	303849	15.16"	Brown
120CA	303285	13.12"	Yellow
120CA	311824	13.31"	Bronze
1500 Std.	232561	16.62"	White-Yellow
1500, 1 Fdr. Well	237559	16.24"	White-Orange
1501, 2 Std.	232480	16.62"	White-Red
1502 Fndr. Well	237425	16.57"	White-Green
1506 Std.	237905	15.84"	White-Blue
1506, 7 Fndr. Well	237686	16.39"	Red-Yellow
1507, 8 Std.	237906	16.12"	White-Yellow
1508 Fndr. Well	237907	16.74"	Red-Silver

1938 Spring Specifications

1600,R	326949	16 7/16"	Red-Green
1601,R; 1601-D, DR	326860	13⅝"	Green
1601,R; 1601-D,DR (FW)	326861	17⅛"	Silver
1601-A, AR	326925	15½"	White-Green
1602,R	326880	16½"	White-Blue
1602,R (FW)	326938	16 15/16"	Orange
1603	232561	16.62"	White-Yellow
1603,4 (FW)	237559	16.24"	White Orange
1604,5	232480	16.62"	White-Red
1605 (FW)	237425	16.57"	White-Green
1605—See Note	237853		White-Brown
1605 (FW)—See Note	237854		White-Pink
1607, 8	237686	16.39"	Red-Yellow
1607 (FW)	237907	16.74"	Red-Silver
1608 (FW)	240293		Green-White

(FW)—Cars with fender wells—Spare at rear on others.

1600, 1601, 1602 Note—First cars equipped with short front spring with spacer collar on top of spring. When installing service springs, remove and discard this spacer collar (long springs only furnished for replacement).

1605 Note—8 Pass. Business Sedan & Limo. only.

1939 Spring Specifications

Model	Part No.	Color Marks
1700	335413	Yellow & Blue
1701	326860	Green
1701 FW	326861	Silver
1701A	326925	White & Green
1702	326880	White & Blue
1702 FW	326938	Orange
1703	335692	Red & Silver
1703 FW	338166	Yellow & Silver
1703A	338897	See Note
1705	338156	Orange & Purple
1705 FW	335990	Orange & Blue
1707, 1708	237686	Red & Yellow
1707 FW	237907	Red & Silver
1708 FW	240293	Green & White

NOTE—This spring Orange, Red and Silver.

SHOCK ABSORBERS:—Delco, Double Acting type. See separate article for complete data and valve calibrati n.

STUDEBAKER PLANAR TYPE

Used On:

CHAMPION, MODEL G (1939)

DICTATOR MODEL 2-A (1935), 4-A (1936).

DICTATOR MODEL 6A (1937)

COMMANDER MODEL 1-B (1935).

COMMANDER MODEL 7A (1938)

STATE COMMANDER MODEL 8A (1938)

COMMANDER, MODEL 9A (1939)

PRESIDENT MODEL 1-C (1935), 2-C (1936).

PRESIDENT MODEL 3C (1937)

PRESIDENT MODEL 4C (1938)

PRESIDENT, MODEL 5C (1939)

NOTE—Model 7A called 'Six', Model 8A 'Commander' in early 1938.

DESCRIPTION:—Consists of vertical steering knuckle support pivoted at lower end on outer end of transverse cantilever spring and at upper end on tubular support arm which is pivoted on frame siderail. An additional spring control link is linked to the support and the frame cross member directly below the spring to insure control and act as a jack pad in raising the car. Control link is rubber bushed at both ends and upper support arm is rubber bushed at frame end.

1938 Models:—Design changed as follows:

Shock Absorbers:—Houdaille double-acting type mounted on bracket on frame side rail and linked to lower control link at outer end.

Spring Mounting:—Spring bolted to lower spring plate by two 'U' bolts. Spring plate bolted on lower face of spring housing or cross-member.

1939 Models:—Design changed from that used in 1938 and special features used on new Champion model as follows:

Support Arms (Champion)—Upper support arm is wishbone type with arms widely separated and attached to frame by individual brackets at inner end, yoked to knuckle pin (kingpin) pivot pin at outer end. Shock absorber mounted on rear face of forward arm and pivots with arm (lever stationary). Knuckle pin has yoke at lower end for spring (lower support) pivot pin so that no separate knuckle support used. Lower control link not required (spring has two outer leaves wrapped around knuckle pin pivot pin).

Upper Support Arm & Knuckle Pin (President)—Support arm is tubular type (as on previous models) with new type frame brackets and camber adjusting shims between brackets and frame. Shock absorber mounted on front face of arm and pivots with arm (lever stationary). Knuckle pin (kingpin) has eye at upper end which is linked directly to support arm by pivot pin (no separate knuckle support) and yoke on lower end for spring eye bolt (lower support pivot pin).

Shock Absorbers (Champion & President)—Reversed type mounting with shock absorber body pivoting with upper support arm and shock absorber lever held stationary (bolted to top of frame side rail).

Steering Linkage (all models)—New type with adjustable tie rod connected between steering gear pitman arm and idler arm mounted on right hand frame side rail. Pitman arm connected to left wheel, and idler arm connected to right wheel by non-adjustable reach rods.

CHECKING & ADJUSTMENT:—Car weight must be on wheels. Adjust front wheel bearings and check following points first:

Tire Inflation—30 lbs. (1935), 33 lbs. (1936-38), 30 lbs. (Comm., Pres. '39), 26 lbs. (Champion '39).

Frame Height—Bounce car up and down several times to insure frame assuming normal position.

Kingpin Inclination—9½° all models before Serial Nos. 5,258,246 (Dict. South Bend), 5,803,288 (Dict. Pacific Coast), 7,111,836 (Pres.). 5½° all models after these numbers.

Caster:—Should be Neg. ¼° to Pos. ¾° (all models except Champion '39), 5½-6½° (Champion '39). Caster angle controlled by front spring and is not adjustable.

Camber:—Should be 1-1½° (all models 1935-36-37), ¼-¾° (all models 1938-39). Controlled by shims between upper support arm and knuckle support pin yoke at outer end of arm (1935), eccentric upper support pin (1936-38 & Comm. 1939), shims between upper support arm mounting brackets and frame (Champion & President 1939).

To Adjust (1935)—Take out bolts mounting upper support arm yoke on outer end of arm, add or remove shims. Shims are 1/32" thick and change camber ¼°. Shims installed must not exceed six.

To Adjust (1936-38)—Loosen clamp bolts in knuckle support upper end. Install wrench on hexagonal head of support pin, move wrench toward car frame to increase, or toward wheel to decrease camber. Tighten clamp bolts. Neutral position of pin is with wrench flats vertical.

To Adjust (Commander '39)—Same as 1938 (above).

To Adjust (Champion & President '39)—Remove shims from between both upper support arm mounting brackets and frame (to decrease camber), add shims (to increase camber). One thin shim will change camber ¼°, thick shims are equal to four thin shims. Shims are slotted and may be removed or installed by loosening bracket mounting bolts (bolts need not be removed). Use extreme care to keep shim thickness equal for both brackets (add or remove shims equally at both points). Tighten bracket bolts securely after making adjustment.

Toe In:—3/16" (⅛-7/32") for 1935-36-37 models, 1/16-⅛" for 1938-39 models.

To Adjust (1935-38 Models)—Loosen clamp bolts and turn longer (right hand) tie rod or reach rod. The shorter left hand tie rod is not adjustable.

NOTE—Non-adjustable reach rod (tie rod) fitted with non-adjustable spring loaded end which absorbs road shocks. Outer bearing (ball end) must be screwed in tight and clamp bolt kept tight at all times.

To Adjust (1939 Models)—Loosen clamp bolts on center tie rod (between steering gear pitman arm and idler arm on frame), turn rod. The two end tie rods (connected to wheels) are not adjustable.

CONTROL ARM ASSEMBLY:—Upper Support Arm Inner Bushing—Support arm should be centered in frame brackets, straight rubber bushings pushed in from each end until they contact shoulder on arm, washer installed on outer end of bushing, and retainer screw turned up until it is tight (washer against shoulder on shaft). This will squeeze rubber out at each end forming flange at bracket. Bushings should not turn, all pivoting action being through elasticity of bushings.

Upper Support Outer Pivot Pin:—Eccentric pin clamped in upper end of knuckle support by two clamp bolts. Assembled by placing knuckle support in position in upper support arm, installing eccentric pin in support, threading support pin bushings in on pin through support arm yoke from front and rear and tightening all clamp bolts.

Lower Control Link:—Mounted on spring plate at inner end and lower end of knuckle support at outer end in rubber bushings. Coat bushings with soft soap when installing control link bolts. Draw bolt nuts down tight. Do not put grease or oil on rubber bushings.

FRONT SPRING:—To remove—Jack up front end with jacks placed under each frame side rail at rear of front wheels. Raise car approximately 3". Remove cotters, nuts and washers on outer ends of spring control link, drive bolts out (use brass drift). Remove threaded spring bolts at each end of spring. Take out 10 bolts attaching spring plate to spring retaining channel, remove plate and control link assembly. Spring may then be taken out.

To Install—See that grease retainers at each end of spring channel are in place, coat spring channel and fill spring plate with fibrous grease before installing spring. Center spring eyes in spring support of knuckle support when installing spring bolts (⅛" minimum clearance between face of spring and inner face of support when entering bolt in threaded spring bushing). See that lock is in place under spring bolt head.

1938-39 Type—Spring is bolted to lower spring plate and can be removed with the plate after the spring plate bolts have been taken out.

Front Spring (Champion)—Spring bolted to lower face of frame cross-member by two 'U' bolts. May be removed by taking off nuts on bolts.

SERVICING:—Steering Knuckle & Kingpin (Champion & President)—Pivot pin yoke at lower end of knuckle pin (kingpin) is keyed to knuckle pin and is a press fit. It must be removed in an arbor press after assembly removed from car. To remove knuckle pin assembly, jack up wheel with jack under spring eye, remove wheel and brake backing plate, disconnect tie rod at steering arm. Remove nut and unscrew knuckle pin lower pivot pin from spring eye. Drive out taper locking pin holding knuckle pin upper pivot pin, remove pivot pin to free knuckle pin from upper support arm. Remove knuckle pin, knuckle, and yoke as an assembly. Take off nut on lower end of knuckle pin, use arbor press to press yoke off lower end of pin. Knuckle is mounted on pin by bronze bushing at lower end, roller bearing at upper end, with ball thrust bearing between upper end and head of knuckle pin. When assembling, install shims (available in various thicknesses) between knuckle and thrust bearing so that endplay is .003-.006" (measured by feeler gauge below lower face of knuckle). Make certain that cork seal installed in groove in top face of lower yoke below knuckle.

Steering Knuckle Removal (Commander)—Jack up car with jack under front spring plate, remove front wheel and backing plate, disconnect tie rod at steering arm. Drive out taper lockpin holding kingpin in knuckle, remove upper Welch plug and felt from knuckle support, use brass drift to drive kingpin down and out.

BUICK 40, 50, 60, 70 TYPE

Used On:

BUICK, SERIES 40-40, 50, 60, 70 (1940)

Suspension design same as used on 1939 Buick 40, 60 except for construction detail and specification changes as given below.

TYPE:—Design same as for 1939 except as follows:

Lower Control Arms—Fabric bushings used at inner ends of lower control arms (frame connection). These bushings swaged on grooved shaft and lower control arms pressed on bushing and shaft assembly with .002-.007" press fit. Control arm, bracket shaft, and spring seat cannot be dismantled and serviced as an assembly only. Rubber seals are used on knuckle support bolt at outer end of control arm.

Upper Control Arm (Shock Absorber Assembly)—Interchangeable on right and left side of car (same as 1939). Caster adjustment located at rear of control arm (left side of car), front of arm (right side). Seals are not used on knuckle support eccentric pin at outer end of upper control arm.

CHECKING & ADJUSTMENT:—Before making adjustments, place front wheels in straight ahead position (measurement from center of tire tread to lower arm frame bracket shaft should be same on each side of car), and check following points:

Frame Height—Distance from lower face of frame cross-member to upper face of lower control arm should be 4". If height not correct or unequal, install shim on outer spring on lower side of car or replace springs (see Spring data below).

Tire Inflation—Check tires and inflate to 25 lbs. (front), 30 lbs. (rear).

King Pin Inclination—3½-4½° crosswise (all cars).

NOTE—Car weight must be on wheels when checking adjustments.

Caster:—Should be ⅜° ± ⅜° Positive (all cars). Machined bosses provided on ends of knuckle support for protractor mounting.

To Adjust—Jack up front wheels, loosen clamp bolt in upper end of knuckle support, remove lubrication fitting in end of upper support bushing (at front on right side of car, at rear on left side of car), insert Allen wrench through hole in bushing and turn upper support pin so as to move upper end of knuckle support to rear (to increase caster) to front (to decrease caster). One quarter turn of pin will change caster ¼°. Use care not to turn support pin beyond end of threads or bind knuckle support on upper control arm. Tighten clamp bolt and recheck with car weight on wheels.

Camber:—Should be Negative ¼° to Positive 1° (all cars). Can be checked by placing protractor on machined end of bearing hub (with hub cap and dust cap removed) or by measuring distance between center of tire treads at top and bottom of wheel. Top distance should be from 58 19/32" to 59 15/64" (40, 50), 59 3/32" to 59 29/32" (60, 70). Bottom distance should be from 58 53/64" to 58¼" (40, 50) , 59 21/64" to 58¾" (60, 70). First figure being for Neg. ¼° Camber, second figure for Pos. 1° Camber in each case.

To Adjust—No adjustment provided. Special eccentric upper support pin, Group 6.178, Part No. 231760, may be installed and will permit slight camber corrections (turning eccentric pin will increase or decrease camber).

Toe-In:—Should be 0-1/16" depending on average camber (half sum of camber for each wheel). To check toe-in, measure between outside of tire treads at rear, roll car ahead ½ revolution and measure between same points on tires at front.

To Adjust—Loosen clamp bolts and turn adjusting sleeve at outer end of each tie rod equally (turn wrench toward rear to lengthen rods to increase toe-in). Three-eighths turn of adjusting sleeve on each side of car will change toe-in ⅛".

Steering Geometry (Toe-out on Turns):—With outer wheel turned exactly 20°, inner wheel should be turned 22° ± ¾°. No adjustment provided.

SERVICING:—Lower Control Arm & Support Pin—Lower control arm cannot be dismantled and is serviced as an assembly. When assembling control arm on knuckle support, first place rubber seal over end of each arm, make certain that bushing tight in lower end of knuckle support with head toward rear, center knuckle support between control arms and thread lower support bolt through arms and bushing from front, install nut on rear end. Then pull rubber seals down over ends of arms and see that they seat on bolt between arm and end of knuckle support bushing.

Upper Control Arm—Both bushings threaded on upper support pin (rear bushing also threaded in control arm, front bushing plain type and locked by clamp bolt in control arm. Seals not used.

SPRINGS:—On 40, 60 models, upper end of front spring has smaller end coil which pilots on cup attached to frame by shock absorber mounting bolts and end coil at lower end is not ground flat (must be fitted in recess in lower spring seat). All springs marked with part number on coil near end and are paint marked for identification. If spring length incorrect by more than ¼", install special spacer shim, No. 1310413 (⅛" thick), on top coil of spring (if spring too short), replace spring (if too long).

Spring Specifications

	(Spare at Rear)		(Fender Wells)	
Car Model	**Part No.**	**Color**	**Part No.**	**Color**
40 (except 41T)	1314889	Yellow	1314890	Red
41T	1314950	White		
51, 56S	1314950	White		
51C, 56C	1317791			
59	1314889	Yellow		
61, 61C, 66C	1314890	Red	1314891	Brown
66, 66S	1314950	White	1314890	Red
71, 76S	1315045	Green		
71C, 76C	1317792			

BUICK 80, 90 TYPE

Used On:

BUICK, SERIES 40-80, 90 (1940)

Suspension design same as used on 1939 Buick 80, 90 models except for construction detail and specification changes as given below.

TYPE:—Design same as for 1939 except as follows:

Lower Control Arms—Welded construction and furnished only as an assembly with frame bracket shaft and lower knuckle support pin and bushings (pins and bushings serviced separately).

Knuckle Support Upper & Lower Support Pins—Pins are threaded in knuckle support ends (lower pin locked by taper lock pin, upper pin locked by taper lock bolt) and are threaded in threaded bushings in both upper and lower control arms (bushings are threaded in control arms and no locking bolts used—bronze bushings used on previous models have been discontinued).

CHECKING & ADJUSTMENT:—Before making adjustments, place front wheels in straight ahead position (measurement from center of tire tread to lower control arm frame bracket shaft should be same on each side of car), and check following points:

Frame Height—Distance from lower face of frame cross-member to upper face of lower control arm should be 4 27/32". If height not correct or unequal, install shim on spring on lower side of car or replace springs (see Springs below).

Tire Inflation—Check tires and inflate to 25 lbs. (front), 30 lbs. (rear).

Kingpin Inclination—4-5° crosswise.

NOTE—Car weight must be on wheels when checking adjustments.

Caster:—Should be 0° ± ⅜°. Machined bosses provided on ends of caster adjuster for protractor mounting.

To Adjust—Jack up front wheels, loosen nuts on caster adjusting bolt and pivot bolt (on inner face of knuckle support) one turn, loosen locknuts on adjusting screws which locate caster adjuster bolt in slotted hole in knuckle support. Back off one adjusting screw, tighten opposite screw equal amount so that caster adjuster is clamped tightly between them (turn front screw in to increase caster, rear screw in to decrease). One-fourth turn of screw changes caster ¼° (check toe in if caster changed greater amount). Tighten adjusting screw locknuts, caster adjuster bolt nut, pivot bolt nut. Recheck caster with car weight on wheels.

Camber:—Should be Negative ¼° to Positive 1°. Can be checked by placing protractor on machined end of bearing hub (with hub cap and dust cap removed) or by measuring distance between center of tire treads at top and bottom of wheel. Top distance should be 59 59/64", bottom 60 11/64" (Neg. ¼° camber); top distance 60 13/32", bottom 59 35/64" (Pos. 1° camber). No adjustment is provided.

Toe-In:—Should be 0-1/16" (depending on average camber (half sum of camber for each wheel). To check toe-in, measure between outside of tire treads at rear, roll car ahead ½ revolution, measure between same points on tires at front.

To Adjust—Loosen clamp bolts on each end and turn each tie rod equal amount (important to maintain correct position of intermediate steering arm). One-quarter turn of each tie rod will change toe-in 5/32".

Steering Geometry (Toe-out on turns):—With outer wheel turned exactly 20°, inner wheel should be turned 24° ± ¾°. No adjustment provided.

SERVICING:—Lower Control Arm & Support Pin—Arms are pivoted on frame bracket shaft at inner ends on bushings which are threaded on shaft and are sealed by rubber seals on shaft which fit over inner ends of bushings. When installing shaft, center shaft in control arms so that distance from mounting bracket bolt hole center line to outer face of control arm is 2 15/16", thread bushings through control arm on shaft and tighten bushings securely making certain that seals fit over ends of bushings. Support pin at outer end of control arms is locked in knuckle support by taper pin. Pin bushings in each control arm are threaded type and are designed to cut their own threads in control arm as they are threaded on support pin. NOTE—Lower support pin bushings have 1¼" hexagonal head, upper support pin bushings are 1⅛" (may be identified in this manner).

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Upper Control Arm Knuckle Support Pin—These bushings threaded type and installed in same manner as lower support pin bushings (see paragraph above).

SPRINGS:—All springs marked with part number on coil near end and are paint marked for identification. If spring length incorrect by more than ¼", install special spacer shim, Part No. 1290142 (⅛" thick), on top coil of spring (if spring too short), replace spring (if too long).

Spring Specifications

Car Model	(Spare at Rear) Part No.	Color	(Fender Wells) Part No.	Color
80 (all)	1309916	Orange	1309917	Blue
90 (all)	1309917	Blue	1309918	Green

CADILLAC TYPE

Used On:

CADILLAC V8, SERIES 40-60S, 62, 72, 75 (1940)

CADILLAC V16, SERIES 40-90 (1940)

LA SALLE V8, SERIES 40-50, 52 (1940)

Suspension design same as used on 1939 models except as noted below.

NOTE:—Two types of suspension design used on these models as follows: (1) Cadillac 60S, 62, 72 & La Salle 50, 52; (2) Cadillac 75, 90. Adjustments are not made in same manner on both types (see instructions below).

ADJUSTMENT:—Before making adjustments check wheels for balance, run-out, and tracking; check front wheel bearing adjustment, see that shock absorbers filled with fluid and operating properly, check steering gear adjustment, see that control arms operate freely and that control arm and knuckle support bushings are correctly installed. Place front wheels in straight ahead position and check following points first:

Tire Inflation—Check tires and inflate to 24 lbs. (50, 52), 26 lbs. (62), 28 lbs. (60S, 72), 32 lbs. (75, 90).

Wheel & Tire Run-Out—Check wheels for run-out and mark high point on tire. Place this mark vertically (at top of wheel) when checking Toe-in and Toe-out, horizontally (at one side of wheel) when checking Caster, Camber and Kingpin Inclination.

Kingpin Inclination—5°6′ (50, 52, 60S, 62), 5°1′ (72, 75, 90) crosswise.

NOTE—Car weight must be on wheels when checking adjustments.

Caster:—Should be Negative 1¾-2¼° (50, 52, 60S, 62, 72), Negative ½-1° (75, 90). Must be equal within ½° on both sides of car.

To Adjust (50, 52, 60S, 62, 72)—Loosen clampscrew in upper end of knuckle support, remove lubrication fitting in front bushing of upper control arm, insert Allen wrench, Tool J-720, through lubricant fitting hole, turn eccentric upper support pin in **complete turns only**, clockwise to increase caster, counter-clockwise to decrease caster. IMPORTANT—Camber will be disturbed unless pin turned in complete turns only.

To Adjust (75, 90)—Loosen retaining nuts fastening upper and lower knuckle support yokes to control arms, loosen clampscrew in upper end of steering knuckle support, remove lubricant fitting from front bushing of upper control arm. Insert wrench J-720 through lubricant fitting hole in bushing, turn threaded support pin clockwise to increase caster, counter-clockwise to decrease caster. After making adjustment, make certain that knuckle support yoke retaining nuts are securely tightened.

Camber:—Should be 0-¾° (50, 52, 60S, 62, 72), 0-½° (75, 90). Must be equal within ½° on both sides of car.

To Adjust (50, 52, 60S, 62, 72)—Same as Caster Adjustment on these same cars (see Caster Adjustment above) except that entire range of adjustment secured in ½ turn of eccentric pin. Pin must not be turned more than ½ turn from point where correct caster secured or caster will be upset when this camber adjustment made.

To Adjust (75, 90)—Take off retaining nut on knuckle support yoke in lower control arm, pull yoke out of arm, rearrange spacers on yoke stud (cars normally set up with one spacer between yoke and control arm, one spacer between control arm and retaining nut). Place both spacers between control arm and retaining nut to increase camber, both spacers between yoke and control arm to decrease camber. Tighten retaining nut securely and lock in place after making adjustment.

Toe-In:—Should be 1/32-3/32" with car at rest. If tested with car in motion, toe-in should be 0-1/16" or 2-6′ sideslip per mile. Camber should be ½° Pos.

To Adjust (50, 52, 60S, 62, 72)—Loosen clamp bolts and turn tie rod adjuster (at wheel end of each tie rod) equally on both sides of car (to maintain correct position of steering gear).

To Adjust (75, 90)—Loosen clamp bolts and turn each tie rod equally (to maintain correct position of intermediate steering arm).

Steering Geometry (Toe-out on turns):—With outer wheel turned exactly 20°, inner wheel should be turned 22¼-23¾° (50, 52, 60S, 62, 72), 22¾-24¼° (75, 90). No adjustment is provided.

SERVICING (50, 52, 60S, 62, 72):—Lower Control Arm & Knuckle Support Pin—Control arm mounted on inner frame bracket shaft by threaded bushings (bushings threaded on shaft and in control arms) with rubber seals on shaft. Shaft can be removed from control arms after bushings have been removed. Support pin at outer end of control arm is threaded through both control arms and bushing in lower end of knuckle support and has nut on rear end. Rubber seal is installed on support pin at front end of bushing (between knuckle support and front control arm).

Upper Control Arm Support Pin—This eccentric pin is threaded in bushings in each upper control arm and in upper end of knuckle support (rear bushing is threaded type and is screwed in control arm, front bushing is plain type and is locked in control arm by clamp bolt). A clampscrew in the upper end of the knuckle support locks the pin in the support to maintain caster and camber setting.

SERVICING (75, 90):—Lower Control Arm & Knuckle Support Pin—Lower control arm mounting on inner frame bracket shaft similar to other models (above) except that front bushing is plain type (threaded on shaft only) and locked by clampscrew in end of control arm. Rubber seals are used. Support pin at outer end of control arm is threaded through bushings in both arms of yoke and is locked in lower end of knuckle support by lockpin. Rear bushing is threaded in yoke arm, front bushing is plain type (threaded on pin only) and is locked by clampscrew in yoke arm. Seals are installed on pin at inner end of each bushing (between bushings and knuckle support).

Upper Control Arm Support Pin—Pin is threaded in upper end of knuckle support and in bushing in each arm of yoke and is locked in knuckle support by clampscrew. Rear bushing is threaded in yoke arm, front bushing is plain type (threaded on pin only) and locked in yoke arm by clampscrew. Seals are installed at inner end of bushings (between bushings and knuckle support).

SPRINGS:—Part number is stamped on end coil of each spring. When installing springs see that insulator at top and bottom of each spring.

Spring Specifications

Car Model	Spare at Rear Part No.	Fender Wells Part No.	Spring Normal Hgt
50, 52	1428430	1428432	9 13/16"
50 Comm'l.	1428429		9 13/16"
60S, 62	1428431	1428433	9 13/16"
72	1428432	1428432	9 13/16"
75	1413789	1413790	9 13/16"
75 Comm'l.	1413791		9 13/16"
90	1413790	1413791	9 13/16"

CHEVROLET TYPE

Used On:

SPECIAL DELUXE KA, MASTER DELUXE KH ('40)

Independent Suspension is same design as used on 1939 Master Deluxe Model.

CHECKING & ADJUSTMENT:—Check the following points first before checking or adjusting front suspension unit.

Tire Inflation—26 lbs. (front), 28 lbs. (rear).

Wheel Runout—Check and adjust front wheel bearings. Check wheel for tire and rim runout and eccentricity. Mark tire midway between high and low spots (mean point) and place this mark at top (vertically) when checking Camber, at side (horizontally) when checking Toe In.

Steering Gear & Connections—Check mounting bolts and tighten if necessary. Check tie rod ball and socket joints for excessive looseness.

Frame Height—Install special gauges at front and rear ends of car to level frame when checking. Front gauge has holes to engage lower control arm shaft (inner end) and pivot pin (outer end) to hold control arms rigid in correct position. Rear gauge clamps axle housing and frame so that clearance between top of axle housing and lower face of frame side rail is 7 7/32".

NOTE—Make all checks with car weight on wheels (curb weight—car ready for road but no load).

Kingpin Inclination:—4¾° plus or minus ½°.

Caster:—0° plus or minus ½°. Adjusted by turning knuckle support eccentric upper pivot pin (same adjustment as for camber—See Camber Adjustment).

Camber:—Neg. ¼° (Wheel tilts in at top) plus or minus ½°.

Adjustment—Remove lubricant fitting on knuckle support upper pivot pin front bushing, loosen clamp bolt in upper end of knuckle support which clamps pivot pin. Insert ¼" Allen wrench through lubricant fitting hole in bushing to engage pivot pin, turn pivot pin clockwise to increase caster, counter-clockwise to decrease caster (pin is eccentric and this same movement will change Camber from minimum to maximum every half turn of the pin) until both caster and camber are correct within limits given above, tighten clamp bolt and replace lubricant fitting. One half-turn of pivot pin will change caster angle 39′ and change camber angle from 0° to 1°2′ (depending on initial position of pin).

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Toe In:—0" to 1/16". **Adjustment**—Loosen clamp bolts and turn left hand (short) tie rod. When tightening clamp bolts, make certain that both tie rod ends are in alignment with the ball studs.

NOTE—Right hand (long) tie rod is not adjustable.

Steering Geometry (Toe out on Turns)—Outer wheel turned in 20°, Inner wheel turned 24° plus or minus 2°. Not adjustable (replace steering arm).

SERVICING:—All servicing operations same as for 1939. ***See 'Chevrolet Type' Independent Suspension article in Mechanical Equipment Section of manual (or 1939 Supplement) for complete instructions.***

SPRINGS:—Springs have end coil at upper end only ground flat. When installing springs, make certain that this flat end placed up and that end coil at lower end of spring is fitted in recess in lower spring seat.

Spring Specifications

KA, KH	No. 3653059

CHRYSLER TYPE

Used On:

CHRYSLER, SIX C25, EIGHT C26, C27 (1940)
DE SOTO, S7 CUSTOM & DELUXE (1940)
DODGE, D14 DELUXE, D17 SPECIAL (1940)
PLYMOUTH, P9 ROADKING, P10 DELUXE (1940)

Suspension design same as used on Corresponding 1939 models except as note below.

TYPE:—Design same as for 1939 except as follows: **Springs**—On Chrysler C25, DeSoto, Dodge, Plymouth (except 7 Pass. cars), lower end of front spring is not ground flat and must be installed in recess formed in lower spring seat. On Chrysler C26, C27 and Chrysler C25, DeSoto, Dodge, Plymouth 7 Pass. cars, both ends of spring are ground flat and lower spring seat is likewise flat. Springs must not be interchanged for this reason.

CHECKING & ADJUSTMENT:—Before making adjustments, check wheel and tire balance and run-out, front wheel bearing adjustment and king pin bushing clearance, steering gear adjustment, and shock absorbers. See that springs and shock absorbers in normal position (grasp bumper and work front end of car up and down several times). Then check following points first:

Frame Height—Use tool C-592 to measure distance from lower face of frame front cross-member lower plate (measure through hole in lower flange of frame side rail) to dimple on lower spring seat directly below this point. Distance should be 3½" (all models) and must be equal within ⅛" on both sides of car. If height not correct, install spacer on spring on low side (see Spring data below).

Tire Inflation—Check tires and inflate to 28 lbs. front and rear (except Chrysler C25, DeSoto, Dodge, Plymouth P10 7 Pass. cars and Chrysler C26 Traveler—30 lbs., Plymouth P9 Roadking—32 lbs.).

Kingpin Inclination—4¾-6° crosswise (all models). NOTE—Car weight must be on wheels when checking adjustments.

Caster:—Negative 1° to Positive 1° (all models). Not adjustable. Controlled by distance knuckle support upper pivot pin bushing (eccentric camber adjustment) turned in on upper control arm. See Camber adjustment following.

Camber:—Positive ¼° preferred (0° to ¾° permissible) for all models. Correct kingpin inclination before adjusting camber.

To Adjust—Loosen clampscrew in upper end of knuckle support, turn eccentric bushing in upper end of knuckle support not more than ½ revolution from place where correct caster is secured (bushing eccentric and entire range of adjustment secured in ½ turn). Bushing must not be turned so as to bind on upper control arm and distance from shoulder on arm to rear of knuckle support should be ⅝" (9/16-¾" permissible).

Toe-In:—1/16" preferred (0-⅛" permissible). To check toe-in, set wheels straight ahead, move car forward one full revolution of wheels. Measure between center of tire treads, hub high, at rear, then roll car forward ½ revolution and measure to same points on tires at front.

To Adjust—Loosen clamp bolts on each tie rod (long rod right side, short rod left side), turn tie rods equally. CAUTION—Make certain that steering gear turned so that roller on 'high' point of worm with wheels in straight ahead position after toe-in adjustment completed. Steering gear position can be corrected by shortening one tie rod and lengthening opposite rod equally.

Steering Geometry (toe-out on turns):—With outer wheel turned exactly 20°, inner wheel should be turned 22° (except Chrysler C26, C27), 21°30′ (Chrysler C26, C27). No adjustment provided. Check for bent steering arm if incorrect.

SERVICING:—Steering Knuckle & Kingpin Bushings—To remove, remove wheel and hub, block brake pedal, remove nuts fastening brake support to steering knuckle, remove steering arm from knuckle, lift complete backing plate & brake shoe assembly off and hang up on frame (Caution—assembly must not be allowed to hang on flexible brake tube, on Models C26, C27 brake tube must be disconnected before assembly can be removed and lines must be bled when reconnected). Drive out kingpin taper lockpin. Drive punch into kingpin upper oil seal disc and pry disc out. Use soft brass drift to drive kingpin down which will force out lower oil seal disc, remove knuckle. Pull upper bearing out toward bottom (use puller C-328—bushings used at this point on Dodge & Plymouth only), pull lower bushing with same tool. Install new lower bushing and line-ream with special tool using pilot in place of upper bearing (on Dodge & Plymouth install upper bushing from top and line up oil hole in bushing and knuckle), install roller bearing from top (trade mark up) and line up oil hole in bearing with hole in knuckle.

Upper Control Arm & Bushings—Control arm mounted on frame bracket shaft by threaded bushings (rear bushing threaded on shaft and in arm, front bushing threaded on shaft and locked in arm by clampscrew) with rubber seal on shaft at inner end of each bushing. Rubber seal also used on outer end of control arm at end of eccentric knuckle support bushing. When assembling control arm, centerline of rear mounting bolt holes in shaft should be 1" (Chrysler C25, DeSoto, Dodge, Plymouth except 7 Pass. Sedans), 1 5/32" (Chrysler C26, C27 and all 7 Pass. Sedans) to rear of front face of outer end of control arm. Eccentric knuckle support bushing should be turned in on arm until distance from rear face of knuckle support to shoulder on control arm is ⅝" (9/16-¾").

Lower Control Arm & Bushings:—Control arms and spring seat are riveted assembly. Bushings at inner end (frame connection) are self-threading type and new bushings should be used when a new control arm assembly is installed as follows:

Control Arm Shaft Bushings—Special tool C-594 must be used to maintain control arm alignment when bushings installed. Insert bracket shaft in control arm, install special tool so that it engages legs of control arm and studs on tool enter shaft mounting bolt holes, install nuts on studs and tighten securely. Tool will position arm correctly so that rear face of arm is 2 5/32" (Chrysler C25, DeSoto, Dodge, Plymouth except 7 Pass. Sedans), 2 7/32" (Chrysler C26, C27 and all 7 Pass. Sedans) in back of rear shaft mounting bolt hole center-line. Start both bushings on shaft, use lubricant such as tapping compound and turn bushings in until bushing shoulders contact faces of control arms (bushings will cut own thread in control arm bosses), tighten bushings with 180 ft. lb. force. Remove tool and make certain that shaft pivots freely in control arms. CAUTION—Do not rotate shaft which would change rear arm dimension as given above.

Knuckle Support Lower Pivot Pin & Bushings—Pin should be inserted through rear arm and is locked by nut and cotter pin on forward arm. To assemble control arm and knuckle support, see that bushing installed in knuckle support with head toward rear, position knuckle support between control arms so that distance from rear face of support to rear face of support pin boss on rear arm is exactly 15/16" (Chrysler C25, DeSoto, Dodge, Plymouth except 7 Pass. Sedans), 1 1/32" (Chrysler C26, C27 and all 7 Pass. Sedans). Thread support pin through rear arm, rubber seal, knuckle support bushing, front rubber seal, and front arm. Install nut on forward end of pin and lock with cotter pin. If correctly assembled, rear face of knuckle support will be 7/16" in front of center-line drawn through frame bracket shaft rear mounting bolt holes.

SPRINGS:—Springs used on Chrysler C25, DeSoto, Dodge, Plymouth (except 7 Pass. Sedans) do not have lower end coil ground flat and must be installed with spring end fitted into recess formed in lower spring seat (frame height will be incorrect if spring not properly installed). On Chrysler C26, C27 and on all 7 Pass. Sedans, both ends of springs are ground flat and lower spring seat is also flat. When installing springs on all cars, see that silencer installed on lower end of all springs (in spring seat), and on upper end of spring (in seat in cross-member). If spacers used, these should be installed between upper end of spring and upper silencer.

Frame Height Correction—If frame height not correct spacer may be installed on top of spring on low side of car (between spring and upper silencer).

Spring Specifications

Car Model	Spring Part No.
Chrysler C25 Royal	857304
Chrysler C25 Windsor	857305
Chrysler C25 18" Wheels (Com'l & Ext. Duty)	860073
Chrysler C25 7 Pass. & Limo. only	674534
Chrysler C26 Traveler	861069
Chrysler C26 New Yorker & Saratoga	861070
Chrysler C26 Comm'l. & Extreme Duty	860075
Chrysler C26 Exp. (Imp.—no Fluid Drive)	861070
Chrysler C27 Crown Imperial	854758
De Soto S7	857303
De Soto S7 Comm'l. & Extreme Duty	860073
De Soto 7 Pass. & Limo. only	674533
Dodge D14, 17	857302
Dodge D14, 17 18" Whls. (Comm'l & Ext. Duty)	860072
Dodge D14 7 Pass. & Limo. only	674533
Dodge D14 7 Pass.&Limo. (Comm'l&Ex. Duty)	860074
Plymouth P9, 10	857301
Plymouth P9, 10 18" or 20" Wheels	860071
Plymouth P9, 10 Comm'l. & Extreme Duty	860071
Plymouth P10 7 Pass. & Limo. only	674532

NOTE—Part No. 657770 spacer used on driver's side of car when Commercial (Comm'l.) or Extreme (Ext.) Duty springs installed.

HUDSON TYPE

Used On:
SIX, MODELS 40T, 40P, 41, 43, 48 (1940)
EIGHT, MODELS 44, 45, 47 (1940)

DESCRIPTION:—Conventional design with knuckle support pivoted on outer ends of upper and lower support arms. Knuckle support upper pivot is an eccentric bushing (for Camber and Caster adjustment), lower support is a bushing and bolt assembly. Control arms are pivoted at inner ends on bracket shafts bolted to the frame with threaded type bushings and rubber seals at pivot points. Shock absorber is mounted in center of the coil spring with mounting studs passing through holes in upper and lower control arm brackets.

CHECKING & ADJUSTMENT:—Before checking specifications and making adjustments, always perform the following operations first:

Wheels & Tires—Check wheels and tires for balance and runout, correct if required. Inflate all tires to correct pressure. Check front wheel bearings and adjust if loose. Runout must not exceed 1/16-3/32". mark 'high' point on tire and place this mark at top of tire (vertical) when checking toe-in, at front of tire (horizontal) when checking Camber and Caster.

Steering Linkage & Kingpin Looseness—Check kingpin bushings, drag link and connecting rod ends, and steering gear for looseness. Adjust steering gear and replace worn bushings and end joints.

Shock Absorbers—Check shock absorber action.

Frame Level and Spring Height—Level car by rocking car sideways (not endwise) several times and allowing it to come to rest. Check spring height at each side of car. If heights not equal within ½", replace or shim low spring (see Springs below).

NOTE—Car weight must be on wheels when checking following specifications

Kingpin Inclination:—4°36' crosswise. NOTE—Kingpin inclination affected by Camber adjustment (decreases as Camber is increased).

Camber:—Should be Pos. ¼° to Pos. ¾° and equal within ½° on both sides of car. NOTE—Toe-in setting depends on Camber and should be checked when Camber adjusted.

To Adjust—Adjusted by turning knuckle support upper eccentric pivot pin (Same as Caster Adjustment). See Caster Adjustment below and turn eccentric bushing not more than ½ turn from point where correct caster is secured.

Caster:—Should be 0° (plus or minus ¼°) and equal within ½° on both sides of car.

To Adjust—Loosen clamp bolt in upper end of knuckle support, turn eccentric bushing into support to increase caster, out of support to decrease caster. One complete turn of bushing will change caster ½°. Correct caster of 0° should be secured with center of knuckle support (clamp bolt center) exactly 1 11/32" ahead of face of upper support arm. After correct caster secured, turn bushing not more than ½ turn in either direction to adjust Camber (½ turn will give maximum camber adjustment of plus or minus ½°). Tighten clamp bolt.

Toe-In:—Should be 0-1/16" measured at wheel rim with wheels set straight ahead and intermediate steering arm centered by means of centering tool J-1442

To Adjust—Loosen clamp bolts and turn both tie rods equally. NOTE—Tie rod lengths must be equal.

Steering Geometry:—With inner wheel turned 24°, outer wheel should be turned 20°50' (or Inner 30°, outer 25°). Allowable variation plus or minus ½°. No adjustment provided (if incorrect, check for bent steering arms).

SERVICING:—Spring Removal & Installation—To remove spring, support front of car on jack stand under inner side of lower support arm on side from which spring to be removed, remove shock absorber (see below), remove bolts from lower support arm inner pivot shaft bracket, raise car slowly and carefully until spring fully expanded. Install spring in same manner. Make certain that spring installed with flat end up and rubber-and-fibre silencer on upper end of spring, and see that lower end of spring properly seated in spring seat on lower support arm. Check spring height (see Springs below).

Shock Absorber Removal & Installation:—Remove retainer nut on upper mounting stud (on upper support arm frame bracket), remove washer and rubber bushing. Remove two screws holding shock absorber lower anchor plate on underside of spring seat on lower support arm, turn shock absorber ¼ turn, and lower through hole in spring seat, remove from below. Replace shock absorber in same manner.

Lower Support Arm:—When installing inner pivot shaft, use tool J-1052 to maintain exact distance of 11½" between inner faces of lower support arms while bushings are being installed. Distance from inner face of support arm to center-line of frame mounting bolt holes must be exactly 1½" for correct alignment. Make certain that seals installed on shaft so that end of seals extends over inner ends of bushings.

Upper Support Arm:—When installing frame mounting shaft bushings, use tool J-1360 installed on center stud of pivot shaft mounting, center arm in tool when bushing installed. See that seals installed on pivot shaft so that ends extend over ends of bushings. When installing knuckle support eccentric bushing, hold support 9/32" from shoulder on arm, screw into support and on arm until support is ⅞" from shoulder on arm. Check Caster & Camber

SPRINGS:—Install springs with flat end up and silencer on upper end of spring. If spring height (measured from upper face of lower support arm to lower edge of upper rubber bumper support bracket) is not equal within ½" on each side of car, spring should be replaced (rock car sideways and allow it to come to rest naturally before checking heights) A maximum of 2 shims .120" thick may be installed on top of low spring to correct minor height differences (replace springs if more than 2 shims required).

Spring Specifications

Car Model	Part No.	Color
40, 41, 48	160510	Light Blue
43	160511	Yellow
44 45	160512	White
47 Right Side	160512	White
47 Left Side	160513	Green

Identification Note—Part No. marked on flat end of spring with Brinell mark, and Limit Mark as follows: 1 Grind Mark—Low Limit, 2 Grind Marks—High Limit.

NASH TYPE

Used On:
NASH, SIX MODEL 4020, EIGHT 4080 (1940)
NASH-LAFAYETTE, MODEL 4010 (1940)

DESCRIPTION:—Linked parallelogram type with vertical knuckle support linked to short upper control arms (shock absorber arms) and longer lower control arms pivoted at inner ends to bracket bolted on frame front cross member. Coil spring is seated at upper end in spring seat formed in cross member and at lower end in spring seat riveted to lower control arms. Adjustments provided for Caster, Camber, and Toe-in.

CHECKING & ADJUSTMENT:—Always check following points first before making any adjustments:

CAUTION—Always place 2" blocks, Tool J-886, between frame top flange and front suspension upper control arms before jacking up car so as to remove weight from front wheels. Wheels must not be allowed to hang on control arms without these blocks being installed first.

Tire Inflation—Check tires and inflate to recommended pressure of 28 lbs. (4010), 27 lbs. (4020), 26 lbs. (4080).

Front Wheel Bearings—Check for looseness and adjust front bearings if required.

Wheel & Tire Balance & Runout—Check wheel and tire assemblies for balance. Check front wheels for runout which must not exceed ⅛". Mark high point (point of greatest runout) on tire and place this mark on top (vertical) when checking toe-in and toe-out (steering geometry), place mark on side (horizontal) when checking Camber, Caster, and Kingpin inclination.

Wheel Straight-ahead Position—Wheels must be set in straight-ahead position when checking toe-in. Use centering gauge, Tool J-1383.

Kingpin Inclination:—Should be 4½° crosswise for all models. No adjustment.

Caster:—Should be 0° to Neg. ½° for all models with car weight on wheels.

Adjustment—Loosen clamp bolt in upper end of steering knuckle support, remove lubrication fitting in front bushing of outer end of upper control arm, insert special wrench, Tool J-720, in lubrication fitting hole and turn eccentric upper support pin clockwise to increase caster, counter-clockwise to decrease caster. Tighten knuckle support clamp bolt and replace lubrication fitting.

Camber:—Should be Pos. ¼° to Pos. ¾° for all models with car weight on wheels and frame leveled by 2" blocks (see Caution Note above).

Adjustment—Adjust in same manner as for Caster above (wrench inserted through lubrication fitting hole in upper control arm front bushing) except that entire range of adjustment secured in ½ turn of eccentric pin. This adjustment changes caster but caster will be within limits given above providing that it has been correctly set first and pin is not turned more than ½ turn maximum

Toe-in:—Should be 1/32-3/32" measured 10" from floor with wheels in straight-ahead position.

Adjustment—Loosen clamp bolts and turn each outer tie rod equally toward front of car to decrease toe-in, toward rear to increase toe-in. Center connecting rod is not adjustable.

CAUTION—See that center connecting rod ball stud is not raised from its normal position while making toe-in adjustment and that outer tie rod ends are horizontal with ball studs fitting squarely in seats before tightening clamp bolts.

Toe-out (Steering Geometry):—With outer wheel turned 20°, inner wheel should turn 21½°. No adjustment. If toe-out incorrect, check for bent steering arms, recheck Caster, Camber, and Toe-in.

SERVICING:—Upper Control Arm Pivot Pin. Eccentric pivot pin is threaded in upper end of knuckle support and in bushings in front and rear upper control arms Rear bushing is threaded in control arm.

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Front bushing is plain type and is locked in control arm by clamp bolt. Clearance between front face of control arm and head on bushing must be 1/32".

Lower Control Arm Outer Pivot Pin. Pivot bolt is threaded in knuckle support bushing and in front and rear lower arms. Bushing is threaded on bolt and in lower end of knuckle support with rubber seal on bolt between each end of bushing and control arm. When assembling, bushing should be centered in control arm with equal clearance of 3/16" between each end of bushing and control arms.

Lower Control Arm Frame Bracket. Lower control arm inner ends are bushed on frame bracket shaft with washer and nut on shaft ends. Shaft is bolted directly to frame cross member.

SPRINGS:—Coil springs are same on all body styles and are interchangeable on 4010 and 4020. 4080 springs are paint marked for identification. Check spring heights on car with special height gauge, Tool J-709, which should fit between spring seat on lower control arm and lower face of front frame cross member. If spring height not correct, replace spring or install special ¼" spacer under spring.

Spring Specifications

Model	Free Length	Loaded Height	Color Mark
4010, 20	13⅛"	9"	
4080	13⅞"	9"	Yellow

PACKARD SAFE-T-FLEX TYPE

Used On:

'110' SIX, MODEL 1800 (1940)
'120' EIGHT, MODELS 1801, 1A (1940)
'160' SUPER 8, MODELS 1803, 4, 5 (1940)
'180' CUSTOM SUPER 8, 1806, 7, 8 (1940)

Suspension design same as used on 1939 models except for construction details and specifications given below.

CHECKING & ADJUSTMENT:—Check front wheel bearings and set wheels in straight ahead position, check following points first:

Tire Inflation—Check tires and inflate to correct pressure for each model.

Frame Height—Must be correct when checking caster and camber. To check, load car with 300 lbs. (front—all models), 225 lbs. (rear—Coupe), 375 lbs. (rear—5 Pass. Sedan), 675 lbs. (rear—7 Pass. Sedan), 500 lbs. (rear—1801A Hearse), 800 lbs. (rear—1803A Hearse). Measure from floor to top of frame side rail at front spring center-line (front) from underside of frame to top of axle housing (rear). If height not correct, install spacer or replace spring (see Springs below).

Car Model	Front — Frame Height — Rear
1800 Six	18⅝" — 6⅜"
1801 Eight	18¾" — 6¼"
1801A Comm'l.	19¼" — 6¼"
1803, 4, 5, 6, 7, 8	19¼" — 6¼"

Kingpin Inclination—1°54' crosswise (all models). NOTE—Car weight must be on wheels when checking following adjustments.

Toe-in:—1/32-1/16" at hub height (all models).

To Adjust—Loosen clamp bolts and turn both tie rods equally. Tie rod lengths must be equal within ⅛" after adjusting with intermediate steering arm centered and steering wheel roller on 'high' point of worm (adjust by shortening one rod, lengthening opposite rod equally).

Caster:—Positive 1½° ± ½° (Six & Eight), Negative 1° ± ½° (Super 8 except 1803A), Positive 2½° ± ½° (1803A).

To Adjust—Install wedge shims (furnished in ½° and 1° taper) between front face of lower torque arm and lower control arm. Install shims with thick end up to decrease caster, thick end down to increase caster. If 1° shim does not correct caster, check for bent parts. Check torque arm alignment (end of arm must be square with face of lower control arm).

Camber:—½° (limits ½° to 1¼°) for all models.

To Adjust—Remove support pin linking upper control arm and knuckle support, change pilot thimbles in outer end of each upper control arm. Thimbles furnished with offset of 0", 1/16", ⅛", 3/16", and change of 1/16" in offset will change camber ⅓°. CAUTION—Make certain that thimbles installed in both arms with offset in same direction (reversing offset will change camber).

Steering Geometry (toe-out on turns):—With outer wheel turned exactly 20°, inner wheel should be turned 23° (Six), 22°50' (Eight and Super 8 1803, 6), 22°30' (Super 8 1804, 7), 22°20' (Super 8 1805, 8). No adjustment provided (check for bent steering arms if not correct).

SERVICING:—Upper Control Arm Damper—To check, remove knuckle support upper pivot bolt at outer end of shock absorber arms and damper bolt at center of arms. Clearance between arms at damper friction disk should be .125-.135". If clearance not correct arms should be straightened or replaced. Damper tension spring pressure should be 105-115 lbs. compressed to 13/16". To assemble damper, install spring on bolt, insert bolt through arm which has larger hole, tighten nut securely so that opposite arm seated against shoulder on bolt.

Lower Control Arm Pivot Pin—Pivot pin is clamped in knuckle support and is mounted on special roller bearings in control arm ends with ball thrust bearing between knuckle support and rear arm. Bearing should be pre-loaded by installing thrust bearing shims (furnished in .001" thickness steps) between arm and support so that pull of 1-6 lbs, required to move upper end of knuckle support with upper pivot bolt removed. CAUTION—Roller bearings are caged type and one of the two bearings must be renewed whenever pivot pin or either bearing is removed.

Lower Control Arm Frame Mounting—Arm is rubber bushed on frame bracket pin (two Harris type bushings used, bushings held by locking ring on pin at one end-washer). Bushings can be installed without using arbor press but must be aligned in neutral position (flat on pin must be in line with flat on special gauge bolt installed in hole in outer end of arm—new type gauge required, 1939 type cannot be used).

Torque Arm Frame Mounting (Six, Eight, Super 8 1803, 6 Only)—New type mounting consisting of two Harris type rubber bushings in end of arm. When installing torque arm, tighten mounting bolt until frame mounting bracket bottoms on bolt shoulder. NOTE—Frame mounting on other models same as 1939.

Kingpin Bushings—Steel-backed bronze split bushings (same as 1939). Bushings should be finished by burnishing with Packard Burnishing Broach ST-5046 or by reaming to inside diameter of .866". NOTE—Kingpins also furnished .005" oversize to compensate for worn spindle bushing holes. When installing kingpin, pre-load thrust bearing by installing shims (furnished in thickness steps of .001") so that force of 3½-5 lbs. applied at end of spindle required to turn spindle on kingpin.

SPRINGS:—Springs paint-marked for identification as shown in table below. If frame height not correct, install not more than two spacers #326836 (¼" thick) between upper spring cup and insulator on top of spring (if two spacers used, install Insulator #326706 between spacers). If height cannot be corrected by this means, replace springs.

Spring Specifications

Model	Part No.	Color Marks
1800 Std.	348127	Yellow & Red
1801 Std.	348377	Yellow & Blue
1801 FW.	326860	Green
1803, 6 Std.	335692	Red & Silver
1803, 6 FW.	338166	Yellow & Silver
1803, 6 Exp.	338269	Blue & Silver
1803, 6 Exp. FW.	351708	Silver & White
1803A Comm'l.	326925	White & Green
1804, 7 Std.	354690	Orange, Red, Blue
1804, 7 FW.	354691	Orange, Red, Purple
1804, 7 Exp.	333736	Brown & Blue
1804, 7 Exp. FW.	333575	Brown & Silver
1805, 8 Std.	351256	Purple & Silver
1805, 8 FW.	354710	Yellow, Red, Silver
1805, 8 Exp.	351256	Purple & Silver
1805, 8 Exp. FW.	354710	Yellow, Red, Silver

Std.—Spare at Rear. **FW.**—Fender Well cars.

OLDSMOBILE-PONTIAC TYPE

Used On:

OLDSMOBILE SIX, '60' F-40, '70' G-40 (1940)
OLDSMOBILE EIGHT, '90' MODEL L-40 (1940)
PONTIAC SIX, 40-25 SPECIAL, 40-26 DELUXE ('40)
PONTIAC EIGHT, 40-28 & 40-29 TORPEDO (1940)

Suspension design same as used on 1939 models.

CHECKING & ADJUSTMENT:—Check and adjust front wheel bearings, check kingpins for looseness, check shock absorbers and following points:

Tire Inflation—Check tires and inflate to 27 lbs. min. (Oldsmobile 60 & 90), 25 lbs. min. (Oldsmobile 70) 26 lbs. front, 28 lbs. rear (Pontiac 40-25 & 40-26 with 6.00x16 Tires); 23 lbs. front, 25 lbs. rear (Pontiac 40-26 & 40-28 with 6.50x16 Tires), 28 lbs. front and rear (Pontiac 40-29 Torpedo).

Wheel Runout—Check wheels and tires for run-out. Must not exceed ⅛". Mark 'high' point on tire and place this mark at top (vertically) when checking Toe-in and Toe-out, at one side (horizontally) when checking Caster, Camber & Kingpin Inclination.

Frame Height—Raise and lower front end of car several times by grasping front bumper to allow frame to come to normal level.

Kingpin Inclination—4°51'10" (Oldsmobile), 4⅝-5¼° (Pontiac) crosswise.

NOTE—Car weight must be on wheels and wheels should be set in straight ahead position when checking adjustment.

Caster:—0° to Negative ¾° (Oldsmobile), Negative ¾° (limits Neg. ½° to Neg. 1°) on Pontiac models. Must be equal within ½° on both sides of car. Machined bosses provided on front side of knuckle support for protractor mounting.

To Adjust—Loosen clamp bolt in upper end of knuckle support, remove lubricant fitting on front bushing of upper support pivot pin, insert Allen wrench J-720 through lubricant fitting hole and turn upper pivot pin clockwise to increase caster, counter-clockwise to decrease caster. CAUTION—Pin must always be turned in complete turns only to avoid disturbing camber adjustment (below).

Camber:—Negative ¼° to Positive ¾° (Oldsmobile), Positive ⅜° (limits 0° to Pos. ⅝°) for Pontiac.

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To Adjust—Same as for Caster (above) except that entire range of adjustment secured in ½ turn of eccentric pivot pin. CAUTION—Do not turn pin more than ½ turn when adjusting camber to avoid disturbing caster adjustment.

Toe-In:—1/16-⅛" (Oldsmobile), 0-1/16" (Pontiac) measured 9-10" above floor with wheels straight ahead.

To Adjust—Loosen clamp bolts at wheel end of each tie rod, turn tie rod adjuster on each rod equally. On Oldsmobile, turn both adjusters in direction opposite to that in which wheel revolves to increase toe-in. On Pontiac, turn right hand adjuster in same direction wheel revolves, and left hand adjuster in opposite direction to increase toe-in.

Steering Geometry (toe-out on turns):—With outer wheel turned exactly 20°, inner wheel should be turned 23° ± ½°. No adjustment provided (check for bent steering arms if incorrect).

SERVICING:—Lower Control Arm & Pivot Shaft—Serviced as an assembly and not interchangeable on right and left sides of car. Pivot shaft at inner ends of control arms can be removed by taking out bushing in each arm. To install shaft, install tool J-1052 or block between arms adjacent to shaft eyes so that distance between inner faces of arms at shaft eyes is exactly 11½" (necessary to prevent distortion of arms when bushings installed). Install shaft with seal on each end adjacent to mounting bracket, thread bushing in on shaft and in arm simultaneously (new bushings cut their own thread in arm as they are turned in), tighten bushings with 150 lb. pull on 16" wrench (200 lbs. on 12" wrench) so that there is no clearance between bushing flange and control arm. See that distance between shaft bracket mounting holes and inner face of control arm is exactly 1½" at each end (turn shaft to centralize), and that seal ends lap over bushings.

Knuckle Support Lower Pivot Pin—To install pin, slip rubber seal over outer end of each lower control arm, center knuckle support between lower control arms (approximately ⅛" between end of bushing and front arm, same distance between head of bushing and rear arm). Screw pivot pin through front arm, knuckle support bushing, rear arm, install nut on rear end of pin. Pull seals down over end of arms so that they seat on pin between arm and bushing at each side.

Knuckle Support Upper Pivot Pin—To install, center knuckle support in upper control arm yoke, screw pivot pin in until larger center section is centered in knuckle support, tighten clamp bolt. Install seal on pin at each side, start front bushing in on pin, then screw rear bushing in control arm and on pin and tighten securely. Turn front bushing in until clearance between front face or arm and head on bushing is 1/32" and tighten clamp bolt.

Kingpin Installation (Oldsmobile)—Bushings should be installed with oil hole lined up with oil hole in knuckle support and short groove on inner surface leading from oil hole to outer end of bushing (up on top bushing, down on lower bushing). Bushings should be burnished with J-722-1 burnishing tool and line-reamed to size with tool HM-592.

Kingpin Installation (Pontiac)—Bushings are floating type and should be installed with lubrication groove on inner face leading toward outer end of bushing (up on top bushing, down on lower bushing).

SPRINGS:—Lower end of spring not ground flat and must be installed with end coil fitted into recess in lower spring seat. Upper end of spring is ground flat. CAUTION—Spring must be installed with flat (ground) end up and lower end fitted in spring seat. Oldsmobile springs are paint marked on end coil for identification.

Oldsmobile Springs

Car Model	Wire Diameter	Color Mark
60, 70	.608"	Yellow
90	.635"	Brown

Pontiac Springs

Car Model	Wire Diameter	Free Length
40-25	.594"	14⅞"
40-26	.608"	14 27/32"
40-28	.635"	14 7/16"
40-29	.635"	14 27/32"

STUDEBAKER PLANAR TYPE

Used On:

CHAMPION, MODEL 2G (1940)

COMMANDER, MODEL 10A (1940)

PRESIDENT, MODEL 6C (1940)

Suspension design same as used on corresponding 1939 car models except as noted below.

1939 PRODUCTION CHANGE NOTE:—Commander Model 9A—Beginning with Serial No. 4112701, upper support arm changed to same type used on 1939 President Model (new type upper support arm frame bracket with shims for Camber adjustment located between bracket and frame). At the same time, the knuckle pin design and Shock Absorber mounting was likewise changed to the same type used on the President Model.

Camber Adjustment Note—All Commander Cars after Serial No. 4112701 in 1939, and 1940 cars, are adjusted by adding or removing shims from between both upper support arm frame brackets equally. See Camber adjustment directions below.

TYPE:—Design changed from 1939 type as follows:

Steering Knuckle Supports—Knuckle pin (kingpin) has eye at upper end for connection to upper support arm and has bracket bolted on lower end for transverse spring connection. Spring has second main leaf which is wrapped around spring eye in main leaf so that no additional lower link or support arm is required (this construction same as used on 1939 Champion model).

Steering Gear Linkage—Steering Gear has insulated steering arm (bolted to adapter arm on steering gear shaft through rubber bushings) and non-adjustable link between steering arm and idler lever on bracket on right frame side rail. Each wheel linked individually to steering arm (left wheel) or idler lever (right wheel) by adjustable reach rod. See Toe-in adjustment for special reach rod adjusting instructions.

CHECKING & ADJUSTMENT:—Adjust front wheel bearings, check shock absorbers, steering gear adjustment, steering arm and tie rods for looseness. Check following points first:

Frame Height—Raise and lower front end several times by grasping bumper so that frame will assume normal position.

Tire Inflation—Check tires and inflate to 26-28 lbs. (Champion & Comm.—front), 30-32 lbs. (Champion—rear), 28-32 lbs. (Comm.—rear), 30 lbs. (Pres. —front and rear).

Kingpin Inclination—5½° crosswise (all models).

Caster:—1-2° (Champion), Negative ¼° to Positive ½° (Comm. & Pres.). Caster angle determined by front spring and is not adjustable.

Camber:—½° (¼-¾°) for all models—same as 1939.

To Adjust—Loosen upper support arm frame mounting bracket bolts, remove shims from between mounting bracket and frame to decrease camber, add shims to increase camber (shims slotted). One thin shim will change camber ¼°, thick shims are equal to four thin shims. Tighten bracket bolts securely after adjusting. CAUTION—Make certain that shim thickness equal on both mounting brackets (add or remove shims equally at each bracket when making adjustments).

Toe-In:—⅛-7/32" (Champion), 1/16-⅛" (Comm. & President).

To Adjust—Set steering gear in straight ahead position (center of travel with lever lugs on 'high' points of cam), loosen clamp bolts and turn **l ft hand** reach rod until left hand wheel is in straight ahead position (parallel to rear wheel). Then loosen clamp bolts and turn **right hand** reach rod (between steering idler arm and right hand wheel) to adjust toe-in. CAUTION—Toe-in adjustment must be made exactly as detailed above to insure correct steering gear position.

Steering Geometry (toe-out on turns):—With outer wheel turned exactly 20°, inner wheel should be turned 22½° (Champion), 22° (Comm. & Pres.). No adjustment provided (check for bent steering arms if incorrect).

SERVICING:—Steering Knuckle Pin (All Models)—Pivot pin yoke at lower end of knuckle pin (kingpin) is keyed to knuckle pin and is a press fit. It must be removed in an arbor press after asembly removed from car. To remove knuckle pin assembly, jack up wheel with jack under spring eye, remove wheel and brake backing plate, disconnect tie rod at steering arm. Remove nut and unscrew knuckle pin lower pivot pin from spring eye. Drive out taper locking pin holding knuckle pin upper pivot pin, remove pivot pin to free knuckle pin from upper support arm. Remove knuckle pin, knuckle, and yoke as an assembly. Take off nut on lower end of knuckle pin, use arbor press to press yoke off lower end of pin. Knuckle is mounted on pin by bronze bushing at lower end, roller bearing at upper end, with ball thrust bearing between upper end and head of knuckle pin. When assembling, install shims (available in various thicknesses) between knuckle and thrust bearing so that endplay is .003-.006" (measured by feeler gauge below lower face of knuckle). Make certain that cork seal installed in groove in top face of lower yoke below knuckle.

Insulated Steering Arm—To remove assembly from steering gear shaft, remove cotter pin, nut, and washer from steering gear lever shaft, use puller J-871 to remove assembly from shaft (On Champion, nuts on steering arm bushing studs can be removed and arm pulled off without disturbing adapter arm on steering gear lever shaft). Adapter shaft and steering gear shaft are marked and marks should be lined up when assembly re-installed.

SPRINGS:—Front spring is transverse leaf type. Spring eye is formed in main leaf and second leaf is wrapped around eye for additional strength.

SPIRAL BEVEL & HYPOID GEAR ADJUSTMENT (ALL MAKES)

NOTE ON PINION SETTING GAUGES:—These gauges are designed to locate the pinion gear (with respect to ring gear center line) so as to duplicate the factory set up when the gears were burnished or run in. Mated gears of this type will run quieter and give more satisfactory service in this position and other settings should not be used. See separate articles for each type axle and complete instructions and specifications for use of these gauges.

RING AND PINION GEAR MESH:—To check gears, paint a number of ring gear teeth with some suitable indicator such as Prussian Blue or red lead mixed with oil. Rotate ring gear by hand applying tension on pinion shaft flange with a block of wood to simulate load. Indicator will be wiped off on teeth in area of tooth contact so that mesh can be judged. See illustration (No. 1) for desired tooth contact and possible variations which should be corrected as directed below. If desired, gears can be turned over a few times by the engine with the rear wheels jacked up and brakes applied for load (preliminary inspection of mesh should be made by turning gears by hand to avoid damage caused by running gears under load when badly meshed).

High Tooth Contact (Illustration No. 2):—Will be noisy and cause gear teeth to roll over at top if run for any length of time. To correct, move pinion in toward ring gear. If backlash is then insufficient, move ring gear away from pinion.

Low Tooth Contact (Illustration No. 3):—Will be noisy and gear teeth will groove or score if run with this setting. To correct, move pinion out or away from ring gear. If backlash is then excessive, move ring gear in toward pinion to decrease backlash.

Heel Contact (Illustration No. 4):—Will be noisy and cause excessive wear, chipping, and tooth breakage. To correct, move ring gear in toward pinion. If backlash is then insufficient, move pinion out or away from ring gear to increase backlash.

Toe Contact (Illustration No. 5):—Will be noisy and cause excessive wear due to small contact area, chipping, and tooth breakage. To correct, move ring gear away from pinion. If backlash then excessive, move pinion in toward ring gear.

Backlash Specifications:—See individual Rear Axle articles for recommended backlash for each axle type and complete directions on moving pinion and ring gears to secure above adjustments.

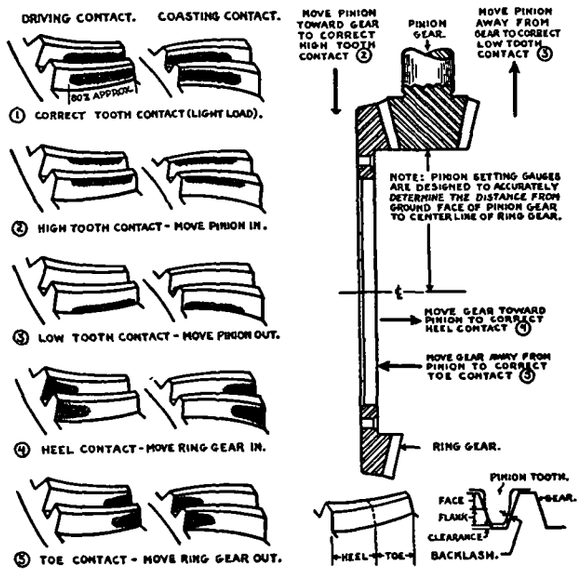
TROUBLE SHOOTING:—Before attempting to classify rear axle trouble from noise (hum or growl), eliminate other sources such as tires, engine, transmission as follows:

Tire Noise. Will change on different road surfaces and continue as speed decreases, will be more noticeable with low pressures. To check, coast car with gears in neutral from speed of 30 M.P.H. down. Rear axle noise will ordinarily disappear, tire noise will continue with lower tone as speed decreases.

Engine & Transmission. With car stationary, hold clutch disengaged, operate engine and vary speed through range in which noise previously noticed, check for similar sound. Then repeat test, engaging clutch to note transmission idling noises (gears in neutral). This will also check for muffler and exhaust noise.

REAR AXLE TROUBLE SHOOTING TABLE

1. **Drive Noise.** Most pronounced when car accelerated at constant rate from 15 to 45 M.P.H. Pinion should be moved in toward ring gear slightly.
2. **Coasting Noise.** Most evident when car allowed to coast from 45 M.P.H. down to 15 M.P.H. with throttle closed and clutch engaged. Pinion should be moved out or away from ring gear slightly.
3. **Float Noise.** Most evident when speed held constant at close intervals between 15 and 45 M.P.H. Correct by same adjustment as for coasting noise above, or by changing backlash slightly.
4. **Continuous Noise.** Check axle shaft bearing, differential bearing, pinion bearing adjustment. Check ring and pinion gear for incorrect adjustment, not matched or defective, gear teeth badly worn, scuffed or chipped. Backlash may be excessive or insufficient.



5. **Noisy on Turns.** Check for tight, binding, chipped, scuffed differential pinion gears or side gears, worn or rough thrust washers, excessive differential gear backlash, excessive axle shaft endplay.
6. **Intermittent Noise.** Check for sprung or warped differential case, excessive ring gear runout, loose or broken differential bearings.

WORM DRIVE AXLES

Used On:

CHRYSLER CUST. IMP., CW (1934), CW* (1935)
NASH ADVANCED 8, MODEL 1180 (1933)
NASH AMBASSADOR 8, 1190 (1933), 1290 (1934)
PIERCE ARROW 8, MODEL 836, 839 (1933)
PIERCE ARROW 12, MODEL 1236 (1933)

TYPE:—Worm gear type with underslung worm. Worm mounted on taper roller bearings with shim adjustment at rear bearing cap. Worm wheel and differential assembly mounted on taper roller bearings with adjusting nut under bearing cap at each side (worm wheel seated in groove in outer rim of differential case formed by riveting together of the case halves, rivets must be cut and worm wheel disturbed to get at differential pinions and side gears).

Chrysler—Worm and worm wheel mounted in carrier bolted to lower face of axle housing. Inspection plate bolted on top face of housing can be removed without disturbing gears or axle shafts.

Nash 1180, 1290—Design same as Chrysler (carrier bolted to lower face of housing) except that top cover cannot be removed.

Nash 1190—Separate carrier not used (worm and worm wheel mounted in center section of axle housing) with inspection cover at top. Axle housing halves are bolted at each side of the worm housing.

Pierce Arrow—Design same as on Nash 1190 except that no inspection plate provided.

SERVICING:—Gear Adjustment. Correct backlash for gears stamped on worm wheel with prefix 'B.L.' Adjusted by backing off one differential bearing adjusting nut and tightening opposite nut equally (see Differential Bearing Adjustment below). Set gear for maximum backlash (secured when worm wheel centered over worm), paint gears and adjust for correct mesh. Tooth contact should be approximately 80% of entire tooth area starting at the 'leaving' side (where tooth is almost vertical) and extending toward the 'entering' side (where tooth has flattest angle).

Axle Shaft Removal:—Remove wheel and brake backing plate at wheel end. Wheel bearings adjusted as follows:

Chrysler—Shims located behind inner bearing cup at outer end of axle housing. Shaft endplay .0025-.005".

Nash—Shims located between axle housing and brake support plate. Endplay .003-.006" (1180, 1290), .002-.006" (1190).

OVERHAUL:—Worm Bearing Adjustment:—Tighten rear universal joint flange nut securely. Set up dial indicator and check worm shaft endplay (if no endplay noticed, install shims under rear bearing cap until positive endplay reading secured, rotate shaft slightly while moving back and forth to seat bearings. Adjust as follows:

Chrysler—Remove shims from under rear bearing cap flange equal to amount of endplay plus .001-.002" shim thickness to secure bearing 'draw' or tension of .001-.002" on bearings.

Nash—Remove shims from under front cover plate (1180, 1190), rear cover plate (1290) exactly equal to endplay. Endplay should be zero.

Pierce Arrow—Remove shims from under front cover plate. Worm shaft endplay should be .002-.004". NOTE—With correct adjustment worm shaft should rotate freely but should not spin.

Differential Bearing Adjustment:—Make all bearing adjustments at left hand differential bearing nut without disturbing right hand nut (will not disturb worm and wheel mesh). Remove lock, turn adjusting nut in until tight, then back off one notch (Chrysler, Timken-Pierce Arrow), tighten bearing cap bolts securely, replace lock.

Backlash Adjustment:—When installing differential assembly, turn both adjusting nuts up equally so that worm wheel is centered on worm (maximum backlash in this position), then adjust for mesh by backing off one nut and tightening opposite nut (see Gear Adjustment above). Check differential bearing adjustment.

Differential Gear Assembly:—To remove gears it is necessary to cut rivets mounting worm wheel on differential case halves. Select thrust washers behind side gears (furnished in 3 thicknesses) so that clearance between gears and thrust washers is .007-.015" on each side. Install washers with indentations toward gears.

COLUMBIA TYPE

Used On:

AUBURN SIX, 652X, Y ('34); 653 ('35); 654 ('36-37)

AUBURN EIGHT, 8-100, A ('32); 8-101, 5 ('33), 850X, Y ('34), 851 ('35), 852 ('36-37)

AUBURN SCHGD. EIGHT, 851 (1935), 852 (1936-37)

PIERCE ARROW EIGHT, 836A, 840A ('34), 845 ('35)

PIERCE ARROW TWELVE, 1242, 1247 (1933); 1240A, 1248A (1934), 1245, 1255 (1935)

NOTE:—Auburn Models. Dual-Ratio standard on Models 652Y, 8-100A, 8-105, 850Y (Custom Models) and optional on other models. Dual Ratio axle serviced in same manner as other axles except for Dual-Ratio feature. See special Dual Ratio data below.

Pierce Arrow Models. Gears are Hypoid type. Serviced in same manner as other Columbia axles.

TYPE:—Spiral bevel or hypoid gear, semi-floating type with Hotchkiss drive. Pinion integral with shaft and mounted on taper roller bearings seated directly in housing (bearings positioned by shoulders in housing or by pinion adjusting sleeve which is threaded in housing). Differential assembly mounted on taper roller bearings with adjusting nut at each side.

SERVICING:—Gear Adjustment. Paint gears to check mesh. Backlash should be .003-.005" (Auburn), .002-.003" (Pierce Arrow). See Pinion setting and Backlash adjustment under Differential Bearing Adjustment below.

Axle Replacement. Wheels mounted on single taper roller bearing (designed to take thrust in one direction, thrust in other direction transmitted to other bearing by thrust spacer in differential assembly). To remove axles, remove wheel, take off backing plate which retains wheel bearing, pull shaft and bearing out. Bearings adjusted by adding or removing shims between backing plate and flange on axle housing.

NOTE—On models with Dual-Ratio, speedometer driven by gear on axle shaft near wheel. Remove speedometer pinion assembly before pulling axle shaft. When reassembling speedometer pinion, see that endplay is .010".

OVERHAUL (SLEEVE ADJUSTMENT TYPE):—Pinion Bearing Adjustment. Bearings adjusted by nut on end of pinion shaft (rear universal flange retaining nut). To adjust bearings, back off locknut until lockwasher dowel pin can be freed from pinion nut, turn up nut until all endplay in pinion shaft has just been removed, replace locking washer and tighten locknut securely.

Pinion Setting:—Pinion located by adjusting sleeve in housing which contacts both bearings cups. To adjust pinion, take out two capscrews and remove pinion lock plate on side of housing, loosen housing clamp bolts, turn sleeve (threaded in housing) to move pinion forward or backward in relation to ring gear, tighten clamp bolts securely and replace lock plate.

Differential Bearing Adjustment:—Turn up adjusting nut at outside of each differential roller bearing. See that locks are in place and bearing caps securely tightened after making adjustment.

Ring Gear Backlash Adjustment. When adjusting backlash, back off one differential bearing adjusting nut and tighten opposite nut exactly equal amount so as not to disturb differential bearing adjustment.

OVERHAUL (SHIM ADJUSTMENT TYPE):—Pinion Bearing Adjustment. Controlled by shims between front bearing cone and shoulder on pinion shaft. Shims furnished .100", .003, .005", .010" thick. See that pinion nut at rear universal joint flange is tight when checking bearing adjustment.

Pinion Setting:—Controlled by shims on pinion shaft between pinion and rear bearing cone. Shims furnished from .115" to .135" thick in .002" steps. Increase shim thickness to move pinion in toward ring gear, decrease shim thickness to move pinion out or away from ring gear.

Differential Bearing & Ring Gear Backlash Adjustment:—Same as for Sleeve adjustment type. See instructions above.

AUBURN DUAL-RATIO

TYPE:—Consists of a planetary reduction gear built in a housing around the differential assembly (ring gear mounted on this housing so that it transmits drive from engine to planetary pinions which are likewise mounted on it. Internal gear is integral with differential housing and sun gear is mounted on a sleeve which is free to revolve on the axle shaft within the dual-ratio housing. The control mechanism consists of a sliding clutch sleeve splined on the sun gear sleeve which is shifted by a vacuum cylinder so as to engage clutch teeth on a stationary gear bolted to the left hand differential bearing pedestal (high or dual-ratio drive through planetary gears), or similar clutch teeth on an extension of the dual-ratio housing (low or direct drive with planetary gears locked so that the entire mechanism revolves as a unit).

OPERATION:—Direct Drive. When the vacuum line from the intake manifold is connected to the rear end of the operating cylinder, the piston moves toward the axle, rotating the yoke and shifting the clutch sleeve in so that the dual-ratio housing (planetary pinion drive plate) and the sun gear are locked together and rotate as a unit. The pinions are thus prevented from rotating on their shafts and act merely as clutch teeth to revolve the large internal gear at the same rate as the housing (ring gear speed), affording a direct drive.

Dual-Ratio Drive. When vacuum is connected to the forward end of the cylinder, the clutch sleeve is shifted out so as to engage the stationary gear bolted to the axle housing (differential bearing pedestal) so that the sun gear is held stationary. The rotation of the dual-ratio housing causes the planetary pinions to revolve as they are carried around the sun gear causing the internal gear on the differential housing to revolve at a different rate, affording a high axle ratio.

SERVICING:—Serviced in same manner as other axle types (see preceding article on Columbia Axles) except for Dual-ratio disassembly and Differential Bearing adjustment as follows:

Dual-ratio Assembly:—Dual-ratio housing halves are bolted together by ring gear mounting capscrews. Taking out these screws will allow dual-ratio housing to be split, exposing all gears.

Differential Bearing Assembly. Clutch gear for dual-ratio drive bolted to left hand differential bearing pedestal with shoulder extending into pedestal to act as retainer for bearing cup (no adjusting nut used). Shims under the clutch gear flange are used for ring gear backlash adjustment.

Ring Gear Backlash Adjustment. Controlled by shims between stationary clutch gear flange and left hand differential bearing pedestal. Shims furnished .003", .010", .030" thick. Increase shim thickness to increase backlash, decrease shim thickness to move ring gear in and decrease backlash.

Differential Bearing Adjustment. After Ring Gear backlash correctly adjusted (above), adjust differential bearings by turning right hand differential bearing nut in to take up bearing endplay or looseness. See that lock plate installed and bearing cap securely tightened after completing adjustment.

COLUMBIA TWO-SPEED TYPE

Optional Equipment On::

FORD '85' MODELS (1938-39)

LINCOLN-ZEPHYR, MODELS HB (1937), 86H (1938), 96H (1939)

MERCURY, MODEL 99A (1939)

NOTE:—This axle provides low axle ratio for power and acceleration (with planetary gears locked out) and a higher ratio to reduce engine R.P.M. at high speeds (with planetary gears operating). Do not confuse this type with the Ford Two-Speed Truck Axle which operates differently.

TYPE:—Consists of a planetary gear reduction unit built in a special differential assembly case which is installed in place of the regular Ford or Lincoln-Zephyr differential (furnished with new right hand axle housing which replaces original housing). A vacuum cylinder mounted on the axle housing operates the planetary gear clutch and is controlled by a valve assembly linked to the clutch pedal and to a control button on the instrument board. An adapter (two-speed gear box) is provided for connection in the speedometer drive cable and is linked to the control button so that the speedometer drive ratio is changed for overdrive operation to insure speedometer reading accurately at all times. NOTE—Some 1939 cars have a speedometer drive gear on the right hand axle shaft and a driven gear assembly mounted on the axle housing. These cars do not require a separate adapter.

OPERATION:—With the dash control button pushed in (for direct drive), the sliding clutch in the rear axle locks the sun gear and the differential case (in which planetary pinions are mounted) so that the entire planetary gear system (sun gear, pinions, and outer internal gear) rotate as a unit and the

COLUMBIA TWO-SPEED TYPE CONT.

ring gear drives the rear wheels directly. When the clutch is released and the control pulled out to the overdrive position, the vacuum cylinder pulls the sliding clutch out so that the differential case is free and engages the stationary clutch plate so that the sun gear is prevented from rotating. The ring gear then drives the differential case and pinions, and the rotation of the pinions (on the stationary sun gear) causes the internal gear and the axle shafts to revolve at a faster 'overdrive' speed.

INSTALLATION:—When Overdrive axle is installed, the regular Ford or Lincoln-Zephyr axle should be dismantled (center pinion mounting housing need not be removed but torque tube should be blocked up so that it does not hang on the universal joint ball housing). Right hand axle housing, differential case (right and left halves and bearing on right half), differential pinion spider, and ring gear bolts and nuts should be discarded (replaced by overdrive axle parts). Overdrive axle assembly should be assembled on pinion housing using original capscrews except for top front hole (special long capscrew and copper washer furnished wired to hole in which it should be installed). Original right hand axle shaft should be filed smooth for distance 8" back from side gear to remove all scale and high spots, thoroughly cleaned, and dipped in regular axle lubricant (5" at side gear end), then insert shaft through overdrive unit (these instructions for shafts without speedometer drive gear only). Original differential pinions should be assembled on new spider, bronze thrust washer installed on spider in back of each pinion (lubricate washers with axle lubricant before installing), and inserted in overdrive differential case so that spider engaged in slots in internal gear case and pinions properly meshed with side gear. Original left hand axle shaft should be threaded through new yellow bronze side gear thrust washer and original ring gear, washer tongues entered in slots in differential case through which differential spider was assembled, and ring gear bolted to face of differential case with new capscrews. Left hand axle housing can then be assembled. **Important**—See that ring gear and differential clean and free from all nicks to insure gear running true, tighten mounting screws evenly and securely and lock screws with lockwire. Make certain that side gear thrust washer tongues do not slip out of slots in case while gear is being installed.

Control & Speedometer Adapter (Ford):—Control valve is mounted on bracket bolted to top of left hand frame side rail ahead of steering gear (bracket center hole engages rivet head, other holes must be drilled for bolts). Special clip should be bolted to lower end of clutch pedal and connected to bellcrank on control valve by rod (see adjustment below). Forward vacuum tube connection on valve should be connected to manifold spacer installed between carburetor and manifold (manifold studs must be replaced with new longer studs when spacer installed). Vacuum connections at rear of valve should be connected to vacuum cylinder by rubber tubing and copper tubing running along left hand frame side rail (connect 'low' top connection on valve to right hand end of cylinder, 'high' bottom connection to left hand end of cylinder). Control button is installed in drilled hole in instrument panel (2½" up from starter button, 1⅝" to left of instrument cluster), and control cable taken through drilled hole in dash (3½" in from left edge). Connect cable wire to lever on top of valve, see that lever is in forward detent position and that control button in forward position against instrument panel, then tighten cable clamp on valve.

Speedometer Adapter—Adapter screws directly on speedometer head (install square key furnished for connection between adapter and speedometer bfore mounting) with regular speedometer cable connected to adapter and short control cable (from control button connected to adapter lever.

CAUTION—Control cables, speedometer cables and vacuum tubes must not be kinked or bent in short radius which will interfere with correct operation.

Control Button & Valve Assembly (Lincoln-Zephyr):—Control valve mounted on steering gear housing cover plate. Connected in same manner as Ford except as follows: Clutch pedal rod clip clamped to shaft at clutch pedal end and inside edge of engine mud pan notched to provide clearance for rod, control valve vacuum line connected to windshield wiper connection on manifold with special adapter, control valve mounted on lower edge of instrument panel 2½" to right of starter button.

Speedometer Adapter—Adapter should be mounted on left front side of dash and connected to speedometer by special short length of cable taken through 15/16" hole drilled in center of dash. Regular speedometer cable should be looped up on left side of engine compartment and connected to adapter.

ADJUSTMENT:—Control Valve Clutch Connection—Adjust clevis on valve operating rod at control valve end so that valve plunger is depressed ⅛" minimum, ¼" maximum with clutch pedal depressed to floor. Valve travel must not exceed ¼".

Control Button—Cable conduit should be positioned in clamp on valve body so that valve lever is in forward position (stopped by detent) with control button pushed in toward dash and fastened in this position by tightening clampscrew.

SERVICING:—Axle Lubrication—When first installed, axle should be filled with 4½ pints (Ford), 6 pints (Lincoln-Zephyr) recommended axle lubricant and car should be run with rear wheels jacked up (transmission in high, overdrive in low) for 5 minutes to circulate oil through overdrive unit. Axle should then be refilled to level of filler plug in overdrive case. **Always fill to level of overdrive filler plug, do not use regular axle filler plug for this purpose.**

Vacuum Cylinder Lubrication—At 10000 mile intervals, remove vacuum cylinder, lubricate leather piston cups thoroughly with Houghtons Cosmolubric #1000 hydraulic oil or equivalent.

Speedometer Adapter Lubrication—At 10000 miles, or sooner if noise develops, remove adapter, take out small plug on side and repack case with Alemite lubricant by hand—**do not use pressure.**

TROUBLE SHOOTING:—If overdrive axle does not shift properly, check all vacuum lines and connections for leaks, check tubes for kinks, sharp bends, or flattened spots, make certain that rubber tubing not cut or torn so as to obstruct opening at valve and copper tubing connections. Check valve settings (see adjustment section above).

OVERHAUL:—See Ford and Lincoln-Zephyr Rear Axle articles for axle servicing data.

SPICER (SALISBURY) HYPOID TYPE

HUPMOBILE SIX, 421-J ('34), 521-J ('35)
HUPMOBILE 8, 427T('34), 521-O,527T('35), 621N(36)
STUDEBAKER DICTATOR, 5A, 6A (1937)
STUDEBAKER PRESIDENT, MODEL 3C (1937)
Model 23
STUDEBAKER CHAMPION, G (1939)
Model 41-2.
GRAHAM, STD. & SPEC. 96 (1938-39)
GRAHAM, SUPERCHARGER 97 (1938-39)
HUPMOBILE SKYLARK, R (1939)
STUDEBAKER, SIX & COMM. 7A (1938)
STUDEBAKER, COMM. & STATE COMM. 8A (1938)
STUDEBAKER, PRESIDENT MODEL 4C (1938)
STUDEBAKER COMMANDER, 9A (1939)
STUDEBAKER PRESIDENT, 5C (1939)
Model 50-2
HUPMOBILE 8, 825-H ('38), 925-H ('39)

TYPE:—Hypoid gear, semi-floating type with Hotchkiss drive. The hypoid gear pinion is integral with the pinion shaft and is mounted on taper roller bearings which seat directly against shoulders in housing. Bearing adjustment controlled by shims located between front bearing cone and spacer on pinion shaft (on models where no spacer used, shims are located between bearing cone and shoulder on pinion shaft). Pinion position controlled by shims installed between rear bearing cup and shoulder in housing (all models). Differential assembly mounted on taper roller bearings with adjusting shims on differential case hub at inner end of each bearing.

SERVICING:—Gear Adjustment. Paint gears to check mesh, or check pinion setting (see directions below). Backlash should be .004-.008" (except Hupmobile '34-37—.004-.007", Hupmobile '38-39—.003-.006", Studebaker—.005-.007"). Adjusted by shifting differential bearing adjusting shims from one side to the other. See differential bearing adjustment.

Axle Shaft Removal. Remove wheel, take off axle shaft nut and washer, use puller to remove hub and brake drum assembly. Disconnect brake line and cables, take out bolts mounting oil seal assembly and backing plate on axle housing flange and remove backing plate (do not lose wheel bearing shims), pull axle shaft and bearing assembly out. Use bearing puller and remove bearing from shaft.

OVERHAUL:—Disassembly. To remove differential assembly (with axle shafts out), take out bearing cap screws, remove bearing caps, pull differential assembly out. Remove nut on end of pinion shaft, take off rear universal joint flange, press pinion out of housing toward rear to avoid damage to oil seal and bearing. Pry oil seal out toward front. Use new oil seal when reassembled if old seal worn or damaged.

Pinion Bearing Assembly:—Make certain that pinion setting shims installed in housing ahead of rear bearing cup, insert pinion and rear bearing cone in housing from rear, install spacer and pinion bearing adjusting shims on pinion shaft, tap front bearing cone in place, assembly universal joint flange, tighten nut securely (if bearing adjustment to be checked, oil seal assembly may be left out until adjustment completed).

Pinion Bearing Adjustment. With pinion shaft nut tight, pinion should rotate with slight drag (no endplay). Adjust by removing front bearing cone and adding or removing shims between cone and spacer or shoulder on shaft. Shims furnished .003," .005", .010", .030" thick.

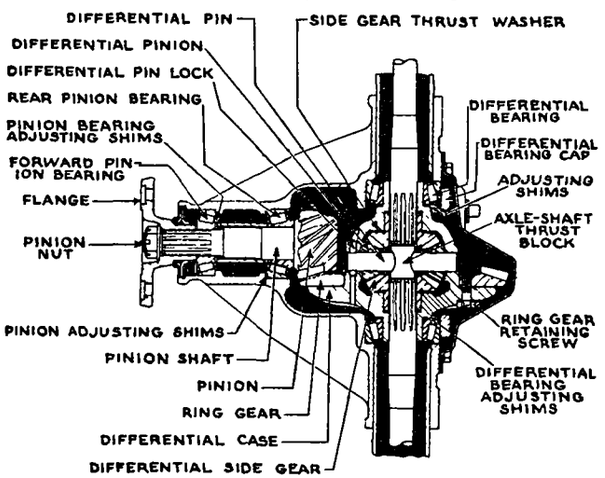
Pinion Setting:—Use special Pinion Setting Gauge, Salisbury No. J-772 or Studebaker No. HMJ-589 (see note below for Hypoid Gear Fittings). Set microme-

SPICER HYPOID TYPE CONT.

ter on gauge to correct figure for each axle model (see table below—this figure correct for standard pinions marked '0' on end) and correct micrometer for each pinion as follows: Figure etched on pinion indicates amount (in thousandths) that pinion should be set in toward ring gear (— figures) or out away from ring gear (+ figures). Install gauge in axle housing in place of differential assembly with side discs seated in differential bearing bores, add or remove shims located between rear bearing cup and shoulder in housing until micrometer pointer just contacts ground face of pinion gear (or adapter on hypoid gears—see note below).

Axle Type	Pinion Zero Setting
23, 41-2	.719"
50-2	.500"
Studebaker Models	
Dict. '37, All Models '38-39	.719"
President '37	.500"

Hypoid Gear Pinion Setting. Pinions are offset and micrometer gauge pointer will not contact ground face of pinion. Use special adapter on face of pinion and adjust so that micrometer pointer contacts face of offset plate on adapter. Special



clamp can be bolted on face of axle housing which has setscrew to hold adapter on pinion.

Differential Bearing Adjustment:—Shims installed on differential case hub at inner end of each bearing cone. To adjust differential bearings (with axle dismantled), remove bearing cones, add or remove shims until differential assembly will just slide into housing (no endplay when installed), then add additional .003-.006" (Studebaker .008-.010") shim thickness to secure correct bearing pre-load. Shims furnished .003", .005", .010", .030" thick. With correct adjustment, fairly heavy drag should be felt when ring gear revolved by hand (test preferably with pinion out to avoid added drag of pinion bearings and oil seal). When installing differential assembly, tighten bearing cap screws securely.

Ring Gear Backlash Adjustment. Adjust by transfering differential bearing adjusting shims from one side to the other (from left hand bearing to right hand bearing to increase backlash, from right to left to decrease backlash). Total shim thickness must not be changed. Shifting ring gear .005" will change backlash .0035".

SPICER (SALISBURY) SPIRAL BEVEL TYPE

Used On:

GRAHAM SIX, 65 ('33), 68 ('34), 73, 74 ('35)
GRAHAM EIGHT, 64 ('33), 67, 69 ('34), 72, 75 ('35)
GRAHAM CRUSADER, 80, 80A, ('36), 85 ('37)
GRAHAM CAVALIER, 90, 90A ('36), 95 ('37)
GRAHAM SUPERCHARGER, 110 ('36), 116, 120 ('37)
HUPMOBILE SIX, 321 ('33), 417, 421, A ('34), 518-D, (1935), 618-G (1936)
HUPMOBILE EIGHT, 422, 426 (1934)
LA FAYETTE, MODEL 110 (1934)
REO, MODELS 6A (1935), 6D (1936)
STUDEBAKER DICT., A ('34), 1A, 2A ('35), 3A, 4A (1936)
STUDEBAKER COMMANDER, MODEL B (1934)
STUDEBAKER PRES., C (1934), 2C (1936)

Model 10.

BANTAM, MODEL 60 (1937-38-39)

Model 21-1.

WILLYS TRUCKS, ALL MODELS ('38-39)

Model 42.

HUPMOBILE 6, 822-E ('38), 922-E ('39)

TYPE:—Spiral bevel, semi-floating type with Hotchkiss drive. Pinion is integral with pinion shaft and mounted on taper roller bearings which seat directly in carrier housing (rear bearing positioned by shoulder in housing, front bearing by spacer on shaft on Axle Models 20, 30, 30-1 or by second shoulder in housing for Axle Models 40, 40-1, 51 (no spacer used). Differential carrier mounted on roller bearings in housing.

SERVICING:—Gear Adjustment. Paint gears to check mesh or check pinion setting (see directions below). Backlash should be .004-.008" (Bantam .008", Hupmobile .004-.007", Studebaker .006-.008" '34, .002-.004" '35-36, .005-.007" '37-39). Adjust by shifting differential bearing adjusting shims from one side to the other (total shim thickness must not be changed to avoid disturbing differential bearing adjustment). See Pinion Setting and Differential Bearing Adjustment below.

Axle Replacement. When replacing axle shafts, check endplay. Total endplay between shafts and spacer in differential which transmits thrust from one shaft to the other should be .002-.007" (Bantam .005", Studebaker .001-.005"). Adjust by removing shims between backing plate and axle housing flange (at one wheel if clearance less than maximum, both wheels if greater). Shims furnished .003", .005", .010", .030" thick.

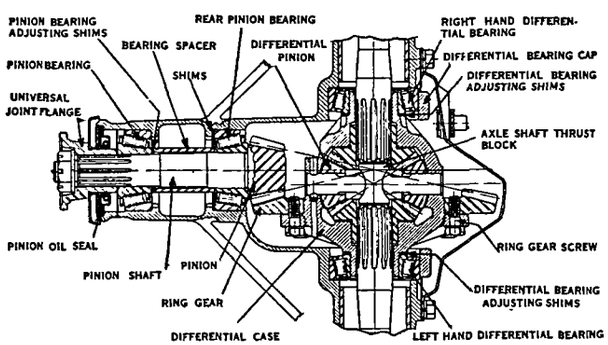
OVERHAUL:—Pinion Bearing Adjustment. When dismantling pinion assembly, pinion should be pressed out (to avoid damaging forward bearing) and oil seal should be pried out. Use new oil seal when reassembling if old seal damaged by removal. To adjust bearings, add or remove shims between forward bearing cone and spacer (or shoulder on pinion shaft on types where no spacer used), install universal joint flange and tighten nut securely. Pinion should rotate with slight drag (approximately .002" tight). Shims furnished .003", .005", .010", .030" thick.

Pinion Setting:—Use special pinion setting gauge, Salisbury No. J-772 or Studebaker No. HMJ-589 (see special instructions below for Reo gauge No. T-547), set gauge for correct zero position for each axle type or car model as shown in table below (correct for pinions marked 'O'). Figure etched on end of each pinion indicates amount in thousandths which pinion should be set ahead (plus figures) or in back (minus figures) of this zero position. Install gauge in axle housing in place of differential assembly, adjust pinion position by adding or removing shims between rear pinion bearing cup and shoulder in housing until correct gauge reading is secured (see note below for hypoid axles). Recheck pinion bearing adjustment (disturbed by pinion setting adjustment). Shims furnished .003", .005", .010" thick.

Axle Type.	Pinion Zero Setting.
10 (See Note)	.218"
20, 21-1, 30, 30-1	.407"
40, 40-1, 42	.126"
50	.000"
Studebaker Models.	
Dict. A ('34), 1A, 2A ('35), Rockne 65, 10	.407"
Comm. B ('34), Dict. 3A, 4A ('36)	.126"
Pres. C ('34), 2C ('36)	.000"

Model 10 Note—A special smaller pinion gauge must be used for this model. This gauge has an endplate diameter of 2.714-2.716" (to engage differential bearing bore) and the end of the micrometer pointer extends 2.000" beyond the differential bearing bore center-line with the micrometer set at zero.

Reo Models. Special Reo gauge (T-546) is fixed type without micrometer. Used by measuring clearance between pin and ground face of pinion, or between gauge cross-bar and front face of differential bearing bore in housing with feeler gauge. Standard setting (for pinion marked 'O') is 1.487" (gauge length).



Differential Bearing Adjustment:—Shims installed between bearing cones and differential case on each side. To adjust bearings, take out axle shafts, take off rear cover, remove capscrews and lift off differential bearing caps, then pull out differential assembly. Remove bearing cones, add or remove shims installed between bearing cone and case on each side until assembly will just slide into place in axle housing, then add additional shim thickness of .003-.006" (.008-.010" on Studebaker models), install assembly, tighten bearing caps. Ring gear should have fairly heavy drag when revolved by hand. Shims furnished .003", .005", .010", .030" thick.

NOTE—Early models fitted with adjusting nut at each bearing. These types adjusted by removing locks, loosening bearing caps, and turning up adjusting nuts to secure desired bearing adjustment.

Ring Gear Backlash:—Adjusted by transfering shims from behind left hand bearing to right hand bearing (to increase backlash), or from right to left (to decrease backlash). Total shim thickness must not be changed to avoid disturbing bearing adjustment. Shifting ring gear .005" will change backlash .0035".

BUICK (FIRST TYPE)

Used On:

MODEL 50, 60 (1932-33-34-35)

MODEL 80 (1932-33)

MODEL 90 (1932-33-34-35-36)

TYPE:—Spiral bevel gear, semi-floating (50), ¾ floating (60, 80, 90). Pinion shaft integral with propeller shaft and carried on double row ball bearing (front), single row ball bearing (rear) with spacer between bearings. Front bearing mounted in adjusting sleeve. Oil seal located in forward end of sleeve. Differential assembly carried on ball bearings with adjusting nuts under bearing caps on carrier.

SERVICING:—Gear Adjustment. Check pinion setting (see instructions below) or paint gears to check mesh. Backlash should be .006-.010" (recommended figure stamped on each pinion with prefix 'L'). To adjust, back off one differential bearing adjusting nut, tighten opposite nut equal amount (see differential bearing adjustment below).

Axle Replacement. On 60, 80, 90 with ¾ floating axle, cotter pin and nut at inner end of axle shaft (in differential case) must be removed before shaft can be pulled out.

OVERHAUL:—Pinion Bearing Assembly. Bearing inner races should be press fit on shaft or pinion shoulder. See that pinion key engages bearing spacer to prevent spacer turning. Front double row ball bearing should have no side play (outer race movement), rear single row bearing sideplay .010" max. Bearing sleeve runout (assembled) .005" max.

Pinion Setting:—Standard setting (distance from nearest face of differential bearing boss in carrier to face of pinion) shown in table below (correct for pinions marked '0.') Figure etched on face of each pinion should be added (plus mark) or subtracted (minus mark) to secure setting. Use recommended pinion setting gauge (HMJ-162), set gauge for zero on master gauge using correct locating button for each model, install gauge in differential carrier (differential assembly removed), remove adjusting hole cover on side of pinion housing, loosen clamp bolt, turn adjusting sleeve until correct pinion setting secured, tighten clamp bolt, replace adjusting hole cover. See that lock engages slot.

Car Model.	Pinion Setting.
50 (1932-35)	1.95725"
60 (1932-35)	2.0731"
80 (1932-33), 90 (1932-35)	2.21225"
90 (1936)	3.875"

Ring Gear:—Drill out old rivets. Reface ring gear seat if runout exceeds .002". New ring gear runout must not exceed .006" installed (measure on back face, use differential hubs as centers).

Differential Gears:—Bronze thrust washers installed in back of side gears and pinions. Backlash between gears .008" maximum.

Differential Bearing Adjustment:—Back off bearing cap nuts on right hand differential bearing 1½ turns, tap cap lightly with hammer to loosen, free lock, back off bearing adjusting nut slowly and note point where outer bearing race stops turning with nut. If race does not turn with nut (caused by bearing wear or race turning on hub due to 'locking'), determine the 'just free' position by turning nut in until outer race just starts to turn with nut. For correct adjustment, turn adjusting nut in one notch minimum or two notches maximum from the just free position, tighten bearing cap nuts and replace adjusting nut lock.

NOTE—Mark position of adjusting nut before dismantling or removing differential assembly and install in same positions so that ring gear backlash will not be changed.

Ring Gear Backlash Adjustment. Check backlash by rocking ring gear back and forth with pinion held stationary. To adjust backlash, back off one differential bearing adjusting nut and turn up opposite nut equal amount (to avoid disturbing bearing adjustment).

BUICK SPIRAL BEVEL TYPE

Used On:

MODEL 40 (1934-35-36)

MODEL 60 (1936)

MODEL 80 (1936-37)

MODEL 90 (1937)

TYPE:—Spiral bevel gear, semi-floating type with torque tube drive. Pinion integral with shaft and is splined and pinned to propeller shaft within torque tube. Pinion shaft mounted on double row ball bearing (front), roller bearing (rear—except 40 '34-35 which has single row ball bearing). Bearings mounted directly in housing with spacer between them and held in place by setscrew and locknut on side of housing which engages tapered hole in spacer. Differential assembly carried on ball bearings with adjusting nuts under bearing caps on carrier.

SERVICING:—Gear Adjustment. Check pinion setting (see instructions below) or paint gears to check mesh. Backlash should be .006-.010" for new gears or slightly more for worn gears. To adjust, back off one differential bearing adjusting nut, tighten opposite nut equal amount (see differential bearing adjustment below).

Axle Replacement. Axles retained by 'C' washer (40), nut and cotter pin (others) at inner end in differential case. To remove axle, take out locking pin, withdraw differential pinion shaft, remove spacer block, pull axle in and remove 'C' washer or take off nut, then push axle out. Shafts formed with integral flange at outer end to which brake drums and wheels attached.

NOTE—Spacers should be selected to give axle shaft endplay of .000" minimum, .008" maximum. Model 40 spacers ground on two sides to provide minimum and maximum production limit sizes. Spacers for 60, 80, 90 are furnished std., and .020" oversize.

Propeller Shaft Front Bearing (90 1937)—Consists of a bronze bushing in a removable cast-iron sleeve seated against a shoulder in the forward end of the torque tube and held by a setscrew. Bushing assembly may be removed from rear end of torque tube after setscrew taken out. NOTE—Plug provided in torque tube at this bearing for lubrication. Use transmission oil.

OVERHAUL:—Pinion and shaft must be removed from propeller shaft by cutting off head of pin and disengaging splines to remove bearings. Use new pin when reassembling.

Pinion Bearing Assembly:—Bearings should be press fit on pinion shaft. Tighten pinion bearing nut securely and stake in place. When installing assembly in housing tap outer race of rear roller bearing forward against collar to prevent possibility of race rubbing on pinion. See that adjusting shims installed ahead of front bearing and tighten pinion adjusting setscrews securely.

Pinion Setting:—Standard setting shown in table below (Dimension 'A' distance from rear face of pinion to nearest face of differential bearing boss in carrier, 'B' distance to ring gear center line), add (plus figure) or subtract (minus figure) the amount in thousands stamped on rear face of pinion. Use approved pinion setting gauge (with master test fixture to check gauge '0' point). Set gauge for each model, install gauge in differential carrier (differential assembly removed) so that locating rings seat in side bearing holes, add or remove shims located ahead of front pinion bearing in housing until pinion location correct, tighten adjusting setscrews and locknuts securely. Adjusting shims furnished .012", .015", .018", .060" and 3/16" thick.

Car Model.	'A' Pinion Setting	'B'
40(1934-35-36)	1.894"	3.4688"
60, 80 (1936)	1.947"	3.7187"
80, 90 (1937)	1.947"	3.7187"

Differential Bearing Adjustment:—Same as for other Buick models. See preceding article for complete instructions. Setting should be 1 notch minimum, 1½ notches maximum, tight or turned in from the just free position.

BUICK HYPOID TYPE

Used On:

MODELS 40, 60 (1937-38-39)

MODELS 80, 90 (1938-39)

TYPE:—Hypoid gear, semi-floating type with torque tube drive. Pinion integral with shaft and is splined and pinned to propeller shaft within torque tube. Pinion shaft mounted on double row ball bearing (which takes thrust in both directions) at front, roller bearing at rear. Bearings mounted directly in housing and front bearing locked in place by collar which is held in housing by tapered setscrews. Locking collar serves as spacer between bearings on Models 80, 90 (On Models 40, 60 rear bearing outer race seats against shoulder in housing). Differential side bearings are Hyatt self-aligning (barrel) roller type with adjusting nut under bearing cap on carrier at each bearing.

Model 40, 60 ('39). Torque tube built in two sections, rear section extending only to universal joint ball which is mounted on frame at rear of X member. Torque tube struts are not adjustable (bolt holes at forward end must be drilled in new torque tubes when installed). Pinion shaft front bearing has been increased in size and has one shielded side which must face forward. No pinion bearing washer (between bearing and seat in torque tube) is used as new type heavier pinion setting shims used which make this washer unnecessary. New type roller bearing is used at forward end of propeller shaft. Rear axle gears are not interchangeable with 1938 parts but rear wheel bearings, oil seals, axle shafts, and bearings (except double row pinion bearing) are interchangeable.

NOTE—Special removal and installation instructions required to maintain alignment of engine and rear axle on these models. See Buick Shop Notes in 'M' section for complete instructions on re-alignment.

BUICK HYPOID TYPE CONT.

Model 80, 90 ('39). Torque tube changed slightly (cast in differential carrier housing instead of being riveted) and strut bolts must be drilled in new torque tubes when installed. All axle parts, except for torque tube and axle housing interchangeable with 1938 parts.

SERVICING:—Gear Adjustment. Check pinion setting (see instructions below) or paint gears to check mesh. Backlash should be .006-.010" for new gears (slightly more for worn gears). Total lash measured at outside diameter of tire (one wheel jacked up) should not exceed ¾". To adjust backlash, back off one differential side bearing adjusting nut, tighten opposite nut equal amount (see Differential Bearing Adjustment below).

Axle Replacement:—Axles retained by 'C' washer at inner end (all models). To remove axle shaft, take out locking pin, remove differential pinion shaft and spacer block, push axle in and remove 'C' washer at inner end within differential side gear, pull shaft out (wheel bearing inner race is press fit on shaft and will be removed with it, outer race is light press fit in axle housing and can be removed with J-528-B puller).

Axle Shaft Endplay. Controlled by spacer block between axle ends in differential case and should be .000" minimum; .008" maximum. Four block sizes used in production, replacement spacer block ground on four sides to furnish minimum and maximum production sizes. (one size each for 40-60 and 80-90). **Important**—New bronze side gear thrust washers should be installed back of differential side gears before new axle shaft spacer block installed to correct endplay (not possible to secure correct endplay of .008" maximum with spacer block only if thrust washers worn).

NOTE—On '38-39 cars, right hand axle shafts are ¾" (40,60), 15/16" (80, 90) longer than left hand shafts and shaft not interchangeable. Shafts also not interchangeable with those used on 1937 models.

Propeller Shaft Front Bearing (40, 60 1939). The sleeve on the shaft (bearing race) is light press fit on shaft and will not be disturbed by shaft removal (will come out with shaft leaving bearing in torque tube. To dismantle bearing for servicing, remove propeller shaft, take out front oil seal, front bearing spacer, bearing roller assembly, bearing outer race, rear bearing spacer, and rear oil seal in order. When reassembling, use new oil seals, and remove bearing inner race sleeve from propeller shaft before installing shaft (oil seal will be damaged if shaft installed with sleeve in place).

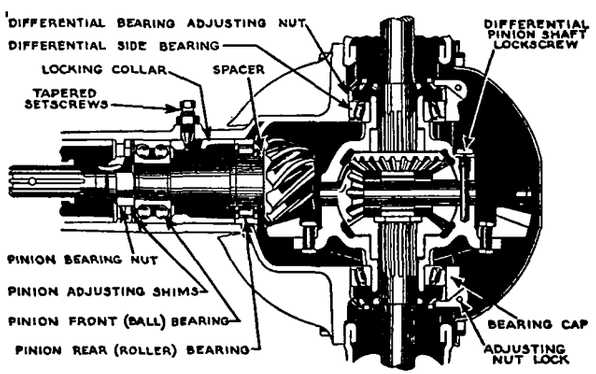
Propeller Shaft Front Bearing (80, 90):—Consists of bronze bushing in cast-iron body seated against shoulder at forward end of torque tube and held in place by setscrew. Shaft clearance in bushing should be .012-.016".

NOTE—Plug provided in torque tube at this bearing for lubrication. Use 10-W engine oil only.

OVERHAUL:—Disassembly. Mark differential bearing adjusting nuts and bearing caps before disassembling. To remove pinion and shaft assembly, loosen locknuts and take out taper setscrews on side of housing. To remove pinion from propeller shaft, file off head of pin, drive pin out, use tool J-862-A to pull pinion from propeller shaft (this tool used also to install pinion). Pry up staked portion of pinion bearing nut, remove nut, dismantle bearing assembly.

Pinion Bearing Assembly:—Bearings should be press fit on pinion shaft (use tubing of correct diameter to engage inner race when pressing bearings on shaft). No inner race used for rear pinion bearing (outer race and rollers furnished as assembly) and spacer must be installed between rollers and pinion to prevent creeping. Tighten pinion bearing nut securely and stake into notch on shaft. Assemble pinion to propeller shaft riveting pin to prevent it loosening in service (see propeller shaft straightening below). When installing assembly in housing, tap outer race of rear bearing in against shoulder in housing (40, 60), bearing collar (80, 90), to prevent race rubbing on pinion. Make certain that adjusting shims installed ahead of front bearing and tighten setscrews and locknuts securely.

Pinion Rear Bearing (40, 60)—With some optional gear ratios, pinion is larger in diameter than rear bearing and special forked tool must be inserted between pinion and bearing so that pinion bearing can be driven in place (use bronze driving block to drive on face of pinion), remove tool after bearing seated in carrier bore.



Propeller Shaft Run-out. With propeller shaft supported on 'Vee' blocks at point just behind splines at forward end and rear pinion bearing outer race at rear, run-out on tubular shaft 1½" back of forward end should be less than .010", run-out at center of tubular shaft should be less than .015", run-out at front pinion bearing outer race should be less than .002". With these limits, run-out at universal joint end (before joint connected) should be less than 1/16" (greater run-out will cause universal joint bushing wear and possible oil leak from transmission).

Ring Gear Installation:—Ring gear and pinion furnished only in matched sets. To remove old gear, drill out rivets with ⅜" drill on differential case flange side (cutting rivets with chisel will distort case). Case run-out must be less than .002" with gear removed. Bolt ring gear in place with 5/16" bolts in alternate holes, then install opposite rivets between bolts, remove bolts and finish riveting. Run-out at back of gear must not exceed .006".

Pinion Setting:—Pinions marked on rear face by etched figure and plus or minus sign for necessary correction of standard setting (micrometer reading for standard settings given below). Plus sign indicates that pinion should be moved away from axle shaft center-line, minus sign toward axle center-line, the amount (in thousandths) of the figure following this plus or minus sign. Use J-681-A Pinion Setting Gauge, check micrometer '0' on test fixture, set micrometer to standard figure (as given in able below for each model), turn micrometer pointer in (for plus figure) or out (for minus figure) the amount stamped on face of pinion, install gauge in axle housing (with differential carrier removed) seating gauge rings on differential bearing posts, add or remove shims between pinion front bearing and shoulder in housing until micrometer pointer contacts face of adapter installed on pinion (adapter must be used on all hypoid gears). Shims furnished .011", .012", .015", .018", .060" and 3/16" thick.

1939 Pinion Setting Note—Production pinions are not ground on face and have definite tooth for pinion setting gauge measurements. When using gauge, measure to blank tooth (between tooth which has factory inspection mark of letter and number, and tooth with + or — mark) and again at opposite side of pinion (place adapter on pinion with blank tooth up and then with blank tooth down) and average these two readings to determine shim correction. NOTE—All service pinions have ground face. Above procedure is for original production pinions only.

Pinion Setting Shims ('39 40, 60)—New heavier type shims used between pinion front double-row ball bearing and torque tube seat to adjust pinion for correct mesh (these shims eliminate thrust washer used on previous models). Shims furnished in .001" steps from .010" to .020" thick inclusive (use two shims for greater thicknesses).

Standard Pinion Setting

Car Model	Micrometer Setting
50 (1932-33-34-35)	.649
60 (1932-33-34-35)	.336
80 (1932-33), 90 (1932-33-34-35)	.000
40 (1934-35-36)	.711
60, 80 (1936)	.461
90 (1936)	.305
80, 90 (1937)	.461
40, 60 (1937-38-39)	.379
80, 90 (1938-39)	.203

NOTE—This J-681-A gauge can be used for pinion setting on previous models and standard micrometer readings given for these models above. Use adapter for all models with hypoid gears.

Differential Bearing Adjustment:—Remove adjusting nut locks, mark adjusting nuts, loosen right bearing capscrews 1½ turns, tap cap lightly to free nut, back off right hand nut slowly and note point where bearing race stops turning with nut, mark this new position, return nut to original position and repeat check. Race should stop turning at same point and number of notches nut has been turned is 'notches tight' of old setting. Correct setting is 1-1½ ('37), 2-2½ ('38) notches tight. If bearing did not turn when nut backed off, turn up adjusting nut until bearing starts to turn and note number of notches that bearing was free. If this free setting not caused by bearing wear (lapped free or race turning on hub of case), equalize adjustment by turning each adjusting nut up 1 notch from point where race started to turn. Tighten both bearing capscrews and replace bearing locks.

Ring Gear Backlash Adjustment. When adjusting ring gear backlash, make certain that differential side bearing adjustment not disturbed (back off one nut and tighten opposite nut equally). Check bearing adjustment. If adjusting nuts marked before dismantling, setting nuts up to original marks should give correct ring gear position.

BUICK REAR SUSPENSION

Used On:

MODELS 40, 60, 80, 90 (1938-39)

TYPE:—New type using coil springs with conventional rear axle. Springs retained at top and bottom by steel plates and insulated from frame by rubberized fabric insulator at top. Radius Bar linked to frame and to axle housing on right side controls side movement. Shock absorbers are direct acting type (1938), double acting type (1939).

SERVICING:—No adjustment required except that spring heights ('Trim' dimension) must be correct to insure satisfactory shock absorber action and special directions necessary to remove and replace springs.

Spring Removal:—Disconnect lower ends of shock absorbers at axle bracket, raise rear of car to distend springs, remove bolts in upper and lower spring cups (upper bolt has right hand thread, lower bolt threaded up through spring bracket has left hand thread).

Spring Installation:—Make certain that insulator is in place between top of spring and frame, turn spring cups on bolts so that they are snug in end coils, see that rubber insulator in place on upper bolt, tighten bolts securely.

Trim Dimension (1938):—At curb weight, with full tank of gasoline, distance between spring seat on frame side rail and spring seat on rear axle bracket should be 14" maximum (if this 'trim' dimension greater than 14" shock absorber will be damaged on rebound). Replace spring if incorrect. If spring bottoms excessively under load, install special substitute springs (see Table #1—Special Springs) in matched pairs and check to see that these springs do not exceed 14" trim dimension. **1939 Models**—Check distance between lower face of frame side rail at center-line of rubber bumper and top of axle housing. Distance should be 6¾-7¾ for all models. Replace spring if this trim dimension incorrect.

SPRING SPECIFICATIONS:—Spring part number stamped on flat of end coil and springs paint-marked on first coil for identifications as follows:

1938 Standard Springs

Model	Part No.	Color	Length
40C, 41, 44, 47, 48	1304057	Yellow	18¾"
46, 46C, 46S, 66C, 66S	1304583	Blue	19¼"
60C, 61, 67, 68	1304584	Red	19"
80C, 81, 81F, 87	1304585	Orange	18¾"
90, 90L	1304586	Green	18¾"
91	1305032	White	18½"

1939 Standard Springs

Model	Part No.	Color Mark	Length
39-41, 41C, 48	1310363	Brown	20⅛"
39-46, 46C, 46S	1310361	Blue	20⅛"
39-61, 61C	1310362	Red	20⅛"
39-66C	1310363	Brown	20⅛"
39-66S	1310361	Blue	20⅛"
39-80C, 81, 81C, F, 87	1309893	Orange	20¼"
39-90, 90L	1308803	Green	20¼"
39-91	1309892	White	19⅞"

Heavy Duty (Overload) Springs:—Where springs bottom excessively or where heavy loads are customarily carried, heavier rear springs may be installed on all models as follows:

1938 Heavy Duty Springs

Table #1—For cars where trim dimension less than 14" and when spring bottoms excessively with load.
Table #2—For use with trailers or heavy loads in rear compartment (will maintain correct trim with 500 lb. overload on axle).

Model No.	Table #1 Part No.	Table #2 Part No.
40, 60 Coupes	1304057	1305364
40 (others)	1304584	1305364
60 (others)	1304585	1305364
80	1304586(*)	1305365
90	1305365	1305366

(*)—1305364 may also be used.

1939 Heavy Duty Springs

	Front Spring	Rear Springs 200 lbs. Overload	300 lbs.
40 Sedan	1311185*	1306461	1309893
40 Coupe	1311185	1310363	1304584
60 Sedan	1311186**	1304584	1309892
60 Coupe	1311186	1311621	1304584

*—With Spare at rear. No. 1311186 for Fender wells.
**—With Spare at rear. On Fender Well cars, install two steel shims No. 1310413 between spring and insulator at upper end of springs.

NOTE—See Independent Suspension article for special front springs used with heavier rear springs.

CADILLAC—LA SALLE (FIRST TYPE)

CADILLAC V8, ALL SERIES (1932 to 35)
CADILLAC V12, ALL SERIES (1932 to 35)
CADILLAC V16, ALL SERIES (1932 to 37)
LA SALLE V8, ALL SERIES (1932-33)

TYPE:—Spiral bevel, ¾ floating type with torque tube drive (1932-33), Hotchkiss drive (1934 on). Design same except for minor differences due to change in drive. Pinion integral with shaft (splined and pinned to propeller shaft on 1932-33 models, rear universal flange held on shaft by pinion bearing nut on later models). Pinion shaft mounted on double row ball bearing (front), single row ball bearing (rear). Front bearing mounted in adjusting sleeve with shims between sleeve and housing. Differential assembly mounted on roller bearings with adjusting nut at each side under bearing cap.

SERVICING:—On V16 models, complete differential carrier assembly should be returned to factory for service.

Gear Adjustment:—Paint gears to check mesh. Backlash should be .004" minimum, .012" maximum. Adjusted by backing off one differential bearing adjusting nut and tightening opposite nut equal amount. See differential bearing adjustment below.

OVERHAUL:—Pinion Bearing Assembly. On 1932-33 models, disconnect torque tube by taking out capscrews at rear flange on housing (these screws also hold pinion bearing sleeve), disconnect propeller shaft from pinion shaft by taking out pin and disengaging splines. On later models without torque tube, these screws hold bearing sleeve only. To dismantle assembly, take off pinion bearing nut on forward end of shaft. See that spacer installed between bearings and tighten pinion nut securely when reassembling (lock nut to prevent loosening). NOTE—New front double row ball bearing should be used when new gears installed.

Pinion Setting:—Pinion position controlled by shims between front bearing sleeve flange and carrier. When installing new gears, install .075-.090" shim thickness at this point (shims furnished .010", .015", .035" thick), then add or remove shims to secure correct gear mesh.

Ring Gear:—Mounted on differential housing by capscrews. Wire screws to prevent loosening. Ring gear runout installed must not exceed .001-.004" (measure on back face of gear).

Differential Gears:—Bronze thrust washers installed behind pinion and side gears. Pinion clearance on shaft .010" max., backlash between pinion and side gears .020" maximum.

Differential Bearing Adjustment:—Loosen bearing caps slightly, free locking plates, turn adjusting nuts in until pull required to rotate ring gear is 8-10 lbs. measured at rim of gear (hook spring scale on rim of gear, pressure to start gear should be approximately 15 lbs. but 8-10 lbs. should rotate gear after starting).

Ring Gear Backlash Adjustment. Adjust by backing off one differential side bearing adjusting nut and tightening up opposite nut equal amount.

CADILLAC—LA SALLE SPIRAL BEVEL & HYPOID TYPE

CADILAC V8, ALL SERIES (1936 to 39)
CADILLAC V12, ALL SERIES (1936-37)
CADILLAC V16, SERIES 90 (1938-39)
LA SALLE, SERIES 50 (1935 to 39)

NOTE—Manufacturer recommends that Differential Carrier assembly not be dismantled.

TYPE:—Spiral bevel (1935-36-37 models except Cadillac 37-60, LaSalle 37-50), Hypoid gear type (all 1938-39 models and 37-50, 60) with Hotchkiss drive. differential housing is barrel type with provision made to remove and install pinions and side gears through right hand end (case closed by end cap screwed in housing and retained by locking screw or taper locking pin installed from outside of case. Differential assembly mounted on taper roller bearings (bearing cups seated in ends of differential housing) with threaded sleeve type adjusting nut at outer end of each bearing. Adjusting sleeves are locked by clamp bolt in each bearing post. Several types of pinion mountings used as follows:

Spiral Bevel Type Pinion Mounting—Pinion mounted on double row ball bearing (front), roller bearing without inner race (rear). Assembly retained in housing by spacer collar bearing against front bearing outer race and retained by taper locking screws in housing. Rear roller bearing outer race is seated against rear face of spacer collar.

1937 Hypoid Pinion Mounting—Same as for Spiral Bevel Pinion (above) except that rear roller bearing race seated against shoulder in housing and spacer collar shortened so that it does not extend beyond locking screws.

1938 Hypoid Pinion Mounting—Pinion mounted on taper roller bearings seated directly against shoulders in housing with spacer on shaft between bearing cups (see illustration). Bearing adjustment by shims between spacer and front bearing cup.

1939 Hypoid Pinion Mounting—Same as 1938 type (above) except that compressible type steel spacer used and bearing adjusting shims omitted. Bearings are pre-loaded by turning up rear universal joint yoke nut which compresses or buckles the spacer. CAUTION—Loosening or tightening this universal joint yoke nut will change pinion bearing setting.

SERVICING:—Differential carrier assembly should be serviced by replacement. Manufacturer recommends that axles not be dismantled.
CAUTION—Do not loosen rear universal yoke nut which will disturb pinion bearing pre-loading setting.

CHEVROLET SPIRAL BEVEL PASSENGER CAR & TRUCK TYPE

Used On:
STANDARD, CC ('33), DC ('34), EC ('35), FC ('36)
MASTER, MODELS CA ('33), DA ('34), EA, ED ('35), FA, FD ('36).
HALF-TON, ¾ TON, ¾ TON SPECIAL, 1 TON TRUCK MODELS (1933 TO 1939)

NOTE:—Axle used on each model may be identified by letter prefixed to axle number stamped on carrier as follows:

Truck Model	Axle Ratio	Prefix Letter
GC, HC, HD, JC, JD Std.	4.11-1	B (or none)
GC, HC, JC Optl.	3.82-1	F or FB
HE, JE Optl.	4.11-1	T or TB

TYPE:—Spiral bevel, semi-floating type with torque tube drive. Pinion integral with shaft which is splined and pinned in bushing in rear end of tubular propeller shaft. Pinion shaft mounted on double row ball bearing at front (which takes thrust in both directions), roller bearing at rear (for radial load only, no inner race with this bearing). Differential assembly mounted on ball bearings with adjusting nut under bearing caps on outer ends.

SERVICING:—Gear Adjustment. Paint gears to check mesh. Backlash should be .004-.006" (1933-38), .006-.010" ('39). Adjust by backing off one differential bearing adjusting nut and tighten opposite nut equally. See Pinion Setting and Differential Bearing Adjustment below.

Axle Replacement. Wheel mounting flange integral with axle shaft. Wheel bearings pressed in axle housing. To remove shafts, take off differential case cover, take out differential pinion shaft screw, pull out pinion shaft, remove spacer block, pry axle in and remove retaining 'C' washer (recessed in side gear), pull axle shaft out. When replacing axle see that 'C' washer seated in gear. Check endplay.
NOTE—On 1933-35 models, brake drum held on axle flange by wheel mounting bolts and cannot be removed separately (drive out bolts to remove drum with axle out of car). When installing drum, use new bolts, coat gasket between drum and oil deflector with shellac or paint on both sides to insure oil-tight joint, line up extra hole in brake drum and gasket with oil pocket in deflector and notch in axle shaft flange, install bolts and peen shoulder into countersink in axle flange so as to rivet these parts together. On 1936 and later models, drum mounted on outer face of axle flange and held by wheel bolts (with wheel installed), two screws only (wheel removed). Drum can be removed separately without disturbing axle by taking out these screws. See that hole in drum and axle flange are lined up. Deflector and wheel bolt installation same as for earlier model above.

Axle Shaft Endplay. Controlled by spacer block and should be Free Fit to .014" max. Spacers furnished in three sizes (one block for two larger sizes, obtained by turning block which is ground on all four sides) as follows: Std. Models (1933-36) 1.0105", 1.0195", 1.0285". Master (1933-36) & All Trucks—1.1485", 1.1575", 1.1675".

Propeller Shaft Front Bearing. Consists of a bushing and leather oil seal seated against a shoulder in the housing at forward end of torque tube and an additional bushing (All Master and Truck models, Standard Model 1936 only) which engages the stub shaft of the universal joint. Bushings are doweled in place. Replace bushings when clearance exceeds .010". To remove bushings (front bushing must be removed to take out rear bushings), drill out dowel pins, drive bushing out with chisel through slot in housing, remove packing washer and retainer. Drive new bushing in until packing washer retainer seats against shoulder in housing, drill hole in bushing for new dowel pin, drive dowel in and prick-punch dowel head to prevent it loosening in service.

Front Propeller Shaft Assembly (HD, HE only). Same type as used on 1½ ton truck model except that bushing at forward end of housing engages front universal stub shaft (instead of propeller shaft. See 1½ ton truck axle article (following).

OVERHAUL:—Pinion Bearing Assembly. To dismantle assembly after propeller shaft removed from torque tube housing, loosen pinion bearing locknut, cut off head of rivet at rear end of propeller shaft, drive pinion shaft out of propeller shaft splines. Remove bearing locknut and press bearings off shaft. Front double row bearing should have no perceptible endplay (new bearings may have .001" tightness or drag). Rear ball bearing endplay .004-.006". Press bearings on shaft, asemble locking ring in front of rear bearing (roller bearing type only), install locking sleeve (ball bearing type) with tapered side toward pinion, use new locknut. Tighten locknut after pinion shaft riveted to propeller shaft and lock nut by peening metal into shaft keyway with a chisel. Maximum allowable runout at double row bearing .002".

Pinion Setting:—Pinion position controlled by shims in housing in front of front double row bearing. Standard shim assembly consists of one .188" spacer, one .015" and one .018" shim. With correct setting ring gear and pinion teeth will be flush at toe end of teeth. Vary the shim thickness as required to correct pinion position between .030" and .036" (two .015" or two .018" shims). Drive assembly into housing to seat bearings against shims, turn up three locking screws evenly to engage collar or locking sleeve and tighten securely, tighten locknuts.

Differential Bearing Assembly:—Install differential side bearings with the thick side of the inner race (marked 'thrust here') toward the differential case.

Differential Bearing Adjustment:—Differential ball bearings (Difrax type) have .018" max. sideplay (new). To adjust bearings, with differential bearing cap screws sufficiently tight to flatten lockwashers, turn adjusting nut in until snug, then turn nut in additional 1-1½ notches (1933-36), 1-2 notches ('37 & later) for correct bearing pre-load or tension install locks and tighten bearing cap screws securely.

Ring Gear Backlash Adjustment. When installing differential assembly, turn left hand adjsuting nut in until all backlash taken up between ring and pinion with ring gear turned so that high spot is at pinion (max. allowable runout .007"), then back off adjusting nut one notch. Adjust differential bearings by turning in right hand adjusting nut as directed above. This should give correct backlash .004-.006" (1933-38), .006-.010" (1939).

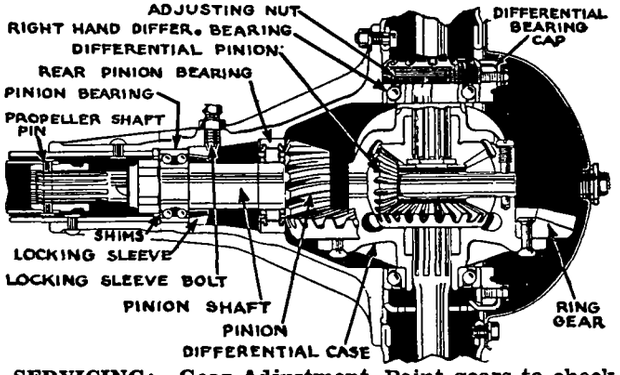
Ring Gear Replacement:—Ring gear riveted on differential case flange. To remove gear, cut off rivet heads on back of flange, drive rivets out with punch. When riveting new ring gear, install opposite rivets alternately using four bolts to hold gear on case. Run-out at back face of ring gear must not exceed .007" when installed.

CHEVROLET HYPOID TYPE (PASSENGER CARS)

Used On:
MASTER DELUXE, GA ('37), HA ('38), JA ('39)
MASTER PASS. CAR & SEDAN DELIVERY, GB ('37), HB ('38), JB ('39).

NOTE:—Master Deluxe axles (4.22-1 ratio) marked by Prefix 'B' (or no prefix) on axle number stamped on differential carrier. Master axles (3.73-1 ratio) marked by prefix 'C' or 'CB' on number.

TYPE:—Hypoid gear, semi-floating type with torque tube drive. Pinion integral with shaft which is splined and pinned in bushing in rear end of tubular propeller shaft. Pinion shaft mounted on double row ball bearing (front) which takes thrust in both directions, roller bearing (rear) which takes radial load only. Rear bearing does not have inner race and is assembled directly on shaft. Differential assembly mounted on 'barrel' type roller bearings with adjusting nut under bearing cap at outer end of each bearing.



SERVICING:—Gear Adjustment. Paint gears to check mesh. Backlash should be .004-.008". Adjusted by backing off one differential bearing adjusting nut and tightening opposite nut equally. See Differential Bearing Adjustment and Pinion Setting below.

Axle Shaft Removal. Remove wheels, take out two machine screws mounting brake drum on axle shaft flange and remove drum. Remove axle housing rear cover, take out pinion shaft screw, withdraw pinion shaft, lift out axle shaft spacer block. Push shafts in toward center of axle, remove 'C' washer at inner end within differential side gears, withdraw axle shaft. When replacing shaft, check endplay.
NOTE—Axle shafts are of unequal length. Install longer shaft on right hand side.

Axle Shaft Endplay. Controlled by spacer block at inner end of shaft and should be Free to .014". Spacers furnished in three sizes (one block for two larger sizes, obtained by turning block which is ground on all sides): 1.0105", 1.0195", 1.0295".
1939 Spacer Blocks—Furnished in four sizes as follows: 1.0105", 1.0195" & 1.0295" (one block, ground on all sides), 1.0345" (new size).

New Axle Shaft Installation. Wheel hub bolts are press fit in axle flange and must be installed in new shafts (these bolts hold oil deflector assembly on flange). Coat new gasket with heavy shellac or paint, install gasket and oil deflector on flange lining up oil holes (extra center hole of three closest together should be lined up with notch in flange, oil pocket in deflector should also line up with this notch), insert special wheel bolts and force heads

CHEVROLET HYPOID CONT.

down to deflector, peen shoulder on bolts into countersink around bolt holes in flange (this is very important). Check shaft endplay.

Propeller Shaft Front Bearing. Consists of a bushing and leather oil seal seated against shoulder in housing at forward end of torque tube, and an additional bushing at the extreme end of the torque tube which engages the stub shaft of the universal joint. Both bushings are doweled in place. Replace bushings when clearance exceeds .010". To remove bushings (front bushing must be removed to take out rear bushing), drill out dowel pins, drive bushings out from rear end of torque tube. Install oil seal with open end of leather toward front, insert rear bushing, use J-968 bushing driver to seat bushing and oil seal firmly. Drill new dowel hole in bushing (being careful not to break through wall), coat dowel with Permatex to prevent oil leaks, peen dowel in place. Install new front bushing in same manner, using arbor to prevent damage to bushing while drilling dowel hole and installing dowel (bushing has very thin wall).

OVERHAUL:—Pinion Bearing Assembly. To remove assembly from torque tube, loosen locknuts and take out retaining screws on side of housing, withdraw assembly from torque tube. To dismantle assembly, drill out head of rivet pin in propeller shaft, loosen pinion bearing locknut, disassemble pinion from propeller shaft. Use J-996 pinion bearing remover to press double row ball bearing from pinion shaft, remove locking sleeve or bearing retaining collar, remove lock ring from pinion shaft, take off roller bearing. Front double row ball bearing must have no perceptible endplay (new bearings may be .001" tight or have some drag). Assemble in reverse order making certain that lock ring installed on shaft ahead of roller bearing (to prevent rollers creeping) and that locking sleeve installed with beveled edge toward pinion. Tighten bearing locknut securely and stake nut into slot in shaft. Use new rivet pin when assembling pinion and propeller shaft and rivet both ends of pin securely. Make certain that pinion setting shims installed in housing (see Pinion Setting below), insert propeller shaft assembly and drive it down to seat bearings (use drift in hole in end of pinion, do not drive on pinion teeth). Make certain that locking sleeve down against bearing, install the three tapered lockscrews, tighten screws evenly and securely, tighten locknuts.

Pinion Setting:—Pinion position controlled by shims installed in housing ahead of front bearing. Standard assembly .033" shim thickness (one .015" shim, one .018" shim) and should be used for new gears. Shims furnished .015", .018" thick and shim pack can be varied from .030" to .036".

Differential Bearing Assembly:—Use special puller to remove bearings from differential case hubs (notches provided in case for puller so that pressure applied to inner races only). Use J-994 bearing replacer to install bearings. When installing differential assembly in carrier (third member), make certain that marks on bearing caps and carrier line up.

Differential Bearing Adjustment:—With carrier or third member assembly out of axle housing, tighten differential bearing cap screws until lockwashers are just flattened, turn right hand adjusting nut up until it is just snug, then turn nut additional 1-2 notches to locking position, tighten bearing cap screws securely and install adjusting nut locks.

Ring Gear Backlash Adjustment. To set up differential assembly for correct backlash when installing assembly in carrier, turn left hand adjusting nut in slowly until all balcklash between ring gear and pinion taken up (revolve ring gear while making this adjustment), then back adjusting nut off one notch. Adjust differential bearings by turning right hand adjusting nut as directed above. This setting should give correct backlash of .004-.008". If backlash not correct, back off one adjusting nut, turn up opposite nut equal amount.

Ring Gear Replacement:—Run-out of differential case flange must not exceed .001" with ring gear removed. When installing ring gear, use guide pins in alternate bolt holes to position gear while bolts are being installed, use new lockwashers under bolt heads, tighten all bolts evenly and securely and lock with wire. Ring Gear run-out .004" maximum.

CHEVROLET FULL-FLOATING TRUCK TYPE

Used On:

1½ TON TRUCK, MODELS O ('33), P ('34), Q ('35), R ('36), S ('37), T ('38), VA TO D ('39)

CAB-OVER-ENGINE TRUCKS, VE TO H (1939)

TYPE:—Spiral bevel, semi-floating (1933-34-35), full floating (1936 on) with torque tube drive. Pinion integral with shaft and straddle mounted on double row ball bearing (front), single row ball bearing (rear). Differential assembly mounted on ball bearings (1933-35), barrel type roller bearings (1936 on) with adjusting nut under bearing cap on each side. Thrust button located behind ring gear at pinion. Differential assembly mounted on ball bearings with adjusting nut under bearing cap at outer end of each bearing.

SERVICING:—Gear Adjustment. Pinion not adjustable. Backlash should be .006-.010" (see Differential Bearing Adjustment below).

Axle Shaft & Wheel Bearing (Semi-floating (type). Double row ball bearing pressed on axle shaft against shoulder. No adjustment required. To remove axle, take out capscrews in bearing retainer on outer end of axle housing, use puller to remove shaft and bearing.

Axle Shaft & Wheel Bearing (Full-Floating Type). Barrel type taper roller bearings used. To remove axle shaft, take out 8 capscrews in axle shaft flange at outer end, install two screws in tapped hole in flange (between regular screw holes) and turn these screws up evenly to loosen shaft. To adjust wheel bearings, remove axle shaft, remove locknut and star lock washer, turn inner adadjusting nut up tight and then back off to nearest tank of lock washer, install lock washer and locknut, bend lock washer tangs into notches on both nuts. When installing axle shaft, make certain that vellumoid gasket on inner face of flange is in good condition, use new soft steel locks under axle capscrews (axle lubricated by oil from differential case, gasket prevents leaks at hub, locks prevent leaks around mounting screws).

Wheel Bearing Adjustment—Wheel should be removed (permits more accurate bearing adjustment). Use special wrench J-870 to turn adjusting nut and tighten nut moderately tight while turning the hub (no spring in races and nut will come to definite stop under normal tension). After installing lock and locknut make certain that hub turns freely.

Wheel Bearing Assembly. No spacer used, inner bearing outer race seated against shoulder in hub, inner race seated against shoulder in axle housing, outer bearing outer race seated against snap ring in hub, inner race positioned by adjusting nut. Install outer bearing first, pressing inner race and roller assembly and outer race (thin edge down) into hub with special replacer J-872-1 until outer race just clears snap ring groove, then install snap ring in groove in hub and use special driver J-872-3 through capscrew holes in end of hub to drive outer race back in positive contact with snap ring. Install inner bearing outer race (thick edge down) in hub using driver J-872-4, then install inner race and roller assembly. Press oil seal in place in arbor press using replacer J-872-2, lock seal in place by prick-punching at three points on rim.

NOTE—Oil slinger in axle housing must be installed with special replacer J-973 (which pilots on housing) to insure correct alignment with slinger in hub.

Rear Propeller Shaft Front Bearing. Consists of a bronze bushing, packing washer and washer retainer in forward end of torque tube and retained by dowel pin in housing. Replace when clearance between shaft and bushing exceeds .010". To remove, drill out dowel, drive bushing out with chisel inserted through slot in housing. Install new bushing and packing assembly, then drill bushing in line with dowel hole, install new dowel and lock by prick-punching edge of housing.

Front Propeller Shaft Assembly. Consists of short front shaft and intermediate universal joint assembly. To dismantle assembly, remove rear universal joint by taking out capscrew in rear end of front shaft, take out snap ring holding ball bearing in front shaft housing, withdraw shaft and bearing assembly, press bearing from shaft. Bushing in forward end of shaft housing removed and installed in same manner as rear propeller shaft front bushing (above).

OVERHAUL:—Pinion Bearing Assembly. Pinion shaft and propeller shaft splined and pinned in connecting sleeve. To dismantle, remove rivet in propeller shaft, use special tool and push sleeve off propeller shaft, then remove rivet in pinion shaft and press off sleeve. Use new rivets when reassembling. Bearings are press fit on pinion shaft. Rear single row ball bearing endplay .004-.006" new. Retained on pinion shaft by locking ring. Front double row ball bearing should have no endplay (.001" drag permissible when new). Tighten pinion shaft nut securely and stake in place by peening metal into shaft keyway.

Propeller Shaft Run-out. After assembling pinion and propeller shaft assembly, mount on 'Vee' blocks at ground surface on shaft (at rear of splines) at forward end, and at double row ball bearing at rear end. Maximum run-out for assembly is as follows: .003" at front single row bearing, .010" at finished part of propeller shaft in front of rear splines, .015" at center of propeller shaft (unfinished portion), .005" at extreme front end of propeller shaft. Straighten assembly if run-out exceeds these figures.

Pinion Setting:—Pinion non-adjustable. Bearing should be seated against shoulder in housing and is retained by torque tube flange.

Differential Bearing & Backlash Adjustment:—Adjusted in same manner as on passenger car models (see preceding article). Left hand adjusting nut should be backed off 2 notches from tight position to secure correct backlash of .006-.010". Right hand

CHEVROLET FULL-FLOATING TYPE CONT.

nut should be turned in 1½-2 notches from the snug position for correct bearing pre-load.

Differential Bearing Assembly. Bearings are press fit on differential case hubs. Use special puller to remove bearings applying pressure to inner race only (bearings will be damaged if pressure applied to outer race when removing or installing bearings).

Ring Gear Servicing:—Ring gear furnished riveted to differential case (not serviced separately). When installing ring gear, make certain that marks on differential case and cover line up. Tighten the bolts in cover evenly and lock with wire. Check ring gear run-out with differential bearings installed on case. Run-out measured on back of ring gear must not exceed .007".

Ring Gear Thrust Pad Adjustment. Replace thrust pad if bronze tip is worn. To adjust, loosen locknut on thrust pad screw (on left hand side of axle housing), turn screw in until thrust pad contacts back of ring gear, then back screw off 1/12 turn and tighten locknut. With correct adjustment clearance between thrust pad and ring gear should be .005-.010".

CHEVROLET TWO-SPEED (DOUBLE REDUCTION) TRUCK TYPE

Optional Equipment On:
CHEVROLET, ALL TRUCK MODELS (1939)

TYPE:—Double reduction type with conventional ring and pinion gear and second gear reduction consisting of a helical gear on the right gear shaft meshing with a larger gear on the differential case (ring gear mounted on short separate shaft in front of differential case and axle shafts). Two speed feature consists of a duplicate set of the double reduction gears with a shifting sleeve between the gears on the ring gear shaft so that either high or low speed set of gears can be engaged at the will of the operator (gears are constant-mesh type and free to revolve on shaft, one gear at a time is locked to the shaft by the shifting sleeve). Three spring-loaded poppet balls are located within the shifter sleeve to maintain its position and an additional lock pawl is located under the shift lever on the axle housing. This lever is linked to auxiliary shift lever in cab by a combination rod and cable linkage.

SERVICING:—**Gear Adjustment**—Paint gears to check mesh. Pinion position controlled by shims. Backlash should be .006-.012". Controlled by shims at bearing caps on ends of double reduction (ring gear) shaft. See Pinion Setting and Double Reduction Shaft Bearing Adjustment below.

Axle Shaft & Wheel Bearings—All servicing operations same as for regular Full-floating truck axle (see preceding article) except that studs and conical locking sleeves used to retain axle shaft flange on wheel hub. To remove shafts, take off nuts on studs, install two 7/16x14" capscrews in extra holes in axle flange and turn screws up evenly to loosen axle, being careful not to lose locking sleeves.

OVERHAUL:—**Disassembly**—Take out capscrews retaining torque tube on pinion cage, remove torque tube. Mark differential bearing caps and adjusting nuts with punch to insure reassembly in exact same positions, remove tie wire, adjusting nut locks, bearing cap bolts, remove differential assembly from carrier. Take out pinion cage and propeller shaft assembly retaining nuts, remove assembly (two tapped holes provided in cage flange for removing tight cages) using extreme care not to lose shims under cage (these shims control pinion mesh). Remove shifter lever retaining nut and lockwasher, remove lever, being careful not to lose woodruff key and pawl, remove shaft bushing (raise bushing with screwdriver inserted through notch in carrier). Take off nuts and lockwashers on double reduction shaft bearing caps, remove bearing caps using extreme care not to lose shims under caps which control bearing adjustment and ring gear backlash (if necessary, use short bar between back of ring gear and carrier to remove left bearing cap which is piloted in carrier). Remove double reduction shaft assembly by sliding it toward left and pulling ring gear to rear so that assembly can be threaded past differential bearing supports. Remove shifter yoke, tap right hand bearing outer race out of carrier with soft drift punch.

Propeller Shaft & Pinion Assembly:—To disassemble, cut off coupling rivet heads with chisel, drive out rivets, use special press to separate pinion from coupling. Raise pinion bearing locknut edge, remove locknut and thrust washer, press pinion out of bearings toward rear. To remove bearing outer races, use Front Wheel Bearing Outer Race Driver. NOTE—Pinion cage serviced with front and rear bearing outer races pressed in place. To reassemble, lubricate bearing races, install pinion and rear bearing in cage, press front bearing race assembly on shaft until slight drag felt when cage is turned. Install thrust washer, bearing nut, lockplate, and locknut. Adjust bearings by turning bearing nut until cage can be turned with slight drag, tighten locknut and bend lock plate tangs over both nuts. Install propeller shaft and coupling, install new rivets in coupling. Use new gasket and same shims removed with cage and install cage on carrier, being careful to line up oil holes in gasket and shims with hole in case (top right side).

Double Reduction Shaft Assembly:—To disassemble, remove locking rings on bearing nuts, remove nut on end opposite ring gear first, remove bearing, low speed reduction gear, shifter sleeve, detent balls and springs (ball will fly out when sleeve removed, use care not to lose these parts). Clamp shaft in vise (engage clutch gear machined on shaft in copper vise jaws), remove bearing nut on ring gear end of shaft. Install shifter sleeve on shaft so that it bears against high speed reduction gear, install assembly in arbor press (supported on shifter sleeve), press bearing and ring gear off shaft, lift off high speed reduction gear. To reassemble, coat inner bearing surface of reduction gears with light grease, install parts in same order as when taken off (use outer race on bearing rollers when pressing bearings on shaft). Ring gear and bearing should be pressed tightly on shaft and bearing nut tightened securely (see that nut is in locking position so that locking ring can be installed). Install clutch sleeve with tapered face toward ring gear and three tapered teeth in line with detent balls and springs (see Note), make certain that detent balls and springs in place in shaft holes. Press right hand bearing on shaft until clearance between bearing inner race and low speed reduction gear is .012-.015", tighten bearing nut and install locking ring. When installing assembly in carrier, make certain that shifter fork engages shift sleeve, tap right hand bearing outer race in flush with case, use new gasket and install shims removed from under bearing cap when disassembled, being careful to line up cut-outs in gasket and shims with lubrication opening in housing, install bearing caps and tighten securely (inner race is permanently assembled in left hand bearing cap—bearing cap serviced with race installed). Install shifter shaft bushing, cork oil seal, shifter lock spring and pawl, key, shift lever, lockwasher, and nut. Check bearing adjustment (see adjustment instructions below).

Differential & Bearing Assembly:—To disassemble, remove lock wire, take out bolts in case, remove cover, high speed reduction gear, differential spider, pinions, and side gears (low speed reduction gear riveted to case and serviced as an assembly—do not remove this gear). To reassemble, lubricate thrust washers, side gear hubs and pinions, install in case. Install high speed reduction gear on pilot on case with flat side of gear toward case, match 'X' marks on cover and case, install four bolts first and tighten evenly and securely, then install balance of bolts and securely lock with wire. Lubricate differential side bearings, install races, install assembly in carrier, turn adjusting nuts up to marks made before disassembly, tighten bearing cap bolts snug, check bearing adjustment as directed below.

ADJUSTMENT:—**Pinion Mesh**—Check mesh by painting gears. If tooth bearing below pitch line (low contact), pinion is set too deep and should be moved out away from ring gear. If tooth bearing above pitch line (high contact), pinion should be moved in toward ring gear. To adjust, add shims between pinion cage and carrier (to move pinion out), remove shims (to move pinion in). When adjustment completed, tighten all pinion cage mounting bolts securely.

Double Reduction Shaft Bearing & Ring Gear Backlash Adjustment:—With double reduction shaft bearing caps in place and securely tightened, shaft should turn by hand with slight drag. Adjust by adding or removing shims under bearing caps (shims furnished .003" and .005" thick). Then check ring gear backlash.

Ring Gear Backlash Adjustment—Check with dial indicator contacting heel of ring gear tooth. If backlash not .006-.012", adjust by transferring shims from one bearing cap to the other as follows: Move shim from left side to right side to increase backlash, move from right to left to decrease backlash. CAUTION—Total shim thickness must not be changed (these shims control reduction shaft bearing adjustment). Then check shift sleeve adjustment.

Shift Sleeve Adjustment—Check clearance between shift sleeve and each reduction gear pinion with shift lever moved to engage that gear. Should be .015-.025". Adjust by turning eccentric shifter lever stop pins.

Differential Bearing Adjustment:—With bearing cap bolts tightened just snug and adjusting nuts turned up to align marks on nuts and case made before disassembly, check alignment of double reduction pinions. Align gears by backing off one adjusting nut and tightening opposite nut. Then adjust bearings by turning adjusting nut up tight and backing off 1 notch. Tighten bearing cap bolts securely, install adjusting nut locks and lock all bolts with wire.

Control Linkage Adjustment:—Disconnect front adjustable pull rod (at front end) and rear adjustable rod. Unscrew front connector from cable (at front frame bracket) and turn lock on cable so that it is 11/16" from end, replace connector and tighten locknut. Move connector so that front end is 2"

CHEVROLET (TWO-SPEED) CONT.

from front face of bracket. Place hand lever vertical or slightly forward so that clearance between lever and seat cushion is not less than 1", adjust front pull rod length so that clevis pin can just be inserted, tighten locknut at connector. Move shift lever on axle housing to forward or Low Ratio position, see that detent ball engaged in notch, adjust rear pull rod so that clevis pin can just be installed. Shift to High Ratio position and see that detent ball engages notch.

IMPORTANT LUBRICATION NOTE:—When axle dismantled for service and reassembled, remove pipe plug in pinion cage and fill space between pinion bearings with 1 pint of regular lubricant for initial lubrication (no further attention required at this point in service).

Regular Lubricant—Use SAE. No. 90 gear lubricant. Capacity 13½ pints.

CHRYSLER (FIRST TYPE)

Used On:

CHRYSLER ROYAL 8, MODEL CT (1933)
CHRYSLER IMPERIAL 8, CH ('32), CQ ('33)
CHRYSLER CUST. IMPERIAL, CL ('32), CL* ('33)
DE SOTO, MODEL SC (1932)
DODGE SIX, MODEL DL (1932)
DODGE EIGHT, MODELS DK ('32), DO ('33)

TYPE:—Spiral bevel, semi-floating type. Pinion integral with shaft and mounted on taper roller bearings (spacer between front and rear bearings) carried in cage. On Chrysler Models CT, CQ & Dodge Models DK, DO, cage forms cup for both bearings (no separate cups used). Differential assembly mounted on roller bearings with adjusting nut under bearing cap at each side.

NOTE—Pinion shaft assembly may be removed for pinion bearing adjustment (pinion mesh adjusted without removal, See Pinion Setting below) without disturbing differential.

SERVICING:—Gear Adjustment. Paint gears to check mesh. Backlash should be .005-.010" adjusted by backing off one differential bearing adjusting nut and tightening opposite nut equally. See Pinion Setting and Differential Bearing Adjustment below.

Axle Replacement. See that endplay is .0025-.005" for each shaft. Adjusted by adding or removing shims between cup of inner wheel bearing and shoulder in axle housing.

OVERHAUL:—Pinion Bearing Adjustment. Check pinion shaft endplay (before disassembling unit). Should be .0015-.0025" when pushing shaft by hand. Adjust by adding or removing shims between front bearing cone and front face of spacer.

Pinion Setting:—Pinion position controlled by split shims between flange of pinion bearing cage and front face of differential carrier. Adjust pinion by adding or removing shims equally above and below. This adjustment can be made by removing four capscrews and two stud nuts holding cage to carrier.

Differential Bearing Adjustment. Loosen bearing caps slightly, free adjusting nut locks, turn adjusting nuts in until slight drag in bearing, then back off adjusting nuts one notch.

Ring Gear Backlash Adjustment. Back off one adjusting nut, tighten opposite nut equal amount. Check bearing adjustment (above).

CHRYSLER SPIRAL BEVEL TYPE

Used On:

CHRYSLER MODELS

SIX, MODELS CO ('33), CA, CB ('34), C6 ('35).
AIRFLOW 8, MODELS CU ('34), C1 ('35), C9 ('36), C17 ('37)
IMPERIAL 8, MODELS CV ('34), C2 ('35), C10 ('36),
CUSTOM IMPERIAL, MODELS C3 ('35), C11 ('36),

DE SOTO MODELS

SIX, MODEL SC (1933)
AIRFLOW, MODEL SE (1934)
AIRSTREAM, SF (1935), S1 DELUXE (1936)

DODGE MODELS

SIX, DP ('33), DR, DS ('34), DU ('35), D2 ('36)

PLYMOUTH MODELS

SIX, MODELS PC, PD ('33), PE, PF, PG ('34), PJ ('35), P1, P2 ('36).

NOTE—On Dodge Model D2 ('36) some cars equipped with Hypoid gears, others with spiral bevel gears (see following article for Hypoid data).

TYPE:—Spiral bevel, semi-floating type with Hotchkiss drive. The pinion gear is integral with the pinion shaft and mounted on taper roller bearings which seat directly in carrier housing (positioned by spacer on shaft). Differential carrier mounted on roller bearings in housing.

SERVICING:—Gear Adjustment. Paint gears to check mesh. Backlash should be .005-.010" (1933-34-35 models), .006-.008" (1936 models), .006-.010" (1937 models). Adjust by backing off one differential bearing adjusting nut and tightening opposite nut equally. See Pinion Setting and Differential Bearing Adjustment below.

Axle Replacement (Cars with double wheel bearings). See that endplay is .0025-.005" for each shaft. Adjusted by adding or removing shims between cup of inner wheel bearing and shoulder in axle housing.

Axle Replacement (Cars with single wheel bearings). Total endplay between shafts and spacer in differential which transmits thrust from one shaft to the other should be .003-.008". Take up clearance by removing or adding shims equally between rear wheel brake support and each end of axle housing at the flange. Shims furnished .010", .0125" and .030" thick.

OVERHAUL:—Pinion Bearing Adjustment (1933 Models). Check pinion shaft endplay (before disassembling). Should be .0015-.0025" when shaft pushed backward and forward with 1400 lbs. pressure. Adjust by adding or removing shims between front bearing cone and front face of spacer.

(1934-37 Models). Check endplay with dial indicator, if no endplay, disassemble to remove front pinion bearing, add shims at front face of spacer to give free endplay. Reassemble and recheck endplay. Then remove shims to take up all endplay plus an additional .004" (1933-36), or .002" (1937) to give proper 'draw' or 'tension'. Pinion shaft bearings should be .004" (1933-36), .0015-.0025" (1937) tight.

Pinion Setting:—Pinion position controlled by shims between pinion gear and pinion shaft rear bearing. Adjustable from rear only.

Differential Bearing Adjustment (1933 Models):—Adjusted in same manner as early models (see preceding article).

(1934-35-36 Models). Bearings should be 'preloaded' to give .016" 'spread' on bearing supports. To adjust, set up a dial indicator on each side of drive gear with finger resting against one side of each bearing cap. Loosen bearing cap nuts slightly, free adjusting nut locks, then turn each adjusting nut in until total reading of both indicators is .016". Tighten bearing cap nuts, replace adjusting nut locks.

(1937 Models). Tighten bearings to seat cups in place. Then back off adjusting nuts to relieve strain. Tighten nuts slightly to give slight drag when pulling ring gear by hand.

NOTE—Gear mesh should be checked whenever differential bearings adjusted. Also mark bearing cap and adjuster before disassembling to facilitate readjustment of bearings.

Ring Gear Backlash Adjustment. Check with dial indicator. Back off one adjusting nut, tighten opposite nut equal amount. Check bearing adjustment (above).

CHRYSLER HYPOID TYPE

Used On:

CHRYSLER MODELS

ROYAL, MODEL C7 ('36), C16 ('37), C18 ('38)
ROYAL & WINDSOR, MODELS C22 (1939)
IMPERIAL, MODEL C14 (1937), C19 (1938)
IMPERIAL, SARATOGA, NEW YORKER, C23 (1939)
CUSTOM IMPERIAL, MODEL C15 ('37), C20 ('38)
CUSTOM IMPERIAL, MODEL C24 (1939)

DE SOTO MODELS

AIRSTREAM, S1 CUST. ('36), S3 ('37), S5 ('38)
AIRFLOW, MODELS SG (1935), S2 (1936)
MODEL S6 (1939)

DODGE MODELS

SIX, MODELS D2 ('36), D5 ('37), D8 ('38)
LUXURY LINER, STD. & SPEC. D11 (1939)

PLYMOUTH MODELS

SIX, MODELS P3, P4 ('37), P5, P6 ('38)
STD. MODEL P7, DELUXE P8 (1939)

TYPE:—Hypoid gear, semi-floating type with Hotchkiss drive. Pinion integral with shaft and mounted on taper roller bearings seated directly in differential carrier housing. Bearings positioned by spacer on shaft and adjustment controlled by shims assembled between spacer and front bearing. Differential assembly mounted on taper roller bearings with adjusting nut at outer end of each bearing.

SERVICING:—Gear Adjustment. Paint gears to check mesh. Backlash should be .006-.010". Adjusted by backing off one differential bearing adjusting nut and tightening opposite nut equally. See Pinion Setting and Differential bearing adjustment below.

Axle Shaft Replacement. Remove wheel, axle shaft nut, hub and brake drum assembly (use special hub puller C-319), disconnect brake line at wheel cylinder, take out stud nuts and remove oil seal and backing plate, remove and save wheel bearing adjusting shims, use puller C-158 and remove axle shaft and bearing assembly. Use puller C-293 to remove bearing from shaft.

NOTE—If new oil seals installed, soak in thin oil for 30 minutes, roll seal with smooth bar before installing (use special drift C-201 or C-202 to install seals).

OVERHAUL:—Pinion Bearing Adjustment. With pinion assembled in differential carrier, check pinion shaft endplay with dial indicator. If no endplay, take off pinion shaft nut, pull oil seal (see below), remove front bearing, add shims to give positive endplay reading, reassemble and check endplay (universal yoke flange must be in place and nut on shaft tight). Remove shims equal to observed endplay plus .004" (1936), .002" (1937 & later models) shim

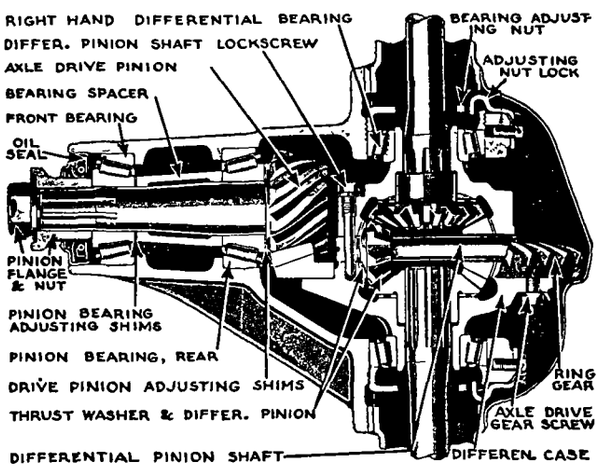
CHRYSLER HYPOID TYPE CONT.

thickness which will give required 'draw' or bearing pre-load. Bearings should be .004" (1936), .0015-.0025" (1937 & later models) tight.

Pinion Shaft Oil Seal. Can be removed and installed without removing differential bearing assembly or pinion. To remove, take off nut on end of pinion shaft, remove rear universal yoke flange, use puller C-358 to remove oil seal. Use special drift C-359 to seat oil seal. Seal leather must be soft and pliable (soak in thin oil for 30 minutes.

Pinion Setting:—Pinion position controlled by spacer washers installed on shaft between pinion and rear bearing. Pinion must be removed from carrier housing and bearings removed from shaft to change washer to correct pinion mesh.

Differential Bearing Adjustment:—Bearings should be just tight enough to cause slight drag when ring gear revolved by hand (assembly must not spin). Mark adjusting nuts and bearing caps before dismantling differential assembly to allow replacement in correct position. When installing assembly,



tighten adjusting nuts with sufficient force to seat bearing cups solidly against shoulder in bore, back off nuts, then tighten just enough to cause slight drag (see note for 1936 models), tighten bearing cap nuts securely and install adjusting nut locks. NOTE—On 1936 models, use dial indicator set up at each differential bearing post and tighten adjusting nuts until total spread of both posts is .016" (sum of both indicator readings). This will provide correct bearing pre-load.

Differential Side Gear Assembly—Differential pinion gear shaft retained by pin or lockscrew. Clearance between differential side gears and pinions should be .004-.012" (controlled by thrust washer in back of each side gear). When assembling differential gears make certain that thrust block installed on shaft at center with thrust washer between block and each differential pinion (this thrust block takes thrust of axle shafts).

Ring Gear Replacement:—Ring gear is press fit on differential case and is held in place by bolts or by capscrews (C19, all 7 Pass. models except C20).

Ring Gear Backlash Adjustment. Check with dial indicator. To adjust, back off one differential bearing adjusting nut, tighten opposite nut equally. Check differential bearing adjustment.

DUESENBERG (OWN MAKE)

Used On:

MODEL J, SJ (1932-37).

NOTE:—Rear axle should not require adjustment during the life of the car and manufacturer recommends that no attempt be made to dismantle assembly. Entire axle assembly should be removed from car if service work is required.

TYPE:—Hypoid gear, semi-floating type with torque tube drive. Pinion shaft integral with pinion and mounted on double row ball bearing (front), single row ball bearing (rear). Front bearing mounted in sleeve with pinion adjusting shims between sleeve flange and carrier flange. Pinion shaft is hollow and splined rear end of propeller shaft engages internal splines in forward end. Differential assembly mounted on single row ball bearing (left side), double row ball bearing (right side) with sleeve adjustment for ring gear backlash.

SERVICING:—Gear Adjustment. Ring gear backlash controlled by adjusting nut at right hand differential bearing. See also Pinion Setting below.

Axle Replacement. Complete axle shaft, brake drum, and wheel bearing assemblies may be removed by taking out 8 wheel bearing retainer bolts in axle housing flange on inner face of backing plates. Axles mounted on single row ball bearings which require no adjustment.

OVERHAUL:—Pinion Bearing Assembly. Bearings assembled on pinion shaft with spacer between them and held by pinion nut, lockwasher and locknut at forward end.

Pinion Setting:—Correct distance from rear face of pinion to center-line of ring gear marked on each pinion. Adjusted by adding or removing shims located between front bearing sleeve flange and carrier flange. When reassembling pinion, install same shim thickness at this point as previously to maintain pinion setting.

Differential Bearing Adjustment:—Ball bearings used. No adjustment required.

FORD (PASSENGER CAR)
LINCOLN ZEPHYR & MERCURY

FORD MODELS

V8 '60', ALL PASS. CAR & COMM'L. (1937-38-39)
V8 '85', ALL PASS. CAR & COMM'L. (1932 to 1939)

LINCOLN ZEPHYR

MODELS H (1936), HB (1937)

MERCURY MODELS

V8 '95', MODEL 99A (1939)

LINCOLN-ZEPHYR NOTE:—Axle on 1936-37 models similar in design to Ford type and serviced in same manner.

1938-39 Models—Hypoid type. See separate article on Lincoln-Zephyr Hypoid Rear Axle for complete data.

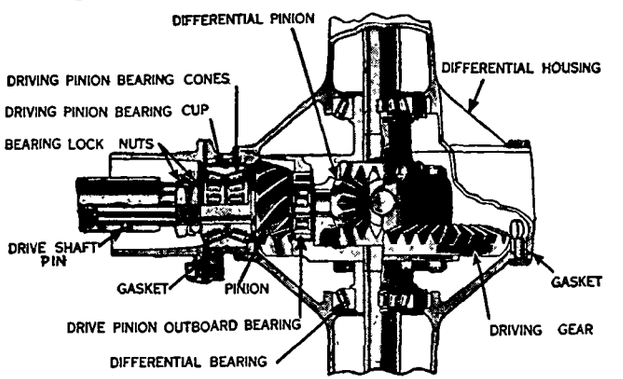
TYPE:—Spiral bevel, ¾ floating with torque tube drive. Pinion mounted on double roller bearing (straddle mounted with additional roller bearing behind pinion after November, 1932). Pinion shaft integral with propeller shaft (first type stub mounted pinion), splined and pinned to tubular propeller shaft (straddle mounted pinion, pinion integral with shaft on this type). Differential assembly mounted on roller bearings directly in axle housing (right and left hand housings bolted directly to pinion housing).

SERVICING:—Gear Adjustment. Backlash should be .010" Max. Controlled by gaskets between axle housings and pinion housing (see differential bearing adjustment).

Axle Replacement. Axle shafts must be removed from inner end after axle dismantled and differential case bolts removed (side gears integral with shafts). When installing axles see that free travel or play at wheels keyway does not exceed .010" or endplay exceed .015". If play excessive, check differential gears for wear (pinion clearance .005" maximum).

Propeller Shaft Forward Bearing:—In forward end of torque tube behind speedometer drive gear. Two types used (use B-4645-A roller assembly with split sleeve, 68-4645 with small rollers with solid sleeve). Use special puller SV-245 to remove solid sleeve from torque tube. Install new grease retainer (use tool A-310) with sharp edge of leather toward universal joint (old grease retainer will be damaged by sleeve removal).

Propeller Shaft Center Bearing:—In torque tube at center. On types with solid propeller shaft, front bearing sleeve must be removed before center bearing can be removed with SV-186 tool (see above).



OVERHAUL:—Disassembly. Remove speedometer driven gear assembly. Remove snap ring on forward end of propeller shaft, withdraw speedometer drive gear and thrust washer. Take out flange mounting screws at rear of torque tube, withdraw propeller shaft from tube toward rear. Drive out rivet in coupling, disconnect propeller shaft from pinion. Use AATA-1 driver to remove pinion assembly from housing, BV-92 puller to remove bearings.

Pinion Bearing Assembly:—Assemble bearings on pinion shaft (see Note below), tighten bearing locknuts so that bearing cup turns on cones with heavy drag. Heat housing (use approved heater or immerse housing neck in boiling water or hot oil for 1-2 minutes), install outboard bearing (use BV-94 driver), then with housing still hot install pinion assembly making certain that bearing cup is against shoulder in housing. Check pinion bearing adjustment only after installed in housing.
NOTE—Only bearings marked 'P' on end of cone should be used next to pinion

Pinion Bearing Adjustment:—Use approved gauge (ABV-129) to check bearing adjustm't. Setting must be 15-20 in. lbs. (V8 stub pinion), 12-17 in. lbs. (V8 with straddle mounted pinion, Lincoln Zephyr). To adjust, tighten pinion bearing nut until correct gauge reading secured (check only after pinion assembly installed in axle housing), then tighten locknut securely and turn lockwasher ears over on nuts.

Differential Bearing Adjustment:—Assemble axle with one 18-4035-A gasket (.008-.010" thick) between right and left hand axle housing and pinion housing. Check bearing adjustment by rotating both axle shafts simultaneously (rotating one shaft will not turn differential assembly). Differential assembly should turn with a heavy drag. If clearance too great, replace gasket between right hand axle housing & pinion housing with B-4035-BR gasket (.004-.005" thick). Then check gear for backlash.

Ring Gear Backlash. Use dial indicator mounted to show pinion gear shaft movement with ring gear stationary. Backlash should be .003" minimum, .010" maximum. Adjust by increasing or decreasing thickness of gasket between left hand axle housing and pinion housing. Total gasket thickness must not be changed in order not to disturb bearing adjustment (increase or decrease right hand gasket thickness equally).

FORD (TRUCK TYPE)

Used On:

ALL '60', '85', '95' TRUCKS (1932 TO 1939)

TYPE:—Spiral bevel, 3/4 floating (1932-33), full floating (1934 on) with torque tube drive. Pinion integral with shaft and straddle mounted on taper roller bearings (front), plain roller bearing (rear). Front bearings mounted in sleeve in pinion housing (sleeve flange clamped between flanges on torque tube and pinion housing which is integral with right section of axle housing). Pinion shaft splined in rear end of tubular propeller shaft. Differential assembly mounted on taper roller bearings seated directly in recesses in axle halves.

SERVICING:—Gear Adjustment. Backlash should be .008-.020" (1932-36), .004-.016" (1937 on).

Axle Shafts & Wheel Bearings (3/4 Floating Type). Axle shaft and differential side gear are integral. Axle must be dismantled and shafts withdrawn at inner end. No wheel bearing adjustment required. See that axle shaft nut at wheel kept tight (tighten with load off wheels).

Axle Shaft (Full Floating Type):—Can be removed without disturbing wheel or bearing adjustment. To remove, take off hub cap, remove nuts on 8 studs, turn in the two bolts located between studs to break axle shaft flange free from hub, then back off these bolts, strike axle flange sharp blow to loosen centering cones on three studs, pull axle shaft out, being careful not to lose the split centering cones on three studs. To install axle shaft, back off loosening bolts, install cones on three studs, tighten nuts on these studs first to center axle shaft, then tighten all stud nuts evenly and securely. Tighten loosening bolts just enough to prevent their loosening

Wheel Bearing Adjustment:—With axle shaft out, remove outer locknut, nut retainer, and grease retainer. Turn inner nut up tight, then back off 1/8 turn, install nut retainer and grease retainer, tighten outer locknut securely, replace axle shaft.

Propeller Shaft Front Bearing:—In forward end of torque tube behind speedometer drive gear. Consists of two plain roller bearings side by side on shaft within split sleeve in torque tube. Use tool BB-309 to remove or install bearing sleeve, BB-140 to install new grease retainer in tube behind bearing sleeve.

OVERHAUL:—Disassembly. Propeller shaft removed from torque tube in same manner as passenger car model (see preceding article). Pinion bearing sleeve or cup clamped between torque tube flange and axle housing flange, use AAT13 tool to remove and install assembly after torque tube removed. Use BB-143 tool to remove bearing cups, BB-144 to install. Use tool BB-142 to remove and install pinion bearing roller and cone.

Pinion Bearing Assembly & Adjustment:—Tighten pinion nut (on pinion shaft in front of forward bearing) until force required to turn shaft is 12-16 in. lbs. Use ABV-129 gauge to check setting (gauge reads in. lbs. directly which is force in lbs. times distance out from center of shaft at which force is applied in inches). Tighten locknut securely and see that lockwasher ears turned over against both nuts

Pinion Setting:—Not adjustable. Replace worn parts.

Differential Bearing Adjustment:—Not adjustable.

FORD TWO-SPEED TRUCK TYPE

Optional Equipment On:

ALL TRUCK MODELS (1939)

NOTE:—This axle provides a ratio of 5.83-1 for speed with reduced engine R.P.M. (planetary gears locked out) and a ratio of 8.11-1 for power (with planetary gears operating—these gears provide a supplementary reduction of 1.39-1). Do not confuse this type with the Ford Overdrive Axle used on passenger car models which operates differently.

TYPE:—Spiral bevel, full-floating type with torque tube drive. Pinion integral with shaft and is straddle mounted on two taper roller bearings (front), plain roller bearing (rear). Pinion shaft is splined and pinned to propeller shaft within torque tube housing. Differential assembly mounted on taper roller bearings with bearing adjusting nut under bearing cap at outer end of each bearing.

Two-Speed (Planetary) Gears. Two speed design consists of a set of four planetary pinions mounted on hardened bronze pins in the differential case and meshing with an internal gear cut on the inner rim of the ring gear. A sliding gear clutch on the left side of the differential assembly (operated by a shift lever extending through the axle housing) controls the planetary system.

Lubrication System. Special lubricating system consists of a drum on the ring gear which picks up lubricant and a scraper tube which is held against the drum by light spring pressure so as to collect this lubricant. Scraper tube is divided by partition so that lubricant directed to front pinion bearings through one channel and to right differential bearing through second channel in housing.

SERVICING:—Gear Adjustment. Paint gears to check mesh. Backlash should be .006-.020". Adjusted by backing off one differential bearing adjusting nut and tightening opposite nut equally (to avoid disturbing differential bearing adjustment). See Pinion Setting and Differential Bearing Adjustment below.

Axle Shafts & Wheel Bearings. Same design as used on regular full-floating Ford Truck Axle. See separate Ford Truck Axle article for adjustment directions.

Two-Speed (Planetary Gear) Adjustment. No adjustment is required. Planetary gears are Spur type.

OVERHAUL:—Pinion Bearing Assembly & Adjustment. Pinion bearing design and assembly similar to type used on other Ford models. Pinion bearing adjustment controlled by pinion bearing nut on forward end of pinion shaft. To adjust, tighten nut until bearings have no perceptible endplay but make certain that pinion rotates freely. Lock Adjustment by tightening locknut and making certain that lockwasher ears are turned over nuts.

Pinion Setting. Pinion position controlled by shims installed between bearing cage flange and carrier.

Differential Bearing Adjustment. After correct gear mesh and backlash secured (see below), tighten right hand differential bearing adjusting nut until bearings are tight, then back off adjusting nut one notch which should allow bearings to roll freely. Install adjusting nut locks and make certain that bearing cap nuts are securely tightened.

Ring Gear Backlash Adjustment. Back off right hand differential bearing adjusting nut and turn up left hand nut until backlash between gears is .006-.020" (measured at gear teeth). Paint gears to check mesh, adjust ring gear position for corect lengthwise contact, adjust pinion position for correct contact on tooth (contact depth on face of tooth). After correct gear mesh and backlash secured, adjust differential bearings (above).

HUDSON (OWN MAKE)

Used On:

HUDSON MODELS

'112' MODELS 89 (1938), 90 (1939)
SIX, ALL MODELS (1933 TO 1939)
EIGHT, ALL MODELS (1932 TO 1939)

TERRAPLANE MODELS

SIX & EIGHT, ALL MODELS (1932 TO 1939)

TYPE:—Spiral bevel, semi-floating type. Axle housing rear cover welded in place requiring removal of differential carrier assembly for any work on axle. Pinion integral with shaft and mounted on taper roller bearings with bearing cups seated directly in housing. Differential assembly mounted on roller bearings with adjusting nut under bearing cap at each side.

1939 Type:—Design changed from 1938 type as follows: **Differential Carrier**—heavier construction with integral pinion shaft oil baffle; **Differential Case**—Heavier construction with additional reinforcing webs, ring gear mounting now eight 7/16" bolts (bolts 1/16" larger and two extra bolts used), differential hubs have greater diameter with larger side bearings; **Gears**—Ring gear same as previous model except for greater number of mounting bolts, pinion shaft increased in diameter with new larger pinion bearings; **Ring Gear Bolts**—Shakeproof lockwashers used instead of lockplates, bolts 1/16" larger.

Interchangeability of Parts—Following parts not interchangeable on previous models: Differential carrier, pinion gear and bearings, ring gear, differential case halves and bearings.

NOTE—Differential carrier and gear assembly may be installed on previous models as a unit. Optional ratio gear sets (for previous models) cannot be installed on 1939 cars.

SERVICING:—Gear Adjustment. Paint gears to check mesh. Pinion position controlled by shims between pinion and rear bearing cone. Backlash should be .0005-.003". Adjusted by backing off one differential bearing adjusting nut and tightening opposite nut equally. See Pinion setting and differential bearing adjustment below.

HUDSON TYPE CONT.

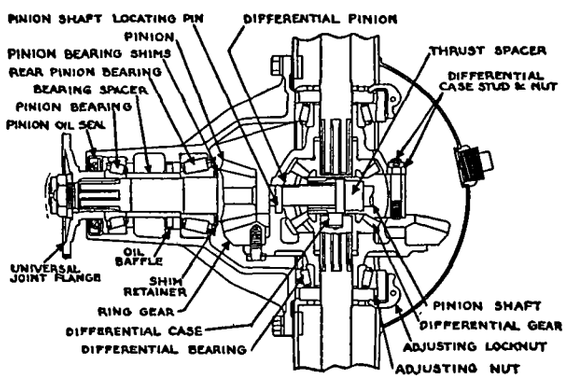
Axle Shaft Replacement. Remove rear wheels, axle shaft nut and washer, use wheel puller to remove hub and brake drum assembly (do not use knock-out type puller). Take off 4 nuts on wheel bearing adjusting cap, remove cap and bearing adjusting shims, use puller J-352 to remove shaft and bearing assembly. Use Bearing Remover J-358 to remove bearing cone and rollers from shaft.

Axle Shaft Thrust Button Renewal. Thrust button consists of hardened steel plug in inner end of axle shaft. To remove button, grind end flush with shaft, center punch button and drill through center with 11/32" drill, tap hole with 3/8-16 tap, screw in 3/8-16 capscrew, place head of screw in vise and tap end of shaft with soft hammer to remove button. Drive new button into place in shaft.

Axle Replacement. When replacing axle or adjusting wheel bearings remove shims equally at both wheels for endplay of .004-.010" (before '39), .002-.004" ('39) & uniform clearance between thrust buttons and thrust spacer on differential pinion shaft (unequal clearance on one side will cause spacer to contact shaft and transmit thrust to differential).

OVERHAUL:—Pinion Bearing Adjustment. Install pinion bearing adjustment shims between bearing spacer and front bearing cone, tighten pinion shaft nut securely with rear universal joint flange in place, check bearing adjustment. It should be just possible to turn pinion shaft with one hand. Add thin shim if bearings too tight. Pinion bearing endplay should be .000-.001".

Pinion Setting:—When reassembling pinion install same shim thickness between pinion and rear bearing cone to retain correct pinion position. Adjust pinion by adding or removing shims at this point.



Differential Bearing Adjustment:—To set up bearings when installing differential carrier, tighten differential bearing cap capscrews finger tight, turn left hand adjusting nut in until all play eliminated between pinion and ring gear, then tighten right hand adjusting nut securely. Set up dial indicator to check gear backlash, back off left hand adjusting nut one half notch and tighten right hand nut equal amount until gear backlash is .0005-.003" Tighten bearing capscrews securely on left hand adjusting nut, turn right hand adjusting nut in one additional notch to secure correct bearing pre-load of .009" bearing tension. Tighten right hand bearing capscrews securely and install locks on both nuts.

Ring Gear Replacement:—Ring gear mounted on differential case by capscrews (screws locked in place by locking plate under heads). When installing ring gear, always use new screw locks, tighten screws evenly and securely, bend ears on locks over screws.

NOTE—Manufacturer recommends that shakeproof lockwashers be used under screw heads when installing gear instead of the soft steel lock plates.

LINCOLN (OWN MAKE)

Used On:

V12 MODEL (1932 TO 1939)

TYPE:—Spiral bevel, full floating type with torque tube drive. Pinion integral with shaft which is splined and pinned in sleeve at rear end of propeller shaft (propeller shaft should be disconnected by taking out pin and disengaging splines when pinion bearing assembly is to be dismantled). Pinion straddle mounted on two taper roller bearings (front), single roller bearing (at rear of pinion). Differential assembly mounted on taper roller bearings with adjusting nut under bearing cap at each side. Thrust block located behind ring gear at pinion is mounted on bracket bolted to carrier housing.

Propeller Shaft Front Bearing. Consists of a roller bearing assembled within the forward end of the torque tube (speedometer gear housing). Bearing is lubricated from universal joint and should not require servicing.

SERVICING:—Gear Adjustment. Paint gears to check mesh. Backlash should be .010". Adjusted by backing off one differential bearing adjusting nut and tightening opposite nut equally. See differential bearing adjustment below.

Axle Replacement. To remove shafts, remove locking ring at brake drum hub, pull shafts out (does not disturb wheels or wheel bearing adjustment). Shafts interchangeable.

Wheel Bearing Adjustment. Adjust bearings whenever removed for lubrication (5000 mile intervals). To remove, remove axle shafts, take off lock nut, lock washer, bearing nut on end of axle housing. When replacing bearings, turn up bearing nut so that bearing play is hardly perceptible, install lockwasher and lock nut.

OVERHAUL:—Pinion Bearing Assembly. Rear bearing held in place in housing by rivet adjacent to bearing hole (washers at each end of rivet engage bearing outer race). Pinion bearings seated in bearing sleeve against shoulder. Bearings adjusted by taking up pinion bearing nut at forward end of bearing assembly. Tighten lock nut securely and turn up lockwasher ears against nut after adjusting.

Pinion Setting:—Not adjustable. Replace worn parts.

Differential Bearing Adjustment:—To adjust, remove adjusting nut locks, loosen bearing cap nuts slightly, turn adjusting nuts. Replace locks and tighten bearing caps securely.

Ring Bear Backlash Adjustment:—When adjusting backlash, back off one differential bearing adjusting nut and tighten opposite nut exactly same amount to avoid disturbing bearing adjustment. Backlash should be .010".

LINCOLN ZEPHYR TYPE

Used On:

MODEL 86H (1938), 96H (1939)

TYPE:—Hypoid gear, 3/4 floating, with torque tube drive. Similar to design used on 1937 model (see preceding article) except for pinion mounting as follows:

Pinion Assembly:—Pinion integral with shaft and mounted on taper roller bearings. Bearing cups seated directly against shoulders in housing. Bearing cones positioned on shaft by spacer.

Replacement Exchange Axle Assemblies—Assemblies consisting of differential housing (axle housing center section) with pinion gear installed (and set up for correct bearing adjustment and pinion gear mesh), and mated ring gear are furnished for both 86H (1938) and 96H (1939) as Part No. 86-H-4020.

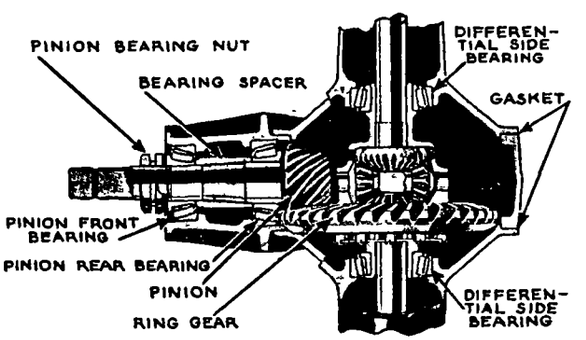
SERVICING:—Serviced in same manner as Ford Axle except for following points:

Ring Gear Backlash—Should be .002-.004". Ring gears marked with etched figure indicating correct clearance for each ring and pinion gear set.

Pinion Bearing Adjustment—Correctly set at factory and should not be disturbed in service. Bearing pre-load should be 18-20 in. lbs. (measured with ABV-129 gauge).

OVERHAUL:—Manufacturer recommends that Axle Assembly (Differential housing with Pinion installed) not be dismantled and should be serviced by Axle Assembly Exchange (Assembly furnished with Pinion installed, bearings adjusted, and set for marked backlash with mated Ring Gear). Overhaul data below applies to 1938 model.

Pinion Bearing Assembly—With propeller shaft disconnected, remove locknut and pinion bearing nut on forward end of pinion shaft, press pinion out toward rear. Use special pullers to remove bearing cups from housing.



Pinion Bearing Assembly & Adjustment:—Reverse dismantling directions above. Pinion bearing adjustment controlled by spacer on shaft between bearing cones (see also Pinion Bearing shims under Pinion mesh below). Spacers furnished in following thicknesses: 2.2700-2.2705", 2.2720-2.2725", 2.2740-2.2745", 2.2760-2.2765", 2.2780-2.2785", 2.2800-2.2805", 2.2820-2.2825", 2.2840-2.2845", 2.2860-2.2865", 2.2880-2.2885". With pinion assembled and pinion nut tight, pinion shaft should turn with 18-20 in. lbs. force (use ABV-129 gauge).

LINCOLN ZEPHYR TYPE CONT.

Pinion Setting:—Pinion position controlled by shims installed between rear pinion bearing cup and shoulder in housing. These shims furnished .009", .010", .011", .012", .013", .014", .015" thick. First type shims (86H-4663-A to G) were flat washers 3.18" outside diameter. These shims superseded by new type (86H-4663-T to Z) cup-shaped shims installed between rear bearing and shoulder of pinion shaft. Whenever rear bearing cup removed, remove old shims and install new type.

Differential Bearing & Ring Gear Backlash Adjustment—Gaskets for installation between differential housing and right and left axle housings furnished in three thicknesses as follows: .008-.010" (86H-4035-A), .004-.006" (86H-4035-B), .013-.018" (86H-4035-C). Normal gasket thickness (for correct backlash and differential bearing adjustment) is .005-.008" at each side of differential housing. Vary thickness at left hand housing to adjust backlash (keep total thickness for both sides same to avoid disturbing differential bearing adjustment), vary thickness at right hand side to adjust differential bearings (without changing backlash).

NASH 1933-35 TYPE

Used On:

NASH MODELS.

SIX, 1120 (1933), 1220 (1934), 3520 (1935)
STANDARD 8 1130, SPECIAL 8 1170 (1933)
ADVANCED EIGHT, 1280 (1934), 3580 (1935)

LAFAYETTE MODELS.

SIX, MODELS 110 (1934), 3510 (1935)

TYPE:—Spiral bevel, semi-floating type. Pinion integral with shaft and mounted on taper roller bearings seated directly in housing. Differential assembly mounted on taper roller bearings with adjusting nut under bearing caps at each side (on some models, adjusting nut located at right hand side only for bearing adjustment, shims on left hand side for backlash adjustment).

SERVICING:—Axle serviced as a unit by manufacturer. **Gear Adjustment.** Paint gears to check mesh. Backlash adjusted by backing off one adjusting nut equally, or by adding or removing shims located between left hand differential bearing cone and differential case. See Pinion Setting and Differential Bearing Adjustment below.

Axle Replacement. Check axle shaft endplay. Should be .003-.006". Adjust by adding or removing shims between backing plate and axle housing flange (at one wheel, spacer installed in differential housing transmits thrust from one shaft to the other).

OVERHAUL:—Pinion Bearing Adjustment. When assembling pinion, see that pinion adjusting shims installed between pinion and rear bearing cone, and pinion bearing shims installed between spacer and front bearing cone (on some models bearing adjusting shims located between rear bearing cup and shoulder in housing).

Pinion Setting:—Position adjusted by adding or removing shims located between rear bearing cone and pinion. Pinion position not changed by bearing adjustment on Nash models.

Differential Bearing Adjustment:—Adjust by loosening bearing cap screws slightly, removing lock and turning up bearing adjusting nut.

Ring Gear Backlash Adjustment. On models with right and left hand differential bearing adjusting nuts, back off one screw and tighten opposite screw equally to avoid disturbing bearing adjustment. On models with right hand bearing adjusting nut only, it will be necessary to remove differential assembly and add or remove shims between left hand bearing cup and differential housing to secure correct backlash and then adjust differential bearings.

NASH 1936-39 TYPE

Used On:

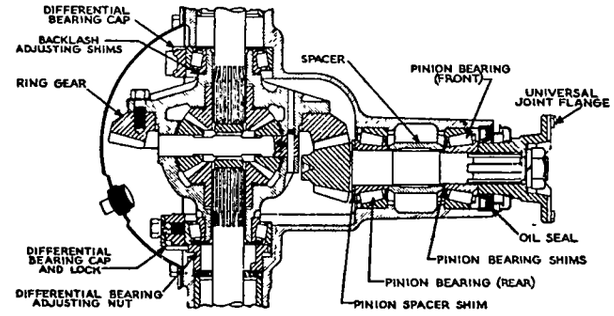
NASH MODELS

AMBASS. 6, 3620('36), 3720('37), 3820('38), 3920('39)
AMBASS. 8, 3680('36), 3780('37), 3880('38), 3980('39)
'400' MODEL, 3540, 3640 ('35-36), 3640A ('36)

NASH-LAFAYETTE MODELS

3610 ('36), 3710 ('37), 3810 ('38), 3910 ('39)

HYPOID AXLE NOTE:—Manufacturer recommends that Hypoid axles (used on some models) not be disassembled or serviced in the field. Service data below applies to Spiral Bevel axles only.



NOTE:—Two types used—"Small Type" (Six and Nash-Lafayette). "Large Type" (Nash 8). Axles similar except that Small Type does not have separate differential carrier (differential assembly mounted on bearings seated directly in housing). Large Type has separate carrier which can be removed from housing for servicing. Servicing operations are same for both exles except as noted below.

TYPE:—Spiral bevel, semi-floating type with Hotchkiss drive. Pinion integral with shaft and mounted on taper roller bearings seated directly in housing with spacer on shaft between bearing cones. Differential assembly mounted on taper roller bearings with adjusting sleeve at right hand bearing only (Small Type), both bearings (Large Type). NOTE—Small Type axle has shims for backlash adjustment located at left hand differential bearing.

SERVICING:—Gear Adjustment—Paint gears to check mesh. Backlash should be .005-.007". Backlash adjusted by adding or removing shims located behind left hand differential bearing (Small Type), backing off one differential bearing adjusting sleeve and turning up opposite sleeve equally (Large Type). See Pinion Setting and Differential Bearing Adjustment below.

Axle Shaft Replacement—To remove shaft (with wheel and hub removed), take off nuts on bearing retainer on backing plate, remove oil seal, retainer, backing plate and bearing adjusting shims. Pull axle and bearing assembly. When replacing shims adjust endplay by adding or removing shims between backing plate and housing flange to secure desired endplay of .004-.006" total. This adjustment must be made equally at both wheels to insure thrust block being centered on differential pinion shaft.

OVERHAUL:—Disassembly—With axle shafts out, remove rear housing cover (Small Type only), loosen bearing cap bolts, mark adjusting sleeve position (to insure correct reassembly) and back sleeves off (sleeve at right hand end only on Small Type), remove bearing cap bolts and bearing caps, lift differential assembly out. To remove pinion, take off universal joint companion flange nut, pull flange, press pinion out of housing toward rear. Use pullers to remove bearings from housing.

Pinion Bearing Assembly:—Bearing adjustment controlled by shims located between spacer on shaft and forward bearing cone. When assembling pinion, install correct washer and shim pack (for correct pinion mesh—see Pinion Setting below) on pinion shaft against pinion, install rear bearing cone and bearing spacer. Install pinion shaft in housing, install sufficient shims on shaft in front of bearing spacer to insure positive endplay in shaft when assembled (for bearing adjustment), install front bearing cone, companion flange and nut, tighten nut securely, check bearing adjustment as directed below. NOTE—Do not install oil seal in front end of housing until after bearing adjustment completed, then install new seal.

Pinion Bearing Adjustment—Use dial indicator to check pinion shaft endplay with companion flange nut tight. Disassemble pinion shaft and remove shims from between front bearing cone and spacer equal to this endplay plus .003" additional to insure bearings being pre-loaded or set up .003" tight.

Pinion Setting:—Pinion mesh controlled by washer (or washer and shim pack) installed on shaft between pinion and rear bearing cone. Use Pinion Setting Gauge SE-534-A to determine washer thickness for pinions as follows: With pinion installed in housing or carrier, install gauge with end discs seated in differential bearing bores in housing, install rectangular checking block on rear face of pinion, turn gauge micrometer so that shaft just contacts ground surface of checking block (rock gauge slightly on end discs to secure extremely accurate reading). Subtract gauge reading from standard figure of .408" (Small Type), .190" (Large Type) which will give correct washer thickness for standard pinions (marked by =0 following the set number on the end of the pinion teeth). If pinion

NASH 1939 TYPE CONT.

marked + or —, subtract shims (if pinion marked +), add shims (if pinion marked —) equal in .000" to the figure on the pinion following this plus or minus mark. Install washer and shims equal to this final figure on shaft between pinion and rear bearing cone and re-install pinion in housing.

Pinion Adjusting Washer Note—Washers for pinion adjustments are .129", .130", .131" thick and are used in combination with one to three .003" shims to make up all necessary thicknesses from .117" to .140" (in .001" steps—thicknesses outside these limits not required). Part Nos. for these washers and shims are as follows: Washer—No. 28283 (Small Type), 22838 (Large Type), Shims—No. 18742 (Small Type), 15578 (Large Type). CAUTION—Adjusting washer must be installed with chamfered side toward pinions and Shims (if used) between washer and bearing cone.

Differential Gear & Bearing Assembly:—To dismantle differential gear assembly, drive out pin in differential pinion shaft, remove shaft, axle shaft thrust block, pinions, side gears and thrust washers. When reassembling, make certain that thrust washers are installed on back of each side gear and pinion and that thrust block is installed on pinion shaft (this block transmits thrust from one shaft to the other). On Small Type axles only, shims are installed on differential case hub on left side (between case and differential side bearing) to control ring gear backlash. NOTE—On Large Type Axles, when installing differential assembly in carrier, tighten left hand bearing adjusting sleeve until all backlash removed between ring and pinion gears, then back off adjusting sleeve six notches or one half turn until notch is in line with lock on cap, make all bearing adjustments by turning right hand adjusting sleeve. This procedure will insure correct ring gear backlash of .005-.007".

Differential Bearing Adjustment:—With right hand bearing adjusting sleeve lock removed, and bearing cap loosened slightly so that sleeve can be turned, tighten adjusting sleeve until all bearing endplay is just removed and notch in sleeve lines up with lock, then tighten adjusting sleeve two notches additional to provide correct bearing pre-load, tighten bearing cap and install adjusting sleeve lock.

Ring Gear Backlash Adjustment (Small Type)—Check backlash at several points around ring gear. If backlash not within limits of .005-.007", dismantle axle, remove left hand differential side bearing, add or remove shims on hub behind bearing cone (add shims to increase backlash, remove shims to decrease backlash—.005" shim thickness will change backlash .0025"), reassemble axle. Readjust differential bearings (bearing adjustment will be affected by any change in shim thickness).

Ring Gear Backlash Adjustment (Large Type)—Check backlash at several points around ring gear. If outside limits of .005-.007" adjust by loosening both bearing caps and backing off right hand adjusting sleeve (to decrease backlash), left hand adjusting sleeve (to increase backlash), then **tighten opposite sleeve exactly same number of notches** to avoid disturbing differential bearing adjustment. See Note under Differential Bearing assembly above for correct setting up of differential bearings when assembling axle to insure backlash being correct.

OLDSMOBILE—LA SALLE (OWN MAKE)

Used On:

OLDSMOBILE 6, MODELS F-32 ('32), F-33 ('33)
OLDSMOBILE 8, L-32 ('32), L-33 ('33), L-34 ('34)
LA SALLE 350, SERIES 50 (1934-35)

TYPE:—Spiral bevel, semi-floating type. Pinion integral with shaft which is mounted on double row ball bearing (front), single row ball bearing (rear) with spacer between bearings. Bearings seated directly in carrier with adjusting nut on each side of front bearing for pinion adjustment. Differential assembly mounted on ball bearings with adjusting nut under bearing cap in carrier.
NOTE—Pinion bearings changed on later LaSalle cars. Single roller bearing used at rear, spacer discontinued and double row ball bearing at front positioned by shoulder on shaft.

SERVICING:—Gear Adjustment. Paint gears to check mesh. Backlash for LaSalle models stamped on rear face of each pinion with prefix 'L' (figure following indicates desired backlash in thousandths). Adjusted by backing off one differential bearing adjusting nut and tightening opposite nut equally. See differential bearing adjustment below.

Axle Replacement. Wheel bearings are ball bearing type (no adjustment required). Bearings pressed on axle shafts against shoulder and retained by backing plate which engages outer race.

OVERHAUL:—Pinion Bearing Assembly. See that oil baffle installed on front pinion bearing under front adjusting nut, and that front bearing inner race seated against spacer (first type), or shoulder on pinion shaft (later type), tighten pinion nut at rear universal joint flange securely.

Pinion Setting: Controlled by adjusting nut at each side of front bearing. Tighten both nuts securely against bearing race before checking mesh. Adjust by backing off one nut and tighten other nut equally, moving each nut a few notches at a time. Back off rear nut (to move pinion in toward ring gear), front nut to move pinion out or away from ring gear. Install locking plates on both nuts after adjusting.

Differential Bearing Adjustment:—Loosen bearing caps, remove locks, turn up adjusting nut at outside of each bearing. With correct setting, pull at rim of ring gear required to turn gear should be 8-10 lbs. (15 lbs. to start gear, 8-10 lbs. to rotate gear) on LaSalle models.

Ring Gear Backlash Adjustment. When adjusting backlash, back off one adjusting nut and turn up opposite nut equal amount to avoid disturbing differential bearing adjustment.

OLDSMOBILE (OWN MAKE)

Used On:

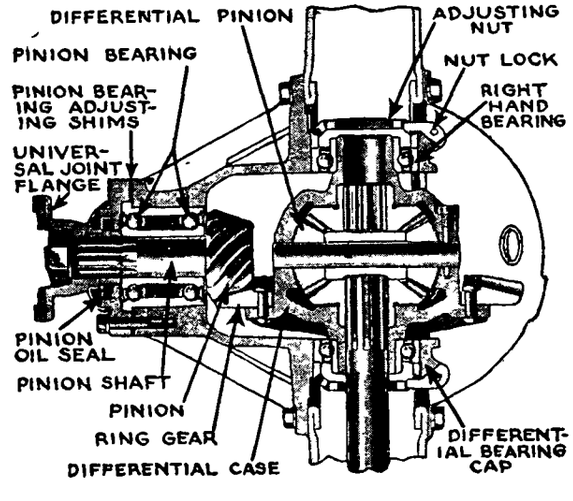
SIX, MODELS F-34 ('34), F-35 ('35), F-36 ('36)
EIGHT, MODELS L-35 (1935), L-36 (1936)

TYPE:—Spiral bevel, semi-floating type. Pinion integral with shaft and mounted on special long double row ball bearing. Differential assembly mounted on Radax or Difrax ball bearings (designed to take thrust in one direction) with adjusting nuts under bearings caps in carrier.

SERVICING:—Gear Adjustment. Check pinion setting or paint gears to check mesh. Backlash should be .004-.008". Adjusted by backing off one differential bearing adjusting nut and tightening opposite nut equal amount (see differential bearing adjustment below.)

Axle Replacement. Wheel bearings are special shielded type lubricated at factory. Sideplay on new bearings .008-.010", replace bearings when sideplay exceeds .015". Bearings pressed on shaft against shoulder with 3000 lb. pressure and should be removed and installed in an arbor press. No bearing adjustment required.

OVERHAUL:—Pinion Bearing Assembly. Shielded type (packed with lubricant at factory and should not be washed out). Bearing should have no endplay (replace if endplay noted). Bearing inner race is a press fit on the pinion shaft (remove and install on an arbor press, apply pressure to inner race only).



Pinion Setting:—Use Pinion Setting Gauge, J-705, install gauge in carrier in place of differential assembly, adjust micrometer so that stem contacts rear face of pinion. Gauge reading should be .0625" (1935-36 models) for pinions marked '0'. Figure stamped on end of pinion should be added (minus figure), or subtracted (plus figure) from standard .0625" reading to secure setting for each pinion. Adjust pinion position by adding or removing shims installed between bearing retainer flange and front flange of carrier.
NOTE—On 1934 model, adjusting nut used instead of flanged bearing retainer. Nut locked by locking plate on carrier.

Differential Bearing Adjustment:—Back off bearing cap bolts one half turn, remove locks, turn adjusting nut in until bearing race just starts to turn, turn nut in two additional notches, replace lock, tighten bearing cap bolts.

Ring Gear Backlash Adjustment. To set up differential bearings for correct ring gear backlash when installing differential assembly, tighten bearing cap bolts securely and then back off one half turn, tighten left hand adjusting nut until all lash between ring gear and pinion taken up, then back off this nut exactly four notches to point where notch lines up with lock slot in cap. Then adjust differential bearings by turning up right hand adjusting nut as directed above. This setting should give correct backlash of .004-.008".

OLDSMOBILE 1937-39 TYPE

Used On:
SIX, F-37 ('37), F-38 ('38), '60' F-39 ('39)
SIX '70', MODEL G-39 (1939)
EIGHT, L-37 ('37), L-38 ('38), '80' L-39 ('39)

1939 NOTE:—Ring and pinion gear ratio stamped on outer surface of differential carrier of all axles as follows: 43-10 (4.3-1 Std. axle), 40-11 (3.636-1 Std. axle with Self-shifting Trans.), 41-9 (4.55-1 Optl. Mountain ratio).

TYPE:—Spiral bevel gear (1937-38 models). Hypoid gear (1939), semi-floating type with Hotchkiss drive. Pinion integral with shaft and mounted on double row ball bearing at front (this bearing takes thrust in both directions), roller bearing at rear (takes radial load only, no inner race used with this bearing). Bearings mounted directly in housing (front bearing locked in place by retainer sleeve held by tapered lockscrews in housing, rear bearing seats against shoulder in housing). Differential assembly mounted on Hyatt self-aligning (barrel) roller bearings with adjusting nut under bearing cap at outer end of each bearing.

SERVICING:—Gear Adjustment. Paint gears to check mesh. Backlash should be .004-.008". Adjusted by backing off one differential bearing adjusting nut and tightening opposite nut equally. See Pinion Setting and Differential Bearing Adjustment below.

Axle Replacement. Wheel mounting flange integral with axle shaft. To remove shafts, remove wheel (wheel nuts on left side of car have left hand threads), take out two bolts holding brake drum on axle shaft flanges, remove drums, take off nuts on 4 bolts holding backing plate on axle housing flange, remove static collector, pull axle shaft bearing retaining plate away from backing plate (be careful not to disturb backing plate which will damage brake lines), withdraw axle shaft and bearing assembly using puller J-942, replace one nut to hold backing plate in position.

Wheel Bearings & Oil Seal. Bearings are shielded type (lubricated at factory) and pressed on axle shaft against shoulder at wheel end of shaft. Remove bearings only when new bearings installed (see Bearing Collar Note below). To remove, use tool J-947-2 (to prevent bursting of race), and plate J-947-1 and press bearing off shaft in arbor press. Install new bearings in same manner using tool J-947-3 and plate J-947-1 to insure pressure being applied to inner race only. Before installing shaft, make certain that double feather edge of leather oil seal is in good condition or install new seal with tool J-944 (1937-38), J-1049 (1939) and coat outer rim of seal with Permatex or white lead to prevent oil leaks.

Bearing Collar Note—On 1937-38 models, collar installed on shaft behind bearing. Collar must be split with chisel before bearing removed. After new bearing installed, press new collar on shaft firmly against bearing with tapered end away from bearing. Oil seal contacts collar (1937-38), shaft (1939).

Wheel Bearing Note—New wheel bearings have .008-.010" sideplay and should not be replaced unless sideplay exceed .015" or bearings are noticeably rough.

OVERHAUL:—Disassembly. Mark both differential bearing adjusting nuts and caps to insure correct reassembly, remove bearings caps and adjusting nuts, lift differential assembly out of carrier. Remove rear universal companion flange nut, use tool J-962, remove flange from shaft, press pinion shaft back through front ball bearing inner race and remove, remove and save shims installed on shaft directly back of this bearing. Do not remove snap ring on pinion shaft directly in front of pinion gear (this gear prevents rear bearing rollers from creeping on shaft). Remove rear bearing rollers (rollers cannot be removed singly on new bearings), use tool J-983 to pull outer race out of housing, take out 3 lockscrews in housing, remove locking sleeve, tap front bearing out.

Pinion Bearing Assembly:—Push front ball bearing into housing and tap lightly on outer race to seat bearing against shoulder in housing, insert bearing retainer sleeve (tapered end toward rear) and lock sleeve firmly in place against ball bearing race by turning up the three cone-pointed lockscrews evenly and securely and tightening lockscrew locknuts. Use tool J-940 to drive rear roller bearing outer race in place in carrier, coat the 14 bearing rollers with heavy grease and install in place in bearing race. Install correct shim thickness for each pinion against shoulder on pinion shaft (see Pinion Setting directions below), make certain that roller lock ring in place on pinion shaft at pinion end, install pinion in carrier guiding shaft through washer at forward end of carrier. Install companion flange, tighten flange nut (hold flange in vise). NOTE—Front ball bearing has slight 'pre-load' when new and should be replaced if any endplay noted. Pinion shaft should not be worn more than .0007" (compare with unworn shaft ahead of bearing). If any radial play noted at pinion when assembled, gears will not run quietly (replace roller bearing if shaft not worn).

Pinion Setting:—Standard shim thickness for each carrier indicated by marking on flange as follows: D5—.049", D4—.048", D3—.047", D2—.046", D1—.045", C—.044", S1—.043", S2—.042", S3—.041", S4—.040", S5—.039". 'D' indicates bearing shoulder deeper than standard, 'C' on center or standard, 'S' shallower than standard. These figures correct for standard or unmarked pinions. When pinion marked by plus or minus figure on face, shims should be added (+ sign), subtracted (— sign) from this standard shim thickness equal (in thousandths) to the figure following this plus or minus sign. Pinions which are unmarked do not require any correction to be made to the shim thickness as indicated by the carrier marking. Shims furnished in four sizes and colored for identification as listed below (use combinations of shims for all required thicknesses).

Shim Thickness	Part No.	Color
.012"	499528	Plain
.014"	503063	Blue
.015"	499529	Copper
.018"	499530	Plain

Pinion Marking Note—Standard pinions (which require no shim correction) are marked by figure 'OC' 1937), and are unmarked for 1938-39.

Differential Gear & Bearing Assembly:—To remove side bearings, use tool HM-483B ('37-38), HM-986 ('39) installed so pressure applied to bearing cone only. Use J-941 driver to install bearings. To dismantle differential gears and pinions, take out pinion shaft lockscrew and shaft, revolve pinions until aligned with openings in case, withdraw pinions, remove side gears and thrust washers. Install in same manner (thrust washers may be installed with either face toward gears).

Differential Bearing Adjustment:—Adjusting nuts and bearing caps should be marked before disassembly to insure correct replacement. To adjust bearings, loosen each bearing cap bolt one-half turn, remove locks, back off right hand adjusting nut until bearing outer race stops turning with nut, turn nut up until race begins to turn, tighten 3 notches, then repeat adjustment and turn nut up 1½-2 notches from point where bearing race begins to turn with nut, tighten bearing cap bolts and replace locks.

Ring Gear Backlash Setting—When installing differential assembly, back off right hand adjusting nut four turns, then turn left hand adjusting nut up until all backlash removed from between ring and pinion gears, finally back off left hand adjusting nut exactly four notches. Adjust differential bearings by turning right hand adjusting nut as directed above. This procedure should give correct backlash of .004-.008".

OLDSMOBILE REAR SUSPENSION

Used On:
SIX '60', MODEL F-39 (1939)
SIX '70', MODEL G-39 (1939)
EIGHT '80', MODEL L-39 (1939)

TYPE:—New type using coil springs with conventional rear axle. Springs are seated in bracket on frame at upper end, seat on rear end of support arm at lower end and support car only (all driving and braking torque taken by support arms which are mounted on rubber bushings on frame 'X' member at front end and bolted to axle housing near wheel at rear end). A track bar is linked between the frame cross-member and the axle housing to prevent side movement. Shock absorbers are mounted on rear ends of support bars under axle housing with shock absorber arms pointing toward the rear of the car and are linked to the frame.

SERVICING:—Spring Removal—Disconnect brake hose at rear axle, disconnect shock absorber link at shock absorber arm, raise car to remove weight from spring, remove lower spring clamp and bolt (bolt has left hand thread), remove upper spring clamp and bolt, remove spring and insulator pad. CAUTION—Brake hose must be disconnected from axle whenever shock absorber arms or springs are disconnected to prevent damage.

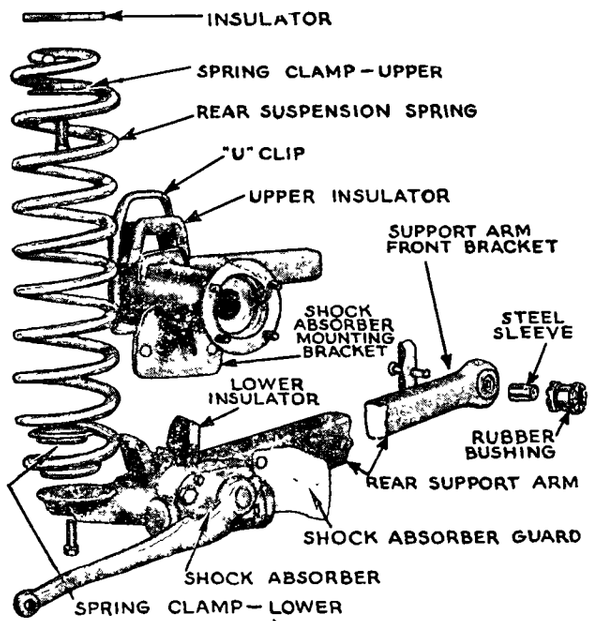
Spring Installation:—Spring must be installed with 'curled' end (small diameter end coil) at bottom with curled end toward left side of car and pointing straight ahead (if spring has both ends curled, install with either end up, if one end is straight, this straight end must be installed at top). Place spring in position, install insulator on top of spring and spring clamps in end coils (lower clamp has grommet nut, upper clamp does not have nut which is located in frame side rail). Assembly will be facilitated if upper clamp and insulator are taped to spring. Line up holes in clamp and frame, lower car slightly to hold spring while bolts installed. Make certain that clamps turned so as to grip end coils tightly (clamps are cam shaped), install clamp bolts and tighten securely.

Support Arms:—To remove support arms, proceed as directed above for spring removal (without disturbing spring upper clamp bolt at frame). Disconnect rear axle housing 'U' bolt, free support arm from frame by loosening support arm brackets and removing support arm bolt. To install new rubber bushing in forward end of support arm, apply weak solution of soapy water to bushing, start bushing in arm, pound arm on wood block until bushing

OLDSMOBILE REAR SUSPENSION CONT.

seated. Install steel bushing in same manner and make certain that it is centered in the rubber bushing. To install new insulators at rear axle, see that metal bearing edges of insulators are clean and free of rubber, apply soapy water to rubber to insure good seat. When replacing support arm, tighten U bolts to tension of 75 ft. lbs. (plus or minus 5 lbs.) with J-1264 torque wrench.

Track Bar:—Mounted on rubber bushings at both ends. To remove bar, take off nut on frame end bolt, pry bar forward to loosen serrated bolt from frame, then disconnect axle end of bar in same manner. When installing bar, attach at frame end first, lower car slightly on springs, if necessary, to align axle end bolt holes.



REAR SPRINGS:—Spring part number is stamped on outside of one end coil (top or bottom—will not be visible with spring installed) and are paint-marked for identification as follows:

Car Model	Color Mark
F-39 Bus. & Club Coupe	Blue
F-39 Tour. Coupe & Sedan	Red
G-39 Bus. & Club Coupe, Convertible	Green
G-39 Tour. Coupe & Sedan	Yellow
L-39 Bus. & Club Coupe, Convertible	Green
L-39 Tour. Coupe & Sedan	Yellow

PACKARD 1939 TYPE REAR SUSPENSION

Used On:

PACKARD SIX, MODEL 1700 (1939)
PACKARD '120' EIGHT, 1701, 1A, 2 (1939)
PACKARD SUPER EIGHT, 1703, 3A, 5 (1939)

TYPE:—Consists of a special Lateral Stabilizer (with double acting shock absorber control), Anti-sway Bar, and opposed mounting of shock absorbers as follows:

Lateral Stabilizer:—Connected between shock absorber (mounted on right side of frame cross-member above axle housing) and bracket on axle housing at left spring seat. This lateral stabilizer shock absorber is the 'Fifth' shock absorber.

Shock Absorber Mounting:—Regular rear shock absorbers are mounted on underside of axle housing at spring seats with shock absorber arm pointing forward (right side), toward rear (left side). Both shock absorber arms are linked to frame.

Anti-Sway Bar:—Right end of bar is bolted to right hand shock absorber arm, left end of arm is pivoted in bracket bolted to underside of left hand spring seat and linked to frame (forward of axle) by link similar to those used on shock absorbers.

SERVICING:—Shock Absorber Refilling—Remove filler plug, fill housing to level of bottom of filler plug hole with Houde 800 second fluid. Move arm up and down through two full strokes to eliminate all air from chamber, recheck fluid level.

Shock Absorber Adjustment:—Check adjustment by mounting shock absorber in vise with arm pointing up, attach 50 lb. weight to bolt hole in end of arm, check time required for arm to make complete stroke (from extreme upper to extreme lower position with weight attached). Time should be 18 seconds minimum, 24 seconds maximum at room temperature. If outside these limits, remove plug on end of shaft (at arm), turn adjusting needle valve in or out as required and recheck performance. Standard setting of valve is ¼ turn out from inner seated position. Tighten packing nut to correct leakage at valve.

Spring Leaf Inserts:—Spring leaves are separated by special rubber and lead alloy disks installed in cups at ends of leaves (various combinations of inserts used on various spring types). Springs should not be lubricated. If springs squeak, remove all metallic inserts, clean both sides of inserts with a wire brush and pack retainer cups with #3 cup grease when re-installing.

TROUBLE-SHOOTING:—If rear seat unsteady or rattles occur under car on rough roads, check lateral stabilizer shock absorber for free travel (arm should have no free travel and should require considerable force to move it). If refilling or adjustment does not correct shock absorber performance, replace unit. Check anti-sway bar and see that mounting bolts are tight at shock absorber arm.

PACKARD SIX & EIGHT (OWN MAKE)

Used On:

SIX, 115C ('37), 1600 ('38), 1700 ('39)
'120' EIGHT, 120 ('35), 120B ('36), 120C ('37) 1601,1A,2 ('38), 1701,1A,2 ('39)
SUPER EIGHT, 1603,3A,5 (1939)

TYPE:—Angle-set (except 1938), Hypoid gear, semi-floating type same as Packard Senior line except for pinion mounting. Pinion mounted on taper roller bearings seated directly against shoulders in carrier housing (at inner side of each bearing) and adjusted by flexible bearing sleeve on shaft. Differential assembly mounted on taper roller bearings with adjusting nut at outer end of each bearing under bearing cap.

NOTE—On 1935-36 models, pinion mounted on two single row ball bearings (each bearing taking thrust in one direction).

Ring Gear Support Roller (Super Eight only)—Consists of a roller-bearing-mounted roller mounted on an eccentric stud in the forward face of the differential carrier housing so as to act as a support for the back face of the ring gear. Roller is adjustable (see Servicing data below).

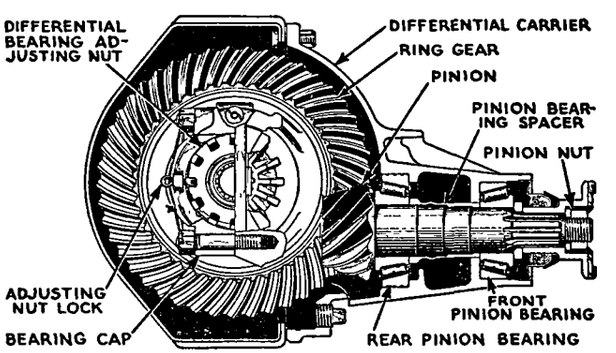
SERVICING:—Gear Adjustment. Paint gears to check mesh. Backlash should be .003-.005". Adjusted by backing off one differential bearing adjusting nut and taking up opposite nut equal amount. See differential bearing adjustment.

Axle Shaft Replacement. To remove axle shaft, remove wheel, take off axle shaft nut and washer, remove hub and brake drum assembly (use puller), disconnect brake line, take out nuts in backing plate, remove backing plate, pull axle and bearing assembly.

Wheel Bearing Adjustment. Endplay up to .050" can be taken up by removing shims between backing plate and axle housing flange on one side. If endplay greater than .050", remove shims at both wheels equally. Endplay should be .004-.007".

OVERHAUL:—Pinion Bearing Assembly. Bearing mounted directly in recesses in pinion housing. On 1935-36 models, bearings adjusted by spacers assembled in housing in back of rear bearing outer race. This spacer also controls pinion position.

Pinion Bearings (1937-39). Adjusted by turning up rear universal flange nut to buckle bearing spacer and apply pre-load to bearings. To adjust, tighten nut until spacer is felt to buckle and pressure required to turn pinion shaft is 25-30 in. lbs. (5-6 lbs. pressure at outer end of 5" wrench, rear wheels must be off floor or carrier out of housing when this test made). Check bearing adjustment whenever this nut is loosened.



Pinion Setting:—On 1935-36 models, pinion position controlled by spacer behind rear bearing outer race (same spacer as controls bearing pre-load). On 1937 and later models, pinion position not adjustable.

Differential Bearing & Backlash Adjustment:—Adjusted in same manner as other Packard models (see following article on Packard Senior Line). Bearings should be pre-loaded to secure spread of bearing support pedestals of .010-.012" (Six & Eight), .015" (Super Eight). NOTE—On Super Eight model, make certain that there is sufficient clearance between ring gear and support roller when making this adjustment.

Ring Gear Support Roller Adjustment (Super Eight only)—After adjusting ring gear backlash and differential bearing pre-load, adjust ring gear support roller by loosening lockscrew on roller stud sector plate and turning roller stud so that clearance between roller and back face of ring gear is .005". Make certain that sector plate and lockscrew are tight after making adjustment.

PACKARD 'SENIOR LINE'

Used On:

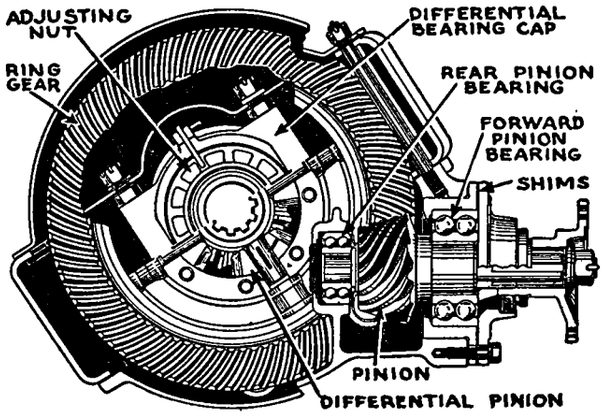
EIGHT, 901, 2 ('32), 1001, 2 ('33), 1100, 1, 2 ('34), 1200, 1, 2 ('35), 1400, 1, 2 ('36)

SUPER 8, 903, 4 ('32), 1003, 4 ('33), 1103, 4, 5 ('34), 1203, 4, 5 ('35), 1403, 4, 5 ('36), 1500, 1, 2 ('37) 1603, 4, 5 ('38)

TWELVE, 905, 6 ('32), 1005, 6 ('33), 1107, 8 ('34), 1207, 8 ('35), 1407, 8 ('36), 1506, 7, 8 ('37) 1607, 8 ('38), 1707, 8 ('39)

IMPORTANT NOTE—Whenever rear universal joint flange is removed, fill pinion bearing oil reservoir with 1¼ ounces SAE. #50 oil after assembling spacer but before installing universal joint flange.

TYPE:—Angle-set, Hypoid gear, semi-floating type. Pinion straddle mounted on double row ball bearing front and rear. Front bearing mounted in sleeve with adjusting shims located between sleeve flange and carrier. Differential carrier mounted on roller bearings with adjusting nut under bearing caps on carrier.



SERVICING:—Gear Adjustment. Paint gears to check mesh. Backlash should be .003-.005". Adjust by taking up one differential bearing adjusting nut and backing off opposite nut equal amount. See differential bearing adjustment.

Axle Shaft Removal. To remove axle shaft, remove wheel, take off axle shaft nut and washer, remove hub and brake drum assembly (use puller), disconnect brake line, take out nuts in backing plate, remove backing plate, use puller to remove axle and bearing assembly.

Wheel Bearing Adjustment. Wheel bearings are double taper roller type and each wheel is adjusted independently. After axle shaft removed (see above) add or remove shims located between inner bearing cup and axle housing to secure desired endplay of .003" plus or minus .001". Coat inner face of bearing cap with good grade of gasket paste before installing.

OVERHAUL:—Pinion Bearing Assembly. Front double row bearing held on pinion shaft by spacer and rear universal joint companion flange with pinion shaft nut at forward end.

Pinion Setting:—Pinion position controlled by shims installed between pinion carrier flange and face of differential carrier casting. Shims furnished .005", .008", .015" thick. Paint gears to check gear mesh.

Differential Bearing Adjustment (1932-36):—Loosen bearing cap nuts ¾ turn, remove locks, turn right hand bearing adjusting nut up until some drag noticed when ring gear rotated by hand, tighten cap nuts and install locks.

Bearing Adjustment (1937-38-39). Bearings should be pre-loaded for .015" spread of support pedestals or differential bearing posts. To adjust, loosen bearing cap nuts ¾ turn, remove locks, back off right hand bearing adjustment nut until differential assembly is loose in bearings (make certain that left hand adjusting nut position allows backlash between ring and pinion gears). Use outside calipers to measure distance between outer faces of differential bearing posts with .015" feeler under one caliper leg, lock caliper. Tighten right hand bearing adjusting nut until posts are spread so that caliper will just slide over bearing cap lock bosses without feeler. Tighten bearing cap nuts, check backlash. Install adjusting nut locks after adjustment completed.

Ring Gear Backlash Adjustment. Back off one adjusting nut, tighten opposite nut equal amount. Check differential bearing adjustment as directed above.

PONTIAC 1935-36 TYPE

Used On:

SIX, MODELS 701-A, B ('35), 36-26 A, B ('36)

EIGHT, MODELS 601 ('33), 603 ('34), 605 ('35), 36-28 ('36)

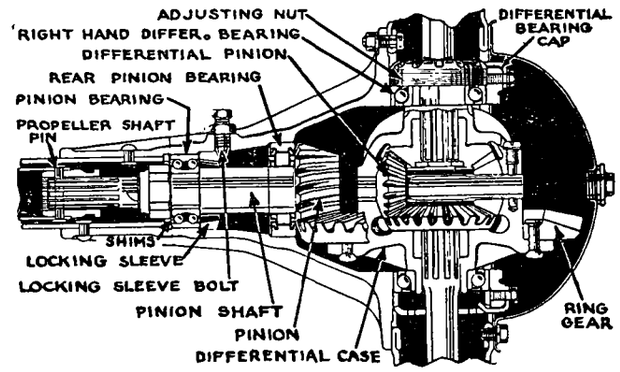
TYPE:—Spiral bevel, semi-floating type with torque tube drive. Pinion integral with shaft which is pinned and splined to propeller shaft within torque tube. Pinion shaft mounted on double row ball bearings (front), single row ball bearing (1933-34-early 35) roller bearing (late 35-all 1936) at rear. Front pinion bearing takes thrust in both directions, rear carries radial load only. Differential assembly carried on ball bearings with adjusting nuts under bearing caps on carrier.

SERVICING:—Gear Adjustment. Paint gears to check mesh. Backlash should be .005-.010" for new gears or slightly more for worn gears. To adjust, back off one differential bearing adjusting nut, tighten opposite nut equal amount. See Pinion Setting and Differential Bearing Adjustment below.

Axle Replacement. Axles retained by 'C' washer at inner end in differential case. To remove axle, take out locking screw, withdraw differential pinion shaft, remove spacer block, pull axle in and remove 'C' washer, then push axle out. Shaft formed with wheel mounting flange integral.

Axle Shaft Endplay. Controlled by spacer block and should be Free Fit to .014" max. Spacer blocks furnished standard and .015" oversize.

OVERHAUL:—Pinion Bearing Assembly. With propeller shaft removed from torque tube, pinion shaft can be removed by cutting off head of pin and disengaging splines. Bearings are press fit on shaft and front double row ball bearing should have no perceptible endplay. When installing assembly in housing see that adjusting shims installed ahead of front bearing, tap pinion into seat against shims, with pinion screws drawn up evenly against pinion locking ring make final adjustment with full arm pull on 6-8" wrench for each screw.



Pinion Setting:—Adjusted by adding or removing shims located ahead of front pinion bearing in housing until location is correct. See Pinion Bearing Assembly (above) for directions.

Differential Bearing Adjustment:—Correct adjustment for both bearings is one to two notches tight of adjusting nut from point where outer race of bearing stops turning when nut backed off, if race does not turn when nut backed off, turn adjusting nut for each bearing up equally to point where race begins to turn, then one additional notch tight will give correct adjustment.

Ring Gear Backlash Adjustment. Back off one adjusting nut, tighten opposite nut equal amount. Check differential bearing adjustment as directed above.

PONTIAC 1937-39 TYPE

Used On:

QUALITY SIX, MODEL 39-25 (1939)
SIX, 37-26CA ('37), 38-26DA ('38), 39-26 ('39)
EIGHT, 37-28CA ('37), 38-28DA ('38), 39-28 ('39)

TYPE:—Spiral bevel gear (1937-38 car models), Hypoid gear (1939), semi-floating type with Hotchkiss drive. Pinion integral with shaft and mounted on double row ball bearing (front), roller bearing (rear). Front bearing designed to take thrust in both directions, rear bearing radial load only. Differential assembly mounted on barrel type roller bearing at each side with adjusting nut under bearing cap at outer end of each bearing.

SERVICING:—Gear Adjustment. Paint gears to check mesh. Make certain that pinion flange nut, ring gear mounting screws, and pinion thrust bearing wedging screws are tight and that differential bearing adjustment is correct before checking gears. Backlash .003-.010". Adjust by backing off one differential bearing adjusting nut and tighten opposite nut equally. See Pinion Setting and Differential Bearing Adjustment below.

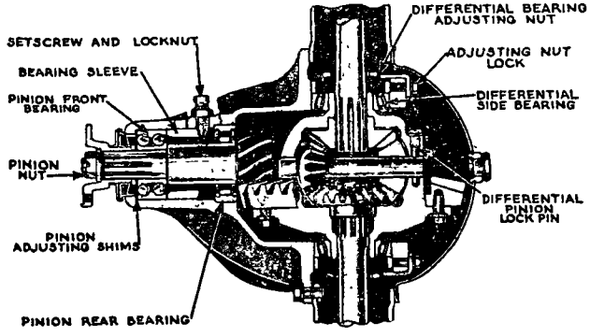
Axle Shaft Replacement. Wheel mounting flange integral with axle shaft. Bearings are special shielded type (lubricated at factory) pressed on axle shaft and held by retainer collar pressed on shaft. To remove shaft, remove wheel and brake drum, remove nuts from four bolts holding backing plate on housing, withdraw axle shaft (use puller J-942) taking care not to drag shaft on oil seal or to dislodge backing plate which will damage brake line. New bearings must be installed whenever removed from shaft. To remove bearings, use chisel to split retainer, press bearing off using special tool J-947 on outer race (pressure exerted on outer race which may burst if tool not used). Use same tool to install new bearing (pressure on inner race only) and retainer, pressing bearing on shaft against shoulder. Install shaft with left hand wheel studs on left hand side of car, shaft with right hand studs on right side of car. To renew oil seal, use tool J-943 to remove seal assembly, lubricate new seal with oil and coat outside rim of retainer with Permatex, use tool J-944 (1937-38), J-1049 (1939) to install seal assembly.

NOTE—If edge of brake drum flange is not flush with surface of shield on backing plate when installed, use sufficient gaskets, Part No. 499776 or 499930, installed between drum and axle flange for correct alignment.

OVERHAUL:—Axle Disassembly. Mark differential bearing caps and adjusting nuts (to insure correct replacement), remove bearing caps and adjusting nuts, lift out ring gear and differential assembly. Remove universal joint flange nut, use puller J-962 and remove flange. Press pinion out of carrier taking care not to damage pinion shaft threads or oil washer. No further disassembly required if pinion setting only being adjusted (see Pinion setting below). Loosen locknuts and remove three wedging screws on outside of housing, press bearings and locking sleeve out of housing using tool J-964.

Pinion Bearing Assembly:—Double row ball bearing should have no endplay (replace if endplay is perceptible). Roller bearing may have moderate amount of radial clearance on pinion shaft (no inner race). Bearings are drive fit in carrier housing. To install, drive ball bearing in against shoulder in housing (use tool J-939), install locking sleeve against bearing, back off locknuts and install locking sleeve wedge screws (oil screws before installing, tighten each screw one-half turn at a time, finish with full arm swing on 6-8" wrench), tighten locknuts, drive rear roller bearing in against shoulder in case (use tool J-940). Install rear bearing spacer on pinion shaft, select correct shim thickness for each carrier and pinion (See Pinion Setting below), install shims on pinion shaft, press pinion in carrier through bearings being careful that no pressure exerted on pinion teeth and that bearing rollers are not wedged against shaft. Install universal joint flange (at right angles to cotter pin hole), tighten pinion nut securely.

Pinion Setting:—Standard shim thickness for each carrier (indicated by mark on carrier flange) is as follows: D5—.049", D4—.048", D3—.047", D2—.046", D1—.045", 0—.044", S1—.043", S2—.042", S3—.041", S4—.040", S5—.039" ('D' indicates carrier bore deeper, 'S' shallower, than standard '0' dimension). To this standard shim thickness (which is correct for all unmarked or standard pinions), add additional shims (when pinion marked +), subtract shims (when pinion marked —) equal to amount of figure following this plus or minus mark on pinion (figure indicates shim thickness in thousandths). This total shim thickness will position pinion for correct mesh with ring gear. Shims furnished in four sizes and



colored for identification as listed below (use combinations of these shims for all required thicknesses).

Shim Thickness	Part No.	Color
.012"	499528	Plain
.014"	503063	Copper
.015"	499529	Blue
.018"	499530	Plain

NOTE—Unmarked pinions are standard and indicate no correction need be made to indicated carrier flange shim thickness.

Differential Gear & Bearing Assembly:—To disassemble, take out locking screw (in case at end of pinion shaft), withdraw shaft, take out differential gears, thrust washers and pinions. Shaft must be removed before 'mountain-ratio' ring gear can be removed. Differential bearing inner race is .0012" press fit on hub (if less than this amount, replace case or copper-plate hub). To remove bearing, use puller J-986 (exert pressure on inner race only), install in same manner using tool J-941. Replace bearings if rough or pitted.

Differential Bearing Adjustment:—Remove adjusting nut locks, back off bearing cap nuts just enough to relieve strain so that nuts can be turned, mark nut and cap to establish original position, back off right hand nut slowly until bearing race just stops turning with nut (amount nut turned indicates 'notches tight' of nut. Turn adjusting screw in until race just starts to turn with nut, then tighten nut additional 1½ (minimum), 2½ (maximum) notches for correct bearing pre-load. Tighten bearing cap nuts securely and replace locks.

Ring Gear Backlash Adjustment—When adjusting differential bearings (above), if ring gear has slight backlash (.005"), equalize differential bearing adjustment by tightening each adjusting nut one notch (do not make entire adjustment at right hand nut). Backlash can be adjusted without disturbing differential bearing adjustment by backing off one adjusting nut and tightening opposite nut exactly same number of notches. Recheck bearing adjustment after adjusting backlash.

Ring Gear Replacement:—Replace ring and pinion gears as matched sets. Ring gear mounted on differential case by special heat treated alloy steel capscrews (do not use ordinary screws). Use new heavy type lockwasher on each screw each time screws are removed.

REO (OWN MAKE)

Used On:

MODELS S, S2, S3, S4, S7 (1932-35)

NOTE:—Spicer (Salisbury) axle used on other Reo models. See Spicer article for complete data.

TYPE:—Spiral bevel, semi-floating type. Pinion straddle mounted on double row ball bearing (front), single row ball bearing (rear). Bearings mounted directly in housing. Differential assembly mounted on taper roller bearings with adjusting nut under bearing cap at each side.

SERVICING:—Gear Adjustment. Pinion not adjustable. Backlash should be .010-.015". Adjusted by backing off one differential bearing adjusting nut and taking up opposite nut equally. See differential bearing adjustment.

Axle Replacement. When installing new axle, place approximately .042" shim thickness between wheel bearing cap and axle housing flange. Check endplay. If greater than .005" remove shim.

OVERHAUL:—Pinion Bearing Assembly. Rear ball bearing peened in place in axle housing. To remove bearing, cut peen marks with sharp chisel. See that new bearing peened in place to prevent shifting. When removing front bearing, save shims installed between outer race and shoulder in housing at rear of bearing, and re-install these shims when replacing bearing (these shims compensate for variation in machining housing and are not an adjustment).

Pinion Setting:—Non-adjustable type. When installing new pinion, see that shims furnished with each pinion are installed between front bearing inner race and pinion at rear of bearing. These shims will insure correct pinion position.

Differential Bearing Adjustment:—Remove adjusting nut locks, loosen differential bearing cap screws, turn up adjusting nuts to remove all endplay. Differential assembly should revolve freely after adjustment completed. Tighten bearing caps and replace locks.

Ring Gear Backlash Adjustment. Back off left hand adjusting nut (to increase backlash), right hand nut (to decrease backlash), tighten opposite nut same amount to avoid disturbing bearing adjustment. Set backlash at .010" or to secure quietest running position (backlash limits .010-.015").

STUDEBAKER (OWN MAKE)

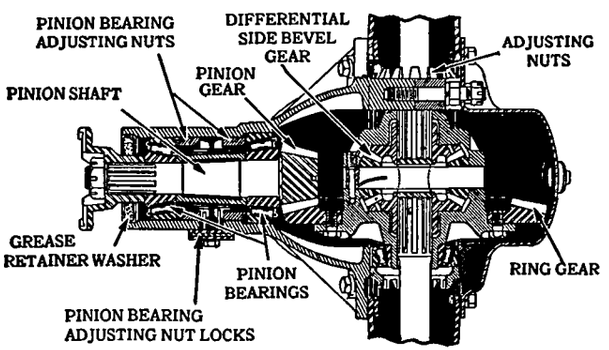
Used On:
SIX, MODEL 56 (1933)
COMMANDER, MODEL 73 (1933), 1B (1935)
PRESIDENT, MODEL 82 (1933), 1C (1935)

NOTE:—Spicer (Salisbury) Axles used on other models. See Spicer article for complete data.

TYPE:—Spiral bevel, semi-floating type. Pinion integral with shaft and mounted on roller bearings which are seated directly in carrier housing and positioned by pinion adjusting nuts (double nuts in housing between bearings). Differential carrier mounted on taper roller bearings with adjusting nut at each side under bearing cap.

SERVICING:—Gear Adjustment. Paint gears to check mesh or use pinion setting gauge to check pinion (see Pinion Setting). Backlash should be .006-.008" ('33), .002-.004" ('35). Adjusted by backing off one differential bearing adjusting nut and tightening other nut (see Differential Bearing Adjustment).

Axle Replacement. See that endplay is .001-.005" (total clearance between shafts and thrust block which transmits thrust from one shaft to the other). Adjust by adding or removing shims between backing plate and axle housing flange. Shims furnished .003", .005", .010",. 030" thick.



OVERHAUL:—Pinion Bearing Adjustment. Remove pinion bearing adjusting nut locks (one side of housing), tighten both adjusting nuts as much as possible while turning pinion shaft. Tap carrier housing lightly to seat bearing cups and rollers. Then back off one nut one notch so that pinion turns with slight drag, install adjusting nut locks.

Pinion Setting:—Pinion position adjusted by backing off one pinion bearing adjusting nut and tightening the other nut an equal amount (necessary to maintain pinion bearing adjustment, see above). Backing off front adjusting nut will move pinion toward ring gear; rear nut, away from ring gear.

Pinion Setting Gauge:—If Gauge Fixture No. HMJ-589 used for 1935 models, set micrometer for special zero setting by turning clockwise .010" to '15' (correct for pinions marked '0'). Install in axle housing in place of differential carrier, adjust pinion until gauge contacts ground surface on end of pinion (pinions marked '0') subtract (plus figure), or add (minus figure), the figure etched on end of each pinion. These figures indicate in thousandths the amount the pinion should be moved forward (plus) or to rear (minus) from the standard or zero setting.

Differential Bearing Adjustment:—Loosen bearing cap studs enough so that bearing adjusting nuts can be turned with 6" or 8" wrench. Tighten right hand adjusting nut until the bearing cup and rollers just start to rotate with the nut, tighten nut one additional notch, tighten bearing cap studs and install locks (lockscrews enter through case with screw heads on outside). Repeat adjustment on left hand adjusting nut.

Ring Gear Backlash Adjustment:—When adjusting ring gear backlash, back off one adjusting nut and tighten opposite nut exactly the same amount to avoid disturbing bearing adjustment. Check bearing adjustment (above).

WILLYS (OWN MAKE)

Used On:
WILLYS, 77 (1933-36), 37 ('37), 38 ('38), 48 ('39)
WILLYS-OVERLAND, MODEL 39 (1939)

TRUCK NOTE:—Spicer (Salisbury) Axles used on 1938-39 truck models. See Spicer article for complete data.

TYPE:—Model 77. Spiral bevel, semi-floating type. Pinion shaft integral with pinion and straddle mounted on two taper roller bearings (front), single roller bearing (rear). Differential assembly mounted on taper roller bearing at each side with adjusting shims in housing under bearing caps.

1937-39 Type—Spiral bevel, semi-floating type with Hotchkiss drive. Pinion mounted on taper roller bearings seated directly in housing with pinion bearing adjusting shims between front bearing cone and spacer, pinion adjusting shims in housing in front of rear bearing cup. See special directions below for pinion bearing adjustment and pinion setting on this model.

NOTE—Differential assembly is Spicer Model 22.

SERVICING:—Gear Adjustment. Paint gears to check mesh. Backlash should be .004-.008". Adjusted by shifting shims from one differential bearing to the other (same number of shims should be used to avoid disturbing differential bearing adjustment). See Pinion Setting and Differential Bearing Adjustment below.

Axle Shaft Removal. Remove rear wheels, take off axle shaft nut and washer, pull hub and brake drum assembly (use puller), remove nuts on backing plate, remove oil deflector, oil seal, backing plate and brake assembly, pull axle shaft and bearing assembly. Use puller to remove bearing from shaft.

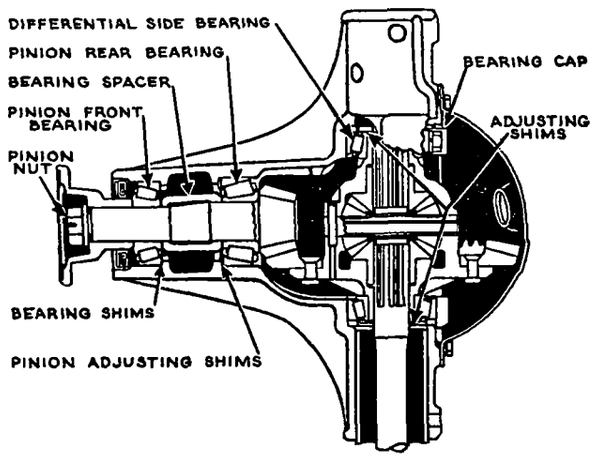
Axle Replacement. When replacing shafts, check endplay and adjust by adding or removing shims between bearing retainer and axle housing flange at each wheel. Wheel bearings designed to take thrust in one direction (transmitted through spacer to opposite shaft in other direction).

OVERHAUL:—Disassembly. Remove differential housing cover, remove differential bearing caps, remove shims on right hand side of differential assembly first, then left hand shims (keep shims separate and install same shim pack at each point when reassembling axle). Take off nut and remove rear universal joint companion flange, use brass drift and drive pinion out of housing toward rear (rear bearing cone, rollers and bearing spacer will come out with shaft). Drive front bearing cup, rollers, and oil seal out toward front as an assembly (notches provided for drift in opposite sides of housing). Drive rear bearing cup out toward rear in same manner.

Pinion Bearing Adjustment (1933-36 Models):—Shims installed on pinion shaft between front bearing cones. When assembling pinion assembly, install same shim thickness as removed from old assembly for initial trial. Pinion should have no endplay but should turn freely with nut tight.

Bearing Adjustment (1937-39). Shims installed between front bearing cone and bearing spacer. Install shims removed from old assembly when reassembling pinion. Tighten nut securely and check adjustment. Pinion should have no endplay but should turn with 1 lb. pressure on 15" leverage (1937), 2 lbs. pressure on 10" leverage (1938-39). Adjust by adding or removing shims furnished .004", .010", .030" thick. Bearing adjustment changed by pinion setting adjustment and should be rechecked when adjusted.

NOTE—If dial indicator used to check pinion bearing adjustment, measure endplay, then remove shims equal to endplay plus additional .002" shim thickness to secure correct .002" tension or bearing pre-load.



Pinion Setting (1933-36):—Shims located between pinion bearing shell or cup and shoulder in housing behind bearing. Add shims to move pinion away from ring gear, remove shims to move pinion toward ring gear.

1937-39 Type. Shims located between pinion rear bearing cup and shoulder in housing ahead of bearing. Install same number of shims as removed from old assembly when assembling pinion, check mesh. Add shims to move pinion in toward ring gear, remove shims to move pinion away from ring gear. Shims furnished 004", .010", .030" thick. Recheck pinion bearing adjustment.

Pinion Setting Gauge—Available from factory for setting new pinions to insure correct mesh with ring gear (Part No. W-101—part of Kit No. W99). When re-installing pinions, make certain that all shims originally installed in housing behind rear pinion bearing cup are replaced to insure correct pinion mesh.

Differential Bearing Adjustment:—Shims located between bearing cups and housing on either side. Furnished .180", .184", .188", .192", .196" thick. Select shims for correct bearing adjustment. When removing differential assembly, take off bearing caps, remove shims on right hand side first, install same shim thickness when reassemblying.

Ring Gear Backlash Adjustment. Transfer shims from behind left hand differential bearing to right hand bearing to increase backlash, or from right to left to decrease backlash. Total shim thickness must not be changed to avoid disturbing differential bearing adjustment.

SPICER SPIRAL BEVEL & HYPOID TYPES

SPIRAL BEVEL TYPES

Model 10

BANTAM, MODEL 63 & SUPER FOUR 65 (1940)

Model 11

CROSLEY, MODEL A (1939-40)

Model 21-1

WILLYS, MODEL 440P PANEL TRUCK (1940)

HYPOID GEAR TYPES

Model 23

STUDEBAKER CHAMPION, MODEL 2G (1940)

Model 41-2

GRAHAM, SPECIAL 108, SUPERCHARGER 107 ('40)
GRAHAM, HOLLYWOOD SUPERCHARGER 109 (1940)
STUDEBAKER COMMANDER, MODEL 10A (1940)
STUDEBAKER PRESIDENT, MODEL 6C (1940)

Model 41-3

HUPMOBILE SKYLARK, MODEL R (1939-40)

These Axles same design as used on corresponding 1938 car models.

CROSLEY NOTE:—Crosley Axle is new design with Torque Tube drive. Serviced in same manner as other Spicer models after torque tube has been removed.

SERVICING & OVERHAUL:—These models serviced in same manner as on previous car models. ***See Spicer (Salisbury) 'Spiral Bevel' and 'Hypoid Gear' Rear Axle articles in Mechanical Equipment Section of manual for complete data and adjust axles to following specifications:***

Axle Shaft Endplay—Total endplay for both shafts should be .005" (Bantam), .001-.005" (Studebaker), .002-.007" (others). When adjusting, shims should be removed equally at both wheels to keep thrust block at inner ends of axle shafts centered on differential pinion shaft (excessive shim removal at one wheel will cause block to bind on shaft).

Ring & Pinion Gear Backlash—Should be .006-.008" (Bantam), .004-.008" (Crosley, Graham, Willys), .004-.007" (Hupmobile), .003-.005" (Studebaker Champion), .005-.007" (Studebaker Comm. & Pres.). Adjusted by shifting differential bearing shims from one side to the other (total must be kept the same to avoid disturbing differential bearing adjustment).

Pinion Setting—Zero cone setting (for pinions marked '0') for each axle model shown in table below. This figure should be used with pinion setting gauge (See Model 10, 11, 23 Note below) and must be corrected for pinions marked + or — as directed in manual article.

Axle Model	Zero Cone Setting
10	.218"
21-1	.407"
23, 41-2, 41-3	.719"

Model 10 Note—Special smaller pinion gauge must be used for this model (endplate diameter of 2.714-2.716"). Pointer extends 2.000" beyond differential bearing bore center-line with micrometer set at zero.

Model 11 Note—This is special small axle and regular pinion setting gauge cannot be used.

Model 23 Note—Regular Pinion Setting Gauge cannot be used for this model. Special pinion setting gauge available (Studebaker Tool No. J-589-D —use with J-589-10-2 step plate and special retaining cross-bar which are part of complete gauge set). This J-589-D is used on Champion model only, regular Studebaker Pinion Setting Gauge No. J-589-C should be used on Commander & President models.

Pinion Bearings—Should be set up for slight drag when revolving pinion by hand with differential assembly out of axle (all models).

Differential Bearings—Should be set up for fairly heavy drag with pinion out of axle. To secure this setting, install shims sufficient to remove all bearing endplay, then install additional shim thickness of .003-.006" (except Studebaker), .008" (Studebaker Champion), .008-.010" (Studebaker Com. & Pres.).

Ring Gear Backlash Adjustment—When adjusting backlash, shift shims from one side of differential case to the other. Total shim thickness must not be changed as this would disturb differential bearing adjustment.

BUICK HYPOID TYPE

Used On:

SERIES 40-40, 50, 60, 70, 80, 90.

These Axles same design as used on 1939 models except as noted below.

SERIES 50, 70 NOTE:—These are new models (no corresponding 1939 models) but axles are same design as used on Series 40, 60.

TYPE:—Design changed from type used on 1939 models as follows:

Series 40, 60. Torque tube is separate part with flanged end which is bolted to flange on differential carrier. Torque tube should not be removed from carrier and bolts should not be loosened when servicing axle (except for installation of special gasket to correct oil leaks), as these parts furnished as an assembly only, not available separately. Universal joint ball housing and torque tube connection same design as used on 80, 90 except that no propeller shaft front bearing used (frame mounted universal and two-section torque tube as used on 1939 Models 40, 60 has been discontinued). Right hand axle shaft ¾" longer than left shaft and not interchangeable (same as for 1938-39 models).

Series 50, 70. Axle same design as 40, 60 (above).

Series 80, 90. Same design as used on previous 80, 90 models. Right hand axle shaft is 15/16" longer than left hand shaft and not interchangeable.

Axle Identification (All Models). Gear ratios of production car axles marked by paint marks on both axle shaft flanged ends as follows:

Car Model	Axle Ratio	Color Mark
40 Std.	4.4-1	White
40 Optl.	3.9-1	Red
50 Std.	4.4-1	.....
60, 70 Std.	3.9-1	Red
60 Optl.	3.6-1	Blue

SERVICING & OVERHAUL:—All service operations same as for corresponding previous models. ***See "Buick Hypoid Type" Rear Axle article in Mechanical Equipment Section of manual for complete data and note following points:***

Axle Shaft Endplay—If installation of new spacer block does not reduce shaft endplay to desired .008" maximum, install new bronze thrust washers in back of differential side gears.

Pinion Bearing Assembly. Use tool J-1292-B to remove and install pinion shaft on propeller shaft. Install front pinion bearing with shielded side toward front (splined end of shaft) with loading groove in outer race toward top to prevent oil leakage into torque tube. When installing pinion assembly in carrier, when pinion is larger in diameter than rear roller bearing so that bearing outer race cannot be tapped into place in housing, use special tool J-1192 inserted between pinion and rear bearing and drive on end of pinion with bronze driving block to seat bearing.

Torque Tube (40, 50, 60, 70). Do not disturb bolted connection between torque tube flange and carrier flange unless installation of new gasket required to stop oil leaks (special gasket required). Tube and carrier are matched and must be kept lined up (furnished as an assembly only, separate parts not available).

Pinion Setting. Production pinions not ground on face and gauge measurements must be made at particular pinion tooth. When using gauge measure to blank tooth between tooth having factory inspection number and tooth with + or — mark and again at opposite side of pinion (place adapter on pinion with blank tooth up and then with blank tooth down) and average these two readings to determine shim correction. Pinion setting figures same as for 1939 models (.379 for 40, 50, 60, 70; .203 for 80, 90). NOTE—Service pinions have ground face. Above procedure required for production pinions only.

Differential Bearing Adjustment. Should be set 2-2½ notches tight (same as for 1939 models).

Ring Gear Backlash. Should be .006-.010" (new gears) with slight increase over .010" permissible for worn gears (same as for 1939 models).

BUICK REAR SUSPENSION

Used On:

SERIES 40-40, 50, 60, 70, 80, 90 (1940)

This "BuiCoil" type suspension same as used on 1938-39 Buick models except as noted below.

TYPE:—Design changed for 1940 models as follows:

Shock Absorbers (40, 50, 60, 70). Shock absorbers are double-acting, parallel cylinder Delco type mounted on brake backing plate by two bolts (remove wheel and brake drum to remove shock absorbers). Upper end of shock absorber arm link is fastened to lower flange of frame side rail.

Shock Absorbers (80, 90). Delco double-acting, end-to-end discharge type mounted on frame side rails and linked to axle housing at spring seat (same as 1939).

SERVICING:—Serviced in same manner as previous models. ***See "Buick Rear Suspension" article in Mechanical Equipment Section of manual and note following changes:***

Trim Dimension (Spring Height)—With car at curb weight (ready for road but no passenger load), check distance from lower face of frame side rail (straight section to rear of spring on 40, 50, 60, 70; insulator seat on 80, 90) to lower face of spring on axle housing bracket. If trim dimension less than shown in table below, replace spring (see spring data).

Car Model	Trim Dimension
40, 50, 60, 70	6¼-7¼"
80, 90	6¾-7¾"

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Rear Spring Specifications—Springs have identical ends at top and bottom. Spring part number stamped on coil near end and spring paint marked for identification as follows:

Car Model	Spring Part No.	Color Mark
41, 41C, 48	1312433	Yellow
41T	1310399	Red
46, 46S	1315049	Blue
46C	1315105	Brown
51	1312433	Yellow
51C	1317788	
56S	1315047	
56C	1317790	
59	1315231	
61, 61C	1310399	Red
66, 66S	1315049	Blue
66C	1315105	Brown
71	1310399	Red
71C	1317789	
76S	1312433	Yellow
76C	1317788	
80C; 81, F, C; 87, F	1309893	
90, 90L	1308803	
91	1309892	

Heavy Duty (Overload) Springs. If spring bottoms excessively when loaded, a spring from a heavier model car may be installed providing that new spring does not increase trim dimension (above) more than 1". Make certain that same type spring installed on both right and left sides of car. For use with trailers or when heavy loads carried in rear compartment (not to exceed 500 lbs. in addition to normal passenger load of 500 lbs.), special rear springs may be installed as follows:

Heavy Duty Rear Springs

Model	200 lb. Overload	300 lb. Overload
41, 41C, 48, 51	1310399	1315233
46, 46S, 46C, 56S	1312433	1315231
61, 61C, 71	1315231	1315233
66, 66S, 66C	1312433	1315231
76S	1310399	1315233
80C; 81, F, C; 87, F	1304586	1305365
90, 90L, 91	1305365	1305366

Rear Stabilizers:—When installing stabilizer links, nuts should be tightened down to ends of threads which should compress rubber grommets to over-all length of 1 11/16" (to outer face of metal cup on each end of grommet), adjust nuts as required to secure this dimension. On 80, 90 models, grommet cups are positioned on link by collars and each grommet must be adjusted separately. On other models a tubular spacer is used on the link between the inner grommet cups. Over-all free length of new grommets is ⅞" (40, 50, 60, 70), 15/16" (80, 90).

CADILLAC-LA SALLE HYPOID TYPE

Used On:

CADILLAC V8, SERIES 40-60S, 62, 72, 75 (1940)
CADILLAC V16, SERIES 40-90 (1940)
LA SALLE V8, SERIES 40-50, 52 (1940)

These axles same design as used on 1939 models.

TYPE:—Hypoid gear. Same design as used on 1939 car models with pinion bearing adjusting spacer as follows:

Pinion Bearing Adjusting Spacer—Compressible steel spacer is installed on pinion shaft between pinion bearing cones. Tightening of rear universal joint companion flange nut causes the spacer to "buckle" and pre-loads bearings.

SERVICING & OVERHAUL:—Differential carrier assembly should be serviced by replacement. Manufacturer recommends that no attempt be made to disassemble axles further than removal of carrier assembly or replacement of pinion shaft and axle shaft oil seals.

CHEVROLET HYPOID TYPE (PASSENGER CARS & TRUCKS)

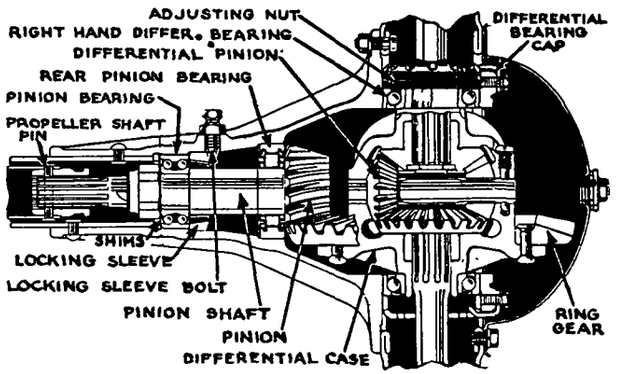
Used On:

PASSENGER CAR TYPE
SPECIAL DELUXE KA, MASTER DELUXE KH ('40)
MASTER '85', MODEL KB (1940)

TRUCK TYPE
HALF TON KC, ¾ TON KD, ¾ TON SPEC. KE ('40)
These Axles same design as used on 1939 models except as noted (Truck Axle New Hypoid Gear Type).

TRUCK AXLE NOTE:—Truck axles are same design as those used on Passenger Car Models except they are of heavier construction. Truck axles also have improved lubrication system as follows:

Pinion Bearing Lubrication—Drilled passage in differential carrier provided for greater oil flow to front (double row ball) pinion bearing. Oil retainer installed in carrier in front of rear (roller) pinion bearing retards oil return to axle housing so that front bearing operates in an oil bath.



TYPE:—Same design as used on 1939 Passenger Car models. Passenger car axles marked for identification as follows:

Rear Axle Ratios & Marks—Axle used on each Passenger Car model may be identified by prefix letter of part number stamped on top of differential carrier casting on right side of center rib as follows: 'B'—4.11-1 Ratio (KA, KH), 'C' or 'CB'— 3.73-1 Ratio (KB). NOTE—This 4.11-1 axle ratio is new, 3.73-1 ratio is same as used on 1939 Master '85'.

SERVICING & OVERHAUL:—All specifications and servicing operations same as for previous models except as noted below. *See 'Chevrolet Hypoid Type (Passenger Cars)' Rear Axle article in Mechanical Equipment Section of manual (or 1939 Supplement) for complete instructions and note following new specifications:*

Ring Gear Backlash—Should be .005-.008" for all models.

Axle Shaft Endplay (Passenger Cars)—Controlled by spacer assembled on differential pinion shaft between inner ends of axle shafts. Endplay should be from a Free Fit to .014" max. Spacer blocks now furnished in three types providing four sizes as follows: Narrow—1.0105". Medium—1.0195" and 1.0295", Wide—1.0345". These dimensions taken across ground faces of block and block should be installed with these ground faces toward axle shaft ends. NOTE—Medium block ground on all four sides and may be installed either way to secure either of these two sizes.

Axle Shaft Endplay (Trucks)—Same as for Passenger Car (above) except that spacer blocks furnished in two types for three sizes as follows: Narrow—1.1485", Wide—1.1575" & 1.1675" (this block ground on all four sides and may be installed either way to secure both sizes).

Pinion Bearing Assembly (Trucks)—When assembling pinion bearings on shaft, install rear roller bearing and lock ring, then thread pinion front bearing oil retainer on shaft with bevel of large diameter of retainer toward pinion, assemble bearing lock sleeve with bevel side toward pinion, install front double row ball bearing and bearing retainer nut. All other assembly and adjustment instructions same as for passenger car models.

CHEVROLET FULL-FLOATING HYPOID TRUCK TYPE

Used On:

1½ TON MODELS WA, WB; SCHOOL BUS WC ('40)
CAB-OVER-ENGINE TRUCKS, WD, WE, WF (1940)

NOTE—Two axle ratios used (5.43-1 and 6.17-1) and each type may be identified by prefix letter of part number stamped on top surface of top rib on right side of differential carrier casting as follows: 5.43-1 Ratio—'B' or not lettered (straight part number), 6.17-1 Ratio—'H' or 'HB'.

TYPE:—Hypoid Gear, full floating type. Similar to design used on previous Chevrolet Truck models except for new Hypoid Gears and new Ring Gear Mounting (ring gear held on differential case by same screws as used to clamp differential case halves together). NOTE—Ring gear can now be replaced without replacing differential case (as required on previous model).

SERVICING:—Gear Adjustment—Pinion not adjustable. Backlash should be .005-.008" (see Differential Bearing Adjustment below).

Axle Shaft & Wheel Bearings:—Wheels mounted on double barrel type roller bearings on outer end of axle housing and axle shafts can be removed without disturbing bearings. To remove axle shaft, bend lugs of lock plate away from bolt heads (on axle shaft flange on wheel hub), remove eight ½" capscrews, remove and discard lock plate. Install two ½" x 13 capscrews in tapped holes in flange (between mounting screw holes), turn these screws up evenly to loosen axle shaft, remove axle and aluminum gasket. When installing shaft, use new aluminum gasket and new lock plate, tighten capscrews evenly and securely, then bend lock plate lugs against screw heads.

Wheel Bearing Adjustment—Remove axle shafts (above), remove adjusting nut locknut and lock (within wheel hub), use special wrench J-870 (see Note below) and turn adjusting nut up tight, then back nut off 45° (⅛ turn). Rotate wheel hub by hand to make certain that it turns freely. Install lock and see that tangs line up with slots in adjusting nut, bend lock tang into slot in nut. Install and tighten outer locknut, bend lock tang into notch in nut. Re-install axle shaft. NOTE—Wheel bearing adjusting nuts on later trucks do not have slots extending entirely across face of nut (slotted at

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outer edge only) and the J-870 wrench must be reworked for use on these models as follows: Remove wrench handle, mount wrench body in lathe and machine inner ends of wrench lugs to inside diameter of 2½".

Wheel Bearing Assembly—To remove wheel bearings, remove axle shafts (above), take out locknut, lock, adjusting nut, remove hub and drum assembly. Install clamp on brake cylinder. Use puller J-918 to remove inner bearing and oil seal. To remove outer bearing from wheel hub, tap outer race to relieve tension on snap ring, remove snap ring on inside of hub, use long ⅛" punch inserted through mounting screw holes in end of hub and tap outer race out of hub (inner race and roller assembly will come out with outer race—use extreme care to tap on outer race only and to drive race out evenly). Wash bearings in gasoline and pack roller assemblies with #2½ cup grease. To replace outer bearing, place inner race, roller assembly and outer race on wheel hub with thin edge of outer race toward hub, use bearing replacer J-872-1 in an arbor press and press bearing in hub just far enough so that snap ring can be installed, install snap ring, then tap bearing out against snap ring (use driver J-872-3 inserted through mounting screw holes and tap on outer race only). To install inner bearing, use special driver J-872-4 to press outer race in against seat (install with wide side of race toward hub), install inner race and roller assembly. Press oil seal in place using oil seal replacer J-872-2 in arbor press, stake oil seal in place by prick punching at three equally spaced points on edge. Install wheel hub and drum assembly (turn wheel to seat bearings) and adjust bearings (above).
NOTE—Oil slinger on rear axle housing must be installed with special tool J-973 so it will be correctly positioned in relation to slinger in wheel hub. Always install new slinger whenever removed.

Rear Propeller Shaft Front Bearing—Consists of a bronze bushing and oil seal in forward end of housing retained by a dowel pin. To replace bushing, drill out dowel pin, use old shaft to drive out old bushing and oil seal from rear end of torque tube. Dip new oil seal in heavy oil, install in front end of torque tube with free end of leather toward front, use driver J-1362 to seat oil seal against shoulder in tube. Install bushing with end which has machined angle on face toward oil seal and seat bushing in tube with same J-1362 driver. Drill dowel hole in bushing (use care not to break through inner wall), install new dowel pin and peen in place,

Front Propeller Shaft Assembly:—To disassemble, remove capscrews retaining rear universal joint ball retainer, remove retainer and ball. Use long socket wrench and remove capscrew in rear end of shaft (visible through hole in universal cross), remove universal from shaft. Take out snap ring retaining ball bearing in shaft housing, withdraw shaft and bearing from housing, press bearing from shaft.

Front Bearing—Consists of a bronze bushing and oil seal in forward end of shaft housing similar to rear propeller shaft front bearing (see above) and installed in same manner except that special driver J-1363 should be used.

OVERHAUL:—Disassembly—Remove ring gear thrust pad, adjusting nut locks, bearing cap bolts and lock-washers, take off bearing caps (bearing caps now piloted on carrier by sleeve type dowels to maintain alignment), lift differential case and ring gear assembly out of carrier. Take out bolts mounting torque tube on differential carrier, remove torque tube, withdraw propeller shaft assembly.

Pinion Bearing Assembly:—To disassemble, cut off rivet heads holding pinion shaft in coupling, drive out rivets, use special replacer and removal press J-985 and press pinion and coupling off propeller shaft, use press plates and press coupling off pinion shaft in an arbor press. Remove lock ring retaining bearing on end of pinion shaft, use special press plate J-1453 and press pinion and shaft out of this bearing (use extreme care that press plate bears against inner race of bearing only—bearing will be damaged if pressure applied to outer race). Clamp pinion shaft in vise (use universal joint yoke as clamp plate), remove pinion bearing retaining nut. Thread special pinion bearing bearing remover over pinion (J-1439 for 6 tooth pinions, J-1440 for 7 tooth pinions) and against bearing, press bearing off shaft. To assemble, reverse directions given above and note following points: Use new bearing retaining nut, tighten nut securely and lock by cutting sleeve on nut in line with keyway and driving edge of nut sleeve into keyway. Install rear roller bearing on shaft with chamfered side of inner race toward pinion, use lock ring installer J-1364 to install lock ring on end of shaft. Make certain that holes in coupling and shaft line up when pressing coupling on, use new flat head rivets and securely rivet ends. Check runout.

Propeller Shaft Run-out—Support assembly on 'V' blocks at double row pinion bearing (rear end), ground diameter back of shaft splines (front end). Run-out must not exceed following maximums (straighten shaft assembly if excessive): .003" at roller bearing on rear end of shaft, .010" at finished part of shaft in front of coupling, .015" at rough section in middle of propeller shaft, .005" at extreme front end of shaft.

Pinion Setting:—Pinion position not adjustable. Double row bearing should be seated against shoulder in carrier and is retained by torque tube

Differential Bearing Assembly:—Bearings are press fit on differential case hubs. Use special puller to remove bearings (puller fingers must fit in notches in case so that pressure applied to inner races only). Mark differential case halves before dis-assembly to insure reassembling in same position—this is very important. Remove twelve ½" bolts holding case halves and ring gear together, lift off case cover, remove differential pinions and side gears, tap ring gear off case with soft-faced hammer. When reassembling, oil pinions and side gears and install in left side of case, assemble right side of case being careful to line up marks made before disassembly, install guide pins in two opposite bolt holes (guide pins can be made up of two #2652253 ring gear screws with heads removed and end slotted to permit removal). Make certain that ring gear seat on case is clean and not burred, install ring gear on guide pins, install bolts in all holes (except guide pin holes), tighten all bolts evenly and securely until ring gear face is flush with flange on case, remove guide pins, install remaining bolts and tighten all bolts. Use special driver to install differential side bearings on case hubs and see that wide side of inner race is toward case. Check differential case run-out which must not exceed following maximum figures: .004" at ring gear pilot on case and face on which ring gear is bolted, .007" on back of ring gear after gear bolted in place.

Differential Bearing Adjustment:—When installing differential assembly in carrier, make certain that bearing cap marks line up with marks on carrier, tighten bearing capscrews until lock washers just flatten out, screw both bearing adjusting nuts up until snug to seat bearings. Back off right hand adjusting nut, tighten left hand nut until all clearance or backlash between ring gear and pinion is just taken up, then back off adjusting nut two notches to locking position (slot in nut in line with lock). Tighten right hand adjusting nut solidly, back nut off until free of bearing, then tighten right hand adjusting nut until all play in bearing is taken up, and then tighten nut one to two notches more to locking position, tighten bearing cap screws and install adjusting nut locks. Check backlash.

Ring Gear Backlash Adjustment—If backlash not correct after setting up bearings as directed above, loosen left hand adjusting nut one notch and tighten right hand nut one notch (if backlash less than .005-.008"), or loosen right hand nut one notch and tighten left hand nut one notch (if backlash greater than .005-.008"). In making any backlash adjustment both adjusting nuts must be turned an exactly equal number of notches (in opposite directions) to avoid disturbing bearing adjustment.

Ring Gear Thrust Pad Adjustment:—Examine bronze tip on ring gear thrust pad and replace if worn. To adjust, tighten thrust pad adjusting screw until bronze tip engages back of ring gear lightly (turn gear while making adjustment), then back screw off 1/12 turn, hold screw from turning and tighten locknut. This adjustment will give clearance of .005-.007" between thrust pad and ring gear.

CHEVROLET TWO-SPEED (DOUBLE REDUCTION) TRUCK TYPE

Optl. Equipment On:
CHEVROLET TRUCK, ALL MODELS (1940)
This Axle same design as used on 1939 models.

SERVICING, OVERHAUL & ADJUSTMENT:—All operations same as for 1939 Two-speed Rear Axle except as noted below. *See 'Chevrolet (Double Reduction) Two Speed Type' Rear Axle article in Mechanical Equipment Section of manual (or 1939 Supplement) for complete instructions and note following new data:*

Axle Shaft Gasket—Soft aluminum gasket used between wheel hub and axle shaft flange. Install new gasket whenever axle shafts are removed. NOTE—This type aluminum gasket can be installed on previous truck models (to replace earlier type Vellumoid gasket) to correct oil leaks at this point.

Wheel Bearing Servicing—Wheel bearings installed in same manner as on regular full-floating axle (see preceding article) except that when using Outer Wheel Bearing Driver J-872-3, the eight studs must be removed from the hub in order to permit the driver pins to engage the bearing outer race and seat the bearing firmly against the snap ring. NOTE—The regular J-872-3 driver can be reworked by drilling four 9/16" holes midway between pins. With this change, it will be necessary to remove 4 studs only from hub instead of entire 8.

Shifter Sleeve Installation Note—Shifter sleeve has three tapered teeth which must line up with poppet balls and springs in shaft. These tapered teeth are unevenly spaced on the shaft and in the sleeve (two groups of 8 teeth and one group of 9 teeth between these tapered teeth). Determine the 9 tooth group on the sleeve and the 9 space-between-teeth group on the shaft and mesh these together. CAUTION—If sleeve and shaft not meshed in this manner, one or more lock balls will be out of position in the sleeve.

CHRYSLER HYPOID TYPE

Used On:

CHRYSLER, MODEL C25 ROYAL & WINDSOR ('40)

CHRYSLER, C26 TRAVELER, SARATOGA, NEW YORKER (1940)

DE SOTO, MODEL S7 CUSTOM & DELUXE (1940)

DODGE LUXURY LINER, D14 DELUXE, D17 SPECIAL (1940)

PLYMOUTH, P9 ROADKING, P10 DELUXE (1940)

These Axles same design as types used on corresponding 1939 car models.

SERVICING & OVERHAUL:—All service operations same as for previous models. *See "Chrysler Hypoid Type" Rear Axle article in Mechanical Equipment Section of manual for complete data and adjust axles to following specifications:*

Axle Shaft Endplay—Should be .003-.008". When dismantling axle, make certain that shims installed between backing plate and axle housing flange are saved and replaced when axle reassembled. If new shaft installed, adjust shim thickness for correct endplay as noted above (adjust equally at both wheels).

Ring and Pinion Gear Backlash—Should be .006-.010". When making this adjustment (by backing off one differential bearing adjusting nut and tightening opposite nut), note new differential bearing adjustment data below.

Pinion Bearing Adjustment—Bearings should be .0015-.0025" tight (draw or tension). Use dial indicator to check with sufficient shim stock installed between spacer and front bearing cone so that pinion shaft has some endplay, then remove shim stock equal to this measured endplay plus .0015-.0025" so as to provide this amount of draw or tension when installed on car. Universal joint flange must be in place on shaft and pinion shaft nut must be tight when checking bearing adjustment. Oil seal need not be installed until after bearing adjustment completed (use special drift C-359 to seat oil seal in carrier bore).

Pinion Setting—Controlled by washer (Chrysler C25, De Soto, Dodge, Plymouth except 7 Pass. cars), shims (Chrysler C26 and Chrysler C25, De Soto, Dodge, Plymouth 7 Pass. cars) between pinion and pinion shaft rear bearing cone. Shims or washer thickness should be varied to secure correct pinion mesh (pinion assembly must be dismantled to remove or install these washers or shims).

Differential Bearing Adjustment—When checking adjustment, both bearing adjusting nuts should be tightened sufficiently to seat bearing cups solidly against rollers, then back off adjusting nuts to relieve strain and tighten until assembly turns with slight drag. NOTE—Adjustment can be checked by setting up dial indicator to measure bearing post 'spread' as adjusting nuts are tightened. With correct adjustment, bearing support pedestals should spread or move out .008-.010" measured at the bearing caps.

Ring Gear Backlash Adjustment—When adjusting backlash, note number of notches one adjusting nut is backed off and tighten opposite nut exactly same number of notches to avoid disturbing bearing adjustment.

Differential Side Gear Assembly—Differential pinion gear shaft retained by pin (except 7 Pass. cars), lock screw (7 Pass. cars). Gears can be dismantled (with ring gear removed) by taking out this pin or lockscrew, pulling out shaft and removing thrust block (on center of shaft). When reassembling, make certain that this thrust block installed on shaft with spacer on shaft between block and each differential pinion, and that thrust washers installed in back of each differential pinion and side gear. Clearance between side gears and pinions should be .004-.012" (controlled by thrust washers in back of gears).

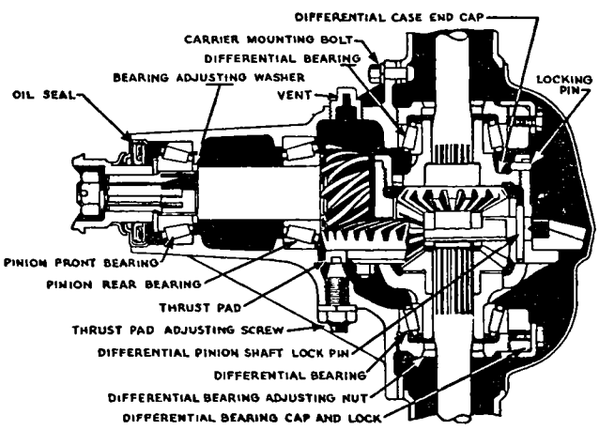
CHRYSLER NEW C27 HYPOID TYPE

Used On:

CHRYSLER, MODEL C27 CROWN IMPERIAL ('40)

TYPE:—New design Hypoid Gear, semi-floating type with 'barrel type' differential case. Differential case has open end on right hand side through which differential gears are installed, this opening then being closed by cap which is threaded into case and locked by pin extending through drilled hole in case and cap. Right hand differential case side bearing is seated on shoulder on cap. Pinion shaft bearing cups are seated against shoulders in carrier bore and front bearing cone seats against shoulder on shaft (spacer washer between cone and shaft shoulder), no tubular shaft spacer being used. Special ring gear thrust pad and adjusting screw is installed in left hand side of differential carrier so as to contact back of ring gear.

SERVICING:—Gear Adjustment—Paint gears to check mesh. Backlash should be .006-.010". Adjusted by backing off one differential bearing adjusting nut and tightening opposite nut equally. See Differential Bearing adjustment below.



Axle Shaft Replacement—To remove shaft, remove wheel, axle shaft nut, hub and shaft key (use special hub puller C-319). Disconnect brake line, remove stud nuts holding oil seal and backing plate on housing, remove oil seal, backing plate, and wheel bearing adjusting shims (save shims and reinstall when assembling). Use shaft puller C-158 to pull shaft and bearing (if bearing to be removed from shaft use puller C-293). When installing new shaft, adjust shim thickness at each wheel equally for desired endplay of .003-.008" (shims furnished .010", .0125", .015", .030" thick). NOTE—Shims must be installed or removed equally at each wheel to maintain correct position of spacer block on differential pinion shaft at inner end of axle shafts.

Wheel Bearing Oil Seal—Use special puller C-358 to remove oil seal washer from housing, special drift C-201 to install new seal washer.

OVERHAUL:—Disassembly—Mark differential bearing adjusting nuts and bearing caps to insure replacement in correct position. Remove adjusting nut locks, back off adjusting nuts, take out bearing cap screws, remove bearing caps, lift differential assembly out of carrier. Remove drive pinion shaft nut, pull universal joint drive pinion flange, remove pinion and shaft through rear end of carrier. Use special puller C-293 to remove rear bearing cone from pinion shaft. Use special puller C-358 to remove pinion oil seal from carrier bore, special drift C-359 to install new seal. NOTE—Seal can be serviced without disassembling carrier assembly. New seals should be soaked in thin oil for 30 minutes and leather should be worked by rolling with smooth bar until it is pliable.

Pinion Bearing Adjustment:—Bearing should be .0015-.0025" tight (draw or tension) with pinion shaft nut securely tightened. To check bearings, mount dial indicator so as to measure pinion shaft endplay. Install pinion bearing washer of sufficient thickness between front bearing cone and shoulder on pinion shaft so that shaft has measurable endplay (pinion assembly must be dismantled to change this washer). Then install washer which is thin enough to take up all endplay plus .002" to provide proper draw or tension on bearings (subtract measured endplay plus .002" from first washer thickness to find correct final washer thickness).

Differential Gear Assembly:—To disassemble differential gears, use special puller C-293 and puller blocks to remove right hand differential bearing from differential case cap. Drive cap locking pin through hole in case so that pin is entirely within cap. Heat differential case in boiling water, then unscrew cap from right hand end with special spanner wrench. Drive differential pinion shaft locking pin out of case, withdraw pinion shaft and all differential gear parts. When reassembling, make certain that thrust washers installed behind each differential pinion and side gear and that thrust block installed on center of pinion shaft with spacer between block and each pinion. Peen edge of differential pinion shaft locking pin hole after pin installed to prevent pin working out in service. Heat differential case in boiling water before installing end cap, tighten end cap securely, drill new hole through cap and case and drive new groove pin in hole until flush (do not reuse old groove pins). Clearance between differential pinions and side gears should be .004-.012" and is controlled by thrust washer thickness installed in back of gears.

Differential Bearing Adjustment:—When installing carrier assembly, turn adjusting nuts up to marks made before disassembly, then check bearing adjustment as follows: Tighten both bearing adjusting nuts sufficiently to seat bearing cups solidly

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against rollers, then back off nuts to relieve strain and tighten until differential assembly turns with slight drag or bearing support pedestals 'spread' .008-.010" as measured at bearing caps (use dial indicator to measure this spread or outward movement of pedestals as nuts are tightened). Replace bearing and adjusting nut locks and tighten bearing cap screws securely.

Ring Gear Backlash Adjustment—When adjusting backlash, note number of notches one adjusting nut is backed off and tighten opposite nut exactly same number of notches to avoid disturbing bearing adjustment. Make certain that ring gear thrust pad has sufficient clearance to permit ring gear movement and adjust thrust pad after correct backlash of .006-.010" is secured.

Ring Rear Thrust Pad Adjustment:—Clearance between thrust pad and back face of ring gear should be .006-.008". To adjust, loosen locknut on thrust pad stud (on left hand side of carrier housing), turn stud up finger tight, then back stud off slightly less than ⅛ turn, tighten locknut.

FORD (PASSENGER CAR) & MERCURY

Used On:

FORD, 022A (60), 01A (85), PASS. CARS (1940)

FORD, 022C (60), 01C (85), 09C (95) COMM'L. ('40)

MERCURY, MODEL 09A (1940)

These Axles same design as used on corresponding 1939 models except as noted below.

NOTE:—Ford '60' Comm'l. Model—Axle used on this model has new 4.55-1 Ratio and uses a new Part No. 022A-4209 Matched Gear & Pinion Set. Axle ratios on all other models are same as on corresponding 1939 models.

SERVICING & OVERHAUL:—All specifications and service operations same as for previous models except as noted below. *See 'Ford (Passenger Car)' Rear Axle article in Mechanical Equipment Section of manual (or 1938 Supplement) for complete instructions and note following new specifications:*

Ring & Pinion Gear Backlash—Should be .012" Maximum (All Ford models), .010" Maximum (Mercury).

FORD TWO-SPEED TRUCK TYPE

Optl. Equipment On:

FORD TRUCKS, ALL '60', '85', '95' MODELS (1940)

This Axle same design as used on 1939 models.

SERVICING & OVERHAUL:—All specifications and service operations same as for 1939 model. *See 'Ford Two Speed Truck Axle' article in Mechanical Equipment Section of manual (or 1939 Supplement) for complete data and note following new specifications:*

Pinion Bearing Setting—Force required to turn pinion shaft should be 8-12 inch lbs. (measure with ABV-129 gauge).

FORD FULL-FLOATING TRUCK TYPE

Used On:

ALL '60', '85', '95' TRUCK MODELS (1940)

TYPE:—Spiral bevel, full-floating type with Hotchkiss drive. Axle similar to design used on previous truck models except that Torque Tube has been discontinued and axle has been designed for Hotchkiss drive by adding grease container and bearing support on forward end of axle housing.

¾ & 1 Ton Truck—Axle used on these models same as on other trucks except that pinion bearing sleeve (double bearing cup) is not flanged and is retained in housing by separate bearing retainer which is bolted on front end of housing with separate grease retainer assembly.

SERVICING:—Gear Adjustment—Backlash should be .004-.016". No adjustment provided.

Axle Shafts—Shafts can be removed without disturbing wheels and hubs as follows: Take out two screws in hub cap, remove cap. Remove nuts on 8 studs on axle shaft flange, turn two bolts (located between studs) in evenly to loosen axle shaft flange from hub. Then back off these two bolts, strike sharp blow on center of axle shaft flange to loosen locking cones on studs. Remove locking cones, pull axle shaft out. When installing shaft, see that gasket in place under axle shaft flange, back off loosening bolts sufficiently to allow axle shaft to seat on hub, install locking cones on studs, tighten stud nuts evenly and securely, then tighten the two loosening bolts just enough to prevent their loosening in service.

Wheel Bearing Adjustment—Remove axle shaft (above), remove outer locknut, lockplate, and grease retainer (except on ¾ and 1 Ton). Turn inner bearing adjusting nut up tight, then back nut off ⅛ turn, install lockplate being certain that locking pin in nut engages notch in lockplate (except ¾ & 1 Ton), bend lockplate tang against nut (¾ & 1 Ton). Install outer locknut and tighten securely. Rotate wheel by hand and see that it turns freely. Re-install axle shafts.

Wheel Bearing Assembly—To disassemble wheel bearings, remove axle shafts, remove outer locknut, grease retainer, lockplate and inner adjusting nut, remove wheel hub. Remove snap ring in inner end of hub, use puller BB-139 to remove grease retainer. remove inner bearing roller assembly, use puller BB-148 to remove inner bearing cup from hub. Remove outer bearing roller assembly from hub, use puller BB-148 to remove bearing cup from hub. Re-install parts in same manner using BB-150 to install both bearing cups in hub and to install grease retainer. Make certain that grease retainer snap ring installed in inner end of hub. Adjust bearings after hub installed on axle (see above).

OVERHAUL:—Disassembly—Remove axle shafts and wheel hubs, take out capscrews holding left hand axle housing on right hand housing, remove left hand housing using care not to lose thrust pin and plate. Withdraw ring gear and differential assembly from housing (differential side bearing roller and cone assembly will come out on differential case hubs, bearing cones will remain in housing halves). Remove and service pinion assembly and differential assembly as directed below.

Pinion Bearing Assembly (Except ¾ & 1 Ton):—To disassemble, take out screws mounting grease retainer and pinion sleeve flange on forward end of axle housing, remove grease retainer and pinion assembly. To disassemble pinion, remove locknut, lockplate, adjusting nut, and washer on end of pinion shaft, use tool AATA13 to remove pinion from sleeve (rear bearing roller and cone will come out with shaft). Use BB-142 to remove and install this rear bearing on pinion shaft. If bearing cups to be removed from sleeve, use puller BB-143 to remove cups and BB-144 press to install bearing cups. Use puller BB-145 to remove outboard bearing from axle housing and BB-147 to install this bearing. Reinstall pinion and bearings in sleeve in this same manner, tighten adjusting nut until force required to turn pinion shaft is 12-16 inch lbs. (use ABV-129 gauge which reads directly in in. lbs.). Tighten locknut securely and see that lockplate tangs turned over against both nuts.

¾ & 1 Ton Models—Pinion bearing sleeve is not flanged and pinion assembly should be removed from axle housing with special driver (after grease retainer and bearing retainer removed). Bearings are removed from pinion shaft as an assembly with special puller (after pinion bearing adjusting nut and locknut have been taken off). When installing bearings, install rear bearing first, then install front bearing and bearing sleeve or cone as an assembly. Heat axle housing before installing pinion assembly and check bearing adjustment only after assembly installed in housing. Force required to turn shaft should be 16-20 inch lbs. (same as other models) and is adjusted in same manner .

Pinion Setting:—Pinion position not adjustable. If pinion mesh with ring gear not correct, replace all worn parts.

Differential Assembly:—To disassemble take out capscrews holding right hand half of differential case on left hand half, remove right half of case and lift out differential gears, pinions and pinion shaft. To remove differential bearing rollers and cones from differential case hubs, use special puller AATA1. Replace these bearings with tool BB-147. Use BB-148 to remove bearing cups from axle housing and BB-149 to install these bearing cups. Ring gear is serviced as a unit with the differential case and should not be removed. Differential bearings are not adjustable and use of additional gaskets between axle housing halves to control bearing adjustment is not recommended.

Assembly Note:—When reassembling axle, see that thrust block and thrust pin not worn and properly installed in left hand axle housing, use one 61-4035 gasket (¾ & 1 Ton), BB-4035 gasket (Others) between axle housing hlaves.

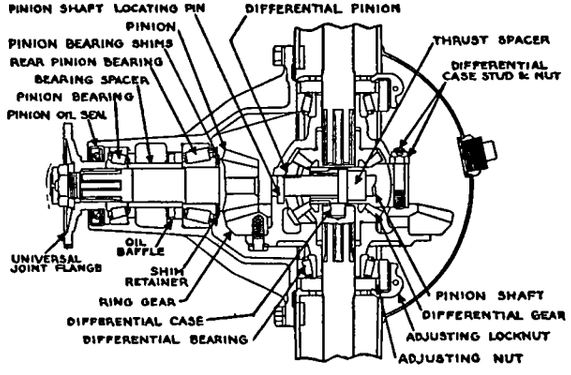
HUDSON SPIRAL BEVEL TYPE

Used On:

SIX, 40T TRAVELER, 40P DELUXE (1940)
SUPER SIX 41, COUNTRY CLUB SIX 43 (1940)
EIGHT 44, COUNTRY CLUB EIGHT 47 (1940)

This Axle same as used on corresponding 1939 models except as noted below.

TYPE:—Spiral bevel, semi-floating type of same design as used on 1939 cars except that axle construction is heavier throughout (housing wall section increased, carrier ribs and mounting flange heavier) and new perforated bronze thrust washers used on differential pinions (replaces former bakelite type). Housing is vented by new threaded type vent with loose cap installed on housing in place of former brake tube bolt. NOTE—This new bronze thrust washer can be used on previous models as service replacement (has longer life than former bakelite type).



Model 40 Changes—This model has 2¾" wheel bearings and axle shaft with 1 5/16" diameter at bearings (other models have 2⅞" bearings and shaft diameter of 1⅜"). New Optl. gear ratio of 4⅞-1 requires special re-designed differential carrier and new pinion bearing spacer (ring gear larger than on other gear ratios). This special ratio used on Model 40 only.

SERVICING & OVERHAUL:—All specifications and service operations same as for previous models except as noted below. *See 'Hudson (Own Make)' Rear Axle article in Mechanical Equipment Section of manual (or 1938 Supplement) for complete data and note following new specifications:*

Ring Gear Backlash—Should be .0005-.0035".

Axle Shaft Endplay—Should be .002-.004". Adjust by removing shims from under bearing cap at both wheels equally (necessary to keep thrust spacer centered on differential pinion shaft—if adjustment made at one wheel only, spacer will bind on shaft).

LINCOLN V12 TYPE

Used On:

LINCOLN, V12 MODEL (1940)

This Axle same design as used on previous models.

SERVICING & OVERHAUL:—All specifications and service operations same as for previous models. *See 'Lincoln (Own Make)' Rear Axle article in Mechanical Equipment Section of manual (or 1938 Supplement) for complete data.*

LINCOLN-ZEPHYR HYPOID TYPE

Used On:

LINCOLN-ZEPHYR, MODEL 06H (1940)

This Axle same design as used on 1939 model.

SERVICING & OVERHAUL:—All specifications and service operations same as for previous models except as noted below. *See 'Lincoln-Zephyr Type' Hypoid Rear Axle article in Mechanical Equipment Section of manual (or 1938 Supplement) for complete data and note following changes:*

Replacement Exchange Axle Assemblies:—Furnished in assemblies consisting of differential housing (axle housing center section) with pinion gear installed (set up for correct bearing adjustment and ring gear mesh) and mated ring gear. This assembly is Part No. 86H-4020 and can be used on Models 86H ('38), 96H ('39), 06H ('40).

Ring Gear Backlash—Should be .002-.004" and should be set at figure etched on the particular ring gear being used (ring and pinion gears mated and it is very important that these individual clearance figures be used for each set of gears).

Pinion Bearing Adjustment—Correctly set at factory and should not be disturbed in service. Bearing pre-load should be 18-20 in. lbs. (force required to turn pinion shaft with bearings properly adjusted). Use ABV-129 gauge to measure this setting.

Differential Gear & Ring Gear Backlash Adjustment—Controlled by gasket thickness between axle housing halves and differential housing. Normal gasket thickness for correct backlash and differential bearing adjustment is .005-.008" at each side of differential housing. Gasket furnished in three thicknesses as follows: .008-.010" (86H-4035-A), .004-.006" (86H-4035-B), .013-.018" (86H-4035-C). Vary thickness at left hand housing to adjust backlash (keep total thickness for both sides same to avoid disturbing differential bearing adjustment), vary thickness at right hand side to adjust differential bearings (do not change thickness on left hand side to avoid disturbing backlash).

NASH HYPOID TYPE

Used On:

NASH-LAFAYETTE, MODEL 4010 (1940)
NASH AMBASSADOR 6, MODEL 4020 (1940)
NASH AMBASSADOR 8, MODEL 4080 (1940)

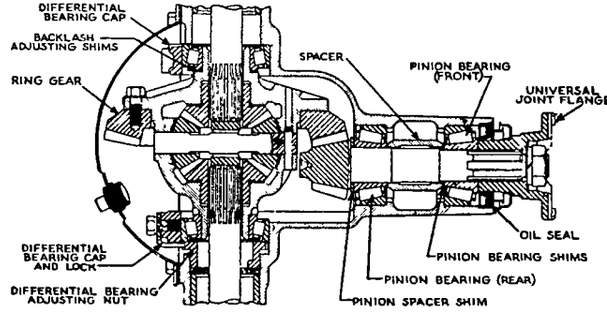
TYPE:—Hypoid gear, semi-floating type with Hotchkiss drive. Same design as "Small Type" spiral bevel gear axles used on previous Nash models except for Hypoid gear feature.

NOTE—Axles on all models similar except for size. May be identified by diameter of tubes (pressed and welded in center casting) which are 2½" (4010, 4020), 3" (4080).

SERVICING:—Gear Adjustment—Paint gears to check mesh. Backlash should be .005-.007". Adjusted by adding or removing shims located between shoulder on differential case and cone of left hand differential side bearing. See Pinion Setting and Differential Bearing Adjustment below.

Axle Shaft Replacement—To remove shaft with wheel and hub removed, take off nuts on bearing retainer (rear brake support plate), remove oil seal, retainer plate, bearing adjusting shims, then pull axle shaft and bearing assembly. When installing shaft, add or remove shims between retainer plate and axle housing flange to secure desired axle shaft endplay of .003-.006".

OVERHAUL:—Disassembly—With axle shafts out, remove rear housing cover, mark adjusting nut on right hand differential side bearing to insure replacing in same position, back adjusting nut off, remove bearing cap bolts and bearing caps, lift differential assembly out. To remove pinion, remove nut on end of pinion shaft, pull universal joint flange, press pinion out of housing toward rear. Remove pinion shaft oil seal, use special pullers to remove bearing cups from housing.



Pinion Bearing Assembly:—Bearing adjustment controlled by shims located on pinion shaft between spacer and forward bearing cone. When installing pinion, install correct washer and shim pack for correct pinion mesh (see Pinion Setting below) on shaft against pinion, install rear bearing cone and bearing spacer. Install sufficient shims on shaft in front of spacer to insure positive endplay of shaft when installed in housing, install front bearing cone, universal joint companion flange or special tool (splined sleeve) and tighten nut on shaft securely. Then check bearing adjustment as directed below. NOTE—Do not install oil seal until after bearing adjustment has been made.

Pinion Bearing Adjustment—Use dial indicator to check pinion shaft endplay with companion flange nut securely tightened (oscillate shaft in both directions while applying end pressure to insure bearings seated). Disassemble pinion shaft and remove shims from between spacer and front bearing cone equal to the observed endplay **plus .003"** to insure the bearings being correctly pre-loaded or set .003" tight.

Pinion Setting:—Pinion mesh controlled by washer or washer and shim pack installed on shaft between pinion and rear bearing cone. Use Pinion Setting Gauge SE-534-A to determine washer thickness for each pinion as follows: Make certain that rear bearing cup properly seated in housing, coat bearing with film of light oil, install bearing and bearing cone, roll bearing back and forth while applying

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pressure to insure bearing being seated. Install rectangular checking block on bearing cone, install gauge and make certain that end discs seated in differential bearing bores in housing (tap lightly with hammer to insure seating). Turn gauge micrometer until end of shaft just contacts ground surface of checking block while pinion bearing is being rotated under pressure. Subtract gauge reading from .408" which will give correct washer thickness for standard pinions (marked by figure =0 following the set number stamped on the end of the teeth). If pinion marked by + or — figure, subtract shims (if pinion marked +), add shims (if pinion marked —) equal in thousandths to the figure following this plus or minus mark. Install washer and shims equal to this final figure on the shaft between the pinion and the rear bearing cone when installing pinion in housing.

Pinion Adjusting Washer Note—Pinion Adjusting Washers furnished in six thicknesses as follows: .117",.118",.119" and .129",.130",.131". These washers can be used with not more than three .003" shims to make all necessary thicknesses from .117" to .140". CAUTION—Install washer with chamfered side toward pinion and shims (if used) between the washer and the bearing cone.

Pinion Setting without Gauge—If new pinion being installed and pinion setting gauge not available, note washer and shim thickness used for old pinion, secure standard washer thickness for this housing by adding (if pinion marked +), subtracting (if pinion marked —) shims equal to figure following this plus or minus mark on the old pinion, finally correct this standard washer thickness in accordance with new pinion marking as directed under Pinion Setting above.

Differential Gear & Bearing Assembly:—To dismantle differential gear assembly, drive out pin in differential pinion shaft, remove shaft, axle shaft thrust block, pinions, side gears and thrust washers. When reassembling, make certain that thrust washers installed in back of each side gear and pinion and that thrust block is installed on pinion shaft (this block transmits thrust from one shaft to the other).

Differential Bearing Adjustment:—With lock on right hand bearing adjusting nut removed, and bearing cap loosened so that adjusting nut can be turned, turn adjusting nut up until all bearing endplay is just removed and notch on nut is in line with lock on cap, then tighten adjusting nut two notches additional for correct bearing pre-load. Tighten bearing cap bolts and install adjusting nut lock.

Ring Gear Backlash Adjustment—Check backlash with dial indicator at several points around ring gear. If backlash not within limits of .005-.007", dismantle axle, remove left hand differential side bearing, add or remove shims on hub behind bearing (add shims to decrease backlash, remove shims to increase backlash), reassemble axle, readjust differential bearings (bearing adjustment affected by change in shim thickness).

OLDSMOBILE HYPOID TYPE

Used On:

'60' SERIES SIX, MODEL F-40 (1940)
'70' SERIES SIX, MODEL G-40 (1940)
'90' SERIES EIGHT, MODEL L-40 (1940)

This Axle same design as used on 1939 models.

SERVICING & OVERHAUL:—All service operations same as for corresponding 1939 models. *See "Oldsmobile Hypoid Type" Rear Axle article in Mechanical Equipment Section of manual (or 1939 Supplement) for complete data and note following changes:*

Axle Markings—Ring and pinion gear ratio stamped on upper outer surface of differential carrier on all axles for identification purposes as follows: 41-10 (F-40 Std. 4.1-1 Axle), 43-10 (G-40, L-40 Std. 4.3-1 Axle), 41-9 (4.55-1 Optl. Mtn. Ratio Axle for all models).

Housing Cover—Rear banjo cover welded in place and not removable. Axle may be drained by taking out lower differential carrier mounting capscrew.

Ring Gear Backlash Setting—When installing differential assembly in carrier, backlash adjustment will be simplified if left hand adjusting nut turned up to eliminate all backlash between ring gear and pinion (right hand nut must be backed off to permit this movement) and then backed off 4 notches so that lock slot in adjusting nut and bearing cap are lined up. Adjust differential bearings by turning right hand nut only and then check backlash which should be within limits of .004-.008". If any readjustment necessary, adjust left hand adjusting nut and turn right hand adjusting nut exactly same number of notches in opposite direction to avoid disturbing bearing adjustment.

OLDSMOBILE REAR SUSPENSION

Used On:

'60' SERIES SIX, MODEL F-40 (1940)
'70' SERIES SIX, MODEL G-40 (1940)
'90' SERIES EIGHT, MODEL L-40 (1940)

This Coil-spring type Rear Suspension same design as used on 1939 Oldsmobile models.

SERVICING:—All service operations same as for corresponding 1939 models. *See "Oldsmobile Rear Suspension" article in Mechanical Equipment Section of manual (or 1939 Supplement) for complete data and note new spring specifications as follows:*

Oldsmobile Rear Springs

Car Model	Color Mark
F-40 Coupes	Blue (2)
F-40 Sedans	Red (2)
G-40 Coupes	Orange
G-40 Sedans	White
L-40 Coupes	Green
L-40 Sedans	Yellow

PACKARD HYPOID TYPE

Used On:

'110' SIX, MODEL 1800 (1940)
'120' EIGHT, MODELS 1801, 1801A (1940)
'160' SUPER 8 MODELS 1803, 4, 5 (1940)
'180' CUSTOM SUPER 8, 1806, 7, 8 (1940)

These Axles same design as used on 1939 models.

TYPE:—Hypoid type. Same design as used on corresponding 1939 car models. Ring Gear Support Roller used on Super Eight '160' and '180' models only.

SERVICING:—Gear Adjustment—Backlash should be .003-.005". Adjusted by backing off one differential side bearing adjusting nut and tightening opposite nut equally. See Differential Bearing Adjustment below. Pinion position not adjustable (for gear mesh adjustment).

Axle Shaft Replacement—To remove axle shaft, remove wheel and hub, disconnect brake lines, remove backing plate and wheel bearing adjusting shims, pull axle and bearing assembly. When installing axle shaft, select shim thickness between housing flange and backing plate on each side so that total axle shaft endplay is .004-.007".

OVERHAUL:—Pinion Bearing Adjustment—Pinion bearing pre-load controlled by compressible spacer on pinion shaft between bearings and adjusted by tightening universal joint companion flange nut. Bearing pre-load must be adjusted whenever this nut is loosened or disturbed. To adjust, tighten nut until spacer is felt to buckle, then check pull required to rotate pinion shaft. If less than 25 inch pounds (5 lbs. pull on end of 5" lever arm), tighten nut further until pre-load is 25-30 inch pounds. Special scale, Packard ST-5087, may be used to check this pre-load. Adjust only with both wheels jacked up or differential carrier out to eliminate drag on pinion shaft.

Pinion Assembly:—Pinion position not adjustable. Pinion mounted on taper roller bearings with bearing cups seated directly against shoulders in carrier bore and compressible spacer on pinion shaft between bearing cones. Bearing pre-load must be adjusted by compressing or "buckling" spacer whenever universal joint companion flange nut is loosened (see above).

Differential Gear Assembly:—Differential side gear endplay should be .002-.005". Adjust by installing thrust washer of correct thickness between side gear and differential case. These washers furnished in various thicknesses as follows: .031" (No. 330797), .036" (324583), .041" (324584), .046" (324585). When assembling differential gears, make certain that thrust block installed between inner ends of axle shafts (this block transmits thrust from one shaft to the other).

Differential Bearing Adjustment:—Bearings should be pre-loaded so that "spread" of bearing support pedestals of .010-.012" is secured. To make this adjustment, free adjusting nut locks. Loosen bearing

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cap nuts slightly to free adjusting nuts, make certain that there is some backlash between ring gear and pinion and clearance between ring gear and support roller (Super 8 only). Then back off right hand bearing adjusting nut until ring gear and differential assembly is loose in its bearings. Use accurate caliper and set caliper so that it will just slide over differential carrier with one leg resting on machined boss (adjusting nut lock pin boss) on each side of carrier **with .010" feeler between boss and caliper on one side.** Remove feeler, tighten right hand adjusting nut until caliper will just slide in place with the feeler removed (pedestals will have 'spread' this .010"). Correct pedestal spread should be .010-.012". Then adjust ring gear backlash and support roller clearance (Super 8 only).

Ring Gear Backlash Adjustment—After adjusting differential bearings (above), check ring gear backlash with dial indicator. If not within limits of .003-.005", adjust by backing off one differential bearing adjusting nut and tightening opposite nut exactly the same number of notches (to avoid changing bearing adjustment). Back off right hand nut to decrease backlash, left hand nut to increase backlash, use extreme care to tighten opposite nut exactly same amount. Then tighten bearing cap nuts and install adjusting nut locks.

Support Roller Adjustment (Super 8 Models):—Clearance between roller and back face of ring gear should be .005". To adjust, loosen lockscrew on roller stud sector plate, turn roller shaft (apply wrench to square end of shaft) until correct clearance secured, tighten sector plate lockscrew securely.

PACKARD REAR SUSPENSION

Used On:

'110' SIX, MODEL 1800 (1940)

'120' EIGHT, MODELS 1801, 1A (1940)

'160' SUPER EIGHT, MODELS 1803, 4, 5 (1940)

'180' CUSTOM SUPER EIGHT, 1806, 7, 8 (1940)

This Rear Suspension same design as used on corresponding 1939 models except as noted below.

TYPE:—Design changed from that used on 1939 car models as follows:

Model 1800 Six. Lateral Stabilizer and 'Fifth' shock absorber not used. New Direct Acting Shock Absorbers (Monroe on domestic cars, Delco for export) are used and mounted diagonally crosswise of the car so that the lateral stabilizer not required.

Model 1801 Eight, 1803, 6 Super Eight. Lateral Stabilizer and 'Fifth' shock absorber are same design as for 1939. Rear Shock Absorbers are direct acting type (Delco on 1801 and 1803, 6 Export; Monroe on 1803, 6 domestic cars) and are mounted diagonally lengthwise of the car. No Roll Bar is used.

Model 1801A Comm'L, 1804, 5, 7, 8 Super Eight. Rear suspension on these models same design as on 1939 cars (Lateral Stabilizer, 'Fifth' Shock Absorber, Double-acting Shock Absorbers, and Roll Bar).

SERVICING:—Service operations same as for 1939 models. ***See Packard Rear Suspension article in Mechanical Equipment Section of manual (or 1939 Supplement) for data and note following changes:***

Shock Absorber Servicing & Refilling—See separate articles on Delco and Monroe Direct Acting Shock Absorbers for refilling, servicing, and valve calibration data on these new type rear shock absorbers.

Rear Springs—Spring inserts (Rubber, Silenite, or Antimony-Lead type) are installed in recesses in ends of rear spring leaves. Arrangement and type of insert for each spring leaf is shown in table below.

NOTE—Inserts are numbered 1-2-3 etc. from outer end (shackle end) of spring toward center.

Rear Spring Inserts

Model	Insert No.	Type	Part No.
1800, 1801	1, 2, 3	Silenite	333746
	4	⅜ Rubber	354799
	5	7½% Ant.-Lead	327954
	6	10% Ant.-Lead	327726
1803, 1806	1, 2, 3	Silenite	333746
	4	⅜ Rubber	354799
	5	5% Ant.-Lead	327753
	6, 7	7½% Ant.-Lead	327954
1804, 1807	1	5/16 Rubber	347427
	2, 3, 4, 5, 6, 7	Silenite	333746
1805, 1808	1	5/16 Rubber	347427
	2, 3, 4, 5, 6	Silenite	333746
	7, 8	5/16 Rubber	347427

PONTIAC HYPOID TYPE

Used On:

SPECIAL SIX 40-25, DELUXE SIX 40-26 (1940)

DELUXE EIGHT 40-28, TORPEDO EIGHT 40-29 (1940)

This Axle same design as used on 1939 models.

TYPE:—Same design as for 1939. Axles now marked for identification by paint mark on end of right hand or left hand end of axle shaft as follows:

Torpedo 40-29 Note—Axles for this model have blue mark on shaft in addition to regular ratio color mark.

Axle Ratio	Color Mark
4.3-1 Std. Ratio	White
4.55-1 Mtn. Ratio	Yellow
4.1-1 Plains Ratio	Green
3.9-1 Econ. Ratio	Red

SERVICING & OVERHAUL:—All service operations same as for corresponding 1939 car models. ***See Pontiac Hypoid (Own Make) Axle article in Mechanical Equipment Section of manual (or 1939 Supplement) for complete data and note following corrections:***

Pinion Setting Shims—Shims furnished in following thicknesses and marked for identification for all 1939-40 models as follows:

Shim Thickness	Part No.	Color
.012"	499528	Plain
.014"	503063	Copper
.015"	499529	Blue
.018"	499530	Plain

Ring Gear Backlash—Backlash should be .003-.012" for new gears (same as 1939). Slight excess over .012" permissible for worn gears.

WILLYS SPIRAL BEVEL TYPE

Used On:

MODEL 440 (1940)—PASS. CAR & PICK-UP

This Axle same design as used on 1939 Willys cars.

NOTE:—Model 440 Panel Truck has Spicer (Salisbury) Model 21-1 Rear Axle. See Spicer Rear Axle article for data on this type axle.

SERVICING & OVERHAUL:—All service operations same as for previous Willys models. ***See "Willys (Own Make)" Rear Axle article in Mechanical Equipment Section of manual for data and note following specifications:***

Ring Gear Backlash—.004-.008" (1939-40).

DELCO SINGLE ACTING HYDRAULIC TYPE

1932-37 Car Models

BUICK, SERIES 50 (1932-33)
BUICK, SERIES 40 (1934-35-36)
CHEVROLET STD., CC ('33), DC ('34), EC ('35), FC ('36)
CHEVROLET MSTR., CA ('33), ED ('35), FD ('36), GB ('37)
CHEVROLET MSTR. (KNEE ACTION), DA ('34), EA ('35), FA ('36), GA ('37)—REAR ONLY
CHRYSLER, SIX CO ('33), EIGHT CT ('33)
CHRYSLER, CQ ('33), CA, CB ('34), C6, CZ ('35), C7, C8 ('36)—REAR ONLY
DE SOTO, SD ('33), SE ('34), SF ('35), S1 ('36)
DODGE, DP ('33), DR, DS ('34), DU ('35), D2 ('36)
GRAHAM, 64, 65 (1933), 67, 68, 69 (1934)
PONTIAC, 601 (1933), 701B (1935), 36-26B (1936)
PONTIAC (KNEE ACTION), 603 ('34), 701A, 605 ('35), 36-26A, 36-28 (1936)—REAR ONLY

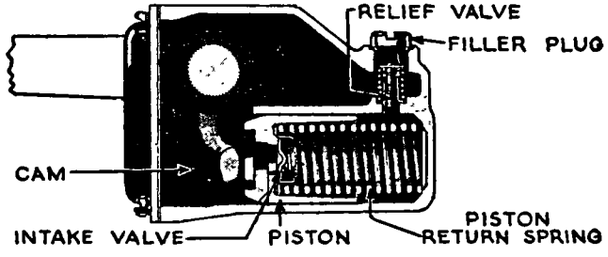
1938 Car Models

Car Model	Front	Rear
Chevrolet Mstr. Deluxe HA	....See Note	....1431-V, W
Chevrolet Mstr. HB (1938)	....1201-A, B	....1201-C, D
Chevrolet Trucks HC, HD	...1201-A, B	....1201-C, D
Chevrolet Truck (1 Ton) HE	...1201-A, B	.... None

1939 Car Models

	Delco Model Nos.	
Car Model	Front	Rear
Chevrolet Mstr. JB		1201-C, D
Chevrolet ½ Ton JC	1430-CA, DA	1430-LA, MA
Chevrolet ¾ Ton JD	1430-CA, DA	1431-X, Y
Chev. ¾ Ton Spec. JE	1430-CA, DA	1431-X, Y
Crosley A	1201-G, H	1201-J,K

NOTE:—Where car models marked 'Rear Only," see separate articles on Delco Double Acting Type, or special Knee Action Type for front shock absorber



DESCRIPTION & OPERATION:—Shock absorber arm is pivoted on a shaft in the shock absorber case with an operating cam locked on this shaft within the case. Cam is always in contact with the piston in the shock absorber cylinder (piston forced out against cam by heavy spring within cylinder). Cylinder is kept filled with fluid which flows freely through intake check valve in piston head from fluid reservoir in case which surrounds cylinder. On rebound, after car springs have been compressed by road shock, shock absorber arm can return to original position only by forcing piston back into cylinder and displacing fluid which has filled the cylinder during the outward stroke. Fluid can flow out of cylinder only through rebound or relief valve located under filler plug on opposite end of case (on some models this valve is incorporated in intake valve assembly in piston). This valve restricts fluid flow and provides shock absorbing action.

NOTE—On Buick 40, rebound valve is two stage or double type providing softer control for light road shocks.

SERVICING:—Disassembly. Use special fixture to clamp shock absorber on bench (clamping cylinder in vise will cause piston to bind). Take out relief valve plug, relief valve. Remove end cover screws, take off cover and gasket. Rotate arm, remove piston, spring and intake valve. Do not remove shock absorber arm or shaft, replace shock absorber if bearing wear excessive or if packing washers worn so oil leaks around shaft (caused by operation with low oil level). Intake valve or intake and relief valve assembly can be removed from open end of piston after piston and spring have been separated.

Assembly. Use new gasket under cover and new lead washer under filler and relief valve plugs. Tighten cover screws securely to prevent leaks.

Filling. Remove filler plug, fill reservoir to level of plug hole with genuine Shock Insulating Fluid, replace plug, work arm up and down vigorously to work oil into cylinder, then remove plug and adjust fluid level so that it is level with lower edge of filler plug hole.

ADJUSTMENT:—Performance can be changed only by changing valves. Standard valve calibrations are shown in table below.

Rebound Valve Type.

Car Model	Front	Rear
Buick 50 ('32-33)	2BE	4BE
Buick 40 ('34-35)	—	3BE
" 40 ('36)	—	2J2
" 46C ('36) only	—	2F2
Chevrolet GA ('37)	—	2BE
" GB ('37)	5G	5G
" GC ('37)	4CG	3CG
Pontiac ('34)	—	4CG
" 6 & 8, ('35-36)	—	3DJ

1938 Rebound Valve Type

Car Model	Front	Rear
Chevrolet Mstr. Deluxe HA		2BE
Chevrolet Master HB	5G	5G
Chevrolet Trucks HC, HD	4CG	3CG
Chevrolet 1 Ton Truck HE	4CG	

1939 Rebound Valve Type

Model	Front	Rear
Chevrolet Mstr. JB		5G
Chevrolet ½ Ton JC	4CG	3CG
Chevrolet ¾ Ton JD, JE	4CG	3CG
Crosley A	2D	1C

IMPORTANT NOTE—Shock absorbers on both sides of car must have same valve calibration (Right & Left Front same, Right & Left Rear same).

DELCO 1939 PARALLEL CYLINDER HYDRAULIC TYPE

Used On:

Car Model	Front	Rear
Buick 39-40, 60 (1939) First		2103A, B
Buick 39-40, 60 (1939) Later		2103E, F
Chevrolet Mstr. Deluxe JA (1939)	2200A,B	2100A, B

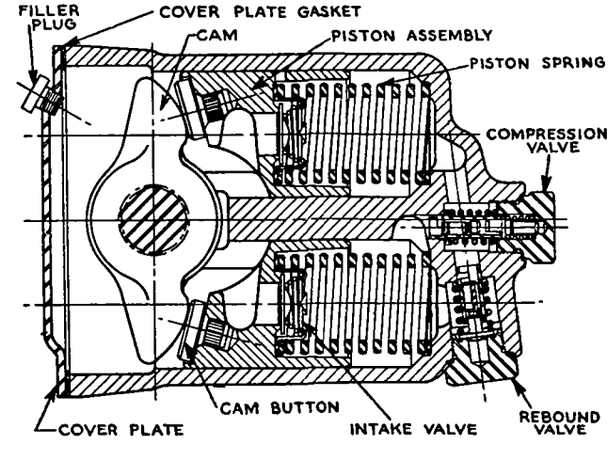
BUICK NOTE:—First type shock absorbers (2103A, B) used on early cars with short frame side rails. Later type 2103-E, F used on longer frame (these models have heavier arms and new valve calibration—see below). NOTE—Front shock absorbers are Delco Double acting, opposed piston type (see preceding article for data).

TYPE:—New design double acting hydraulic type with end-to-end discharge. Independent pistons are used (located in parallel cylinders). Each piston is held out against lever arm cam by a spring installed in the cylinder and has a plain intake valve in the piston head. Fluid displaced by the piston movement flows through a channel in the housing to the opposite cylinder and is controlled by the compression and rebound valves which are installed in tapped holes in the housing (valves are plug type).

REFILLING:—Fluid level in shock absorber should be checked twice yearly and level maintained at bottom of filler plug hole. When adding fluid, move car up and down several times to displace all air in cylinder. When filling to correct poor perfomance complaints, disconnect shock absorber link and move arm through full stroke several times, then recheck fluid level. Use only Delco Shock Absorber fluid.

SERVICING:—No service operations possible other than tightening valve and filler plugs and tightening cover or replacing cover gasket to stop leaks. Pistons, springs, and intake check valve assemblies cannot be removed or serviced.

ADJUSTMENT:—Standard valve calibration for all models shown in table below. Valves can be changed for special operating conditions, if necessary, by removing valve plug and taking out valve assembly. Make certain that valve plugs are securely tightened to prevent leaks. Valve calibration is stamped on valve for identification.



Compression & Rebound Valves

	Front		Rear	
Car Model	Compr.	Reb'd.	Compr.	Reb'd.
Buick 40, 60 (See Note 1)	2E	2	30	L
Buick 40, 60 (See Note 2)	1.5E	4	30	L
Buick 40, 60 (See Note 3)	2E	2	30	L
Chevrolet JA	D-.5	2E	D-.5	5F

Compr.—Compression valve. **Reb'd.**—Rebound valve.

Buick Note 1—Used on cars before Serial No. 3452659 (Flint), 3400716 (South Gate), 3440754 (Linden)

Buick Note 2—Used on cars after above serial numbers with first type short frame.

Buick Note 3—Used on later cars with new type frame with longer side rails.

IMPORTANT NOTE—Shock absorbers on both sides of car must have same valve calibration (Right & Left Front same, Right & Left Rear same).

DELCO DOUBLE ACTING HYDRAULIC TYPE

1932-37 Car Models

AUBURN, 8-101, 5 (1933)
BUICK, SERIES 40 (1934-35-36-37)
BUICK, SERIES 50 (1934-35)
BUICK, SERIES 60 (1932-33-34-35-36-37)
BUICK, SERIES 80 (1932-33), (1936-37)
BUICK, SERIES 90 (1932-33-34-35-36-37)
CADILLAC V8, ALL MODELS (1932-37)
CADILLAC V12, ALL MODELS (1932-37)
CADILLAC V16, ALL MODELS (1932-37)
CHRYSLER AIRFLOW 8, C1('35), C9('36), C-17('37)
CHRYSLER IMPERIAL, CU('34), C2('35), C10('36)
CHRYSLER CUST. IMP., CV('34), C3('35), C11('36)
CORD, MODELS 810 (1936), 812 (1937)
DE SOTO, SF, SG ('35), S1, S2 ('36)
DODGE, DR, DS ('34), DU ('35), D2 ('36)
LA SALLE, ALL MODELS (1932-37)
OLDSMOBILE SIX, ALL MODEL 'F' (1932-37)
OLDSMOBILE EIGHT, ALL MODEL 'L' (1932-37)
PACKARD, ALL MODELS (1933-37)
PIERCE ARROW 8&12, ALL MODELS (1933-35)
PLYMOUTH, PE, PF ('34), PF ('35), P2 ('36) FRONT ONLY
PONTIAC 6&8 (1937) FRONT ONLY

1938 Car Models

Car Model	Front	Rear
Buick, 38-40, 60 (1938)	1947-A, B	
Buick, 38-80, 90 (1938)	1902-C, D	
Cadillac V8, 38-60 (1938)	1946-E, F	1751-G, H
Cadillac V8, 38-65, 75 (1938)	1951-C, D	2052-A, B
Cadillac V-16, 38-90 (1938)	1951-C, D	2052-A, B
La Salle V8, 38-50 (1938)	1946-E, F	1751-G, H
Oldsmobile, F-38, L-38 ('38)	1947-A, B	1713-E, F
Packard Six, 1600 (1938)	1966-A, B	1751-L, M
Packard Spr. 8, 1603,4,5 ('38)	1966-A, B	1751-J, K
Packard 12, 1607, 8 ('38)	1952-A, B	2006-G, H
Pontiac 6, 38-26DA ('38)	1947-A, B	
Pontiac 8, 38-28DA ('38)	1947-A, B	

1939 Car Models

Car Model	Delco Model No. Front	Rear
Buick 39-40, 60 ('39)	1948-A	See Note
Buick 39-80, 90 ('39)	1902-C, D	1751-R, S
Cadillac 39-60S ('39)	1946-E, F	1751-G, H
Cadillac 39-61 ('39)	1946-G, H	1751-V, W
Cadillac 39-75 ('39)	1951-C, D	2010-C, D
Cadillac 39-90 ('39)	1951-C, D	2010-C, D
Chevrolet JC Optl.		1731-T, U
Chevrolet JD, JE Optl.		1732-N, P
Chevrolet V Optl.	1731-C, D	2000-V, W
Graham 96, 97 ('39) Exp.	1737-C, D	1721-J, K
La Salle 39-50 ('39)	1946-G, H	1751-V, W
Nash (All—Exp.) ('39)	1723-L, M	1723-N, P
Oldsmobile 6 60, 70 ('39)	1947-C, D	1751-T, U
Oldsmobile 8 80 ('39)	1947-C, D	1751-T, U
Packard 6 1700 ('39)	1966-C, D	1751-M, Z
Packard 8 1701, 1A, 2 ('39)	1966-C, D	1751-M, Z
Packard Super 8 1703, 5 ('39)	1966-C, D	1751-M, Z
Packard 12 1707, 8 ('39)	1952-A, B	2006-G, H
Pontiac 6 & 8 25, 26, 28 ('39)	1947-C, D	See Note
Pontiac (All—Exp.) ('39)	1947-C, D	1754-A, B

NOTE:—Where other type shock absorbers are used for front or rear of car, see separate articles for data on Delco Single Acting or Direct Acting Types.

Buick 39-40, 39-60 (1939)—Front Shock Absorbers are interchangeable from right to left side of car (single model used). Rear shock absorbers on domestic cars are new Delco Parallel Cylinder type (see separate article for complete data). On export cars, rear shock absorbers are same as on other Buick models (1751-R, S).

Chevrolet Truck Models. Double acting shock absorbers are optional equipment on all truck models. Service data below applies to these types.

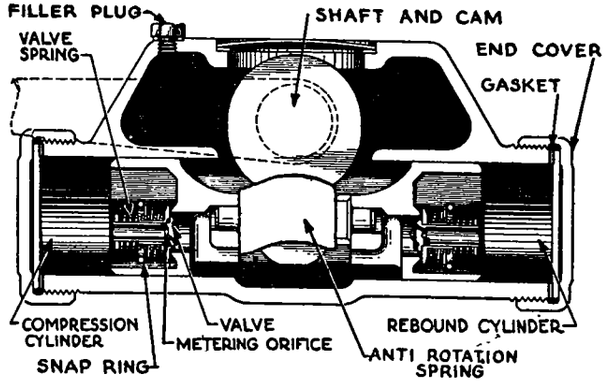
Packard Six, Eight, Super Eight (1939)—These cars have 'Fifth' shock absorber (Houde Model NFT) for Lateral Stabilizer control as well as the above regular shock absorber equipment. See Houde (Houdaille) Shock Absorber article for data on this 'Fifth' shock absorber.

Pontiac (1939)—Three different valve calibrations have been used (changed after 4000 cars and again after 54000 cars). First type valve calibration should be changed to third type (or second type for slightly firmer control at high speeds) as shown in Valve Calibration table below. Rear Shock Absorbers on domestic cars are Delco Direct Acting type (same valve changes made on these models also). See separate article for data on Direct acting types.

TYPE:—Opposed piston types (Units for Independent suspension cars have double lever arm) with valve arrangement and fluid flow as follows:

Types 1721, 23, 31, 32, 37—Center discharge with outside rebound valve (Rebound valve is plug type assembled in tapped hole in housing with simple intake check valve in rebound piston head. Compression valve combined with intake valve and located in compression piston head).

Types 1751, 54; 1946, 51, 52, 66; 2000, 6—End-to-end discharge type with outside compression and rebound valves (both valves are plug type installed in tapped holes in housing). Spring-loaded intake check valve is used in rebound piston head only.



Types 1713, 1947, 48—Center discharge (Compression and rebound valves are combined with intake valves and located in piston head). Type 1948 is inverted with cam and shaft located below centerline of cylinders.

Type 1902—Center discharge type with Inertia Control (compression and rebound valves combined with intake valves and located in piston heads). Inertia control consists of an inertia weight controlled rebound valve which controls fluid flow through by-pass channel and static valve (static valve is outside type installed in tapped hole in housing).

Types 2010, 52—End-to-end discharge with Inertia control and Ride Control adjustment. Compression, Rebound, and Static (Inertia) Valves are plug type installed in tapped holes in housing. Ride control adjustment consists of a separate control valve which is adjusted by means of a slotted adjustment screw on the side of the shock absorber housing (standard setting with mark on valve stem in line with 'M' mark on valve cap nut, turn to 'S' mark for softer action, 'F' mark for firmer action).

DESCRIPTION & OPERATION:—Operates on same principle as single acting type. Piston is double-ended (shock absorber cam engages piston at center) and cylinder is formed with compression chamber at each end. Fluid forced out of one chamber and regulated by 'Compression' valve to control shock when car springs are compressed, and out of opposite chamber and regulated by 'Rebound' valve to control rebound when car springs return to normal position. In each case, when fluid is forced out of one chamber into the reservoir through the relief valve, it flows freely into the opposite chamber (where piston is making a suction stroke) through the intake check valve in the piston head. On most designs, intake valve and relief valve are incorporated in a single assembly mounted in the piston head at each end (see special types below).

'End to End' Discharge Type. On this type, fluid is not expelled into the reservoir from the chamber but flows through a channel in the shock absorber casting to the opposite chamber which is not under compression. Compression and rebound valves are located under plugs on the side of the shock absorber and each control the fluid flow through the channel in one direction. Intake valve in each piston head (or in one piston head only on some models) consists of a simple spring-loaded disc check valve which allows fluid to flow freely into chamber (when fluid in chamber not under compression) to make up for any loss in operation.

Ride Control Types. This type employes the 'end to end' discharge system and has an adjustable by-pass valve or 'Control' valve which supplements the rebound valve. Control valve may be linked to a dash control lever so that the operator can vary the shock absorber action at will (Buick '32-33, Cadillac '32-35, etc.), or may be adjustable at the shock absorber (Cadillac '36-37, etc.). On these types, intake valve is mounted in the compression chamber piston head only.

Inertia Control. Consists of a 'static' (restricting) valve and 'inertia' (cut-off) valve controlling a by-pass around the regular rebound valve through which fluid is allowed to flow from the shock absorber chamber during rebound. Inertia valve remains open as long as frame and body movement is small, so that static valve (which has lighter action than regular rebound valve) controls fluid escape and provides a very soft action. Whenever frame and body movement upward is sudden or severe, inertia weight lags behind (consists of a large lead weight balanced on a spring) closing the inertia valve and cutting off the flow through the static valve. Rebound action is then controlled by the regular rebound valve.

ADJUSTMENT:—When adjusting ride control types, see that all shock absorbers are adjusted evenly (operate dash control lever several times and recheck lever position at each shock absorber). Types without ride control adjustable only by replacing compression and rebound valves. Standard valve calibrations shown in table below.

Cadillac Type—To adjust, turn slotted valve stem (in center of valve cap nut) counter-clockwise toward 'S' mark for softer action, clockwise toward 'F' mark for firmer action. Standard setting is with reference mark on valve stem in line with center 'M' mark on valve cap nut.

1932-37 Compression & Rebound Valves

Car Model.	Front. Compr.	Front. Rebound	Rear. Compr.	Rear. Rebound.
Buick 50, 60, 90 ('34-35)	2F	5L	BO	5L
Buick 40 ('34-35)	2C	2G		
Buick 40 ('36)	1B	1E		
Buick 46C only ('36)	2CX	3F		
Buick 60 ('36)	1B	1G	BO	2G
Buick 80, 90 ('36)	1B	5G	BO	2G
Buick 81C only ('36)	1DX	5G	BO	3J
Buick 40 ('37)	1FX	1E	DOX	2G
Buick 80C ('37)	1FX	5G	CO	2J
Buick 81, 81F ('37)	1DX	5G	BO	2G
Buick 90 ('37)	1FX	5G	BO	2G
(A) Cadillac 60 ('36)	2D	2G	GO	5L
(B) Cadillac 60 ('36)	1CX	1C	GO	5L
(C) Cadillac 70, 75 ('36)	5-A	5-C-	15+	55+
(D) Cadillac 70, 75 ('36)	5-BX	5-DX	15+	55+
(C) Cadillac 80. 85 ('36)	5-A+	5-C+	15+	55+
(D) Cadillac 80, 85 ('36)	5-BX	5-DX	15+	55+
Cadillac 60 ('37)	1DX	1EX	1BX	1L
Cadillac 65, 70 ('37)	1BX	1BX	25X	5X
Cadillac 75, 85 ('37)	1BX	1BX	55X	15X
Cadillac 90 ('37)	5	5	1	5
Cord 812 ('37)	4	6G	C1	2H
(E) LaSalle 35-50 ('35)	1D	2J	1CX	5G
(F) LaSalle 35-50 ('35)	2D	3J	1CX	2L
(G) LaSalle 36-50 ('36)	2D	2G	GO	5L
(H) LaSalle 36-50 ('36)	1CX	1C	GO	5L
LaSalle 37-50 ('37)	1DX	1EX	1BX	1L
(I) Oldsmobile 6&8 ('36)	1D	2J	E1	5L
(J) Oldsmobile 6&8 ('36)	1B	2J	E2	5L
(I) Oldsmobile 6&8 ('37)	1C	2J	E1	1L
(J) Oldsmobile 6&8 ('37)	1B	2J	E2	1L
Pontiac 6&8 ('37)	1C	2J		
Packard 115C ('37)—				
Sedans	2B	2D	E2	1F
Sedans Spec.	2C	2F	E1	2L
Coupe	3C	2D	E2	1F
Sta. Wgn.	2B	2D	E2	1F
Export	3C	3C	3C	3C
Packard 120C ('37)—				
Sedans	3C	3C	E2	1F
Sedans Spec.	2B	2D	E1	1F
Coupe	3C	3D	E2	2J
Export	3C	3C	E2	1F
120CA Comm'l.	2E	2J2	G2	2N
138CD Comm'l.	3C	3C	DO	1F
Packard Super 8 ('37)—				
1500 All—Std.	2C	3F	E2	1F
1500 All—Serv.	1C	2C	E1	1F
1501 Coupe	2B	2B	E2	1F
1501 Coupe 5 Pass.	2C	2B	E2	1F
1501 Sedans	2C	2F	GO	5F
1501 Sedans Spec.	1C	3F	E1	5D
1501 Sedans H.D.	1C	2C	EO	OD
1502 All—Std.	2C	3F	E2	1F
1502 All—Serv.	1C	3F	E2	5D
1502 All—H.D.	1C	2C	EO	OD
1501, 2, 3 Exp.	2D	2F	GO	1F
Packard Twelve ('37)—				
1506 Sedan	C3W	3C	E1	1N
1506 Sedan Exp.	E3	3C	C3W	2N
1507 Sedan	A3W	4C	C2	1H
1507 Sedan Exp.	A3	4C	C3W	2N
1507 Victoria	A3W	4C	E3	1N
1507 Coupe & Cabr.	A3W	4C	E3	1N
1507 Coupe Exp.	E3	3C	E1	1N
1507 5 Pass. Coupe	C3W	3C	E1	1N
1507 " Exp.	E3	3C	E3	3C
1508 Sedan Std.	C3W	3C	E1	1N
1508 Sedan Firm	A2W	3C	E1	5N
1508 Export	A3	4C	C3	3N

(A)—First 4008 cars. (B)—After 4008 cars.
(C)—First 300 cars. (D)—After 300 cars.
(E)—First 665 cars. (F)—After 665 cars.
(G)—First 5025 cars. (H)—After 5025 cars.
(I)—Except Convertibles. (J)—Convertibles.

NOTE—On some models, special valve design used which consists of two thin spring steel washers inserted between tapered valve and valve seat. Old type valves (without these washers) must not be used in place of this new type (valves will leak and performance will be unsatisfactory).

SERVICING:—Disassembly. Use special fixture to clamp shock absorber on bench (do not clamp cylinder in vise.) Use special wrench to remove end cap at each end of cylinder. Remove retainer ring or snap ring which locks valve assembly in piston head, remove valve assemblies. On types with compression, rebound, or control valves mounted under plugs on side of case, unscrew plugs, remove valve assemblies. When installing valve assemblies, use special tool to compress spring while snap ring installed.

Assembly. Use new gasket under end caps and make certain that end caps are securely tightened

Filling:—Remove filler plug on side or top of shock absorber body (on Inertia Control types, also remove vent plug on top of Inertia weight housing), use genuine shock absorber fluid and fill to level of filler plug hole, replace plug, move car up and down several times, remove plug and add additional fluid (if required) to bring level up to plug hole. NOTE—When filling shock absorber after servicing or when performance is unsatisfactory, move shock absorber arm up and down to expel all air from cylinder.

1938 Compression & Rebound Valves.

Car Model	Front Compr.	Front Reb'd	Rear Compr.	Rear Reb'd
Buick 38-40	1C	1C		
Buick 38-60	1HX	1C		
Buick 38-80	1HX	5G		
Buick 38-90	1D	5G		
Cadillac 38-60	ODX	1EX	OCX	1L
Cadillac 38-65, 75, 90	OBX	1BX	25X	O5X
La Salle 38-50	ODX	1EX	BX	1LO
Oldsmobile 6 & 8	1C	2J	E1	1L
" (Conv. Coupe only)	1B	2J	E2	1L
Pontiac 6 & 8	1C	2J		
Packard Six 1600 ('38)—7 Leaf Springs				
All Models	3Aa1	4Cd7	2Aa2	17Ed
Packard Six 1600 ('38)—8 Leaf Springs				
All Std.	3Ad1	4D7	5Ad1	12Ed
All Spec.	6Bd1	3E7	5Bd6	10G
Exp. Sedan	2B1	3F7	5B1	10H
Exp. Coupe	6Bd1	4E7	5Ad1	10G
Packard 8, 1601, 1A, 2 ('38)—				
Canadian Cars only	6Ad1	4Cd7	5Ad6	10F
Packard Super 8 ('38)—				
1603 Sedans	6D1	2C5	EO2	5J
1604 Victoria	4D1	3C3	EO2	5J
1604 Exc. Vict.	3D1	2E1	EO2	5J
1605 All	3D1	3E5	EO2	5P4
Packard Twelve ('38)—				
1607 Sedan Std.	C1W	3E	E1W	1J
1607 Sedan Firm.	A3	4C	C3	1J
1607 Coupe Std.	C4	C3	E1W	1J
1607 Coupe Firm.	E3	3C	E1	1N
1608 All Std.	C1W	3E	E1W	1J
1608 All Firm	A3	4C	C3	3N

1939 Compression & Rebound Valves

Car Model	Compr. Valve Front	Compr. Valve Rear	Reb'd. Valve Front	Reb'd. Valve Rear
Buick 39-40, 60	1.25FX		1.25FX	
Buick 39-40, 60 Exp.	1.25FX	2Bd2	1.25FX	.5F
Buick 39-80	1HX	1.5C2	5G	25H
Buick 39-90	1D	1.5C2	5G	25J
Cadillac 39-60S	ODX	OCX	1EX	1L
Cadillac 39-61	ODX	1A1	1EX	1LX
Cadillac 39-75, 90	OBX	15X	1.25BX	25-5X
Chevrolet JC		G2		2G
Chevrolet JD, JE		GO		1J
Chevrolet 'V' Trks	G2	G2	2J	2E
Graham 96, 97 Exp.	2BX	G1	22CH	15DJ
La Salle 39-50	ODX	1A1	1EX	1LX
Nash (All—Exp.)	DOX	G1	25EL	25DJ
Oldsmobile 60	1C	.40C2	2E	.90F
Oldsmobile 70, 80	1C	.40C2	2G	1J
Packard 6 1700	2Ad1	5Ad1	3Cd5	.10Fd
Packard 6 Exp. (A)	2Bd1	.5C1	3F7	.10J
Packard 6 Exp. (B)	6Bd1	5Ad1	4E7	.10G
Packard 8 1701	2A1	.60Ad5	3Dd5	.12G
Packard 8 1701 Exp.	4C2	.60Cd5	2E7	.10L
Packard 8 1702	3B5	.60A5	4Dd5	.10J
Packard 8 1702 Exp.	3C5	.80Cd5	3E3	.15K
Packard S. 8 1703.	3B1	.60B5	3Dd6	.10G
Packard 1703 (FW)	3B1	.60B5	3Dd6	.10H
Packard 1703 C.C.	3B1	.60B5	3Dd6	.10F
Packard 1703 Exp.	6Bd5	.60C5	2F6	.10L
Packard 1705 (First).	3Ad5	.60B5	3E5	.10L
Packard 1705 (Later)	3Ad5	.90B5	3E5	.40R5
Packard 1705 Exp.	3C3	.5C5	1G4	.05L
Packard 1707, 8 (F).	C4	E1W	E3	1J
Packard 1707, 8 (G)	C1W	E1W	E3	1J
Pontiac 39-25 (C)	3E		2H	
Pontiac 39-25 (D)	1CX		2D	
Pontiac 39-25 (E)	4C		3H	
Pontiac 39-25 Exp.	4C	OCdX	3H	1L
Pontiac 39-26, 28 (C)	3G		2L	
Pontiac 39-26, 28 (D)	1DX		2D	
Pontiac 39-26, 28 (E)	4C		3H	
Pontiac 39-26, 28 Exp	4C	1DX	3H	1L

(FW)—Cars with Fender Wells.
(A)—2 Door & 4 Door Sedans and Chassis.
(B)—Coupe models.
(C)—Used on first 4000 cars. Should be changed to third type (E) valves. Rear shock absorbers (direct acting type) should be changed also.
(D)—Used after 4000 cars up to 54000 cars. Provides slightly firmer control at high speeds.
(E)—Used after first 54000 cars.
(F)—Coupe models.
(G)—Sedan models.
C.C.—Convertible Coupe only.

Ride Control & Inertia Control Valves

Car Model	Control Valve	Inertia (Static) Valve
Buick 50, 60, 90 ('34-35)		5B
Buick 80, 90 ('36)		3B
Buick 80, 90 ('37)		4B
Buick 38-80, 90 (fr. only)		4B
Cadillac 70, 75, 80, 85 ('36)		OJ
Cadillac 65, 70 ('37)	GX	OL
Cadillac 75, 85 ('37)	GX	OL
Cadillac 90 ('37)	B-D(front)	C-D(rear).
Cadillac 38-65, 75, 90 (r. only)	GX	OL

NOTE—'Control' valves used on Ride Control or Adjustable types, 'Inertia Control' valves on Inertia Control type shock absorbers (see above).

DELCO 1937-38 TYPE DIRECT ACTING HYDRAULIC

Used On:	Model Number Front	Rear
Chrysler (Can.), C18,19,20 ('38)	1162-D	1163-U
De Soto, Model S3 (1937)	1162-G	1163-U
DeSoto, Model S5 (1938)	1162-D	1163-U
Dodge, Model D5 (1937)	Made by Chrysler	
Dodge, Model D8 (1938)	1162-U	1163-U
Dodge D8 (20" wheels) '38	1162-X	1163-X
Graham, Crus. Model 85 (1937)	1165-L	1166-K
Graham, Cav. Model 95 (1937)	1166-K	1166-K
Graham, Schgr. 116, 120 (1937)	1166-K	1166-K
Graham, Std. & Spec. 96 ('38)	B1161-K	B1163-P
Graham, Schgr. 97 (1938)	B1161-K	B1163-P
Hudson, All Models (1937)	1175-S	1174-T
Hudson Six, 83 (1938)	1164-S	1163-T
Hudson Eight, 84,5,7 ('38)	1164-S	1163-T
Plymouth, P3, P4 (1937)	1162-U	1163-U
Plymouth P3,4 (20" wheels) '37	1162-X	1163-X
Plymouth, P3,4 Exp.(1) '37	1162-U	1163-U
Plymouth, P3,4 Exp.(2) '37	1162-X	1163-X
Plymouth, P5,6 (1938)	1162-U	1163-U
Plymouth, P5,6 (20" wh.) '38	1162-X	1163-X
Pontiac, All Models (1937)	xx	1174-U
Pontiac Six, 38-26DA ('38)		P1163-U
Pontiac Eight, 38-28DA ('38)		P1163-U
Studebaker, Dict. 5A (1937)	1173-L	1172-U
Studebaker, Dict. 6A (1937)	1171-S	1172-U
Studebaker, Pres. 3C (1937)	1171-S	1172-X

(1) Soft Ride. (2) Firm Ride & 20" wheel Equipment.

NOTE:—Chrysler Models. Monroe Direct Acting Shock Absorbers used on domestic models, Delco Direct Acting (Adjustable) type on export cars. See other Shock Absorber articles for data on these types.

Dodge Models. Delco Direct Acting (Adjustable) type used on Seven-Passenger models. See article (following) for data on this type.

Pontiac Models. Front Shock Absorbers are Delco Double-acting type (part of Independent Suspension assembly). See Delco Double Acting Shock Absorber article for data on this type.

CAUTION:—When clamping shock absorber in vise for refilling, engage flat of 'eye' in vise jaws. When disassembling 'bayonet' type (stud and nut at lower end), use special fixture clamped in vise to hold shock absorber. Do not clamp shock absorber tube or bayonet end in vise under any circumstances.

Refilling—New fluid must not be added unless all old fluid has been removed. Use only correct amount (excess will damage oil seal).

DESCRIPTION & OPERATION:—Direct acting type. Consists of a piston rod and piston attached to the car frame working within a compression cylinder attached to the axle. Reservoir cylinder surrounds compression cylinder and oil seal at upper end contacts piston rod. Outer dust shield cylinder is attached to upper piston rod end of shock absorber. Rebound valve (two types used—see illustration) is located within the piston and controls fluid flow through piston holes from one end of cylinder to the other on compression and rebound. Excess fluid (on compression) is forced out into reservoir chamber through compression valve (in center of compression and intake valve assembly) at bottom of compression cylinder. On rebound, this fluid flows back into the cylinder through the intake valve part of the assembly.

REFILLING:—10,000 Mile Intervals. Remove shock absorber from car, clean thoroughly particularly around filler plug at lower end, pull shock out to extended position, remove filler plug, pump all old fluid out by repeated strokes with filler opening down. Clamp eye at filler plug end in vise at 45° angle with filler hole up (on bayonet type, clamp eye at top in vise), collapse shock absorber to shortest length, screw special filling cup (#494) in filler hole, close shut-off valve, pour correct amount of fluid (see table below) in cup, open shut-off valve, pull shock absorber out to fully extended position, work piston back and forth using short quick strokes until all fluid is drawn into cylinder, replace filler plug and tighten securely.

Capacity Note—Capacity designated by suffix or last letter of model number (see car listing above) as shown in following table for each 'model letter'.

Fluid Capacity

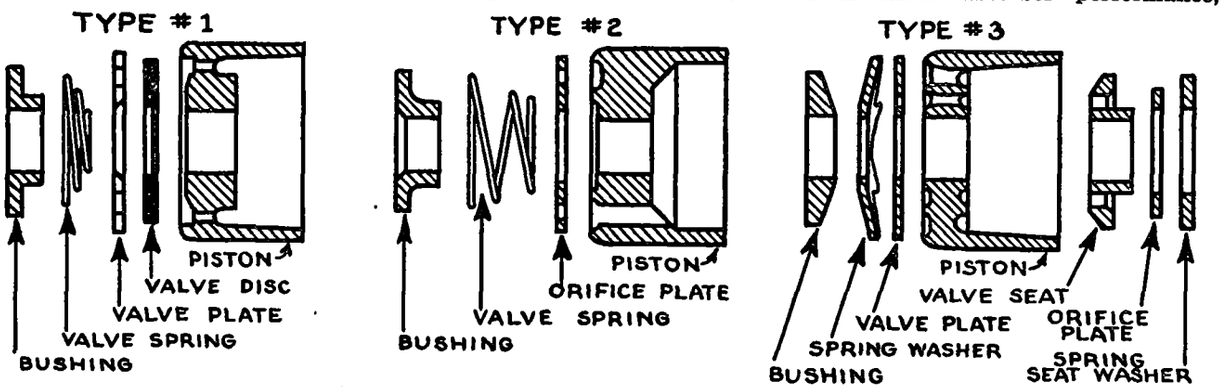
Model Letter	Ounces	CCs.	Model Letter	Ounces	CCs.
A	3½	104	N	5⅝	156
B	3⅝	109	P	5¾	171
C	3⅞	114	Q	6	177
D	4	119	R	6⅛	182
E	4¼	124	S	6¼	187
F	4⅜	129	T	6½	192
G	4½	135	U	6⅝	197
H	4¾	140	V	6⅞	203
J	4⅞	145	W	7	208
K	5⅛	150	X	7¼	213
L	5¼	156	Y	7⅜	218
M	5½	161	Z	7½	223

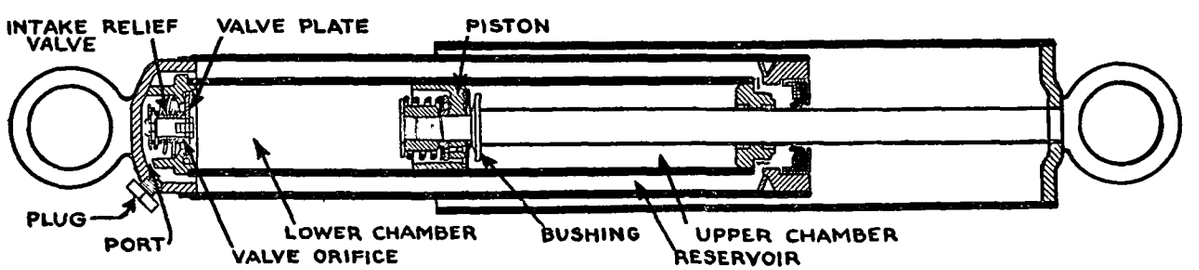
SERVICING:—Disassembling—Thoroughly clean shock absorber, pull out to fully extended position, clamp vertically in vise engaging flat of filler end eye in vise jaws (End Eye Type), or engage filler plug in slot of fixture (#493) clamped in vise (Bayonet End Type), insert special wrench (#491) through slot in dust shield so that lugs engage slots in top guide (see that wrench does not damage piston rod), unscrew this guide, lift top of unit off, remove wrench. Compression and intake valve assembly cage is light press fit in cylinder and may be removed by light tapping. Wash all parts in gasoline and dry with air. If valve assemblies are to be taken apart or oil seal renewed follow directions below.

Oil Seal Assembly & Top Guide Renewal—Clamp top eye of shock absorber in vise, disassemble and remove rebound valve assembly and piston (see below), pull compression cylinder and top guide assembly off piston rod. If guide is to be renewed, remove from cylinder tube by tapping lightly (press fit). Use special puller (#489) to remove old seal assembly. Insert new piston rod seal gasket using flat end of 1 1/16" round stock to seat gasket evenly on shoulder in guide. Use this same 1 1/16" stock to press in new seal assembly until it rests firmly on gasket (use arbor press—pressure must not be great enough to distort top of seal). Use special thimble (#496) on end of piston rod when inserting rod through seal to avoid damage.

Compression & Intake Valve Assembly—Support assembly on bench, spring end up, engage special tool (#492) under stem head and over square washer so that recessed portion of tool engages open side of washer, press down on tool and press washer from under stem head. Assembly can then be taken apart. Reassemble in same position. Cylindrical valve (on stem) or spring (heavy spring which engages collar on valve) may be changed to alter shock absorber performance.

Piston Rebound Valve—Various types of Rebound Valve assemblies have been used (see illustrations). To disassemble all types, clamp top eye in vise, use special socket wrench to remove piston nut. Mark piston in line with punch mark on rod (replace in same position), remove valve assembly parts and piston. To alter shock absorber performance,





DELCO DIRECT ACTING CONT.

change Valve plate (Type 1), orifice plate (Type 2), valve spring or orifice plate (Type 3). Reassemble valve parts in original positions. Tighten piston nut securely and stake to prevent loosening.

Car Model	Valve Assembly Illustration
De Soto, Dodge, Plymouth	Type 3
Graham	Type 1
Hudson, Pontiac	Type 3
Studebaker	Type 2

Reassembling—See that all valve assemblies made correctly (see illustrations). Assemble piston in exact original position on piston rod. If new piston installed, before tightening piston nut, pull pressure cylinder to fully extended position, rotate 90°, force downward to locate piston properly on rod. Tighten piston nut securely and stake. Operate through entire travel to make certain that piston does not bind. Use new rubber gasket in reservoir tube under top guide (dip gasket in shock absorber fluid and stretch to fit), replace steel gasket retainer if necessary. Reassemble shock absorber by reversing disassembling directions making certain that top guide is securely tightened to prevent leakage past gasket.

TROUBLE SHOOTING:—Shock Absorber Noisy. See that shock absorber brackets on frame are tight and that shock absorber does not strike or rub on frame or chassis parts. Check rubber mounting bushings, replace if worn. Check shock absorber, see that dust shield does not strike reservoir tube, operate shock absorber by hand slowly and see that piston does not bind in compression tube. Check fluid. Disassemble shock absorber and check valves.

Oil Leaks—If fluid leaks at filler plug, tighten plug. If fluid leaks at top, see that top guide is screwed down tightly. Replace guide seal assembly or top guide gasket (see Servicing data).

Performance Unsatisfactory—Valve calibration may be changed to compensate for unusual operating condition (see standard calibration below).

CONTROL VALVE CALIBRATION:—Standard calibration for all models as given below.

Car Model	Compr. Valve Front	Compr. Valve Rear	Rebound Valve Front	Rebound Valve Rear
Chrysler C18	HO	C1	OD6	OF6
Chrysler C19	JO	C1	OF8	OF6C
Chrysler C20	JO	C1	OF8	OF6
DeSoto S3	EO	B1	OC6	1F6
DeSoto S5	HO	C1	OD6	OF6
Dodge D8	E1	C1	OO6	OF6
Dodge D8 (20" Wh.)	E1	B1	OE6	OJ8
Graham 85	B2	C4	5-0	5-4
Graham 95, 116, 120	B2	A4	7-0	9-0
Graham 96, 97	B2	A2	1T1010	2R1D10
Hudson 73,4,5,6,7	C3	A4	3L	3N
Hudson 83, 4, 5, 7	E3	B3	2D6	2E6
Nash 3810, 3820	B1	B1	3NV6	3HR6
Nash 3880	A2	B2	2AD4	OBD6
Plymouth P3,4	E1	B1	004	1F6
Plym. P3,4 (20" wh.)	E1	B1	004	1F6
Plym. P3,4 Exp. (1)	E1	B1	004	1F6
Plym. P3,4 Exp. (2)	E1	4B	OE6	OJ6
Plymouth P5, P6	E1	C1	OO6	OF6
Plym'th P5,6 (20"W)	E1	B1	OE6	OJ8
Pontiac 6 37-26CA		A2		1N
Pontiac 8 37-28CA		A2		1N
Pontiac 6 38-26DA		B2		4R8
Pontiac 8 38-28DA		A2		1J6
Studebaker 5A	B1	C2	2-76	2-70
Studebaker 6A	B2	C2	2-110	2-67
Studebaker 3C	B2	B1	3-98	2-67

(1) Soft Ride. (2) Firm Ride & 20" wheel Equipment.

DELCO 1939 TYPE DIRECT ACTING HYDRAULIC

Car Model	Delco Model No. Front	Delco Model No. Rear
Chevrolet Mstr. JB ('39)	1116M	
Chrysler C22, 23 ('39)	1110C	1111T
De Soto Model S6 (1939)	1110C	1111T
Dodge Model D11 (1939)	1110C	1111T
Dodge D11 ('39)—20" Wheels	1110C	1111W
Graham 96, 97 (1939)	1112J	1120N
Hudson 6 & 8 93, 5, 7 ('39)	1113R	1120S
Nash-Lafayette Std. 3910 ('39)	1112N	1117DD
Nash-Lafayette (See Note)	1112Q	1117EE
Nash-Lafayette Del. 3910 ('39)	1112Q	1117DD
Nash-Lafayette (See Note)	1112S	1117EE
Nash Ambass. 6 3920 ('39)	1112P	1117DD
Nash Ambass. (See Note)	1112R	1117EE
Nash Ambass. 8 3980 ('39)	1112M	1117DD
Nash Ambass. (See Note)	1112P	1117EE
Plymouth P7, P8 (1939)	1110C	1111T
Plymouth P7, 8 ('39) 20" Whls.	1110C	1111W
Pontiac 6 39-25, 26 (1939)		1116V
Pontiac 8 39-28 (1939)		1116V

NASH NOTE—Export Models with Heavy Spring.

NOTE:—Chevrolet Models—Delco Single Acting Hydraulic type shock absorbers used on rear end.

Chrysler, De Soto, Dodge, Plymouth Models—Three separate valve calibrations for 'Soft', 'Firm', and 'Super' Control used on these models. Monroe Direct Acting shock absorbers used on some Chrysler cars and Delco Adjustable Direct Acting Shock Absorbers (1" and 1⅜" Cylinder Types) used on Export Cars.

Nash-Lafayette & Nash Models—Gabriel Direct Acting Shock Absorbers used on some cars.

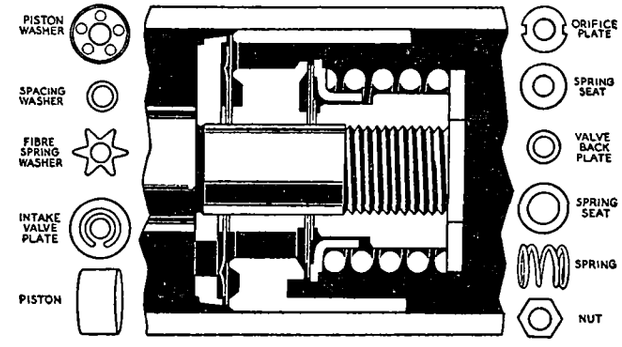
Pontiac Models—Three different valve calibrations have been used (changed after 4000 cars and again after 54000 cars). First type valve calibration should be changed to third type (or second type for slightly firmer control). See Valve Calibration data below.

TYPE:—Double acting piston type similar to previous types except for new piston guide oil seal (double type), new valve assemblies, and new lower housing without filler plug. NOTE—Filler plugs provided on some models but should not be used when refilling units—see refilling directions below).

SERVICING:—Disassembly—To service shock absorbers, remove unit from car, clamp in vise in upright position (engage lower mounting eye in vise jaws, use special clamping fixture for bayonet end types—do not clamp shock absorber tube in vise jaws), pull out to fully extended position, insert prongs of special wrench through holes in outer dust shield tube on side opposite model number stamping so as to engage slots in top of piston rod guide, unscrew guide from upper end of reservoir tube, lift entire top assembly (dust shield, piston rod, pressure tube and compression valve assembly) out of lower reservoir tube. Press in on compression valve plunger (at lower end of pressure tube) and pour out old fluid in cylinder. Remove compression valve from end of cylinder by tapping with blunt chisel against groove in edge of valve body (valve assembly is light press fit in cylinder), do not dismantle valve (serviced as an assembly). Mount top assembly in vise (grip upper mounting eye in vise jaws), press cylinder down on piston press so that piston rod nut accessible, remove nut, lift off piston and valve parts, remove pressure tube and piston rod guide as an assembly. Tap guide and seal assembly out of pressure tube (guide is press fit in upper end of tube). Do not remove oil seal from guide (serviced as an assembly).

Servicing—Wash all parts in naptha or gasoline and dry with compressed air (do not use cleaning compounds which may damage oil seal).

Reassembly—Install guide in top end of pressure tube (press on outer rim of guide only—not on oil seal), use special thimble (Chrysler MT-104, Pontiac J-475-3) on piston rod end (to prevent damage to oil seal) and install pressure tube and guide assembly on piston rod. Install valve parts and piston in correct order (see illustration), then install piston nut. With nut tight, check piston alignment by working piston up and down in cylinder. If piston binds, loosen nut, work piston up and down several times, tighten nut and recheck alignment. When piston works freely in cylinder, tighten piston nut with 20 lb. pull on 5" wrench (100 in. lbs.), stake nut to prevent loosening in service. Pull cylinder up on piston rod, measure exact correct amount of new fluid in measuring cup (see Capacity Chart above), pour fluid into cylinder above piston until cylinder is full. Install compression valve in end of cylinder and tap in place with a soft mallet. Pour remainder of fluid into reservoir tube. Install new gasket in upper end of tube, install top assembly and tighten guide securely with special wrench. NOTE—Install rear shock absorbers on car with stone shield (welded to reservoir tube) to front.



REFILLING:—All shock absorbers should be removed from car and disassembled, old fluid poured out, and refilled with exact correct amount of new fluid when reassembled. See chart below for correct fluid capacity for each type and servicing section (following for disassembly directions.

NOTE—Shock Absorbers with filler plugs at lower end should be refilled in same manner as types without plugs by disassembling units. Do not disturb filler plugs (used for initial filling at factory). Capacity for each unit determined by suffix letter of model number (1110-C) as follows:

Fluid Capacity Chart

Model Letter	Capacity Ozs.	Capacity CCs.	Model Letter	Capacity Ozs.	Capacity CCs.
A	3½	104	N	5⅝	166
B	3⅝	109	P	5¾	171
C	3⅞	114	Q	6	177
D	4	119	R	6⅛	182
E	4¼	124	S	6¼	187
F	4⅜	129	T	6½	192
G	4½	135	U	6⅝	197
H	4¾	140	V	6⅞	203
J	4⅞	145	W	7	208
K	5⅛	150	X	7¼	213
L	5¼	156	Y	7⅜	218
M	5½	161	Z	7½	223

DELCO 1939 DIRECT ACTING TYPE CONT.

CONTROL VALVE CALIBRATION:—Standard compression and Rebound Valve calibrations for each model are listed in table below (See Notes for Production Changes and recommended valve calibrations for special operating conditions).

Compression & Rebound Valves

Car Model	Comp. Valve Front	Comp. Valve Rear	Reb'd Valve Front	Reb'd Valve Rear
Chevrolet Mstr. JB	A1	....	4E6	.....
Chrysler (All)—See (A)	FO	A1	1B6	2C6
Chrysler (All)—See (B)	GO	B1	OG6	1H6
Chrysler (All)—See (C)	HO	CO	ON8	ON6
De Soto S6—See (A)	GO	A1	1B6	2C6
De Soto S6—See (B)	GO	B1	OG6	1H6
De Soto S6—See (C)	HO	CO	ON8	ON6
Dodge D11—See (A)	GO	A1	1B6	2C6
Dodge D11—See (B)	GO	B1	OG6	1H6
Dodge D11—See (C)	HO	B1	ON8	ON6
Dodge D11—20" Wheels	GO	B1	OG6	1H6
Graham 96, 97	C1	A2	3E6	4E10
Hudson Six 93	E3	B3	4C6	4D6
Hudson Eight 95, 7	E3	B3	4C6	4D6
Hudson 6 & 8 Export	E3	B3	2E6	3E8
Nash-Lafayette	A2	A1	2A4	4A8
Nash-Lafayette—See (D)	B1	A3	3N6	3G6
Nash 6 & 8	A2	A1	2A4	4A8
Nash 6 & 8—See (D)	B1	A3	3N6	3G6
Plymouth P7, 8—See (A)	GO	A1	1B6	2C6
Plymouth P7, 8—See (B)	GO	B1	OG6	1H6
Plymouth P7, 8—See (C)	HO	CO	ON8	ON6
Plymouth P7, 8—7 Pass.	GO	A1	OE6	2C6
Plymouth P7, 8 20" Wheels	GO	B1	OG6	1H6
Pontiac 39-25—See (E)	.....	A2	.....	OC4
Pontiac 39-26, 28—See (E)	.....	A2	.....	2E8
Pontiac (All)—See (F)	.....	A2	.....	5D4
Pontiac (All)—See (G)	.....	B4	.....	6G6

(A)—Soft Control. **(B)**—Firm Control.
(C)—Super Control.
(D)—Export Cars with heavy spring.
(E)—Used on first 4000 cars. Should be changed to third type (G) valves or, for slightly firmer control, to second type (F) valves.
(F)—Used after 4000 cars up to 54000 cars. Provides slightly firmer control at high speeds than third type (G) valve calibration.
(G)—Used after 54000 cars. This valve calibration should be installed on first 4000 cars with first type (E) valve calibration.

IMPORTANT NOTE—Shock absorbers on both sides of car must have same valve calibration (Right & Left Front same, Right & Left Rear same).

TROUBLE SHOOTING:—Shock Absorber Noisy. See that mounting brackets are tight. Replace rubber grommets in shock absorber mounting eyes if worn. Check shock absorber alignment. See that unit not striking or rubbing on frame or body or other parts of car. Disconnect one end of shock absorber and operate by hand to make certain that piston not binding in cylinder. Dismantle unit, check fluid level, see that valves correctly assembled and that piston rod nut tight on piston.

Oil Leaks—Tighten piston rod guide securely. If leakage continues at piston rod or around edge of guide, dismantle unit, replace guide and seal assembly, make certain that new gasket installed at top of reservoir tube when guide reassembled.

Performance Unsatisfactory—Operate shock absorber by hand to see that piston not binding in cylinder and all parts operate freely. Dismantle unit and check fluid level and valve assembly. Change valves for unusual operating conditions (see Valve Calibration data above.

DELCO 1936 TYPE DIRECT ACTING HYDRAULIC

Used On:

AUBURN EIGHT, 852 (1936-37)
GRAHAM CRUSADER, MODELS 80, 80A (1936)
GRAHAM CAVALIER, MODELS 90, 90A (1936)
GRAHAM SUPERCHARGER, MODEL 110 (1936)
HUDSON SIX, MODEL 63 (1936)
HUDSON EIGHT, MODELS 64, 65, 66, 67 (1936)

DESCRIPTION & OPERATION:—Direct acting, hydraulic type. Same design as Spicer 1935 type and operates in same manner (see article on Spicer Direct Acting Shock Absorbers).

REFILLING:—See Spicer article for complete directions. Capacity for all Hudson units is 4¾ fluid ounces (front), 5¼ fluid ounces (rear).

SERVICING:—Serviced in same manner as Spicer (second type). See Spicer article for complete data.

DELCO 1937 ADJUSTABLE DIRECT ACTING TYPE

Used On:

Car Model	Model Number Front	Model Number Rear
Studebaker Dict., 5A (Late '37)	1180-L	1182-U
Studebaker Dict., 6A (Late '37)	1181-S	1182-U
Studebaker Pres., 3C (Late '37)	1181-S	1182-X

DESCRIPTION & OPERATION:—Similar to type used on early 1937 cars except for adjustable feature. This consists of a mask or shield over the rebound valve orifice which can be turned to open or close the orifice ports providing a softer or firmer action. Shock absorber need not be dismantled for adjustment.

REFILLING:—Refilled in same manner as other types (see preceding article) using filler cup #494 and shut-off valve #490. Note rebound orifice setting (see adjustment instructions below) and take care not to disturb this setting when manipulating shock absorber. Capacity can be determined by suffix letter of model number as shown in table below.

Fluid Capacity Chart

Model Letter	Capacity Ozs.	Capacity CCs.	Model Letter	Capacity Ozs.	Capacity CCs.
A	3½	104	N	5⅝	166
B	3⅝	109	P	5¾	171
C	3⅞	114	Q	6	177
D	4	119	R	6⅛	182
E	4¼	124	S	6¼	187
F	4⅜	129	T	6½	192
G	4½	135	U	6⅝	197
H	4¾	140	V	6⅞	203
J	4⅞	145	W	7	208
K	5⅛	150	X	7¼	213
L	5¼	156	Y	7⅜	218
M	5½	161	Z	7½	223

ADJUSTMENT:—Disconnect bottom end of shock absorber and collapse unit so that notch at lower end of dust shield is adjacent to graduations on reservoir tube. Hold in this collapsed position and rotate lower end until ratchet spring on rebound orifice valve can be felt to engage notch in lower end of cylinder. With 'normal' factory setting, notch in lower edge of dust shield should line up with inverted 'V' at center of graduations at this point. To adjust, turn cylinder to right for firmer action, left for softer action as indicated on scale, being careful not to allow ratchet spring to disengage from notch in cylinder. Shock absorbers on both sides of car must be adjusted equally. This is important.

SERVICING:—Serviced in same manner as other types except that rebound orifice setting must be set at 'normal' (notch in dust shield in line with 'V' of scale with ratchet engaged in notch in lower end of cylinder) before unit is disassembled. Take care not to change ratchet adjustment when removing piston nut (valve assembled as unit on nut). Check normal, or standard position when unit is reassembled, and if necessary make a new notch on the dust shield opposite the 'V' of the scale to indicate this position (fill up old notch to avoid possibility of confusion).

Compression & Rebound Valves

Car Model	Compr. Valve Front	Compr. Valve Rear	Rebound Valve Front	Rebound Valve Rear
Studebaker 5A	C2	E2	425	550
Studebaker 6A	C2	E2	175	650
Studebaker 3C	C2	D1	75	550

DELCO 1938-39 ADJUSTABLE DIRECT ACTING TYPE

1" Cylinder—See Note

Car Model	Model Numbers Front	Model Numbers Rear
Chrysler Royal C18 (1938) Export	1183-D	1184-U
Chrysler Imp. C19 (1938) Export	1183-D	1184-U
Chrysler Cust. Imp. C20 ('38) Ex.	1183-D	1184-U
Chrysler C22, 23 ('39) Exp.	1114C	1115T
De Soto S6 (1939) Exp.	1114C	1115T
Dodge, Mod. D8-7 Pass. Cars (1938)	1183-U	1184-U
Dodge D11 ('39) Exp.	1114C	1115T
Dodge D11 Exp. 20" Wheels	1114C	1115W
Nash-Lafayette Model 3810 (1938)	1187-K	1189-N
Nash Ambass. Six 3820 (1938)	1187-K	1189-N
Nash Ambass. Eight 3880 (1938)	1187-K	1189-N
Plymouth P7, 8 ('39) Exp.	1114C	1115T
Plymouth P7, 8 Exp. 20" Wheels	1114C	1115W

1⅜" Cylinder—See Note

Chrysler C22, 23 ('39) Exp.	1134E	1130W
Chrysler C24 ('39) Dom. & Exp.	1134E	1130W
De Soto S6 (1939) Exp.	1134E	1130W
Dodge D11 ('39) Exp.	1134E	1130W
Dodge D11 Exp. 20" Wheels	1134E	1130Y
Hudson 6 & 8 ('39) Exp.	1132S	1131T
Plymouth P7, 8 ('39) Exp.	1134E	1130W
Plymouth P7, 8 Exp. 20" Wheels	1134E	1130Y

MODEL IDENTIFICATION NOTE:—1" and 1⅜" Shock Absorber models can be readily distinguished by diameter of outer dust shield tube which is approximately 2" (1" types), 2⅝" (1⅜" types).

NOTE:—Chrysler Models. Monroe Direct Acting Shocks used on domestic models, Delco Direct Acting (Non-adjustable) Shocks on Canadian cars.

Nash Models. Gabriel Direct Acting Shocks used on some cars. See Gabriel article for data.

TYPE:—Double acting piston type similar to other Delco models except for adjustable feature which consists of an adjustment cam assembled on the piston rod nut below the piston by which the spring tension of the Rebound valve can be varied from 'Soft' to 'Firm' for special operating conditions. This adjustment can be made without dismantling the shock absorber (see Adjustment section below).

DELCO ADJ. TYPE CONT.

REFILLING:—Shock absorbers must be removed from car, all old fluid pumped out, and refilled with exact correct amount of new fluid in same manner as other Delco models. Capacity designated by suffix or last letter of model number (see car list above) for each model as shown in following table. See preceding Direct Acting Shock Absorber article for complete filling directions.

1939 Type—Shock absorbers must be removed from car and disassembled, old fluid poured out, and refilled with exact correct amount of new fluid when reassembled. See chart below for correct capacity for each type and Servicing section (following) for disassembly directions. NOTE—Shock absorbers with filler plugs at lower end should be disassembled for refilling in same manner as types without plugs. Do not disturb filler plug (used for initial filling at factory).

Fluid Capacity—Capacity for each unit determined by suffix letter of model number (1114-C) as follows:

Fluid Capacity—1" Types

Model Letter	Ounces	CCs.	Model Letter	Ounces	CCs.
A	3½	104	N	5⅝	166
B	3⅝	109	P	5¾	171
C	3⅞	114	Q	6	177
D	4	119	R	6⅛	182
E	4¼	124	S	6¼	187
F	4⅜	129	T	6½	192
G	4½	135	U	6⅝	197
H	4¾	140	V	6⅞	203
J	4⅞	145	W	7	208
K	5⅛	150	X	7¼	213
L	5¼	156	Y	7⅜	218
M	5½	161	Z	7½	223

A, B, C Note—When these units fitted with hexagonal headed filler plug, capacity is 4¾ ozs. (A), 5¼ ozs. (B, C).

Fluid Capacity—1⅜" Types

Model Letter	Capacity (in Ozs.)
E	6¾
S	10½
W	12
Y	12⅝

ADJUSTMENT:—Disconnect lower end of shock absorber (keep upper end stationary), collapse unit fully and rotate lower end of shock absorber until adjustment engages (tang on adjusting cam washer will engage slot in pressure cylinder lower end within unit). Note position of notch on dust shield with relation to mark on cylinder (two settings only —'F" firm, 'S' soft). To change setting, rotate lower end of shock absorber in **counter-clockwise direction only** as viewed from below until a stop position is felt (unit will tend to shorten slightly when approaching 'Firm' position, lengthen when approaching 'Soft' position). There are six stop positions in one complete revolution which are alternately Soft and Firm. In order to line up reference notch on dust shield with mark on reservoir tube in each position, turn lower end 1/6 revolution (to change setting from Firm to Soft), or 5/6 revolution (to change setting from Soft to Firm). See that filler plug points toward rear of car when re-connecting shock absorber. Adjust shock absorbers on both sides of car for same setting to insure balanced operation.

SERVICING:—Serviced in same manner as other Delco type (see preceding Direct Acting Shock Absorber article) except for following points:

Disassembly. Set shock absorber in 'Soft' position before disassembling. This is important. When clamp fixture (#493) used to hold 'bayonet end' type on bench, filler plug must be removed and special steel plug (#44288) installed in filler plug hole to prevent sheering off plug when shock absorber turned with wrench.

Rebound Valve Assembly. Use Allen wrench (#488) to remove piston rod nut (regular wrench cannot be used as nut has tangs which engage adjusting cam washer), lift off adjusting cam washer, valve spring, valve back plate, spring disc, and orifice plate (orifice plate not used on all models). Mark piston to insure replacing in same position on rod, remove piston, valve plate, spacer washer, spring washer and bushing. Assemble in same order. Replace valve spring, orifice plate, or spring disc for lighter or heavier rebound resistance.

Assembling. When installing piston rod nut, see that tangs on nut are in depressions in cam washer so that spring is not compressed (soft position). Stake nut on rod to prevent loosening in service. Check reference marks as follows: With shock absorber completely reassembled and filled with fluid, collapse unit and turn until tang on adjusting cam washer is felt to engage notch in pressure cylinder lower end. If notch on dust shield does not line up with 'S' mark on pressure cylinder, cut new notch in dust shield in line with 'S' mark, fill up old notch to prevent confusion. NOTE—Before making new notch, make certain no one of the three identical soft settings (equi-distant apart in one complete counter-clockwise revolution of shock absorber lower half) lines up with old notch. Adjust shock absorber for Firm or Soft action before installing on car (See Adjustment section above).

IMPORTANT NOTE—Always adjust shock absorbers on both sides of car for same setting to insure balanced operation).

CONTROL VALVE CALIBRATION:—Standard Compression and Rebound Valve calibrations for each model are listed in table below.

1938 Compression & Rebound Valves

Car Model	Compr. Valve Front	Compr. Valve Rear	Rebound Valve Front	Rebound Valve Rear
Chrysler C18, 19, 20	J0	D0	0FR8	0FR6
Dodge D8	F0	D0	OO6	0FR6
Nash-Lafayette 3810	B1	B1	3NV6	3HR6
Nash 3820	B1	B1	3NV6	3HR6
Nash 3880	A2	B2	2AD4	0BD6

1939 Valve Calibration—1" Types

Car Model	Compr. Valve Front	Compr. Valve Rear	Reb'd Valve Front	Reb'd Valve Rear
Chrysler C22, 23 Exp	HO	CO	OEN8	OEN6
De Soto S6 Exp	HO	CO	OEN8	OEN6
Dodge D11 Exp	HO	CO	OEN8	OEN6
Hudson (All) Exp	6F1	6C2	OOD6	OEL8
Plymouth P7, 8 Exp.	HO	CO	OEN8	OEN6

1939 Valve Calibration—1⅜" Types

Chrysler C22, 23 Exp	1OG1	4B2	OEL6	1CG6
Chrysler C24 Dom	1OG1	4A4	4CG6	6AD4
Chrysler C24 Exp	1OG1	4B2	OEL8	1CG6
De Soto S6 Exp	1OG1	4B2	OEL6	1CG6
Dodge D11 Exp	1OG1	4B2	OEL6	1CG6
Plymouth P7, 8 Exp	1OG1	4B2	OEL6	1CG6

DELCO 1938 BUICK TYPE DIRECT ACTING HYDRAULIC

Car Models	Model No.
Buick, Models 38-40, 60, 80, 90 (1938)	1100-S

NOTE:—This type shock absorber used at rear end only in conjunction with new type rear suspension. Delco double-acting hydraulic shock absorbers used at front end (part of independent suspension assembly).

TYPE:—This type has larger (1⅜") piston and may be identified by larger dust shield (outer tube) which is approximately 2⅝" in diameter. Similar to design used on other models except for valve assemblies (see Servicing), special orifice in rod guide at top of upper cylinder (this orifice will keep cylinder free of air if shock absorber properly mounted on car), and baffle ring assembled below rod guide at upper end of reservoir tube.

REFILLING:—Shock Absorber must be removed from car (see special Removing Instructions), all old fluid pumped out, and refilled with exact correct amount of new fluid twice each year. See preceding Direct Acting Shock Absorber article for complete instructions. If Delco #494 filling cup used, assemble with #490 shut-off valve and adapter. Buick type filler cup is No. J-1108. Capacity for all units is 10 ozs.

REMOVING & INSTALLING SHOCK ABSORBERS:—Removal. Take out two bolts mounting upper bracket on frame, remove shock absorber and upper bracket as a unit. To remove bracket, use Frame Bracket Tool (Delco #854, Buick No. J-1111), and compress upper rubber grommet slightly in a vise or arbor press, remove snap ring from end of frame bracket stud.

Installing. Make certain that stone shield is on forward side (necessary for correct action of top cylinder rod guide orifice).

SERVICING:—Serviced in same manner as other Delco types (see preceding Direct Acting Shock Absorber article) except for following points:

Disassembly. Collapse shock absorber to shortest length and remove knock-out plug on side of dust shield (this will prevent damage to piston rod). Extend shock absorber, install special wrench (Delco #582, Buick No. J-1117) and unscrew rod guide retainer nut being careful not to damage piston rod with wrench. If gaskets stick to reservoir tube when lifting off top unit, pull up on dust shield.

Rebound Valve Assembly. To disassemble, use ⅝" socket wrench to remove nut on lower end of piston rod under piston, lift off valve spring, valve reinforcing plate, valve back plate, spring disc, and orifice plate. Mark piston to insure replacing in same position on rod, remove piston, valve plate, spacer washer, spring washer, and bushing. Assemble in same order making certain that dowel on bushing engages hole in piston. Replace spring, orifice plate, or spring disc to secure lighter or heavier rebound resistance.

Compression & Intake Valve Assembly. Has new type valve assembly consisting of spider (riveted to spring stud), valve disc and spring seat in cage at upper end of spring. Valve assembly retained by light spring at lower end of cage and safety hairpin spring at upper end. To disassemble, depress octagonal washer at lower end of spring stud until head of stud is freed from grooves in washer, turn washer 45° and slip off. Change spring or valve disc for lighter or heavier compression resistance. Reassemble in same order. Valve assembly is light press fit on lower end of pressure tube and should be tapped on and off.

DELCO (1938 BUICK) TYPE CONT.

Piston Rod Guide & Seal. Can be removed from reservoir tube by tapping lightly. Seal cannot be serviced and complete guide and seal assembly should be replaced if seal is defective. When installing, make certain that baffle is in place on lower surface of guide, use new reservoir gaskets (dip gaskets in shock absorber fluid), install cork gasket first, then rubber gasket on shoulder on guide assembly. Use special thimble (Delco #583, Buick No. J-1109) on piston rod end when installing rod through guide assembly to avoid damage to seal.

CONTROL VALVE CALIBRATION:—Standard valve calibration for all 1938 models as follows:

Car Model	Compr. Valve	Rebound Valve
38-40C, 41, 44, 46, 46S, 47, 48, 46C	6C3	2E6
38-61, 64, 66C, 66S, 67, 68	6D3	2E6
38-81, 81F, 80C	6D3	2F8
38-90, 90L, 91, 91F	8D3	2G8

DELCO HYDRAULIC TYPE (SPECIAL CHEVROLET-PONTIAC TYPE)

CHEVROLET MSTR., DA ('34), EA ('35), FA ('36), CHEVROLET MASTR. DELUXE, GA ('37), HA ('38) PONTIAC SIX, 701A (1935), 36-26A (1936) PONTIAC EIGHT, 603 ('34), 605 ('35), 36-28 ('36)

NOTE:—This type used on front end of these models in conjunction with special 'Knee Action' unit. See separate article on Delco Single Acting Shock Absorbers for type used on rear end and for other Chevrolet and Pontiac models.
NOTE—Each unit consists of complete cylinder and piston assembly.

DESCRIPTION & OPERATION:—Similar in design to Single Acting type (spring loaded single acting piston with intake and relief valve assemblies located in head). Two units used (upper—compression unit, lower—rebound unit) so that double acting shock absorber action provided. Units are bolted directly on front face of knee action case with pistons extending through case to contact cams on suspension unit shaft. Shock absorbers operate on fluid used to fill suspension unit case and case acts as reservoir or supply tank (fluid drawn into shock absorber cylinder on suction stroke, expelled through relief valve into case on compression stroke).

SERVICING:—**Disassembly.** To remove units, turn all three capscrews in mounting flange out evenly one turn at a time to relieve spring pressure. With unit removed, withdraw piston, spring, valve assembly.
Assembly. Assemble spring, valve and piston in cylinder, press piston in until small hole on side lines up with hole in cylinder under mounting flange, insert cotter pin in this hole to hold assembly together while it is being installed (withdraw cotter pin as soon as mounting screws are started). See that gasket under mounting flange is in good condition and use new lead washers on mounting screws. Turn all screws up evenly and securely.

ADJUSTMENT:—No adjustment provided. Valve assemblies are calibrated and should not be changed. Standard valve calibration as follows:

Car Model	Valve Number Compression	Rebound
Chevrolet ('34-36)	2B	2BX
Chevrolet ('37-38)	1B	1BX
Pontiac 6 & 8 ('34-36)	GO	3C

GABRIEL DOUBLE ACTING HYDRAULIC TYPE

Used On:

Car Models	Model Numbers Front	Rear
Hudson Eight (1932)	KM*	KM*
Hudson Eight (1933)	KT	KT
Hupmobile 216B ('32), 321K ('33), 421J ('34)	KT	KT
Hupmobile 222F ('32), 322F ('33), 427T ('34)	OT	OT
Hupmobile 226I ('32), 326I ('33)	OT	OT
Hupmobile 417W ('34), 517W ('35)	KT	LT
Hupmobile 518D ('35), 618G ('36)	LT	LT
Hupmobile 521O ('35), 621N ('36)		
Hupmobile 6, 822E ('38), 922E ('39)	KT	KT
Hupmobile 8, 825H ('38), 925H ('39)	OT	KT
Hupmobile Skylark, Model R (1939)		
Lafayette 110 ('34), 3510 ('35), 3610 ('36)	LT	LT
Lafayette 3610 (Late 1936)	LT	P†
Nash-Lafayette 3710 (1937)	KT	LT
Nash 1120, 1130 ('32), 1220 ('33)	KT	KT
Nash 3520 ('35), 3620 ('36), 3720 ('37)	KT	KT
Nash 1280 ('34), 3580 ('35), 3680 ('36)	OT	KT
Nash 1290 ('34)	OT	OT
Nash 3540, 3640, A ('35-36)	LT	LT
Nash 3780 (1937)	OT	KT
Stutz M (1932-34)	OT	OT

*—Use Model KT for replacement.
†—Gabriel-Walex type (see separate article for data on this type).

DESCRIPTION & OPERATION:—Single vane, double acting, hydraulic type. Vane mounted on shaft displaces fluid from working chambers on compression and rebound. Fluid flow from chamber restricted by non-adjustable fixed orifice on compression, adjustable piston valve on rebound. Rebound valve control types are as follows:
Manual Adjustment. Consists of an adjusting screw within filler plug opening which can be turned to vary action.
Ride Control Type. Adjusting lever on shock absorber case linked to dash control lever so that shock absorber action can be varied at the will of the operator.
Automatic Thermostatic Control Type. This type fitted with adjusting screw located within filler plug opening but screw connected to valve by thermostatic element so that valve position is automatically compensated for temperature, assuring even shock absorber action regardless of temperature changes.

SERVICING:—**Fluid Level.** Inspect at 5000 mile intervals and fill with genuine Gabriel fluid to level even with bottom of filler plug hole (unit must be in normal mounting position). Work arm up and down several times to expel air bubbles.

ADJUSTMENT:—**Ride Control Types.** All units should be adjusted evenly. Linkage should be adjusted so that levers are against stops when dash control button is in extreme inner or outer position.
Manual & Thermostatic Control Types. Use special filler plug wrench and adjusting tool, remove filler plug, use wrench to turn adjusting screw slightly in or clockwise for firmer action, out or counter-clockwise for softer action. Adjustment range is from 1½ to 3 turns out from the inner seated position (see table below for standard setting for each car model). To adjust setting, turn screw in until it is seated (count turns required to determine original setting), then turn screw out specified amount for correct setting. Do not use excessive force when turning screw in to check seated position.

Car Model	Setting (Turns Open) Front	Rear
Hudson '33	1¾	2¼
Hupmobile B, F, I ('32-33)	2	2½
Hupmobile 321K ('33)	1½	2¼
Hupmobile 421J ('34)	1½	2⅞
Hupmobile 427T ('34)	2	2½
Hupmobile 417W ('34), 517W ('35)	1⅝	2½
Hupmobile 518D ('35), 618G ('36)	1¾	2
Hupmobile 521O ('35), 621N ('36)		
Hupmobile 822E ('38), 922E, R ('39)	2⅛	2
Hupmobile 825H ('38), 925H ('39)	2	1¾
Lafayette 110 ('34)	2⅛	2⅜
Lafayette 3510 ('35)	2	2¼
Lafayette 3610 Sedan ('36)	3	2½
Lafayette 3612, 12R Coupe ('36)	2⅞	2¼
Nash-Lafayette 3710 Sedan ('37)	2½	2⅛
Nash-Lafayette 3710 Coupe ('37)	2⅝	2
Nash 1120, 1130 Sedan ('33)	1⅝	2
Nash 1120, 1130 Coupe ('33)	1⅜	2
Nash 1220 Sedan, 1222 Coupe ('34)	2	2
Nash 1280 Sedan ('34)	2⅜	2
Nash 1282 Coupe ('34)	2¼	2
Nash 1290 Sedan, 1292 Coupe ('34)	2	2¼
Nash 1294 Sedan ('34)	2¼	2½
Nash 3520 ('35), 3620 ('36)	2½	3
Nash 3580 ('35), 3680 ('36)	2⅜	3
Nash 35, 3640, A Sedan ('35-36)	3	2½
Nash 35, 3642, R Coupe ('35-36)	2½	2¼
Nash 3720 ('37)	2¼	2
Nash 3780 ('37)	2¾	2⅛
Stutz M ('32-33-34)	2½	2½

GABRIEL-WALEX

Used On:

LAFAYETTE, 3610, 3612 ('36) AFTER SERIAL No. L-33847.

NOTE:—This type used on rear only. Regular Gabriel Hydraulic Shock Absorbers used on front end on these cars and both front and rear on early 1936 cars. See separate Gabriel service article for data on these regular types.

DESCRIPTION & OPERATION:—Hydraulic, single acting, piston type. Operated by eccentric pin on shock absorber arm shaft within case which contacts movable cylinder which slides on stationary piston and is kept in contact with operating pin by spring. Intake valve (by which cylinder is kept filled with fluid) is a ball check type and is located in the piston head. Control valve which restricts fluid flow from cylinder on rebound stroke is a spring loaded ball check type and is located within the piston with an adjusting screw at the opposite end. Cylinder is sealed by a leather packing ring assembled on the head of the piston.

SERVICING:—Entire cylinder, piston, valves and springs assembled as a unit in a 'cartridge.' Parts not furnished separately and cartridge should not be disassembled. To remove cartridge, unscrew large hexagonal nut on opposite end of unit from lever, withdraw cartridge from housing.

GABRIEL-WALEX TYPE CONT.

Fluid Level. Special Garbriel-Walex fluid must be used. Unit will not operate satisfactorily it filled with standard Gabriel Thermostatic type fluid.

ADJUSTMENT:—Remove small hexagonal headed plug on end of cartridge. Use special adjusting wrench, Nash No. SE-783, turn adjusting screw within plug recess clockwise or in for firmer action, counter-clockwise or out for softer action. Check performance after turning screw ¼ turn. Do not turn screw out more than 3 turns. Standard setting for each model as follows:

Car Model	Setting (Turns Open)
Lafayette 3610 (Sedan)	2½ turns
Lafayette 3612 (Coupe)	2¼ turns

NOTE—One fourth turn will have noticeable effect on riding quality of car.

GABRIEL HYDRAULIC ADJUSTABLE DIRECT ACTING TYPE

Used On:

Nash Ambass. 6, 3820 ('38), 3920 ('39)
Nash Ambass. 8, 3880 ('38), 3980 ('39)
Nash-Lafayette, 3810 ('38), 3910 ('39)

NOTE:—Delco Direct Acting Shock Absorbers used on some cars. See separate article for data an Delco Shock Absorbers.

TYPE:—Direct Acting, adjustable, piston type. Shock Absorber case is welded in assembly and cannot be dismantled for servicing or refilling.

SERVICING:—Serviced by replacement (case is welded and Shock Absorber cannot be dismantled).

ADJUSTMENT:—Shock absorbers set at factory for normal control (valve 1 turn open) and performance should be satisfactory for all average riding conditions. Before changing adjustment to correct riding complaints, see that tires are properly inflated, springs and shackles lubricated and properly adjusted.

To Adjust—Remove shock absorber from car or disconnect lower mounting (necessary in order to collapse instrument fully). Collapse shock absorber fully by pressing upper and lower halves together and hold in this position until adjustment completed. Turn shock absorber cylinder to right (clockwise) slowly until adjustment key can be felt to drop into and engage slot in valve (within shock absorber). Continue to turn cylinder to right until a definite stop is felt (1-2 turns rotation) which indicates that valve is closed. Then turn cylinder to left (counter-clockwise), to open valve, desired number of turns as shown in table below.

IMPORTANT NOTE—Shock absorbers on both sides of car must always be adjusted alike (Right & Left Front same, Right & Left Rear same).

Valve Opening (No. of turns)	Type Control
¼-1 turn open	Very Firm to Firm
1-1½ turns open	Standard
1½-2 turns open	Soft

CAUTION—Adjustment valve must be at least ¼ turn open (operating with valve fully closed will damage shock absorber and mountings). Maximum adjustment is 2 turns open (do not force valve beyond this position). Use hand pressure only when making adjustments and do not force beyond fully closed and fully open positions. Operate shock absorber only in upright position (do not invert). When installing rear shock absorbers, see that stone shield faces forward.

HOUDE (HOUDAILLE) HYDRAULIC TYPE

Used On:

CHRYSLER CUST. IMP., CL* ('33), CW ('34), CW* ('35)
FORD V8, ALL MODELS (1932-37)
LINCOLN V12, ALL MODELS (1932-37)
LINCOLN ZEPHYR, MODELS H ('36), HB ('37)
PIERCE ARROW 8, 1601 ('36), 1701 ('37)
PIERCE ARROW 12, 1602, 3 ('36), 1702, 3 ('37)
STUDEBAKER SIX, MODEL 56 (1933)
STUDEBAKER DICT., 1A, 2A ('35), 3A, 4A ('36)
STUDEBAKER COMM., 73 ('33), B ('34), 1B ('35)
STUDEBAKER PRES., 82, 92 ('33), C ('34), 1C ('35), 2C ('36)

1938 Car Models.

Car Models.	Front.	Rear.
Ford, All Models (1938)	BBDE	BBDU
Lincoln, V12 Model (1938)	ALG	ALG
Lincoln-Zephyr, Model 86H (1938)	BBLCE	BBCU
Packard 8, Series 1601, 1A, 2 (1938)	OBBDI	OBBCP
Pierce Arrow 8, Model 1801 (1938)	APGH	AGH
Pierce Arrow 12, Mod. 1802, 3 ('38)	APGH	AGH
Studebaker Comm. (Six), Model 7A ('38)	BEDVS	ASC
Studebaker State Comm., Model 8A ('38)	BEDVS	ASC
Studebaker Pres., Model 4C (1938)	BEDVS	ASC

1939 Car Models

Ford, All Models (1939)	BBDK	BBDW
Lincoln V12 Model (1939)	ALG	ALG
Lincoln Zephyr 96H (1939)	BBLCE	BBCU
Mercury Model 99A (1939)	BBDK	BBDW
Studebaker Champ. G (1939)	BBFS	ACHS
Studebaker Comm. 9A (1939)	BBFS	ACHS
Studebaker Pres. 5C (1939)	BBFS	ACHS
Packard (see Note) 1939)		NFT

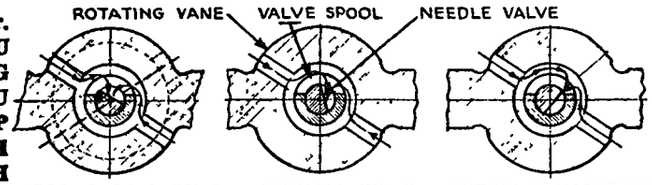
NOTE:—**1938 Packard.** Front shock absorbers special double lever type (shaft extended through case with lever mounted on each end, levers serve as upper control arm of independent front suspension assembly). Units have base mounting lugs and are bolted on top of frame side rail. No adjustment provided (replace valves to change action).

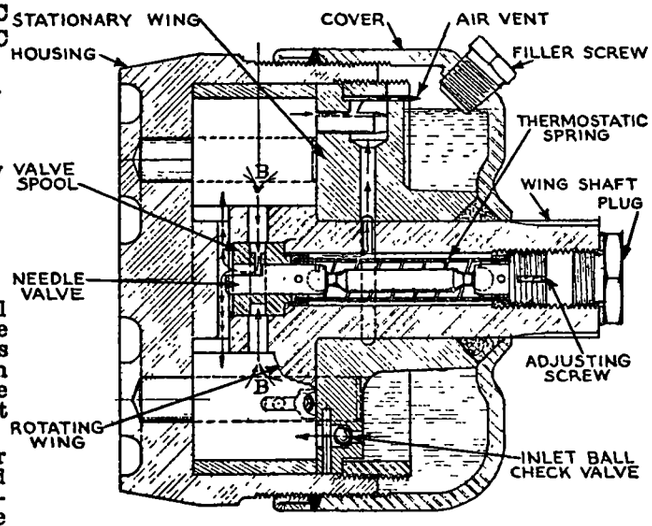
Production Change Note—First type shock absorber with domed filler plug (using #1402 fluid) should be replaced by later thermostatic control type exchange shock absorbers with flat filler plug (use #800 fluid).

1939 Packard Models—On Six 1700, '120' Eight 1701, 1A, 2 and Super Eight 1703, 3A, 5 models. This Model NFT shock absorber is the 'Fifth' Shock Absorber used to control the Lateral Stabilizer at the rear of the car. Regular shock absorbers are Delco double-acting, opposed-piston type. See separate article for Delco Shock Absorber data.

DESCRIPTION & OPERATION:—Double vane, hydraulic type. Case is divided into two semi-circular chambers by stationary wing or partition. Rotating wing is integral with shaft to which shock absorber arm is attached and moves backward and forward in the chamber displacing the fluid from the compression space (in front of the moving vane) to the non-compression space behind it. Fluid escape from compression chamber is regulated by valves in the movable wingshaft as detailed below for each type. In addition, on the compression stroke (when car springs compressed by road shock) fluid is allowed to flow through ball check valves in the stationary wing into the opposite non-compression chamber which lessens the shock absorbing action. On the rebound these check valves close and all fluid flow is regulated by the movable wingshaft valves.

Adjustable Orifice Type. By-pass in rotating wing-shaft controlled by needle valve which is adjustable by turning handle at end of shaft within shock absorber lever or by removing plug on end of shaft and turning valve stem with special adjusting tool.





Thermostatic Automatic Ride Control Type. By-pass valve in rotating wingshaft consists of an inserted valve spool and a needle valve controlled by a thermostatic coil. The opposite end of the thermostatic coil is connected to an adjusting screw under the plug on the end of the shaft within the shock absorber arm (this adjustment not provided on all models). Needle valve is formed with a flat portion within the valve spool which causes valve to close somewhat under the impact of fluid velocity so that flow is restricted to provide firmer control on rough roads. Thermostatic coil positions valve so that action is uniform for all temperatures.

HOUDE TYPE CONT.

ADJUSTMENT:—Adjustment provided for both Adjustable Orifice type and Automatic Thermostatic Control type so that softer or firmer shock absorber action can be secured for particular operating conditions. Adjustments are sensitive and screw should not be turned more than 1/32" at a time (road test car to check performance).

Adjustable Orifice Type (Ford, Lincoln-Zephyr). Adjusting handle located at end of wing-shaft within lever. Original standard setting indicated by one or two chisel marks on shaft (center pointer on single mark or between double marks), turn handle clockwise to increase, or counter-clockwise to decrease shock absorber action. Stops provided to limit motion in each direction. Do not force adjusting handle beyond stops.

Adjustable Orifice Type (Studebaker front units). Adjusted in same manner as Automatic Thermostatic Control types (adjusting valve stem under plug on end of shaft which can be turned by special tool toward 'O' mark for softer action, 'S' mark for firmer action. Valve must not be turned beyond marks (turning valve beyond 'S' mark will result in excessive pressures and damage to unit).

Automatic Thermostatic Type (Lincoln, Pierce Arrow, Studebaker rear units)—Remove cap on end of wingshaft within shock absorber arm, note position of arrow on adjusting screw within shaft recess (with standard factory setting, arrow should be in line with reference mark on shaft between 'O' and 'S' marks. Reference marks 'O' (open), 'S' (shut) indicate limits of adjustment and adjusting screw must never be turned so that arrow is beyond these points. This is important as additional adjustment may cause excessive pressure and leakage. To adjust, use special adjusting tool, turn screw 1/32" at a time toward 'O' for softer action or toward 'S' for firmer action, road test car before repeating adjustment. See that copper gasket under cap is in good condition and tighten cap securely.

Packard 1938 Type—See Production Change Note (above) for later type thermostatic control shock absorbers which should be installed on cars with first type units. Shock absorbers are adjustable by turning adjusting screw in shaft (accessible by taking out plug) but adjustment is very sensitive and screw should not be turned more than 1/16 turn at a time. **Do not turn screw more than ½ turn**

Front Shock Absorbers

Car Model	Part No.	Valve Calibration
1601, 2	A-5246	3 P 11/2 N 11—T
1601, 2 Firm Cont.	A-5274	4 P 11/4 M 11—T
1601, 2 Exp.	A-5823	5 G 11/3 M 11—T
1601, 2 Exp. Firm Cont.	A-5320	5 G 11/6 K 11—T
1601-A Comm'l.	A-5143	5 R 11/2 N 11—T

Rear Shock Absorbers

1601, 2	A-5247	4 D 12/4 1 13—T
1601, 2 Firm Cont.	A-5127	6 G 12/1 2 13—T
1601, 2 Exp.	A-5255	6 G 12/2 2 13—T
1601, 2 Exp. Firm Cont.	A-5406	6 B 12/4 1 13—T
1601-A Comm'l.	A-5145	5 C 12/6 4 13—T

Packard 1939—Adjustable type with needle valve located under plug on end of shaft. Setting must be checked or "timed" when adjustments made. See Packard Rear Suspension article (Rear Axle section) for complete directions.

SERVICING:—Fluid Level. Inspect at 5000 mile intervals and fill with genuine Houdaille fluid, even with bottom of filler plug hole (unit must be in normal mounting position). Work arm up and down several times to expel all air bubbles.

MONROE DIRECT ACTING HYDRAULIC TYPE

Used On:

Auburn Six, 653 (1935), 654 (1936-37)
Hudson Eight, LL, LT, LTS (1934)—Some Cars.
Reo Royale Six, 4S, 5S, 7S (1934-35)
Reo Flying Cloud, 6A (1935), 6D (1936)
Terraplane, K, KU, KS ('34), G, GU ('35), 61, 62 ('36)

1937 Models.

Used On:	Front	Rear
Chrysler, Model C14 (1937)	665566	665899
Chrysler, Model C15 (1937)	665567	665899
Chrysler, Model C16 (1937)	665568	665899
Terraplane, 70, 71, 72 (1937)	635702	635703
Willys, Model 37 (1937)	152941	152942

1938 Car Models.

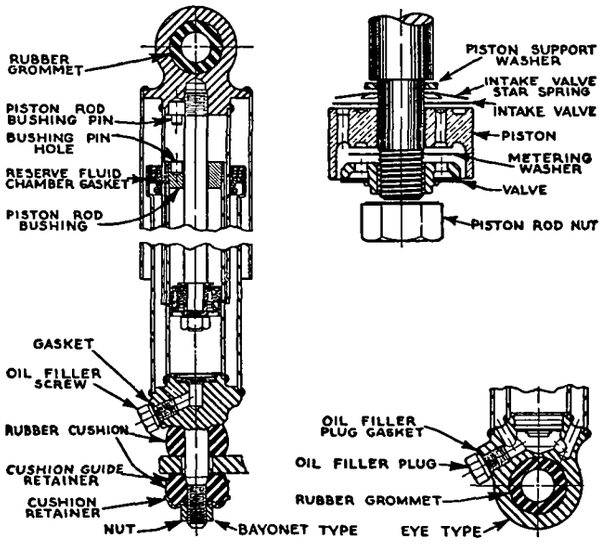
Car Model	Front	Rear
Chrysler, Royal C18	676739	682604
Chrysler, Imp. C19	683091	682604
Chrysler, Cust. Imp. C20	683091	682604
Hudson 112 Model 89	156778	*156578
Terraplane 80, 81, 82, 88	156577	156578
Willys 38 (Pass. Car)	635702	635703
Willys CP-38 (Pick-up)	635702	636450

*—156779 also used.

1939 Car Models

Hudson '112' Model 90 (1939)	156778	157800
Hudson 6, 91, 92, 98 Sedan ('39)	157400	157801
Willys-Overland 39 ('39) Std.	637509	637508
Willys-Overland 39 ('39) H. D.	637645	637644
Willys 48 (1939) Std. Cont.	637509	637508
Willys 48 (1939) H. D. Cont.	637645	637644

These part numbers stamped on outside of dust shield on shock absorber.



NOTE:—Hudson & Terraplane 1934 Models. These types are not serviceable (piston and valve are a single assembly) and later type should be used to replace them. Later type can be adjusted by replacing relief valve and metering washer with parts having different calibration. Spicer Direct Acting Shock Absorbers also used on Hudson Eight (see separate article for data).

1939 Hudson Models. Beginning with Car No. 41494 (90&98 Sedan), 39272 (91, 92), new type shock absorbers were used. See following article for data.

Reo Models. Shock absorbers used on Royale 'S' models not adjustable and should be replaced by new type No. 290 (front), No. 291 (rear) which can be adjusted by changing piston and valve assembly

CAUTION:—New fluid must not be added until all old fluid has been removed from shock absorber. Correct amount of fluid should be used (see Refilling directions below).

DESCRIPTION & OPERATION:—Direct acting type. Consists of a piston rod and piston attached to the car frame working within a compression cylinder attached to the axle. Reservoir cylinder surrounds compression cylinder with oil seal at upper end contacting inner of two concentric dust shield cylinders attached to the upper piston rod end of the shock absorber. Control valves (assembly with piston) control fluid flow through piston holes from one end of cylinder to the other on compression and rebound. Excess fluid (on compression) is forced out through bleed hole at lower end of cylinder into reservoir. On rebound, this fluid flows back into the cylinder through a flapper valve.

NOTE—On 1937 Terraplanes, a valve similar to the piston valves located at the bottom of the compression cylinder below the flapper valve and bleed hole. This valve does not open on compression until pressure builds up to a definite point improving the control.

REFILLING:—Use special refill kit and filler cup to measure fluid. Remove shock absorber from car, clean all dirt from around fillers plug at lower end of shock absorber, remove plug, pump all old fluid out by repeated strokes with filler plug opening down. Clamp shock absorber in vise at lower end with filler opening up. Compress unit, screw filler cup in opening, pour exact amount of fluid in cup (see table below), fully extend shock absorber which will draw all fluid in, remove filler cup, replace filler plug (using new gasket), tighten securely.

Fluid Capacity

Car Model	Front	Rear
Auburn 653	4 ozs.	5 ozs.
Chrysler C14, C16	4¾ ozs.	5½ ozs.
Chrysler C15	4¼ ozs.	5½ ozs.
Chrysler C18, C19, C20	4 ozs.	5½ ozs.
Hudson 116" WB '34	4 ozs.	5 ozs.
Hudson 122" WB '34	4 ozs.	5½ ozs.
Hudson 89 '38	5 ozs.	5½ ozs.
Hudson All '39	5 ozs.	5½ ozs.
Overland 39 '39	3¾ ozs.	4¼ ozs.
Reo 6A, 6D	4 ozs.	5 ozs.
Reo 4S, 5S, 7S	4 ozs.	5½ ozs.
Terraplane All '34-36	4 ozs.	5 ozs.
Terraplane All '37-38	5 ozs.	5 ozs.
Willys All '37-38-39	3¾ ozs.	4¼ ozs.

SERVICING:—Disassembly—Clamp base of unit in vise. Compress top fully and rotate until pin in top engages hole in piston rod bushing, tap top lightly to insure full engagement of pin, turn top counter-clockwise (using bar engaged in grommet hole) until bushing is freed from cylinder, pull top off. Clamp top of unit in vise, remove piston rod nut. Valve and piston assembly can then be dismantled.

Servicing—Wash all parts with gasoline and dry with air. Oil seal or gasket at top of reservoir cylinder cannot be removed (replace shock absorber if oil leaks at this point). Flapper valve and control valve (Terraplane) at lower end of compression cylinder are staked in place and cannot be taken out.

MONROE DIRECT ACTING TYPE CONT.

Reassembly—Reverse disassembling directions. See that washers and valve springs are correctly assembled on piston rod (see illustration). Tighten piston rod nut securely and stake to prevent loosening.

TROUBLE SHOOTING:—Shock Absorber Noisy. See that brackets are tight on frame, check rubber grommets at top and bottom, replace if worn or loose. See that shock absorber does not strike frame. On rear units, see that gravel shield (welded to lower tube) is toward front of car. Drive car with shock absorbers removed. If noise definitely located in shock absorber, check fluid, or disassemble as directed above.

Oil Leaks. If oil leaks at filler plug, replace plug gasket. If oil leaks excessively at oil seal gasket at upper end of reservoir cylinder (oil will run down cylinder and be apparent at lower end of dust cover), shock absorber must be replaced (oil seal permanently assembled in cylinder and cannot be serviced).

Performance Unsatisfactory. Check fluid, check tire inflation and springs. Valve calibration may be changed for special service requirements such as heavy loads (Heavy Control) or low speeds on smooth roads (Light Control). See section below.

CONTROL VALVE CALIBRATION:—To change control for special service, disassemble shock absorber (see Servicing above), replace relief valve and metering washer with correct type as noted below (Fr.) Front, (Rr.) Rear, (All) front and rear.
IMPORTANT NOTE—Shock absorbers on both sides of car must have same valve calibration (Right & Left Front same, Right & Left Rear same).

Reo Valve Calibration.

Model.	Lgt. Cont.	Std.	Hvy. Cont.
6A (front)	C-3000	C-3800	C-4600
6A (rear)	C-3226	C-4026	C-4826
4S, 5S, 7S (front)	C-4200	C-5300	C-6400
4S, 5S, 7S (rear)	C-3024	C-3824	C-4624

1937 Relief Valve Specifications

	Lt. Cont.	Stand.	Hvy. Cont.
Chrysler C14, 15 (Fr.)	71-17	71-20	71-25
Chrysler C14, 15 (Rr.)	71-15	71-17	71-22
Chrysler C16 (All)	71-15	71-17	71-22
Terraplane 70, 1, 2 (Fr.)	71-12	71-15	71-20
Terraplane 70, 1, 2 (Rr.)	71-35	71-45	71-57
Willys 37 (Fr.)	71-40	71-47	71-57
Willys 37 (Rr.)	71-37	71-45	71-45

1938 Relief Valve Specifications

Car Model	Light Control	Standard Control	Heavy Control
Chrysler C18 (Frt.)	71-15	71-20	71-25
Chrysler C18 (Rear)	71-15	71-20	71-20
Chrysler C19, C-20 (Frt.)	71-17	71-22	71-27
Chrysler C19, C20 (Rear)	71-15	71-20	71-25
Hudson 112 (Frt.)	71-15	71-20	71-27
Hudson 112 (Rear)	71-17	71-22	71-30
Terraplane 80,1,2 (Frt.)	71-10	71-12	71-17
Terraplane 80,1,2 (Rear)	71-17	71-22	71-30
Willys 38 (Frt.)	71-40	71-47	71-57
Willys 38 (Rear)	71-37	71-45	71-45
Willys CP-38 (Frt.)	71-37	71-47	71-57
Willys CP-38 (Rear)	71-45	71-55	71-65

1939 Relief Valve Specifications

Car Model	Light Control	Standard Control	Heavy Control
Hudson 90 (Front)	71-15	71-20	71-27
Hudson 90 (Rear)	71-17	71-22	71-30
Hudson 91, 92 (Frt.)	71-10	71-12	71-17
Hudson 91, 92 (Rear)	71-20	71-22	71-27
Overland & Willys (Frt.)	71-40	71-47	71-47
Overland & Willys (Rear)	71-32	71-40	71-60

1937 Metering Washer Specifications

	Light & Standard Cont.	Heavy Cont.
Chrysler C-14, 15, 16 (Fr.)	None	None
Chrysler C14, 15, 16 (Rr.)	10641-3	Same
Terraplane 70, 1, 2 (All)	10641-4	Same
Willys 37 (Fr.)	10641-3	Same
Willys 37 (Rr.)	10641-5	10652-5

1938 Metering Washer Specifications

Car Models	All Control Types
Chrysler C18, C19, C20 (Frt.)	None Used
Chrysler C18, C19, C20 (Rear)	10641-3
Hudson 112 (Frt.)	10641-4
Hudson 112 (Rear)	10641-5
Terraplane 80, 81, 82 (Frt. & Rear)	10641-5
Willys 38 (Frt.)	10641-3
Willys 38 (Rear)	10641-5
Willys CP-38 (Frt. & Rear)	10641-3

1939 Metering Washer Specifications

Car Model	Light & Standard Control	Heavy Control
Hudson 90 (Front)	10641-4	10641-4
Hudson 90 (Rear)	10641-5	10641-5
Hudson 91, 92 (Frt.)	10641-5	10641-5
Hudson 91, 92 (Rear)	10641-6	10641-6
Overland & Willys (Frt.)	10641-5	10641-4
Overland & Willys (Rear)	10641-4	10641-4

Hudson 1938-39 Note—For softer ride, new .008" metering washer, Hudson Part No. 157075, may be installed in place of the original types.

MONROE DIRECT ACTING (NEW 1939 TYPE)

Used On:

Car Model	Front	Rear
Chrysler Royal C22 (1939)	696240	696242
Chrysler Imp. C23 (1939)	696240	696242
Chrysler Cust. Imp. C24 (1939)	696241	696242
Hudson 90, 91, 92, 98 Sedan ('39)	See Note	

NOTE:—Delco Direct Acting Shock Absorbers used on some cars. See separate articles for data on Delco Shock Absorbers.
Hudson 1939 Note—These shock absorbers used beginning with Car No. 41494 (90, 98 Sedan), 39272 (91, 92). See preceding article for data on type used on first cars.

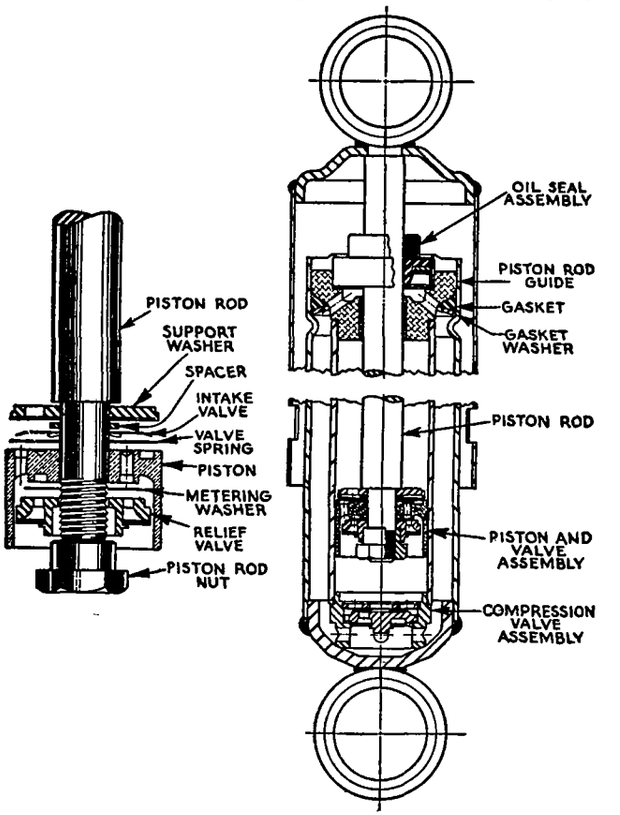
DESCRIPTION & OPERATION:—Direct acting type similar to previous Monroe designs except for new valve design and new piston guide (requires new dismantling instructions as given below). No filler plug provided (dismantle unit for refilling).

REFILLING:—Refill at 25000 mile intervals for ordinary driving conditions (more frequently for hard service or if unit shows serious leakage or loss of control). To refill, disassemble unit as directed in Service section below, clean out all old fluid and wash all parts, install correct amount of new fluid when reassembling.

Fluid Capacity Chart

Car Model	Front	Rear
Chrysler (all models)	3⅞ ozs.	6½ ozs.
Hudson (all models)	6 ozs.	6½ ozs.

SERVICING:—Disassembly—Remove shock absorber from car, clamp lower eye in vise with unit vertical, pull out to fully extended position, insert prongs of special T-317 wrench through slots in outer dust tube so as to engage holes in top of piston rod guide, turn wrench counter-clockwise to unscrew guide from reservoir tube, lift entire head assembly out. Clamp upper eye in vise so that head assembly mounted vertically, remove compression valve assembly by



tapping it lightly while working assembly out of pressure tube. Remove nut on end of piston rod, remove piston and valve parts from piston rod. If piston rod seal to be replaced, remove pressure tube and piston rod guide from piston rod, tap guide out of pressure tube (guide is press fit in end of tube). Seal should not be removed from guide (serviced as an assembly). CAUTION—Do not clamp pressure tube in vise and use extreme care not to distort tube.

Servicing—Wash all parts in clean naptha or gasoline, replace all worn or defective parts, always use new gasket under piston rod guide in reservoir tube when reassembling.

MONROE (NEW) DIRECT ACTING CONT.

Reassembly & Refilling—Use Thimble T-343 to install piston rod guide on piston rod to avoid damage to seal, install all valve parts and piston in correct order (see illustration—metering washer not used on all models), tighten piston nut securely. Measure correct amount of new fluid in measuring cup, pull pressure tube and guide up on piston rod, pour fluid into tube above piston until tube is full. Install compression valve assembly on upper end of pressure tube, tapping valves securely in place in tube and using extreme care not to spill fluid out of tube. Clamp base assembly in vise vertically, pour remainder of fluid into reservoir tube. Use new gasket in top of reservoir tube, install head assembly and tighten piston rod guide securely with T-317 wrench.

NOTE—See that stone shield (on lower tube) faces forward on rear shock absorbers when installed.

CONTROL VALVE CALIBRATION:—Standard Control relief valve and metering washer calibration should provide satisfactory control for normal operating conditions. Shock absorber performance can be varied for special operating conditions by changing valve calibration to 'Light Control' or 'Heavy Control' as shown in table below.

IMPORTANT NOTE—Shock absorbers on both sides of car must have same valve calibration (Right & Left Front same, Right & Left Rear same).

Relief Valve Specifications

Car Model	Light Control	Standard Control	Heavy Control
Chrysler C22 (Front)	74-15	74-17	74-22
Chrysler C22 (Rear)	74-17	74-20	74-25
Chrysler C23 (Front)	74-15	74-17	74-22
Chrysler C23 (Rear)	74-17	74-20	74-25
Chrysler C24 (All)	74-17	74-20	74-25

Metering Washer Specifications

Car Model	Standard Control	Light & Heavy Control
Chrysler (All—Rear)	10641-3	10641-4

NOTE—Metering washers not used in Front Shocks.

Hudson Specifications.

Car Model	Metering Washer Size Front	Rear
90, 98 Sedan	.004"	.005"
91, 92	.006"	.005"

TROUBLE SHOOTING:—Shock Absorber Noisy. Make certain that mounting bolts are tight and that shock absorber not striking any part of car. If rubber grommets in mounting eyes are worn, install new grommets, using liquid soap, if grommets tight fit, to assist in working grommets in eyes.

Fluid Leaks. If fluid leakage serious, disassemble unit and replace piston rod guide and seal assembly. **Performance Unsatisfactory.** Check tire inflation, spring and shackle lubrication and adjustment first. Check fluid level in shock absorber and refill.

MONROE SINGLE ACTING HYDRAULIC TYPE

Used On:

ESSEX-TERRAPLANE SIX, K, KU (1932-33)
ESSEX-TERRAPLANE EIGHT, KT (1933)
WILLYS, MODEL 77 (1933-34-35-36)

DESCRIPTION & OPERATION:—Single Acting, hydraulic type. Piston within cylinder is held out against cam on shock absorber shaft by spring within cylinder. On outward stroke (when car springs compressed by road shock), fluid flows freely into cylinder through check valve in piston head. On rebound stroke, fluid escape from cylinder is restricted by adjusting needle valve in by-pass channel and by relief valve in piston head.

ADJUSTMENT:—Adjusting needle valve should be turned in for firmer action, out for softer action. Standard settings are ½ turn open (Essex Terraplane), 2/3 turn open (Willys). To adjust, turn valve in until it is seated, then back off required amount. Valve must not be set at less than 1/6 turn open.

SERVICING:—Refilling. Remove top cover screw, fill case with Monroe fluid to level even with lower edge of screw hole.

Disassembly. Take out cover screws, remove cover and gasket, withdraw piston, spring and valve assembly. When reassembling, see that gasket in good condition and tighten cover screws securely to prevent leaks.

SPICER DIRECT ACTING HYDRAULIC TYPE

Used On:

AUBURN SIX, MODEL 652X, Y (1934)
AUBURN EIGHT, 850X, Y ('34), 851 ('35)
GRAHAM SIX, 74, 73 ('35)
GRAHAM EIGHT, 72 (1935)
GRAHAM SUPERCHARGER, 75 ('35)
HUDSON SIX, MODEL GH (1935)
HUDSON EIGHT, LL, LT, LTS ('34), HT, HU, HHU ('35)

NOTE:—Monroe Direct Acting Shock Absorbers used on some Hudson Eight models for 1934. See article on Monroe Shock Absorbers for data on these cars.

DESCRIPTION & OPERATION:—Direct acting type. Consists of a piston rod and piston attached to the car frame working within a compression cylinder attached to the axle. Reservoir cylinder surrounds compression cylinder and has a leather oil seal at its upper end which contacts piston rod. Outer dust shield cylinder is attached to upper or piston rod end of shock absorber. On compression stroke the fluid displaced from the lower end of the cylinder flows through valve ports in the piston into the upper portion of the cylinder. Excess fluid (to compensate for displacement of piston rod in upper end of cylinder) is expelled through a bleed hole in the flapper valve at the lower end of the cylinder into the reservoir. On rebound stroke, fluid is trapped in upper cylinder until valve plate is sprung away from valve disc (valve assembly mounted on top of piston), and then flows through piston ports into lower end of cylinder. Flapper valve permits free flow of fluid into lower cylinder from reservoir so that cylinder is kept full at all times.

REFILLING:—Remove shock absorber from car, pull out to fully extended position, remove filler plug and lead washer. Place unit in horizontal position on bench with filler plug hole up (use special fixture, do not clamp housing in vise). Pour genuine Spicer fluid slowly into filler hole until fluid rises to top of bleeder hole at side of filler hole. Do not fill above this point as sufficient air space must be left above fluid in reservoir. See that lead washer is in good condition and tighten filler plug securely.

Hudson Models. Special filler cup furnished so that required amount of fluid can be installed. Remove old fluid by pumping piston back and forth with filler plug and gasket removed. Clamp base end of shock absorber in vise (mounting eye, not housing) so that housing is horizontal and filler plug hole up. Collapse to shortest length, screw filler cup in place in filler hole, pour correct amount of fluid in cup (see table), pull shock absorber out to fully extended position and work piston back and forth with short quick strokes to draw all of fluid in, remove filler cup, install filler plug.

Capacity (Fluid Ounces).

Car Model.	Front	Rear
Hudson 8 116" WB. ('34)	4¾ ozs.	5 ozs.
Hudson 8 122" WB. ('34)	4¾ ozs.	5¼ ozs.
Hudson 6 & 8 ('35)	4¾ ozs.	5¼ ozs.

SERVICING:—1934 model cannot be dismantled and is serviced as an assembly (replace as a unit). Later types can be dismantled and serviced as directed below.

Disassembly. Remove all fluid by pumping piston with filler plug removed. Clamp top eye of shock absorber in vise (do not clamp housing), collapse shock absorber and turn slowly until pin in top engages hole in top guide (top of pin must be flush with outside top surface of housing), continue turning toward left until top unit can be lifted off. Clamp top eye in vise, remove piston nut, take off piston, valve plate, valve disc, spring and guide. Remove piston rod guide and oil seal assemblies.

Servicing. Wash all parts with gasoline and dry with air.

Reassembly. Reverse disassembly directions. Use special two or three prong tool when assembling valves. Install piston on tool with valve side down, press ends of pins against valve to compress spring so that end of bushing projects slightly above top surface of valve disc, press piston down into tube until it bottoms against bushing maintaining tool pressure on valve, withdraw tool without releasing pressure on piston, install nut loosely. Extend shock absorber to full length, rotate 90° and collapse it again before tightening piston nut securely. This will align piston on rod. To check assembly, use tool to see that valve can be depressed slightly.

DELCO SINGLE ACTING TYPE

Car Model	Delco Model Number Front	Rear
Chevrolet KB Mstr.		1201-E, F
Chevrolet KC ½ Ton	1430-CA, DA	1430-LA, MA
Chevrolet KD ¾ Ton	1430-CA, DA	1431-X, Y
Chev. KE ¾ Ton Spec.	1430-CA, DA	1431-X, Y
Crosley A (1939-40)	1201-G, H	1201-J, K

These Shock Absorbers same as used on corresponding 1939 car models.

NOTE:—Chevrolet KB—Front Shock Absorbers are Delco Direct Acting Type. See separate article for data.

SERVICING & ADJUSTMENT:—Same as for previous models. ***See 'Delco Single Acting Hydraulic Type' Shock Absorber article in Mechanical Equipment Section of manual (or 1938 Supplement) for complete date and note following valve specifications:***

Rebound Valves

Car Model	Front	Rear
Chevrolet KB		5G
Chevrolet KC, KD, KE	4CG	3CG
Crosley	2D	1C

IMPORTANT NOTE—Shock Absorbers on both sides of car must have same valve calibration (Right & Left Front same, Right & Left Rear same).

DELCO PARALLEL CYLINDER TYPE

Car Model	Delco Model Number Front	Rear
Buick 40, 50, 60, 70 (1940)	See Note	2105-A, B
Chevrolet KA, KH (1940)	2200-A, B	2100-A, B
Packard Six 1800 (1940)	2206-A, B	See Note
Packard Eight 1801 (1940)	2206-A, B	See Note
Packard Super 8 1803,6 (1940)	2206-A, B	See Note

NOTES:—Buick Front Shock Absorber—Front Shock Absorber on these models is Delco Double-acting Type. See separate article for data on this type.

Packard Rear Shock Absorbers—Rear Shock Absorbers on these models are Delco or Monroe Direct-acting type. Front Shock Absorbers on other Super 8 models (1804, 5, 7, 8) are Delco Double-acting type. See separate articles for data on these types.

TYPE:—Double acting, parallel cylinder type with end-to-end discharge and plug type compression and rebound valves.

REFILLING, SERVICING, ADJUSTMENT:—Same as for shock absorbers used on 1939 car models. ***See 'Delco Parallel Cylinder Hydraulic Type' Shock Absorber article in Mechanical Equipment Section of manual (or 1939 Supplement) for complete data and note following valve specifications:***

Compression & Rebound Valves

Car Model	Front Compr.	Front Reb'd.	Rear Compr.	Rear Reb'd.
Buick 40, 50, 60, 70			2D2	5J
Chevrolet KA, KH	D-.5	2E	D-.5	5F
Packard 1800	1.5B1	3Ed5		
Packard 1800 Exp.①	1D1	1K4		
Packard 1800 Exp.②	2.5Bd5	4.5B4		
Packard 1801	1 5B1	3Ed5		
Packard 1801 Exp.①	1D5	.60J7		
Packard 1801 Exp.②	.70B5	4.5B4		
Packard 1803, 6①	1 5Ad3	3Dd5		
Packard 1803, 6②	1.75B1	3.5Dd4		
Packard 1803,6 Exp.①	1D5	.60J7		
Packard 1803,6 Exp.②	.70B5	4.5B4		

①—First Cars. ②—Later Cars.

IMPORTANT SERVICE NOTE—Shock absorbers on both sides of car must have same valve calibration (Right & Left Front same, Right & Left Rear same).

DELCO DOUBLE ACTING TYPE

Car Model	Delco Model Number Front	Rear
Buick 40, 50, 60, 70 (1940)	1948-A	See Note
Buick 80, 90 (1940)	1902-E, F	1751-R, S
Cadillac V8 60S (1940)	1946-G, H	1751-G, H
Cadillac V8 62 (1940)	1946-G, H	1751-V, W
Cadillac V8 72 (1940)	1946-G, H	2007-N, P
Cadillac V8 75, V16 90 ('40)	1951-C, D	2010-C, D8
Chevrolet KC ('40) Optl.	1731-C, D	1731-T, U
Chevrolet KD, E ('40) Optl.		1732-N, P
Chevrolet WA,B,C, ('40) Optl	1731-C, D	2000-V
Chevrolet WD,E,F ('40) Optl.	1730-C, D	
La Salle V8 50, 52 (1940)	1946-G, H	1751-V, W
Nash 4020, 4080 (1940)	1947-C, D	See Note
Nash-Lafayette 4010 (1940)	1947-C, D	See Note
Nash All—Exp. ('40)	1947-C, D	1723-N, P
Oldsmobile 6, 60, 70 (1940)	1947-C, D	1754-L, M
Oldsmobile 8, 90 (1940)	1947-C, D	1754-L, M
Packard 1801A, 3A (1940)	1966-C, D	1751-M, Z
Packard Super 8 1804,7 ('40)	1966-C, D	2007-G, H
Packard Super 8 1805,8 ('40)	1966-C, D	2007-G, H
Pontiac 6 & 8 (1940)	1947-C, D	See Note
Pontiac 40-25 Exp. ('40)	1947-C, D	1754-E, F
Pontiac 40-26, 28 Exp. ('40)	1947-C, D	1754-A, B
Pontiac 40-29 Exp. ('40)	1947-C, D	1754-G, H

NOTES:—Buick 40, 50, 60, 70—Front Shock Absorber interchangeable from right to left side of car (single model used). Rear Shock Absorbers on these models are Delco Parallel Cylinder type (see separate article for data).

Nash & Nash-Lafayette—Rear Shock Absorbers are Delco Direct Acting type (see separate article for data).

Packard Models—Other Packard models have Delco Parallel Cylinder (front), Delco or Monroe Direct Acting Type (rear) shock absorbers. 'Fifth' Shock Absorber (lateral stabilizer control) is Houde (Houdaille) double acting type. See separate articles for data on these types.

Pontiac Models—Rear Shock Absorbers are Delco Direct Acting type (see separate article for data).

TYPE:—Same design as previous Delco double-acting opposed-piston types with valve arrangement and fluid flow as follows:

Types 1723, 1730, 1731, 1732—Center discharge type with outside rebound valve (rebound valve is plug type installed in tapped hole in housing). Compression valve combined with intake valve and located in compression piston head. Valve in rebound piston head is simple intake check valve.

Types 1751, 1754—End-to-end discharge type with outside compression and rebound valves (valves are plug type installed in tapped holes in housing). Spring-loaded intake check valve is located in piston head.

Type 1902—Center discharge type with Inertia Control. Compression and rebound valves are combined with intake valves and located in piston heads. Inertia control consists of an inertia weight controlled rebound valve which controls fluid flow through by-pass channel and static valve (static valve is plug type installed in tapped hole in housing). Static valve controls rebound except when cut off by inertia valve closing (on rough roads) in which case rebound controlled by rebound valve in piston head.

Type 1946, 1951, 1966, 2007—End-to-end discharge type with outside compression and rebound valves (both valves are plug type installed in tapped holes in housing). Spring loaded intake check valve located in piston head. All types except 2007 are used with independent front suspension (shock absorbers have double arms which form upper control arm of suspension unit).

Type 2010—End-to-end discharge type with Ride Control Adjustment. Compression and rebound valves are plug type and installed in tapped holes in housing. Intake check valve is spring-loaded type and located in piston head. Ride Control Adjustment consists of a separate control with a slotted adjustment screw located on the underside of the shock absorber housing (see Adjustment below).

ADJUSTMENT:—Cadillac 75, 90 Ride Control—Standard setting is with mark on adjusting screw in line with 'M' mark on valve locking cap. To change adjustment, press up on locking cap to free adjusting screw, turn screw clockwise to 'F' position (for firm control), counter-clockwise to 'S' position (for soft control). CAUTION—Both shock absorbers (right and left) must be adjusted alike.

Other Models—No adjustment provided other than changing control valves. See standard Valve Calibration table below.

REFILLING & SERVICING:—Same as for previous models. ***See 'Delco Double Acting Hydraulic Type' Shock Absorber article in Mechanical Equipment Section of manual (or 1938 Supplement) for complete data and note new specifications as follows:***

Std. Compression & Rebound Valves

Car Model	Compr. Valve Front	Compr. Valve Rear	Reb'd. Valve Front	Reb'd. Valve Rear
Buick 40, 50	1.25FX		1.25FX	
Buick 60, 70	1B		1FX	
Buick 80	1HX	1.5C2	.5X	.25H
Buick 90	1D	.1.5C2	5G	25H
Cadillac 60S	2Cd1	1C1.	2DX	1.5NX
Cadillac 62	2Cd1	1A1	2DX	1 5NX
Cadillac 72	2D1	2A1.	1EX	.1EdX
Cadillac 75	0BX	1.5X	1.25BX	.25-5X
Cadillac 90	0BX	1.5X	1.25BX	.25-5X
Chevrolet KC	G2	G2	2J	2G
Chevrolet KD, E		G0		1J
Chevrolet WA, B, C	G2	G2	2J	2E
Chevrolet WD, E, F	G2		2J	
LaSalle 50	2Cd1	1j1	2DX	1.5NX
LaSalle 52	2Cd1	1A1.	2DX	1.5NX
Nash 4020①③	2A		4B	
Nash 4020①④	1A		4B	
Nash 4020②	4AX		4B	
Nash 4080①.	1A		4B	
Nash-Laf. 4010①	1A		4B	
Nash-Laf. 4010②	4AX		4B	
Oldsmobile 60③	1.5C	1.5DX	2 5H	.5M2
Oldsmobile 60④.	3C	1.5DX	4H	.5M2
Oldsmobile 70	1.5C	1.5DX.	2 5H	.5M2
Oldsmobile 90	2C	.40C2	2.5H	1.25G
Packard 1801A	2A1	.60Ad5	3Dd5	.12G
Packard 1803A	3Ad5	.60Ad5	3E5	.12G
Packard 1804,7③	A32	Ad4W.	3 50D4	.40Fd4
Packard 1804,7④.	2A3	2n1	3Bd5	.70C
Packard 1804,7 Exp.	2Cd5	Ad02	.50H4	.05H
Packard1805,8③	2.5C3	A1W.	1D4	.10E
Packard 1805,8④	2A3	p02	3Bd5	.60D
Packard 1805,8 Exp.	1E3	2C3	.90J4	.70L
Pontiac (all).	4C		3H	
Pontiac 40-25 Exp.	1CX	OCX	2D	2J
Pontiac 40-26,28 Exp.	1DX	1DX	2D	1L
Pontiac 40-29 Exp.	1DX	1DX	2D	1L

①—Lgt. or Hvy. Springs (Dom)., Hvy. Springs (Exp).
②—Light Springs (Convertible Cars Only).
③—First Cars. ④—Later Cars.

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Inertia Control Valves

Car Model	Static Valve	Cut-in Valve
Buick 80, 90	4F	85

Ride Control Valve

Car Model	Control Valve
Cadillac 75, 90	CX

IMPORTANT SERVICE NOTE—Shock Absorbers on both sides of car must have same valve calibration (right&left front same, right&left rear same).

DELCO DIRECT ACTING TYPE

Car Model	Delco Model Nos. Front	Rear
Chevrolet KB (1940)	1000-N	
Chrysler C25, 26 ('40)	1000-C	1001-T
Chrysler C25, 26 ('40) Exp.	1002-C	1003-T
Chrysler C25 (1940) ①	1000-C	1001-W
Chrysler C25 (1940) ① Exp.	1002-C	1003-W
De Soto S7 (1940)	1000-C	1001-T
De Soto S7 (1940) Exp.	1002-C	1003-T
De Soto S7 ('40) ①	1000-C	1001-W
De Soto S7 ('40) ① Exp.	1002-C	1003-W
Dodge D14, 17 (1940)	1000-C	1001-T
Dodge D14, 17 ('40) ②	1000-C	1001-W
Dodge D14, 17 ('40) ②	1002-C	1003-W
Dodge D14, 17 ('40) ② Exp.	1002-C	1003-T
Graham 107, 108, 109		
Hudson 43, 44, 47 (1940)	1007-C	1008-S
Nash 4020, 80 (1940) ③		1006-DD
Nash 4020, 80 (1940) ④		1006-EE
Nash-Lafayette 4010 ('40) ③		1006-DD
Nash-Lafayette 4010 ('40) ④		1006-EE
Packard '120' 1801 (1940)		1001-V
Plymouth P9, 10 (1940)	1000-C	1001-T
Plymouth P9, 10 ('40) ②	1000-C	1001-W
Plymouth P9, 10 ('40) ②	1002-C	1003-W
Plymouth P9, 10 ('40) ② Exp.	1002-C	1003-T
Pontiac—all models ('40)		1000-V

①—Cars with 18" Wheels.
②—Cars with 18" or 20" Wheels.
③—Cars with Light Springs.
④—Cars with Heavy Springs.

NOTES:—**Chevrolet KB**—Rear Shock Absorbers are Delco single acting type (see separate article).

Chrysler, DeSoto, Dodge, Plymouth Models—Delco Direct Acting Adjustable Shock Absorbers are optional or special equipment on these models. See separate article (following) for data. Monroe Direct Acting Shock Absorbers also used on Chrysler Models C25, C26 (see separate article for data).

Hudson—Monroe Direct Acting Shock Absorbers used on other Hudson models (see separate article).

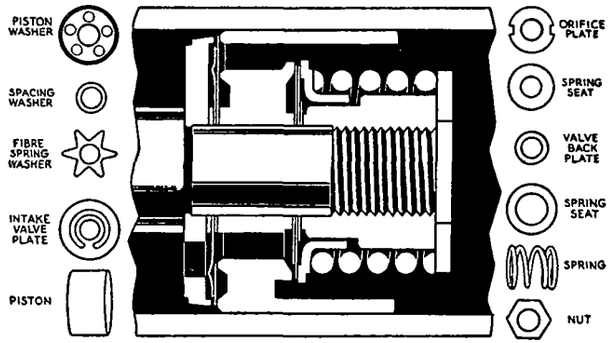
Nash—Front Shock Absorbers are Delco double acting type (part of front suspension assembly). See separate article for data on this type.

Packard—Front Shock Absorbers are Delco Parallel Cylinder double acting type (see separate article). Delco Direct Acting Adjustable Shock Absorbers are used on export models (see following article).

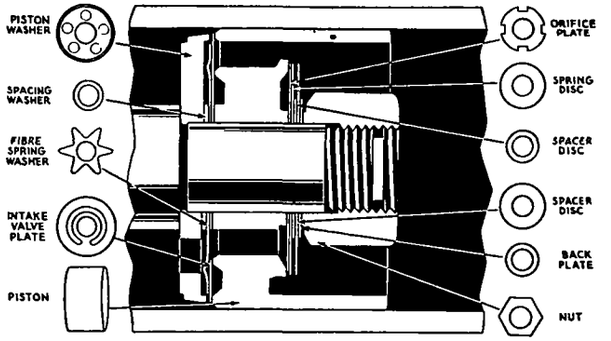
Pontiac—Front Shock Absorbers are Delco double acting type (part of front suspension assembly). See separate article for data on this type.

TYPE:—Double acting, three-tube, piston type similar to previous types used on 1939 car madels except that piston rod diameter is ½" and seal can be replaced (requires new service tools). NOTE—These models do not have filler plugs and must be disassembled for refilling (see Refilling directions following).

REFILLING:—Shock absorbers must be removed from car and disassembled as follows: Clamp lower eye in vise with shock absorber vertical (use special two-piece fixture #730 to hold bayonet end types—do not clamp bayonet end or shock absorber tube in vise). Pull shock absorber out to fully extended position, insert prongs of special wrench through holes in dust cover tube so as to engage slots in top guide (at upper end of reservoir tube—use care not to mar piston rod), unscrew guide, lift entire top assembly off, remove wrench. Remove lower end assembly (reservoir tube) from vise and pour out old fluid. Tap inlet and compression valve assembly out of lower end of pressure tube (top assembly), pull pressure tube out of dust tube and piston rod assembly so as to remove all old fluid from cylinder. Clamp top eye of shock absorber in vise with top assembly vertical and pressure tube fully extended. Measure exact correct amount of new fluid (see Fluid Capacity data below) and pour fluid into pressure tube until it is filled within ¼" of top, pour remainder of fluid into reservoir tube before it is installed. Install inlet and compression valve assembly in end of pressure tube. Clamp reservoir tube in vise, install new rod guide retainer gasket in top of reservoir tube (soak gasket in fluid and see that it seats properly in upper end of tube), install top assembly and tighten rod guide securely.



Type 1000, 1, 2, 3



Type 1006, 7, 8

Fluid Capacity:—Fluid capacity differs for each type shock absorber and correct amount can be determined by suffix letter of model number or collapsed length as explained below.

Model Suffix Letter—Letter following model number—1000-C—indicates capacity as shown in table below. NOTE—Do not confuse this letter with valve calibration lettering which is also stamped on outer dust tube of shock absorber.

Collapsed Length—Fluid capacity may also be determined by measuring length with shock absorber fully collapsed. On 'Eye End' types, measure from center of eye on each end (on eye end types with one bayonet end, measure from center of eye to base of bayonet stem on opposite end). On 'Bayonet End' types, measure from base of bayonet stem on each end.

Model Letter	Collapsed Length Eye End	Bayonet End	Fluid Capacity Ozs.	CCs.
A	8 3/16"	7¼"	3½	102
B	8 7/16	7½	3⅝	107
C	8 11/16	7¾	3¾	112
D	8 15/16	8	4	117
E	9 3/16	8¼	4⅛	122
F	9 7/16	8½	4¼	127
G	9 11/16	8¾	4½	133
H	9 15/16	9	4⅝	138
J	10 3/16	9¼	4⅞	143
K	10 7/16	9½	5	148
L	10 11/16	9¾	5⅛	153
M	10 15/16	10	5⅜	158
N	11 3/16	10¼	5½	163
P	11 7/16	10½	5⅝	168
Q	11 11/16	10¾	5⅞	173
R	11 15/16	11	6	178
S	12 3/16	11 1/16	6¼	183
T	12 7/16	11½	6⅜	188
U	12 11/16	11¾	6½	194
V	12 15/16	12	6¾	199
W	13 3/16	12¼	7	204
X	13 7/16	12½	7⅛	209
Y	13 11/16	12¾	7¼	214
Z	13 15/16	13	7⅜	219
AA	14 3/16	13¼	7½	224
BB	14 7/16	13½	7¾	229
CC	14 11/16	13¾	8	234
DD	14 15/16	14	8⅛	239
EE	15 3/16	14¼	8¼	244
FF	15 7/16	14½	8⅜	249

CONTROL VALVE CALIBRATION:—Standard valve calibration for each type shock absorber shown in table below. Valves consist of Compression and Inlet Valve Assemby (seated in lower end of pressure tube) and Rebound and Relief Valve (assembled on piston and held in place by piston nut).

Compression & Inlet Valve Assembly—This assembly cannot be dismantled and must be replaced as a unit.

Rebound & Relief Valve—See illustration for valve assembly which is different for the series 1000 to 1003 and 1006 to 1008 shock absorbers. Performance is controlled by the Orifice Plate (all models), Valve Disc and Valve Spring (1000 to 1003 only), Spring Discs and Spacing Discs (1006 to 1008 only).

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Compression & Rebound Valves

Car Model	Compr. Valve Front	Compr. Valve Rear	Reb'd. Valve Front	Reb'd. Valve Rear
Chevrolet	A1		4E6	
Chrysler C25①	E0	A1	2C6	3D6
Chrysler C25,26②	F0	B1	1F8	1F8
Chrysler C25,26③	F0	C1	1H8	1H8
Chrysler C25,26 Exp.	F0	B1	1DH8	1DH8
Chrysler C25 7 Pass.①	F0	A1	0E8	3D6
Chrysler C25 18" Whls.	F0	B1	1F8	1F8
Chry. C25 18" Whls. Exp.	F0	B1	1DH8	1DH8
DeSoto S7①	E0	A1	2C6	3D6
DeSoto S7②	F0	B1	1F8	1F8
DeSoto S7③	F0	C1	1H8	1H8
DeSoto S7 Exp.	F0	B1	1DH8	1DH8
DeSoto S7 7 Pass.	F0	A1	0E8	3D6
DeSoto S7 18" Whls.	F0	B1	1F8	1F8
DeSoto S7 18" Whls. Exp.	F0	B1	1DH8	1DH8
Dodge D14,17①	E0	A1	2C6	3D6
Dodge D14,17②	F0	B1	1F8	1F8
Dodge D14,17③	F0	C1	1H8	1H8
Dodge D14 7 Pass.①	F0	A1	0E8	3D6
Dodge D14,17④	F0	B1	1F8	1F8
Dodge D14,17⑤	F0	B1	1DH8	1DH8
Dodge D14,17⑥ Exp.	F0	B1	1DH8	1DH8
Hudson (All)	E2	A2	⑦	⑧
Hudson (All) Exp.	E2	A2	⑨	⑩
Nash (All) Lgt. Springs	j0			⑪
Nash (All) Hvy. Springs	A3			⑫
Packard 1801	j1			4G4
Plymouth P9,10①	E0	A1	2C6	3D6
Plymouth P9,10②	F0	B1	1F8	1F8
Plymouth P9,10③	F0	C1	1H8	1H8
Plymouth P10 7 Pass.①	F0	A1	0E8	3D6
Plymouth P9,10④	F0	B1	1F8	1F8
Plymouth P9,10⑤	F0	B1	1DH8	1DH8
Plymouth P9,10⑥ Exp.	F0	B1	1DH8	1DH8
Pontiac (All)		A4		4-C-10-10
(Except 7 Pass.)	F0	A1	1C6	2D6
(7 Pass. Cars)	F0	A1	0E8	2D6

①—Soft Control (Later Cars). First cars as follows:

②—Firm Control.

③—Super Control.

④—18" & 20" Wheels (Models 1000C & 1001W).

⑤—18" & 20" Wheels (Models 1002C & 1003W).

⑥—18" & 20" Wheels (Models 1002C & 1003T).

⑦—3-8-6-4-10-10.

⑧—5-8-4-10-10.

⑨—0-8-8-4-10-10.

⑩—3-10-4-10-10.

⑪—4-4-6-10 (4010, 20 First Cars), 4-4-6-10-6-10 (4010,20 Later Cars, 4080 All Cars).

⑫—2-10-10-10-10.

IMPORTANT SERVICE NOTE—Shock absorbers on both sides of car must have same valve calibration (Right & Left Front same, Right & Left Rear same).

SERVICING:—Disassembly—Remove top assembly (outer tubes, piston rod, and piston) as directed under Refilling (above). Unscrew piston rod nut (nut is staked in place), remove piston and valve parts (mark piston to insure replacement in same position on piston rod, note position of valve parts to insure correct order of replacement). Withdraw pressure tube and piston rod guide (see guide removal directions below if seal is to be replaced). Wash all parts of shock absorber in gasoline and dry with air (do not use solvents which will damage seal). All parts must be absolutely clean and dry.

Piston Rod Guide Seal Renewal—Remove guide from end of pressure tube by inserting handle of long screwdriver in tube and tapping guide out using care not to damage guide threads. Use Seal Extractor Fixture #724 (for shock absorbers with ½" piston rod) clamped in vise with round end up, place guide assembly on end of extractor and hold firmly while seal is being pried out with screwdriver. Press new seal in being careful to press only on outer edge of seal on types with leather wiper or raised center portion (use old shock absorber piston as press tool). On types without this leather wiper or raised center portion, apply pressure evenly on all sides of seal (use round stock of same diameter as seal).

Piston & Valve Assembly—When re-installing old piston, use care to line up marks on piston and rod (made before disassembly) to prevent piston binding in cylinder and install all valve parts in same order as removed. If new piston being installed, check for binding in cylinder after piston nut is tightened by moving tube up and down. If piston binds, loosen nut and try new position on rod. Piston can also be seated before piston nut is tightened by pulling cylinder out to fully extended position and then rotated 90° and forced down on piston. Nut should then be tightened and staked in position to prevent loosening in service. Recheck for binding by moving shock absorber through entire travel.

Reassembly—If piston rod removed from rod guide (for seal removal, etc.), install special #721 thimble on end of rod when installing rod through seal assembly and rod guide to prevent damage to seal. Install piston and valve assembly (above), then fill with exact correct amount of new fluid and reassemble as directed under Refilling above.

DELCO ADJUSTABLE DIRECT ACTING TYPE

Std. Equipment On:	Delco Model Number Front	Delco Model Number Rear
Chrysler C27 (1940)	1134-E	1130-W
Spec. Equipment On:		
Chrysler C25, 26 ('40)	1134-E	1130-W
Chrysler C25 ('40) 18" Whls.	1134-E	1130-Y
De Soto S7 (1940)	1134-E	1130-W
De Soto S7 ('40) 18" Whls.	1134-E	1130-Y
Dodge D14, 17 (1940)	1134-E	1130-W
Dodge D14, 17 18"&20" Whls.	1134-E	1130-Y
Packard 1800, 1, 3, 6 ('40) Exp.		1130-W
Plymouth P9, P10 (1940)	1134-E	1130-W
Plymouth P9, 10 18"&20" Whls.	1134-E	1130-Y

NOTE:—Chrysler, De Soto, Dodge, Plymouth—Delco Direct Acting Shock Absorbers (not adjustable) used as standard equipment on all models except C27 (see preceding article for data). Monroe Direct Acting Shock Absorbers also used on Chrysler models (see separate article for data).

Packard Models—Delco or Monroe Direct Acting Shock Absorbers used on domestic cars. See separate articles for data on these types.

TYPE:—1⅜" piston, double acting, three tube, piston type with adjustment for Soft and Firm control. Same as types used on 1939 car models (see Orifice Plug data below). NOTE—These large type shock absorbers with 1⅜" piston may be readily identified by larger diameter of outer dust tube (approx. 2⅝").

Orifice Plug—Consists of a calibrated metering restriction installed in the piston rod guide at the top of the pressure tube which allows fluid to escape from the cylinder directly into the reservoir tube when the shock absorber is being extended (rebound stroke). See Orifice Plug service data below.

REFILLING:—Shock absorber must be removed from car, disassembled, old fluid poured out, and filled with exact correct amount of new fluid when being reassembled. Procedure same as for non-adjustable types (see preceding article) except as follows: Shock absorber must be set in 'Soft' position before being disassembled (see Adjustment directions following) and knock-out plugs in dust tube slots must be removed before wrench can be inserted. Retainer nut is separate part and not combined with rod guide and oil seal assembly. When assembling shock absorber use new cork and rubber guide gaskets under retainer nut (install cork gasket first and rubber gasket on top). IMPORTANT—Check Adjustment before re-installing shock absorber on car.

Fluid Capacity:—Differs for each type and correct amount can be determined by model letter or collapsed length as follows:

Model Suffix Letter—Letter following model number—1134-**W**—indicates capacity as shown in table below. NOTE—Do not confuse this letter with valve calibration lettering which is also stamped on outer dust tube of shock absorber following model designation.

Collapsed Length—Fluid capacity may also be determined by measuring length with shock absorber fully collapsed. On 'Eye End' types, measure to center of eye on each end (on models with one bayonet end, measure from center of eye to base of bayonet stem on opposite end). On 'Bayonet End' types, measure to base of bayonet stem on each end.

Fluid Capacity

Model Letter	Collapsed Length Eye End	Collapsed Length Bayonet End	Capacity Ozs.	Capacity CCs.
E	9"		6¾	202
L	10⅜"		8¾	260
S		11 9/32"	10⅞	320
T	12⅛"		11⅛	330
W	12⅞"		12	359
Y	13⅜"		12⅝	379

ADJUSTMENT:—Disconnect lower end of shock absorber or remove unit from car (upper end must be held stationary while adjustment being made). Collapse unit fully and turn lower end in direction of arrow on tube (counter-clockwise) until tang on adjusting cam engages slot in lower end of pressure cylinder within unit (determine engagement by feel). Note position of notch on dust tube in relation to marks on (two positions only—'S' Soft, 'F' Firm; if unit has been disassembled these marks may not indicate setting correctly). To change setting, rotate lower end of unit in **counter-clockwise direction only** until a stop position is felt (unit will tend to shorten slightly in Soft position, lengthen slightly in Firm position). There are six stop positions in one revolution which are alternately Soft and Firm (collapsed length changes approximately 1/16" between positions). In order to line up reference marks on housing in each position, rotate lower end 1/6 revolution (to change from Soft to Firm), 5/6 revolution (to change from Firm to Soft). IMPORTANT NOTE—Shock absorbers on both sides of car must be set alike to insure balanced operation.

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SERVICING:—Disassembly—Clamp lower eye in vise with shock absorber vertical (use special fixture for bayonet end types—do not clamp bayonet end or shock absorber tube in vise), remove knock-out plugs in dust tube holes, pull shock absorber out to fully extended position, insert prongs of special wrench through dust tube holes and engage slots in retainer nut (use care not to mar piston rod), unscrew retainer nut, lift entire top assembly off. Tap compression valve assembly out of lower end of pressure tube. Use Allen wrench to unscrew nut on lower end of piston rod (nut seats in adjusting cam so that ordinary wrench cannot be used), withdraw piston and valve parts (mark piston to insure replacement in same position on piston rod, note position of valve parts to insure correct order of replacement). Wash shock absorber parts in gasoline (do not use solvents which will damage seal), dry with air. All parts must be absolutely clean and dry.

Rod Guide & Seal Assembly—Seal is integral part of guide assembly and cannot be removed (serviced as an assembly). If guide removed from pressure tube, make certain that baffle ring installed on upper end of tube under guide with open end at seal drain hole (diametrically across from Orifice Plug). See Valve Calibration data for Orifice Plug sizes.

Rebound Valve Assembly—When re-installing old piston, use care to line up marks on piston and rod (made before disassembly) to prevent piston binding in cylinder. If piston not marked, or new piston being installed, align piston in cylinder before piston rod nut is tightened by pulling tube out to fully extended position and then rotating tube 90° and forcing it down on piston. Nut should then be tightened and staked to prevent loosening in service. All valve parts should be installed in same order as removed and adjustment cam should be turned to 'Soft' position (spring not compressed).

Compression Valve Assembly—Serviced as an assembly but can be dismantled to change valve parts. To disassemble, use special tool to press in on valve washer (on lower end of intake valve stem), turn washer until hole registers with square end on stem, remove washer. Remove hairpin retainer spring in upper end of valve mounting and remove valve parts.

Reassembly—If piston rod removed from rod guide, use special thimble #583 installed on end of piston rod when inserting rod through seal and guide (will prevent threads on rod damaging seal). Install piston and valve assemblies (above), then fill with exact correct amount of new fluid and complete assembly by reversing disassembly directions above. Use new gaskets under retainer nut (install cork gasket first, rubber gasket on top). Check setting marks on shock absorber tube (if notch on dust tube not in line with 'S' mark, make new notch in line with mark and fill up old notch). Check shock absorber setting and adjust before installing on car.

CONTROL VALVE CALIBRATION:—Standard valve calibration for each type shock absorber shown in table below. Valves consist of Compression Valve (seated in lower end of pressure tube), Rebound Valve (assembled on piston), and Orifice Plug (in rod guide at top of pressure tube).

Compression Valve—Performance controlled by spring disc and valve spring (heavy inner spring).

Rebound Valve—Performance controlled by Orifice Plate, Spring Disc and Valve Spring (see illustration for valve assembly).

Compression & Relief Valves

Car Model	Compr. Valve Front	Compr. Valve Rear	Reb'd. Valve Front	Reb'd. Valve Rear
Chrysler C25, 26	10G	8B	OEL6	1CG6
Chrysler C25, 26 Exp.	10L	8C	OFR8	OEL8
Chrysler C27	10G	8A	4CG6	6AD4
Chrysler C27 C'm.&Ex.	10L	8C	OFR8	OEL8
DeSoto S7	10G	8B	OEL6	1CG6
DeSoto S7 Exp.	10L	8C	OFR8	OEL8
Dodge D14,17	10G	8B	OEL6	1CG6
Dodge D14,17 Exp.	10L	8B	OFR8	OEL8
Packard 1800 Exp.①		10C		OGR15-15
Packard 1800 Exp.②		8B		4GR6
Packard 1801,3,6 Exp.①		8C		OGR15-4
Packard 1801,3,6 Exp.②		8Ad		4GR8
Plymouth P9,10	10G	8B	OEL6	1CG6
Plymouth P9,10 Exp.	10L	8B	OFR8	OEL8

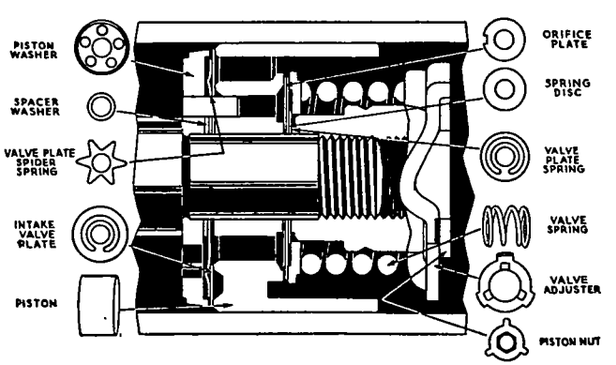
①—First Cars. ②—Later Cars.

Orifice Plug

Car Model	Front	Rear
Chrysler C25, 26	1	2
Chrysler C27	1	4
Chrysler C27 Com. & Exp.	1	2
DeSoto, Dodge	1	2
Packard 1800 Exp.		1①, 2②
Packard 1801,3,6 Exp.		1
Plymouth	1	2

①—First Cars. ②—Later Cars.

IMPORTANT SERVICE NOTE—Shock absorbers on both sides of car must have same valve calibration and be adjusted alike for balanced performance (Right & Left Front same, Right & Left Rear same).



GABRIEL HYDRAULIC ADJUSTABLE DIRECT ACTING TYPE

Used On:

Car Model	Gabriel Model No. Front	Gabriel Model No. Rear
Hupmobile Sen. 6 922E ('39)	B-6002	B-7006
Hupmobile Skylark R ('39-40)	B-7005	B-7504
Willys 440 (1940)	B-5375	B-6250

NOTE:—Hupmobile Models—For data on Gabriel Double Acting (rotary) Shock Absorbers used on first 1939 cars, see 1939 Supplement.

Willys—Monroe Direct Acting Shock Absorbers (3 tube type) also used on these cars. See Monroe shock absorber article for data.

TYPE:—Direct Acting, adjustable, piston type. Shock Absorber case is welded in assembly and cannot be dismantled for servicing or refilling.

SERVICING:—Serviced by replacement (case is welded and Shock Absorber cannot be dismantled).

ADJUSTMENT:—Shock absorbers set at factory for standard control (see table below) and performance should be satisfactory for all average riding conditions. Before changing adjustment to correct riding complaints, see that tires are properly inflated, springs and shackles lubricated and properly adjusted.

To Adjust—Remove shock absorber from car or disconnect lower mounting (necessary in order to collapse instrument fully). Collapse shock absorber fully by pressing upper and lower halves together and hold in this position until adjustment completed. Turn shock absorber cylinder to right (clockwise) slowly until adjustment key can be felt to drop into and engage slot in valve (within shock absorber). Continue to turn cylinder to right until a definite stop is felt (1-2 turns rotation) which indicates that valve is closed. Then turn cylinder to left (counterclockwise), to open valve, desired number of turns as shown in table below.

IMPORTANT NOTE—Shock absorbers on both sides of car must always be adjusted alike (Right & Left Front same, Right & Left Rear same).

Adjustment Table

Car Model	Valve Opening (No. of Turns) Soft	Standard	Firm
Hupmobile (All) Frt.	2	¾	¼
Hupmobile (All) Rear	2	¾	¼
Willys (All) Front	2	¾	¼
Willys (Sedan) Rear	2	⅝	¼
Willys (Coupe) Rear	2	⅞	¼

CAUTION—Adjustment valve must be at least ¼ turn open (operating with valve fully closed will damage shock absorber and mountings). Maximum adjustment is 2 turns open (do not force valve beyond this position). Use hand pressure only when making adjustments and do not force beyond fully closed and fully open positions. Operate shock absorber only in upright position (do not invert). When installing rear shock absorbers, see that stone shield faces forward.

HOUDE (HOUDAILLE) TYPE

	Houde Model No. Front	Rear
Ford All '60' & '85' ('40)	BBDM	BBDX
Lincoln V12 (1940)	ALG	ALG
Lincoln-Zephyr 06H (1940)	BBCM	BBCX
Mercury 09A (1940)	BBDM	BBDX
Packard 1801,1A,3,4,5,6,7,8 (1940) —See Note		NFT
Studebaker Champ. 2G (1940)	BBFSS	BBDS
Studebaker Comm. 10A (1940)	BBFS	ACHS
Studebaker Pres. 6C (1940)	BBFS	ACHS

These Shock Absorbers same as types used on corresponding 1939 car models except as noted below.

PACKARD NOTE:—This Shock Absorber is the 'Fifth' shock absorber of the rear suspension system (lateral stabilizer control). Regular rear shock absorbers on these models are Delco or Monroe Direct Acting Type. See separate articles for data on these types.

TYPE:—Same design as used on 1939 car models except as follows:

Ford, Lincoln-Zephyr, Mercury 1939-40 Models—On late 1939 cars and all 1940 models a new spring-loaded automatic type packing gland is used which does not require attention in service. With this type construction, packing is installed within the housing end cover and uniform pressure is maintained on the packing by a spiral spring.

ADJUSTMENT:—Ford, Lincoln-Zephyr, Mercury Models—Adjustment handle and pointer provided on end of shaft. Original setting is with pointer in line with indicating mark on lever. Pointer can be turned approximately ¼ turn in either direction but must not be forced past stops on shaft. Turn pointer clockwise for firmer action, counter-clockwise for softer action. CAUTION—Do not turn pointer more than 1/32" at a time without road testing car (slight movement has considerable effect on performance). Shock absorbers on both sides of car must be adjusted alike for balanced performance.

Lincoln V12—Automatic, thermostatic control type. Can be adjusted by removing cap in end of shaft which will expose adjusting screw. Original setting is with slot in adjusting screw in line with indicator mark on end of shaft. Screw can be turned approximately ¼ turn in either direction but must not be turned past '0' and 'S' marks on end of shaft which indicate end-points for adjustment. Use special tool (do not use screwdriver) and turn adjusting screw clockwise toward 'S' mark for firmer action, counter-clockwise toward '0' mark for softer action. CAUTION—Do not turn adjusting screw more than 1/32" at a time without road testing car (slight movement has considerable effect on performance). Shock absorbers on both sides of car must be adjusted alike for balanced performance.

Packard 'Fifth' Shock Absorber—Shock absorber must be removed from car, disconnected from lateral stabilizer arm and clamped vertically in vise (regular mounting position) to check timing. Hang 50 lb. weight on shock absorber arm, place arm in extreme upper position, note time required for full travel of arm from upper to lower position which should be 18 to 24 seconds. If not within this time limit, adjust as follows: Remove plug in outer end of shaft which will expose adjusting screw, turn screw in (clockwise) to increase time, out (counter-clockwise) to decrease time, recheck timing.

Studebaker Champion (all), Commander & President (Front Shock Absorbers only)—Adjustment same as for Ford models (above) by turning adjusting handle and pointer on shaft between two end-stops.

Studebaker Commander & President (Rear)—Automatic, thermostatic control type. Adjustment same as for Lincoln V12 (above).

REFILLING & SERVICING:—Same as for previous models. Shock absorbers should be inspected at 5000 mile intervals and filled to level of bottom of filler plug hole with genuine Houdaille fluid (unit must be in normal mounting position and arm should be worked up and down several times to allow all air to escape from cylinder—do not overfill).

MONROE DIRECT ACTING TYPE

Car Model	Monroe Model Nos. Front	Rear
Chrysler C25,26 ('40)	854568	854570
Chrysler C25 ('40) 7 Pass.	854569	854570
Hudson 90,1,2,8 (Late '39)		See Note
Hudson 40,1,2,8 ('40) ①	160101	160107
Hudson 40,1,2,8 ('40) ②	160102	160108
Packard 1800 (1940)		347416
Packard 1803,6 ('40)		351194
Willys 48, Overland 39 (Late '39)		See Note
Willys 440 (1940)	638316	638317

①Cars with regular springs.
②Cars with Heavy Duty springs.

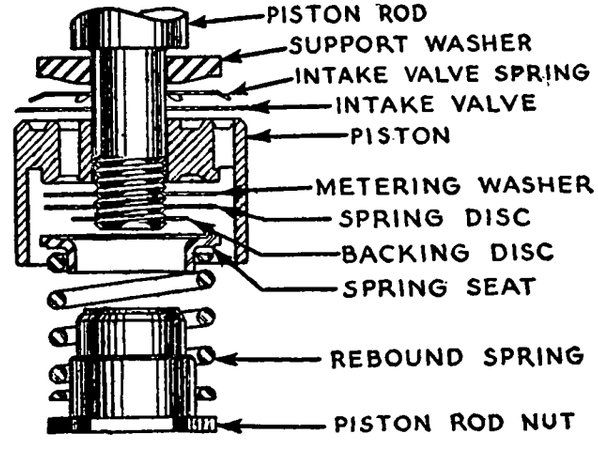
LATE 1939 CHANGES:—Hudson 90,1,2,8—These new '3 Tube' Shock Absorbers used on these models after Car No. 41494 (90 & 98 Sedan), 39272 (91 & 92). Data on this new type given below (see 1939 Supplement for data on first type shock absorbers).

Willys 48 & Willys-Overland 39—These new '3 Tube' Shock Absorbers, Model 637798 (Front), 637799 (Rear), used on 1939 cars after Serial No. 13313 (Std.), 14039 (Heavy Duty). Data on this new type given below (see 1939 Supplement for data on first type shock absorbers).

NOTE:—Chrysler Models—Delco Direct Acting Shock Absorbers used on some cars (see Delco article for data).

Hudson Models—Delco Direct Acting Shock Absorbers used on other Hudson models (see Delco article for data).

Packard Models—Delco Direct Acting Shock Absorbers used on export cars and other Parckard models. Fifth Shock Absorber (rear suspension control) is Houde Model NFT (see Delco and Houde articles for data).



Willys 1940 Models—Gabriel Direct Acting Shock Absorbers also used (see Gabriel article for data).

TYPE:—Double acting, hydraulic, piston type with '3 tube' construction (Inner Pressure Tube and Reservoir Tube are part of lower assembly, Outer Dust Tube part of top assembly). New type rod guide and seal assembly is screwed in upper end of reservoir tube and requires special T-317 wrench for removal (wrench inserted through slots in dust tube with shock absorber fully extended). Compression valve is light press fit in lower end of pressure tube (must be removed for refilling) and is serviced as an assembly. Rebound relief valve (on piston rod) differs on various car models (see Valve Calibration data below).

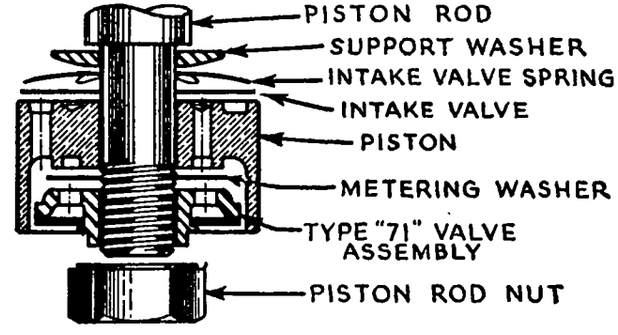
REFILLING:—Refill at 25000 mile intervals for ordinary driving conditions (more frequently for hard service or if unit shows serious leakage or loss of control). To refill, disassemble unit as directed in Service section below, clean out all old fluid and wash all parts, install correct amount of new fluid when reassembling.

Fluid Capacity Chart

Car Model	Front	Rear
Chrysler (all)	3¾ ozs.	6⅜ ozs.
Hudson 90,1,2,8	6 ozs.	6½ ozs.
Hudson 40,1,2,8	3¾ ozs.	6⅜ ozs.
Packard 1800,3,6		6¾ ozs.
Willys (all)	4¾ ozs.	5½ ozs.

SERVICING:—Disassembly—Remove shock absorber from car, clamp lower eye in vise with unit vertical, pull out to fully extended position, insert prongs of special T-317 wrench through slots in outer dust tube so as to engage holes in top of piston rod guide, turn wrench counter-clockwise to unscrew guide from reservoir tube, lift entire head assembly out. Clamp upper eye in vise so that head assembly mounted vertically, remove compression valve assembly by tapping it lightly while working assembly out of pressure tube. Remove nut on end of piston rod, remove piston and valve parts from piston rod. If piston rod seal to be replaced, remove pressure tube and piston rod guide from piston rod, tap guide out of pressure tube (guide is press fit in end of tube). Seal should not be removed from guide (serviced as an assembly). CAUTION—Do not clamp pressure tube in vise and use extreme care not to distort tube. **Servicing**—Wash all parts in clean naptha or gasoline, replace all worn or defective parts, always use new gasket under piston rod guide in reservoir tube when reassembling.

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Reassembling & Refilling—Use Thimble T-343 (1939 Hudson & Willys), T-347 (all 1940 models) to install piston rod guide on piston rod to avoid damage to seal, install all valve parts and piston in correct order (see illustration—metering washer not used on all models), tighten piston nut securely. Measure correct amount of new fluid in measuring cup, pull pressure tube and guide up on piston rod, pour fluid into tube above piston until tube is full. Install compression valve assembly on upper end of pressure tube, tapping valves securely in place in tube and using extreme care not to spill fluid out of tube. Clamp base assembly in vise vertically, pour remainder of fluid into reservoir tube. Use new gasket in top of reservoir tube, install head assembly and tighten piston rod guide securely with T-317 wrench. NOTE—See that stone shield (on lower tube) faces forward on rear shock absorbers when installed.

CONTROL VALVE CALIBRATION:—Standard Control relief valve and metering washer calibration should provide satisfactory control for normal operating conditions. Shock absorber performance can be varied for special operating conditions by changing valve calibration to 'Light Control' or 'Heavy Control' as shown in table below.

CONTROL VALVES:—Consists of Rebound Relief Valve (on piston rod under piston) and Compression Valve Assembly (in lower end of pressure tube). Compression valve cannot be dismantled and is serviced as an assembly. Several types of Rebound Relief Valves have been used as follows (see Valve Calibration data below for part numbers for each car model):

Hudson '39, Packard, Willys '39 Type—Type '71' valve assembly installed on piston rod directly below metering washer. These Type 71 valves cannot be dismantled and are serviced as an assembly.

Chrysler, Hudson '40, Willys '40 Type—These Rebound Relief valves are built up of calibrated valve discs installed on piston rod directly below metering washer (two groups of two with spacer disc between each group—total number of valve discs differ on various models, see valve calibration chart below). Chrysler models have a spring below the valve assembly which increases the tension of the valve spring disc (see illustration).

IMPORTANT NOTE—Shock absorbers on both sides of car must have same valve calibration (Right & Left Front same, Right & Left Rear same).

Car Model	Metering Washer	Relief Valve Disc Assembly 1st Disc	2nd Disc	Spacer	3rd Disc	4th Disc
Chrysler C25,26 Front①	10863-1	10849-6		10856-8④		
Chrysler C25,26 Front②	10863-2	10849-6		10856-8④		
Chrysler C25,26 Front③	None	10849-8		10856-8④		
Chrysler C25,26 Rear①	10863-2	10849-6		10856-8⑥		
Chrysler C25,26 Rear②	10863-3	10849-6		10856-8⑥		
Chrysler C25,26 Rear③	10863-1	10849-6		10856-8		
Chrysler C25 7 Pass. Front①	None	10849-8		10856-8⑤		
Chrysler C25 7 Pass. Front②	10863-1	10849-6		10856-8⑤		
Chrysler C25 7 Pass. Front③	None	10849-6&8		10856-8⑤		
Chrysler C25 7 Pass. Rear①	10863-2	10849-6		10856-8⑥		
Chrysler C25 7 Pass. Rear②	10863-3	10849-6		10856-8⑥		
Chrysler C25 7 Pass. Rear③	10863-1	10849-6		10856-8⑥		
Hudson 40,1,2,8 Front①	10863-2	10849-6	10849-8	10856-4	10849-10	10849-10
Hudson 40,1,2,8 Front②	10863-3	10849-6	10849-6	10856-4	10849-8	10849-10
Hudson 40,1,2,8 Front③	None	10849-8	10849-8	10856-4	10849-20	None
Hudson 40,1,2,8 Rear①	10863-4	10849-8	None	10856-4	10849-10	10849-10
Hudson 40,1,2,8 Rear②	10863-5	10849-6	None	10856-4	10849-8	10849-10
Hudson 40,1,2,8 Rear③	10863-2	10849-6	None	10856-4	10849-20	None
Willys 440 Front①	10863-3	10894-6	10849-8	10856-4	10849-8	10849-10
Willys 440 Front②	10863-3	10849-6	10849-6	10856-4	10849-8	10849-10
Willys 440 Front③	10863-2	10849-8	10849-8	10856-4	10849-10	10849-10
Willys 440 Rear①	10863-3	10849-8	10849-8	10856-4	10849-10	10849-10
Willys 440 Rear②	10863-3	10849-6	10849-8	10856-4	10849-8	10849-10
Willys 440 Rear③	10863-2	10849-8	10849-10	10856-4	10849-10	10849-10

①Standard Control. ②Light Control. ③Heavy Control.
④With #10865 Valve Spring. ⑤With #10866 Valve Spring. ⑥With #10850 Valve Spring.

Valve Calibrations (71 Type Relief Valve)

Car Model	Metering Washer	Relief Valve	Compr. Valve
Hudson 90,98 Front	10641-4	71-26	75-A10
Hudson 90,98 Rear	10641-5	71-25	75-A15
Hudson 91,92 Frt.①	10641-6	71-12	75-A12
Hudson 91,92 Frt. ③	10641-4	71-20	75-A12
Hudson 91,92 Rear①	10641-5	71-25	75-A15
Hudson 91,92 Rear③	10641-4	71-57	75-A15
Packard 1800 Rear①	10952-D1	71-40	76-A2
Packard 1800 Rear②	10952-D1	71-35	76-A2
Packard 1800 Rear③	10952-D1	71-47	76-A2
Packard 1803,6 Rear①	10952-B4	71-42	76-A3
Packard 1803,6 Rear②	10952-B4	71-37	76-A3
Packard 1803,6 Rear③	10952-B4	71-42	76-A3
Willys 48, 39 Front①	10641-5	71-47	10920-F
Willys 48, 39 Front②	10641-5	71-40	10920-F
Willys 48, 39 Front③	10641-5	71-55	10920-F
Willys 48, 39 Rear①	10641-4	71-40	10920-F
Willys 48, 39 Rear②	10641-4	71-32	10920-F
Willys 48, 39 Rear③	10641-4	71-47	10920-F

①Standard Control. ②Light Control. ③Heavy Control.

MONROE SINGLE ACTING HYDRAULIC TYPE

Used On:

BANTAM, MODEL 65 PASS. CARS (1940)

NOTE:—This type shock absorber used on passenger car models only. See Bantam 'M' page for data on friction type shock absorbers used on other models.

DESCRIPTION & OPERATION:—Single Acting, hydraulic type. Piston within cylinder is held out against cam on shock absorber shaft by spring within cylinder. On outward stroke (when car springs compressed by road shock), fluid flows freely into cylinder through check valve in piston head. On rebound stroke, fluid escape from cylinder is restricted by adjusting needle valve in by-pass channel and by relief valve in piston head.

ADJUSTMENT:—Adjusting needle valve should be turned in for firmer action, out for softer action. To adjust, turn valve in until it is lightly seated, then back valve off required amount to secure desired shock absorber action.

CAUTION—Valve must not be set at less than 1/6 turn open. Shock absorber will be damaged if operated with valve completely closed.

SERVICING:—Refilling. Remove top cover screw, fill case with Monroe fluid to level even with lower edge of screw hole.

Disassembly. Take out cover screws, remove cover and gasket, withdraw piston, spring and valve assembly. When reassembling, see that gasket in good condition and tighten cover screws securely to prevent leaks.

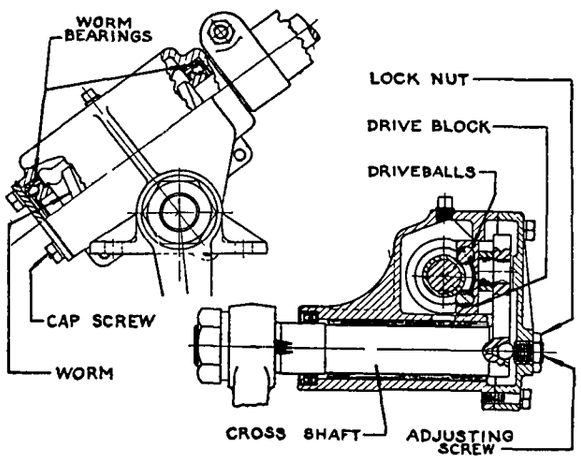
LAVINE MODELS.

Used On:

BANTAM, MODEL 60 (1937-38)
WILLYS, MODEL 77 (1933-34-35-36)

DESCRIPTION:—Steering worm on steering wheel shaft mounted on ball thrust bearings at top and bottom. Rotating nut or drive block on cross-shaft lever engages worm through two balls which are free to turn in block and worm. Adjustments provided for cross-shaft endplay (lash or play in steering wheel) and for worm shaft endplay (up and down movement of shaft and wheel).

ADJUSTMENT:—Before making any adjustment, jack up front end of car, turn wheels to straight ahead position, disconnect drag link at steering gear ball arm. See that front wheels turn freely without drag and without excessive looseness at drag link and tie rod ends. With steering wheel in straight ahead position, adjust as follows:



Cross-Shaft Endplay (Backlash between Drive Block and Worm):—Loosen locknut on adjusting screw on cover plate at inner end of cross-shaft, turn adjusting screw clockwise until all steering wheel play is eliminated, hold screw and tighten locknut. Check by rotating wheel through range from right to left extreme end positions. Wheel should be free at all positions. If wheel binds at any point, back off adjustment screw slightly.

Worm Shaft Endplay:—Check endplay by grasping steering wheel rim and noting movement when wheel pulled up. To adjust, take out four capscrews in housing lower end cover, take off cover, remove sufficient shims under cover to eliminate endplay, replace cover and tighten cover screws securely, check by rotating wheel through range from right to left extreme end position. Worm shaft should not bind at any point.

Note:—When adjustments completed, steering wheel should have no appreciable lash at center straight ahead position and should turn freely throughout range.

GEMMER WORM-AND-SECTOR TYPES

Used On:

CHRYSLER ROYAL EIGHT, MODEL CT (1933).
FORD V-8 (1932-33-34-35-36).
HUDSON SIX, (1933, 35 & 36).
(1) **HUDSON EIGHT (1932-33-34-35-36).**
HUPMOBILE 6, 417-W ('34), 517-W ('35).
TERRAPLANE 6, (1932-33-34-35-36).
TERRAPLANE 8 MODEL KT (1933).
WILLYS, 37 ('37), 38 ('38), 48 ('39)
WILLYS-OVERLAND, MODEL 39 (1939)

(1)—Hudson Eight, Models LT (1934), HHU (1935) only, are equipped with Gemmer-Worm-and-Roller type. See article on Gemmer Worm-and-Roller type.

DESCRIPTION:—Consists of 'hour glass' type worm mounted on steering shaft and carried on roller bearings at top and bottom. Bearings are provided with an automatic take-up under housing cover at upper end which eliminates necessity for adjustment except after considerable wear. The three-tooth sector on the cross-shaft engages the worm. Cross-shaft is provided with endplay adjustment. Housing cover in which cross-shaft is mounted is provided with eccentric adjusting sleeve and eccentric rivet adjustments to adjust sector clearance in worm.

ADJUSTMENT:—Before making adjustments, jack up front wheels and disconnect drag link to free steering gear (front wheels should turn freely with not more than 10 lbs. pull on drag link in either direction). Align steering column by loosening frame bracket bolts to allow gear to shift in frame, tighten bolts, then loosen instrument board bracket bolts to allow bracket to shift in alignment with column, tighten bracket bolts. Make adjustments in order as follows:

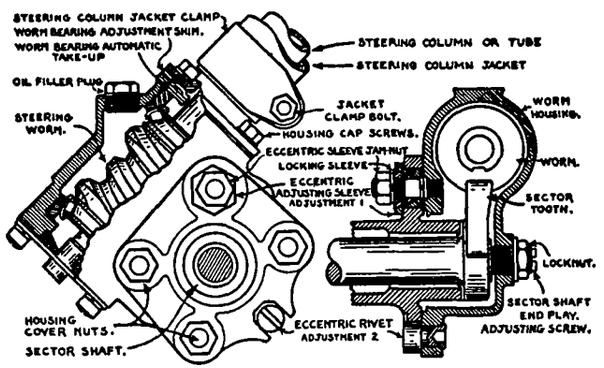
Worm Bearing Endplay:—Evidenced as up and down movement of steering wheel. Adjust when this exceeds .010" (to check, turn wheel 1 turn off center, hold wheel, shake front wheels). To adjust, loosen jacket clamp bolt above housing upper cover, shift clamp up ⅜" above lower end of jacket, loosen instrument board bracket clamp, work jacket down until lower end is against housing arm, remove housing capscrews, work jacket up as far as possible. This will provide approximately ⅜" clearance between housing cap and housing. Clip and remove one shim, reassemble gear, locating jacket clamp as near bottom end of jacket as possible. Check adjustment. Wheel should turn freely without stiffness.

Cross-shaft Endplay:—See that housing cover nuts and jam nut are securely tightened. Turn steering wheel to extreme end position and then back ⅛ turn. Loosen locknut and turn adjusting screw in housing at inner end of cross-shaft until shaft rotates freely with no endplay, tighten locknut.

Sector Tooth Mesh in Worm:—Turn steering wheel to 'straight ahead position' midway between end points, loosen housing cover nuts ¼ turn and eccentric sleeve jam nut ½ turn. Turn eccentric adjusting sleeve slowly clockwise until backlash can just be felt at ball end of steering arm. Check by turning steering wheel throughout full travel. If wheel is too tight in any position, turn eccentric sleeve counter-clockwise until wheel is free and then readjust. Sleeve must be turned clockwise to finish adjustment. Tighten eccentric sleeve jam nut, then tighten cover nuts. With correct adjustment sector should have minimum clearance at center position and gradually increased clearance toward ends.

Centralization of Tooth Contact:—Check clearance or backlash between sector teeth and worm at points 1/3 turn of steering wheel each side of center position. If clearance is not equal, note at which point (right or left) backlash is greatest, loosen cover nuts and eccentric sleeve jam nut, turn eccentric rivet in notch in edge of cover slightly clockwise (if greater clearance with wheel turned to right) or counter-clockwise (if greater clearance with wheel turned to left). Tighten cover nuts and jam nut securely, repeat test.

Steering Wheel Position (Hudson-Terraplane'36):—On these models, steering wheel spoke with trademark on underside must point straight down with wheels in 'straight ahead position'. If this spoke more than 2" on either side (position affected by Caster adjustment), steering gear pitman arm should be bent (first cars) or drag link adjusted (later cars) as follows:



To Bend Pitman Arm—Wrap hardened pitman arm ball in wet rags, drip water on ball, heat arm 2" above ball with torch until color begins to show, bend arm with bending bar approximately 3/64" backward (if spoke to right of center) or forward (if spoke to left of center) to correct each 1" that spoke is off center. Drag link must be disconnected and ball protected as directed to prevent destroying hardened finish.

To Adjust Drag Link—See Car Pages for serial numbers of cars on which adjustable drag link used. Adjustment consists of shims placed at both ends of pitman arm ball seats at rear end of drag link. Transfer shims from one position to the other to throw pitman arm back (wheel spoke to right) or forward (wheel spoke to left).

CHRYSLER WORM-AND-SECTOR TYPE

Used On:

CHRYSLER SIX MODEL CO (1933).
DE SOTO SIX, MODELS SC (1932), SD (1933).
DODGE SIX, MODELS DL (1932), DP (1933).
PLYMOUTH SIX, MODELS PC, PD (1933).

DESCRIPTION:—Consists of 'hour glass' type worm mounted on steering shaft and carried on roller bearings at top and bottom. The three tooth sector on the cross-shaft engages the worm. Adjustments provided for worm shaft endplay, cross-shaft endplay, and sector tooth mesh in worm.

ADJUSTMENT:—Before making adjustments jack up front wheels. Align steering column by loosening frame bracket bolts to allow gear to shift in frame,

CHRYSLER TYPE CONT.

tighten bolts, then loosen instrument board bracket bolts to allow bracket to shift in alignment with column, tighten bracket bolts. Make adjustments in order as follows:

Worm Bearing Endplay:—Evidenced as up-and-down movement of steering wheel. To adjust, turn steering wheel to 'straight ahead position' midway between end points, loosen clamp bolts in steering post dash bracket and clamp bolt on housing. Turn adjusting nut down until slight drag noticed when steering wheel turned through entire range. Back off adjusting nut ¼ turn, tighten clamp bolts in dash bracket and on housing. Check adjustment. Wheel should turn freely without stiffness.

Cross-shaft Endplay:—Turn steering wheel to extreme end position and then back ⅛ turn. Loosen locknut and turn adjusting screw at inner end of cross-shaft until shaft rotates freely with no endplay, tighten locknut.

Sector Tooth Mesh in Worm:—Turn steering wheel to 'straight ahead position' midway between end points. Loosen 4 studs holding adjusting plate to housing. Loosen locknut on worm adjusting screw, turn screw in until slight drag felt in 'straight ahead position' when turning steering wheel through entire range. Tighten locknut and 4 studs.

PACKARD WORM-AND-SECTOR TYPE

Used On:

PACKARD 8, MODELS 901, 2 ('32), 1001, 2 ('33).
PACKARD SUPER 8, 903, 4 ('32), 1003, 4 ('33).
PACKARD TWELVE, MODELS 905, 6 (1932).

DESCRIPTION:—Worm mounted on steering shaft and carried on roller bearings at top and bottom. Cross-shaft mounted in eccentric bushing and end thrust is taken by ball bearings mounted at either side of sector. Adjustments provided for worm endplay, sector shaft endplay, and sector tooth mesh in worm.

ADJUSTMENT:—Jack up front wheels and set steering wheel in 'straight ahead position' midway between end points. Make adjustments in the following order:

Worm Bearing Endplay:—To remove play in worm, loosen clamp bolt at top of gear case, turn adjusting nut to right (down) until all endplay removed. Tighten clamp bolt.

Cross-shaft Endplay:—Remove locking screw on housing at inner end of cross-shaft (do not remove locking plate). Move locking plate forward (toward front of car) to proper hole which will just take up endplay with cross-shaft free to turn, lock with locking screw.

NOTE—If, in order to remove all endplay, cross-shaft binds, back plate off one hole allowing cross-shaft to turn freely.

Sector Tooth Mesh in Worm:—Take out screw only in eccentric bushing lock plate(on outside of frame side rail), turn plate clockwise until all play taken up (test by moving steering arm with drag link removed). If proper setting requires position between holes, remove lockplate from serrations on bushing and engage it one tooth over to align with hole in frame side rail. Then tighten clamp at shaft end and insert screw and tighten.

NOTE—Thin side of eccentric bushing should be toward front of car.

GEMMER LINCOLN V12 MODEL WORM-AND-ROLLER TYPE

Used On:

LINCOLN V12 MODELS (1932 TO 1939)

NOTE:—This model similar in design and operation to other Gemmer models. Adjustments are not similar and are given below.

ADJUSTMENTS:—Make adjustments in order as follows:

Worm Bearing Endplay:—Take out worm adjusting nut lockscrew and plug on top of steering gear housing at upper end. Insert punch through plug hole, engage notches in adjusting nut, turn adjusting nut clockwise (down) until all endplay removed. If notch in worm adjusting nut does not coincide with lockscrew hole, back adjustment off slightly (do not tighten excessively to permit lockscrew to be entered). Insert lockscrew and tighten securely, replace plug.

Roller Shaft Endplay:—Remove locking screw on housing at inner end of cross-shaft (do not remove locking plate). Turn adjusting screw clockwise until all endplay removed. If hole in locking plate does not register with locking screw hole, back adjusting screw off slightly (do not tighten excessively to permit entry of locking screw), insert locking screw and tighten securely.

NOTE—Adjusting screw can be removed and locking plate turned over to secure better position of locking screw hole if necessary.

Roller Mesh in Worm:—Turn steering wheel to straight ahead position, disconnect connecting rod ball from steering gear connecting rod arm. Take out lock bolt in eccentric bushing plate on outside of frame side rail, turn plate clockwise until all play taken up (test by moving steering arm), insert lock bolt and tighten securely. Check adjustment by turning wheel off the straight ahead position. Small amount of play should be noted in all positions except straight ahead.

Final Check:—After adjustments completed, steering wheel should turn freely from one end position to the other without binding at any point. No play should be noticeable in center straight ahead position but small amount of play should exist at other points.

GEMMER WORM-AND-ROLLER TYPE (FIRST TYPE)

Used On:

CHRYSLER IMPERIAL, MODELS CH ('32), CQ ('33).
CHRYSLER CST. IMP., MODELS CL ('32), CL* ('33).
HUPMOBILE 8, MODELS 222-F, 226-I (1932).
HUPMOBILE 8, MODELS 322-F, 326-I (1933).
HUPMOBILE 8, MODELS 422, 426 (1934).
NASH 8, MODELS 1180, 1190 (1933).
PACKARD TWELVE, MOD. 1005, 6('33), 1107, 8(34').

DESCRIPTION:—Same design as later type Gemmer Worm-and-Roller type steering gears (see following article) except that roller mounted on plain bearing in cross-shaft lever.

ADJUSTMENT:—Before making adjustments, jack up front wheels and disconnect drag link to free steering gear (front wheels should turn freely with not more than 10 lbs. pull on drag link in either direction). Align steering column by loosening frame bracket bolts to allow gear to shift in frame, tighten bolts, then loosen instrument panel bracket bolts to allow bracket to shift into alignment with column, tighten bracket bolts. Make adjustments in following order:

Worm Bearing Endplay:—Evidenced as up and down movement of steering wheel. To adjust, turn wheel to either extreme end position, then back ⅛ turn. Loosen instrument panel bracket clamp bolts, loosen locknut on adjusting screw on top of housing, back off adjusting screw ½ turn, tighten housing clamp bolt as much as possible and then back off so that lockwasher under nut is only partially collapsed. Tighten adjustment screw as much as possible with 6" wrench, then back off screw 1/6 turn, hold screw in this position, tighten locknut. Tighten housing clamp bolt securely. Wheel should turn freely without stiffness throughout entire range.

Cross-shaft Endplay:—See that housing cover nuts and eccentric sleeve jam nut tightened securely. Turn wheel to either extreme end position, then back ⅛ turn. Loosen locknut on adjusting screw on housing cover at inner end of cross-shaft, turn adjusting screw in until all end play in shaft removed, hold screw in this position, tighten locknut. With correct adjustment, roller shaft should rotate freely when grasped at pitman arm hub with no perceptible end play.

Roller Mesh in Worm:—Turn steering wheel to center 'straight-ahead position' shake steering arm to determine amount of backlash between worm and roller. Loosen housing cover nuts and eccentric sleeve jam nut ¼ turn, turn eccentric sleeve clockwise slowely until all backlash taken up, tighten housing cover nuts and eccentric jam nut. Check by turning steering wheel throughout entire range. If wheel too tight at any point, back off eccentric sleeve and readjust as above (eccentric must be turned in clockwise direction to complete adjustment). With correct adjustment steering arm should have no perceptible backlash at center position and gradually increased clearance toward ends.

Centralization of Tooth Contact:—Turn steering wheel one turn to right of center straight ahead position, check clearance or steering arm backlash. Then turn wheel one turn to left of center position, repeat backlash check. If backlash at these two points not equal, note whether greater lash present at right or left. Turn steering wheel to center position, loosen housing cover nuts and eccentric jam nut ¼ turn, turn eccentric rivet on housing cover clockwise (if greater backlash at right) or counter-clockwise (if greater backlash at left), tighten housing cover nuts and repeat test. Readjust roller mesh in worm as directed above after making this adjustment.

WORM-AND-ROLLER TYPES 300, 330, 370

Type **Used On:**

1934-36 Car Models

CHRYSLER 6, CA, CB ('34), C6 ('35), C7 ('36).
CHRYSLER AIRST'M 8, CZ ('35), C8 ('36).
CHRYSLER AIRFLOW 8, CU ('34), C1 ('35), C9 ('36).
CHRYSLER IMP. CV ('34), C2 ('35), C10 ('36).
CHRYSLER CST. IMP. 150 HP. CW ('34), CW* ('35).
CHRYSLER CST. IMP. C3 ('35), C11 ('36).
DE SOTO AIRFLOW SE ('34), SG ('35), S2 ('36).
DE SOTO AIRST'M SF ('35), S1 ('36).
DODGE 6 DR, DS ('34), DU ('35), D2 ('36).
HUDSON EIGHT, MODELS LT ('34), HHU ('35).
HUPMOBILE 6, 421-J ('34), 521-J ('35).
HUPMOBILE 8, 427-T ('34), 527-T ('35).
HUPMOBILE 8, 521-O ('35), 621-N ('36).
LAFAYETTE 110 ('34), 3510 ('35), 3610 ('36).
NASH 6, 1220 ('34), 3520 ('35), 3620 ('36).
NASH '400'. 3540 ('35), 3640, 3640-A ('36).
NASH 8, 1280, 90 ('34), 3580 ('35), 3680 ('36).
PACKARD 120 (1935), 120-B (1936).
PACKARD 8, 1100, 1, 2 ('34), 1200, 1 ,2 ('35), 1400, 1 ,2 ('36).
PACKARD SUPER 8, 1103, 4, 5 ('34), 1203, 4, 5 ('35), 1403, 4, 5 ('36).
PACKARD TWELVE 1207, 8 ('35), 1407, 8 ('36).
PLYMOUTH, PE, PF, PG ('34), PJ ('35), P1, P2 ('36)

1937-39 Car Models

300—CHRYSLER ROYAL, MODEL C16 (1937).
DE SOTO, MODEL S3 (1937).
HUPMOBILE 8, 825H ('38), 925H ('39)
330—CHRYSLER IMPERIAL, MODEL C14 (1937)
CORD, MODELS 810 (1936), 812 (1937)
LINCOLN-ZEPHYR, H ('36), HB ('37)
LINCOLN-ZEPHYR, 86H ('38), 96H ('39)
370—CHRYSLER CUST. IMP., MODEL C15 (1937).
CHRYSLER AIRFLOW, MODEL C17 (1937).
FORD, BUS MODELS (1938-39)

Special Types (See Note):

DODGE, MODELS D5 (1937), D8 (1938)
DODGE, MODEL D11 (1939) EXCEPT 7 PASS.
PACKARD SIX, 115C ('37), 1600 ('38)
PACKARD SIX, MODEL 1700 (1939)
PACKARD EIGHT, 120C ('37), 1600, 1, 2 ('38)
PACKARD '120' EIGHT, 1701, 1A, 2 (1939)
PACKARD SUPER EIGHT, 1703, 3A, 5 (1939)
PLYMOUTH, MODELS P3, P4 ('37), P5, P6 ('38)
PLYMOUTH, MODELS P7, P8 (1939)

NOTE:—Steering Column Gear Shifts—For adjustment and servicing directions (removal, etc.) of steering column mounted gear shifts as used on some models, see separate articles on "Transmission Controls" in following section.

Dodge, Plymouth Models—These steering gears built by Chrysler but similar in design to Gemmer Model 300 and adjusted in same manner. Steering gear on Dodge 7 Pass. Model similar to Gemmer Model 305 (see following article).

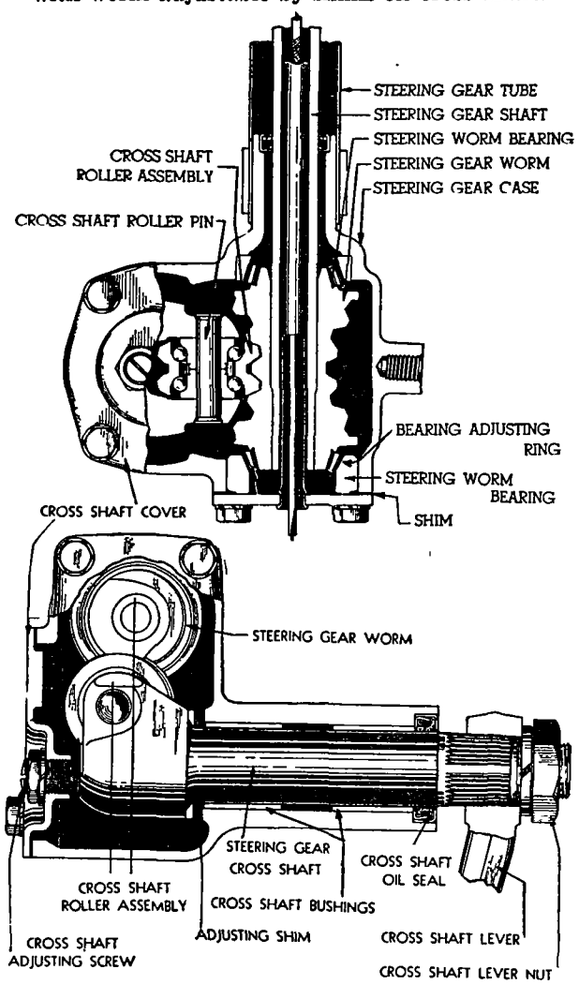
Lincoln-Zephyr—This model has straddle-mounted roller shaft with shaft bushing mounted in steering gear case cover. Adjusted in same manner as other steering gears.

Packard Models—These steering gears built by Packard but similar in design to Gemmer Model 330 and adjusted in same manner.

Chrysler 330, 370; Cord 330 Models—Roller shaft 'straddle mounted' on these models with additional roller bearing on cover plate at adjusting screw end of shaft. Adjusted in same manner as other types.

Model 370—Roller cross-shaft on this model is straddle mounted with additional bearing in side cover. Serviced in same manner as other types.

DESCRIPTION:—Consists of 'hour glass' type worm mounted on steering shaft and carried on roller bearings at top and bottom. Bearings provided with shim adjustment under cover at lower end of case. A double-tooth roller on the cross-shaft engages the worm. Roller is mounted on double-ball bearing or on needle bearings and is free to turn at point of contact with worm. Cross-shaft mounting is integral with housing and endplay adjustment provided by adjusting screw on side cover. Roller mesh with worm adjustable by shims on cross-shaft.



ADJUSTMENT:—Before making adjustments jack up front wheels and disconnect drag link to free steering gear (front wheels should turn freely with not more than 10 lbs. pull on drag link in either direction (except Packard models), 45 lbs. (Packard models). Align steering column by loosening frame bracket bolts to allow gear to shift in frame, then loosen instrument board bracket bolts to allow bracket to shift, tighten bracket bolts. Make adjustments in order as follows:

Worm Bearing Endplay:—Evidenced as up-and-down play of steering wheel. Check by turning wheel one turn to right from center 'straight ahead position', secure wheel, shake front wheels, note endplay. To adjust all models with shims under lower cover (see Note below for spring-loaded type), loosen four screws on lower cover, separate top shim, clip shim and remove using care not to damage other shims. Tighten cover screws and check adjustment. Wheel should turn freely without any stiffness or appreciable endplay. If spring scale used, force required to turn wheel (through scale attached to rim) should agree with figures in table below. If less than minimum figure, remove additional shim, if more than maximum figure, add shim.

Car Model	Worm Bearing Setting
Chrysler C7, C8, C9, C10, C11	① ¼—1¼ lbs.
Chrysler C14, C15, C16, C17	① ½—1 lb.
DeSoto S2, S3; Dodge D2, D5	① ¼—1¼ lbs.
Dodge D8, D11	① ½—1 lb.
Plymouth P3, P4, P7, P8	① ¼—1¼ lbs.
Plymouth P5, P6	① ½—1 lb.
Packard 1937-38-39	②1½—2¼ lbs.

①Worm bearing drag only with roller on midpoint of worm (roller cross-shaft out or Roller shaft endplay adjusting screw backed off).

②With steering wheel turned so that roller off or away from midpoint on worm.

Spring-loaded Type—Used on Chrysler CA, CB '34, DeSoto SE '34, Dodge DR, DS '34, Plymouth PE, PF '34 and other car models. On this type, a spring washer is located under the lower worm bearing cup so as to control worm shaft endplay. Requires no adjustment. If this type gear develops endplay, remove lower cover and examine spring washer, replace if broken.

Roller Shaft (Cross-Shaft) Endplay:—Turn steering wheel to extreme end position and then back ⅛ turn. Check cross-shaft endplay at steering arm hub. To adjust, loosen locknut, turn up adjusting screw in inner cover until shaft turns freely with no endplay, tighten locknut.

Roller Mesh in Worm:—Turn steering wheel to center 'straight ahead position,' shake steering arm to determine play or backlash. If this exceeds 1/32", steering gear must be removed from car and roller shaft position adjusted. With gear out of car and held in vise, take off steering arm nut, remove steering arm, take off side cover, remove roller and cross-shaft. See that all shims on shaft behind roller are removed from housing. Remove steering jacket, replace wheel on steering shaft, check worm shaft bearing adjustment. Remove one shim, reinstall roller shaft. assembling roller shaft thrust washer with chamfered side next to roller shaft thrust face. Check by turning steering wheel nearly to extreme left position, hold roller shaft in against worm, turn wheel to center position, check play at splined end of roller shaft. If play apparent, remove additional shim and repeat test. Replace housing cover, reassemble steering arm (drive arm in roller shaft), adjust roller shaft endplay (see above). If adjustments have been made correctly, play at ball end of steering arm should be .006" and wheel should turn throughout range without heavy drag. Pull at steering wheel rim required to turn steering gear through center position must be within limits shown below. If outside these limits recheck adjustments (add or remove thin shim on roller shaft).

TYPES 300, 330, 370 CONT.

Car Model	Steering Gear Setting
Chrysler C7, DeSoto S2, S3	1—4 lbs.
Chrysler C8, C9, C11	½—3 lbs.
Chrysler C14, C15, C17	1—2½ lbs.
Chrysler C16	1½—3½ lbs.
Dodge D2, D5; Plymouth P3, P4	1—4 lbs.
Dodge D8, D11; Plymouth P5, P6	1½—3½ lbs.
Plymouth P7, P8	¾—2¾ lbs.
Packard 1937-38-39	3—4½ lbs.

NOTE—When removing roller shaft, wrap splines with tape or install special Packard thimble No. ST-5032 to avoid damage to oil seal.

STEERING GEAR POSITION:—With steering gear at mid-point, steering wheel position should be correct, intermediate steering arm should be parallel to center-line of car and wheels should point straight ahead. For all models with independent springing, see Front Suspension articles for tie rod adjustment to correct intermediate steering arm position, and check special points as follows:

Chrysler, DeSoto, Dodge, Plymouth Steering Wheel Height—Steering wheel may be lowered by installing special steering post bracket at dash. Steering gear frame bolts must be loosened to allow steering column to be aligned with new bracket without springing which will cause bearings to bind.

Packard Models—Steering gears may be raised or lowered by installing special brackets at dash as shown in table below. When installing new bracket, loosen steering gear mounting bolts on frame to allow gear to align with new bracket without springing which will cause binding of the shaft and jacket.

	Dash Bracket				
Model	To Raise		Standard	To Lower	
115C	320284		315612	320285	
120C	320286		315611	320287	
1600	326798	(¾")	326806		
	324850	(1⅝")	326806		
1601,2	324850	(1½")	326798	326806	(11/16")
1700	333104	(⅝")	333101		
1701,2,3,5			333104	333101	(⅝")

SPECIAL SERVICE NOTES:—On Independent Suspension cars, check linkage and intermediate steering gear arms as noted below (intermediate steering arms not used on all cars—on some cars, both tie rods linked directly to steering gear pitman arm).

Steering Linkage (with Intermediate Steering Arm):—On all models with intermediate steering arm, toe in adjustment should be made by adjusting both tie rods equally and tie rod lengths should be checked and equalized to insure intermediate steering arm being centered (on center-line of car) and steering gear roller on high point of worm with wheels in straight ahead position.

Steering Linkage (No Intermediate Steering Arm):—On Chrysler, DeSoto, Dodge, Plymouth models without intermediate steering arm, the longer (right hand) tie rod should be adjusted to the correct length first (see table below) and toe in adjustment should then be made by adjusting the shorter (left hand) tie rod. This will insure steering gear roller being on high point of worm with wheels straight ahead.

Car Model	Long Tie Rod Setting
Chrysler C7, C8, C16	31 7/32"
Chrysler C14	30 15/16"
DeSoto S1, S3	31 7/32"
Dodge D11, Plymouth P7, P8	31 11/16"

Intermediate Steering Arm (Chrysler CA, CB '34; Dodge DR, DS '34; Plymouth PE, PF '34):—Intermediate steering arm mounted on tapered roller bearings with bearing adjusting shims between housing and lower cover. Shims are .003" and .005" thick. To adjust, remove shims until arm moves freely but has no perceptible endplay with cover screws tight.

Chrysler C6, CZ '35; DeSoto SF '35—Intermediate steering arm roller bearings adjusted by tightening nut on bolt on top of arm. Tighten nut until arm turns with slight drag, then back nut off 1/6 turn and install cotter pin.

Chrysler Model C17 Intermediate Linkage—Consists of intermediate lever on left front corner of frame which is connected to steering gear pitman arm by adjustable intermediate link at top and to wheel steering arm by adjustable drag link at bottom. When installing this assembly, turn nut on intermediate lever shaft up solid and then back off to nearest cotter pin hole. Adjust upper intermediate link length to exactly 29 5/16" by loosening clamp bolts and turning tube. With steering wheel at mid-point, adjust lower drag link length so that wheels are straight ahead.

Packard '37-38—Adjust bearing pre-load by adding or removing gaskets under bearing covers until force of 3½-4½ lbs. required to move arm when applied at radius of 9 1/6" (attach spring scale to ball on arm).

Packard 1939—Bearings pre-loaded by spring washer on bolt shank above intermediate steering arm. Later cars had longer bolt with additional plain washer at each end of bolt (use this later type for replacement on all cars).

WORM-AND-ROLLER TYPES 305, 335, 375 WITH PUSH-PULL ADJUSTMENT

Used On:

MODEL 305

CHRYSLER ROYAL, C18 ('38), C22 ('39)
DE SOTO, MODEL S5 ('38), S6 ('39)
FORD V8, ALL '60' & '85' CARS (1937-38-39)
HUDSON 6, 73 ('37), 83 ('38), 91,2,3 ('39)
HUDSON 8, 74,5,6,7, ('37), 84,5,7 ('38), 95,7 ('39)
HUDSON '112', 89 ('38), 90, 98 ('39)
HUPMOBILE 6, 822E ('38), 922E ('39)
HUPMOBILE SKYLARK, MODEL R (1939)
MERCURY V8, MODEL 99A (1939)
NASH 6, 3720 ('37), 3820 ('38), 3920 ('39)
NASH-LAFAYETTE, 3710 ('37), 3810 ('38), 3910 ('39)
TERRAPLANE, 70, 71, 72 ('37), 80, 81, 82, 88 ('38)

MODEL 335

CHRYSLER IMPERIAL, C19 ('38), C23 ('39)
NASH 8, 3780 ('37), 3880 ('38), 3980 ('39)

MODEL 375

CHRYSLER CUST. IMP. C20 ('38), C24 '39)

Special Types—See Notes

PACKARD SUPER 8, 1500,1,2 ('37), 1603,4,5 ('38)
PACKARD 12, 1506,7,8 ('37), 1607,8 ('38), 1707,8 ('39)
DODGE & PLYMOUTH EXPORT MODELS (1938)
DODGE 7 PASS., MODEL D11 (1939)

NOTE:—Steering Column Gear Shifts—For Adjustment, Servicing, and Removal of steering column mounted gear shifts, as used on some models, see separate articles on "Transmission Controls" in following section.

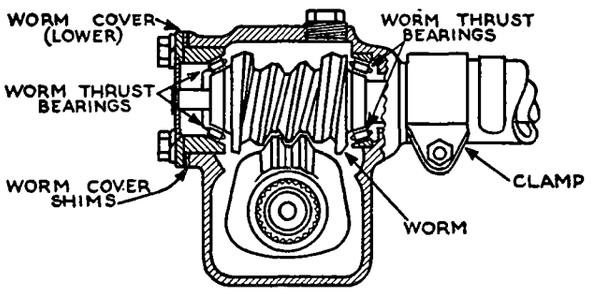
Dodge—This steering gear built by Dodge but is same design as Gemmer Model 305 and adjusted in same manner.

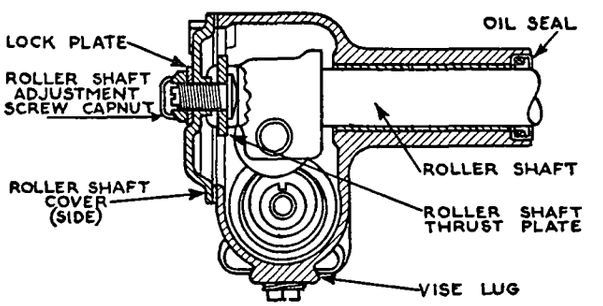
Packard Models—These steering Gears built by Packard but are Gemmer design (similar to Model 375) and serviced in same manner.

Model 375. This model has a 'straddle-mounted' roller shaft with additional roller bearing at adjusting screw end of shaft within side cover. Adjusted in same manner as other models.

DESCRIPTION:—These models are similar in design to other Gemmer Worm and Roller types except that washer on adjusting screw head engages slot in end of roller shaft so that shaft is prevented from moving in either direction. Shims are not used.

ADJUSTMENT:—Before making adjustments, disconnect drag link at steering arm and jack up front wheels. Wheels should turn freely in both directions with not more than 10 lbs. pull on drag link (except Packard) or 45 lbs. pull on intermediate arm at ball end (Packard models). Align steering column by loosening frame bracket bolts to allow gear to shift in frame, tighten bolts. Then loosen dash bracket bolts to allow bracket to be aligned with column, if necessary shim bracket or elongate mounting holes so that column will not be sprung when bracket bolts are tightened.





Worm Bearing Endplay:—Check by turning steering wheel one turn to right, secure wheel, shake front wheels (drag link must be connected), check movement of steering wheel hub on column jacket. If endplay perceptible, adjust by loosening four screws in lower cover about ⅛", clip and remove top shim, being careful not to mar remaining shims. Tighten cover screws, check adjustment. Wheel should turn freely without stiffness at any point. On Packard models, pull at steering wheel rim required to rotate wheel should be 1½-2¼ lbs. with wheel turned off the center or mid-point. If outside these limits, add or remove additional shims.

Roller Mesh in Worm:—Check by turning steering wheel to center position (turn wheel back one-half total number of turns from either end position or place marked spoke straight up or straight down), shake steering arm at ball end. If play or backlash exceeds 1/32", adjust roller shaft position as follows:

GEMMER TYPES 305, 335, 375 CONT.

All Models except Packard—Take off adjusting screw cap nut on side cover, slide locking plate off until it clears lock boss on cover, turn slotted adjusting screw in just enough to take up backlash (further movement will cause damage to gear), engage locking plate, replace cap nut. Steering wheel should turn freely throughout entire range without binding at any point.

Packard Models—Take off adjusting screw cap nut on side cover, disengage lockwasher, engage Allen wrench in adjusting screw, turn screw in until pull on steering wheel rim required to move wheel through center position is 3-4½ lbs., engage locking washer, replace cap nut.

STEERING WHEEL POSITION:—With steering gear at midpoint (roller on high point of worm), intermediate steering arm should be on center-line of car (when used), wheels should point straight ahead, and steering wheel position should be correct as noted below. Check steering wheel position and height as follows:

Hudson, Terraplane Models—Flat spot on serrated end of steering tube should point straight down with roller on high point (center) of worm (visible after taking off horn button and wheel). If wheels not straight ahead with steering gear in this position, shift shims located at front and rear of pitman arm ball in drag link. Install steering wheel so that trademarked spoke (mark under spoke near rim) is straight down. Steering wheel adjustable for height by loosening 3 frame bracket bolts (to allow gear to shift in frame), loosening dash bracket bolts and moving wheel up or down. Add or remove bracket shims, tighten bracket bolts, move wheel to align gear in frame, tighten frame bracket bolts.

Packard Models—Steering wheel height adjustment provided by adjustable bracket at dash. When adjusting wheel height, loosen steering gear mounting bolts at frame to allow steering gear to shift without springing column which will cause binding between shaft and column jacket.

SPECIAL SERVICE NOTES:—On Independent Suspension cars, check linkage and intermediate steering arm position (when used) as follows:

Intermediate Steering Arm (Chrysler C20,C24):—Arm on frame cross-member and linked to each front wheel by individual tie rods and to steering gear pitman arm by short drag link. When adjusting toe in, both tie rods should be turned equally and lengths must be equal after adjusting to insure correct steering gear position (intermediate arm should be on center-line of car with wheels straight ahead).

Bearing Adjustment—Arm mounted on taper roller bearings. To adjust, tighten nut on upper end of steering arm bolt until slight drag felt when arm revolved, then back nut off 1/6 turn and install cotter pin.

Packard Models—Intermediate steering arm pivoted on frame cross-member linked to each wheel by individual adjustable tie rod and to steering gear pitman arm by adjustable drag link. Toe in adjustments should be made by turning both tie rods equally and lengths must be equal after adjustment. Steering gear roller must be on high point of worm with wheels in straight ahead position and intermediate steering arm on center-line of car (adjust drag link length to secure this setting).

Bearing Adjustment (Super 8)—Arm mounted on cup-and-cone ball bearings and adjustable by turning nut on upper end of steering arm bolt. Tighten nut until force required to turn arm (measured at ball on end of arm) is 3-4 lbs.

Bearing Adjustment (Twelve)—Arm mounted on two taper roller bearings. Adjustable by adding or removing gaskets under bearing covers. With correct adjustment, force required to turn arm should be 3½-4½ lbs. measured at ball end of arm with drag link and tie rods disconnected.

Drag Link Ball (Hudson '112' 1938):—To correct excessive movement of rear drag link socket in pitman arm ball, install special larger-than-standard drag link ball seats No. 158592 (.998" diameter). These larger ball seats used on 1939 cars before No. 17607 (new drag link with parallel ends on later cars).

Steering Linkage (Chrysler, DeSoto, Dodge):—No intermediate steering arm used and steering gear pitman arm linked directly to each wheel by individual tie rods. When adjusting toe in, set longer (right hand) tie rod to exact length between ball centers as shown in table below, and then set toe in by adjusting shorter (left hand) tie rod. This will insure steering gear roller being on high point of worm in straight ahead position.

Car Model	Long Tie Rod Setting
Chrysler C18, C22; DeSoto S5, S6	31 5/8"
Chrysler C19, C20	30 25/32"
Dodge D11	31 11/16"

ROSS CAM-AND-LEVER TYPE

Used On:

AUBURN 6, 652-X, Y ('34), 653 ('35), 654 ('36-37)
BANTAM, MODEL 60 (1939)—LATER CARS
CROSLEY, MODEL A (1939-40)
GRAHAM 6, 65 ('33), 74 ('35), 80, 90 ('36)
GRAHAM CRUSADER, MODEL 85 (1937)
GRAHAM CAVALIER, MODEL 95 (1937)
HUPMOBILE 6, 518-D ('35), 618-G ('36)
STUDEBAKER 6, MODEL 56 (1933)
STUDEBAKER COMM. MODEL 73 (1933)
STUDEBAKER DICT. A & YR. AH'D (1934)
STUDEBAKER 6, 1-A, 2-A ('35), 3-A, 4-A ('36)

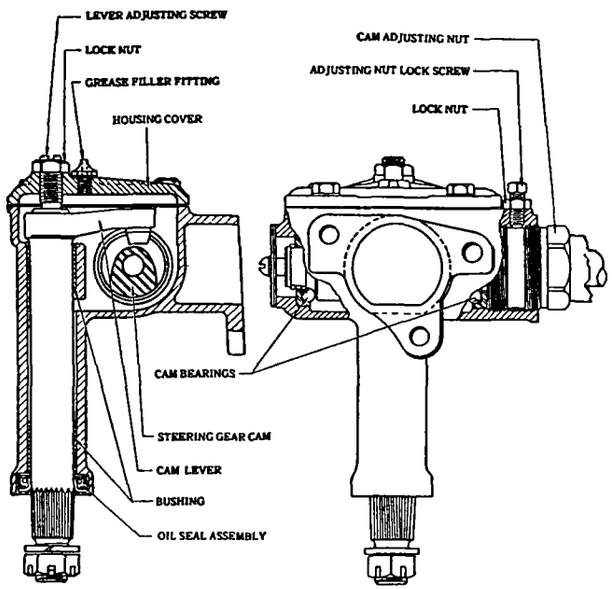
DESCRIPTION:—Consists of a worm-like cam mounted on steering wheel shaft engaging a tapered stud mounted on inner end of cross-shaft lever. Cross-shaft is carried in plain bushings and is adjustable for endplay. Cam is carried on ball thrust bearings at upper and lower end and bearing clearance or endplay is adjustable. Stud track in cam is grooved deeper at each end to provide minimum clearance at center. Adjustments must be made with wheel turned to 'straight ahead position' so that stud is at center of cam groove .

ADJUSTMENT:—Free steering gear from load by disconnecting drag link or jacking up front end of car. Loosen instrument board bracket clamp, loosen jacket tube clamp screw (if no clamp screw used, jacket tube is press-fit in adjusting plug and will turn with plug). Make following adjustments in order:

Cam Endplay (Adjusting Nut Type):—Up and down movement of steering wheel. Loosen housing plate adjusting screw and locknut (to free stud in cam groove). Loosen adjusting plug lockscrew locknut and back off lockscrew. Turn adjusting plug in until slight drag felt when turning wheel, then back off plug about 1/6 turn until wheel turns freely without any up-and-down movement, tighten lockscrew and locknut. Tighten instrument board bracket, check wheel. If movement is stiff steering column is sprung or out of alignment and must be corrected.

Cam Endplay (Shim Type):—Unscrew four clamp screws in upper cover, move cover up as far as possible (about ¼"). Separate top (.003") shim from remainder, clip and remove. Replace upper cover screws and tighten securely. Check adjustment. Wheel should turn freely (with light grip on rim) without any up-and-down movement with barely perceptible drag at mid-point. Remove additional shims, if necessary, until this adjustment secured. Shims are .003" (top), .010" (middle), .030" (bottom) thick with paper gaskets between. Do not destroy or remove gaskets between remaining shims.

Steering Column Alignment:—Loosen frame bracket bolts to permit gear to shift into alignment with instrument board bracket, tighten frame bolts. Loosen instrument board bracket bolts to allow bracket to shift to position of column, tighten bracket bolts. If bracket position not adjustable, change bracket mounting holes so that bracket is aligned with column, do not spring column to bracket.



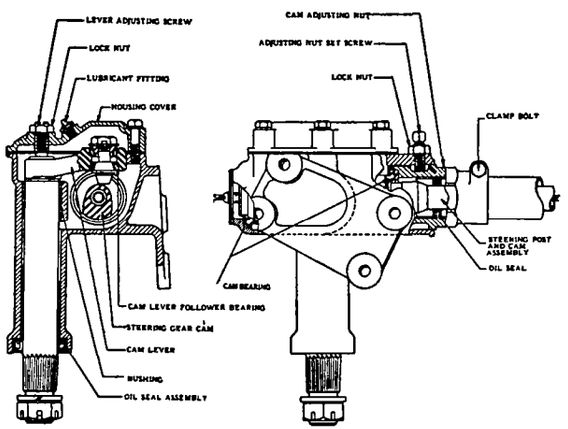
Lever Shaft Endplay (Steering Wheel Backlash):—Turn wheel to straight ahead position so that stud at high point of cam. Never adjust with stud at other points. This will cause binding at center position. Loosen locknut on side cover adjusting screw (on inner cover plate), turn screw up until slight drag felt at center position when wheel turned from one extreme to other, tighten locknut. Drag must be slight and perceptible only in midposition.

Steering Wheel Position:—With drag link disconnected at steering arm, count number of wheel revolution from extreme right to extreme left, turn wheel back ½ this number of turns so that stud is at high point of cam. Turn wheels to 'straight ahead' position, see if drag link can be engaged with ball on steering arm without turning steering wheel. If not, take off nut, pull steering arm, replace arm in position to engage drak link, tighten nut.

CAM-AND-ROLLER TYPES.

Used On:

AUBURN 8, 8-100, 100A ('32), 8-101, 105 ('33)
AUBURN 8, 850-X, Y ('34), 851 ('35), 852 ('36-37)
AUBURN SCHGD. 8, 851 ('35), 852 ('36-37)
DUESENBERG, MODELS J, SJ (1931-37)
GRAHAM 8, 57 ('32), 64, 57A (1933)
GRAHAM 6, MODEL 68 (1934), 73 (1935)
GRAHAM 8, MODELS 67 ('34), 72 (1935)
GRAHAM S'CHGD 8, 69, 67 ('34), 75 ('35)
GRAHAM S'CHGD 6, MODEL 110 (1936)
HUPMOBILE 6, 321 ('33), 421, 421A (1934)
HUPMOBILE 8, MODEL 216 (1932)
PIERCE ARROW EIGHT, ALL MODELS (1932-38)
PIERCE ARROW TWELVE, ALL MODELS (1932-38)
REO 6, S-2, 3 ('33), S-4 ('34), 7-S ('35)
REO FLYING CLOUD 6-A ('35), 6-D ('36)
STUDEBAKER PRES. 82, SPWY. PRES. 92 (1933)
STUDEBAKER COMM. B & YR. AH'D (1934)
STUDEBAKER PRES. C & YR. AH'D (1934)
STUDEBAKER COMM. 1-B, PRES. 1-C (1935)
STUDEBAKER PRES. MODEL 2-C (1936)



DESCRIPTION:—Similar in design to Cam-and-Lever Type with cam adjusting nut (see preceding article) except that tapered stud in lever shaft is mounted on double-row roller bearing and is free to turn at point of contact with lever.

ADJUSTMENT:—Cam Endplay, Steering Column Alignment, Lever Shaft Endplay or Steering Wheel Backlash, and Front Wheel Position adjusted in same manner as Cam-and-Lever Type with Cam Adjusting Nut (see following article). If these adjustments do not result in satisfactory performance, check and adjust stud roller bearing unit on lever shaft.

Stud Roller Bearing Adjustment:—Stud should have no perceptible end play and should turn with a slight drag when stud nut is gripped with the fingers (slightly tighter with new bearings). To adjust, straighten out prong in locking washer, tighten nut. If stud clamped to prevent turning, be careful not to mar or burr bearing surface of stud. Tap stud lightly to check adjustment, turn prong of locking washer up against nut (use new washer or different prong of old washer and remove prongs which have been used previously). Wash all grease out of bearing with gasoline and recheck adjustment.

ROSS CAM & TWIN LEVER TYPE

Used On:

MODEL T-12

BANTAM, MODEL 60 (1939)—FIRST CARS
STUDEBAKER CHAMPION, MODEL G (1939)

MODEL T-14

GRAHAM SUPERCHARGER, 116, 120 (1937)
GRAHAM STD. & SPEC. 96 (1938-39)
GRAHAM SUPERCHARGER 97 (1938-39)
STUDEBAKER DICT. 3A,4A ('36)—LATE CARS
STUDEBAKER DICT. 5A,6A (1937)
STUDEBAKER COMM. 7A,8A ('38), 9A ('39)
STUDEBAKER PRES. 4C ('38), 5C ('39)

MODEL T-21

STUDEBAKER PRES. 3C (1937)

NOTE:—Bantam 1939—Ross Cam-and-Lever Model S-12 (single lever type) used on later cars. See separate article for data on this type.

DESCRIPTION:—Consists of a worm-shaped cam mounted on the steering column shaft engaging two tapered studs mounted on the inner end of the cross-shaft lever. Cross-shaft is mounted on plain bushings and is adjustable for end-play. Cam is mounted on ball thrust bearings at upper and lower ends and bearing clearance or endplay is adjustable. Stud track in cam is grooved deeper at ends to provide minimum clearance at each stud in 'straight ahead' position. All adjustments must be made with wheel turned to this straight ahead position.

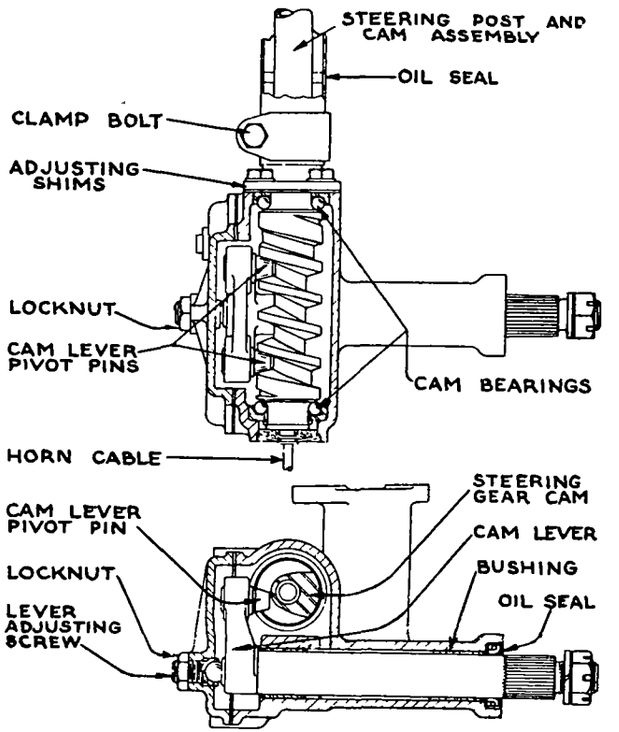
ADJUSTMENT:—Free steering gear from load by disconnecting drag link or jacking up front end of car. Loosen instrument board bracket clamp, loosen jacket tube clamp screw (if no clamp screw used, jacket tube is press-fit in adjusting plug and will turn with plug). Make following adjustments in order:

Cam Endplay (Models T-14, T-21):—Before making adjustment, loosen locknut and back off lever shaft adjusting screw (on side cover) to free lever studs in cam groove. Take out four screws in upper cover, move cover up as far as possible on steering column jacket (about ¼"), separate top .003" shim from shim pack, clip shim and remove using care not to damage paper gaskets and remaining shims. Replace upper cover screws and tighten securely. Check adjustment by turning wheel with light finger grip on rim. Wheel should turn freely with no endplay or up-and-down movement and should have barely perceptible drag at center high point of cam. Shims are .003" (top), .010" (center), .030" (lower) thick and are installed with paper gasket between each shim. Use care not to damage these paper gaskets.

Model T-12—Adjust in same manner as Model T-14 (above) except that shims are located between housing and lower cover plate at bottom of steering gear. Loosen lower cover plate to get at these shims. Shim pack consists of .003", .010", .030" shims.

Steering Column Alignment:—Loosen frame bracket bolts to permit gear to shift into alignment with instrument board bracket, tighten frame bolts. Loosen instrument board bracket bolts to allow bracket to shift to position of column, tighten bracket bolts. If bracket position not adjustable, change bracket mounting holes so that bracket is aligned with column, do not spring column to bracket.

Lever Shaft Endplay (Steering Wheel Backlash):—Turn wheel to straight ahead position so that each stud at high point of cam. Never adjust with studs at other points. This will cause binding at center position. Loosen locknut on side cover adjusting screw (on inner cover plate), turn screw up until slight drag felt at center position when wheel turned from one extreme to other, tighten locknut. Drag must be slight and perceptible only in mid-position.



Steering Wheel Position:—With drag link disconnected at steering arm, count number of wheel revolutions from extreme right to extreme left, turn wheel back ½ this number of turns so that studs are at high point of cam. Turn wheels to 'straight ahead' position, see if drag link can be engaged with ball on steering arm without turning steering wheel. If not, take off nut, pull steering arm, replace arm in position to engage drag link, tighten nut.

WORM-AND-SECTOR TYPES.

Used on:

BUICK MODEL 50 (1932).
CADILLAC V-8, MODELS 355-B, C ('32-33).
CADILLAC V-12, MODELS 370-B, C ('32-33).
CADILLAC V-16, MODELS 452-B, C ('32-33).
LA SALLE V-8, MODELS 345-B, C ('32-33).
OLDSMOBILE 6, MODELS F-32 ('32), F-33 ('33).
OLDSMOBILE 8, MODELS L-32 ('32), L-33 ('33).
PONTIAC EIGHT, MODEL 601 (1933).
WILLYS 77 (1933-34-35).

DESCRIPTION:—Consists of 'hour-glass' type worm on steering gear mounted on roller bearings in steering gear case. Worm engages sector teeth on cross-shaft lever to which pitman arm is attached. Worm provides minimum clearance at center straight ahead position with greater clearance at end positions. Adjustments provided for worm shaft endplay, cross-shaft endplay, and for sector tooth mesh in worm.

ADJUSTMENT:—Jack up front wheels, turn steering gear to 'straight-ahead position', disconnect drag link at steering gear pitman arm, disconnect horn wire from steering post jacket or mast. Make following adjustments in order:

Worm Shaft Endplay:—Evidenced as up-and-down movement of steering wheel. To adjust, turn steering wheel to extreme end position (right or left), loosen clamp bolt at upper end of housing one turn or loosen locknut and back off lockscrew, and loosen column jacket clamp screw so that large adjusting nut at top of housing may be turned. Turn adjusting nut down as far as possible without stiffening the action of steering wheel while turning through its entire range.

NOTE—Some models have additional clamp bolt above adjusting nut. This must also be loosened in making above adjustment.

Cross-Shaft Endplay:—Loosen locknut on adjusting screw on housing at inner end of cross-shaft, turn adjusting screw in until all endplay removed from cross-shaft, tighten locknut.

Worm and Sector Backlash:—Be sure that steering wheel turned to 'straight ahead position' (wheel turned back ½ of total travel from either end position). Check backlash by moving pitman arm back and forth. Loosen all the cover stud nuts, loosen nut on eccentric bolt and sleeve exactly ½ turn, turn eccentric bolt and eccentric sleeve in opposite directions simultaneously and slowly until all backlash of pitman arm has been eliminated. This adjustment must be made slowly and bolt and sleeve should not be turned past the point where backlash has been eliminated but pitman arm moves freely. Tighten eccentric bolt nut and cover stud nuts.

NOTE:—Check steering wheel after all adjustments have been made. Wheel should turn freely throughout entire range. There should be no appreciable backlash in pitman arm at center straight ahead position and slight backlash at extreme right and left end positions.

WORM-AND-ROLLER (FIRST) TYPES

Used On:

(1) BUICK MODELS 60, 80, 90 (1932).
(1) BUICK MODELS 50, 60, 80, 90 (1933).
BUICK MODELS 40, 50, 60, 90 (1934-35).
BUICK MODELS 40, 60, 80, 90 (1936).
CADILLAC V-8, MODEL 355D, SERIES 10, 20 (34-35)
(2) CADILLAC V-8, MODEL 355D, SERIES 30 ('34-35).
(2) CADILLAC V-12, MODEL 370D (1934-35).
(2) CADILLAC V-16, MODEL 452D (1934-35).
CADILLAC V-8, MODEL 60 (1936).
CADILLAC V-8, MODELS 70, 75 (1936).
CADILLAC V-12, MODELS 80, 85 (1936).
CADILLAC V-16, MODEL 90 (1936).
CADILLAC V-8, MODEL 37-75 (1937)
CADILLAC V-12, MODEL 37-85 (1937)
CADILLAC V-16, MODEL 37-90 (1937)
LA SALLE 350, SERIES 50 (1934-35).
LA SALLE 35-50 ('35), 36-50 ('36).
OLDSMOBILE 6, F-34 ('34), F-35 ('35), F-36 ('36).
OLDSMOBILE 8, L-34 ('34), L-35 ('35), L-36 ('36).
PONTIAC 6 701A, B (1935), 36-26A, B (1936).
PONTIAC 8, 603 ('34), 605 ('35), 36-28 ('36).

(1) Models (except Mod. 50) use single tooth roller.

(2) Steering Gear on these models is inverted and mounted outside frame. See special adjustment instructions listed below.

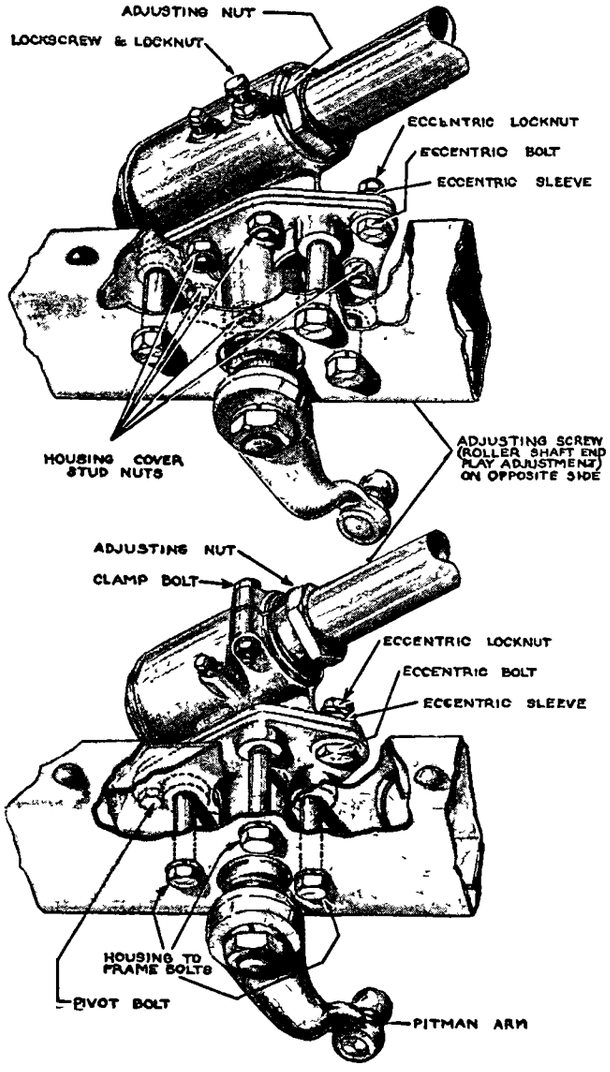
NOTE:—On 80 '36, 75, 85 '36-'37 models, steering gear is offset from steering wheel shaft and two Mechanics Model 1½C universal joints are used (see article in Mechanical Equipment Section for Universal Joint data). The offset shaft and universal joints do not affect steering gear adjustments.

DESCRIPTION:—Consists of 'hour-glass' type worm on steering shaft and carried on roller bearings in housing. Worm engages double tooth roller carried on ball bearings in cross-shaft lever. Roller is free to turn at point of contact with worm. Worm provides minimum clearance at center 'straight-ahead position' with greater clearance at ends. Adjustments provided at upper end of housing (worm bearing adjustment), inner end of cross-shaft (cross shaft endplay) and for housing cover (roller mesh in worm).

ADJUSTMENT:—Jack up front wheels, turn steering wheel to 'straight-ahead position' (wheel turned halfway back from either end position), disconnect drag link at steering gear pitman arm, note ball seat, washer and spring assembly so that they may be reassembled in same order. See that reference mark on pitman arm and shaft are lined up, if pitman arm removed, replace in correct position and tighten nut securely with 18" wrench. Loosen steering post bracket, check column alignment (shim bracket out to column if necessary) tighten bracket bolts. Make following adjustments in order:

Cross-Shaft (Roller Shaft) Endplay:—See that frame mounting bolts are tight, loosen locknut, turn adjusting screw on side of housing at inner end of cross-shaft up until all endplay removed, tighten locknut. Check by turning shaft to extreme end positions (just clear of stops) and noting that pitman arm does not drag when turned through backlash clearance.

Worm Shaft Endplay:—Evidenced as up-and-down movement of steering wheel. To adjust, turn wheel to extreme right position, loosen clamp bolt at upper end of housing one turn or loosen locknut and back off lockscrew, and loosen column jacket clamp screw so that large adjusting nut at top of housing may be turned. Turn down adjusting nut until force required to turn wheel (measured by spring scale hooked to spoke at wheel rim and tangent to rim)



SAGINAW WORM-AND-ROLLER TYPE CONT.

is 1¼ lbs. all models (except Pontiac 6 and 8 '35-36 —½-1 lbs.) Nut must be turned down only to complete adjustment. Pressure in excess of these figures indicate bearings too tight and adjustment should be backed off slightly.

Cadillac V-8, 355D Series 30, V-12 370D, V-16 452D V-16, 90. Worm shaft endplay adjustment provided by plug at lower end of steering gear. To adjust, turn wheel to extreme end position (right or left), loosen lower clamp bolt and turn plug up until 1¼ lb. pull (measured as above) necessary to turn wheel, tighten lower clamp bolt.

Worm and Roller Backlash:—Turn wheel to 'straight-ahead position' (½ total number of turns back from end position or with wheel in position noted below). Check backlash by moving pitman arm back and forth. Loosen housing to frame bolts and pivot bolt ¼ turn, or loosen housing cover stud nuts ¼ turn then loosen eccentric locknut ¼ turn, turn eccentric bolt clockwise and eccentric sleeve counter-clockwise slowly and simultaneously until backlash is taken up (approximately ⅛ turn should be sufficient). Tighten all nuts. Check by turning wheel to right and left. Back off adjustment slightly if excessive binding is encountered at high spots. Force required to turn wheel through center measured on spring scale at wheel rim should be 2¼ lbs. (all models) and there should be no appreciable backlash in pitman arm.

Cadillac V-8, 355D Series 30, V-12 370D, V-16 452D V-16, 90. Backlash adjustment of worm-and-roller provided for by worm sleeve extending from gear case along steering gear shaft. With wheel in position as noted above, loosen upper clamp bolt, turn worm (eccentric) sleeve to take up backlash. Tighten clamp bolt. Check according to directions given above (spring tension should be 2-2½ lbs.)

SAGINAW (CHEVROLET) TYPE

WORM-AND-SECTOR TYPE

Used On:

CHEVROLET STD. CC('33),DC('34),EC('35),FC('36)
CHEVROLET MSTR. CA ('33), ED ('35), FD ('36).
CHEVROLET COM.CB('33),DB('34),EB('35),FB('36)
CHEVROLET TRUCK 1½ TON O('33), P('34), Q('35) R ('36).

WORM-AND-ROLLER TYPE

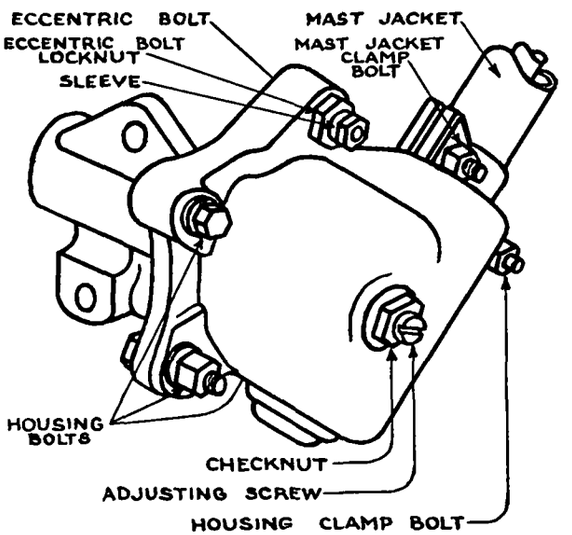
CHEVROLET MSTR. DA ('34), EA ('35), FA ('36).
CHEVROLET MASTER DELUXE GA (1937).
CHEVROLET MASTER DE LUXE MODEL HA (1938)
CHEVROLET MASTER MODEL HB (1938)
CHEVROLET MASTER DELUXE, MODEL JA (1939)
CHEVROLET MASTER '85', MODEL JB (1939)

TYPE:—Worm and Sector or Worm and Roller designs similar to other Saginaw models. Adjustments are not made in same manner as on other models and instructions below should be followed.

Worm & Roller Types. Double tooth roller forms the outer race for a double row ball bearing (all models except HB), loose needle or roller bearings (HB). On ball bearing types, inner race is made up of two sections held together by a snap ring at the center and bearing is pre-loaded to insure long life without adjustment. Roller and bearing assembly is retained in cross-shaft lever by capscrew. On the needle bearing (HB) type, side thrust is taken by a thrust washer assembled on each side of the roller. Roller and bearing assembly is retained by a riveted pin and cannot be dismantled.

1939 Master Deluxe JA—Steering shaft upper bearing in mast jacket has been changed to spring-loaded ball bearing. Ball bearing mounting ring is insulated from mast jacket and serves as horn button contact as on previous models.

ADJUSTMENT:—Jack up front wheels, turn steering wheel to straight ahead position, disconnect steering connecting rod or drag link from pitman arm (note ball seat and spring assembly so that parts may be replaced in same order). See that reference mark on pitman arm and roller shaft line up, tighten pitman arm nut with 18" wrench. Disconnect horn wire at mast jacket.



1939 Model Note—Disconnect the steering connecting rod (drag link) on Master 85 models, remove pitman arm from steering gear roller shaft on Master Deluxe models before making adjustments. Align steering column on Master model in same manner as in 1938. Master Deluxe model has new type frame mounting (roller cross-shaft vertical).

Steering Column Alignment:—Tighten dash bracket clamp, loosen frame bracket mounting bolts so that steering gear is free, check clearance between bracket and frame with feeler gauge. If clearance exceeds .031", install spacer shim, Part No. 476612, to avoid springing column when frame bolts tightened.

Worm Shaft Endplay (1933-38):—Loosen clamp on jacket at instrument board, loosen housing clamp bolt (at upper end of steering gear housing), see that adjusting sleeve clamp bolt (at lower end of mast jacket directly above housing clamp bolt) is tight, check to see that roller and worm have sufficient backlash to permit adjustment, turn mast jacket and adjusting sleeve down (grip clamp bolt with wrench) until all endplay removed from worm shaft and pull required to turn wheel is 1½-1¾ lbs. (All Models 1933-37), 1-1½ lbs. (Models HA, HB 1938) measured at wheel rim. Tighten housing clamp bolt, securely, loosen adjusting sleeve clamp bolt, turn mast jacket (sleeve will not turn if housing clamp bolt tight) until horn wire is at bottom, tighten clamp bolt and instrument board clamp bolt, connect horn wire.

1939 Models—Adjusting nut at the upper end of steering gear housing provided with hexagonal head so that adjustment simplified and should be made as follows: Loosen mast jacket clamp bolt (on lower end of jacket above housing, loosen housing clamp bolt (to free adjuster), use 1 9/16" wrench to turn adjuster at upper end of housing clockwise until all endplay removed and steering gear turns freely, tighten housing clamp bolt and mast jacket clamp bolt (not necessary to loosen instrument panel bracket clamp, do not turn mast jacket clamp when making adjustment as was required on previous models).

Roller Shaft Endplay:—Loosen locknut on engine side of steering gear housing, turn adjusting screw in until all endplay removed from roller shaft (check by shaking pitman arm), tighten locknut.

NOTE—On Master Deluxe JA (1939), this adjusting screw and locknut are located on cover on top of steering gear housing.

Worm and Roller Backlash:—Turn steering wheel to center or straight ahead position (turn wheel back one half total number of turns from either end position). Loosen three housing-to-bracket bolts, check backlash or play at pitman arm, loosen eccentric bolt locknut one half turn, turn eccentric bolt and eccentric sleeve equally in opposite directions until all backlash removed (approximately ⅛ turn should be sufficient). Tighten eccentric bolt locknut and housing bolts, check adjustment by noting pull at wheel rim required to turn wheel through center position. Should be 1¾-2½ lbs. (All Models 1933-37), 1½-2½ lbs. (1938-39 Models) measured at wheel rim. With correct adjustment wheel should have no backlash at center position but should turn freely throughout entire travel.

SERVICING:—**Removal (1939)**—On the Master Deluxe model, steering gear can be removed from car for overhaul without disturbing Vacuum Gearshift as follows: Remove horn button, steering wheel nut, steering wheel (use special puller and adapter), remove mast jacket upper bearing spring, spring seat, and bearing with horn wire. Remove mast jacket grommet from dash, loosen mast jacket instrument panel bracket clamp bolts and lower mast jacket clamp. Remove pitman arm (use J-1025 puller), loosen front screws in engine rear side pan, remove steering gear frame mounting bolts. Raise front end of car so that wheels approximately 6" off floor, pull steering gear assembly down and out of car without disturbing mast jacket.

SAGINAW (CHEVROLET) NEW TYPE

WORM-AND-SECTOR TYPE

Used On:

MASTER PASS. CAR, MODEL GB (1937)

HALF-TON, GC ('37), HC ('38), JC ('39)

¾ TON, HD ('38), JD & SPEC. JE ('39)

1 TON, HE (1938)

1½ TON, S ('37), T ('38), VA, B, C, D ('39)

1½ TON CAB OVER ENGINE, VE, F, G, H ('39)

DESCRIPTION:—New type steering gear with 'hourglass' type worm and three-tooth sector. Worm bearing adjusting screw located on lower housing cover in center of adjusting plate which controls sector mesh with worm (worm bearings mounted in eccentric sleeve which is rotated by adjuster). Sector shaft straddle mounted with additional bearing in side cover.

ADJUSTMENTS:—Jack up front wheels, turn steering wheel to straight ahead position, disconnect steering connecting rod or drag link from pitman arm (note ball seat and spring assembly so that parts can be replaced in same position). See that reference mark on pitman arm and sector shaft are lined up, tighten pitman arm nut with 18" wrench. Make adjustments in following order:

Steering Column Alignment:—Tighten dash bracket clamp bolt, loosen frame bracket mounting bolts so that steering gear is free. Check clearance between bracket and frame with feeler gauge. If clearance exceeds .031" at front or rear, install spacer shim, Part No. 476612, to avoid springing column when frame bolts are tightened.

Worm Shaft Endplay:—Tighten lower cover screws. Turn steering wheel to either end position (just clear of stops). Loosen adjusting locknut, tighten adjusting screw on lower cover until pull required to turn wheel is 1⅛ lbs. (measured at rim), tighten locknut.

Sector Shaft Endplay:—Tighten four side cover screws, loosen adjusting screw locknut, turn adjusting screw until all endplay is removed (check by shaking pitman arm), tighten locknut. Check adjustment by turning steering wheel to extreme end positions (just clear of stops), see that pitman arm does not bind.

Worm and Sector Backlash:—Tighten lower cover screws. Turn steering wheel to straight ahead position (turn wheel back one half total number of turns from either end position). Check backlash or play in pitman arm. To adjust, loosen lash adjuster lockscrew (hexagonal screw in adjuster slot), tap lash adjuster in direction of arrow above screw 1/16" at a time until pull required to turn wheel through center position is 1¾-2½ lbs. (measured at wheel rim), tighten lockscrew securely. With correct adjustment, no backlash should be evident in pitman arm at center position and wheel should turn freely throughout entire travel.

SAGINAW WORM-AND-ROLLER TYPE

Used On:

BUICK, MODELS 37-40, 60, 80, 90 (1937)
BUICK, MODELS 38-40, 60, 80, 90 (1938)
BUICK, MODELS 39-40, 60, 80, 90 (1939)
CADILLAC V8, SERIES 37-60, 65, 70 (1937)
CADILLAC V8, 38-60, 60S, 65, 75 (1938)
CADILLAC V8, 39-60S, 61, 75 (1939)
CADILLAC V16, SERIES 38-90 (1938)
CADILLAC V16, SERIES 39-90 (1939)
LA SALLE V8, SERIES 37-50 (1937)
LA SALLE V8, SERIES 38-50 (1938)
LA SALLE V8, SERIES 39-50 (1939)
OLDSMOBILE SIX, MODEL F-37 (1937)
OLDSMOBILE SIX, MODEL F-38 (1938)
OLDSMOBILE SIX '60', MODEL F-39 (1939)
OLDSMOBILE SIX '70', MODEL G-39 (1939)
OLDSMOBILE EIGHT, MODEL L-37 (1937)
OLDSMOBILE EIGHT, MODEL L-38 (1938)
OLDSMOBILE EIGHT '80', L-39 (1939)
PONTIAC SIX, MODEL 37-26CA (1937)
PONTIAC SIX, MODEL 38-26DA (1938)
PONTIAC QUALITY SIX, 39-25 (1939)
PONTIAC DELUXE SIX, MODEL 39-26 (1939)
PONTIAC EIGHT, MODEL 37-28CA (1937)
PONTIAC EIGHT, MODEL 38-28DA (1938)
PONTIAC QUALITY EIGHT, 39-28 (1939)

NOTE:—Steering Column Gear Shifts (all models)—See separate articles on 'Transmission Controls' in following section for complete adjustment and servicing data.

DESCRIPTION:—New type Steering Gear with 'hourglass' type worm and double-tooth roller. Worm bearing adjusting screw now located on lower housing cover in center of adjusting plate which controls worm mesh in roller (worm bearings mounted in eccentric sleeve which is rotated by adjuster). Roller shaft is straddle mounted with additional bearing in side cover.

ADJUSTMENTS:—Jack up front wheels, turn steering wheel to straight ahead position, disconnect steering connecting rod or drag link from pitman arm (noting ball seat and spring assembly so that parts can be reassembled in same order), see that reference mark on pitman arm and roller shaft are lined up, tighten pitman arm nut with 18" wrench, check column alignment by noting pull at steering wheel rim required to turn wheel through center position (if pull exceeds 1¾-2¼ lbs., align column as directed below.

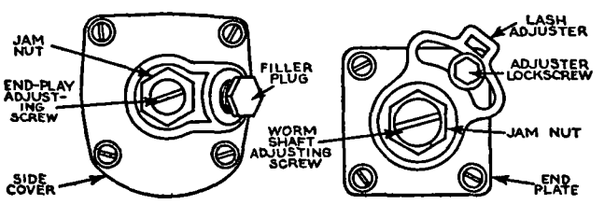
Steering Column Alignment—Loosen dash bracket (except Buick), gear mounting bolts in frame bracket (Buick). If this relieves binding, shim bracket out so that column will not be sprung when bolts are tightened.

Cadillac Models—To correct up and down alignment, install special spacer Part No. 1419066 (37-50, 60), 405554 (37-65, 70) between instrument board and bracket. To correct alignment sideways, install special washer Part No. 871588 under front steering gear housing-to-frame bolts (if column to left of bracket), or rear bolts (if column to right of bracket).

Roller Shaft Endplay:—Tighten side cover plate screws, loosen adjusting screw jam nut, turn slotted adjusting screw down tight by hand, then back screw off 5-10°, tighten jam nut. Turn wheel to each end position (not against stops), check pitman arm to see that adjustment has not caused binding.

Worm Shaft Endplay:—Loosen adjusting screw jam nut on lower cover, turn slotted adjusting screw in slowly until pull at steering wheel rim required to turn wheel in extreme end positions (just clear of stops) is 1 lb. (Buick), 1-1¼ lbs. (Cadillac), 1½ lbs. (Oldsmobile), ½-1 lbs. (Pontiac). Tighten jam nut. When making this adjustment, do not back adjusting screw out which will allow bearings to get out of alignment.

Worm and Roller Backlash:—Tighten three lower housing cover mounting screws. Center steering wheel (turn wheel back ½ total number of turns from either end position or with marked spoke straight down (Buick, Pontiac), straight up (Oldsmobile). Check backlash or play at pitman arm ball end. To adjust, loosen lash adjuster lockscrew (hexagonal screw in adjuster slot), tap lash adjuster in direction of arrow above screw, not more than 1/16" at a time, until pull at steering wheel rim required to turn wheel through center position is 1¾ lbs. (Buick), 2-2½ lbs. (Cadillac), 1¾-2¼ lbs. (Oldsmobile), 1½-2 lbs. (Pontiac). Check for high spots by rotating steering wheel throughout range. Back off lash adjuster just enough to permit wheel to be turned through these high spots without excessive binding.



STEERING WHEEL POSITION:—See articles on Independent Suspension for tie rod adjustment to correct intermediate steering arm position. Steering wheel height and position adjustments as follows.

Buick 1937 Models:—Height is not adjustable as long (left hand) dash bracket bolt burred to prevent removal. If this bolt is removed, standard ⅜" spacer on dash bracket (80, 90 only) may be removed or replaced by spacers furnished ¼", ½", ⅝" thick to provide ½" wheel height variation. Loosen gear frame bracket bolts to permit steering gear to shift into alignment with new bracket position. Marked spoke on steering wheel (mark on under side of spoke at hub) should be straight down with roller on midpoint of worm and wheels straight ahead (drag link connected). Drag link not adjustable, but tie rods can be turned not more than 1 turn to throw intermediate steering arm 3/16" maximum off center, which will rotate steering wheel 2⅞" at rim, to correct spoke location. Wheel stops must be relocated to prevent intermediate steering arm striking cross-member.

Buick 40, 60 (1938):—Steering wheel height not adjustable but wheel can be raised 13/16" by installing 38-80 r 90 steering column bracket. When in-

WORM-AND-ROLLER (LATER) TYPES CONT.

stalling this bracket, elongate two rear steering gear mounting holes in frame ⅛" at upper end (do not touch front hole which locates gear), cut out dash mat, floor mat, and steering column floor felt pad and make certain that clearance between steering column and dash flange and toeboard is ¼", slot instrument panel holes if required so that bracket can be shifted to secure satisfactory lock operation.

NOTE—On models with Self-shifting Transmission, control lever housing will make it difficult to remove steering wheel unless new type puller J-1120 is used.

Steering Wheel Position. Intermediate steering arm not used on these models, steering gear pitman arm being connected directly to right hand wheel by long tie rod which has seat for short left hand tie rod near pitman arm end. Tie rods adjusted by loosening clamp bolt and turning threaded sleeve at wheel end of each rod (rods should be adjusted equally). If indented spoke on steering wheel more than ¾" from straight down position, adjust by lengthening one tie rod and shortening opposite tie rod equal amount (to avoid disturbing toe in). One complete turn of each adjusting sleeve will move wheel 2¼" at rim.

Buick 80, 90 (1938):—Adjusted in same manner as 1937 models (change spacer on dash bracket to adjust wheel height, shorten one tie rod and lengthen opposite rod not more than one complete turn which will shift wheel rim 2⅞" and throw intermediate steering arm 7/32" off center to center indented spoke). Intermediate steering arm bearing pre-load should be set at 4-5 lbs.

Buick 1939:—Wheel height not adjustable. Use special puller J-1120 (used for 1938 cars with self-shifting transmission) to remove steering wheel. Install wheel so that notch in steering tube (on right side) is in line with locating mark on wheel (this mark 90° counter-clockwise from marked spoke on solid-spoke wheels and in line with mark on underside of hub on flexible-spoke wheels).

Cadillac, LaSalle 1939:—Install steering wheel with middle spoke vertical and in line with notch in end of steering column shaft. On 39-75 and 39-90 cars, clamp bolt holding lower universal joint on worm shaft should be horizontal in this position. When installing horn button cap, see that emblem is horizontal.

Oldsmobile 1937:—Spoke opposite mark on hub (visible with horn button removed) should be straight up with roller on midpoint of worm and wheels straight ahead. Correct by removing wheel and changing its position on serrations in hub. Mark on steering column shaft must be in line with keyway.

Oldsmobile 1938:—Standard (3 spoke) wheel should be assembled with spoke opposite mark on hub (visible with horn button removed) straight down with roller on midpoint of worm and wheels straight ahead. Correct by removing wheel and shifting position on shaft serrations (mark on shaft should be lined up with hub mark). On the two spoke (bar type) steering wheel, bar should be horizontal in center position.

Oldsmobile 1939:—Install steering wheel with mark on hub in line with mark on shaft and spoke which is next to horn button connector pointing down (two widely spaced spokes will be up). Steering linkage is same design as used on La Salle (see preceding paragraph).

Pontiac 1937-38:—Steering wheel should be assembled with one spoke straight down within 5° with roller on midpoint of worm and wheels straight ahead. Keyway should be in line with this spoke and emblem on wheel should read across horizontally.

Pontiac 1939:—Install the steering wheel with key on shaft pointing up and two wide-spaced spokes horizontal in straight ahead position (narrow spaced spoke must point straight down within 5°). Steering linkage same design as used on La Salle (see Cadillac-La Salle paragraph above). If idler arm dismantled, turn bushing in on mounting stud so that distance from top face of arm to shoulder on support is exactly 23/32" when reassembled.

SPECIAL SERVICE NOTES:—Check following points when adjusting or servicing steering gear and linkage:

Intermediate Steering Arm:—On Independent Suspension cars with intermediate steering arm (not used on all models), see that intermediate steering arm is parallel to center-line of car with steering gear roller on high point of worm and front wheels in straight ahead position. When servicing linkage check these points:

Buick 1937-38 Intermediate Steering Arm Bearing—Adjust bearing pre-load by turning nut on bearing shaft so that force required to turn arm is 1½ lbs. Max. (40,60 '37), 3-4 lbs. (80,90 '37), 4-5 lbs. (80,90 '38) measured at ball stud end of arm with drag link and tie rods disconnected. NOTE—No intermediate steering arm used on 40,60 '38 or 1939 models.

Cadillac 37-50, 60 (1937)—Springs in the steering connecting rod at steering gear arm pivot were changed in production. New type is longer and heavier. Install new type springs (Part No. 263699) to correct chucking noise when driven over rough roads (first cars only). Check intermediate steering arm looseness if steering rattles develop. If tightening of the pivot bolt on cross-member does not correct looseness, install special shim, Part No. 1300203, at bottom of steering arm pin before tightening bolt.

Cadillac, LaSalle 1939—New type steering linkage used on Cadillac 39-61 and La Salle. Consists of drag link connected between steering gear pitman arm and idler lever on right frame side rail with individual tie rods linked between drag link and each front wheel. Toe in adjustments made in same manner as on previous models (adjust both tie rods equally to insure steering gear roller being on high point of worm in straight ahead position).

Cadillac, LaSalle Intermediate Steering Arm Rattles (1938-39)—On Models 38-50, 38-60, 39-60S, check intermediate steering arm for looseness if rattles develop in steering system. Tighten bolt on lower face of frame cross-member moderately tight. If this does not correct rattle, install additional shim at bottom of steering arm pivot pin.

Cadillac 75 & 90 Universal Joints—To correct chuckling noise caused by lower universal joint striking steering gear case, loosen universal joint clamp-screw, use bar or heavy screwdriver to force universal yoke up approximately 1/32", hold in this position and tighten clamp bolt. NOTE—If lower joint yoke cannot be forced up on shaft, loosen clamp bolt holding upper universal joint upper yoke on steering column shaft, force assembly downward and tighten clamp bolt. It should then be possible to raise lower joint lower yoke without trouble.

Steering Linkage Adjustments:—On 1939 cars with special idler arm type linkage, adjust idler arms as follows:

Cadillac 39-50, 39-61—Idler arm mounted on threaded bushing screwed in lever and secured by lock ring. When installing idler arm, tighten idler arm support additional ¼-1¼ turns after it seats firmly against the rubber bushing.

Oldsmobile 1939—Idler arm mounted on frame support by bushing which is threaded on support and in arm. If arm removed, install so that clearance between upper face of arm and shoulder on support is exactly 23/32". Assembly will be simplified if bushing first screwed in idler arm so that it is tight, and support removed from frame and screwed into bushing until clearance is correct.

Pontiac 1939—Idler arm mounting same as Oldsmobile. See Oldsmobile directions above for assembly and arm clearance (23/32").

GEMMER WORM-AND-SECTOR TYPE

Model 120

WILLYS, 440 PICK-UP, 440P PANEL DELVRY. ('40)

This Steering Gear same as type used on 1939 Willys.

ADJUSTMENT & SERVICING:—All adjustments made in same manner as on previous Gemmer 120 models. *See Gemmer Worm-and-Sector Steering Gear article in Mechanical Equipment Section of manual for complete data.*

GEMMER (LINCOLN V12) MODEL WORM-AND-ROLLER TYPE

Used On:

LINCOLN, V12 MODEL (1940)

This Steering Gear same design as on previous Lincoln V12 models.

ADJUSTMENT & SERVICING:—Same as for previous models. *See 'Gemmer Lincoln V12 Model, Worm-and-Roller Type' steering gear article in Mechanical Equipment Section of manual for complete data.*

GEMMER WORM-AND-ROLLER TYPES 250, 330, 370

Model 250—See Note

WILLYS, 440 SPEEDWAY & DELUXE PASS. CARS (1940)

Model 330

LINCOLN-ZEPHYR, MODEL 06H (1940)

Model 370

FORD, BUS MODELS (1940)

Special Types—See Note

DODGE, D14 & D17 ('40)—EXCEPT 7 PASS SEDAN
PLYMOUTH, P9 & P10 ('40)—EXCEPT 7 PASS. SEDAN
PACKARD SIX, '110' MODEL 1800 (1940)
PACKARD EIGHT, '120' MODEL 1801, 1A, (1940)
PACKARD SUPER 8, '160' 1803, 3A, 4, 5 (1940)
PACKARD CUST. SUPER 8, '180' 1806, 7, 8 (1940)
These Steering Gears same design as used on corresponding 1939 car models (except Willys).

NOTE:—Model 250 (Willys)—This is a new model which is similar to Model 300 except for size and fact that worm is mounted on ball bearings (each bearing takes thrust in one direction). This model adjusted and serviced in same manner as other models.

Dodge & Plymouth Models—These steering gears built by Chrysler but are similar in design to Gemmer Model 300 and adjusted in same manner. Steering gear on 7 Pass. Sedans is Gemmer Model 305 with push-pull adjustments (see following article for data).

Lincoln-Zephyr Model 330—This model has straddle mounted roller shaft with additional shaft bushing mounted in side cover on housing. Adjusted in same manner as other models.

Packard Models—These steering gears built by Packard but similar in design to Gemmer Model 330 and adjusted in same manner.

ADJUSTMENT & SERVICING:—Except for new specifications and adjustment data below, these models serviced in same manner as on previous cars. *See 'Gemmer Worm-and-Roller Type' steering gear article in Mechanical Equipment Section of manual for complete data and adjust as follows:*

Worm Shaft Bearing Adjustment—Loosen lower cover screws, separate and remove top shim (use care not to damage remaining shims), tighten cover screws and check adjustment. Steering wheel should turn freely without stiffness (if stiffness still evident after steering column alignment checked, worm bearings are too tight). On Dodge & Plymouth models, wheel should turn with ½-1 lb. pressure on rim with cross-shaft out of housing (worm bearing drag only). On Packard models, wheel should turn with 1½ lbs. min., 2¼ lbs. max. pressure at rim except at center 'high' point of worm.

Roller Shaft Endplay—To check, turn wheel to end position and back ⅛ turn. Check endplay at hub of pitman arm (with drag link disconnected). To adjust, loosen locknut and turn adjusting screw on side cover just enough to take up all endplay, tighten locknut. Check to see that steering gear turns through entire range freely but without evident endplay.

Roller Mesh in Worm—To check, place steering wheel in mid-position with roller on 'high' point of worm (count number of turns from one end position to the other, then turn wheel back ½ this number of turns), check play or lost motion at end of pitman arm. If this exceeds 1/32", roller mesh in worm should be adjusted. To adjust, dismantle steering gear and remove roller shaft from housing, remove shim from shoulder on shaft and housing so that play at end of pitman arm will be not more than .006" when reassembled and steering gear will turn freely without excessive drag. On Dodge & Plymouth models, wheel should turn through center position with 1½-3½ lbs. pull on rim (including ½-1 lb. pull required for correct worm bearing adjustment—above). On Packard models, pull of 3-4½ lbs. on rim of wheel should be required to turn wheel through center position. CAUTION—Make certain that thick thrust washer (between adjusting shims and shoulder on roller shaft) installed with bevel face toward roller (away from splined end of shaft. Use special thimble (Packard ST-5032) or wrap splined end of roller shaft with tape when installing roller shaft in housing to avoid damage to oil seal.

Steering Wheel Position (Packard):—Steering wheel height not adjustable but can be raised or lowered by installing instrument panel bracket from other models as follows: **Six**—Wheel cannot be lowered but can be raised approximately ⅝" by installing 1801 steering colum bracket. **Eight & Super Eight**—Wheel cannot be raised but can be lowered ⅝" by installing 1800 steering column bracket.

Steering Linkage (Dodge & Plymouth):—Steering gear arm connected directly to each wheel by separate long (right hand), short (left hand) tie rod. Toe-in adjustments should be made by shortening or lengthening both tie rods equally. If steering gear roller not on 'high' mid-point of worm with wheels in straight ahead position (after toe-in adjustment completed), correct steering gear position by lengthening one tie rod and shortening other tie rod exactly equal amounts (to avoid disturbing toe-in adjustment).

Packard Models—Intermediate steering arm used with individual tie rod for each wheel. If steering gear roller not on 'high' midpoint of worm and intermediate steering arm not centered with wheels straight ahead, check tie rod lengths (must be equal within ⅛") and correct by lengthening one rod and shortening other exactly equal amount (to avoid disturbing tie rod adjustment). Intermediate steering arm bearing is pre-loaded by spring washer on top (nut end) of arm shaft. Bearing not adjustable and nut should be tightened until it bottoms on bearing shoulder.

GEMMER WORM-AND-ROLLER WITH PUSH-PULL ADJUSTMENT TYPES 305, 335

Model 305

CHRYSLER 6, C25 ROYAL & WINDSOR (1940)
DE SOTO, S7 CUSTOM & DELUXE (1940)
DODGE, D14 7 PASS. SEDAN ONLY (1940)
FORD, ALL '60' & '85' MODELS (1940)
HUDSON SIX, 40T TRAVELER, 40P DELUXE ('40)
HUDSON, SUPER 6 41, COUNTRY CLUB 6 43 ('40)
HUPMOBILE, SKYLARK MODEL (1940)
MERCURY, MODEL 09A (1940)
NASH-LAFAYETTE, MODEL 4010 (1940)
NASH SIX, MODEL 4020 (1940)
PLYMOUTH, P10 7 PASS. SEDAN ONLY (1940)

Model 335

CHRYSLER 8, C26 TRAV., SARATOGA, NEW YORKER (1940)
CHRYSLER 8, C27 CROWN IMPERIAL (1940)
HUDSON, EIGHT 44, COUNTRY CLUB 47 (1940)
NASH EIGHT, MODEL 4080 (1940)

These Steering Gears same design as used on corresponding 1939 car models except as noted below.

NOTE:—Dodge, Plymouth (other models)—Steering gear on other models similar to Gemmer Model 300. See preceding article for data.

Hudson—All models now have Independent Suspension and new type steering linkage. Steering gear reversed on frame (steering arm end of roller shaft in toward engine) and hand hole provided in left frame side rail for access to roller shaft endplay adjustment screw. Steering wheels are two-spoke type.

Nash & Nash-Lafayette—All models now have Independent Suspension and new type steering linkage (see Steering Linkage data below).

ADJUSTMENT & SERVICING:—Except for new specifications and adjustment data below, these models serviced in same manner as on previous cars. *See 'Gemmer Worm-and-Roller Type with Push-Pull Adjustment' steering gear article in Mechanical Equipment Section of manual for complete data and adjust as follows:*

Worm Shaft Bearing Adjustment—Loosen lower cover screws, separate and remove top shim (use care not to damage remaining shims), tighten cover screws and check adjustment. Steering wheel should turn freely without stiffness with drag link disconnected (if stiffness still evident after steering column alignment checked, worm bearings are too tight). On Chrysler, DeSoto, Dodge, Plymouth models wheel should turn with ½-1 lb. pull on rim with cross-shaft out of housing (worm bearing drag only).

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Roller Mesh in Worm—To check, turn steering wheel so that roller on 'high' mid-point of worm (count number of turns from one end position to the other, then turn wheel back ½ this number of turns, or place steering wheel in straight ahead position as directed below), shake steering arm to determine play or lost-motion at ball end (with drag link disconnected). If lost-motion exceeds 1/32", adjust as follows: Remove roller shaft adjustment screw locknut on steering gear side cover (accessible through hole in frame rail on Hudson models), slide lock plate off far enough to clear lock boss on cover, tighten adjusting screw just enough to eliminate steering arm lost-motion but without causing roller to bind on worm (slight play preferable to any binding), slide lock plate into position so that it engages boss on cover, install and tighten locknut. Check to see that steering wheel turns freely through entire range without binding. On Chrysler, DeSoto, Dodge, Plymouth models, wheel should turn through this center 'high' point with 1½-3½ lbs. pull on rim of wheel (this pull includes ½-1 lb. worm bearing drag).

NOTE—No separate adjustment required for roller shaft endplay (shaft controlled in both directions by above push-pull adjusting screw).

Steering Wheel Position (Hudson):—Notch in end of shaft should point straight down (visible with horn button and contact plate removed) and steering wheel spokes should be horizontal with roller on 'high' mid-point of worm. If wheel position not correct, adjust by shifting shims from one ball seat to the other in the steering arm end of the drag-link.

Nash & Nash-Lafayette—Steering wheel marked on underside of hub and mark should point straight down with roller on 'high' mid-point of worm.

Steering Linkage (Chrysler, DeSoto, Dodge, Plymouth models):—Steering gear arm connected directly to each wheel by long (right hand), short (left hand) tie rod. Toe-in adjustments should be made by shortening or lengthening both tie rods equally. If steering gear roller not on 'high' mid-point of worm with wheels in straight ahead position (after toe-in adjustment completed), correct steering gear position by lengthening one tie rod and shortening other rod exactly equal amount (to avoid disturbing toe-in adjustment).

Hudson—Center-point steering type linkage with intermediate steering arm on center of front crossmember and individual tie rods between this arm and each wheel. Toe-in adjustments should be made by lengthening or shortening both tie rods equally so that tie rod lengths equal and intermediate steering arm centered with wheels in straight ahead position. If steering wheel position not correct, adjust as directed above.

Nash & Nash-Lafayette—Center connecting rod linked between steering gear arm and idler arm on right frame side rail with individual tie rods from this connecting rod to each wheel. Toe-in adjustments should be made by lengthening or shortening both tie rods equally. If steering gear roller not on 'high' mid-point of worm with wheel straight ahead, correct by lengthening one tie rod and shortening other tie rod equally (to avoid disturbing toe-in adjustment).

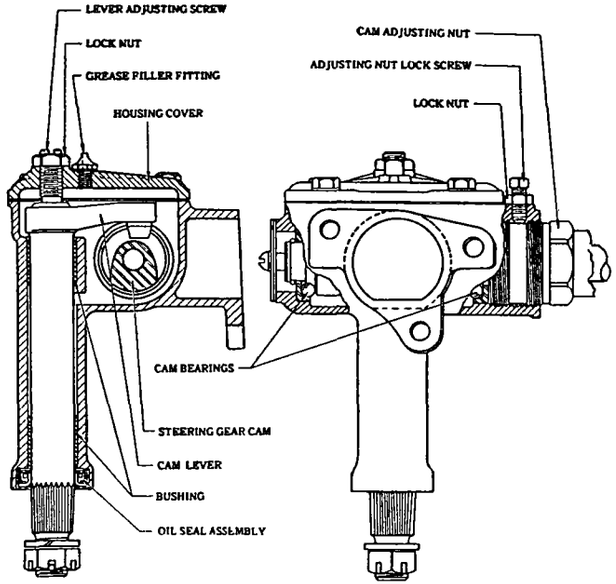
ROSS CAM & LEVER AND CAM & TWIN LEVER TYPES

CAM-AND-LEVER TYPE
Model S-12
BANTAM, SERIES 63 & NEW SUPER FOUR 65 ('40)
CROSLEY, MODEL A (1939-40)

CAM-AND-TWIN LEVER TYPES
Model T-12
STUDEBAKER CHAMPION, MODEL 2G (1940)
Model T-14
GRAHAM SENIOR, 107 SCHGR., 108 SPEC. (1940)
STUDEBAKER COMMANDER, MODEL 10A (1940)
STUDEBAKER PRESIDENT, MODEL 6C (1940)
These Steering Gears same design as previous Ross Models.

DESCRIPTION:—Same design as previous S-12, T-12 & T-14 models.

ADJUSTMENT:—Before making adjustments, free steering gear from load by jacking up front wheels or disconnecting drag link (see Studebaker Steering Linkage data below). Check steering gear alignment by loosening instrument panel bracket.



Cam Endplay—Check up-and-down movement of steering wheel and shaft in column jacket with steering wheel in center position and lever studs on high points of cam. If movement perceptible adjust by removing four retaining screws in top cover on upper end of steering gear housing, move cover up on column jacket as far as possible (about ¼"), clip and remove one shim (shims are .003", .010", .030" thick and are assembled with paper gaskets between them) using extreme care not to damage remaining shims, tighten cover screws and check adjustment. Wheel should turn through center position with barely perceptible drag (thumb and finger grip on rim) and should not bind in any position.

Cam and Lever Backlash—Check end-play or lost-motion of lever shaft at pitman arm with steering gear turned to center position with lever studs on high points of cam. If play evident, adjust by loosening locknut on steering gear housing side cover and turning adjusting screw in until play just taken up and steering wheel turns freely throughout entire range with barely perceptible drag at center position, hold adjusting screw and tighten locknut. CAUTION—This adjustment should be made only with lever studs on high points of cam (straight ahead position). If adjusted in any other position, gear will bind at this center point.

Steering Wheel Position (Studebaker):—Center spoke should point straight down with lever studs on high points of cam. To check, count number of turns of the wheel from one extreme end position to the other, then turn wheel back exactly ½ this number of turns. If spoke does not point straight down, remove wheel and re-install on shaft in correct position. See linkage data below for steering gear pitman arm installation and location.

Other Models—Before connecting drag link, turn steering wheel to center position with lever stud on high point of cam (count number of turns of wheel from one end position to the other, then turn back ½ this number of turns), place front wheels in straight ahead position, then connect drag link without disturbing position of steering gear or front wheels.

Steering Linkage (Studebaker):—Steering gear pitman arm is special insulated type (see data below) and tie rod for left wheel is connected directly to this arm. A connecting rod is linked between the steering arm and an idler lever on the right frame side rail with tie rod for right hand wheel connected to this idler lever. This design similar to type used in 1939 but adjustments must be made differently as follows: See that punchmarks on end of steering gear lever shaft and steering arm adapter (short arm on shaft to which insulated steering arm is bolted) are in line and adjacent to each other. Set steering wheel in center position with lever studs on high points of cam (see Steering Wheel Position above), loosen clamp bolts on **left hand tie rod** (between steering arm and left wheel), turn this left hand rod until left front wheel is straight ahead (wheel should be parallel to rear wheel but ⅜" in on Champion, ⅝" in on Comm. and Pres. due to wider rear tread), tighten clamp bolts. Then make toe-in adjustment by turning **right hand tie rod only** without disturbing position of left hand tie rod after it has been correctly set for straight ahead position.

Insulated Steering Arm—On Champion, insulated steering arm can be removed by taking off nuts on two studs (on which neoprene insulators are mounted) without disturbing position of adapter on steering gear lever shaft. If adapter being removed, use puller J-871 and make certain that punchmarks on shaft and adapter lined up when adapter replaced. On Commander & President, pull insulated steering arm and adapter as an assembly using puller J-871 after removing cotter pin, nut and washer from lever shaft and disconnecting left tie rod and connecting rod from steering arm. Assembly can then be dismantled by taking off nuts on two mounting studs. When reassembling, tighten nuts on studs until washers seat against shoulders on studs. See that punchmarks on adapter and end of steering gear lever shaft line up when assembly installed.

Connecting Rod Idler Arm—Spring washer used on upper end of idler lever stud on Commander and President models to prevent idler lever rattles. This spring washer not used on Champion and idler lever stud nut should be tightened just enough to eliminate all up-and-down play of lever without causing lever to bind in bracket.

SAGINAW WORM-AND-ROLLER TYPES

Used On:

BUICK, SERIES 40-40,50,60,70,80,90 (1940)
CADILLAC V8, SERIES 40-60S, 62, 75 (1940)
CADILLAC V16, SERIES 40-90 (1940)
LA SALLE V8, SERIES 40-50, 52 (1940)
OLDSMOBILE 6, '60' F-40, '70' G-40 (1940)
OLDSMOBILE 8, '90' L-40 (1940)
PONTIAC SIX, 40-25 & 40-26 (1940)
PONTIAC EIGHT 40-28, TORPEDO 40-29 (1940)

These Steering Gears same design as used on corresponding 1939 car models.

NOTE:—**Cadillac 40-72**—Steering gear on this model is new Saginaw 'Recirculating Ball Type'. See separate article (preceding) for data on this type.

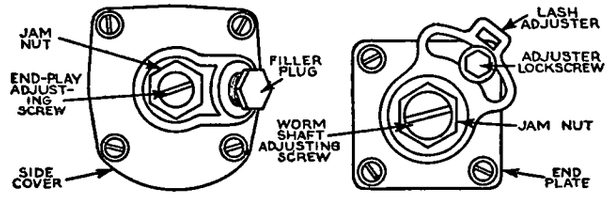
SPECIAL SERVICE NOTES:—**Cadillac 40-75 & 90**—To correct 'chuckle' in steering gear shaft universal joints, loosen clampscrew holding lower joint on steering worm shaft, use pinch bar or heavy screwdriver inserted between lower yoke and top of steering gear case to force yoke up approximately 1/32", tighten clampscrew. NOTE—If yoke cannot be forced up, loosen clampscrew locking upper universal joint upper yoke on steering wheel shaft, force top yoke down and tighten clampscrew. This will make it possible to adjust lower joint as above.

ADJUSTMENT & SERVICING:—Except for specifications and adjustment data below, these models serviced in same manner as on previous cars. ***See 'Saginaw Worm-and-Roller Type' steering gear article in Mechanical Equipment Section of manual for complete data and adjust as follows:***

Roller Shaft Endplay—If endplay perceptible with steering wheel turned to within ⅛ turn of either end position, adjust as follows: Tighten retaining screws on steering gear housing side cover (faces up on some models), loosen adjusting screw locknut, turn adjusting screw in until endplay is just taken up, hold screw and tighten locknut. Check to make certain that wheel revolves freely without binding.

Worm Shaft Endplay—Turn steering wheel to within ⅛ turn of either end position, loosen locknut on adjusting screw at center of lower cover, turn adjusting screw (adjusting nut on Cadillac 75, 90) in until steering wheel turns with pull of 1 lb. max. (Buick), ¾-1 lb. (Cadillac—1-1¼ lbs. on cars driven less than 1000 miles), 1-1½ lbs. (Oldsmobile), ⅜-⅝ lb. (Pontiac) measured at steering wheel rim with wheel turned near the end position. Hold adjusting screw and tighten locknut, recheck pull with locknut tightened. CAUTION—Do not back adjusting screw out which will allow bearings to get out of alignment.

Worm and Roller Backlash—Turn steering wheel to center position with roller on 'high' mid-point of worm (see Steering Gear Position adjustment below), tighten lower cover screws, loosen lash adjuster lockscrew on lower cover (hexagonal headed capscrew in lash adjuster slot), tap lash adjuster in direction of arrow cut in adjuster above lockscrew not more than 1/16" at a time until pull required to turn steering wheel through center 'high' position is 2½ lbs. max. (Buick), 1½-2 lbs. (Cadillac—2-2½ lbs. on cars driven less than 1000 miles), 1¾-2¼ lbs. (Oldsmobile), 1¼-1¾ lbs. (Pontiac), tighten lash adjuster lockscrew. Check to see that wheel turns freely throughout range without binding. CAUTION—Lash adjuster must not be tightened beyond maximum figure given above, and lash adjuster should be tightened only when making this adjustment (do not back adjuster off).



Steering Wheel Position (Buick):—Steering wheel spoke with small indentation on underside near hub should point straight down with roller on high point of worm and wheels in straight ahead position. If wheel position incorrect, see that mark on steering tube (visible with horn ring and cover removed) is toward indented spoke. CAUTION—Directional signal switch must be in 'off' position whenever steering wheel removed or replaced.

Cadillac—Center steering wheel spoke should point straight down and roller should be on high point of worm (within 10°) with wheels straight ahead. Adjust by changing tie rod lengths (see Steering Linkage Adjustment below).

Oldsmobile—On three-spoke wheels, spoke next to horn button connector opening should point straight down with roller on high point of cam and wheels in straight ahead position (mark on hub should be adjacent to and in line with mark on shaft). Adjust by removing wheel and changing position on shaft. Make certain that steering wheel nut staked to prevent loosening when wheel reinstalled.

Pontiac—Lower center spoke of wheel should point straight down within 5° with roller on high point of worm and wheels in straight ahead position. Steering wheel emblem must be horizontal.

Steering Linkage (Buick 40, 50, 60, 70):—Design same as 1939 type (long right hand tie rod between steering arm and right wheel, short left hand tie rod between other tie rod and left wheel). Adjuster at wheel end of each tie rod should be turned equally when making toe-in adjustments. If steering gear roller not on high mid-point of worm with wheels straight ahead, correct by lengthening one tie rod and shortening other tie rod equally (so that toe-in adjustment not disturbed).

Buick 80, 90—Same design as 1939 (intermediate steering arm and individual tie rod for each wheel). Both rods must be adjusted equally when making toe-in adjustment to insure intermediate steering arm being centered and steering gear roller on high mid-point of worm (check tie rod lengths if wheel position incorrect). Intermediate steering arm mounted on ball bearings which are pre-loaded by mounting bolt nut adjustment. To adjust pre-load, tighten nut on lower end of mounting bolt until pull of 4-5 lbs. (at steering connecting rod ball stud—rod must be disconnected) required to turn arm. Pre-load held constant in service by spring washer under nut.

Cadillac 60S, 62; LaSalle—Linkage same as 1939 (connecting rod between steering gear arm and idler lever on right side of frame, individual tie rods from connecting rod to each wheel). Tie rods should be adjusted equally when setting toe-in. If steering wheel position not correct and steering gear roller not on high mid-point of worm with wheels in straight ahead position, correct by shortening one tie rod and lengthening other tie rod equally. Recheck toe-in. Idler lever is threaded in bushing and idler arm support should be tightened ¼-1¼ turns after it seats firmly against rubber bushing.

Cadillac 75 & 90—Linkage same as 1939 (intermediate steering arm on cross-member with individual tie rod to each wheel). Tie rods should be adjusted equally when adjusting toe-in. If steering wheel position not correct or steering gear roller not on high mid-point of worm with wheels straight ahead, check tie rod lengths and adjust by lengthening one rod and shortening other rod. Recheck toe-in. Intermediate steering arm mounted on ball bearings. If arm disassembled, pack bearings with G-12 wheel bearing grease and tighten nut on mounting bolt just enough to eliminate bearing play but without causing arm to bind.

Oldsmobile & Pontiac—Linkage same as 1939 (connecting rod between steering gear arm and idler lever on right side, individual tie rods from connecting rod to each wheel). Idler arm mounting has been changed and bushing is now threaded in arm and on support. Arm must be assembled as follows: Remove arm support from frame, screw bushing into idler arm and tighten securely, install seal on support and screw support into bushing until distance from shoulder on support to top face of arm is 23/32", then install assembly on frame.

SAGINAW RECIRCULATING BALL TYPE

Used On:

CADILLAC V8, SERIES 40-72 (1940)

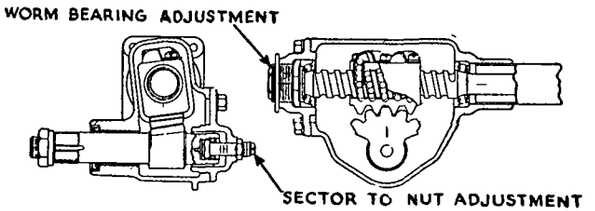
NOTE:—**Cadillac (Other Models)**—Steering gears are Saginaw Worm-and-Roller Type. See following article for data.

DESCRIPTION:—New design Worm-and-Nut type steering gear with circulating ball contact. Balls are assembled in groove between worm and nut in two groups with return channels assembled on back of nut so that balls are free to move through circuit as nut moves up and down on worm (each circuit has 33 balls of which 23 or a total of 46 in both circuits carry the load). Gear teeth on nut mesh with sector teeth on cross-shaft so that cross-shaft (and steering gear pitman arm) rotate as the steering wheel is turned and the nut moves up and down on the steering shaft worm.

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ADJUSTMENT:—Worm Bearings—Disconnect drag link at pitman arm, loosen steering column bracket, loosen locknut and back off pitman shaft adjusting nut a few turns (this adjusting nut on side cover on lower side of housing). Turn steering wheel to within 1 turn of extreme end of travel (CAUTION—do not turn steering wheel hard against stops which will damage ball return mechanism). Loosen locknut and turn worm bearing adjusting screw (on bottom endplate of housing) until pull at wheel rim required to turn wheel is ¾-1 lb. (1-1¼ lbs. on cars driven less than 1000 miles), hold adjusting screw and tighten locknut. Check clearance at steering column bracket to determine if column will be sprung when bracket screws tightened (if clearance at this point, loosen frame mounting bolts to allow steering gear to shift into alignment, or shim bracket), tighten steering column bracket. Recheck worm bearing adjustment setting.



Pitman Shaft End-play (Nut and Sector Mesh)—Turn steering wheel to center position with nut on high point of gear. Tighten pitman shaft adjusting nut on lower side cover until pull at wheel rim required to turn wheel through high point is 1½-2 lbs. (2-2½ lbs. on cars driven less than 1000 miles), hold adjusting nut and tighten locknut.

NOTE—This is push-pull type adjustment and controls pitman arm shaft endplay as well as gear mesh.

Steering Wheel Position:—Center steering wheel spoke should point straight down and nut should be on high point of gear (within 10°) with wheels in straight ahead position. Adjust by lengthening one tie rod and shortening other tie rod equally. Check toe-in after making this adjustment.

SERVICING:—Disassembly—Remove steering wheel, disconnect drag link at pitman arm, remove steering gear and column assembly from car. Remove steering column upper bearing. Loosen locknuts and back off both adjusting screws (on lower side and bottom cover plates). Remove screws on side cover and pull cover approximately 2" out of housing so that pitman arm shaft and sector gear will be disengaged from nut. Take out bottom cover screws, remove cover, lower worm bearing, cup and thrust washer. Pull steering worm and nut assembly out through lower end of housing. CAUTION—Hold shaft in horizontal position and use extreme care that nut is not allowed to run down on worm against stops which will damage ball return mechanism (nut will move of own weight if shaft tilted or vertical). Manufacturer recommends that worm nut and balls not be disassembled.

Reassembly—Replacement shaft and nut assemblies are taped to prevent nut moving on worm. When removing tape, hold shaft horizontally and use extreme care that nut does not run down on worm against stops which will damage ball return mechanism. Install shaft and nut assembly in steering gear housing, replace worm bearing, cup, thrust washer, gasket, bottom cover plate, insert and tighten cover screws. Install upper bearing spring seat and spring, bearing washer, cotter pin, steering wheel. Adjust worm bearings (see Adjustment above). Rotate steering wheel until nut in center of travel so that center tooth of pitman arm shaft sector gear will engage center tooth space on nut, push shaft and side cover into place, tighten cover screws. Fill housing with steering gear lubricant, re-install steering gear in car.

SAGINAW (CHEVROLET PASS. CARS) WORM-AND-ROLLER TYPE

Used On:

CHEVROLET, KA, KB, KH PASS. CARS & SEDAN DELIVERY MODELS (1940)

These Steering Gears same design as used on 1939 car models.

ADJUSTMENT & SERVICING:—Except for specifications and adjustment data given below, these models serviced in same manner as on previous cars. *See 'Saginaw (Chevrolet) Type' steering gear article in Mechanical Equipment Section of manual for complete data and adjust as follows:*

Steering Column Alignment (Model KB)—Check alignment by loosening frame mounting bolts (instrument panel bracket must be tight). If clearance between steering gear housing bracket and frame exceeds .031", install shim No. 476612 to prevent column being sprung when mounting bolts tightened.

Worm Shaft Endplay—With pitman arm removed (KA, KH) or drag link disconnected (KB), loosen jacket clamp bolt (on lower end of column directly above steering gear housing), loosen adjusting nut clamp bolt in upper end of housing, see that some backlash exists between worm and roller (if necessary, loosen locknut and back off roller shaft adjusting screw located on side of housing on KB, on top of housing on KA, KH). Use 1 9/16" wrench and turn adjusting nut in upper end of housing in until pull of ½ lb. at rim of steering wheel required to turn wheel. Tighten adjusting nut clamp bolt and jacket clamp bolt.

Roller Shaft Endplay—Loosen locknut and turn roller shaft adjusting screw (on side of housing on KB, on top of housing on KA, KH) in until tight, then back screw off until it is free, finally turn screw in until it just contacts end of roller shaft, hold screw and tighten locknut.

Worm and Roller Backlash—Turn steering wheel to center position with roller on high point of worm (count number of turn from one end position to the other, then turn wheel back ½ this number of turns). Check roller shaft backlash or play by shaking pitman arm. To adjust, loosen three steering gear cover bolts ¼ turn, loosen eccentric bolt locknut ½ turn. With one wrench on eccentric bolt and second wrench on eccentric bolt sleeve, turn bolt and sleeve slowly in opposite directions until pitman arm play has been taken up (CAUTION—Use extreme care not to turn eccentric bolt and sleeve more than necessary to take up play, any excess will damage steering gear, normal adjustment is approximately ⅛ turn). Hold eccentric bolt from turning and tighten eccentric bolt locknut, tighten housing cover bolts. Check steering gear to make certain that it turns freely. Pull of 1⅜ lbs. max. at wheel rim should be required to turn wheel through center high point.

Steering Linkage (Models KA, KH):—Individual tie rods used and are connected between special rubber-bushed link on steering gear pitman arm and each wheel. Long right hand tie rod is non-adjustable and toe-in adjustments should be made by turning short left-hand rod to insure steering gear roller being on high point of worm with wheels in straight ahead position.

Horn Ring Adjustment (Special Deluxe KA):—Horn ring tension is adjustable by turning steering wheel lower hub housing. To adjust, loosen lockscrew, turn hub under steering wheel until desired horn ring tension secured, then tighten lockscrew.

SAGINAW (CHEVROLET TRUCKS) WORM-AND-SECTOR TYPE

Used On:

CHEVROLET, ALL TRUCK MODELS (1940)

This Steering Gear same design as used on 1939 models.

ADJUSTMENT & SERVICING:—Except for new specifications and adjustment data given below, these models serviced in same manner as on previous trucks. *See 'Saginaw (Chevrolet) New Type' steering gear article in Mechanical Equipment Section of manual for complete data and adjust as follows:*

Steering Column Alignment—Check by loosening frame mounting bolts (instrument panel bracket must be tight). If clearance between steering gear bracket and frame rail exceeds .031", install shim No. 476612 before tightening mounting bolts to prevent column being sprung out of alignment.

Worm Shaft Endplay—With drag link disconnected from pitman arm, turn steering wheel to point near one end position (must not be at center 'high' point of worm). Tighten three cover screws on steering gear lower cover, loosen locknut and turn adjusting screw (in center of lower cover plate) until slight drag felt when wheel is turned, check in other extreme end position before tightening locknut. Check adjustment by noting pull required to turn wheel at point near end position which should be 1⅛ lbs. max. measured at wheel rim (greater pull required to turn wheel through center high point). CAUTION—Do not back adjusting screw out when making this adjustment as this will allow bearings to get out of alignment.

Sector Shaft (cross-shaft) Endplay—Tighten four screws in side cover plate on housing, loosen locknut and turn adjusting screw on cover plate in until endplay has just been removed, hold screw and tighten locknut. CAUTION—Do not use excessive force or turn screw in beyond point where all endplay just taken up when making this adjustment.

Worm and Sector Backlash—Place steering wheel in center position with sector gear on high point of worm (count number of turns of wheel from one end position to the other, then turn wheel back ½ this number of turns). Check backlash or lost motion between sector gear and worm. To adjust, loosen hexagonal headed lockscrew in lash adjuster on lower cover plate, tap lash adjuster in direction of arrow cut in adjuster not more than 1/16" at a time until play taken up and pull at steering wheel rim required to turn wheel through center position is 1¾-2½ lbs., tighten lash adjuster lockscrew. Check to see that cross-shaft has no play in center position and that steering wheel turns throughout entire travel without binding.

BUICK HANDI-SHIFT

Std. Equipment On:

BUICK, MODELS 39-40, 60, 80, 90 (1939)

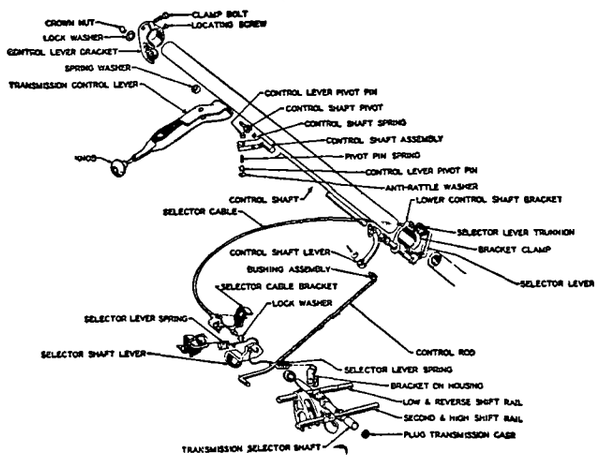
NOTE:—Transmission used with this type control is similar to that used on previous models except for shifter mechanism (selector shaft with two fingers which engage slots in shifter shafts—endwise movement of shaft for cross-shift at neutral insures that only one finger engaged at a time). See separate article for complete Transmission servicing data.

TYPE:—Handi-shift remote control with shift lever mounted on steering column under steering wheel. Shift lever linked to selector shaft in transmission case by control rod (for gear engagement), and selector cable (for cross-shift). Movement of shift lever toward or away from steering wheel causes endwise motion of control shaft and actuates selector cable so as to pull on selector shaft (to engage low-reverse shifter shaft) or push on selector shaft (to engage second-high shifter shaft), one shifter shaft only being engaged at a time (when one finger of selector shaft engages notch in one shifter shaft, other finger is disengaged from opposite shaft and this free shifter shaft is prevented from moving by notch on shaft engaging larger diameter of selector shaft). Movement of shift lever forward and backward rotates selector shaft in transmission to engage gears.

ADJUSTMENT:—Place steering column shift lever in second gear position. Loosen clamp bolt on control shaft lever at lower end of control shaft (lever is serrated so as to grip smooth shaft firmly and slotted end of lever may need to be spread slightly to free shaft—clamp bolt groove on shaft will permit ⅛" up and down movement of the lever), loosen Allen type setscrew locking selector cable wire in trunnion at selector lever on control shaft lower bracket. Move shift lever forward in second gear position until clearance between lever and steering gear mast jacket is 1/16" (use scale or 1/16" stock as spacer). Set selector shaft lever on transmission in second gear position (push selector shaft into transmission case as far as possible and shift forward until detents can be felt to engage. Tighten control shaft lever clamp bolt securely without disturbing position of shift lever or selector shaft, then press in on end of selector cable wire at control shaft trunnion (make certain that selector shaft pushed in transmission case as far as possible), tighten Allen setscrew in selector cable trunnion securely.

NOTE—This adjustment provides farthest forward position of shift lever. If operator desires closer position of lever, leave more than 1/16" clearance between shift lever and steering gear mast jacket in second gear position (above). Make certain that shift lever has full stroke so that low and high gears are properly engaged.

SERVICING:—**Steering Column Unit**—See that shift lever bracket is tight on upper end of steering column mast jacket and that locating setscrew is centered in mast jacket hole. Shift lever should move freely on pivot pins (to remove lever, press in on both pivot pins to clear lever; when installing lever see that spring in place between pivot pins and that anti-rattle washer installed on one pin). Make certain that control shaft does not bind on grommet at floor boards and that all joints operate freely. Lever at lower end of control shaft should contact rubber bumper (on shaft between lever and shaft bushing) with shaft in lower (Neutral, Second, High) position but bumper must not prevent full stroke of shaft necessary to push selector shaft into transmission case as far as possible (lever can be adjusted ⅛" up or down on shaft by loosening clamp bolt). Make certain that control shaft lower bracket is tight on steering column mast jacket and that locating tip on bracket is centered in hole in mast jacket.



Transmission Case Unit—Selector cable must not be kinked or bent at sharp angles and bracket on transmission case must be lined up so that cable wire is straight (bent bracket for alignment). Selector lever springs designed for over-center action (no spring tension in neutral position) and must be hooked to brackets and lever in correct manner. Selector shaft must not bind in transmission case seal (lever side of case) and must rotate freely.

NOTE—To avoid damage to seal, shaft must always be removed through opposite side of case (free lever and shift fingers on shaft, drive shaft through case which will drive out sealing plug in case) and installed on seal side of case (seal plug hole on opposite side of case with sealing compound).

CADILLAC-LA SALLE 1938 TYPE

Used On:

ALL CADILLAC & LA SALLE MODELS (1938)

NOTE:—Transmission used with this type control similar to previous model except for new shifter mechanism (conventional shifter shafts not used).

TYPE:—Consists of special shift lever assembly mounted on steering column under steering wheel. Lever can be moved toward or away from steering wheel at neutral position to engage lug on either of two concentric shafts at side of steering column. Movement of lever then engages gears by rotating shaft which is linked to shift lever on transmission case by adjustable rod. Inner shaft (upper lug—engaged by pressing shift lever away from steering wheel) is linked to forward shifter shaft lever on transmission and controls second-and-high, outer shaft (lower lug—engaged by pressing shift lever toward steering wheel is linked to rear lever on transmission and controls low-and-reverse sliding gear. Lugs on shafts must be lined up to permit this cross-motion at neutral.

ADJUSTMENT:—**Shifter Rods.** Make certain that steering column control lever, torsion shafts, and transmission gears and shifter mechanism in neutral (spring loaded lock balls engage notches on inner ends of transmission levers in each gear position). Tighten adjustable end of each rod in succession (adjusting clevis and locknut at rear end of each rod) until control lever just starts to move. This adjustment must be accurately made or control lever will not cross over at neutral from high & second to low & reverse torsion tube lug.

Shifter Levers. See Note below for first cars on which spacers and spring-washers not used. Use tool J-1204 installed on lower end of steering column shafts (tool cannot be used on first cars with tapped hole at lower end of inner shaft instead of groove). Loosen clampscrews on both shaft levers (leave loose while tension being adjusted), tighten thumbscrew on tool until correct feel secured for low gear shift (lever action smooth with no binding or up-and-down play in the tube), tighten clampscrews on low-and-reverse lever. Check second-and-high lever action, adjust in same manner and tighten clampscrew on lever. If tool not used, make trial setting for each lever, check shifting action.

NOTE—If correct setting cannot be secured on first cars (without spring-washers), disassemble levers at lower end of control and reassemble with correct washers as follows: At bottom of shifting tube bracket install two spring-washers (#1425904), spacer #1427417, low-and-reverse lever, two spring-washers (#1424479), second-and-high lever.

SERVICING:—Entire steering column mechanism exposed by removing steering wheel. Transmission case mechanism not disturbed by transmission removal (disconnect control rods at transmission case, on Model 60 only remove levers also—see assembly directions below for lever replacement).

Assembly:—Assemble the control in order beginning at the steering column shift lever and working toward the transmission. Assemble levers as directed below and adjust control rod lengths (see Adjustment above).

Steering Column Shaft Levers—Lever at lower end of inner shaft can be assembled in two positions. Install lever in lower position (50, 60, 60S), upper position (75, 90).

Transmission Shifter Shaft Levers—Levers can be installed in two positions. Install levers in upper position on all models.

CADILLAC-LA SALLE 1939 TYPE

Std. Equipment On:

CADILLAC V8, SERIES 39-60S, 61, 75 (1939)

CADILLAC V16, SERIES 39-90 (1939)

LA SALLE V8, SERIES 39-50 (1939)

TYPE:—Same design as used on 1938 car models except as follows: Steering Column Control Shaft Levers assembled differently with outer shaft lever (low-reverse) above mounting bracket and spring washers between mounting bracket and lower lever only. Transmission case forward shift lever (second-high) shortened for more convenient shifting.

ADJUSTMENT:—See that steering column shift lever, control shafts, and transmission case shift levers are all in neutral position. Loosen locknut and turn

CADILLAC-LA SALLE 1939 TYPE CONT.

adjustable end (transmission case end) of each control rod until shift lever can be lifted into low-reverse position without interference. This adjustment important to insure correct cross-over at neutral from Second-high position to low-reverse position.

SERVICING STEERING COLUMN UNIT:—Disassembly—Remove horn button, steering wheel nut and steering wheel. Remove lower (second-high) lever on steering column, loosen clampscrew holding upper (low-reverse) lever in place. Remove cross-over spring at upper end of steering column, loosen clampscrew holding upper shifter housing to steering column. Lift upper housing with shifter tube and shaft attached from steering column. Pull inner (second-high) shaft out of outer tube, remove gear shift lever, pull outer (low-reverse) tube out of housing.

Reassembly—Reverse disassembly directions given above, making certain that lug on low-reverse shifting tube points away from center of housing and clamping bolt washer on lower steering column bracket engages slot in column on 39-50 and 61 cars. Install two anti-rattle spring washers between bracket and upper (low-reverse) lever, three washers between bracket and lower (second-high) lever (see Note below). Adjust connecting rods after installation completed.

NOTE—Some cars equipped with only one anti-rattle spring washer (between bracket and lower lever). To correct rattles on these cars, install four additional washers as directed above.

Control Shaft Lever Adjustment:—Use tool J-1204 (same tool used for 1938 models) installing tool on lower end of control shaft assembly. Tighten tool thumbscrew lightly, loosen clamping screws on both levers, turn down thumbscrew on tool until high gear shift is smooth and not too tight (test with shift lever, control shaft clamping screws may be left loose while making adjustment), tighten lever clamping screw when correct adjustment secured, remove tool. Push upper lever down on shaft until clearance between lever and upper face of support bracket is .005" (measure with feeler gauge), tighten clamping screw. If tool not used, pry lower lever up with screwdriver to secure tension on spring washers, tighten clampscrew, check setting. Repeat these trial settings until satisfactory operation secured. Adjust control rods as directed above.

TROUBLE SHOOTING:—Shifter Rattles—Adjust control shaft levers (above) to correct excessive clearance. See that correct number of anti-rattle spring washers used between bracket and levers (see Reassembly Note above).

Hard Shifting—Check control shaft lever adjustment (above) for insufficient clearance. Check shifter control lever and control tube and shaft lugs for chipped lugs, incorrect adjustment, or other interference preventing smooth operation of lever. IMPORTANT SERVICE NOTE—Detent springs on all first 1939 cars were .022" and were changed on later cars to .018" (except 39-90). To correct hard shifting complaints, install these later type detent springs on first cars (except 39-90).

SERVICING TRANSMISSION UNIT:—See Transmission article for data (shifter shafts and quadrants, and interlock mechanism can only be removed from within transmission case after transmission dismantled).

CHEVROLET 1939 TYPE

Optl. Equipment On:

MASTER DELUXE MODEL JA, MASTER JB (1939)

IMPORTANT SERVICE NOTE:—Anti-rattle bushing should be installed on control rod swivel in control shaft lever on lower end of steering column to correct rattles at this point on first cars (new type lever No. 3650931 with anti-rattle bushing is used in production on later cars). See installation directions below.

NOTE:—Transmission used with this control identical with standard model except for cover and shifter mechanism. See separate article on Chevrolet 3-speed Transmission for complete servicing data.

TYPE:—Remote control, vacuum assistor type with shift lever mounted on steering column under steering wheel and vacuum cylinder assembly mounted on bracket at left of transmission case. Steering column unit consists of an outer control shaft (linked to gear engagement lever on side of transmission case) and an inner selector rod (linked to selector or cross-shift bell crank on forward end of transmission case cover. Cross-shift mechanism is entirely mechanical and vacuum power is used only for gear engagement. Vacuum cylinder is new type with control valve located in piston rod with separate hose connections for vacuum (forward hose—connected to vacuum pipe from intake manifold) and air (rear hose—connected to air cleaner on frame). Valve control mechanism is mounted under protective boot on gear engagement lever and is designed to provide a 'follow-up' action (vacuum cylinder piston follows action of steering column gear shift lever exactly).

OPERATION:—Selector mechanism (mechanical linkage for cross-shift) and gear engagement mechanism (mechanical linkage with vacuum assistor) operate independently as follows:

Selector (Cross-shift)—Steering column gear shift lever is spring-loaded in lower (Second-High) position. Lifting up on lever in neutral position depresses push rod in control shaft and actuates selector bell crank on transmission cover through a lever on lower end of control shaft and selector rod connector.

Vacuum Cylinder (Gear Engagement)—Sleeve valve in vacuum cylinder piston rod is normally centered so that air is admitted to both ends of cylinder and piston has no tendency to move. When shift lever moved backward (for Low or High) or forward (for Reverse or Second), the clearance at the control rod clevis pin 'A' and the piston rod yoke pin 'B' allows an initial movement of the inner sleeve valve rod (before gear engagement lever begins to move) which admits vacuum to one end of the cylinder and causes the vacuum cylinder piston to follow-up the control rod. This piston movement sets up a reaction in the control valve lever mechanism (reactionary lever tip moves in one direction, idler lever in opposite direction) which results in a movement of the valve rod to cut off the vacuum port and stop the piston rod as soon as the steering column shift lever movement stops (whether in 'gear-engaged' position or at any intermediate point).

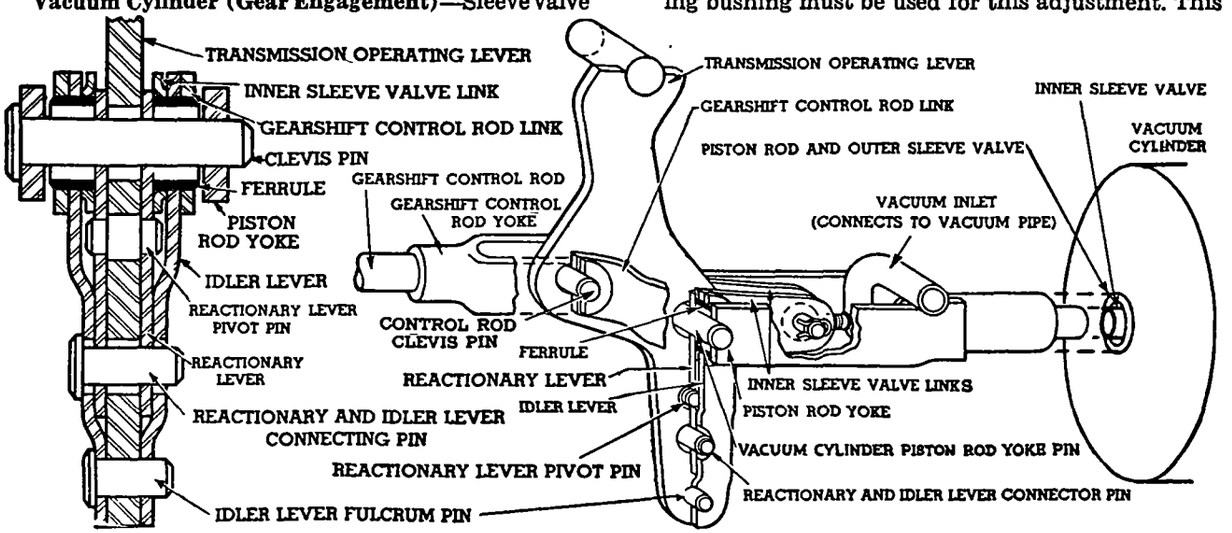
ADJUSTMENT:—If operation unsatisfactory, or if shift mechanism dismantled for servicing, adjust each unit as follows:

Steering Column Control Assembly—See Servicing directions below for dimensions to which parts should be set up when assembled (no service adjustments required).

Selector Rod—Pull selector control rod (attached to selector bell crank on transmission cover) forward firmly against its stop, loosen locknut and adjust swivel on forward end of rod until swivel pin is ⅛" to rear of hole in lever, tighten locknut. Pull lever toward rear and connect rod installing anti-rattle spring, flat washer and cotter pin on swivel pin. NOTE—Pulling lever back in this manner necessary to place selector linkage under spring tension to insure remaining normally in second-high position and to prevent rattles.

Control Rod (Gear Engagement) Linkage—Set shift lever on steering column in horizontal (neutral) position. See that clevis pin at rear end of control is exactly centered in hole in gear engagement lever on transmission case (remove boot on lever), adjust swivel on forward end of rod so that pin lines up with hole in control shaft lever, engage pin in lever, install anti-rattle spring and lock on pin.

Vacuum Cylinder Control Valve—A special adjusting bushing must be used for this adjustment. This



bushing should be made up to following dimensions: Inside Diameter—.373-.378", Outside Diameter—.685-.688". Length—1 1/32". To adjust, remove control rod clevis pin 'A' on lever on transmission case, remove boot on lever which covers valve lever assembly, remove vacuum cylinder piston rod yoke clevis pin 'B' which will disconnect piston rod and valve links from lever assembly, push piston into cylinder to provide clearance for adjustments, thread special adjusting bushing through valve link eyes, install clevis pin in piston rod yoke and bushing. Operate engine to provide vacuum (if adjustment made on bench, separate vacuum source must be provided). Move valve links out or away from cylinder until all clearance between bushing and clevis pin is toward front, Piston rod should move slowly out of cylinder. Move valve links toward cylinder until all clearance between bushing and clevis pin is toward rear. Piston rod should move slowly into cylinder. If piston rod moves out but does not move in, valve links are set too far in toward cylinder; if piston rod moves in but does not move out, valve links are set too far out from cylinder. To adjust, remove clevis pin, screw valve links in or out on valve rod ½ turn at a time and repeat test until correct operation is secured. Reassemble linkage as directed in Servicing section below.

SERVICING STEERING COLUMN UNIT:—Disassembly—Remove steering wheel (and spring retaining mast jacket bearing on Deluxe models), instrument panel bracket nuts and U clamp, raise toeboard grommet up about 12", disconnect selector rod and control rod from levers at lower end of control shaft, remove locknut and selector control lever guide at lower end of control shaft. Remove screws from lower support bracket, unscrew bracket from control shaft, loosen clamp on control shaft lever, remove lever and counter-balancing spring from end of control shaft, remove control shaft and gear shift lever (do not remove upper support bracket from mast jacket). To remove gear shift lever from control shaft, press in on pivot pin on each side of housing, remove lever. Then remove selector push rod assembly through top of control shaft.

Servicing—Remove all burrs from gear shaft lever housing in control shaft and push rod opening at top of shaft. See that selector pushrod is free in control shaft (if rubber bushing tight in tube, replace with #3651629 Neoprene bushing). Make certain that shift lever pivot pins are free in lever and in control shaft housing.

Reassambly—Install selector pushrod in control shaft, assembly pivot pins in shift lever (with spring between them and anti-rattle washer on one pin, shim on opposite pin), install lever in control shaft housing by compressing pin spring until pins enter housing and slipping open end of lever over end of push rod, check to see that shift lever and pushrod operate freely. Check upper support bracket by measuring from top of bracket to top of mast jacket (should be ⅜" Master Deluxe, 1 3/16" Master), see that mast jacket key enters keyway on bracket, tighten bracket screw securely. Install control shaft through instrument panel bracket and toeboard grommet, assemble counterbalancing spring and lever on lower end of shaft (slip up on D section as far as possible), screw lower support bracket on shaft so that shaft extends 3/16" through bracket, enter upper end of control shaft in upper support bracket, allowing end of counterbalancing spring to drop in behind mast jacket, install lower support bracket on mast jacket and make certain that key on jacket enters keyway on bracket, install bracket cap, tighten screws loosely. Check lever position on mast jacket by placing straightedge across top of jacket and measuring from straightedge to center of shift lever pivot pin (should be 1 1/32" Master Deluxe, 1 23/32" Master) and adjust by shifting lower support bracket up or down on mast jacket, then tighten lower bracket screws securely. Adjust shift lever on lower end of control shaft so that clearance between lever and upper face of lower support bracket is 3/16", tighten clamp bolt on lever securely and hook end of counterbalancing spring under lever. Engage end of selector lever bell crank in guide, screw guide on selector control rod until clearance between upper face of guide and lower end of control shaft is 1/16", install guide locknut and tighten securely. Check mast jacket height by measuring from top of jacket to shoulder on steering gear shaft (should be 1 17/64" Master Deluxe, 23/32" Master) and adjust by loosening mast jacket clamp at steering gear housing and moving mast jacket up or down. Turn mast jacket until control shaft is in center of instrument panel bracket hole, tighten instrument panel bracket nuts first and mast jacket clamp bolt last. Adjust selector rod and control rod as directed in Adjustment section above.

SERVICING TRANSMISSION LEVER LINKAGE:—Disassembly—Remove control rod clevis pin and wires around end of transmission operating lever rubber boot, remove boot. Remove clevis pin from vacuum cylinder piston rod yoke and lever system, remove two shift control rod links (with bushing sleeves on which vacuum cylinder control valve links are mounted), push piston rod back into cylinder and install clevis pin through piston rod yoke and valve links (this will prevent valve links turning and upsetting valve adjustment). Take out transmission case cover capscrews, remove cover, idler lever fulcrum pin, idler lever connecting pin, dismantle levers.

Servicing—Wash cover and levers in gasoline, inspect for wear at pin holes and any burrs or roughness preventing free movement. Check transmission shifter interlock for free movement of selector, and see that shifter mechanism operates freely.

Reassembly—Coat reactionary and idler levers lightly with graphite grease, install reactionary lever pivot pin in operating lever, assemble reactionary levers and idler levers, installing clevis pins and cotter pins. Install transmission cover on case, making certain that shifter interlock ends fit into slots in shifter yokes and that cover capscrews are tightened securely. Remove piston rod clevis pin, pull rubber boot forward on yoke so that valve links extend beyond yoke, connect valve links by pushing bushing sleeves (on control rod links) through eyes in idler levers and valve links. Push piston rod yoke forward over reactionary levers, line up link holes and install clevis pin and cotter pin. Coat inside of leather boot lightly with graphite grease, install boot over reactionary levers, install shift control rod, line up holes in control rod clevis, boot washers, and control links, install clevis pin and cotter pin. Secure forward end of rubber boot and operating lever boot with wires. Connect selector control rod. See Adjustment Section above for Selector rod, Control rod, and Vacuum cylinder valve adjustment.

ANTI-RATTLE BUSHING INSTALLATION (FIRST CARS):—To correct rattles at control rod swivel connection on lever, install new lever No. 3650931 or drill out swivel connection hole in lever to 9/16" (hole in old lever was 25/64"), install new anti-rattle bushing No. 3652244 and use new lock No. 3652249 to retain bushing (pinch ends of lock together securely).

SERVICING VACUUM CYLINDER:—Removal—Disconnect piston rod and valve links (see Transmission Control Linkage servicing above), disconnect vacuum and air hose lines at vacuum cylinder fittings, remove cotter pin and unscrew nut on cylinder mounting stud.

Installation—Install rubber cushion and steel retainer on mounting stud, thread stud through lower hole on mounting bracket, install steel retainer, rubber cushion, flat washer, and nut on stud in this order, tighten nut just enough to insert cotter pin. CAUTION—Washers and cushions must be assembled in this order and nut not tightened excessively in order to provide necessary flexibility in cylinder mounting. Connect valve links and piston rod yoke. When installing vacuum hose, make certain that clampscrew is toward rear and vertical (to provide clearance for speedometer cable).

Vacuum Cylinder Lubrication:—Disconnect vacuum hose at vacuum stack, shift transmission into second gear (to open vacuum port to forward end of cylinder), pour ½ oz. Shock Insulating Fluid into cylinder through stack, allow transmission to stand for several minutes (to allow fluid to drain into cylinder). Shift transmission into third gear (to open vacuum port to rear end of cylinder), repeat lubrication. After several minutes, shift transmission between second and third gears several times to work fluid into piston leather, then connect vacuum hose.

Air Cleaner Servicing:—At 10,000 mile intervals, remove cleaner, wash in gasoline, dip in engine oil before re-installing.

TROUBLE SHOOTING:—Sticky or sluggish Shift—Check shift lever for binding by disconnecting selector control rod and moving lever up and down. If lever does not return to lower position freely, check pivot pins for binding in housing, gear shift lever clearance in bracket, burrs or roughness in bracket, rubber anti-rattle bushing on selector push rod binding in control shaft, selector rod bell crank binding in lower support, incorrect clearance between selector rod guide and control shaft, bent selector push rod, selector lever binding in transmission cover. See Servicing Steering Column Unit above for assembling directions.

Hard Shifting—Check vacuum line for leaks (if shift hard in all gears), check vacuum hose clamp for interference with speedometer cable (if shift hard in high gear only), lubricate vacuum cylinder (see Vacuum Cylinder Servicing above), remove leather boot on lever system (transmission operating lever), clean out old grease and lubricate with graphite grease (see Transmission Control Linkage servicing above for lever assembly).

Creeping out of Gear—Check vacuum hose clamp for interference, check shift linkage and lever system for binding or sticking, adjust vacuum cylinder valve (see Adjustment above).

Blocking out of Gear—Check selector lever on transmission case for full stroke by disconnecting rod and moving lever and rod full distance in both directions. If selector rod too long (caused by bending), install new rod. If lever movement in forward direction insufficient, check steering column unit assembly (see Steering Column Servicing data above for dimensions). Check vacuum hose clamp for interference.

Excessive lash in Shift Lever—Tighten clamp bolt connecting shift control lever to control shaft. This lever must be firmly locked to shaft.

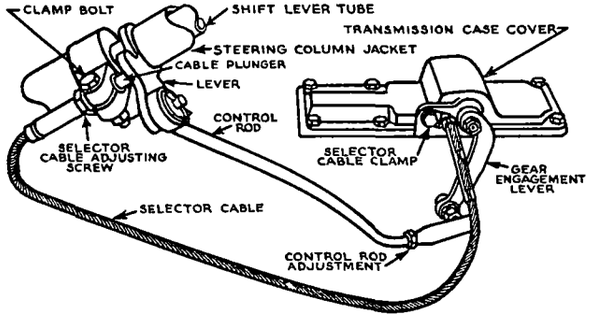
CHRYSLER 1939 TYPE

Std. Equipment On:

CHRYSLER ROYAL, MODEL C22 (1939)
CHRYSLER IMPERIAL, MODEL C23 (1939)
CHRYSLER CUSTOM IMPERIAL, C24 (1939)
DE SOTO, MODEL S6 (1939)
DODGE, MODEL D11 (1939)
PLYMOUTH, DELUXE MODEL P8 (1939)

NOTE:—This control not used on Plymouth Std. P7.

TYPE:—Remote control type with gear shift lever on steering column under steering wheel and gear shift tube (operating shaft) within steering column jacket. Special type steering column jacket is used which consists of two halves bolted together at a flanged joint (in front of the dash) which is slotted



for the lever attached to the lower end of the shift lever tube. This lever is linked to the shift lever on the transmission case by a control rod (for gear engagement) and also operates the selector cable (for cross-shift) through a plunger on the steering column below the lever. Plunger and cable assembly is spring-loaded by a spring behind the rail shift lever on the shift lever shaft in the transmission case so that selector cable and plunger assembly normally in second-high position (plunger up against control lever plate).

ADJUSTMENT:—Control Rod (Gear Engagement)—Remove nut and disconnect control rod from lever on side of transmission case. Make certain that transmission gears are in neutral and that steering column shift lever is in neutral position (mid-point of stroke where up-and-down movement for cross-shift is possible). Loosen locknut at adjustable joint on transmission end of control rod, turn joint on rod until ball joint stud freely enters hole in lever with lever moved back approximately ⅛" toward rear to take up all free movement (all models except Chrysler C23, C24), or exactly centered with free movement divided toward front and rear (Chrysler C23, C24), tighten locknut and connect rod.

Selector Cable (Cross-shift)—Make certain that steering column shift lever in neutral position, loosen clamp bolt locking adjusting nut in steering column jacket flange, back adjusting screw out until play or clearance is evident between end of plunger and steering column tube lever plate, then turn screw in just enough to take up this clearance, tighten clamp bolt. CAUTION—Do not turn adjusting screw in more than enough to eliminate plunger endplay. Excessive tightening will cause wear of plunger and plate.

SERVICING STEERING COLUMN UNIT:—Disassembly—Remove steering wheel. Remove screws holding draft pad to dash, pull pad 6" up on steering column jacket, remove screws holding steering column clamp to instrument panel bracket, free hand brake and overdrive control cables and overdrive control bracket from steering column. Loosen clamp bolt and remove selector cable adjusting nut from steering column jacket flange, disconnect control rod at steering column lever. Take out capscrews holding upper and lower sections of steering column jacket together, pull upper section with gear shifter tube assembly off at upper end of steering gear shaft. Remove screws on lower face of shift lever housing (hold housing in place by hand to prevent loss of shift lever ball and spring), lift housing off, remove spring and ball from under shift lever. Remove nut on upper end of shift lever tube, remove shift lever, withdraw tube from lower end of jacket.

Reassembly—Reverse disassembly directions above. Bushings are press fit in column jacket and should be removed with a puller. NOTE—If draft pad to be removed, coat lower end of column jacket with thin film of soft soap and work pad off.

SERVICING TRANSMISSION UNIT:—Disassembly—Take out selector cable mounting screw, pull cable assembly out of transmission cover, disconnect control rod at lever on transmission case. Remove transmission case cover. To remove shift lever and shaft, remove nut on **opposite end** of shaft from lever, pull shaft and lever assembly out, lift out rail shifter lever and spring.
CAUTION—Do not remove shift lever from shaft which will destroy alignment between lever and keyway in shaft which positions rail shifter lever (shifter finger). Lever and shaft serviced as an assembly only.

EVANS-GRAHAM VACUUM TYPE

Optional Equipment On:

GRAHAM STD. & SPEC., MODEL 96 (1938)
GRAHAM SUPERCHARGER, MODEL 97 (1938)

NOTE:—Transmission used with this type shift control is similar to standard model except for shifter mechanism. See Graham Transmission article for servicing data.

TYPE:—Remotely controlled, manually operated, mechanical gear shift with vacuum booster. Control unit on dash consists of miniature gear shift linked to selector lever on transmission (for cross-shift to engage Low-Reverse or Second-High shifter rails) and to valve operating lever (intermediate lever) on shift lever (for gear engagement). Gears can be engaged by dash shift lever when engine is not running (to start car by towing or coasting with gears engaged) although in normal operation dash shift lever merely operates cross-shift and Operating Valve and actual gear engagement effected by Vacuum Cylinder which is linked directly to shift lever. Operating Valve is combined piston and diaphragm type linked to intermediate lever on shift lever (to which dash shift lever also connected) and controls air and vacuum admission to each end of Vacuum Cylinder. When dash shift lever moved forward (Reverse or Second Gear), or backward (Low or High Gear), this motion first operates valve which admits air to one end of vacuum cylinder but without cutting off vacuum connection to opposite end (cylinder normally vacuum-suspended) so that piston moves toward vacuum end of cylinder and resultant shift lever movement engages gears. The intermediate lever moves with the shift lever and tends to balance the vacuum cylinder so that the piston follows the dash shift lever movement exactly. When shift is completed (or dash shift lever movement stopped), piston remains stationary in that position until new shift is made by the dash shift lever (or lever is returned to neutral).

CHECKING & ADJUSTMENT:—Whenever adjustment required due to unsatisfactory operation, removal or replacement of units, or linkage being disconnected, check and adjust entire mechanism in order as given below.

Operating Valve Linkage:—Remove clevis pin in lever at lower end of vertical shaft on dash (to disconnect dash control unit). Check operation of shift cylinder and operating valve linkage (intermediate lever and shift lever). Free linkage if it is binding. Remove clevis pin at rear end of operating valve plunger, see that plunger moves freely and has maximum travel of 5/16". If plunger binds, loosen large mounting nut at rear of valve assembly, if this frees plunger, check gaskets between nut and bracket and between bracket and valve body (these gaskets installed to prevent misalignment of valve which might cause plunger to stick). If linkage and valve plunger operate freely, connect plunger to intermediate lever by installing clevis pin.

Dash Gear Shift Unit Linkage:—Disconnect selector rod at lever on forward side of dash (lower dash unit rod) by taking out wire 'hairpin' and freeing trunnion from lever. Tighten nut on selector lever on left side of transmission case (forward lever). Operate dash shift lever and make certain that linkage is free in all positions. Check for excessive play in lever, adjust by turning nut at shift lever end of lower connecting rod under instrument panel.

EVANS-GRAHAM TYPE CONT.

Linkage Neutral Setting:—With all linkage operating freely, and with rod at lower end of vertical shaft still disconnected, operate engine to furnish vacuum to shift mechanism. This will cause Operating Valve and linkage to automatically assume correct neutral position. Place dash shift lever in neutral position, adjust connecting rod at lower end of vertical shaft by loosening locknut and turning clevis at forward end of rod until rod can be connected to lever on shaft without disturbing position of shift lever or valve and vacuum cylinder linkage, tighten clevis locknut and install clevis pin. If this adjustment correctly made, selector rod and lever should move freely throughout entire travel (for cross-shift which is only possible at neutral position).

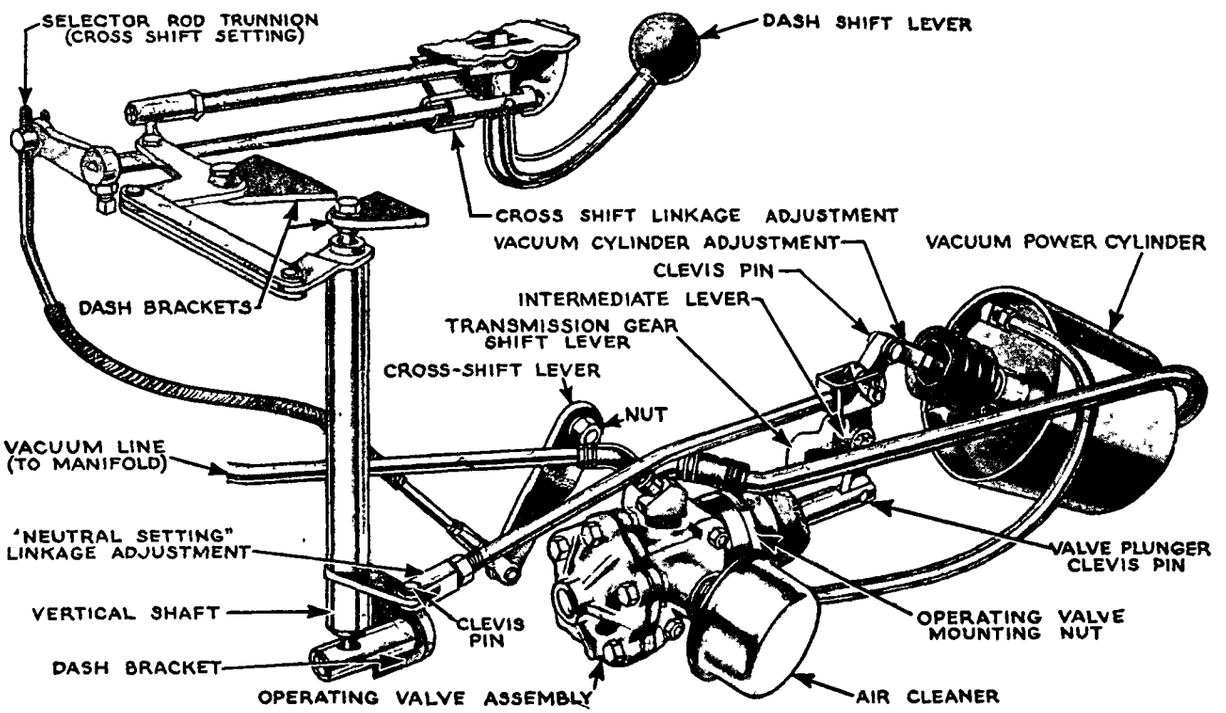
Selector Rod Setting:—Move dash gear shift lever to one side of slot at neutral as far as possible without springing lever, hold in this position and pull selector rod in same direction to limit of travel, adjust swivel block or trunnion on upper end of rod so that is can be installed in hole on dash unit lever without disturbing position of linkage, install trunnion and fasten with lock wire.

Checking Vacuumatic Shift Operation:—After making adjustments listed above, operate gear shift in all positions, watch linkage action and make certain that no interference exists at any point.

SERVICING:—Vacuum Cylinder. To remove cylinder, disconnect both vacuum lines at cylinder, take out clevis pin at forward end of piston rod, take out cotter pin and remove nut holding cylinder on attaching bracket, remove cylinder. Install cylinder in same manner, adjusting piston rod length before installing clevis pin as follows:

Vacuum Cylinder Adjustment—With vacuum cylinder piston rod disconnected, move transmission shift lever to extreme rear or reverse position, push piston into cylinder until it bottoms, loosen locknut and adjust piston rod length by turning clevis until rod is ⅛" too short to line up with hole in shift lever (one half of shift lever hole should be visible through piston rod clevis), pull piston out of cylinder until holes line up and install clevis pin.

Operating Valve:—To remove valve assembly, remove clevis pin at rear end of valve plunger, disconnect vacuum lines at valve by loosening hose clamps, take off large nut at rear end of valve body, remove valve assembly. If new valve being installed, remove air cleaner unit from top of old valve and install on new unit. When installing valve, make certain that gasket is in place between valve body and mounting bracket and also between bracket and large mounting nut, **leave nut slightly loose until all adjustments made.** Connect vacuum lines, align valve so that air cleaner points to left and vacuum line connection from engine manifold is on top, operate shift in all positions to make certain that linkage does not strike vacuum pipes or connections, then tighten the large mounting nut. Install clevis pin at rear end of valve plunger, make certain that there is no bind at this point, adjust selector and shift linkage as directed in 'Adjustment' section above.



GRAHAM 1939 TYPE

Used On:

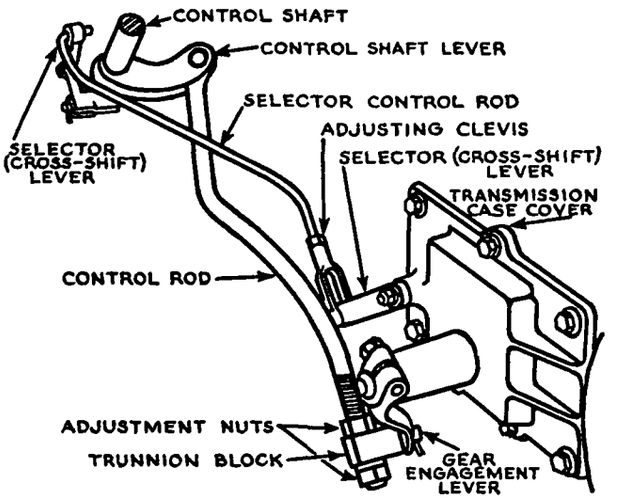
GRAHAM, MODELS 96, 97 (1939)

NOTE:—Transmission used with this control similar to other 'Horizontal' types except for shift mechanism (two levers on cover on side of case—forward lever for cross-shift, rear lever for gear engagement). See separate article for complete Transmission servicing data.

TYPE:—Remote control type with shift lever mounted on steering column. Shift lever pivoted on bracket on steering column so that up-and-down motion of lever actuates selector (cross-shift) shaft and rod linked to forward lever on transmission case, while backward-and-forward motion of lever rotates control shaft and moves lever and rod linked to rear (gear engagement lever on transmission case).

ADJUSTMENT:—Adjust both control rods at transmission lever (rear end) as follows:

Cross-shift Linkage—See that steering column shift lever in normal neutral position, remove clevis pin linking rod to forward cross-shift lever on transmission, loosen locknut on clevis. Pull transmission lever up (forward) as far as possible, adjust clevis on control rod so that clevis pin can just be inserted without disturbing position of transmission lever or steering column shift lever, tighten clevis locknut.



Gear Engagement Linkage—Loosen both nuts on control rod at rear gear engagement lever on transmission. Place steering column shift lever in second gear position (push lever as far forward as possible). Move transmission case lever forward as far as possible, hold in this position and turn down top nut on control rod until lower face of nut is exactly 3/16" from face of square trunnion block on lever, then tighten lower nut securely.

Standard Equipment On:
CORD, MODELS 810 (1936), 812 (1937), SUPERCHARGED MODEL 812 (1937)

TRANSMISSION NOTE:—Transmission is unconventional in that drive in all four speeds is through transmission gears (no direct drive—pinion mounted directly on end of countershaft). Gears engaged through three shifter rails on right hand side of transmission case by forward-and-backward motion of shifter shaft lever (cross-shaft at front of case) and are selected by endwise motion of the shaft to engage one of the shifter rails. Shaft is normally engaged with center (Second-Third) rail and moves to the left to engage the Low-Reverse rail, or to the right to engage the Fourth Speed rail. Neutral position secured by centralizing shift lever (power piston centralized by neutral switch).

OPERATION:—Cord transmission control is of the pneumatic type (utilizing manifold vacuum) with electrical control of the vacuum cylinder valves. Transmission is not conventional and the control is not entirely similar to other Bendix types. Forward and backward motion of the shift lever to engage gears is effected by the double-acting 'Power Cylinder' mounted on the transmission case cover. Control of the vacuum connection to each end of the cylinder is effected by a solenoid operated valve in the Selector Valve Assembly (#1 solenoid for forward or First-Third engagement, #2 solenoid for backward or Reverse-Second-Fourth engagement). Power cylinder piston is normally centered in cylinder in neutral position (See Neutral Switch below).

Endwise movement of the shift lever shaft to engage shifter rails effected by Diaphragm Cylinder on shifter shaft on front of transmission case on right side. Diaphragm normally centered by springs within case so that shifter shaft engages center (Second-Third) shifter rail. Control of vacuum connection to each end of diaphragm cylinder effected by solenoid operated valves in Selector Valve Assembly (#3 solenoid for left hand or First-Reverse engagement, #4 solenoid for right hand or Fourth speed engagement).

All solenoid controlled valves are mounted as an assembly on the right side of the transmission case and have a common vacuum line connection (at front of unit) and air intake (at rear of unit). Valves are poppet type and are normally held down at lower end of stroke by spring at upper end of valve plunger when solenoid is not energized (vacuum cut off and cylinder open to atmosphere). Valves are pulled up when solenoid is energized (cutting off air and opening vacuum port so that air is evacuated from cylinder). Solenoid circuits are controlled by Selector Switch, Clutch Pedal Cutout Switch, Interlock Switch, and Neutral Switch (in Power Cylinder) as follows:

Selector Switch—Located on steering column below steering wheel. Consists of a gate type switch lever which duplicates conventional shift lever motion to pre-select gear position (or neutral) which is next desired (lever must be raised against spring tension before it can be shifted to 'Reverse' and is shifted to the right and forward to the 'Fourth' position from a point between Third and Neutral). This selection may be made at any time and no shift occurs until the clutch pedal cutout switch contacts are closed by depressing the clutch pedal.

Clutch Pedal Cutout Switch—Located on left side of engine and linked to clutch throw-out shaft so that circuit is open when clutch is engaged and is closed only when pedal depressed to disengage clutch. Acts as a main switch for transmission control circuits and shift will occur when clutch disengaged if new gear position has been set on selector switch since last previous clutch disengagement. Startix 'IGN' lead connected to cutout switch so that Startix operative only with clutch disengaged and Transmission Control operative.

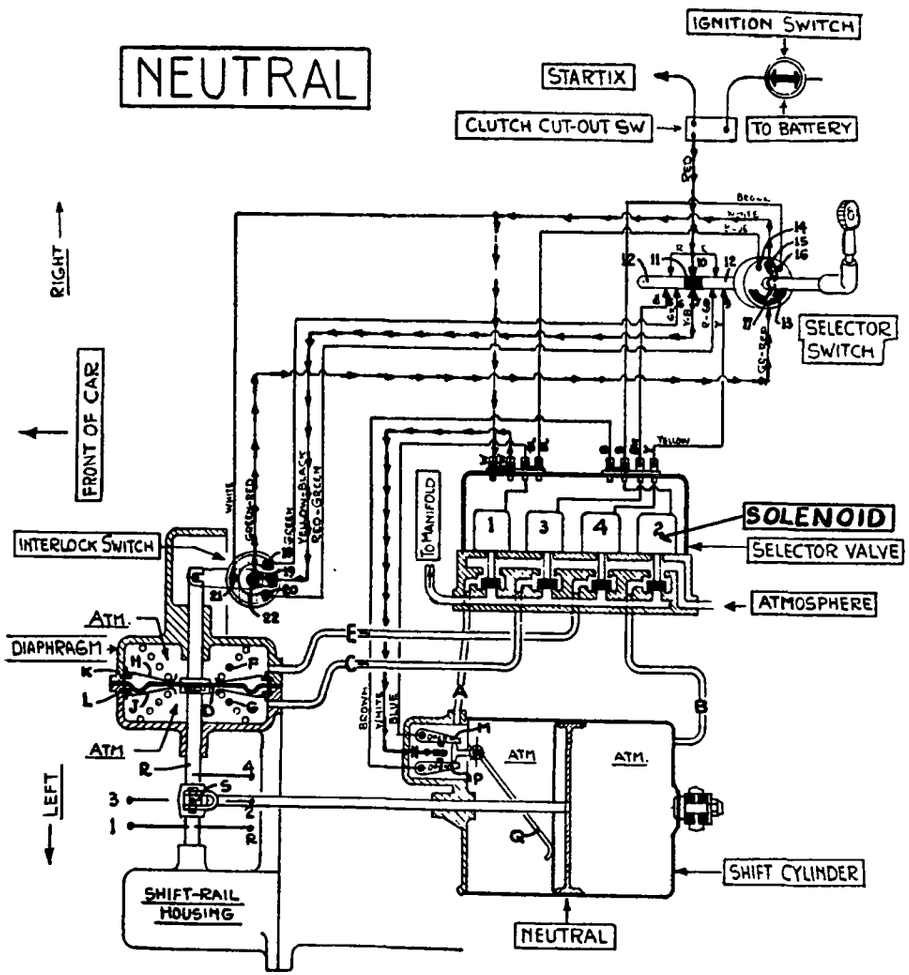
Interlock Switch—This switch interrupts circuit from selector switch to power unit solenoid valves to insure a cross shift in neutral (from one shifter rail to another) if this is necessary in order to secure the gear engagement set on the selector switch. Interlock switch lever is linked to Diaphragm Cylinder shaft (shifting shaft) and will close a new set of circuits after Diaphragm Cylinder operates so that the shift to a different gear position will be completed. Interlock switch does not operate as long as shifts are confined to a single shifter rail (Reverse-low or second-third).

Neutral Switch—Located in end of Power Cylinder. Consists of central stationary contact and two movable contact arms each connected to one power cylinder solenoid valve. Neutral switch operating lever in cylinder is linked to contact arms so that both sets of contacts are open when piston is centralized in cylinder. Movement of cylinder in either direction from center allows one set of contacts to close and when stationary contact is 'live' (as will normally be the case with selector switch lever in neutral) solenoid valve will be energized and vacuum connection made at one end of cylinder so that piston will be drawn back toward center. At center position circuit will be broken by movement of operating lever.

ADJUSTMENT:—Mechanical adjustments provided for each unit of Transmission Control. Make these adjustments in order noted below. Check adjustments by jacking up front end of car, removing splash shield over driving unit, and running engine so that control can be operated and performance noted.

Clutch Pedal Cutout Switch Adjustment—With motor running, depress clutch pedal fully, note whether circuit through cutout switch completed (can be checked readily by moving selector lever back and forth in neutral from Reverse-First to Second-Third end of slot and noting if shifter cross shaft moves accordingly). If no action noted, connect test lamp between red wire terminal on cutout switch and ground. Lamp should light. If lamp does not light, adjust switch by removing clevis pin from operating rod and turn clevis rod until lamp lights. If adjustment cannot be secured check line from cutout switch to ignition switch, check cutout switch for open-circuit, replace if necessary. Release clutch pedal slowly until clutch begins to engage, then release pedal ⅛-¼" more, hold in this position, adjust cutout switch rod length by turning clevis so that switch contact just broken (lamp will go out at this point).

Power Cylinder Adjustment—With motor running, place selector switch in neutral, depress clutch pedal fully, see that transmission is in neutral. Remove clevis pin connecting shift lever and piston rod, adjust clevis on end of piston rod so that pin can be inserted freely in clevis and hole in shift lever. Insert pin, move piston backward and forward to point where considerable pressure back toward center is noted (neutral switch coming into action). Travel in each direction should be approximately equal and transmission should be in neutral when piston comes to rest in center position. This test checks Neutral Switch operation as well as power cylinder adjustment.



CORD REMOTE CONTROL GEAR SHIFT CONT.

Interlock Switch Adjustment—Remove green wire with red tracer on Interlock Switch, connect test lamp to this wire and ground lamp on transmission case. With motor running, place selector switch in neutral, depress clutch pedal fully, move transmission shift lever by hand to extreme left hand position, allow lever to come back slowly toward center neutral position, note point at which test lamp lights and travel from this point to center neutral position. Repeat test by moving lever to extreme right hand position and noting travel from point where lamp lights to center neutral position. Travel should be the same on each side. Adjust by loosening four screws mounting interlock switch on diaphragm housing, move switch sideways, tighten screws, repeat test. With correct adjustment lamp should light at approximate midpoint of travel between extreme right or left hand position and center or approximately ⅛-3/16" from center position.

SERVICING:—Repair operations to clutch cutout switch, interlock switch, and solenoid assembly are not recommended by manufacturer and entire unit should be replaced if satisfactory performance not secured by adjustment.

HUDSON & TERRAPLANE ELECTRIC HAND

Optional Equipment On:

HUDSON, SIX MODEL GH (1935), EIGHT MODELS HT, HU, HHU, (1935)
TERRAPLANE, MODELS G SPECIAL, GU DELUXE (1935)

DESCRIPTION:—The Electric Hand Automatic Transmission is of the pneumatic type (utilizing manifold vacuum) with electric control of the vacuum cylinder valves. The transmission is entirely conventional and shifting of gears is effected by the usual shift lever (a 'stubbed' lever is used but an extension for the lever is provided for hand shifting). The actual engagement of the gears is effected by the large 'Shift Cylinder' located on the left side of the transmission case (backward and forward movement of the shift lever). A smaller 'Diaphragm Cylinder' located above the Shift Cylinder controls the right and left movement of the shift lever necessary to engage Reverse-Low or Second-High shifter rails (this is similar to the right and left movement of the hand shift lever in 'neutral').

Both the forward and backward movement of the Shift Cylinder Piston (Reverse or Second gear engaged in forward position, Low or High gear engaged in rear position) are effected by admitting manifold vacuum to the rear or forward end of the Shift Cylinder. Two solenoid controlled valves are used for this purpose.

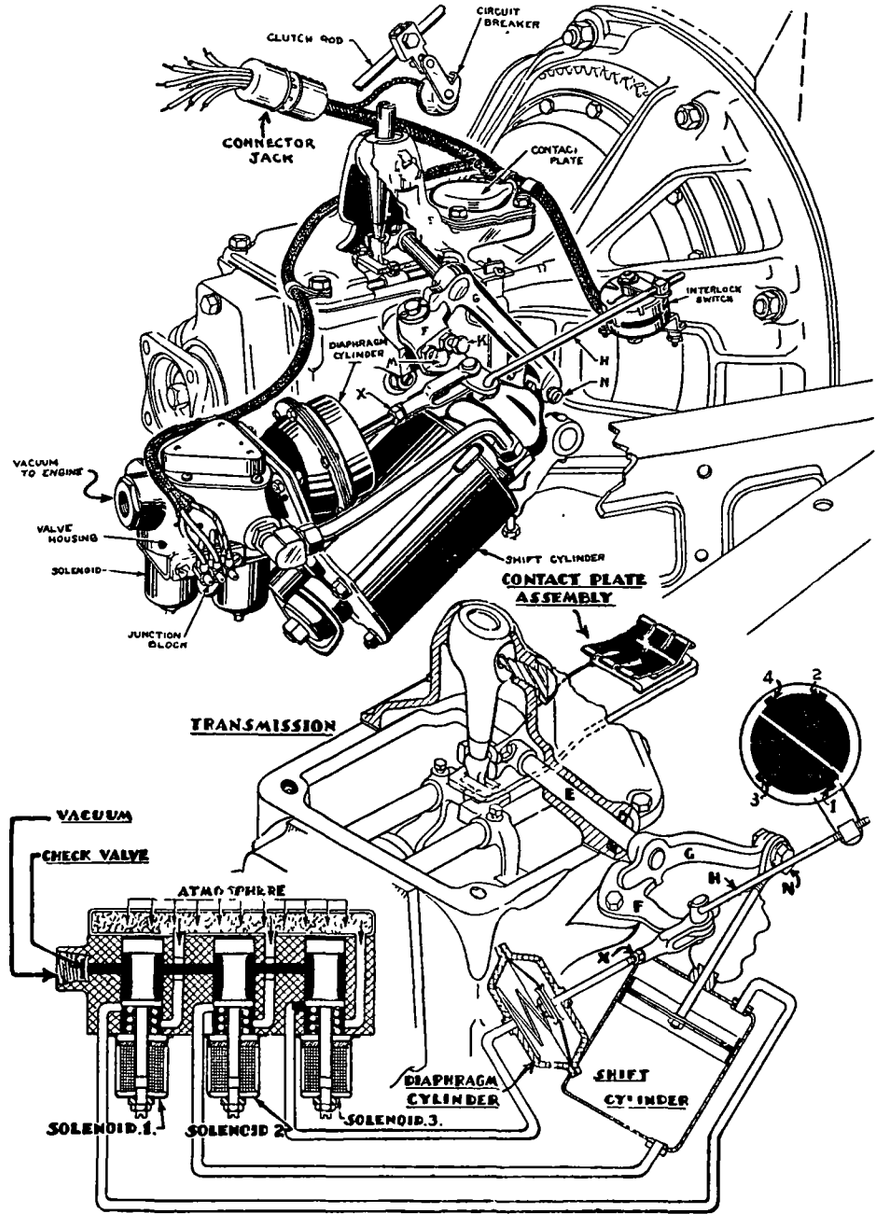
The gear shift lever is normally in the left hand position and is held there by the spring within the Diaphragm Cylinder. The shift lever is moved to the right-hand position at neutral so as to engage the Second-High shifter rail by admitting manifold vacuum to the Diaphragm Cylinder. An additional solenoid-controlled valve is used for this purpose.

The solenoid-controlled valves are combined in one assembly mounted directly behind the Shift Cylinder and have a common vacuum line connection (at the rear of the assembly) and air intake (through the air cleaner element on top of the assembly). They are spring-loaded piston type valves held normally in the upper position by the spring under the valve so that vacuum is cut off and the air passage through the valve is open. When the solenoid located below the valve is energized the valve is pulled down, cutting off the air intake port and connecting the vacuum and cylinder ports. The solenoid circuits are controlled by the Selector Switch, Clutch Pedal Circuit Breaker, Contact Plate Assembly, and Interlock Switch as follows:

Selector Switch—Located below steering wheel on steering column. Consists of a gate type switch lever which duplicates the conventional shift lever movements to pre-select the gear position (or neutral position) which is next desired. This selection may be made at any time as no action results until the clutch pedal circuit breaker is closed. A cutout switch is located on the Selector Switch housing. This switch is normally closed and is opened only to cut out automatic shift when hand shifting used.

Clutch Pedal Circuit Breaker—Located on left side of engine and connected to clutch pedal so that circuit is open with clutch engaged and is closed only when pedal is depressed to disengage clutch. Acts as a main switch for the Electric Hand circuits and shift will occur when circuit breaker is closed if new gear position has been chosen since last previous clutch disengagement (on cars with automatic clutch, clutch will be disengaged whenever accelerator pedal is fully released.

Contact Plate Assembly—This is a three-position switch mounted on the transmission cover directly in front of the shift lever. The five terminals on the terminal block are connected to five stationary contacts and circuits are completed through the switch by two sets of contact fingers mounted on a sliding plate which is moved backward and forward by the movement of the shift lever. With the transmission in gear, the Contact Plate Assembly completes the proper circuits to move the shift lever to neutral when a new gear position is set on the Selector Switch. As the shift lever



moves to neutral, the contact finger plate moves with it, completing a new set of circuits so that after a momentary pause the shift lever is moved to the new gear position. If the shift requires that the shift lever move from one side to the other at neutral (as in the shifting from Low to Second) the circuits are completed through the Interlock Switch and the shift lever cannot move out of the neutral position until the Diaphragm Cylinder has completed this cross motion.

Interlock Switch—Located on clutch housing and connected to the Diaphragm Cylinder lever. Does not operate as long as no cross motion of the shift lever is required (for example, in shifting from Low to Reverse, or Second to High). When this cross motion is required, the second set of circuits (to move shift lever from neutral to the new gear position) are completed by the rotation of the Interlock Switch spider as the Diaphragm Cylinder completes the cross motion of the shift lever.

ADJUSTMENT:—Mechanical adjustments are provided for each of the units comprising the Electric Hand. The adjustments are correctly made when the Electric Hand is installed and should not require resetting unless new units are installed or the setting is disturbed by removing the units from the car or when other work is done on the engine or transmission. Check settings and make adjustments in order noted below.

Clutch Pedal Circuit Breaker—Check adjustment with clutch fully engaged. Pointer on circuit breaker lever should line up with reference arrow on top of circuit breaker housing. This setting is important as contact must not be made with too little clutch pedal movement (shift will be made while engine is still driving car), or too much pedal movement (shift will not be made if gear teeth 'butt', requiring slight shaft rotation to mesh gears). The contact must not be broken until there is a slight clutch drag or partial engagement in order to turn transmission shaft and insure meshing of gears. If necessary the pointer on the circuit breaker lever can be set slightly ahead of the arrow to secure this action. Circuit Breaker adjustment is different on cars with and without automatic clutch.

(1) With Automatic Clutch Control. Loosen clamp bolt nut on bracket on vacuum clutch rod, slide clip on rod until pointer lines up with arrow, tighten locknut.

(2) Without Automatic Clutch Control. Take out cotter pin in circuit breaker lever pin, loosen locknut on operating rod, free rod end from lever pin, rotate circuit breaker lever until pointer lines up with arrow on cover, turn rod end in or out until it will slip on pin without disturbing position of lever, tighten locknut and replace cotter pin.

Shift Cylinder Piston Rod Length—Shift transmission into high gear, remove clevis pin linking piston rod to lever (G), push rubber piston guard on piston rod back and loosen locknut on piston rod. Turn rod end in or out until holes in rod and lever (G) line up with piston rod and piston in extreme forward position, then lengthen piston rod by backing off rod end four threads (four complete turns), tighten locknut, insert clevis pin.

Cross Shift Stopscrews (Diaphragm Cylinder Lever)—With transmission in high gear, loosen locknut and back off front stopscrew (K) until it does not touch the stop, then turn screw in until it just touches the stop (note when this occurs), turn screw in ¼ additional turn and tighten locknut. With this setting, clearance between outside face of Shift Cylinder lever (G) and outside finger of bellcrank (F) should be .004" (measure with a feeler gauge). Use Electric Hand to shift transmission into low. With transmission in low gear, loosen locknut and adjust rear stopscrew (M) in same manner, turning screw in ¼ turn after it contacts stop. With this setting, clearance between inner face of Shift Cylinder lever and inner finger of bellcrank should be .004" as measured by feeler gauge.

Diaphragm Cylinder Shaft Length—Take out clevis pin in forward end of Diaphragm Cylinder clevis, loosen locknut (X) at rear of clevis, push bellcrank (F) forward until front stopscrew (K) is against its stop, turn clevis in or out on rod until clevis pin hole is ¼" in front of or beyond the hole in the bellcrank lever with the Diaphragm Cylinder rod in the extreme forward position, tighten locknut, push rod back into Diaphragm Cylinder until holes line up and insert clevis pin.

Interlock Switch Adjustment—Check adjustment by using Electric Hand to shift transmission into low and then into high. See that pointer on Interlock Switch lever lines up with reference line on switch cover. If it does not, loosen front stop, turn rear stop until pointer and line register with switch lever held against rear stop, tighten front stop. Shift transmission into low and then back to high and recheck setting.

TROUBLE SHOOTING & TESTING:—For trouble shooting and testing (with and without special test equipment), see following article on 1936 Type.

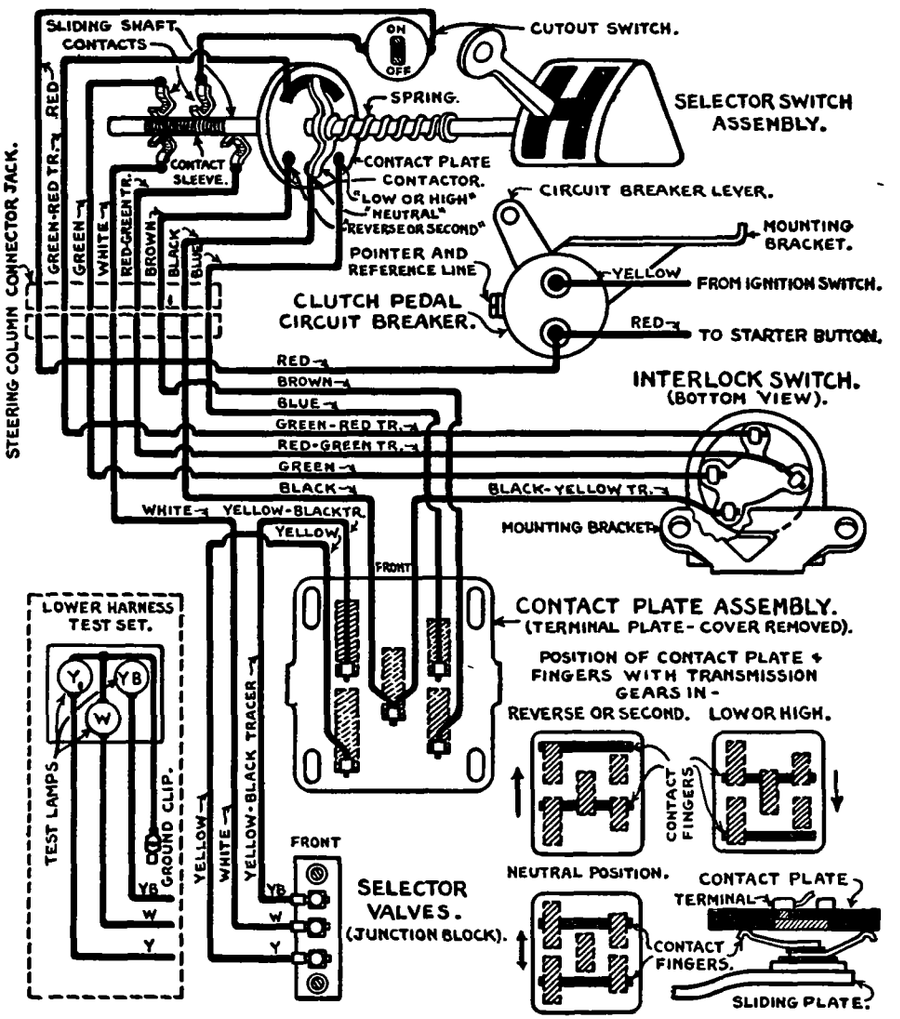
SERVICING:—For complete directions in disassembling and servicing this equipment see following article on 1936 type. Selector Switch and contact plate assembly design has been changed and data on these units given below.

Contact Plate Assembly:—Sliding block design changed to new type using pivoted contact finger similar to 1936 type. Replace old block with new Part No. 74485. This can be distinguished from regular 1936 part by the fact that it has all contact fingers of equal thickness (two fingers on 1935 block are thicker than others).

Selector Switch:—To remove, disconnect cap and jack at base of steering column by lifting until lock lug is out of groove in base and twisting ¼ turn. Separate halves of jack, unsolder wires, remove loom from wires. Take out four screws in selector switch bracket cap, remove cap, draw wires out of steering column.

To Disassemble—Take out two screws in end of 'H' plate cap, remove cap. Turn selector lever ¼ turn clockwise, withdraw lever and shaft, remove washer retainer, washer, springs and lever from shaft. To remove cutout switch, take out two screws in switch plate, lift switch out, unsolder wires from switch terminals. To remove switch base and rotor, pry out switch base lock ring, withdraw base, rotor, and spring (cutout switch must be removed first).

To Install—Assemble in reverse order to disassembly directions given above. Install in same manner as 1936 type (see following article for complete directions and wire connecting chart for jack).



Optional Equipment On
HUDSON, SIX MODEL 63 (1936), EIGHT MODELS 64, 65, 66, 67 (1936)
TERRAPLANE, MODELS 61 DELUXE, 62 CUSTOM (1936)

NOTE:—See following article for improved type Electric Hand on late 1936 cars.

DESCRIPTION:—Similar to equipment used on 1935 models except for minor differences in design of units as follows:

Selector Switch—Housing design and mounting on steering column changed but internal circuits and operation identical with previous model.

Clutch Pedal Circuit Breaker—New type push-pull switch replacing rotary type used previously. Switch provides 'lost-motion' necessary for correct closing and opening of circuit and adjustment is not the same as 1935 type (see adjustment below).

Transmission Shifter Rail Lock Bars—New feature on 1936 type. Consists of spring loaded plunger and ball detent which engages notch in shifter rail and prevents shifter rail movement until clutch is disengaged which raises lock bar and releases ball plunger. One lock bar mounted on each side of transmission case and operated by adjustable linkage from clutch throw-out shaft. See adjustment below.

Contact Plate Assembly—Contact plate sliding block now operated by rod connected to plate at lower end of shift lever (first type sliding block mounted directly on this plate). Sliding block has been redesigned and consists of six contact fingers pivoted individually on block and held in contact with plate by coiled springs on pivot rod.

NOTE—Similar type sliding block (Part No. 48745) available for replacement on 1935 models equipped with first type block. Replacement block has all contact fingers of equal thickness and may be distinguished from 1936 standard type (Part No. 152197) which has two fingers which are thicker than the others.

Interlock Switch—Same as for 1935 models.

Diaphragm Cylinder Linkage—Cross shift stopscrews (K and M on 1935 illustration not used on 1936 model.

Power Unit Solenoid Valves—Valves have been redesigned and are now poppet type. Valves are held at upper end of stroke (cutting off vacuum and admitting air to cylinder) by spring at lower end of valve plunger when solenoid is not energized, and are pulled down (cutting off air and opening vacuum port) when solenoid is energized. Air cleaner element in valve assembly cover has been discontinued and air connection is by means of a separate tube connected to the lower end of the carburetor air cleaner.

ADJUSTMENT:—Mechanical adjustments provided for each unit. All adjustments should be checked, in order given below, whenever Electric Hand is serviced or when settings are disturbed by work on engine, clutch or transmission.

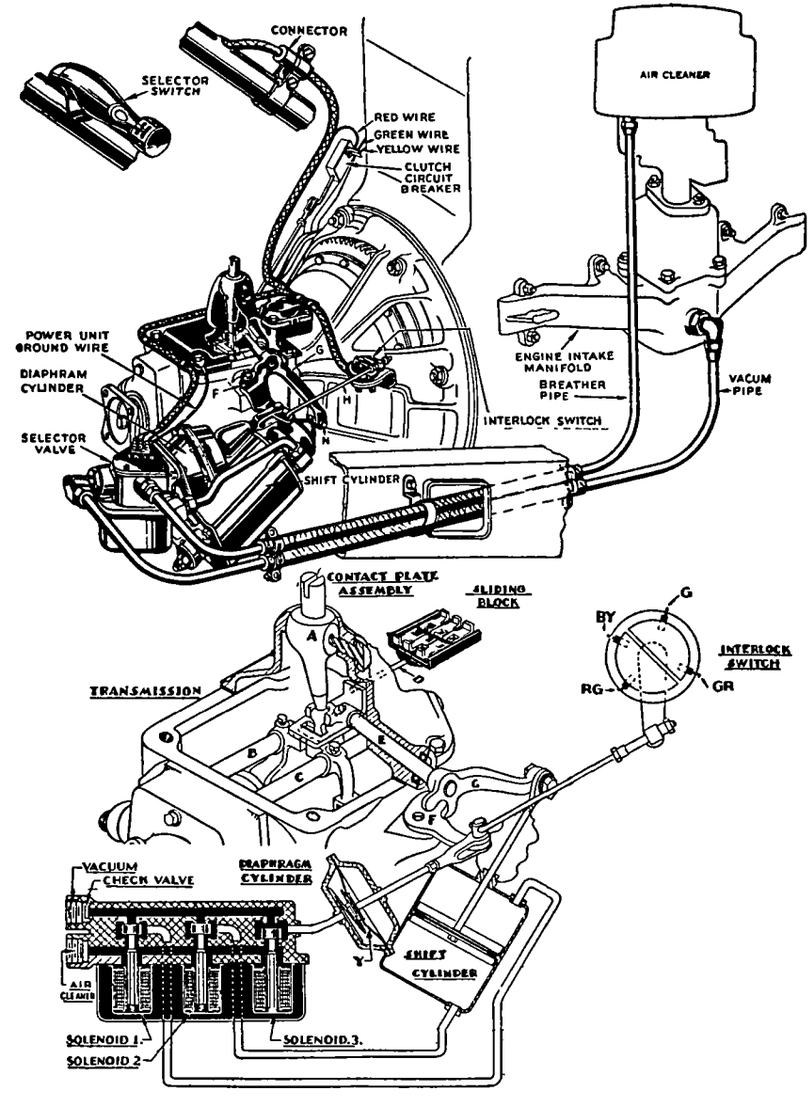
Clutch Pedal Circuit Breaker—Circuit through switch should not be completed until clutch is disengaged with pedal depressed half way to floor board (to avoid gear clash caused by engine driving car when shift is made). To adjust, take out clevis pin in linkage at circuit breaker, loosen locknut on rod, turn clevis. With correct setting, notch on forward end of circuit breaker rod should be flush with housing. Transmission shifter rail locks must be released when circuit breaker makes contact (see shifter rail lock adjustment below). Circuit breaker contact must not be broken until clutch has started to engage to insure gears meshing when car is not in motion and gear teeth strike). Check by running engine, shifting transmission into low or reverse, engaging clutch slowly. Car should start to move before 'click' of cross shift linkage, which indicates circuit breaker contact broken, is heard.

Transmission Shifter Rail Locks—Shifter rail locks (on each side of transmission case) must be released when circuit breaker contact made. Check by depressing clutch pedal to point where circuit completed through circuit breaker (halfway to floor—see paragraph above). Shifter rail lock bar link should be raised so that notch in link is opposite end of plunger in transmission case. Adjust by turning nut on link operating rod at lever on throw-out shaft (this adjustment provided at each lock link. Check to see that lock link drawn down so that plunger is held in when clutch is engaged. This is important to prevent transmission jumping out of gear. If lock links not drawn down with transmission in gear and clutch engaged, recheck lock setting (above), check power cylinder piston rod length, check circuit breaker contact opening point. If this does not correct lock action, use Lower Harness Test Lamp Set and check contact plate position to determine whether power cut off before shift completed (see Testing below).

Power Unit Mounting—Power unit must have sufficient clearance so that it does not strike frame 'X' member and must be lined up so that power cylinder piston rod enters fork of shifting lever freely with transmission in high (forward) or second (rearward) position. Maximum clearance secured by pushing up on unit while tightening nuts on studs which hold mounting bracket on transmission. Power unit cylinder mounting stud nut should be tightened just enough to insert cotter pin. This will insure maximum flexing of rubber mounting blocks for alignment.

Power Cylinder Piston Rod Adjustment—Piston rod movement must be sufficient to complete shifts in either direction. To adjust, place transmission in high gear, hold shift lever forward to take up all lash, take out pin linking piston rod to shift lever, pull piston all the way forward, loosen locknut on piston rod, turn rod eye out until it is ¼" farther forward than hole is in shift lever, tighten locknut. Check adjustment by placing transmission in second gear, hold shift lever backward to take up all lash, push piston all the way in, see that piston rod eye is ¼" farther back than hole in shift lever. Line up eye and shift lever hole by pulling piston out slightly, insert pin.

Diaphragm Cylinder (Cross Shift Control Mechanism) Adjustment—With transmission in high or second gear, remove clevis pin from diaphragm cylinder rod yoke at cross shift bell-crank. Spring in diaphragm cylinder should move rod and yoke ¼" farther forward. Loosen locknut and turn yoke until rod must be moved ¼" back in order to insert clevis pin. Hold clevis from turning while



tightening clevis locknut to avoid damaging diaphragm. Shift transmission to all gear positions, see that bell-crank contacts lobe on shift lever only at outer end of bell-crank fork and that mechanism does not bind. Check action of stub shift lever on transmission case cover to see that fulcrum dowel screw does not bind in lever ball groove. First type dowel screw (Part No. 35442) was 23/32" long and a 1/16" plain washer was assembled under the head in addition to the lock. Dowel screw later changed to Part No. 151787 which is 21/32" and washer omitted. Washers must be used with first type screw to prevent binding.

Interlock Switch Adjustment—Check by using Electric Hand to shift transmission into low and then into high or second. Interlock switch lever must line up with reference line on switch cover marked 'S/H' when these shifts completed. To adjust, loosen jam nut on forward end of switch rod, turn adjusting sleeve (head of sleeve directly behind switch lever), tighten jam nut. Shift transmission to low, back to high, recheck switch. Operation of switch can be checked with Lower Harness Test Lamp Set in Testing section below (circuit in switch should change at same distance from end of cross shift travel in each direction).

Contact Plate Adjustment—Lower Harness Test Lamp Set must be used to check operation of main contact plate. See directions in Testing section below.

TROUBLE SHOOTING:—Complete testing of the Electric Hand requires the use of a Master Selector Switch to check Selector Switch and upper wiring harness, a Power Unit Test Cable to check shift mechanism or Power Unit, and a Lower Harness Test Lamp set to check the lower wiring harness and switches (this must be used in conjunction with a Selector Switch which is known to be operating satisfactorily). Directions for use of this test equipment is given under 'Testing' below. Before making complete tests, check following points:

1. See that Cutout Switch on Selector Switch is closed or 'on'.

2. Check transmission by hand shifting in all positions. See that lever moves into each gear position freely with clutch pedal depressed to point where circuit breaker circuit is closed (starter will be operative). Adjust Interlock straps on transmission if necessary. See that correct lubricant is used in transmission case and that shifting is not being retarded by oil which is too heavy for prevailing temperatures.

3. Check vacuum line and fittings. If hard shifting experienced in cold weather, check power cylinder for gasoline condensation from manifold. If this trouble experienced, shift vacuum line connection from lower to upper hole on manifold (upper hole for automatic clutch connection, if clutch not used hole closed by plug, if clutch installed use tee connection. Use plug to close lower manifold hole.

4. Check wiring harness for breaks or damaged insulation, check connections on Interlock switch, Contact Plate Junction Block (check soldered connections, see that terminals are not shorted to cover, examine for broken parts, note condition of contacts), Selector Valve Junction Block, and Steering Column Jack (remove covers by twisting with jack assembled, check soldered connections within covers).

5. Check Circuit Breaker setting (see Adjustment above). Test for short-circuit by pressing starter button with clutch engaged. If starter operates, replace circuit breaker. Test for open-circuit by pressing starter button with clutch pedal depressed. If starter operates, circuit through circuit breaker is satisfactory. If starter does not operate, connect test lamp between yellow wire terminal on circuit breaker and ground. If lamp lights, circuit breaker is open and should be replaced. If lamp does not light, check wire from circuit breaker to ignition switch for open-circuit.

6. Check for short-circuits in Electric Hand by turning on instrument light and shifting into each gear position. If light dims noticeably, a short-circuit is indicated for that position (valve solenoids should draw approximately 2.5 amperes each).

If Electric Hand operation is unsatisfactory after completing these checks, use test equipment and make complete tests outlined below.

Trouble Shooting Table

If transmission fails to shift into or out of any of the gear positions noted below, check the wire indicated for open or short-circuits. A defective selector switch may cause any of the conditions noted and selector switch should first be checked by substituting a master selector switch or a selector switch known to be operating correctly and the Electric Hand operation noted.

1. In or out of any position—Check Red Wire (feed from circuit breaker). If transmission will shift into neutral by moving selector switch to opposite side at neutral, check Green Wire with Red Tracer.

2. Into Low or Reverse—Check White Wire and Green Wire. If transmission shifts to neutral instead of low, check Green Wire with Red Tracer. If cross-shift is still correctly made, check Green Wire.

3. Into Low or High—Check Blue Wire. If transmission also fails to shift out of Second or Reverse, check Yellow Wire with Black Tracer.

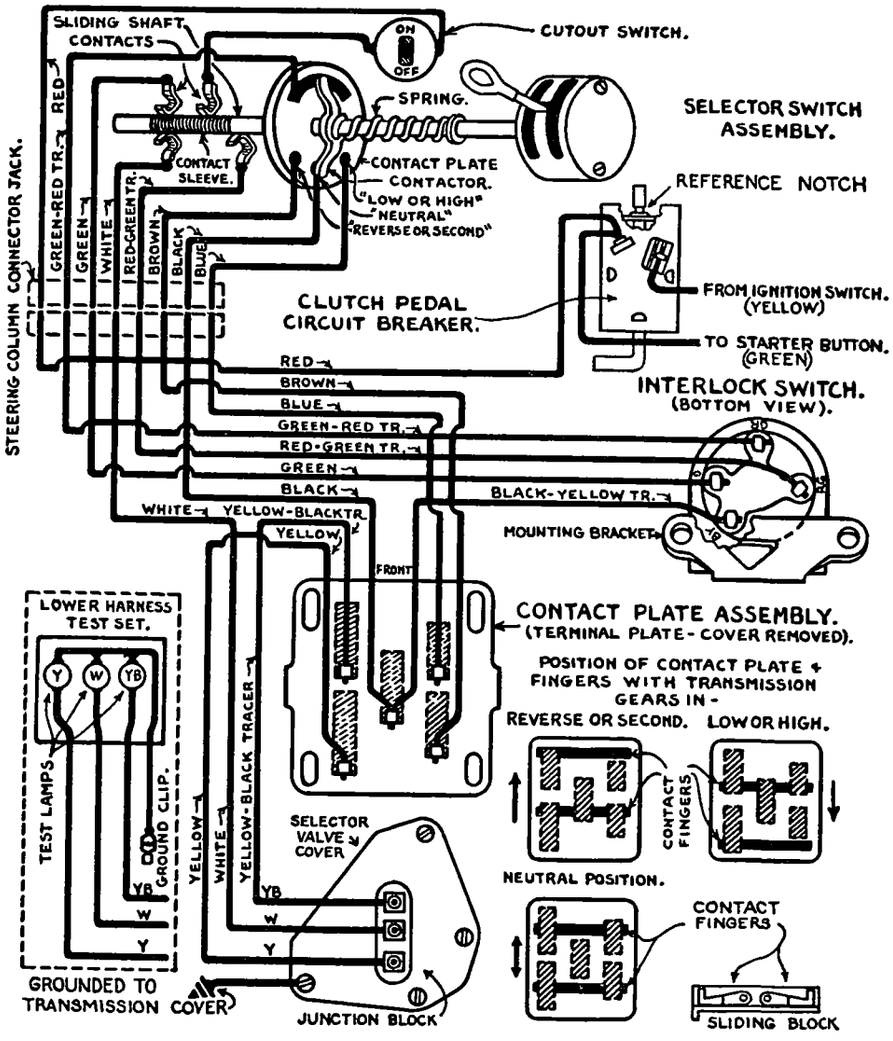
4. Into Second or Reverse—Check Brown Wire. If transmission also fails to shift out of Low or High, check Yellow Wire.

5. Into Second or High—Check Red Wire with Green Tracer.

6. Into Neutral—Check Black Wire. Transmission will shift to neutral from Second or High by moving selector switch to left at neutral for the cross-shift.

7. Into or out of some positions except when started by hand—Examine contact plate assembly and see that contact surfaces are clean.

8. Transmission is slow in making any shift involving a cross-shift—Check Black Wire with Yellow Tracer.



TESTING ELECTRIC HAND:—Selector Switch and Upper Wiring Assembly—Disconnect Selector Switch jack at lower end of steering column, plug in Master Selector Switch (no ground required). Operate Master Selector Switch to shift into all gear positions. If Electric Hand operates satisfactorily, replace complete Selector Switch and upper wiring assembly (all parts down to and including the upper half of the jack). Test lamp on Master Selector Switch (6-8 volts, 32 cp., must be single contact type) should burn at half - brilliance if circuits are normal. A short - circuit will cause fuse (7½ ampere) to blow and lamp to burn at full-brilliance. When this occurs leave Selector Switch in this position and check all circuits involved for short-circuits. Do not replace fuse until short-circuit has been located and corrected. Use only 7½ ampere fuse for replacement.

Shift Mechanism (Power Unit)—Connect power unit test cable to red wire terminal on circuit breaker. Operate engine with clutch disengaged and rear wheels jacked up so that shifts can be made. Touch the test prod of the test cable to the points indicated and note whether transmission shifts properly (some tests require contacting two terminals on the Selector Valve junction block at the same time). Terminals are designated by the color of the wires attached as follows: 'YB'—terminal toward front of car (yellow wire, black tracer), 'W'—center terminal (white wire, no tracer), 'Y'—terminal toward rear of car (yellow wire, no tracer).

1. Test Prod on YB—Transmission should shift into high gear.
2. Test Prod on Y—Transmission should shift into second gear.
3. Test Prod on W—With transmission in neutral, cross-shift or left-right movement of lever should be made.
4. Test Prod on W and YB—Transmission should shift into low gear.
5. Test Prod on W and Y—Transmission should shift into reverse gear.

If any of these shifts are not made, check valve solenoid by connecting accurate ammeter between terminal and circuit breaker lead (ammeter lead should be merely touched to terminal to avoid damage if solenoid dead short-circuited). Current draw should be approximately 2.5 amperes. Larger current indicates that solenoid is shorted, smaller current indicates an open-circuit. If current draw is satisfactory, examine valve to see that it is free and not sticking in upper position, check for vacuum leakage in valves, lines or shift units. Check units for mechanical drag by disconnecting shift cylinder from lever (G) and Diaphragm Cylinder from bellcrank (F). If units do not operate when disconnected, entire Power Unit (Shift Cylinder, Diaphragm Cylinder, Selector Valve Assembly) must be rebuilt or replaced.

Switches and Lower Wiring Harness—Disconnect wires on selector valve junction block and connect these wires to clips on Lower Harness Test Set in accordance with wire color (see illustration). Attach Test Set ground clip to clean place on engine for good ground connection. Make tests by manipulating selector switch (selector switch must be known to be OK) and shift lever and noting whether correct test lamps light (lamps designated by color of wire connected to leads as for shift mechanism test above). See that ignition is turned on, Cutout switch turned on, and clutch held completely disengaged and make following tests:

1. Place selector lever in neutral (right end of slot). Shift transmission to neutral manually. Lamp 'YB' should light when shift lever moved short distance toward second gear. Lamp 'Y' should light when shift lever moved equal distance toward high gear.

2. Place transmission shift lever in neutral. Move selector lever to low gear position. Lamp 'W' only should light.

3. Place transmission shift lever in neutral. Move selector lever to each gear position in turn. Lamps should light as follows: High gear—'Y', Second gear—'YB'. Low or Reverse—'W' only.

4. With selector lever in each gear position in turn as above (3), complete shift by moving shift lever to same position. Lamps should go out when shift completed except that lamp 'W' will remain lighted with transmission in low or reverse (lamp 'Y' will light momentarily when transmission shifted to low, and lamp 'YB' during shift to reverse—these lamps do not light during test (3) since no vacuum available to operate Diaphragm Cylinder and Interlock Switch which occurs when transmission shifted manually).

If above tests indicate that proper circuits are not being completed (correct lamps do not light or go out at the right time, or additional lamps light), replace Lower Harness. After replacing lower harness, check Contact Plate Assembly adjustment as directed below.

Contact Plate Assembly Adjustment—If lamp 'Y' or 'YB' are lighted with transmission shift lever in neutral (Test 1 above) or if lever movement forward to light lamp 'YB' and rearward to light lamp 'Y' are not equal, contact plate requires adjustment. To adjust, loosen four screws holding contact plate assembly, shift plate slightly to rear (if 'YB' lighted in neutral) or to front if (if 'Y' lighted in neutral) until lamp goes out, tighten screws. With correct adjustment, movement forward and backward to light each lamp should be equal. Screw holes in contact plate are slotted to permit this movement. If plate is not free to move, remove from transmission and carefully cut off locating dowel pins.

Transmission Shifter Rail Lock Action—If correct lock action cannot be secured, connect Lower Harness Test Lamp Set (as directed above), move selector lever to low gear position, depress clutch pedal. Lamps 'W' and 'YB' should be lighted. Shift transmission manually toward low gear until lamp 'YB' goes out, release clutch pedal. Shifter rail lock bars should both drop down. If right hand lock bar is not down, leave clutch engaged and pull shift lever to complete shift, noting movement necessary. If more than slight movement required before lock bar moves down, adjustment of contact plate, replacement of contact plate sliding block, or replacement of transmission cover linkage is required. To determine whether adjustment will correct condition, move selector lever to reverse, depress clutch pedal. Lamps 'W' and 'Y' will be lighted. Move shift lever toward reverse until lamp 'Y' just goes out. Release clutch. If lock bar at right of transmission goes down, contact plate can be moved back slightly for longer contact in low. If lock bar does not go down and considerable shifting lever movement necessary before lock bar goes down, sliding block or linkage in transmission cover must be replaced.

Interlock Switch Setting—Shift transmission to low gear manually, place selector lever in high gear, depress clutch pedal. Lamp 'Y' should light and remain lighted until transmission is shifted manually to neutral. Lamp 'YB' should light when cross shift to second-high side is completed. If lamp 'YB' lights before cross shift is practically completed, interlock switch adjustment is incorrect (see adjustment above). With correct adjustment shift lever travel in either direction at neutral to light lamp should be equal. To check, place selector lever in low, move shift lever to left in neutral, note travel before lamp 'YB' lights. Then place selector lever in high, and shifter lever at extreme left in neutral, move shifter lever to right, note travel before lamp 'YB' lights. Travel in either direction should be equal.

REMOVAL AND INSTALLATION:—Selector Switch Assembly—To remove, disconnect connector jack at lower end of steering column by lifting cap from jack until lug is out of groove in jack base, then turn cap ¼ turn. Separate jack halves, unsolder wires on upper half, pull off jack and loom on cable. Take off end cap and washer on selector switch, loosen selector housing mounting bolt nut inside housing, slide selector housing downward and remove, withdraw wires from steering column.

To Disassemble—Take out cutout switch cover screws, remove switch plate, lift switch up and unsolder wires, pull wires out of end of housing from which end cap previously removed, insert cotter pin puller through hole to right of cutout switch and press lock ring out of groove in switch base, pull wires and switch base out of housing, remove switch rotor and spring. Remove two screws in 'H' plate cap (selector lever segment), hold cap to right and remove washer retainer, washer, spring, and lever, turn selector switch shaft ¼ turn to right (clockwise facing selector lever end) and withdraw.

To Assemble—Assemble in reverse order as above. See that rotor is inserted with side with three contacts to left and that it slides over tongue on shaft. See that switch base tongue engages groove in bottom of housing, and that locking ring engages groove in housing.

To Install—See that eight wires of selector switch harness are laid out flat side-by-side and do not cross (clips can be used to hold wires). Feed wires down through steering column tube. Install selector switch on steering column so that head of mounting bolt enters wire hole in column, move selector up so that bolt shank engages slot, tighten nut inside selector housing. Pull wires down in steering column so they do not project through end cap hole on selector, install loom on lower end, solder wires to upper half of connector jack. In making connections, designated wire colors must be connected to marked terminals as follows: 'R'—red wire, 'BK'—black, 'G'—green, 'RG'—red with green tracer, 'W'—white, 'GR'—green with red tracer, 'B'—brown, 'BL'—blue.

Contact Plate Assembly:—To remove, take out four capscrews in cover, lift up cover and plate, remove sliding block. Unsolder wires on contact plate if plate to be removed from harness.

1936 TYPE CONTINUED

To Install—When soldering wires on contact plate lugs, designated wire colors must be connected to marked lugs as follows: 'YB'—yellow wire with black tracer, 'Y'—yellow, 'BY-BK'—black wire with yellow tracer and black wire, 'BL'—blue, 'B'—brown. When inserting sliding block into contact plate guides make certain that driving block on lug is to rear when assembled. Insert one ounce of contact plate grease (No. 48705) in cavity in transmission cover in which sliding block operates before installing assembly.

Power Cylinder:—To remove power cylinder from power unit assembly (with assembly off the car), disconnect vacuum lines, remove three end plate staybolts, remove cylinder from assembly.

To Disassemble—Use special tool HMO-12-1 to remove cylinder end plate, remove end plate inner seal, pull out piston and rod assembly, take off piston rod nut, disassemble pistons.

To Assemble—Put felt retainer and piston plate on rod, wrap packing ring around retainer with the felt ring over it, put leather cup packing and center plate on rod to hold felt and packing ring in place, then put second leather cup packing and second plate on rod. Wrap packing ring and felt around second felt retainer, install in place in packing on rod, install piston rod nut, tighten securely and stake in place.

To Install—Saturate leather packing cups and felts in Hudson shock absorber oil until leather is soft and pliable, then install piston assembly in cylinder being careful not to turn edges of packing cups back when inserting. Use new end-plate inner seal and end plate gasket, install end plate, draw down in to place by tightening stay bolt nuts evenly and securely when attaching cylinder to bracket. Test seal by holding thumb on front vacuum line connection and pulling on piston rod. Rod should move out only slightly and air compressed in cylinder should resist further movement.
NOTE—Vacuum line should be disconnected at front of cylinder and one ounce Hudson Shock Absorber Fluid injected in cylinder at 15000 mile intervals to maintain piston seal.

Diaphragm Cylinder:—Mounted on mounting bracket by mounting plug and washer at vacuum connection and can be disassembled without being removed from bracket.

To Disassemble—Remove rod yoke, locknut and rod guard, take out six bolts in flange, remove housing cover and diaphragm assembly. Take off rod nut and disassemble diaphragm.

To Assemble—Reverse operations above. See that spring is seated in flanged plate, and hold diaphragm rod in while tightening flange bolts to avoid distortion of diaphragm. Tighten all bolts evenly and securely to insure tight seal. Check by pushing rod in and then holding finger over vacuum connection in mounting bracket. The rod should not move out.

Selector Valve Unit:—Mounted on mounting bracket by four screws. Wash unit with gasoline (brush off only, do not dip in gasoline) before disassembling.

To Disassemble—Take out four screws in cover plate, lift cover slightly and unsolder wires from terminal block. Remove solenoid cover stud, washer and gasket, remove cover. Remove three screws in solenoid retainer, remove retainer and solenoid being careful not to loosen springs from bottom of valve plunger. Remove valve seats and valve assemblies from body (if necessary tap seats out with blunt bar inserted through center holes in housing, do not attempt to pull on valve plunger). Remove rubber valve heads from valve plunger washer. Take out check valve nut and check valve in vacuum connection.

Servicing—Wash all parts except solenoids and rubber valve heads in gasoline. See that all dirt removed from valve body passages.

To assemble—Reverse disassembly operations. Use new rubber valve heads if old heads swollen or spongy from gasoline, or worn or cut. When reassembled, valve travel up and down should be 1/32-1/16". Movement must not be less than 1/32" or performance will be sluggish. Use new cover gasket and solenoid retainer gasket and see that cover screws fastened securely to keep out water and dirt.

IMPROVED TYPE USED ON HUDSON-TERRAPLANE 1936-37 MODELS

Optional Equipment On:

Hudson Custom Six, Model 63 (1936) After No. 638319—See Note.
Hudson Deluxe Eight, Model 64 (1936) After No. 644398—See Note.
Hudson Custom Eight, Model 65 (1936) After No. 652078—See Note.
Hudson Deluxe Eight, Model 66 (1936) After No. 663201.
Hudson Custom Eight, Model 67 (1936) After No. 674296.
Terraplane Deluxe, Model 61 (1936) After No. 6151381—See Note.
Terraplane Custom, Model 62 (1936) After No. 6213759—See Note.
Hudson Six, Model 73 (1937)—All Cars.
Hudson Eight, Custom & Deluxe Models 74, 75, 76, 77 (1937) All Cars.
Terraplane, Models 70, 71, 72 (1937) All Cars.

NOTE:—Serial numbers for 1936 models apply with the following exceptions: (63) 638351 to 638470 inc., (64) 644439 to 644464 inc., (65) 652159 to 652160 inc., (61) 6151401 to 6151779 inc., (62) 6213901 to 6213963 inc.

DESCRIPTION:—Same as type used on previous models except for the following changes:

Selector Switch—Special high gear lock-out switch or solenoid gear ground strap added for Automatic Clutch control (see separate article for Automatic Clutch data). Extra wire (yellow) added in Selector switch harness and extra terminal (Y) provided on jack for this circuit. On cars without Automatic Clutch, extra wire not provided in lower harness and standard 8-wire harness used. This line and lock-out switch do not enter into Electric Hand operation.

Contact Plate Assembly—Discontinued. New 'Neutral Switch' mounted in end of power cylinder used to return piston to neutral position (see Power Cylinder). High Gear Ground Switch and Governor Switch on transmission case are part of Automatic Clutch Control and do not enter into Electric Hand operation (see article on Automatic Clutch).

Diaphragm Cylinder—Same as previous model but larger.

Power Cylinder—Same design as previous model except for larger size and new Neutral Switch located on rear end plate.

Neutral Switch—Consists of stationary central contact and two movable contact arms each connected to one of the power cylinder solenoid valves. Neutral switch operating lever in cylinder is linked to contact arms so that both sets of contacts are open when piston centralized in cylinder (transmission neutral position). Movement of piston in either direction from center allows one set of contacts to close and, whenever center contact is live (as will be the case with Selector Switch and Transmission in neutral) solenoid valve will be opened and vacuum connection completed to one end of cylinder so that piston will be drawn back toward center. At center neutral position, circuit will be broken by operating lever.

ADJUSTMENT:—Mechanical adjustments for Clutch Pedal Circuit Breaker, Transmission Shifter Rail Locks, Power Unit Mounting, and Diaphragm Cylinder same as for previous model (see 1936 article—disregard Contact Plate instructions). Power Cylinder Piston Rod adjustment is new.

Power Cylinder Piston Rod Adjustment—Run engine, hold clutch pedal depressed. See that all wiring in place and Selector Switch Cut-out Switch 'on'. Remove clevis from piston rod, loosen locknut, adjust piston rod length so that clevis pin can just be inserted with Selector Switch and Transmission in neutral. For more exact setting, use Lower Harness Test Set. Disconnect wires on terminals on solenoid valve cover, attach Lower Harness Test Set (YB clip to BL wire, W clip to W wire, Y clip to B wire, ground clip to chassis). Place Selector Switch in neutral, depress clutch, turn on ignition but do not start engine (engine must not be running for this test). Use manual shift lever, shift transmission toward high gear until 'Y' lamp lights, then toward second until 'YB' lamp lights. Movement in each direction must be equal and lamps should not be lighted in neutral position. Adjust by lengthening piston rod (Lamp YB will light sooner) or shortening rod (Lamp Y will light sooner).

TESTING:—All tests made in same manner as on previous model. Terminal markings and wire colors have been changed in some cases so that some test instructions are new as given below.

Selector Switch and Upper Wiring Harness:—Use Master Selector Switch plugged in at jack at lower end of steering column (adapter required for new 9 prong jack if old type 8 prong Selector Switch jack used). Make tests in same manner as previously (see 1936 data). To check switch circuits, disconnect jack at lower end of steering column, test by touching test lamp prods to prongs on upper half of jack as follows (test lamp should light in each case):

Selector Switch Position	Current Supply	Test Lamp Prod.
1. Neutral, High or Second	R	RG
2. Low or Reverse	R	G-W
3. Low or High	GR	BL
4. Second or Reverse	GR	B
5. Neutral	GR	BK

If lamp does not light for Test #1 or #2, check Selector Switch Cut-out Switch, red wires in harness, and contact in selector switch. If lamp lights for one test but not for the other, check wire to which lamp connected (see table) and contact in selector switch to which wire is connected. If lamp flickers as selector switch moved from one position to another in Test #2, check contact sleeve for roughness and check contact finger tension. If lamp does not light for Tests #3, 4, 5, check GR wire and connection at selector switch. If lamp does not light for one test only, check wire to which lamp connected (see table) and connection at Selector switch. If lamp lights when test prod touched to any other terminal than ones indicated, check for play in selector shaft rotor and short circuits.

Shift Mechanism (Power Unit):—Connect Power Unit Test Cable to Red Wire terminal on circuit breaker. Operate engine with clutch disengaged and rear wheels jacked up so that shifts may be made. Touch test prod of the test cable to points indicated (two points simultaneously in some cases) and note whether shifts made properly. Terminals on solenoid valve cover (at which tests made) are labeled as follows: #1 (front) BL, #2 W, #3 B, #4 BK, (rear—junction only, not used in making this test).

1. Test Prod on BL—Transmission should shift into High Gear.
2. Test Prod on B—Transmission should shift into Second Gear.
3. Test Prod on W—With transmission in neutral, cross-shift or left-right movement of lever should be made.
4. Test Prod on W & BL—Transmission should shift into Lower Gear.
5. Test Prod on W & B—Transmission should shift into Reverse Gear.

If any shifts not made, check valve solenoid by connecting accurate ammeter between terminal and circuit breaker lead (merely touch ammeter lead to terminal to avoid damage if solenoid dead short circuited). Current draw should be 2.5 amperes. Larger current indicates solenoid short-circuited, smaller draw open-circuits. If current draw satisfactory, examine valve to see that it is free and not sticking, check for vacuum leaks in valves, lines, or shift units. Check units for mechanical drag by disconnecting shift cylinder and diaphragm cylinder rods. If units do not operate when disconnected, Power Unit (Shift Cylinder, Diaphragm Cylinder, Selector Valve assembly) must be rebuilt or replaced.

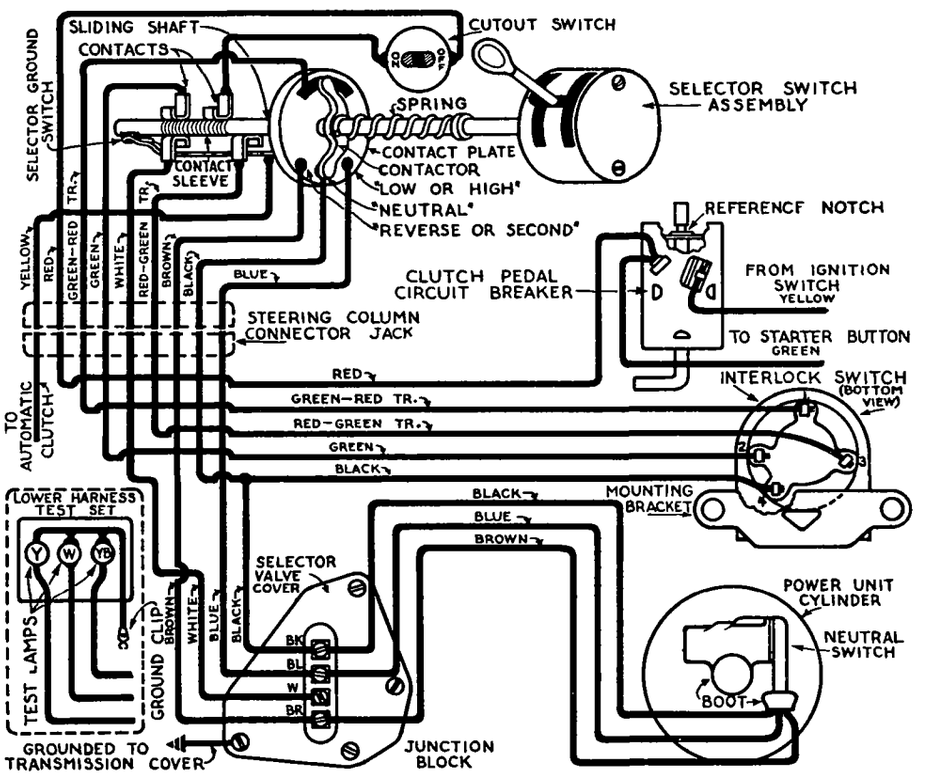
Switches & Lower Wiring Harness:—Disconnect all wires (except those on BK terminal) on solenoid valve cover, connect these wires to clips on Lower Harness Test Set (YB clip to BL wire, W clip to W wire, Y clip to B wire, ground clip to chassis). Make tests by manipulating Selector Switch (Selector switch must be OK) and shift lever and noting if correct test lamps light. Turn on ignition, hold clutch disengaged, see that Selector switch Cut-out switch 'on'.

1. Place selector switch in neutral. Shift transmission to neutral manually. Lamp YB should light when shift lever moved short distance toward second gear, lamp Y when shift lever moved equal distance toward high gear (see Power Cylinder Piston Rod Adjustment above).
2. Place transmission shift lever in neutral. Move selector switch to low gear. Lamp W only should light.
3. Place transmission shift lever in neutral. Move selector switch to second gear, Lamp Y should light. Move selector switch to high. Lamp YB should light.
4. With selector switch in each gear position in turn, complete shift by moving transmission shift lever to same gear position. Lamps should light (and remain lighted until clutch pedal released) as follows: High Gear—YB. Second Gear—Y. Low & Reverse—W and when cross-shift completed, YB for low or Y for reverse.
5. With transmission in high or low gear, move selector switch to neutral. Lamp Y should light. With transmission in second move selector switch to neutral. Lamp YB should light.

If lamps do not light as indicated, or if additional lamps light, check or replace lower wiring harness and Interlock switch.

Lower Wiring Harness—Disconnect jack at lower end of steering column. Use test prod connected to hot lead to supply current to terminal designated on lower half of jack, ground one test lamp lead. Test lamp should light when other lead touched to designated terminal on Interlock Switch, Solenoid Valve Cover terminals, or Circuit Breaker.

Hot Prod on Jack	Lamp Connected to:
R	R on Clutch Circuit Breaker.
BK	BY Interlock Sw. & BK Solenoid Valve.
G	G on Interlock Switch.
RG	RG on Interlock Switch.
W	W on Solenoid Valve Cover.
GR	GR on Interlock Switch.
B	B on Solenoid Valve Cover.
BL	BL on Solenoid Valve Cover.



TROUBLE SHOOTING:—Same as for previous model (see 1936 article). Yellow wire, and Yellow wire with Black tracer are no longer used and need not be checked. If transmission is slow in making any shift involving a cross-shift, check the Black wire (was Black wire with Yellow tracer).

REMOVAL & INSTALLATION:—Same as for previous model (see 1936 article) with exception of Neutral Switch in Power Cylinder which is new.

Neutral Switch—Remove two screws in neutral switch cover and withdraw the switch before taking off power cylinder end plate. After end plate has been removed, take out two screws in neutral switch operating bracket and remove operating mechanism. When re-installing Neutral Switch, see that gasket is in good condition, and that the operating lever is between the two bakelite arms on which the movable contacts of the switch are mounted.

Optional Equipment On:
HUDSON 6, 83 ('38), 91, 92, 93, 98 ('39)
HUDSON 8, 85,86,87 ('38), 95,97 ('39)
TERRAPLANE, MODELS 80, 81, 82, 88 (1938)

NOTE:—Electric Hand not available for Hudson '112'.

TYPE:—Same design as type used on previous models except for new Interlock Switch design (incorporated in Diaphragm Cylinder), new Gear Abutment Indicator, and minor changes in other units as listed below.

Interlock Switch—Breaker contact type mounted in housing which is integral with diaphragm cylinder cover and operated by spring-loaded camshaft linked to diaphragm rod by crank-and-lever mechanism (crank is mounted on floating sleeve on diaphragm rod, sleeve movement being limited by flange at diaphragm end of rod, stop pin at outer end, and provides slight 'lost' motion required for correct switch operation). No switch adjustment is required.

Gear Abutment Indicator—Consists of a rigidly mounted solenoid in the extreme left hand end of the selector switch housing and a detent rotor assembly mounted on the end or the selector switch shaft next to the solenoid. Solenoid is energized whenever selector lever moved to left end of neutral slot (lead taken from diaphragm solenoid contactor in selector and circuit completed to ground through right hand shift rail switch on top of transmission). When solenoid energized, detent rotor slides along flattened portion of selector shaft until detent balls engage slots in face of solenoid. This prevents rotor revolving with shaft as selector lever moved toward Reverse or Low Gear positions, flattened shaft acting as a cam to expand rotor plungers against tension of plunger spring on outer rim of rotor and spring sets up a back pressure against the selector shaft and lever. If gear abutment occurs within transmission, this spring pressure will cause selector lever to snap back to neutral as soon as it is released. However, if gears mesh properly, operating ball in shift rail switch will drop into notch in shifter rail as soon as gear meshing ¾ complete, opening switch and breaking solenoid circuit. This releases rotor which revolves to normal position on selector shaft so that there is no tendency of the selector lever to move from its position.

Clutch Pedal Circuit Breaker—New type mounting used which makes linkage adjustment unnecessary. Switch mounting bracket holes are slotted to permit limited up-and-down movement but switch is normally held in one positon by springs on mounting screws. Lug on clutch shaft operating lever engages slot in switch mounting bracket so that switch is pulled down to new position as required when clutch engagement point changes due to clutch facing wear.

Automatic Clutch Selector Switch Terminal—Automatic clutch high gear lock-out switch in Selector has been changed to same type contactor used for other circuits. See Automatic Clutch article for data on this switch as well as complete automatic clutch wiring.

ADJUSTMENT:—Make adjustments in order as listed below. No Clutch pedal circuit breaker or separate Interlock Switch adjustment required for 1938 equipment.

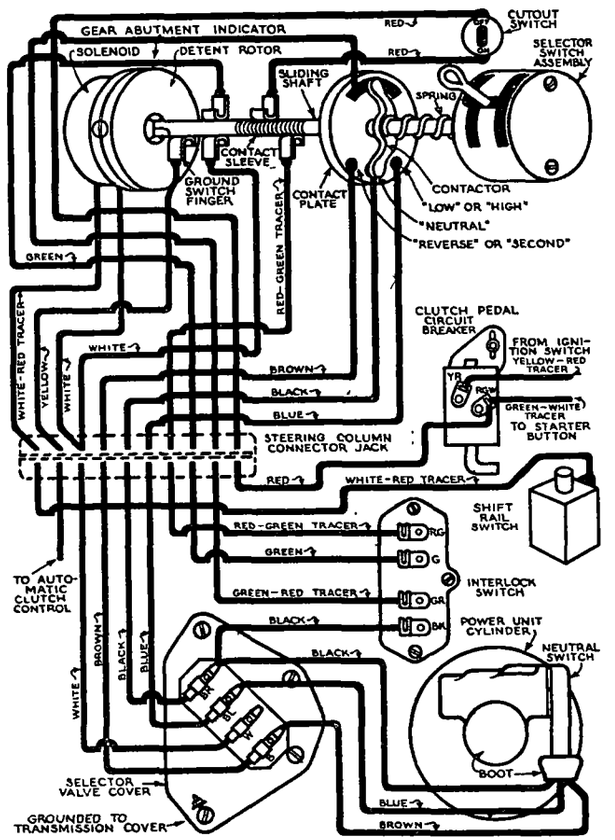
Diaphragm Cylinder (Cross-shift) Rod:—This adjustment also controls Interlock switch timing. Remove clevis pin at forward end of diaphragm rod (at cross-shift lever on transmission), push rubber boot back to expose clevis locknut, loosen locknut (clevis must be on lever when loosening or tightening this nut to prevent rod turning which would damage rubber diaphragm), turn clevis so that rod is 3/16" long, requiring diaphragm return spring to be compressed this amount to line up clevis and lever holes, with transmission in neutral. If clevis placed on lever to check this setting, only 1/16" width of lever hole should be visible through clevis pin hole. Install clevis pin, make certain that locknut tightened and rubber boot pulled forward over locknut onto clevis stem.

Power Cylinder Piston Rod:—Run engine, hold clutch pedal down, place selector lever in neutral position, remove clevis pin which links piston rod and shift lever on transmission, make certain that transmission in neutral, adjust piston rod length so that holes in rod and lever line up, install clevis pin.

Power Unit Mounting:—Power unit must be mounted more firmly than previous models (plain nut and additional 3/32" washer used instead of castellated nut). Make certain that both washers in place (one 1/16" washer, one 3/32" washer), turn nut down until cotter pin can just be installed behind nut.

TESTING:—All tests made in same manner as on 1937 model except as noted below.

Selector Switch & Upper Wiring Harness:—One additional wire (White with Red Tracer—for Gear Abutment Solenoid circuit) used in upper and lower wiring harness with new 10-prong jack. All other wire colors same as in 1937 and tests made in same manner as on previous model. If old type Electric Hand Test kit used, Adapter No. J-813-5 must be used.



Power Unit & Lower Wiring Harness:—New Test Lamp Kit available with five test lamps (3 lamps labeled Y-B, W-W, YB-BL correspond to same three lamps in old test kit). New Lamps are simple test lamps with double leads as follows: "Valve Solenoid" lamp—Leads G-87 and H-87—15 cp., Mazda No. 87 bulb; "Abutment Indicator" Lamp—Leads H-63 and G-63—3 cp., Mazda No. 63. If new test kit not available, test lamps with suitable leads can be made up for Valve Solenoid and Abutment Indicator testing. Old test lamp kit can be used to check lower wiring harness. Make tests in same manner as on 1937 type.

Valve Solenoids:—Use 'Valve Solenoid' Test lamp in new kit or make up test lamp using 15 cp. bulb to test solenoids (using lamp will eliminate possibility of burning out test meter if solenoid shorted). Disconnect leads on power unit, clip one test lamp lead (H87) to battery terminal, touch other lead (G87 prod) to each solenoid terminal in turn (see wiring diagram). Lamp should burn with dull red glow. If lamp does not light, solenoid is open. If lamp lights brightly, solenoid is short-circuited. When solenoids disassembled, make certain they are clean and free from dirt, oil or grease, that plungers have 1/16" minimum travel, and use new valve discs when reassembling.

Abutment Indicator:—If selector lever will not stay in Low or Reverse Gear after shift has been completed in transmission, disengage clutch and hold in this position, place selector lever in gear position and hold it in place while selector 'Off-On' switch moved to 'Off' position. If click is heard in selector when switch reaches off position, check for short-circuit in wiring or defective Shift Rail Switch (see tests below). If no click is heard, replace detent rotor assembly. With transmission in neutral, turn on ignition but do not start engine, depress clutch pedal and hold in this position, shift selector lever to Low or Reverse and release lever. If lever does not return to neutral when released, check for open-circuit or defective Shift Rail Switch. If lever returns to neutral from one position but not from the other, check for excessive friction in selector 'H' slot or bind or drag in selector switch shaft.

Abutment Indicator Solenoid—Ground 'WR' prong of upper wiring harness jack. Use 'Abutment Indicator' test lamp in new kit or make up test lamp using 3 cp. bulb, clip one test lamp lead (H63) to battery cable terminal, touch other lead (G63 prod) to 'W' prong of jack. Lamp should burn with dull red glow. If lamp does not light, solenoid is open. If lamp burns brightly, solenoid is short-circuited. If ohmmeter used to check solenoid circuit, meter reading should be 10 ohms between 'W' and 'WR' prongs in upper wiring harness jack.

Shift Rail Switch—Use 'Abutment Indicator' test lamp (or 3 cp. test lamp mentioned above for Abutment Indicator Solenoid testing), disconnect lead (WR wire) on Shift Rail switch (left hand switch on transmission), connect test lamp between battery cable terminal and shift rail terminal. Use manual shift lever to shift transmission into Low and then into Reverse. Test lamp should remain lighted until each shift ¾ completed and should then go out. If lamp indicates switch not operating correctly, examine switch ball and see that it is free in pilot hole, replace switch.

Abutment Indicator Wiring—With 'WR' wire disconnected from shift rail switch, clip one test lamp lead to battery cable terminal, other lead to this 'WR' wire. Place selector lever in neutral. Lamp

ELECTRIC HAND CONT.

should not light. If lamp is lighted, Abutment Indicator wiring is shorted. Separate wiring harness jack. If lamp goes out, short-circuit is in upper wiring harness. If lamp remains lighted, short-circuit is in lower wiring harness.

Interlock Switch:—Use new Test Lamp Kit (connect leads used for Power Unit testing to each of three Interlock Switch terminals, connect 'H63' Gear Abutment test lamp lead to fourth terminal, ground G63 lead and regular test kit ground lead to engine), or connect 3 cp. test lamps between each Interlock Switch terminal and ground. Turn ignition on (do not start engine—use hand shift lever to shift transmission as required in tests), depress clutch pedal and hold in this position while making following tests:

1. With transmission in neutral, and selector lever in neutral, all four lamps should be lighted.
2. Shift transmission and selector lever to Low Gear position. Lamps connected to 'G' and 'GR' terminal only should light.
3. Shift transmission and selector lever to High Gear position. Lamps attached to 'GR' and 'RG' terminals only should light.

If lamps do not light in this order, or other lamps are lighted, remove and inspect or replace switch.

SERVICING:—Units serviced in same manner as previous model except for new units listed below.

Abutment Indicator:—To disassemble, take off end cap on left end of selector housing (turn cap counter-clockwise), pull solenoid out and rotate downward at same time being careful not to damage solenoid leads. Slide rotor out off shaft by using small bent wire or hook. When replacing rotor make certain that face with two steel detent balls is out (toward solenoid). To replace solenoid, part wiring harness jack at lower end of steering column, remove upper cover by bending back cover lugs, unsolder White and White-Red tracer wires, fasten length of small iron fish-wire to these wires and pull it into tube as other wires withdrawn. Use fish-wire to draw new solenoid leads into place (wires must be carefully straightened and laid parallel in tube), solder wires to correct jack prongs. When installing solenoid, make certain that leads not pinched, engage lug on solenoid in slot in housing, see that solenoid retaining spring in place in center of housing cap.

Interlock Switch:—To remove switch, take out three screws in cover, withdraw switch. To install switch, use manual shift lever to operate switch camshaft (swing lever from left to right) or push in on diaphragm rod until both cams are in line with center of shaft, slip switch into place. Make certain that switch gasket is in good condition, line up cover and gasket holes.

Diaphragm Replacement:—To disassemble Diaphragm Cylinder assembly, disconnect vacuum lines, take out four nuts and wire clip and remove valve assembly (valve assembly must be pulled away from cylinder endplate as nuts are turned off). Remove nut (bushing type) holding diaphragm housing to cylinder bracket, remove clevis, locknut and rod guard, take out six nuts in housing flange, remove rear half of housing and return spring. Pull diapragm and rod assembly out of front housing, unhooking camshaft operating link from camshaft arm by rotating floating sleeve as rod is pulled out. Remove diaphragm rod nut and diaphragm assembly. When reassembling, make certain that diaphragm rod nut is staked in place after installing diaphragm, hold diaphragm rod in (compressing return spring) so that spring will not distort housing halves while flange screws are being tightened. To check diaphragm seal, push diaphragm rod in, place finger over mounting hole. If seal is tight, rod will not move out.

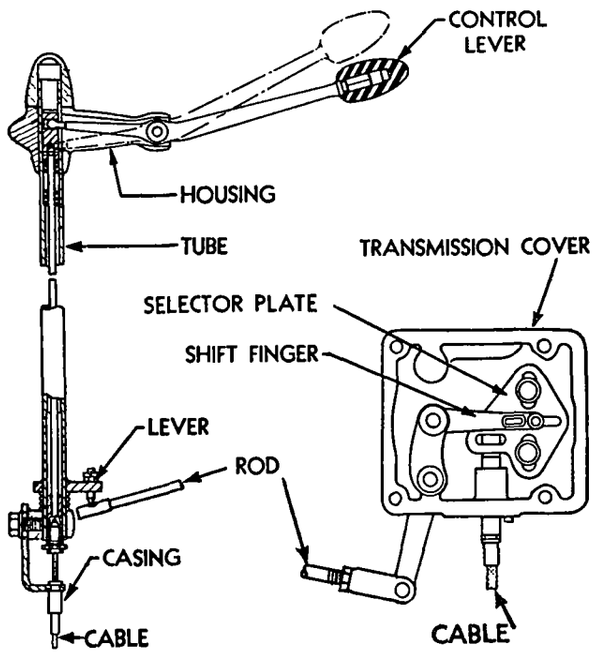
HUDSON 1939 HANDY-SHIFT

Std. Equipment On:
ALL MODELS EXCEPT BUSINESS CARS (1939)

NOTE:—Handy shift control may be installed on Business Cars by dealers or secured from factory as option.

INSTALLATION ON EARLIER MODELS:—Field installation kits available for installation of Handy shift control on all 1937-38 Hudson and Terraplane models.

TYPE:—Handy shift remote control type with shift lever mounted on steering column beneath steering wheel. Shift lever linked to control rod and lever on transmission case (for gear engagement), selector



cable and selector plate in transmission cover (for cross-shift). Backward and forward movement of the shift lever rotates the control tube and actuates the lever on the transmission case which is linked to the shifter lug engaging the shifter shafts in the transmission. Up and down movement of the shift lever actuates the selector cable and moves the selector plate in the transmission sidewise so as to engage the shifter lug with the correct shifter shaft. Normal position of the lever is with the lug engaging the second-high shifter shaft (lever should be raised to engage low-reverse shifter shaft).

ADJUSTMENT:—Operating Rod (Gear Engagement)—Hand lever should be at right angles to center-line of car in neutral position. To adjust, disconnect operating rod by removing cotter pin and clevis pin in yoke at transmission end of rod. See that shift lever on steering wheel and lever on transmission case are in neutral position, loosen locknut and turn yoke on rod until clevis pin can just be inserted without disturbing position of either lever. Tighten locknut and connect rod.

Selector Cable (Cross-shift)—Place steering column shift lever in 'up' position (low-reverse) at neutral and block in this position while adjustment being made. Loosen selector cable conduit bracket capscrew at lower end of steering column and pull up on conduit bracket until all slack removed from cable and cross-shift shaft in transmission is fully over on low-reverse side. Tighten bracket capscrew. See that spring lock in cable has clearance at top and bottom of travel.

SERVICING:—Remove horn button and steering wheel to remove any part of handy shift steering column unit. See illustration for construction of transmission case end of unit.

HUPMOBILE TYPE

Used On:
ALL MODELS (1939)

NOTE:—Transmissions used with this type control are conventional except for shifter linkage in transmission case cover. See separate articles for Transmissin servicing data.

TYPE:—Remote control type with shift lever mounted on steering column beneath steering wheel. Shift lever linked by control rod to lever on side of transmission (for gear engagement) and by selector cable to small lever on transmission case cover (for cross-shift). Backward and forward movement of the shift lever actuates the control rod and gear engagement lever on the transmission case, up and down movement of the shift lever actuates the selector cable and small cross-shift lever on transmission cover. Normal position of the shift lever is in the lower (second-high) range and it must be lifted to engage low or reverse.

ADJUSTMENT:—Control Rod (Gear Engagement)—See that rods are properly connected at idler bell crank on frame side rail (bell crank short lever must point forward and be connected to steering column lever, bell crank long lever must point up and be connected to transmission lever). Disconnect forward control rod at lever on lower end of steering column. Set steering column shift lever in neutral position and parallel to dash. See that gear engagement lever on transmission case is in neutral position (determine by feel of detent engagement). Loosen locknut and adjust coupling on threaded end of control rod so that hole in rod coupling lines up with ball stud on steering column lever, tighten locknut and connect rod.

Selector Cable (Cross-shift)—See that cable conduit mounting bracket nuts on transmission cover are tight. Place steering column shift lever in neutral position of second-high range (lever mounted down away from steering wheel and parallel to dash). Disconnect cable from lever on transmission cover by removing nut on ball stud, place lever in second-high (forward position), loosen locknut and adjust coupling on threaded end of selector cable so that ball stud lines up with second hole from end of cross-shift lever, tighten nut and connect cable to lever.

EVANS-NASH (FIRST) VACUUM TYPE

Optional Equipment On:

NASH AMBASSADOR 6, MODEL 3820 (1938)
NASH AMBASSADOR 8, MODEL 3880 (1938)
NASH-LAFAYETTE, MODEL 3810 (1938)

NOTE:—Transmission used with this type shift control is similar to standard model except for special shifter mechanism. See Nash Transmission article for Transmission servicing data.

GEAR ENGAGEMENT WITH ENGINE NOT RUNNING:—Gears cannot be engaged by means of dash gear shift lever with engine not running (no vacuum). If engine is to be started by engaging gears and towing or coasting car, raise engine hood on right hand side, move connecting rod (between shift cylinder and transmission) slowly to the rear. This will engage high gear.

TYPE:—Consists of miniature gear shift control unit on instrument panel and power units mounted on engine (Diaphragm unit for cross-shift mounted on right side of transmission case, Shift Cylinder and Valve Assembly for gear engagement mounted on bracket on right side of crankcase). Units operated by vacuum (connection to manifold on left side of engine) and controlled by dash gear shift lever as follows:

Diaphragm Unit (Cross-shift)—Control valve for Diaphragm unit located on back of instrument panel control unit. When gear shift lever moved to left at neutral (for low or reverse engagement), valve opens vacuum line to diaphragm chamber, diaphragm moves out against spring pressure and shifts rear end of shift cylinder connecting rod and transmission actuating lever away from transmission case to enage the low-and-reverse shifter shaft in the transmission. When gear shift lever moved to right at neutral (for second or high engagement), the control valve cuts off the vacuum to the Diaphragm unit and vents the diaphragm chamber to the atmosphere. The spring then moves the connecting rod and actuating lever toward the transmission case to engage the second-and-high shifter shaft. This is the normal position of the actuating lever.

Shift Cylinder (Gear Engagement)—Selector valve for Shift Cylinder is combined piston and diaphragm type controlling air and vacuum admission to each end of cylinder. Valve is linked to dash gear shift lever through intermediate vertical lever pivoted on shift cylinder connecting rod at piston rod end. When gear shift lever moved either forward (reverse or second) or backward (low or high), valve stem movement admits air into one end of cylinder but without cutting off vacuum connection to opposite end (cylinder normally vacuum-suspended) so that piston moves toward vacuum end and resultant connecting rod and actuating lever movement engages gears. The vertical intermediate lever moves with the connecting rod and tends to balance the shift cylinder so that the piston movement follows the dash gear shift lever movement exactly. When shift is completed (or dash lever movement stopped), piston remains stationary in that position until a new shift is made by the dash gear shift lever (or lever is returned to neutral).

Clutch Pedal Vacuum Lock—Consists of a main control valve mounted on the vacuum cylinder and connected in vacuum line between manifold and vacuum power unit. This valve operated by clutch pedal (linked to lever on right hand end of clutch throwout shaft) so that vacuum shift operative only with clutch disengaged.

ADJUSTMENT:—Whenever linkage disconnected or disturbed by removal of other units, adjust in following order and then check operation as directed below.

Diaphragm (Cross-Shift) Unit:—With diaphragm link disconnected from connecting rod, adjust length of link (loosen locknut at swivel joint, turn swivel joint) or bend end of connecting rod so that diaphragm cross-shaft must be pulled out ⅛" before link can be connected to connecting rod. This will prevent cross-shaft bottoming in diaphragm in operation. See that linkage permits full right and left movement of transmission actuating lever (approximately 9/16" travel), adjust by bending connecting rod.

Transmission Selector Plate Alignment—Make certain that selector plate slot lines up with slots in shifter shafts in transmission cover. To adjust, loosen two screws on plate. Misalignment of plate will interfere with cross-shift operation.

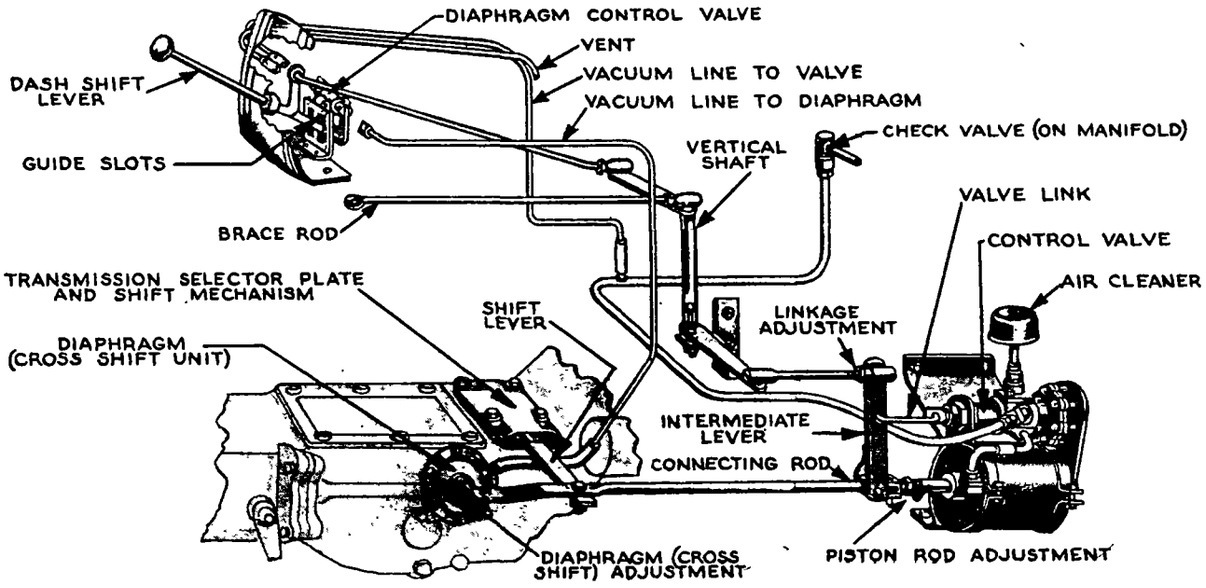
Shift Cylinder Piston Rod Length:—With piston rod disconnected from forward end of connecting rod, make certain that connecting rod and actuating lever is in neutral position (check by moving lever back and forth for cross-shift), place piston in mid-position in cylinder (pull piston rod out until distance from extreme rear edge of cylinder packing gland to locknut seat on end of rod is exactly 2 5/16"), adjust piston rod clevis by loosening locknut and turning clevis until pin can just be inserted in clevis and connecting rod, tighten locknut.

Linkage Adjustment:—After adjusting Diaphragm and Shift Cylinder, place dash gear shift lever in neutral position, loosen nut on ball connector at top of intermediate lever, shift connector (hole is slotted) until center of connector is exactly 5 5/16" above pivot pin at lower end of intermediate lever, tighten ball connector nut. Adjust length of rod attached to this ball connector (rod links intermediate lever and lever on vertical shaft at left rear of engine) by loosening locknut at forward swivel joint and turning rod until selector valve is in neutral position (vacuum line open to both ends of cylinder) and distance from extreme outer end of valve housing to end of stem (end of cylindrical stem rod) is ¼". With correct setting, all pivot points on intermediate lever should be in nearly vertical line and end pins should be exactly 5 5/16" apart.

To Check Linkage Adjustment—Disconnect vacuum line from engine at selector valve, make certain that dash gear shift lever and transmission actuating lever are in neutral position, run engine, connect vacuum line momentarily. If shift cylinder piston tends to move to rear, rod at upper end of intermediate lever should be shortened slightly; if piston moves forward, rod should be lengthened slightly (adjust rod as directed in preceding paragraph).

Vacuum Lock Adjustment:—Should be adjusted so that valve opens just after clutch is definitely released. Check with car in gear and clutch pedal depressed to point where clutch is free. Vacuum lock valve should be closed but should open with slight additional pedal depression. To adjust, make certain that clutch pedal adjusted for correct 1" (max.) free pedal travel, loosen trunnion clamp bolt on clutch throw-out shaft lever, move trunnion toward flanged end (spring end) of trunnion sleeve on vacuum lock connector rod for earlier valve opening (move trunnion away from flange for later opening), tighten trunnion clamp bolt and check performance.

NOTE—When installing the trunnion sleeve and spring assembly on the vacuum lock connector rod, install forward lock block exactly 3¾" from end of operating rod, install spring, sleeve (with flanged end toward spring), engage throw-out shaft lever trunnion on sleeve, install rear lock block moving block on rod until sleeve compresses spring 1/16", hook return spring to hole in rear end of rod and to hole in frame X member, adjust trunnion on sleeve as directed above. With correct adjustment trunnion should be approximately centered on sleeve with clutch engaged.



EVANS-NASH (FIRST) TYPE CONT.

Checking Vacuum Shift:—Make following tests to determine if linkage adjustments correct and shift mechanism operating satisfactorily:

1. With engine running, disengage clutch, place dash shift lever in low gear position, engage clutch, check gear engagement. Then disengage clutch, shift dash lever to high gear, engage clutch. If transmission is still in low gear, rod at upper end of intermediate lever is too long and should be shortened slightly.
2. Repeat above test engaging Reverse and then Second gear. If transmission does not shift out of Reverse, intermediate lever rod is too short and should be lengthened slightly. See adjustment above.

TROUBLE SHOOTING:—If Transmission operation unsatisfactory, check following points:

1. **Does not shift into any gear.** Check all vacuum lines for leaks, tighten connections. Examine check-valve in vacuum line connection at engine (this valve designed to prevent pressure in manifold, caused by backfires, from entering lines). See that linkage operates freely, lubricate pivots and ball connectors.
2. **Does not shift into Low or Reverse.** Check vacuum line from main line to diaphragm valve on dash unit, vacuum line from dash unit to Diaphragm, tighten connections. Check Diaphragm adjustment and selector plate alignment in transmission cover, check connecting rod adjustment.
3. **Does not shift from Low-to-High or Reverse-to-Second.** Check linkage adjustment (intermediate lever rod too long or too short).
4. **Transmission slips out of gear.** See that rod linking dash gear shift lever and lever at top of vertical shaft is free from interference and not striking body in any position.

CONDITIONED-AIR CAR NOTE:—Transmission control dash unit can be removed on these cars without disturbing any part of air-conditioning unit by removing Glove Compartment and Ash Tray first.

EVANS-NASH (LATER) VACUUM TYPE

Optional Equipment On:

NASH LAFAYETTE, MODEL 3810 (LATE 1938)
NASH AMBASSADOR 6, 3820 (LATE 1938)
NASH AMBASSADOR 8, 3880 (LATE 1938)

NOTE:—This type control used on cars beginning with following serial numbers—(3810) LH-13214 & LR-70845, (3820) N6-19595, (3880) N8-8048.

TYPE:—Design similar to that used on early 1938 cars except that vacuum diaphragm not used, mechanical cross-shift linkage provided (with new type shifter mechanism in transmission) and clutch pedal operated Vacuum Lock used as follows:

Transmission Shift Mechanism—Gear engagement lever is linked to center of pivot plate which engages pin on each shifter shaft so that lever movement (to engage gears) causes pivot plate to pivot on one shifter shaft pin (locked in place by cross-shift lever cam) and actuate opposite shifter shaft (unlocked by cross-shift lever cam). No actual cross-shift movement of gear engagement lever occurs (shifter shaft movement depends on shaft lock being freed by cross-shift lever). Cross-shift lever cam has two recesses which permit interlock pins (below cam) to move out of engagement with notch in shifter shaft when cam recess aligns with pin. NOTE—In forward cross-shift lever position, left hand (Second & High) shifter shaft is free; in rear position, right hand (Low & Reverse) shifter shaft is free.

Cross-shift Linkage—Consists of a separate linkage between the instrument panel shift lever and a vertical shaft (within gear engagement vertical shaft on 3820, 3880, mounted separately on 3810) which is linked to a cross-shift lever and shaft on the transmission cover. Cross-shift is mechanical and does not employ vacuum power.

Clutch Pedal Vacuum Lock—Consists of a main control valve mounted on the vacuum cylinder and connected in vacuum line between manifold and vacuum power unit. This valve operated by clutch pedal (linked to lever on right hand end of clutch throwout shaft) so that vacuum shift operative only with clutch disengaged.

ADJUSTMENT:—Adjustments are made differently than on first type control. Make adjustments in order as follows:

Cross-Shift Linkage:—Disconnect adjustable rod (which links lever at lower end of vertical shaft to intermediate lever on piston rod connector link) at vertical shaft end. Place instrument panel gear shift lever in Reverse Gear position, move gear engagement lever on transmission case in neutral position, pull piston rod out of vacuum cylinder so that distance from outer face of piston rod boss on cylinder to inner face of piston rod locknut is exactly 2 5/16" and see that piston rod link pin is centered in elongated hole of connector. Disconnect cross-shift rod (which links instrument panel shift lever cross-shift shaft to lever on top end of vertical shaft) at vertical shaft lever end, move cross-shift cam lever on transmission case to extreme rear position, adjust trunnion on right hand end of cross-shift rod so that ball joint end slips freely into hole on vertical shaft lever, connect rod. Connect adjustable rod between vertical shaft and piston rod intermediate levers.

Gear Engagament Lever Adjustment:—Place instrument panel shift lever in Low Gear position. Adjust rod linking lever at lower end of vertical shaft to intermediate lever on piston rod connector (adjustable ball joint end and locknut at intermediate lever end of rod) so that when instrument panel shift lever moved from low gear to neutral position it is free to cross over to second-high side just before lever shank contacts reverse offset in shifter gate (guide plate on back of instrument panel unit).

Clutch Pedal Vacuum Lock:—Should be adjusted so that valve opens just after clutch is definitely released. Check with car in gear and clutch pedal depressed to point where clutch is free. Vacuum lock valve should be closed but should open with slight additional pedal depression. To adjust, make certain that clutch pedal adjusted for correct 1" (max.) free pedal travel, loosen trunnion clamp bolt on clutch throw-out shaft lever, move trunnion toward flanged end (spring end) of trunnion sleeve on vacuum lock connector rod for earlier valve opening (move trunnion away from flange for later opening), tighten trunnion clamp bolt and check performance.

NOTE—When installing the trunnion sleeve and spring assembly on the vacuum lock connector rod, install forward lock block exactly 3¾" from end of operating rod, install spring, sleeve (with flanged end toward spring), engage throw-out shaft lever trunnion on sleeve, install rear lock block moving block on rod until sleeve compresses spring 1/16", hook return spring to hole in rear end of rod and to hole in frame X member, adjust trunnion on sleeve as directed above. With correct adjustment, trunnion should be approximately centered on sleeve with clutch engaged.

NASH 1939 TYPE

Optional Equipment On:

NASH-LAFAYETTE, MODEL 3910 (1939)
NASH AMBASSADOR 6, MODEL 3920 (1939)
NASH AMBASSADOR 8, MODEL 3980 (1939)

NOTE:—This type control used in conjunction with special transmission with constant-mesh gears (all speeds). See separate article on Nash Transmission for Transmission servicing data.

TYPE:—Remote control tube with shift lever mounted on upper end of control tube under steering wheel. Control tube is mounted on bracket on steering column (upper end) and bracket on frame (lower end) to provide both forward-and-backward motion (for gear engagement), up-and-down motion (for cross-shift at neutral). Operating mechanism at lower end of steering column consists of a gear segment on the lower end of the control tube which meshes with one of two gear segments mounted on ends of two concentric cross-shafts. Levers at opposite ends of these shafts are connected to shift levers on transmission case by rods. Cross-shaft assembly is mounted on ball-and-socket type joints on frame bracket (left end), bracket on crankcase (right end) and outer shaft is mounted on ballbearings on inner shaft. A selector pin in the lower end of the shift lever control tube and a slotted selector plate on the bottom of the lower mounting bracket permits cross-shift to be made only in neutral position and also limits movement of shift lever in the various gear engaged positions. This cross-shift consists of lifting the shift lever and control tube assembly so that the control tube gear segment is lifted out of mesh with the cross-shaft lower gear segment (on inner shaft and connected to the forward or second-high shifter lever on the transmission case) and meshed with the cross-shaft upper gear segment (on outer shaft and connected to rear or low-reverse shifter lever on transmission). A centering spring on a rod connected between a bracket on the control tube lower mounting bracket and a lever on the lower end of the control tube assists in retaining shift lever in neutral or engaged positions and facilitates the lever return to neutral.

ADJUSTMENT:—See that clearance between upper edge of selector pin in lower end of control tube and lower face of selector plate is 1/64" with shift lever in lower or second-high position (adjusted by changing position of upper mounting bracket—see Servicing data below). Disconnect rods linking cross-shaft levers and shift levers on transmission case, place steering column shift lever in neutral (selector pin in line with notch in selector plate), see that forward shift lever on transmission case in neutral position (detent plunger engaging center notch on shifter shaft sector), loosen ball stud mounting nut on inner cross-shaft lever (long lever, nearest engine), adjust position of ball stud so that rod can be connected without disturbing shift lever or transmission case lever, tighten ball stud nut. Adjust outer cross-shaft lever (small lever, nearest frame) ball stud in same manner with rear transmission lever in neutral and shift lever engaging upper gear segment with selector pin in line with selector plate slot. Check operation to make certain

NASH 1939 TYPE CONT.

that cross-shafts operate freely and that levers and rods do not interfere with other parts in any position or during engine movement.

SERVICING:—Control Tube Upper Mounting Bracket—Mounted on steering column by clamp bolts. Adjust position of bracket on steering column so that clearance between upper edge of selector pin in lower end of control tube and lower face of selector plate is 1/64" with shift lever in lower or second-high position.

Cross-Shaft Assembly:—Outer shaft ball bearing cups are driven in ends of shaft and bearing cones are fitted on inner shaft. Bearings should be packed with adhesive oil and rubber seal installed at outer end. Adjust by positioning second-high lever on inner shaft to control bearing endplay (lever is keyed to shaft and locked by clamp bolt.

Cross-shaft Adjustment—Gear segment mesh controlled by left hand (frame bracket) shaft mounting stud. To adjust, loosen locknuts on stud, turn stud with screwdriver to position shaft assembly so that gear segments mesh freely with minimum clearance, tighten both locknuts. Shaft is spring-loaded on engine bracket mounting stud to keep shaft in contact with frame bracket stud.

OLDSMOBILE 1939 HANDI-SHIFT

Std. Equipment On:

SERIES 60 SIX, MODEL F-39 (1939)
SERIES 70 SIX, MODEL G-39 (1939)
SERIES 80 EIGHT, MODEL L-39 (1939)

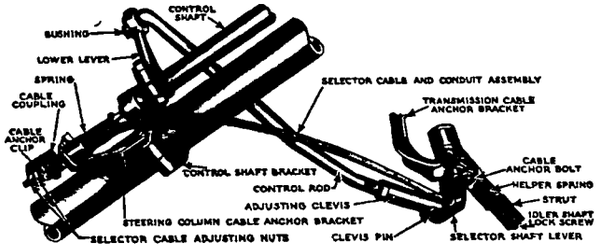
NOTE:—Transmission used with this type control similar to that used on previous models except for shifter mechanism (selector shaft with two fingers which engage slots in shifter shafts—endwise movement of shaft for cross-shift at neutral insures that only one finger engaged at a time). See separate article for complete Transmission servicing data.

TYPE:—Handi-shift remote control with steering column mounted shift lever. Shift lever pivoted on bracket on upper end of control shaft on steering column so that up-and-down motion of lever actuates selector rod (within control shaft) and selector cable (for cross-shift) while backward-and-forward motion of lever rotates control shaft and actuates control rod (for gear engagement). Shift lever normally held down in Second-High position by spring on lower end of selector rod and must be raised against spring tension for Low-Reverse.

ADJUSTMENT:—Selector Cable—See that shift lever and transmission gears in neutral position, measure distance from lower edge of steering wheel rim to upper edge of shift lever. Distance should be 2 7/16-2 9/16". To adjust, back off one nut on cable coupling at lower end of selector rod (top nut to increase distance, lower nut to decrease distance), tighten opposite nut. Make certain that both nuts tight after making adjustment.

Control Shaft Rod—With shift lever and transmission gears in neutral, shift lever should be approximately 1½" above (forward) horizontal position. To adjust, take out clevis pin at selector shaft lever (transmission case) end of control rod, make certain that transmission gears and selector shaft lever in neutral position, place shift lever in neutral position, install J-1082 gauge on selector cable anchor bracket on steering column so that control rod end (extending through control shaft lever) engages slot in gauge. Loosen locknut and adjust clevis on transmission case end of control rod until clevis pin can be entered in clevis and selector shaft lever freely, tighten locknut. NOTE—This adjustment should be made whenever control rod is disconnected at either end.

SERVICING STEERING COLUMN UNIT:—To remove shift lever, use tool J-1044 to press in on both pivot pins and release lever. Use care not to lose pivot pins and spring or tension spring in socket on inner end of lever. Lever clearance in bracket controlled by shims assembled on pivot pins. Install shims as required to secure free fit but make certain that anti-rattle washer installed on one pin. When installing lever, make certain that tension spring in place in inner end of lever and that lever tip is inserted under plunger and plunger spring in upper end of control shaft.



SERVICING TRANSMISSION UNIT—Disassembly—Disconnect control rod from selector shaft lever, and selector cable clip from transmission case cable anchor bracket. Unscrew cable from selector shaft, remove cable, selector shaft lever and springs (selector cable connector locks lever on shaft). Remove transmission cover, use tool KMO-244 to take out setscrews in selector shaft shift fingers, withdraw shaft through side of case being careful not to drop shift fingers or cams into transmission case. Do not remove selector shaft oil seal unless new seal to be installed (seals cannot be re-installed).

Reassembly—With selector shaft installed in transmission case, place special aligning tool J-1066 in end of shaft (where selector cable normally attached), position selector cable anchor bracket so that tool is centered in anchor bracket selector cable slot, tighten anchor bracket mounting bolt. This adjustment important to preserve selector cable alignment and prevent wire binding in cable conduit. Remove tool, install selector shaft lever, selector cable (make certain that cable screw tight in selector shaft and that cable clip tight on anchor bracket), control rod and lever spring.

NOTE—Selector shaft lever spring has over-center linkage (no tendency to rotate shaft in neutral position) and must be correctly installed. Spring link must be below selector shaft and hooked to pin on transmission side of lever.

TROUBLE SHOOTING:—If operation unsatisfactory, check selector cable and control rod adjustment as given above. If transmission shifts hard in all gears, check transmission oil and make certain that correct grade being used.

PACKARD 1939 HANDI-SHIFT

Used On:

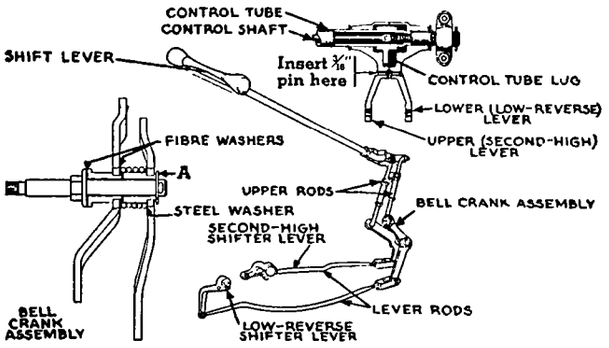
PACKARD, ALL MODELS (1939)

SPECIAL SERVICE CAUTIONS:—Excessive vibration of shift lever or rattles at bellcranks may be caused by lubrication of bellcrank levers. See Bell Crank Friction Dampeners under Servicing (below) for adjustment and correction of this condition.

Control lever misalignment—When working on car in proximity to control rods or shift levers on transmission case, always install 3/16" lock pin through alignment holes in both levers on lower end of control tube on steering column to prevent accidental gear engagement (which can occur without movement of shift lever). **If this occurs, shift lever cannot be operated until gears and control rods reset in neutral position.**

TRANSMISSION SERVICING NOTE:—See separate articles for complete servicing data on transmission used with this type control.

TYPE:—Handi-shift, remote control type with shift lever mounted on steering column below steering wheel. Shift lever is mounted on control tube which has a lug at the lower end to engage the operating levers which are mounted loosely on the lower end of the tube (these levers connected by rods to shift levers on transmission case cover). The lug normally engages the upper (Second-High) lever and is



moved down to engage the lower (Low-Reverse) lever by lifting up on the shift lever which depresses the lug control shaft within the control tube (this shaft spring-loaded by spring at lower end). Each lever is connected to an individual lever on the transmission case by two adjustable rods and an intermediate bell crank (top lever on control shaft connected to left hand bell crank and forward lever on transmission, lower lever on control tube connected to right hand bell crank and rear lever on transmission). Interlock and detent balls and plunger are located in transmission cover and engage notches in sectors on the shifter lever shafts.

ADJUSTMENT:—See that steering column shift lever in neutral, insert 3/16" rod or drill through alignment holes in both levers at lower end of control tube and leave this pin in place while adjustment being made. Disconnect control rods at bell cranks, place shifter levers on transmission in neutral position (determine by feel when detent ball engages center

PACKARD 1939 HANDI-SHIFT CONT.

notch on shifter lever shaft sector within case). Adjust both control rods at each bell crank (adjust upper rod by loosening locknuts and turning adjusting sleeve, adjust lower rod by loosening locknut and turning clevis at bell crank end of rod) so that lengths are correct, connect rods, remove locking pin from alignment hole in steering column levers.

SERVICING:—Bell Crank Friction Dampeners—Bell crank levers are spring-loaded and assembled with special friction washers to provide dampening effect and prevent noise or rattles (see illustration). To check adjustment, disconnect all rods at bell cranks, connect spring scale at upper end of longest (left hand) bell crank. Force required to move lever should be 2-3 lbs. If adjustment not correct, remove cotter pin and add additional washers under end washer 'A' to increase friction.

CAUTION—Bell cranks must not be lubricated (bushings are oil-impregnated type and shaft is zinc-plated). Lubrication will reduce dampening effect and may cause rattles or excessive vibration at steering column shift lever. If bell cranks have been oiled, disassemble, wash in gasoline, and reassemble dry.

PONTIAC 1938 SAFETY-SHIFT

Optional Equipment On:

PONTIAC SIX, MODEL 38-26DA (1938)

PONTIAC EIGHT, MODEL 38-28DA (1938)

NOTE:—Transmission used with this control similar to standard model except for special shifter mechanism. See Pontiac Transmission article for Transmission servicing data.

TYPE:—Consists of special shift lever assembly mounted on steering column and linked by Shift Control Rod and Selector Control Cable to special type shift lever and selector plate and shift bar assembly in transmission case cover. Provides remote control with conventional cross and endwise movement of the shift lever. Shift lever under steering wheel is mounted on pivot which is integral with shifter shaft. Inner end of lever extends through pivot fulcrum to engage selector rod within shifter shaft. This selector rod linked to selector plate in transmission by selector cable so that movement of shift lever toward-or-away from steering wheel shifts selector plate sidewise to engage low-and-reverse or second-and-high shifter fork. Steering column shifter shaft (on which shift lever mounted) is linked to pivot shaft outer lever on transmission case so that forward-and-backward movement of the shift lever rotates the pivot shaft and the lever at the inner end engages the gears.

ADJUSTMENT:—Adjustments provided in both selector linkage (selector control cable) and engagement linkage (shift control rod) for correct position of shift lever in neutral position as follows:

Selector Control Cable—Clearance between shift lever and underside of steering wheel should be 2 11/16 - 2 13/16" with lever in normal position at neutral. To adjust, remove front floor center plate and inspection hole cover on transmission case cover, back off one locknut and tighten opposite nut on selector control cable end at selector plate hook (one nut at each side of hook, move both nuts toward end of flexible wire cable to move shift lever away from wheel, or in opposite direction to move lever toward wheel). Tighten nuts securely.

Shift Control Rod—Shift lever should be horizontal in neutral position. To adjust, loosen locknut at inner end of control rod ball stud on transmission case pivot shaft outer lever, turn stud (stud is eccentric), tighten locknut securely.

Shift Control Rod Endplug Assembly—Whenever rod is disconnected or endplug assemblies disturbed, make certain that parts are installed in correct order and adjust by turning plug tightly in seat assembly and then backing plug off ⅛-⅜ turn before installing cotter pin.

SERVICING:—Disassembly. Remove front compartment floor mat and center floor panel, steering wheel (Use Puller J-1143), shift lever (use Tool J-1140 to compress pivot fulcrums, be careful not to lose fulcrum cups, springs, shims, and anti-rattler washer when lever is pulled out). Disconnect steering column bracket mounting bolts and loosen bracket clamp bolt (Use #4 Phillips screwdriver), remove left hood side panel, disconnect horn button, remove pedal plates. Disconnect selector control cable at lower shift shaft support (use #2 Phillips screwdriver), remove support, disconnect control rod at upper end. Loosen upper support locking bolt (use #2 Phillips screwdriver), pull upper support and shaft assembly up on steering column, sliding rubber grommet up to steering column bracket and then removing both grommet and bracket off upper end of steering column jacket as shift shaft assembly is removed. Pull selector rod out through top of shift shaft. This completes disassembly of steering column unit. To disassemble transmission case unit, remove nut and pull out outer lever off pivot shaft, remove inspection hole cover, loosen locknut on selector cable end, lift cable out of selector plate hook, disconnect cable at side of transmission case and pull cable out being careful not to kink cable. Remove transmission cover screws and lift cover off.

Servicing—Whenever control disassembled, lubricate all threads, plugs, plungers, bearings, ball joints, and anti-rattle springs with Lubriplate. Do not apply lubricant to rubber anti-rattle sleeve on control rod (if sleeve not in place at approximate center of rod, wrap rod with tape to ⅜" maximum diameter).

Assembly—Reverse disassembly directions. Make certain that all springs and plungers replaced in same relative positions. Excessive looseness in shift lever can be corrected by installing extra shims on upper fulcrum cup. Selector control cable must be assembled so that it passes below brake tube.

PONTIAC 1939 SAFETY-SHIFT

Std. Equipment On:

QUALITY SIX, MODEL 39-25 (1939)

DELUXE SIX, MODEL 39-26 (1939)

DELUXE EIGHT, MODEL 39-28 (1939)

NOTE:—Transmission used with this type control similar to that used on previous models except for shifter mechanism (selector shaft with two fingers which engage slots in shifter shafts—endwise movement of shaft for cross-shift at neutral insures that only one finger engaged at a time). See separate article for complete Transmission servicing data.

TYPE:—Safety-shift remote control with shift lever mounted on steering column under steering wheel. Shift lever pivoted on bracket on steering wheel and engages shank of steering column control shaft so that up-and-down movement actuates selector cable (for cross-shift) and forward-and-backward movement actuates control rod (for gear engagement). Control shaft and shift lever held down in Second-High position by spring hooked to clip on lever at lower end of control shaft and must be raised against spring tension for Low-Reverse.

ADJUSTMENT:—See that ⅛" clearance exists between control shaft upper bearing flange (shift lever pivot) and upper face of steering column support bracket (necessary for free movement of shift lever as bearing screws in and out of bracket as shaft rotates). Adjust by removing shift lever and screwing bearing in or out of bracket (see Servicing section below for directions). Adjust selector cable and control shaft lever as follows:

Selector Cable—Loosen locknut and turn selector cable screw in or out of control shaft lower end until distance from lower edge of steering wheel rim to upper edge of shift lever is 2⅞-3⅛" (turn screw in to raise lever, out to lower lever) in neutral position with control shaft retracting spring connected to hold shaft down in second-high position. Tighten locknut securely and replace rubber cable seal after making adjustment.

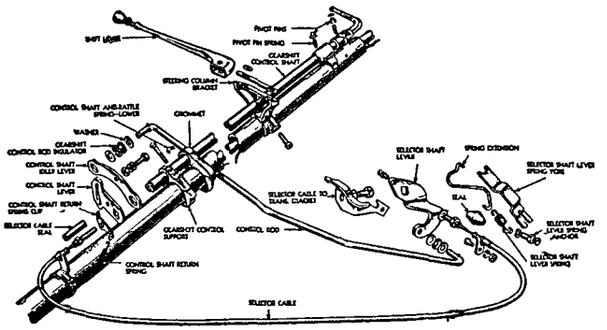
Control Rod Lever—With transmission selector shaft in neutral, steering column shift lever should be approximately horizontal. To adjust, loosen clamp bolt which locks idler lever and control shaft lever together (at lower end of control shaft), shift idler lever and control rod in relation to short shaft lever, tighten clamp bolt. NOTE—Shift lever can be lowered (moved toward driver) up to 1½" in neutral position if desired for less reach in shifting.

SERVICING STEERING COLUMN UNIT:—Disassembly. Remove steering wheel (use J-452 puller), remove shift lever (use J-1044 tool) by pressing in on pivot pin on either side of lever until pins clear holes in lever, being careful not to lose pivot pins and springs or anti-rattle spring in end of control shaft (within shift lever). Disconnect selector cable by unscrewing adjusting screw from lower end of control shaft, remove control rod and lever assembly (do not loosen clamp bolt locking both levers together—if this bolt loosened, levers must be adjusted when re-installed). Loosen clampscrews on control shaft lower support, remove support being careful not to lose flat anti-rattle spring which is in support keyway. Remove upper support screws from steering column mast jacket (use Phillips #2 screwdriver), pull upper support and control shaft upward parallel with steering column being careful not to lose anti-rattle spring and cup located in hole in underside of upper support.

PONTIAC 1939 TYPE CONT.

Servicing—Clean all parts and apply Lubriplate or Delco Brake Lubricant as follows: inner and outer faces of control shaft upper bearing, shift lever pivot pin holes, pivot pins and springs, control shaft ends and flat at top, shaft hole in lower control shaft support, threaded hole in upper control shaft support, anti-rattle springs and cups.

Reassembly—Reverse disassembly directions given above. Make certain that anti-rattle spring installed in end of control shaft within shift lever, on one shift lever pivot pin, in cup in upper support bracket, and in lower support bracket keyway. Adjust selector cable and control shaft levers as directed in Adjustment Section above.



IMPORTANT NOTE—When installing control shaft upper bearing in upper support bracket, see that clearance between bearing flange and bracket is ⅛" (bearing screws in and out of bracket as shaft is rotated). Turning bearing ½ turn will change clearance 1/32".

SERVICING TRANSMISSION UNIT:—Disassembly. Remove bolt in cable clip on transmission case bracket, back off cable screw in end of selector shaft, remove cable (this screw also holds selector shaft lever on shaft), remove selector lever and lever spring (spring is over-center type and has no tendency to rotate lever with shaft in neutral position). Remove transmission case cover, free shift fingers from selector shaft (use special J-1046 tool to back out setscrews locking fingers on shaft), withdraw shaft.

Servicing—Clean parts and apply Lubriplate to transmission end of control rod (do not lubricate steering column end of rod which would damage rubber insulator), over-center spring yoke anchor, and selector shaft lever pin groove.

Reassembly—Reverse disassembling directions. Make certain that selector shaft lever spring is correctly installed.

TROUBLE SHOOTING:—Shift Lever position incorrect—Adjust as directed in Adjustment section above.

Shift Lever rattles or has excessive play—Install extra washers on shift lever pivot pins (make certain that one anti-rattle washer always used).

Shift Lever travel excessive—See that threaded selector cable end tight in selector shaft at transmission, tighten selector cable anchor bracket mounting bolt.

Shift Lever sticks or does not return to Second-High side at Neutral—See that selector cable not kinked or bent at sharp angles and that return spring correctly hooked to control shaft lower end and to underside of selector cable clip on steering column.

Shift Lever vibrates on rough roads—See that control shaft return spring correctly connected (above).

Control Shaft, Rod, or Cable rattles—See that anti-rattle spring installed between control shaft and lower support on steering column. Install special anti-rattle spring, #501772, on selector cable to prevent rattling against steering column, wrap speedometer cable with tape to prevent contact with cable.

EVANS-STUDEBAKER VACUUM TYPE

Optional Equipment On:

STUDEBAKER COMMANDER (SIX), 7A (1938)
STUDEBAKER STATE COMMANDER (COMM.), 8A (1938)
STUDEBAKER PRESIDENT, MODEL 4C (1938)

NOTE:—Transmission used with this type shift control is similar to standard model except for special shifter mechanism. See Studebaker Transmission article for Transmission servicing data.

TYPE:—Remotely controlled, vacuum operated (see note), mechanical gear shift. Control unit on dash consists of miniature gear shift linked to selector lever on transmission case (for cross-shift to engage Low-Reverse or Second-High shifter rails) and to intermediate lever on valve-and-vacuum-cylinder linkage (for gear engagement). Dash shift lever operates selector lever for cross-shift at neutral mechanically without vacuum power, but when shift lever moved forward (Reverse or Second) or backward (low or High) this motion first operates valve which admits air to one end of vacuum cylinder but without cutting off vacuum connection to opposite end (cylinder normally vacuum suspended) so that piston moves toward vacuum end of cylinder and, as piston rod connected directly to shift lever on side of transmission case, this motion engages gears. The valve linkage moves with the piston rod and valve tends to balance the vacuum cylinder so that piston follows dash shift lever movement exactly. When shift is completed (or when dash shift lever is stopped in any position), piston remains stationary in that position until a new shift is made with the dash shift lever (or lever is returned to neutral).

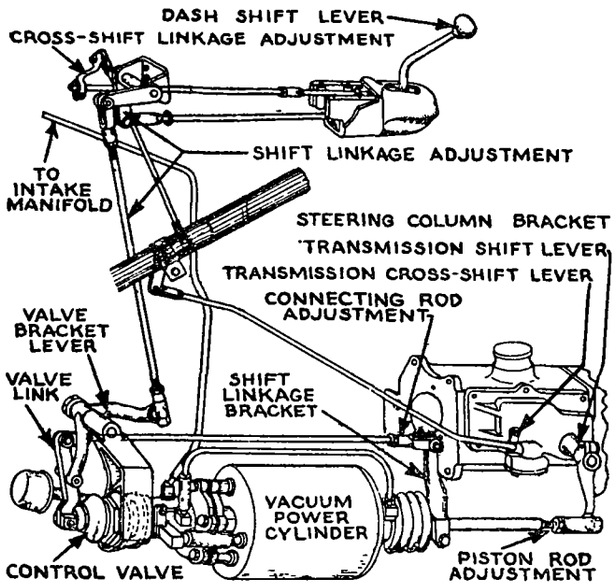
NOTE—Gears can be engaged by dash shift lever when engine is not running (no vacuum) although additional effort required. This will allow engine to be started by engaging gears and towing or coasting car when necessary.

CHECKING & ADJUSTMENT:—Whenever linkage disconnected or disturbed by removal of other units, check and adjust entire mechanism in order as directed below.

Selector (Cross-shift) Linkage:—Move dash shift lever to extreme left hand side of cross-slot at neutral and hold in this position while adjustment being made. Disconnect connecting rod at lever on front of dash (upper right hand dash unit shaft), see that selector lever on transmission (front short lever) is in extreme forward position, adjust connecting rod length so that it can just be connected to lever without disturbing dash shift lever or selector lever.

Dash Unit Shift Linkage:—With dash gear shift lever in neutral, adjust length of connecting rod (lower dash unit rod) between dash unit and lever on cross-shaft on front of dash so that this lever (to which rod attached) is parallel with front face of dash.

Vacuum Cylinder Piston Rod:—Make certain that shift lever on side of transmission case (rear lever) is in neutral position (check by moving lever back and forth for cross-shift which can be made only at neutral), measure distance from extreme rear end of vacuum cylinder to shoulder at rear end of piston rod. This distance should be exactly 10¾" and piston should be at mid-point in cylinder. Adjust by loosening locknut and turning clevis at rear end of piston rod.



Shift Linkage:—Check position of bracket mounted on piston rod (to which shift linkage connected). Bracket should be exactly 6 13/16" from shoulder at rear end of piston rod. Adjust by loosening clamp bolt at lower end of bracket and shifting bracket on rod. Connecting rod linked to upper end of this bracket should be exactly 14 1/16" long between clevis pin centers. To adjust, loosen locknut and turn clevis on rear end of rod.

Valve Linkage:—With all other adjustments correctly made and dash gear shift lever in neutral position, adjust length of vertical rod connecting lever on valve mounting bracket and cross-shaft lever on front of dash so that valve is in center (neutral) position and all pivot points on valve link are approximately vertical. Check this adjustment as directed below.

To Check Valve Setting—Disconnect vacuum line from engine at valve. Operate engine (to supply vacuum), make certain that dash gear shift lever and transmission shift lever are in neutral position, connect vacuum line momentarily. If piston rod tends to move to rear, connecting rod should be lengthened slightly, if piston rod moves forward, connecting rod should be shortened slightly. Repeat test until satisfactory valve setting secured.

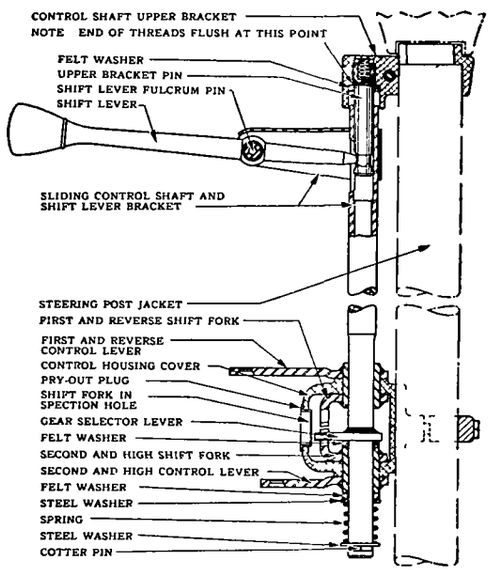
STUDEBAKER CHAMPION TYPE

Used On:

STUDEBAKER, CHAMPION MODEL G (1939)

NOTE:—Transmission used with this type control is conventional except for shifter mechanism. See separate article for Transmission servicing data.

TYPE:—Remote control type with shift lever mounted on steering column below steering wheel. Shift lever is pivoted at inner end in pin screwed in upper bracket and is linked to control shaft by fulcrum pin so that up-and-down movement of the lever (for cross-shift) lifts the entire control shaft and backward-and-forward movement (for gear engagement) rotates the shaft. An integral lug or lever on the lower end of the control shaft (within control housing on steering column) engages a fork attached to the



lower control lever (second-high) and is lifted to engage the fork attached to the upper control lever (Low-reverse) when shift lever is lifted up toward steering wheel (lug normally held down in second-high position by spring on lower end of control shaft below control housing). Control levers are connected to shift levers on side of transmission case by adjustable rods (forward lever for second-high, rear lever for low-reverse). Control housing is entirely enclosed and provided with lubricant fitting so that it can be kept filled with chassis lubricant.

ADJUSTMENT:—See that clearance between lower edge of instrument panel and control shaft is 1/16-⅛" (loosen clamp bolts and rotate steering column slightly to secure this clearance). Use special plug type gauge J-1308 to align control housing forks and levers in neutral position. To install gauge, pry out inspection plug in control housing cover, insert forked end of gauge in inspection hole, press up on control shaft until gauge prongs can be pressed in so as to engage both control lever forks, leave gauge in place until adjustments completed. Disconnect both rods at shift levers on transmission case, place each shift lever in neutral position (determine by feel of detent plungers engaging notches in sectors on shift lever shafts). Loosen locknut and adjust clevis on transmission end of each control rod so that clevis pins can just be inserted, connect rods, remove gauge and replace control housing inspection plug.

SERVICING:—If control mechanism removed from steering column, coat upper bracket pin threads and shift lever ball with Lubriplate, turn pin into upper bracket so that end of thread on pin is flush with lower face of bracket. Make certain that key on lower control housing mounting bracket engages notch in steering column. Control housing lever and fork assembly cannot be dismantled.

STUDEBAKER 1939 COMMANDER & PRESIDENT TYPE

Optl. Equipment On:

COMMANDER, MODEL 9A (1939)

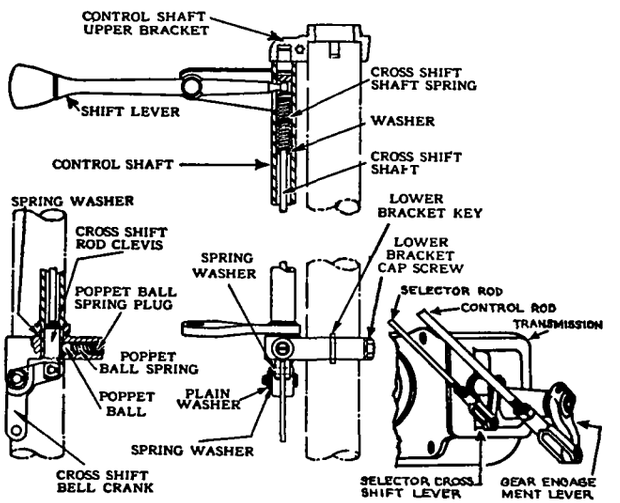
PRESIDENT, MODEL 5C (1939)

NOTE:—Transmission used with this type control similar to standard type except for shift mechanism (two levers on cover on side of transmission case—forward lever for cross-shift, rear lever for gear engagement). See separate article for complete Transmission servicing data.

TYPE:—Remote control type with shift lever mounted on steering column. Shift lever pivoted on bracket on steering column control shaft so that up-and-down motion of lever actuates selector (cross-shift) shaft within control shaft and forward (cross-shift) lever on transmission case. Backward-and-forward motion of shift lever rotates control shaft and actuates rear (gear engagement) lever on transmission case. Shift lever normally held down in Second-High position by spring in control shaft below lever and must be lifted against spring tension for Low-Reverse.

ADJUSTMENT:—Disconnect both control rods at transmission case levers by taking out clevis pins. Rotate shift lever to neutral position (can be determined by poppet ball at lower end of control shaft engaging shaft at this point). Disconnect cross-shift (inner) shaft from cross-shift bell crank at lower end of steering column assembly by taking out clevis pin. Set shift lever parallel with steering wheel and adjust cross-shift shaft length by turning clevis on lower end of shaft until upper edge of clevis slot lines up with lower face of lower bracket, install clevis pin connecting cross-shift shaft and bell crank. Without disturbing position of shift lever, move forward (cross-shift) lever on transmission case as far forward as possible, adjust length of control rod (loosen locknut and turn clevis on transmission end of rod) until clevis pin enters hole in rod clevis and cross-shift lever freely, install clevis pin. Set rear (gear engagement) lever on transmission case in neutral position (approximate center of travel—may be determined by detents engaging shift rails at this point), adjust length of control rod (loosen locknut and turn clevis at transmission end of rod) until clevis pin enters hole in clevis and lever freely, install clevis pin.

SERVICING:—**Disassembly**—Disconnect both control rods at lower end of steering column unit. Take out shift lever fulcrum pin screw and pin, remove shift lever being careful not to lose spring washer on fulcrum pin. Remove plug on poppet ball boss on lower support bracket, take out spring and poppet ball. Disconnect cross-shift shaft from bell crank at lower end of steering column by taking out clevis



pin. Remove lower support bracket capscrews, remove key from slot in steering column jacket, slide support bracket down on steering column until control shaft and bearing plug clear socket in upper support bracket, remove assembly. To remove inner cross-shift shaft, unscrew clevis from lower end of shaft, withdraw shaft, spring, washer, and insulator through upper end of control shaft.

Servicing—Apply Lubriplate to upper and lower ends of cross-shift shaft (these points packed with Lubriplate at assembly).

Reassembly—Reverse disassembly directions given above. When installing lower support bracket, slide bracket up on steering column until light tension placed on spring washer located between lower control lever and upper face of bracket (some tension required to prevent rattles, but bracket should not be pushed up so far as to cause excessive friction at this point). Key slot in steering column is elongated to permit this adjustment. Adjust both control rods as directed above.

DETROIT TRANSMISSION

Used On:

AUBURN EIGHT, MODELS 8-100, A ('32); 8-101, 5 ('33); 850X, Y ('34), 851 ('35), 852 ('36-37)
AUBURN SCHGD. EIGHT, MODELS 851 ('35), 852 ('36-37)
HUPMOBILE EIGHT, MODELS 226 ('32), 326 ('33), 426 ('34)

TYPE:—Constant-mesh, synchro-mesh (second and high), sliding spur gear (low and reverse). Clutch shaft and main drive gear mounted on ball bearing in case. Mainshaft mounted on roller bearing at forward end, ball bearing at rear. Countershaft mounted on bushings on stationary countershaft with thrust washer at each end. Gears are engaged by sliding clutch sleeve (outer member of synchronizing unit) which engages clutch teeth on main drive gear and second speed gear hubs.

Synchronizing Unit. Consists of synchronizing cones on gear hubs and drums on sliding sleeve splined to mainshaft. Synchronizing sleeve (inner) and clutch sleeve (outer) centered by spring-loaded detent balls and move as a unit until synchronizing drums and cones engage. When synchronization completed, outer clutch sleeve slides further to engage gears.

SERVICING:—Disassembly. Remove free wheel unit (see instructions under Free Wheel Unit below). Remove shift lever, cover, shifter shaft and fork assemblies, taking care not to lose lock balls and springs. Remove rear bearing retainer, take out rear bearing lock ring (at front end of bearing inside case). Pull mainshaft to rear as far as possible and tilt up so that second speed gear thrust washer locking plunger is accessible, depress plunger to free washer, withdraw synchronizing unit, washer, and gear from mainshaft, remove mainshaft. Remove main drive gear bearing retainer on front end of case. Drive out countershaft toward rear, allowing counter gear cluster to drop down in case. Remove main drive gear and bearing assembly. Lift out counter gear cluster, taking care not to damage thrust washers. To remove reverse idler, take out cotter pins and drive shaft forward in case.

Main Drive Gear & Bearing Assembly:—See that bearing lock ring is in place in bearing hole in case, install shims under bearing retainer so that bearing outer race is held in case without any endplay.

Mainshaft & Bearing Assembly:—Installed in same manner as main drive gear bearing (bearing lock ring in case, shims under rear retainer so that outer race held snugly without endplay).

Counter Gear Assembly:—Install rotating thrust washer (pinned to end of gear cluster) before inserting gears in case, then install stationary bronze thrust washers and insert countershaft. Make certain that reverse idler shaft and countershaft are locked in place.

DETROIT FREE WHEEL UNIT

Used On:

HUPMOBILE EIGHT, 226 ('32), 326 ('33), 426 ('34)
NASH, ALL MODELS (1932-33)

DESCRIPTION & OPERATION:—Cam and roller type. Cam splined on mainshaft with rollers in cam pockets. Outer sleeve is splined on driving flange which is integral with stub drive shaft. Entire free wheel assembly (cam, roller and sleeve assembly) is shifted on mainshaft so that clutch teeth on cam hub engage clutch teeth within driving flange at rear to lock free wheeling out. Free wheel unit is positioned on mainshaft by spring loaded detent balls within shaft which engage grooves in cam in each position. Snap ring on shaft acts as stop for cam in forward or free wheel position.

SERVICING:—Disassembly. Remove shift lever assembly. Take out mounting screws in rear cover plate (drive shaft bearing housing), withdraw cover plate and stub drive shaft as an assembly. Withdraw free wheel assembly through rear of case, being careful not to lose detent balls and springs.

Free Wheel Unit Assembly:—To dismantle unit, take out snap ring in sleeve at forward end, remove retainer washer, cam and rollers.

Drive Shaft Bearing Assembly:—Shaft mounted on double row ball bearing (Hupmobile), taper roller bearings (Nash) in rear cover plate. To remove shaft, take off nut or capscrews in universal joint flange at rear end of shaft, pull flange, press shaft out of bearing (Hupmobile), take off rear bearing cap (Nash).

Transmission Bearing Assembly (Nash Models):—Free wheel housing serves as mainshaft rear bearing retainer. If housing removed from transmission case, see that gasket and shims which control mainshaft bearing adjustment are replaced between free wheel case and transmission case when reassembled.

L.G.S. FREE WHEEL UNIT

Used On:

AUBURN, 8-100, A ('32), 8-105 ('33), 850Y ('34)
CHEVROLET, BA (1932), CA, CC (1933)
DUESENBERG, J (1932-35)

NOTE:—Free wheel unit on Auburn 850Y and Chevrolet CA, CC models is new design 'single pocket' type. Chevrolet recommends that no attempt be made to dismantle or service this unit.

DESCRIPTION & OPERATION:—Consists of a coil spring mounted in a pocket formed between the outer driving flange sleeve (splined to transmission mainshaft), and an inner spline shaft assembly sleeve (integral with stub drive shaft). Rotation of the driving flange sleeve (when engine is pulling car) tends to unwind the spring so that power is transmitted through the free wheel unit to the rear wheels. When car coasts, faster rotation of spline shaft assembly sleeve tends to wind up the spring allowing the rear wheels to overrun the engine.

Lockout Device.—Consists of a sliding clutch sleeve splined on the outside of the driving flange which is shifted to the rear to engage clutch teeth on the spline shaft so that they are locked together. Clutch sleeve operated by conventional shift lever on top of unit, or by cable (single pocket type).

SERVICING:—Disassembly. Remove cover, shift lever and shift fork assembly, remove speedometer cable and pinion. Take out capscrews mounting free wheel case on transmission, pull case and spline shaft assembly to rear and remove. If spring remains in pocket in driving flange, remove by rotating in one direction. Remove sliding clutch sleeve by pulling to rear, taking care not to lose detent ball and spring which will fall out. To remove driving flange from transmission mainshaft, take off nut on rear end of shaft, pull driving flange, being careful not to lose shims on shaft behind flange (these shims control end clearance and must be replaced). To remove driven flange assembly from housing, remove universal joint flange nut, pull flange, press shaft out (bearing retained by snap ring at front).

Assembly. Reverse disassembly directions. See that locknut plunger is in place in rear of transmission case before installing. When installing spring in spline shaft assembly, see that pilot or prong on end is inserted in hole in base of spring pocket. Make certain that washer is in place behind pilot bearing in driving flange. If new parts installed, check clearance between driving flange and spline flange assembly by assembling unit on transmission with gasket in place on transmission case but with sliding clutch sleeve omitted, drawing up mounting screws finger-tight. Clearance should be .005-.010". Adjust by adding or removing shims on transmission mainshaft in front of driving flange. Shims furnished .003", .005", .010", .015", .030", .060" thick.

WARNER FREE WHEEL UNIT

Used On:

GRAHAM SIX, 58 ('32), 65 ('33), 68 ('34)
GRAHAM EIGHT, 57 ('32), 57A, 64 ('33), 67 ('34)
GRAHAM SUPERCHARGED EIGHT, 69 ('34)
HUDSON, SIX (1932), EIGHT (1932-33)
HUPMOBILE SIX, 216 ('32), 321 ('33), 421, A ('34)
HUPMOBILE EIGHT, 222 ('32), 322 ('33), 422 ('34)
PIERCE ARROW 8, ALL MODELS (1933-35)
PIERCE ARROW 12, ALL MODELS (1933-35)
STUDEBAKER DICT., 56 ('33), A ('34)
STUDEBAKER COMM., 73 ('33), B ('34), 1B ('35)
STUDEBAKER PRES., 82, 92 ('33), C ('34)

DESCRIPTION & OPERATION:—Cam and roller type. Cam splined on sleeve on mainshaft (first type), directly on mainshaft (later type). Outer sleeve integral with stub drive shaft (first type), splined on mounting ring on stub drive shaft (later type). Rollers are located in pockets in cam and wedge between cam and sleeve when engine is driving rear wheels. When car coasts, rollers shift in cam pockets allowing sleeve to rotate faster than cam (free wheeling). On the later type units, stub drive shaft extends through free wheel unit and is mounted on bearing in pocket in mainshaft.

Locking Device. Consists of a sliding clutch gear splined on the mainshaft which can be shifted to the rear to engage clutch teeth in the free wheel sleeve, locking the shaft and sleeve together. Clutch gear is controlled by a conventional shift lever (first type), shifter shaft linked to dash control button (later type). Locking plunger provided on all types so free wheel locked out when reverse is engaged.

SERVICING:—First Type. Remove shift lever. Take out mounting screws in rear cover plate on free wheel housing, withdraw entire free wheel unit as an assembly through rear of case (sliding clutch gear will remain within case on driving sleeve, spring ring within gear hub engages notches in shaft to limit gear travel). To dismantle cam and rollers, take out snap ring in sleeve, remove retaining washer. To remove shaft and sleeve assembly from rear retainer, remove universal joint flange nut on rear end of shaft, pull flange, press shaft out of bearing. Bearing held in retainer by snap ring at forward end.

Later Type. Remove housing cover and shift lever assembly. Take out free wheel housing mounting screws on rear of transmission case, withdraw unit to rear. Dismantle shifter shaft mechanism to free sliding clutch gear and fork. To dismantle cam and rollers, take out snap ring in sleeve at forward end, remove retainer washer, jar assembly on bench to remove rollers. When reassembling, make certain that cam is correctly installed (if cam reversed, engine will not drive car).

WARNER 1932-37 TYPES (WITHOUT OVERDRIVE)

Used On:

AUBURN SIX, 652X, Y ('34), 653 ('35), 654 ('36-37)

BANTAM, MODEL 60 (1937)

CHRYSLER 6, C6 ('35), C7 ('36), C16 ('37)

CHRYSLER 8, CZ ('35), C8 ('36)

CHRYSLER IMP. 8, C1 ('35), C9 ('36), C14 ('37)

DE SOTO, SF, SG ('35), S1, S2 ('36), S3 ('37)

DODGE, DU ('35), D2 ('36), D5 ('37)

GRAHAM 6, 58 ('32), 65 ('33), 68 ('34), 74, 73 ('35)

GRAHAM 8, 57 ('32), 57A,64 ('33), 67 ('34), 72 ('35)

GRAHAM CRUSADER, 80, 80A ('36), 85 ('37)

GRAHAM CAVALIER, 90, 90A ('36), 95 ('37)

GRAHAM SUPERCHARGER, 69 ('34), 75 ('35), 110 ('36), 116, 120 (1937)

HUDSON, SUPER SIX ('33), EIGHT ('32-33)

HUPMOBILE SIX, 216 ('32), 321 ('33), 421A, 417W, 421J ('34), 517W, 518D ('35), 618G ('36)

HUPMOBILE EIGHT, 222 ('32), 322 ('33), 422, 427T ('34), 527T, 521-O ('35), 621N ('36)

PLYMOUTH, PJ ('35), P1, P2 ('36), P3, P4 ('37)

PIERCE ARROW, EIGHT CYL. MODELS (1933-37)

PIERCE ARROW, TWELVE CYL. MODELS ('33-37)

REO SIX, 6-A (1935), 6-D (1936)

STUDEBAKER, MODELS 56, 73, 82, 92 (1933)

STUDEBAKER DICT., A('34), 1A,2A('35), 3A,4A('36), 5A,6A('37)

STUDEBAKER COMM., B('34), 1B('35)

STUDEBAKER PRES., C ('34), 1C ('35), 2C ('36), 3C('37)

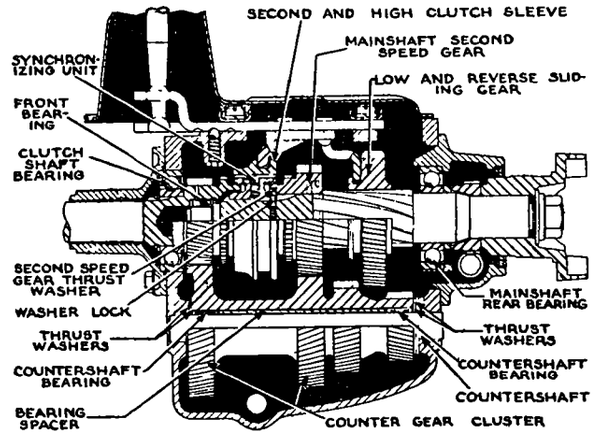
WILLYS, MODEL 37 (1937)

NOTE:—Free-wheeling used as standard or optional equipment on some models. See separate articles for data on Free wheeling and instructions for removal from transmission.

Chrysler C1, C9, DeSoto SG. These models have splined shaft extension at rear of case. Can be removed by taking out housing capscrews and withdrawing to rear to disengage extension shaft from mainshaft splines.

TYPE:—Constant-mesh, synchro-mesh, helical gear (second and high), sliding spur or helical gear (low and reverse). Main drive gear and shaft mounted on ball bearing in front of transmission case. Mainshaft mounted on roller bearing (front), ball bearing (rear). Counter gear cluster mounted on bronze bushings, or roller bearings (caged type or loose rollers) on stationary countershaft. Reverse idler mounted on bronze bushing (loose roller bearing on some Chrysler models) on stationary shaft. Second speed and high gears engaged by sliding clutch sleeve (splined on synchronizing unit spline sleeve) which engages clutch teeth on second speed and main drive gear hubs.

Synchronizing Unit. Consists of synchronizing cones on main drive gear and second speed gear and drums on ends of sliding sleeve splined to mainshaft within sliding clutch sleeve. These two sleeves are centered by spring-loaded detent balls which engage a groove in the outer clutch sleeve and move as a unit when the clutch sleeve is shifted to engage second or high until the synchronizing drum and cone engage. When synchronization is completed, clutch sleeve slides further to engage clutch teeth on gears.



SERVICING:—Disassembly. Remove shift lever, cover, shifter shaft and fork assemblies, being careful not to lose lock balls and springs. Remove universal joint flange nut, pull flange. Take out rear bearing retainer screws, withdraw rear bearing retainer, mainshaft, second speed gear and synchronizing unit as an assembly, being careful not to allow clutch sleeve to move on inner synchronizing sleeve which will allow detent balls and springs to jump out. See note below for types where rear bearing mounted directly in case so that mainshaft assembly cannot be withdrawn through rear of case. Take out screw in countershaft and reverse idler locking plate screw and remove plate, drive out countershaft toward the rear (on types where loose roller bearings used, use dummy shaft or arbor to drive out countershaft leaving the arbor in the gear cluster until it is re-installed, arbor will prevent rollers falling out). Take out screws in bearing retainer on front of case, pull clutch shaft main drive gear and bearing assembly out toward front. Lift out counter gear cluster, being careful not to lose thrust washers and spacers. To remove reverse idler, drive shaft out toward rear (on types with loose roller bearings, rollers will fall out and care should be taken that they are not lost).

NOTE—When rear mainshaft bearing mounted directly in case, pull mainshaft assembly to rear until bearing is free of case, tip shaft up and remove synchronizing unit, and if necessary second speed gear (see dismantling instructions below). Remove bearing snap ring, push shaft forward and remove through top of case.

Countershaft Locking Key Note. On models where locking plate not used, countershaft and reverse idler shaft retained by key in recess in rear face of case which engages slot in shaft. On these models, drive countershaft out to the rear (with rear bearing adapter free) until key is exposed, remove key and drive shaft out (use dummy shaft or arbor for types with loose roller bearings).

Mainshaft & Bearing Assembly:—Bearing is press fit on mainshaft (press bearing on and off shaft). Bearing is retained in case by snap ring at rear, or by snap ring at forward end (where bearing mounted in rear retainer or adapter).

Synchronizing Unit:—Mark outer clutch sleeve and inner synchronizing sleeve before dismantling and assemble in same positions. Use care not to lose detent balls and springs (wrap in cloth when pushing clutch sleeve off so that balls will be caught when they spring out). Use special assembling clips when reassembling. Install on mainshaft with longer hub on both sleeves toward front (see illustration).

Second Speed Gear Assembly:—See Note and special instructions below for removal of early type with thrust washers locked in place by key. On types with front thrust washer locked by plunger in shaft under washer, use a wire to depress plunger and free washer, turn washer so that prongs on inner edge line up with splineways on shaft, pull washer and gear off, taking care not to lose lock plunger and spring. When installing thrust washer, see that it is turned so that prongs engage slots in splines and that it is locked in place by plunger. Gear endplay controlled by thrust washer thickness (furnished in various thicknesses) and should be .003-.008".

NOTE—On some models, additional thrust washer used at rear of gear against shoulder on shaft. This washer locked in place by pin or by locking plunger and spring in same manner as front washer.

Locking Key (Early type). Gear positioned by thrust washer at each end which is locked on shaft by key within gear bushing. To remove gear, insert wire in oil hole at center of gear between teeth, rotate gear until wire can be pushed through hole in bushing, depress plunger under locking key, use wire or flat tool to push key forward until it clears rear thrust washer, rotate washer until prongs on inner edge line up with shaft splineways, move washer to rear slightly. Move key back to free front washer (plunger will engage key at center position and must be depressed again to allow key to be shifted further), withdraw wire and move second speed gear back to expose front thrust washer, rotate washer until prongs are freed from splines, remove washer and gear. When installing gear, make certain that prongs on both washers engage slots in splines, that key engages both washers to prevent any rotation which would allow them to disengage, and that key is locked in place by plunger. When replacing gear bushing see that omitted spline in which key is installed is directly over plunger.

Counter Gear Assembly:—See that bearing spacer installed in gear cluster between bearings. On types with loose rollers, see that rollers installed around arbor, coat end of gear with cup grease to hold rollers in place. Install steel spacers or thrust washers next to gear at each end (not used at front end on some models), bronze washers between steel spacers and case. Install countershaft from rear, driving out arbor toward front (when used). Gear endplay is adjusted by selecting thrust washers of correct thickness and should be .002-.008".

WARNER 1938-39 TYPES (WITHOUT OVERDRIVE)

Used On:

BANTAM, MODEL 60 (1938-39)
CHRYSLER ROYAL, MODEL C18 (1938)
CHRYSLER ROYAL, MODEL C22 (1939)
CHRYSLER IMPERIAL, MODEL C19 (1938)
CHRYSLER IMPERIAL, MODEL C23 (1939)
DE SOTO, MODEL S5 (1938), S6 (1939)
DODGE, MODEL D8 (1938), D11 (1939)
HUPMOBILE SIX, MODEL 822-E (1938)
HUPMOBILE SENIOR 6, MODEL 922-E (1939)
HUPMOBILE SKYLARK, MODEL 915R (1939)
PLYMOUTH, MODELS P5, P6 (1938)
PLYMOUTH, STD. & DELUXE P7, P8 (1939)
WILLYS, MODEL 38 (1938), 48 (1939)
WILLYS-OVERLAND, MODEL 39 (1939)

NOTE:—Steering Column Gear Shifts—Optional on all 1939 car models except Bantam and Willys. See separate "Transmission Control" articles for servicing and adjustment data on each car.

Overdrive Transmissions—Optional on all models except Bantam, Dodge, Plymouth and Willys. See separate articles on Transmissions with Overdrives for data on these types.

TYPE:—Same design as used on earlier car models except for Synchronizer design on some car models as follows:

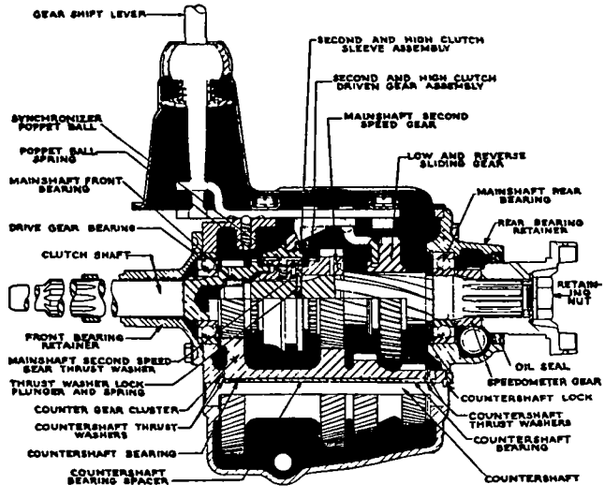
Blocking Type Synchronizer (Chrysler C18, DeSoto S5)—Synchronizing rings are loose in inner synchronizing sleeve and have cam lugs on inner end which engage slots in clutch sleeve. Rings are actuated by inner clutch sleeve (inner and outer sleeves centralized by poppet balls and springs and move as a unit during synchronization) and have teeth on outer rim which engage the clutch teeth on the outer sleeve and block or prevent engagement until synchronization completed. The final movement of the outer clutch sleeve causes the teeth on the rim of the sleeve to slide past the teeth on the synchronizer ring and engage the clutch teeth on the gear hub.

Drag Ring Type Blocking Synchronizer (Chrysler C22, De Soto, Dodge, Plymouth P8)—Synchronizer rings are loose in ends of inner clutch sleeve and are actuated by a drag or friction ring within the outer clutch sleeve which contacts lugs on the synchronizer rings (initial movement of outer clutch sleeve carries drag ring with it and forces synchronizer rings in contact with cones on gear hubs). Teeth on synchronizer rings block or prevent gear engagement until synchronization completed when final movement of outer clutch sleeve causes clutch teeth on rim of sleeve to slide past teeth on synchronizer ring and engage clutch teeth on gear hub. Inner clutch sleeve is stationary on mainshaft and does not move during synchronization and gear engagement.

Lug Type Blocking Synchronizer (Chrysler C19, C23)—Synchronizer rings loosely mounted in ends of inner clutch sleeve and retained by snap rings. Rings are actuated in usual manner by the inner clutch sleeve (inner and outer clutch sleeves centralized by poppet balls and springs and move as a unit for synchronization). Three lugs on synchronizer rings (in recesses in inner clutch sleeve) block or prevent gear engagement until synchronization has been completed when the final movement of the outer clutch sleeve engages the clutch teeth on the gear hubs.

Synchronizer (Other Models)—Conventional type with inner and outer sleeves centered by poppet balls and springs (synchronizer rings or cones fixed in inner sleeve).

SERVICING:—These models disassembled and serviced in same manner as earlier types (see preceding article for complete directions) except for new Synchronizers and Second Speed Gears used with these synchronizers which are serviced as follows:



Disassembly:—Mark both synchronizer rings as well as inner and outer clutch sleeves of synchronizer unit before removal to insure reassembly in same relative positions (on some types synchronizer rings are loose and can be lifted off directly). On Chrysler, DeSoto, Dodge, Plymouth models, note that Synchronizer Ring Spreader Spring installed back of high speed (front) synchronizer ring only.

NOTE—Spreader spring must be installed with three raised fingers toward the synchronizer ring.

Bantam, Willys Disassembly Note—Mainshaft assembly cannot be removed through rear of case and must be dismantled and removed as follows: Pull shaft back until rear bearing is clear of case, tip forward end up and remove synchronizer as a unit (use care not to allow outer clutch sleeve to move on inner sleeve which will release poppet balls and springs), remove second speed gear and low speed gear, then remove shaft.

Synchronizer Assembly (Drag Ring Type):—Install drag ring on inner clutch sleeve so that depressions on spring are directly in line with synchronizer ring lug holes in sleeve and retain in position with three pins inserted through holes so as to pass over spring in slot at center of sleeve while sleeve is being inserted in outer clutch sleeve. Make certain that open ends of drag ring straddle a tooth on the outer sleeve and line up marks on inner and outer sleeves, then remove assembling pins and install synchronizer rings (with spreader spring installed behind high speed ring with three raised fingers toward ring). See second speed gear assembly for installation instructions.

Lug Type Synchronizers—Synchronizer rings are retained in inner clutch sleeve snap rings. With snap rings installed, synchronizer rings should be free to rotate. Backlash between inner and outer sleeves should be .000-.001 (sleeves are selective fit). On Chrysler models, pressure required to break poppets (so that outer sleeve moves on inner sleeve) should be 26-34 lbs.

Other Type Synchronizers—Inner and outer clutch sleeves marked by etched line to maintain alignment and must be reassembled with these lines together (if synchronizer not marked, mark both sleeves before disassembling and assemble in same relative position). On Bantam and Willys models, pressure required to break poppets (so that outer sleeve moves on inner sleeve) should be 45-58 lbs.

Second Speed Gear Assembly (Locking Plate Type on Chrysler C18, DeSoto S5, Dodge D8, Plymouth P5,6) Gear retained by thrust washer and special locking plate on forward end. To disassemble, for gear removal, bend up three fingers on lock plate which engage groove in thrust washer, slide lock plate off shaft and discard (do not re-use lock plates). Rotate washer to line up notches and splines on shaft, remove washer and gear. To reassemble, use new lock plate, make certain that thrust washer turned so that it engages shaft splines and that lock plate fingers locked firmly in washer grooves to prevent loosening in service.

Second Speed Gear Assembly (Drag Ring & Wire Bound Strut Type Synchronizers):—Second speed gear and inner sleeve or hub of synchronizer mounted as an assembly on mainshaft and retained by snap ring on forward end of shaft. To disassemble, remove snap ring in front of synchronizer inner sleeve, withdraw synchronizer assembly and second speed gear. When reassembling, make certain that second speed gear endplay is .003-.008" (Chrysler, DeSoto, Dodge, Plymouth), .003-.014" (others) with synchronizer inner sleeve pressed forward against snap ring.

Second Speed Gear Assembly (Lug Type & Conventional Synchronizers):—Synchronizer assembly is free on shaft and can be removed as an assembly. Second speed gear is retained by a snap ring locked by a spring-loaded plunger in the shaft. To remove gear, depress plunger (under washer on front of gear), rotate washer to line up notches with splines on shaft, withdraw washer, remove gear being careful not to lose plunger and spring. Install gear in same manner, make certain that washer turned so that lugs engage notches in shaft splines and that plunger engages washer to prevent turning and loosening in service.

Counter Gear Endplay Adjustment (Chrysler, DeSoto, Dodge, Plymouth Models):—Thrust washers furnished in three thicknesses for endplay adjustment and marked as follows: A—thinnest, B, C—thickest. Select washers so that endplay is .002-.008" (check with feeler gauge).

WARNER 1935-39 TYPES (WITH TYPE R1 SEPARATE OVERDRIVE)

Used On:

CHRYSLER AIRFLOW, MODEL C1 (1935)—OPTL.
CHRYSLER IMPERIAL, C2 (1935), C10 (1936)
CHRYSLER CUST. IMP. CW* ('35), C3 ('35), C11 ('36), C15 ('37)
CHRYSLER AIRFLOW, MODEL C17 (1937)
DE SOTO, MODEL SG (1935)—OPTL.
HUPMOBILE EIGHT, MODEL 621-N (1936)
NASH, ALL MODELS (1935-38)—SOME CARS.
PIERCE ARROW EIGHT, 1601 ('36), 1701 ('37)
PIERCE ARROW TWELVE, 1602,3 ('36), 1702,3 ('37)
STUDEBAKER PRES., 1C (1935), 2C (1936)—OPTL.

Model AS18-T85.

CHRYSLER CUSTOM IMPERIAL, C20 (1938)

Model AS1-T82A.

PIERCE ARROW EIGHT, MODEL 1801 (1938)
PIERCE ARROW TWELVE, MODELS 1802, 3 (1938)

Model AS11-T85

HUPMOBILE 8, 825-H (1938), 925-H (1939)

NOTE:—These models fitted with Model R1 Overdrive unit in separate case bolted on rear face of transmission case and driven from transmission mainshaft through splined coupling. See separate article (following) for Overdrive servicing data.

TYPE:—Constant-mesh, synchro-mesh (second and high), all helical gear type. Similar in design to regular transmission without overdrive and serviced in same manner (see preceding article).

Chrysler C20 (1938). This model fitted with new 'Blocker' type synchronizing unit. See Chrysler C19 data (preceding article).

Nash Note. Other types of Warner Transmissions and Overdrive units also used. See separate articles for data.

SERVICING:—Disassembly. To remove Overdrive unit, take out mounting screws in overdrive case flange on rear face of transmission case flange, pull unit straight back to disengage shaft from splined coupling of transmission mainshaft. Overdrive case clamps rear bearing retainer in place in transmission case (Chrysler), retains rear bearing (Pierce Arrow models) when bolted in place. With overdrive unit removed, transmission serviced in same manner as other types without overdrive. See preceding article for complete data.

WARNER TYPE R1 OVERDRIVE

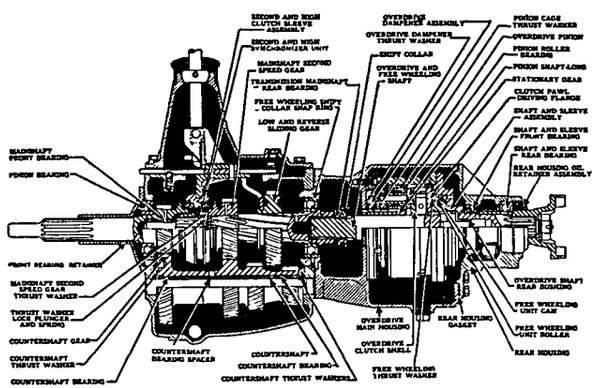
Used On:

CHRYSLER AIRFLOW, C1 (1935), C17 (1937)
CHRYSLER IMPERIAL, C2 (1935), C10 (1936)
CHRYSLER CUST. IMP., CV (1934), C3 (1935), C11 (1936), C15 (1937), C20 (1938)
DE SOTO AIRFLOW, MODEL SG (1935)—OPTL.
HUPMOBILE 8, 621N ('36), 825H ('38) 925H ('39)
NASH, ALL MODELS (1935-38)—SOME CARS.
PIERCE ARROW 8, 1601 ('36), 1701 ('37), 1801 ('38)
PIERCE ARROW 12, 1602,3 ('36), 1702,3 ('37), 1802,3 ('38)
STUDEBAKER PRESIDENT, 1C (1935), 2C (1936)

DESCRIPTION & OPERATION:—Overdrive consists of a planetary gear system with a centrifugally operated actuating clutch and a free wheel unit built in the overdrive case. The outer ring or internal gear of the planetary system is part of the 'sleeve and shaft assembly' permanently connected to the rear axle, while the small central 'sun' gear is stationary (bolted directly to the front face of the overdrive case—spring loaded dampener built in sun gear mounting on some models). The planet gears (pinion assembly) are driven by the engine when overdrive is operative and revolve freely at other times. Overdrive is driven by a sliding shaft splined to the transmission mainshaft which can be shifted backward and forward by means of the dash control button.

Direct Drive Position. Shaft shifted to rear so that clutch teeth at rear end engage free wheel cam and sleeve and shaft assembly. Drive transmitted directly to rear axle. Free wheeling locked out and overdrive inoperative (centrifugal clutch assembly free and not positively driven).

Free wheel & Overdrive Position. Shaft shifted forward to engage free wheel cam and clutch pawl driving flange. Drive transmitted to rear axle through free wheel cam and rollers (free wheel operative at speeds below overdrive cut-in point). Clutch assembly is rotated at engine speed and as speed increases to cut-in point, weights tend to fly out and engage clutch shell which is part of planetary pinion assembly (pinned together by pinion shafts). However pinions and clutch shell rotate at less than engine speed (being driven by ring gear which is part of sleeve and shaft assembly) so that clutch pawls cannot engage. When car is allowed to free wheel (accelerator pedal released momentarily), speed of clutch drops down to pinion speed and pawls engage in notches in shell. Engine then drives pinion assembly and, as pinions rotate on their shafts as the assembly is rotated, ring gear is



rotated at more than engine speed so that sleeve and shaft assembly drive rear axle at greater than engine speed (overdrive). When engine speed decreases to a point approximately 8-10 M.P.H. below cut-in point, clutch pawl springs withdraw pawls from engagement with shell (car must free wheel momentarily to allow this disengagement to occur) and engine again drives car through free wheel cam and rollers.

ADJUSTMENT:—Cut-in point for overdrive is set at factory and should not require adjustment. To adjust, remove the adjusting hole plug on top of case), drain lubricant, place transmission gears in neutral, rotate propeller shaft until holes in free wheel case and clutch shell line up with hole in case. Then engage high gear, depress clutch pedal so that slight drag placed on shaft, rock propeller shaft back and forth to rotate clutch pawl flange until adjusting screw head is visible in hole. Turn screw clockwise or in to increase cut-in speed, counter-clockwise or out to decrease cut-in speed) (two full turns will change cut-in speed 6 M.P.H.). Rock shaft again to bring second adjusting screw in line with hole, repeat adjustment. Adjust both screws equally. NOTE—one screw has double slot in head so that they can be distinguished to avoid possibility of adjusting same screw twice. Check to see that screws have not been turned so far that they interfere with the clutch shell.

First Type (Without Adjusting Plug). On these models, remove drain plug at bottom of case, drain lubricant, adjust through drain plug hole in same manner as directed above.

SERVICING:—Disassembly. Take out rear housing cap-screws, withdraw rear housing and shaft and sleeve assembly, and free wheel assembly. Remove clutch shaft shifting collar snap ring, withdraw clutch pawl assembly, pinion assembly, and shaft through rear of case. To remove stationary sun gear, turn down lockwasher lips, mark mounting flange and case to insure reassembly in same position, remove mounting screws. Damper assembly cannot be serviced and should not be dismantled. Sun gear can be removed by taking out lock ring and pressing gear out of damper member.

Overdrive Shaft & Sleeve Assembly:—Sleeve is riveted to shaft flange and should not be removed. To remove assembly from rear housing, remove propeller shaft flange and speedometer drive pinion, press shaft out of housing toward front, remove oil seal from rear. When reassembling, see that rear ball bearing seated against shoulder in housing and snap ring at rear engaged in slot, front roller bearing seated against snap ring in housing at rear, and that speedometer drive gear snap ring at forward end of gear installed with open end at oil escape hole in shaft.

Pinion Gear Assembly:—Helical type gears can be disengaged and engaged with sun and ring gear by rotating assembly slightly. When spring-loaded spur gears used, line up gear halves against spring tension when meshing these gears (springs tend to rotate gear sections to take up backlash, insuring quiet operation).

Overdrive Assembly:—Install sun gear and damper assembly using new lock washers under screw heads and turning lips up against screws to prevent loosening. See that oil holes in damper plate and case line up to insure lubricant circulation. Install damper thrust washer, overdrive shift rail fork and spring, shift rail (compress spring and install horseshoe lock), planet pinion cage, pawl core, pawl core shell, clutch shaft (from rear of case), shift collar and lock ring, free wheeling cam. Install free wheeling roller springs, compress springs and install rollers. Install free wheeling cam thrust washer and lock in place with cotter pins. Install rear retainer and shaft and sleeve (annulus gear) assembly, adjust endplay as directed below.

Overdrive Endplay Adjustment. See that all gaskets previously used between overdrive housing and rear housing flange are replaced (these gaskets control endplay). To determine correct gasket when new parts have been installed, assemble rear housing (omitting all gaskets), using two screws drawing up finger tight. Use feeler gauge to check clearance between main housing flange and rear housing flange. Assemble gaskets equal in thickness to this clearance plus .015-.025" for endplay (use micrometer to check gasket thickness) and install this gasket pack under rear housing flange.

WARNER 1936 TYPE (WITH INTEGRAL OVERDRIVE)

Used On:

CHRYSLER, MODELS C7, C8 (1936)
DE SOTO, MODELS S1, S2 (1936)—SEE NOTE
GRAHAM, MODELS 90, 110 (1936)
HUPMOBILE SIX, MODEL 618-G (1936)
NASH, ALL MODELS (1935-38)—SOME CARS.
REO FLYING CLOUD, MODEL 6-D (1936)
STUDEBAKER DICTATOR, 3A, 4A (1936)

NOTE:—DeSoto S2 (1936) standard transmission not equipped with Overdrive unit but similar in all other respects (including case). When servicing this type transmission, follow instructions below, disregarding Overdrive data.

Nash Note. Other types of Warner Transmissions and Overdrive units also used. See separate articles for data.

NOTE:—Overdrive unit on these models is mounted on an extension of the transmission mainshaft within the transmission case and must be disassembled in order to remove it from the shaft.

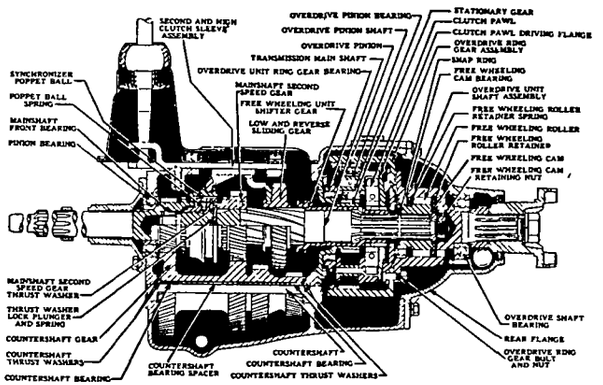
TYPE:—Constant-mesh, synchro-mesh (second and high), all helical gear type. Similar to regular transmissions without overdrive except that overdrive is an integral unit with the transmission and located within the transmission case.

SERVICING:—Disassembly. Remove gear shift, cover, shifter shaft and fork assemblies, taking care not to lose lock balls and springs. Remove universal joint flange nut, pull flange. Take out transmission rear cover flange screws, pull flange (two tapped holes provided in flange, screw 5/16" capscrews in these holes to pull flange). Take off nuts on six overdrive ring gear bolts at rear of unit, remove overdrive shaft assembly. Take off free-wheeling cam retaining nut on rear end of mainshaft, remove free-wheeling cam and roller assembly. Remove oil baffle, overdrive ring gear assembly, overdrive ring gear bearing. Take out capscrews mounting stationary sun gear on case, remove gear. Take out lubricant equalizing trough through top of case. Take off nut on side of case, remove free-wheel shift lever, remove control shaft lock setscrew, move shaft in to disengage shifter gear notch, move sleeve forward at rear end of shaft and remove horseshoe lock, tap shaft forward out of shifter fork and case (shaft will drive out plug at forward end of case), remove shifter fork through top of case. Remove transmission mainshaft gear and synchronizing unit assembly through rear of case. Remove reverse drive countershaft out toward rear of case, using an arbor or dummy shaft and leaving this arbor in the counter gear assembly until it is re-installed (this will retain loose roller bearings). Remove bearing retainer on front end of case, take out clutch shaft main drive gear and bearing assembly at front end. Remove counter gear assembly through rear of case, being careful not to lose bearing rollers or thrust washers.

Synchronizing Unit:—Serviced in same manner as on other Warner models. Mark parts before dismantling and assemble in same positions. Use extreme care not to lose detent balls and springs.

Second Speed Gear Assembly. Retained on shaft by thrust washer locked in place by plunger and spring in shaft. Use a wire to depress plunger, turn washer until prongs line up with splineways on shaft, remove washer and gear. When reassembling see that plunger engages thrust washer and that washer prongs are turned into notches in splines.

Counter Gear Assembly. When installing, see that loose rollers are in place in each end. Install steel thrust washer next to gear, bronze washer next to case at each end (steel washer omitted at forward end on some models). Install counter shaft from rear, driving dummy shaft out at forward end.



OVERDRIVE UNIT

SERVICING:—Ring Gear & Clutch Assembly. To dismantle, take out snap ring, tap out forward plate, remove pinion gears and clutch plate. If clutch pawl adjusting screws are removed, count the number of 'clicks' (half-turns) when turning screws out and turn screws in exactly the same amount when re-installing so that cut-in speed will not be changed (both screws should be adjusted alike).

Pinion Gear Assembly. Pinions are made in two halves and spring loaded (spring tends to rotate halves and take up backlash, one pinion of each set has spring reversed). Assembly will be easier if pinions meshed on stationary sun gear first and then installed in ring gear assembly (withdraw sun gear and install separately in case).

Free-wheeling Roller Assembly. Rubber band can be used to hold free-wheeling rollers in position and wire threaded through overdrive unit shaft assembly to hold cage in released position while assembling overdrive unit shaft assembly. Withdraw wire and remove rubber band as assembly goes into place.

ADJUSTMENT:—Cut-in point should not require adjustment. To adjust, remove large adjusting hole plug on top of case, jack up rear end of car, turn propeller shaft until one hole in clutch shell lines up with adjusting hole. Engage high gear, rotate propeller shaft until one adjusting screw head lines up with hole in shell. Turn screw in to increase cut-in speed, out to decrease cut-in speed. Two full turns will change cut-in speed approximately 6 MPH. Turn screws only in half-turns so that locking washer is engaged to prevent screw turning in service. After adjusting one screw, turn propeller shaft ¾ revolution so that second adjusting screw is lined up, adjust this screw equally. **Important**—both screws must be adjusted equally. One screw has single slot, opposite screw has double slot so that they may be distinguished (use care not to adjust same screw twice). Check adjustment and make certain that screws not turned out so as to strike clutch shell.

WARNER 1937-38 TYPES (WITH R6 OVERDRIVE)

Used On:

CHRYSLER SIX, MODEL C16 (1937)
CHRYSLER IMPERIAL, MODEL C14 (1937)
DE SOTO, MODEL S3 (1937)
GRAHAM CAVALIER, MODEL 95 (1937)
GRAHAM SUPERCHARGER, MODELS 116,120('37)
HUPMOBILE SIX, 822-E (1938), 922-E (1939)
HUPMOBILE SKYLARK, MODEL R (1939)
NASH, ALL MODELS (1935-38)—SOME CARS
STUDEBAKER DICTATOR, 5A, 6A (1937)
STUDEBAKER PRESIDENT, MODEL 3C (1937)

Model AS1-T86A.

CHRYSLER ROYAL, MODEL C18 (1938)
DE SOTO, MODEL S5 (1938)
DODGE, EXPORT MODELS (1938)
PLYMOUTH, EXPORT MODELS (1938)

Model AS2-T85A.

CHRYSLER IMPERIAL, MODEL C19 (1938)

NOTE:—All models fitted with Overdrive unit in separate case bolted on rear end of transmission case. Transmission mainshaft extends into Overdrive case with overdrive planetary gear and clutch pawl assembly mounted on it so that overdrive unit must be dismantled in order to disassemble transmission. Complete instructions given below.

Nash Note. Other types of Warner Transmissions and Overdrive units also used. See separate articles for data.

Studebaker Pres. 3C ('37). Overdrive used on this model is special automatic type. See separate article (following) for data on this type.

TYPE:—Constant-mesh, synchro-mesh (second and high), all helical gear type. Similar in design to regular transmission (see preceding article) except for mainshaft extension and overdrive unit which require special disassembling directions (below).

SERVICING:—Disassembly. Remove shift lever, cover, shifter shaft and fork assemblies, being careful not to lose lock balls and springs. Lock transmission by shifting into two gears at once, remove drive shaft nut at universal joint flange, pull flange. Remove speedometer drive pinion. Take out screws mounting overdrive unit on transmission case, withdraw overdrive housing (free wheeling rollers will fall out, take care not to lose rollers). Remove free wheeling cam locking screw on rear end of shaft, withdraw free wheeling cam and cage assembly, remove ring or annulus gear and bushing assembly. This completes overdrive removal (stationary sun gear integral with adapter which serves as mainshaft rear bearing retainer). See preceding article for transmission disassembly and servicing directions.

TYPE R6 OVERDRIVE CONT.

OVERDRIVE UNIT

ADJUSTMENT:—Cut-in point should not require adjustment. To adjust, remove large adjusting hole plug on top of case, jack up rear end of car, turn propeller shaft until one hole in clutch shell lines up with adjusting hole. Engage high gear, rotate propeller shaft until one adjusting screw head lines up with hole in shell. Turn screw in to increase cut-in speed, out to decrease cut-in speed. Two full turns will change cut-in speed approximately 6 MPH. Turn screws only in half-turns so that locking washer is engaged to prevent screw turning in service. After adjusting one screw, turn propeller shaft ¾ revolution so that second adjusting screw is lined up, adjust this screw equally. **Important**—both screws must be adjusted equally. One screw has single slot, opposite screw has double slot so that they may be distinguished (use care not to adjust same screw twice). Check adjustment and make certain that screws not turned out so as to strike clutch shell.

SERVICING:—Housing & Driveshaft Assembly. Use a brass drift to drive mainshaft out of housing. Operate shifting arm while removing shifting sleeve from housing. See that shifter collar engages groove in sleeve when sleeve replaced in housing. Install shifter sleeve and housing after overdrive has been assembled on transmission case, starting housing upside down until lockout rod touches adapter plate and then rotating housing into correct position (manipulation of lockout lever may assist assembly).

Free wheeling Cam & Roller Assembly:—Fill cage openings with cup grease to hold rollers in place while assembling, rotate cage assembly counterclockwise on cam (viewed from rear) while installing overdrive mainshaft (drive shaft). Make certain that oilite thrust washer on face of free wheel cam is installed with chamfered side toward front of car.

Ring Gear & Clutch Assembly:—To remove clutch assembly, take out snap ring in rim at rear, lift clutch out. Press out overdrive clutch plain bearing using a plug of correct size, take out clutch pawl adjusting screws taking care to measure distance from top of each screw to marks on clutch core first, and counting the number of 'clicks' (half-turns) while removing the screws. When installing, turn screws in exactly this same number of clicks so that the original cut-in speed setting will not be disturbed. When installing clutch pawl sleeve, lock pawls in engaged position, press sleeve in flush with forward face of overdrive clutch, free pawls.

Stationary Sun Gear & Pinion Assembly:—Pinion assembly can be removed by rotating gears off sun gear (gears are helical type). When installing sun gear (adapter plate) see that paper gaskets are in place on each side. Oilite thrust washer should be installed on pinion gear hub at rear.

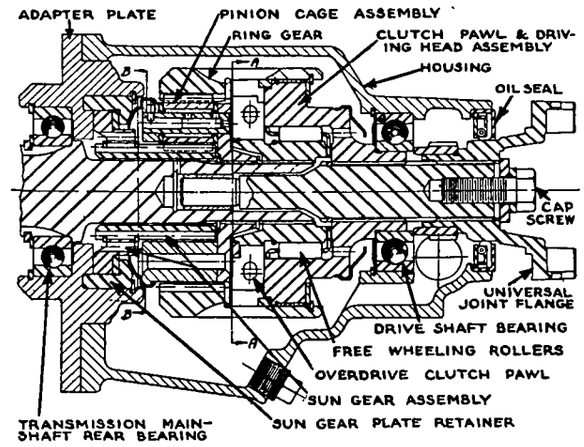
WARNER 1937 STUDEBAKER PRESIDENT AUTOMATIC OVERDRIVE

Used On:

STUDEBAKER PRESIDENT, MODEL 3C (1937)

NOTE:—Overdrive unit is mounted in separate case bolted to rear of transmission case but transmission mainshaft extends through into overdrive unit (with pinion cage assembly and clutch pawl assembly splined on the shaft) so that overdrive must be dismantled before mainshaft can be moved. See overdrive data below and previous article on Warner Transmissions without overdrive for all other transmission servicing data.

DESCRIPTION & OPERATION:—Overdrive is similar to previous designs except for new type sun gear and new type clutch pawl and driving head assembly which allow overdrive to be cut in or out at the will of the operator at speeds above the cut-in point



of 35 M.P.H. Free wheel operates only momentarily during change from direct drive to overdrive and car coasts against engine compression at all speeds. Sun gear is mounted freely on mainshaft and is prevented from rotating by a stationary pawl in the sun gear plate retainer which is free to oscillate between spring bumpers in the adapter plate lugs (pawl is forced out of engagement permitting sun gear to rotate freely for 'conventional overdrive' as described below. Clutch pawls are spring loaded and in the inner position two of the pawls lock the clutch hub or free wheel cam (which is splined on the mainshaft) to the driving head assembly (integral with drive shaft for 'direct drive.' At speeds above 35 M.P.H. pawls move out and engage slots in ring gear for 'overdrive.' Pawl springs are of unequal tension, so that one pawl tends to disengage and engage first (engagement taking place as soon as the second pawl disengages) so that the disengaged period is very short. The third pawl with very light spring tension (single spring) is not used for direct drive and tends to engage the overdrive at lower speed but does not actually transmit drive (pawl contour such that it merely maintains drive connection when driving pawls disengage from ring gear).

Direct Drive. Effective at speeds below 35 M.P.H. Engine drives rear wheels directly through clutch hub splined to mainshaft and driving head assembly (these parts locked together by clutch pawls being in inner position). Pinion cage assembly rotates at engine speed but ring gear is free to revolve on bushing on driving head assembly.

Overdrive. At speeds above 35 M.P.H. Cut in by releasing accelerator pedal momentarily and then gradually accelerating engine which allows clutch pawls to engage ring gear slots. Sun gear plate retainer is rotated clockwise against spring buffer allowing stationary pawl to engage sun gear slot holding gear stationary. Engine drives pinion cage assembly causing ring gear to revolve at faster than engine speed (overdrive). Ring gear locked to driving head assembly by clutch pawls which transmit power to rear axle. Clutch hub (free wheel cam) also rotating at engine speed, this rotation being allowed by the free wheel action.

Conventional Overdrive. At speeds above 35 M.P.H. Cut in by releasing accelerator pedal momentarily and then quickly accelerating engine. Coasting causes reversal of drive reaction on sun gear, rotating sun gear plate retainer counter-clockwise so that stationary pawl is partly disengaged from slot (inclined surface of pawl pressed against stationary pin), and subsequent sun gear rotation (when engine quickly accelerated) forces pawl out of engagement permitting sun gear to rotate. Engine then drives through clutch hub and free wheel rollers to rear axle. Clutch pawls remain in outer position (locking ring gear to driving head assembly) but engine power is not transmitted through planetary gear system since sun gear is free to revolve. Overdrive can be engaged again by releasing accelerator pedal somewhat and then accelerating engine gradually.

ADJUSTMENT:—Hairpin type springs used on clutch pawls (except sun gear pawl) and no adjustment provided. Do not change adjustment of sun gear pawl.

SERVICING:—Disassembly. Remove universal joint flange capscrew, pull flange. Remove stationary pawl adjusting screw and spring from boss at forward end of case (mark screw or note number of turns required to turn screw out so that original setting can be restored when overdrive reassembled). Take out capscrews mounting overdrive on transmission case, slide overdrive case and rear bearing off toward rear (bearing retained in case by snap ring at front). Use pointed tools and pry lock ring out of groove at rear end of ring gear. Withdraw overrunning clutch (free wheel) and pawl assembly. Remove lock ring on mainshaft holding pinion cage in place, withdraw pinion cage assembly and ring gear. Remove lock ring in adapter plate at rear of sun gear plate retainer, withdraw sun gear assembly.

Transmission Disassembly & Servicing. See preceding article on Warner Transmission with R6 Overdrive for complete data.

Overdrive Assembly. Reverse disassembly instructions above. See that all thrust washers and shims are replaced. Use special pusher to install universal joint flange (must not be driven on shaft). Turn stationary pawl adjusting screw in to exactly same position as originally to secure same setting.

WARNER 1939 ELECTRICAL 'KICK-DOWN' OVERDRIVE CONTROL

Standard or Optional Equipment On:

CHRYSLER ROYAL, MODEL C22 (1939)
CHRYSLER IMPERIAL, MODEL C23 (1939)
CHRYSLER CUST. IMPERIAL, MODEL C24 (1939)
DE SOTO, MODEL S6 (1939)
GRAHAM, STD. & SPEC. MODEL 96 (1939)
GRAHAM SUPERCHARGER, MODEL 97 (1939)
PACKARD SIX, MODEL 1700 (1939)
PACKARD '120' EIGHT, MODELS 1701, 1A, 2 (1939)
PACKARD SUPER EIGHT, MODS. 1703, 3A, 5 (1939)
STUDEBAKER, CHAMPION MODEL (1939)
STUDEBAKER COMMANDER, MODEL 9A (1939)
STUDEBAKER PRESIDENT, MODEL 5C (1939)

NOTE:—This electrical control system is used in conjunction with a new type Overdrive in which the sun gear is held stationary (in conventional Overdrive) by the solenoid controlled pawl. See separate article on Warner Overdrive for complete Overdrive disassembling and servicing data.

PACKARD PRODUCTION CHANGE NOTE:—On all cars without Reverse Switch (original equipment on later cars), manufacturer recommends that this switch and new type relay (with extra terminal for switch connection) be installed. See illustration for wiring connections for this new type equipment.

DESCRIPTION:—Control system consists of an operating solenoid (on overdrive case), control relay, and accelerator pedal operated throttle 'kick-down' switch which makes it possible to return to Direct Drive (from Overdrive) at speeds above the overdrive cut-in point, at the will of the operator, simply by depressing the accelerator pedal beyond the wide open throttle position so as to close the throttle switch contacts.

OPERATION:—With the car operating in overdrive (for all accelerator pedal positions between idle and wide-open throttle) the solenoid pawl is held in the 'in' position by a spring on the solenoid plunger stem to engage the sun gear blocker plate and prevent rotation of the sun gear. When the accelerator pedal is fully depressed (for return to Direct Drive), the closing of the throttle switch completes the relay circuit, closing the relay contacts so that the overdrive solenoid is energized. Current flows through both solenoid coils (solenoid main contacts which control 'starting coil' are normally closed) and the solenoid operates in successive steps as follows: 1) small plunger 'B' is drawn in so that contactor 'C' completes circuit from 'IGN' terminal to ground, cutting out the ignition momentarily by shorting out the breaker contacts and grounding the coil directly, causing the engine to miss several firing impulses; 2) As soon as pressure on gear teeth removed (by engine not firing), the solenoid plunger 'F', to which the sun gear pawl is attached, is drawn in so that the sun gear blocker plate and sun gear are released and allowed to rotate for direct drive. 3) This movement of the large plunger 'F' forces the small plunger 'B' out, first opening the ignition contacts and restoring the ignition, and then opening the main solenoid contacts so that the current flow through the 'starting coil' is interrupted. Current continues to flow through the fine 'holding coil' winding and this is sufficient to hold the pawl out of engagement (see specifications below for relative starting and holding coil current draw). When the accelerator pedal is returned to any position below wide open throttle, the opening of the throttle switch contacts opens the relay and solenoid circuits. The sun gear pawl spring then engages the pawl in the sun gear blocker plate and the car returns to Overdrive.

NOTE—The entire solenoid operation is so rapid and the ignition is cut out for so short an interval that it is not apparent to the operator. If for any reason the solenoid is unable to withdraw the pawl, the combined current draw of the starting and holding coils will cause the relay fuse (in ammeter lead at relay) to blow, restoring the ignition. The car will then operate in a normal manner except that it will not be possible to return to direct drive from overdrive.

CAUTION—Do not use any other capacity than 14 ampere fuse in relay circuit (this fuse not used on Graham or Packard Models).

ADJUSTMENT:—Check and adjust throttle switch linkage on each car model as directed below whenever linkage is disconnected or disturbed by carburetor linkage adjustment, removal of units, etc.

Chrysler, DeSoto Models—Depress accelerator pedal until throttle valve just reaches wide open position (remove air cleaner and sight down carburetor barrel to determine this position), hold in this position while making adjustment. Loosen locknut and turn switch plunger contact screw until clearance between contact screw head and switch plunger is exactly 3/32", tighten locknut.

Graham Models—Adjust position of operating block (on connector rod linking bell crank and throttle valve lever) so that throttle kick-down switch plunger is depressed not more than 1/32" with wide open throttle. See that linkage over-travel insures closing of switch contacts before accelerator pedal bottoms on toeboard. NOTE—Carburetor throttle lever should be set so that end is approximately 7/16" above center of shaft when throttle closed and accelerator pedal rod should be connected in top hole on bell crank.

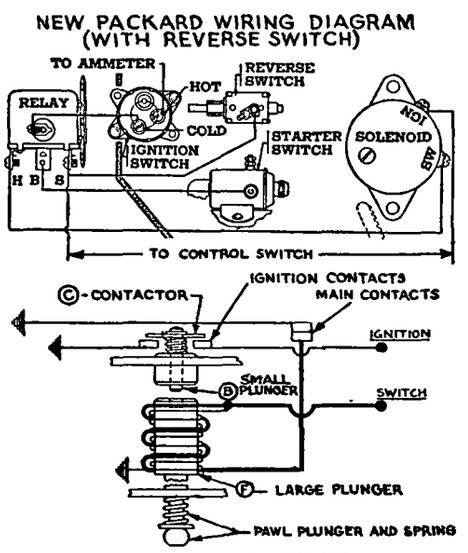
Packard Six, Eight, Super Eight—Depress accelerator pedal until throttle valve is just wide open, hold in this position, loosen locknut on switch plunger tappet screw (on accelerator cross-shaft lever) and adjust screw so that clearance between face of screw and end of switch plunger is exactly .046", tighten locknut. See that accelerator pedal has sufficient over-travel to close switch contacts before bottoming on floor boards.

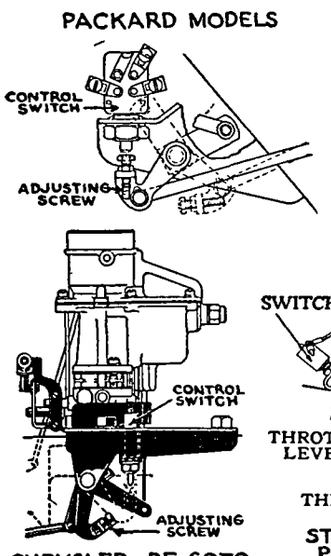
Studebaker Champion, Commander, President—Depress accelerator pedal until throttle valve is just wide open and throttle lever contacts wide open throttle stop, hold in this position, loosen locknut on switch mounting stud, turn switch in or out of mounting bracket until small shoe on idler lever (Commander), end of accelerator rod (President), just contacts switch plunger, tighten locknut.

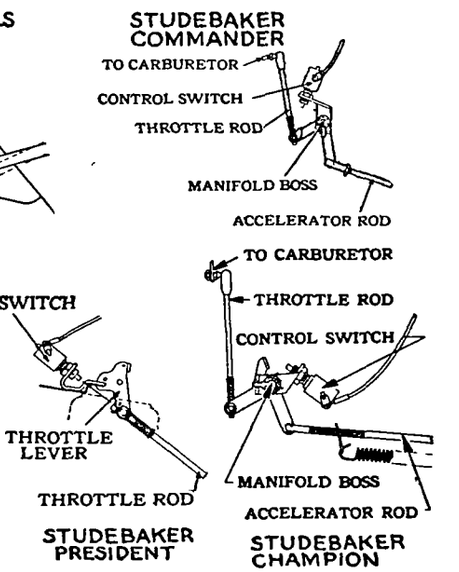
SERVICING OVERDRIVE SOLENOID:—**Removal**—To remove solenoid (for transmission and overdrive removal or for servicing), take out two capscrews in mounting flange, withdraw solenoid case without disturbing base plate and plunger assembly.

CAUTION—Do not lose gaskets under solenoid assembly. These gaskets control pawl mesh and must be replaced when solenoid installed.

Servicing—No servicing required other than to keep contacts clean and parallel so as to make good electrical contact. To remove cover for contact inspection, disconnect wires, take out flat headed screw, pull cover off base. See that lower face of contact disc on plunger 'B' and contact plates (which short out ignition) are clean and smooth. Resurface main contacts (which control 'starting coil' circuit) with a file, if necessary, to secure smooth parallel contact surfaces. Check contact gaps and solenoid performance (see specifications below).







WARNER 1939 ELECTRICAL OVERDRIVE CONTROL CONT.

SPECIFICATIONS:—Control system units for each car model are of various makes as follows:

	Solenoid Relay	Solenoid
Chrysler, DeSoto	Auto-Lite HR-4201	Auto-Lite
Graham 96, 97	R-B-M Model 4740	Delco-Remy
Packard	R-B-M Model 4780	Delco-Remy
Studebaker Comm.	Auto-Lite HR-4201S	Delco-Remy
Studebaker Pres.	Auto-Lite HR-4201	Delco-Remy

Specifications for each type of equipment are as follows:

AUTO-LITE SOLENOIDS

Small Plunger 'B'—Should close with 2.5 volts min., 4 volts max. (6 volt units), 5 volts min., 8 volts max. (12 volt units) with large plunger 'F' 3/8" from bottom.

Large Plunger 'F'—Should exert pull of 21 lbs. min. (70° F.), 15 lbs. min. (210° F.) when 3/8" from bottomed position.

Contact Gap (main contacts)—.047" plus or minus .015" with large plunger 'F' bottomed in coil.

Current Draw (At 70° F.)—'Both coils' figure is for both Holding and Starting coils together (main contacts closed). 'Holding Coil' figure is for Holding coil only (main contacts open—plunger bottomed in coil).

Six Volt Units

	Min. — Amperes — Max.	Volts
Both Coils	29.0 — 31.0	3
Holding Coil	1.2 — 1.3	6

Twelve Volt Units

Both Coils	14	15	6
Holding Coil	.55	.65	12

AUTO-LITE RELAYS

Contact Gap—.026". **Air Gap**—.012-.017" (closed).

Closing Voltage—2.5-3.5 volts (6 volt units), 5.0-7.0 volts (12 volt units).

Current Draw—Measure between 'TH.SW' and 'IGN.SW' terminals at 75° F. Current should be 1.0-1.2 amperes at 6.0 volts (6 volt units—winding resistance 5-6 ohms), .8-.92 amperes at 12.0 volts (12 volt units—winding resistance 13-15 ohms).

Fuse—14 ampere capacity. Mounted on relay.
CAUTION—Do not use any other capacity fuse.

R-B-M RELAYS

Contacts Close—3.5-4.5 volts.
Current Draw—3/4 ampere.
NOTE—No fuse used with this relay on Graham and Packard models.

DELCO-REMY SOLENOIDS

Model 1569 (Six Volt), 1573 (Twelve Volt)
Small Plunger 'B'—Should close at 5.0 volts (1569), 6-10 volts (1573) with 3/8" air gap of large plunger.
Large Plunger 'F'—Should close against 16 lb. pull with 3/8" plunger air gap at 6.0-6.38 volts (1569), 12.0-12.75 volts (1573) with both coils operating, and should hold against 18 lb. pull when bottomed in coil at 6.0-6.35 volts (1569), 12.0-12.75 volts (1573).
Contact Gap (main contacts)—.020-.060" with large plunger 'F' bottomed in coil.
Contact Spring Tension—10-13 ounces.
Current Draw—'Both Coil' figure is for both starting coil and holding coil together (main contacts closed), 'Holding Coil' figure for holding coil only (main contacts open—plunger bottomed in coil).

Six Volt—Model 1569

	Amperes	Volts
Both Coils	28-34	6.0-6.38
Holding Coil	9-1.1	6.0-6.35

Twelve Volt—Model 1573

Both Coils	24.5-27.5	12.0-12.75
Holding Coil	.66-.72	12.0-12.75

TROUBLE SHOOTING:—If overdrive does not operate, check for blown fuse on relay. This fuse will blow if control system does not operate properly. If fuse blows continuously, check wiring circuits for grounds or shorts, make certain that ignition circuit is shorted out momentarily when solenoid first energized (necessary to relieve gear load so that solenoid can withdraw pawl), see that pawl plunger operates freely without binding.
CAUTION—Do not install fuse of any other capacity than 14 ampere. This size fuse designed to protect control circuit from overload and to prevent car stalling if transmission control does not operate for any reason (ignition will be restored and car can be driven after fuse blows. NOTE—No fuse used on Graham and Packard models.

WARNER 1939 TYPE (WITH ELECTRICAL CONTROL OVERDRIVE)

Std. or Optl. Equipment On:

Model AS3-T86A

CHRYSLER ROYAL, MODEL C22 (1939)
DE SOTO, MODEL S6 (1939)

Model AS5-T85A

CHRYSLER IMPERIAL, MODEL C23 (1939)
CHRYSLER CUST. IMP., MODEL C24 (1939)

Model AS7-T88

STUDEBAKER CHAMPION, MODEL G (1939)
STUDEBAKER COMMANDER, MODEL 9A (1939)
STUDEBAKER PRESIDENT, MODEL 5C (1939)

Model AS9-T88

GRAHAM STD. & SPEC., MODEL 96 (1939)
GRAHAM SUPERCHARGER, MODEL 97 (1939)

Model AS9-R6 (Overdrive Only)

PACKARD SIX, MODEL 1700 (1939)
PACKARD '120' EIGHT, 1701, 1A, 2 (1939)
PACKARD SUPER EIGHT, 1703, 3A, 5 (1939)

NOTE:—**Graham Models.** This type used on later cars only. See separate article for data on first type Horizontal Transmission with R6 Overdrive.
Packard Models—This Overdrive unit used in conjunction with the regular Packard Transmission. See Packard Transmission article for data on Transmission. Complete data on Overdrive unit is given below.

Models AS7-T88, AS9-T88—These models are 'Horizontal Type'. Serviced in same manner as other models except that transmission case cover is located on side of case.

TYPE:—Constant-mesh, synchro-mesh (Second & High), sliding gear (Low & Reverse), all helical gear type. Main drive gear mounted on ball bearing in front end of case. Mainshaft mounted on pilot roller bearing in main drive gear hub (front end), ball bearing in bearing retainer or overdrive adapter bolted to rear of case (rear end) and extends through into overdrive unit. Counter gear cluster mounted on roller bearings on stationary countershaft with spacer between bearings and thrust washer at each end. Reverse idler gear mounted on plain bushing on short shaft which is retained by key which engages slot in case at rear end.

Overdrive Unit:—Similar in design to other Type R6 overdrive units except for sun gear mounting and control as follows: Sun gear is free to revolve on transmission mainshaft and is held stationary (for overdrive) by a spring-loaded, solenoid controlled clutch pawl mounted on the overdrive adapter plate. The pawl slides between two guide plates and in the inner position engages the sun gear blocker plate so as to prevent rotation of the sun gear. When the pawl is withdrawn by the solenoid to free the sun gear, a balk ring (assembled loosely on blocker plate) is dragged around sufficiently to block the pawl in the withdrawn position (when torque reversed by accelerator pedal release, balk ring returned to original position so that pawl can engage), but is prevented from further rotation by lugs on the rim of the ring.

Synchronizing Units:—Various types used as follows:
Drag Ring Blocking Type (Chrysler C22, DeSoto)—Synchronizer rings are loose in ends of inner clutch sleeve and are actuated by a drag or friction ring within the outer clutch sleeve which contacts lugs on the synchronizer rings (initial movement of outer clutch sleeve carries drag ring with it and forces synchronizer rings in contact with cones on gear hubs). Teeth on synchronizer rings block or prevent gear engagement until synchronization completed when final movement of outer clutch sleeve causes clutch teeth on rim of sleeve to slide past teeth on synchronizer ring and engage clutch teeth on gear hubs. Inner clutch sleeve is stationary on shaft and does not move during synchronization and gear engagement.

Blocking Lug Type (Chrysler C23, C24)—Synchronizer rings mounted loosely in ends of inner clutch sleeve (retained by snap rings) and are actuated in usual manner by inner clutch sleeve (inner and outer sleeves centered by poppet balls and springs and move as a unit during synchronization). Three lugs on synchronizer rings block or prevent gear engagement until synchronization completed when the final movement of the outer clutch sleeve engages the clutch teeth on the gear hubs.

Wire Bound Strut Blocking Type (Graham, Studebaker)—Synchronizer rings are free in ends of inner clutch sleeve and are actuated by three struts which fit in slots in inner clutch sleeve and engage notches in the rings. Struts are centered in outer clutch sleeve by a locking wire or ring engaging

WARNER 1939 TYPE (ELECTRIC CONTROL) OVERDRIVE CONT.

notches in the struts and move with the clutch sleeve to force the synchronizer rings against the cones on the gear hubs for synchronization. Teeth on the outer rim of the synchronizer rings block or prevent gear engagement until synchronization completed when final movement of outer clutch sleeve causes clutch teeth on rim of sleeve to slide past teeth on rings and engage clutch teeth on gear hubs. Inner clutch sleeve is stationary on shaft and does not move during synchronization and gear engagement.

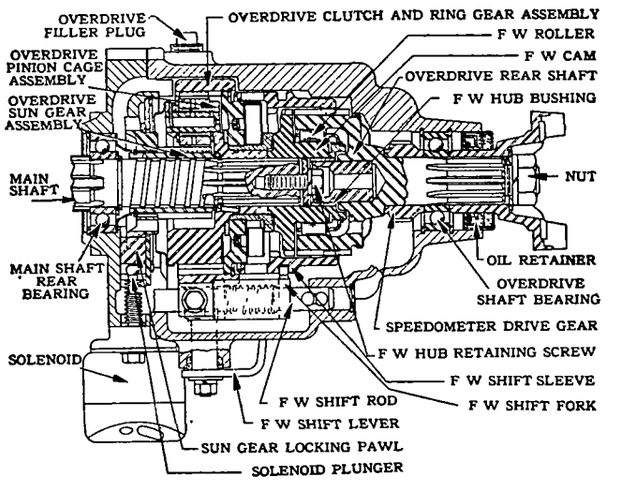
SERVICING:—Disassembly (Overdrive Unit)—Remove speedometer driven gear assembly. Take out five screws mounting overdrive on transmission case, pull case and rear shaft assembly to rear using extreme care not to lose free-wheeling rollers which will be free to drop out and to prevent adapter plate moving away from transmission case (if transmission not being dismantled also). On all models except Packard, nut on universal joint companion flange can be removed, flange removed with puller, and shaft held in place while case is withdrawn without disturbing overdrive free-wheeling cam and roller assembly if desired, rear shaft assembly should then be removed. Take out capscrew in free-wheeling hub (on rear end of mainshaft), remove washer, bushing, and free-wheeling cam and roller assembly. Remove overdrive clutch pawl, ring gear, and pinions as an assembly (do not pull ring gear off pinions unless servicing required—pinions are split type on some models and must be wound up before being meshed in ring gear). Take out two screws and remove overdrive solenoid. Remove snap ring on mainshaft at rear of sun gear, and sun gear retaining plate snap ring (in adapter plate recess), remove sun gear assembly. Remove solenoid base and plunger (tilt base to disengage plunger from pawl), spring, pawl, and pawl guide plates.

Transmission Disassembly—Take out screws and remove transmission case cover. Remove shift rails being careful not to lose interlock ball and poppet balls and springs which are located under rails. Withdraw overdrive adapter plate and mainshaft assembly through rear of transmission case (On Chrysler C23, C24 models see that synchronizer unit does not fall off shaft—if removed from front end of shaft first, do not allow inner and outer clutch sleeves to come apart which will allow poppet balls and springs to fly out). Take out capscrews and remove front bearing retainer on front end of case. Use arbor or dummy shaft and drive countershaft out of case to rear, removing key from slot in rear end of shaft as soon as it is exposed, and leaving arbor in counter gear cluster to retain bearings until re-installed, allow counter gear cluster to drop down in case. Remove drive gear bearing snap ring (on bearing outer race at front end of case), push gear and bearing assembly through into case and remove at rear end. Remove counter gear cluster and thrust washers. To remove reverse idler gear, drive shaft out to rear, remove key from slot at rear end of shaft, lift out gear and bushing assembly.

Mainshaft & Bearing Assembly:—Shaft and bearing can be removed from adapter plate by removing snap ring in adapter at front of bearing, and pulling shaft and bearing forward. To remove bearing, take out snap ring on shaft at rear of bearing, remove thrust washer, press bearing off shaft. Reassemble in same manner.

Second Speed Gear Assembly (With Drag Ring and Wire Bound Strut Type Synchronizers):—Gear and inner clutch sleeve of synchronizer unit retained on shaft as an assembly by a snap ring in front of the synchronizer unit. To remove, take out snap ring, withdraw synchronizer unit and gear from shaft. Do not remove bushing from gear (serviced as an assembly). When reassembled, second speed gear endplay should be .003-.008" (Chrysler models), .003-.014" (others) with synchronizer pressed forward against snap ring.

(With Blocking Lug Type Synchronizer)—Gear retained by thrust washer and locking plunger at forward end. To remove gear (with synchronizer unit off shaft), press down on locking plunger to release washer, rotate washer until notches on inner rim line up with splines on shaft, withdraw washer and gear, being careful not to lose locking plunger and spring which will fly out when gear removed. Install in same manner, making certain that washer turned so it engages shaft splines and that locking plunger engages washer to prevent turning and loosening in service.



Synchronizer Assembly:—Mark inner and outer clutch sleeves and both synchronizer rings to insure reassembly in same relative positions (on some types synchronizer rings are loose and can be lifted off directly). Service each type as follows:

Drag Ring Type—Install drag ring on inner clutch sleeve so that depressions on ring are directly in line with synchronizer ring lug holes in sleeve and retain in this position with three pins inserted through lug holes so as to pass over ring in slot at center of sleeve while sleeve being inserted in outer clutch sleeve. Make certain that open ends of drag ring straddle a tooth on the outer clutch sleeve and line up marks on inner and outer sleeves, then remove assembling pins and install synchronizer rings with spreader spring behind high speed synchronizer ring installed so that three raised fingers on spring are toward ring (spreader spring not used for second speed synchronizer ring). See Second Speed Gear data for installation instructions.

Lug Type—Synchronizer rings retained by snap rings and can be lifted out when snap ring removed. See that rings are free to turn with snap ring in place. Backlash between inner and outer clutch sleeves should be .000-.001" (sleeves are selective fit). Pressure required to break poppets so that outer sleeve slides on inner sleeve should be 26-34 lbs. (Chrysler C23, C24).

Wire Bound Strut Type—Install struts on inner sleeve, install lock wire so that it engages notches on struts with open end of wire midway between two struts. When installing inner sleeve and strut assembly in outer sleeve, narrow strips of .003" shim stock can be installed directly over each strut to prevent wire disengaging from strut notch when it is contracted to enter outer sleeve. CAUTION—See that hook on end of lock wire is engaged between two clutch teeth on outer sleeve. Remove feeler strips used for assembly. See Second Speed Gear data for installation instructions.

Main Drive Gear & Bearing Assembly:—To remove bearing, remove snap ring on shaft in front of bearing, take off thrust washer, press bearing off shaft. Install bearing with shielded side toward gear, use new snap ring and make certain that it is snug fit in groove. When installing gear and bearing assembly in transmission see that retainer fits properly on case and that bearing snap ring is held snugly between retainer and case so that gear has no endplay.

Counter Gear Assembly:—If bearings removed from counter gear, use grease to hold rollers in place and install rollers on dummy shaft or arbor in gear cluster. Install steel washer next to gear and bronze thrust washer between steel washer and case at each end (steel washer not used at front end on Chrysler C23, C24). Drive countershaft in from rear end (displacing arbor at front) and make certain that locking key installed in notch at rear end of shaft so as to engage slot in case. Check endplay with feeler gauge. Endplay should be .002-.008" (On Chrysler models, adjust by selecting thrust washers of correct thickness—washers furnished in three thicknesses, A—thinnest, B, C—thickest).

OVERDRIVE UNIT

SERVICING:—See Transmission Disassembly (above) for overdrive removal and disassembly directions.

Overdrive Mainshaft & Bearing Assembly (except Packard):—Bearing is retained in overdrive case by snap ring installed at each side of outer race and is positioned on shaft by speedometer gear hub (front), universal joint yoke hub (rear). Oil seal is assembled in end of case and can be removed with a puller after universal joint yoke has been removed. Do not remove oil slinger which is spun on rear end of free-wheeling sleeve.

Overdrive Mainshaft & Rear Bearing Assembly (Packard Models):—Two types of rear bearings used as noted below. On cars with first type bearing, universal joint flange nut (at rear end of shaft) controls bearing pre-load, **do not loosen this nut which will disturb bearing adjustment.** See bearing pre-load adjustment instructions below if bearings dismantled or adjustment disturbed. On later cars (may be identified by letter 'M' stamped on side of universal joint flange), this nut does not control bearing adjustment and should be kept tight.

IMPORTANT SERVICE NOTE—This second type bearing adjustment (Solid Spacer No. 341264, Belleville Spring Washer No. 341266) should be installed on all first cars (with compressible spacer type adjustment) whenever overdrive disassembled or bearings removed.

WARNER 1939 TYPE CONT.

Overdrive Unit Rear Bearing (First Type)—Consists of two ball bearings with compressible spacer on shaft between inner races. Bearing adjustment controlled by tension of universal joint flange nut on rear end of shaft. If bearings dismantled or bearing adjustment lost by loosening of universal flange nut, install bearings with snap rings in place in housing between bearing outer races, use new spacer on shaft between bearings and adjust as follows: Clamp universal flange in vise with overdrive case vertical, tighten flange nut slightly, check force required to spin overdrive case on shaft using spring scale hooked in mounting hole on boss at rear of case (first reading should be oil seal drag only), tighten nut a little at a time and repeat check until 3¼-4¼ lbs. additional pull required to spin case. NOTE—If nut tightened so that bearing pre-load of 5 lbs. or more (net after subtracting oil seal drag), new spacer sleeve must be installed and adjustment repeated.

Overdrive Unit Rear Bearing (Later Type)—Solid spacer used on shaft between bearings and bearings pre-loaded by Belleville spring washer assembly between bearings (spring washer rims engage bearing snap rings in housing). With this type assembly, universal flange nut should be tightened securely (does not adjust bearings). NOTE—Cars with this type bearing adjustment assembly may be identified by letter 'M' stamped on side of universal joint flange yoke.

Sun Gear & Plate Assembly:—To remove sun gear from plate, remove snap ring at end of sun gear, slide plate off gear. Check balk ring friction on sun gear plate, 8-10 lb. pull should be required to rotate ring clockwise on plate. When installing sun gear, make certain that oil slots in plate and gear line up.

Overdrive Solenoid:—See separate article on Warner Overdrive Control for complete solenoid specifications and servicing data.

ASSEMBLY & INSTALLATION:—Reverse disassembly directions and note following points: Make certain that snap ring installed on mainshaft in back of sun gear assembly (this ring limits sun gear and planet pinion gear assembly endplay); see that planet pinions are correctly wound up before being meshed in ring gear (split type only); make certain that two pawl guide plates are in position, turn sun gear so that lobe on plate is in line with pawl slot, install pawl with relief notch toward rear. Pack free-wheel rollers in cage with grease to retain rollers while rear shaft being installed. Install case by placing shaft assembly in vertical position, invert case (with clutch collar in case and engaging control fork) and lower on shaft so that collar engages teeth on free-wheel sleeve and cam. When installing overdrive unit on transmission, make certain that reverse lock-out pin in place and install mounting screw with star washer in lower right hand hole of transmission case (necessary to prevent oil leaks).

ADJUSTMENT:—**Cut-in Speed.** Should not require adjustment but can be adjusted in same manner as on previous models by removing plug on top of overdrive case, turning shaft until hole in clutch shell and adjusting screw in clutch pawl assembly (two screws—adjust in succession) line up with hole in case, and turning adjusting screw in to increase cut-in speed, out to decrease cut-in speed. Make certain that screws not turned so far as to cause interference. With standard setting, cut-in speed should be as follows:

Car Model	Cut-in Speed
Chrysler, De Soto (all models)	23-28 MPH.
Packard (all models)	30 MPH. (25-30)
Studebaker (all models)	30 MPH.

CAUTION—Both adjusting screws must be adjusted exactly alike. One screw marked by single slot, opposite screw has double slot, to avoid possibility of adjusting same screw twice.

Overdrive Control (Chrysler, De Soto):—To adjust, loosen screw which holds control wire on lever at overdrive case, push hand control button at instrument panel in as far as possible and then pull button out ⅛" (to insure full travel of lever), move control lever on overdrive case to extreme rear position (Overdrive position), tighten control wire screw and locknut securely.

WARNER 1938-39 HORIZONTAL TYPE (WITHOUT OVERDRIVE)

Model AS2-T88.
GRAHAM STD. & SPEC., MODEL 96 (1938)
GRAHAM SUPERCHARGER, MODEL 97 (1938)
STUDEBAKER SIX & COMM., 7A (1938)
STUDEBAKER COMM. STATE COMM., 8A (1938)
STUDEBAKER PRESIDENT, MODEL 4C (1938)

Model AS4-T88—See Note.
GRAHAM, MODELS 96, 97 (1938)
STUDEBAKER, MODELS 7A, 8A, 4C (1938)

1939 Car Models
GRAHAM STD. & SPEC. MODEL 96 (1939)
GRAHAM SUPERCHARGER, MODEL 97 (1939)
STUDEBAKER CHAMPION, MODEL G (1939)
STUDEBAKER COMMANDER, MODEL 9A (1939)
STUDEBAKER PRESIDENT, MODEL 5C (1939)

NOTE:—**1938 Models.** Transmission with Overdrive (R6 Type) optional on these car models. See following article for Overdrive servicing data and special Disassembly Directions for Transmission and Overdrive.

1939 Models. Transmissions with new type Overdrive (electrically operated 'kick-down' control) are optional on these models. See separate article (preceding) for data on this type.

Model AS4-T88. This model used on Graham and Studebaker cars with Evans Vacuum Gear Shift. Similar to standard transmission except for shifter mechanism and serviced in same manner. See articles on Evans Vacuum Gear Shift for adjustment and servicing data on this equipment.

Transmission Controls. Remote steering column mounted types optional on all car models. See separate articles on "Transmission Controls" for complete data on each type.

TYPE:—Constant-mesh, synchro-mesh, helical gear type (second and high), sliding helical gear (low and reverse). Clutch shaft and main drive gear mounted on ball bearing in front end of transmission case. Mainshaft mounted on roller bearing (in main drive gear hub) at front end and ball bearing (in bearing retainer) at rear end. Counter gear cluster mounted on roller bearings on stationary shaft with thrust washers at each end. Reverse idler gear mounted on bronze bushing on stationary shaft (countershaft and reverse idler shaft retained by locking plate on rear face of case). Second and high gears engaged by sliding clutch sleeve (splined on clutch gear which is splined on mainshaft) which engages clutch teeth cut on the main drive gear and second speed gear hubs.

Lug Type Blocking Synchronizer (Graham, Studebaker with conventional shift lever)—Synchronizer rings loosely mounted in ends of inner clutch sleeve and retained by snap rings. Rings actuated in usual manner by inner clutch sleeve (inner and outer clutch sleeves centralized by poppet balls and springs and move as a unit for synchronization). Three lugs on the synchronizer rings block or prevent gear engagement until synchronization is completed when the outer clutch sleeve slides on the inner sleeve to engage clutch teeth on gear hub.

1939 Wire Bound Strut Blocking Synchronizer (Graham, Studebaker Models with Steering-column Gear Shift):—Synchronizer rings are free in ends of inner clutch sleeve and are actuated by three struts which fit in slots in inner clutch sleeve and engage notches in the rings. Struts are centered in outer clutch sleeve by a locking wire or ring (engaging notches in the struts) and move with the outer clutch sleeve to force the synchronizer rings against the cones on the gear hub for synchronization. Teeth on the outer rim of the synchronizer rings block or prevent gear engagement until synchronization completed when the final movement of the outer clutch sleeve causes the clutch teeth on the rim of the sleeve to slide past the synchronizer ring teeth and engage the clutch teeth on the gear hub. Inner clutch sleeve is stationary on mainshaft and does not move during synchronization and gear engagement.

SERVICING:—**Disassembly.** Remove gear shift lever, take out cover screws (on side of case on Graham and Studebaker models) and remove cover, remove shifter rods or rails and forks taking care not to lose interlock balls and springs. Lock transmission by shifting into two gears at once, remove nut on rear end of mainshaft, pull rear companion flange and brake drum (on models using shaft type parking brake). Remove capscrews on rear bearing retainer, take out screw and remove countershaft locking plate, use dummy shaft or arbor and drive countershaft out to rear leaving arbor in counter gear cluster to retain loose bearing rollers (see note below for removal of countershafts with locking keys). Pull rear bearing retainer and mainshaft assembly through rear of case as a unit (if synchronizing unit allowed to slide off shaft and removed separately, see that sleeve not allowed to come off clutch gear which will cause detent balls and springs to fly out). Take out front bearing retainer capscrews (on front of the case) and withdraw the retainer. Main drive gear must be removed at rear (tap gear forward slightly, remove bearing snap ring at bearing hole in case, drive gear back into case and remove through rear end. Lift out counter gear assembly taking care not to lose the loose bearing rollers at each end or the thrust washrs. To remove reverse idler gear, drive shaft out to rear using a brass drift.

Countershaft Locking Key Note. On models where locking plate not used, countershaft (and reverse idler shaft) retained by key in recess in rear face of case which engages slot in shaft. On these models, drive countershaft out to rear (with rear bearing adapter removed) until key is exposed, remove key and drive shaft out (use dummy shaft or arbor and leave arbor in counter gear cluster to retain bearing rollers until shaft is reinstalled).

Mainshaft & Bearing Assembly:—Bearing is press fit on mainshaft and is held in place by companion flange and nut at rear end of shaft (speedometer drive gear acts as spacer on shaft). Bearing is retained in recess in rear retainer by snap ring at forward end (remove snap ring to remove bearing).

WARNER HORIZONTAL TYPE CONT.

When installing bearing, select snap ring for tight fit in groove.

Synchronizing Unit (Lug Type):—Mark inner and outer sleeves to assure assembling in same position. Use extreme care not to lose detent balls and springs (wrap assembly in cloth when pushing sleeve off so that balls will be caught when they fly out). Rings retained by snap ring in clutch gear hub. Use special assembling clips to install synchronizer balls and springs. Install synchronizing unit on mainshaft with longer hub of clutch gear and sleeve toward front (see illustration).

Wire-Bound Strut Type Synchronizers—Install struts in inner sleeve, install lock wire so that it engages notches in struts with open end of wire midway between two struts (synchronizer will not operate if wire installed with open end at strut so that strut free to move endwise). When installing inner sleeve and strut assembly in outer sleeve, narrow strips of .003" feeler stock can be installed directly over each strut to prevent wire disengaging from strut slot when it is contracted to enter sleeve. CAUTION—Make certain that hook on open end of lock wire is engaged between two clutch teeth in outer sleeve. Remove feeler strips used for assembly before installing synchronizer on mainshaft. See Second Speed Gear Assembly for installation instructions.

Second Speed Gear Assembly (with Lug Type Synchronizer):—Retained by thrust washer and lock plunger or locking plate at forward end (see directions below for dismantling each type). When installing gear, check endplay which should be .002" minimum, .008" maximum. Adjust by installing thrust washer of correct thickness.

Disassembly of Locking Plunger Type—Use wire or pointed tool to depress plunger in shaft (under thrust washer at forward end of gear), rotate washer until notches on inner edge line up with splines on shaft, withdraw gear and washer from forward end of shaft. When installing gear, see that washer is turned so that it is retained by shaft splines and that plunger engages notch in washer to prevent it rotating in service.

Disassembly of Locking Plate Type—Bend up three fingers on lock plate which engage groove in thrust washer, slide lock plate off shaft. Rotate washer to line up notches and splines on shaft, remove washer and gear. Use new lock plate when installing gear, make certain that thrust washer turned so that it engages shaft splines and that lock plate fingers locked firmly in thrust washer grooves to prevent washer turning in service.

Second Speed Gear Assembly (with Wire Bound Strut type Synchronizer):—Second speed gear and inner sleeve or hub of synchronizer mounted as an assembly on the mainshaft and retained by snap ring on forward end of shaft. To disassemble, remove snap ring in front of synchronizer inner sleeve, withdraw synchronizer assembly and second speed gear. When reassembling, make certain that second speed gear endplay is .003-.014" with synchronizer inner sleeve pressed forward against snap ring.

Main Drive Gear & Bearing:—Bearing retained on clutch shaft by thrust washer and snap ring at forward end (within bearing retainer). If bearing removed, use new snap ring selected for tight fit in groove (furnished in various thicknesses). Front bearing for mainshaft (roller type) located within drive gear hub and rollers are retained by snap ring at rear end of gear hub.

Counter Gear Assembly:—See that bearing spacer installed in gear cluster between bearings and that rollers are in place around dummy shaft or arbor (end of gear can be coated with grease to retain rollers during assembly). Install gears with steel and bronze thrust washer at each end (steel washer toward gears, bronze washer toward case), insert countershaft from rear end, pushing out arbor as shaft is installed. Check endplay with feeler gauge between bronze thrust washer and rear of case with gear cluster forced toward front. Endplay should be .002" minimum, .008" maximum. Adjust by changing thrust washers (furnished in three thicknesses). Make certain that locking plate and screw installed to retain countershaft and reverse idler shaft.

WARNER 1938-39 HORIZONTAL TYPE (WITH R6 OVERDRIVE)

Optional Equipment on:
Model AS1-T88
GRAHAM, MODELS 96, 97 (1938)
GRAHAM, MODELS 96, 97 (1939) FIRST CARS
STUDEBAKER, SIX & COMM. 7A (1938)
STUDEBAKER, COMM. STATE COMM. 8A (1938)
STUDEBAKER, PRESIDENT MODEL 4C (1938)
Model AS3-T88—See Note.
GRAHAM, MODELS 96, 97 (1938)
STUDEBAKER, MODELS 7A, 8A, 4C (1938)

NOTE:—Model AS3-T88. This model used on Graham, Studebaker cars with Evans Vacuum Gear Shift. Similar to standard transmission except for shifter mechanism and serviced in same manner. See articles on Evans Vacuum Gear Shift for adjustment and servicing data on this equipment.

Transmission Controls. Remote steering column mounted types optional on all car models. See separate articles on "Transmission Controls" for complete data on each type.

1939 Graham Models. This type Overdrive used on first cars only. See separate article on new type Overdrive with electrical "kick-down" control for data on later cars.

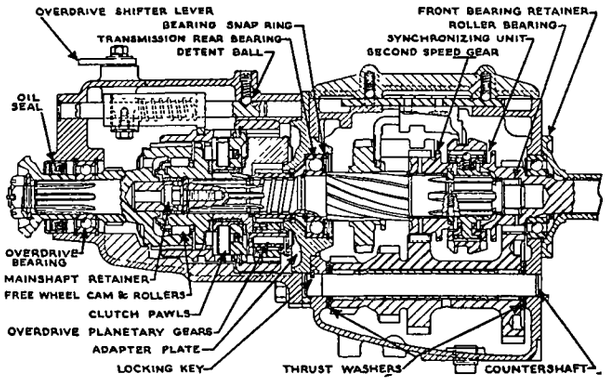
TYPE:—Constant-mesh, synchro-mesh, helical gear type (second and high), sliding helical gear (low and reverse). Synchronizing unit is new 'blocker type'. Design similar to transmission used on these same car models as standard equipment (see preceding article).

Overdrive Unit. Type R6. Mounted in separate case bolted on rear face of transmission case. Transmission mainshaft extends through into overdrive case serving as mounting shaft for Planetary Pinion, Annulus Gear and Pawl, and Free Wheeling Cam assemblies.

SERVICING:—Transmission & Overdrive Disassembly. Remove gear shift lever, take out cover screws (on side of case on Graham and Studebaker models), remove cover, shifter rods or rails and forks taking care not to lose interlock balls and springs. Remove universal joint flange nut and flange (use puller). Remove speedometer drive pinion. Take out mounting screws in overdrive mounting flange on rear face of transmission case, hold mainshaft in forward position, withdraw overdrive housing and rear shaft assembly (take care not to lose free-wheeling rollers which will be free to fall out). Take out capscrew in rear end of transmission mainshaft, withdraw free-wheeling cam and cage assembly, overdrive clutch pawl core and annulus gear assembly, and planetary pinion cage assembly. Remove snap ring on mainshaft at rear end of stationary sun gear. Remainder of transmission disassembly is same as for standard type (see preceding article) except as noted below. See Overdrive section (following) for complete Overdrive servicing data.

Transmission Mainshaft Rear Bearing. Bearing retained in adapter plate by snap ring in bearing recess on forward side. Bearing positioned on mainshaft by thrust washer and snap ring at rear (accessible after removing bearing and shaft assembly from adapter). When reassembling, select snap ring for tight fit in groove (furnished in four thicknesses).

Countershaft and Reverse Idler Shaft Locks. Shafts are locked in place by woodruff key in recess in rear face of transmission case (under adapter plate) which engages notch in shaft. To remove shaft (on models with hole in adapter plate in line with countershaft hole in case), tap adapter plate to rear about ¼", drive countershaft to rear until key clears case, use long screwdriver inserted between case and adapter plate and remove key, then drive countershaft out through adapter plate hole. On other models, adapter plate and mainshaft assembly must be removed before countershaft can be driven out.



Counter Gear Endplay. Should be .002" minimum, .011" maximum. Adjusted by installing thrust washers of correct thickness.

SERVICING:—Disassembly. To dismantle housing and drive shaft assembly, use brass drift to drive shaft out toward front end, lift out clutch pawl core. Bearing retained in housing by snap ring at each end. When installing bearing, select snap ring at rear end of correct thickness to prevent any bearing sideplay in housing (snap ring furnished in four thicknesses).

Clutch Pawl Core Assembly. To dismantle, use plug of correct size and press out steel bushing in pawl core. Mark or note position of clutch pawl adjusting screws (to insure correct adjustment when installed), remove these screws and take out pawls, lock plate and spring. When assembling these parts turn adjusting screws in until screw heads are flush with counterbore in screw holes (see adjustment instructions below).

Stationary Sun Gear. This gear press fit in adapter plate and retained by snap ring at forward end. To remove sun gear (with transmission mainshaft and rear bearing removed from adapter plate), take out oil baffle, remove snap ring on end of sun gear, drive gear out of plate toward rear. Install gear in same manner.

WARNER HORIZONTAL TYPE (WITH R6 OVERDRIVE) CONT.

Planetary Pinion Gears. Pinion gears are split type (gear sections linked by spring within gear which rotate each half in opposite direction to take up backlash and insure quiet operation). Gear teeth in each section will rotate out of line when pinions unmeshed from annulus gear and sun gear and must be rotated back into correct position (marked teeth in each section together) when installed. See *assembling directions* below.

OVERDRIVE UNIT

Overdrive Assembly:—Place clutch pawl core and annulus gear assembly in position on planetary pinion cage hub so that annulus gear meshes with narrow section of pinions only. Install pinion cage on transmission mainshaft so that sun gear meshes with wider section of pinions only. Rotate annulus gear clockwise (to wind up pinion gear springs) until marked tooth on each section of each pinion lines up with marked tooth on adjoining section, then push entire assembly forward so that both annulus gear and sun gear are fully meshed with pinions (force of approximately 11-16 inch lbs. required to wind up these split pinions so that marks line up). Assemble free wheeling cam and cage on mainshaft, install retaining screw and lockwasher on rear end of shaft, tighten screw securely and make certain that bushing is in place in recess in shaft (this bushing engages plug on forward end of overdrive drive shaft). Insert free wheeling rollers (use cup grease to retain rollers while installing hub, or hold rollers in place with rubber band which can be removed after hub started in place). Rotate free wheeling roller cage counter-clockwise (viewed from rear end), slide overdrive drive shaft in place, install speedometer gear on shaft. Install clutch pawl shell in overdrive housing and engage shifter collar in groove. Hold overdrive housing upside down and work it into place on drive shaft until lockout bar contacts adapter plate, rotate housing into correct position (manipulate lockout lever if housing does not slide into position freely).

ADJUSTMENT:—Overdrive clutch pawl adjusting screws correctly set at factory for cut-in speed as noted below and should not be disturbed. If overdrive disassembled or adjustment required for other reasons, adjust as follows: Drive car until lubricant in case is warm, jack up rear wheels, drain overdrive case. Remove adjusting hold plug on top of case. With transmission gears in neutral, line up pawl slots in clutch gear with adjustment opening in pawl shell and overdrive housing by turning the propeller shaft. Engage high gear, place control button in Overdrive position, hold clutch pedal down so that slight drag placed on propeller shaft, rock shaft back and forth until one adjusting screw head is visible through holes. Turn screw in (clockwise) to increase cut-in speed, out to decrease cut-in speed. Two full turns of the screw will change cut-in speed approximately 6 M.P.H. Repeat adjustment at second adjusting screw (rotate screw into line in same manner as used for first screw) using extreme care to adjust both screws exactly alike. One screw has single screwdriver slot, opposite screw has double slot so that screws can be identified, make certain that same screw is not adjusted twice.

Car Model	Overdrive Cut-in Speed
Graham (all models)	43 M.P.H.
Studebaker (all models)	40-45 M.P.H.

BUICK (FIRST TYPE)

Used On:
SERIES 50, 80 (1932-33)
SERIES 60, 90 (1932-33-34-35)

TYPE:—Constant-mesh, synchro-mesh (second and high), sliding spur gear (1932-33) helical gear (1934-35) for low and reverse. Clutch shaft mounted on shielded ball bearing in transmission case which takes gear thrust. Mainshaft mounted on roller bearing (front), ball bearing which takes gear thrust (rear). Second speed gear positioned by shoulder on mainshaft at rear, thrust washer and lock ring at front. Counter gear cluster mounted on roller bearings on stationary shaft with thrust washer at each end. Reverse idler mounted on bronze bushings on a stationary shaft. Gears are engaged by a clutch sleeve splined to the mainshaft between the main drive gear and second speed gear (within synchronizing unit). Clutch sleeve is bolted to shift ring (shifter fork connection) at three arms which extend out through slots in synchronizer sleeve. Clutch teeth at either end of clutch sleeve engage internal clutch teeth on gear hubs when sleeve is moved on shaft.

Synchronizing Unit:—Consists of a 'Cam Sleeve Assembly' encircling clutch sleeve and centralized on it by spring loaded poppets which engage groove in cam sleeve. Synchronizing cones are mounted in each end of cam sleeve and engage similar cones on gears to effect synchronization. Cam sleeve is actuated by the spring poppets (moves as an assembly with the clutch sleeve until the cones engage) and is driven by the engagement of the beveled clutch sleeve arms with the 'V' shaped cam surfaces at the center of the cam sleeve slots.

SERVICING:—Disassembly. Remove gear shift housing, transmission cover (gears must be in neutral). Remove countershaft cover (1932), oil seal (1933 on) at front end of countershaft and cotterpin at rear, drive countershaft out toward rear, lower counter gear cluster in case. Remove main drive gear bearing retainer on front of case, take out clutch shaft and bearing assembly. Take out rear bearing retainer screws, raise front end of mainshaft (rotate retainer 90° on 1934-35 models), remove synchronizing clutch assembly from mainshaft. Use special tool to free second speed gear lock ring, remove thrust washer, gear, rear thrust washer, low speed gear, then remove bearing retainer and mainshaft through rear of case.

Mainshaft & Bearing Assembly:—Rear bearing should be .0005" loose to .0005" tight on shaft and .0005" loose to .0011" tight in retainer. Bearing locked in retainer by snap ring which engages slot.

Main Drive Gear & Clutch Shaft Bearing:—Bearing should be .0007" loose to .0003" tight on shaft, and .0013" loose to .0005" tight in adapter.

Synchronizing Unit (Cam Sleeve Assembly:—Cannot be serviced and should be replaced as an assembly. Endplay when assembled should be ⅛" min., 3/16" max. (total movement from cone-to-cone engagement).

NOTE—Less than ⅛" endplay may cause cone drag and noise in neutral, more than 3/16" may cause gear clash during engagement.

Counter Gear Assembly:—When installing countershaft ,see that bronze and steel thrust washer in place at each end of shaft (1932), bronze washer at front end, steel washer at rear (1933-35). Endplay should be .002-.014".

Reverse Idler Gear:—Clearance on shaft should be .005-.0025".

BUICK 60, 80, 90 TYPE

Used On:
MODELS 60, 80, 90 (1936-37-38-39)

NOTE:—Transmission used on these models similar except that Second Speed Gear mounted on roller bearings (1936), bronze bushing (1937-38). On 1937-38 models, larger second speed synchronizing drum used on synchronizing unit.

1939 Type:—Design changed from 1938 as follows:
Shifter Mechanism—New type cable and rod actuated shifter shafts for 'Handi-shift' steering column mounted gear shift lever. See service directions below for disassembling data and separate article on Buick Handi-Shift Transmission control for adjustment directions.

Synchronizing Unit—Both synchronizing drums are same size (second speed drum reduced in size and made of bronze).

Rear Bearing Retainer—Model 60 retainer new type (similar to 40) with flanged end for front torque tube mounting. Mainshaft splined for front propeller shaft engagement and bearing inner race positioned on shaft by snap ring. Model 80, 90 retainer same design as for 1938 but is not interchangeable.

TYPE:—Constant-mesh, synchro-mesh, all helical gear type (sliding gear for low and reverse). Clutch shaft and main drive gear mounted on shielded ball bearing at front of transmission case (bearing takes gear thrust). Mainshaft mounted on roller bearing (front), ball bearing (rear) which takes gear thrust. Second speed gear positioned by shoulder on shaft at rear, thrust washer and locking ring at front end. Counter gears mounted on roller bearings (cageless type) on stationary shaft with thrust washers at each end. Reverse idler mounted on bronze bushing on stationary shaft with bronze thrust washer at each end. Gears are engaged by a sliding clutch sleeve splined to the shaft which engages clutch teeth inside synchronizing cones on second speed and main drive gears.

Synchronizing Unit:—Consists of two synchr nizing drums mounted on the ends of three pin cams which extend through holes in the sliding clutch ring. Synchronizing drum assembly is centered on the clutch sleeve by detent springs which engage the notches in the pin cams. The entire assembly moves as a unit when the clutch sleeve is shifted until the synchronizing drums and cones engage, synchronizing unit then rotates (relative to clutch sleeve) until cam surfaces on clutch ring engage pin cams. Synchronizing drums are driven through this engagement until synchronization is completed.

SERVICING:—Disassembly. Remove transmission cover, retainer springs and balls, shifter forks and shafts. Remove torque ball retainer and torque ball at rear of transmission, remove universal joint (use puller). Take out mounting screws and remove rear bearing retainer. Remove mainshaft rear bearing from case and shaft. Pull main shaft assembly (including low speed sliding gear, second speed gear, and synchronizing unit) to rear to disengage forward end of shaft from roller bearing in main drive gear, then remove assembly through top of case. Remove main drive gear bearing snap ring (on front case of case), tap main drive gear and bearing assembly back into case and remove through top opening. Remove countershaft lockscrew (at rear end of shaft), drive countershaft out toward rear using special dummy

BUICK 60, 80, 90 TYPE CONT.

shaft or arbor J-101 (.935" diameter, 7.700" long) and allow this arbor to remain within counter gear cluster until replaced in transmission (arbor will retain loose rollers), remove counter gear cluster through top of case being careful not to lose bronze and steel thrust washers. To remove reverse idler, take out shaft retaining screw, drive out shaft, lift out gear and bronze thrust washers.

39-60 Note—Shift rails and selector shaft need not be removed to take out transmission mainshaft if they are properly positioned as follows: Shift transmission into high gear, loosen shifter fork on low-and-reverse rail by removing lockscrew, remove rear bearing retainer, pull speedometer gear (press fit on shaft), remove gear spacer and horseshoe shaped rear bearing retainer ring, pull rear bearing, then remove mainshaft assembly through top of case.

1939 Selector Shaft Disassembly—Remove both shift rails, take out self-locking setscrews in selector shaft cams, move right cam toward center of case and remove horseshoe lock holding shaft, remove shaft by driving it out through right hand side of case (plug which closes opening will be driven out with shaft). IMPORTANT—Shaft must not be removed from left side which will damage oil seal. Always remove shaft from right and install on left side. Seal plug hole on right side of case with sealing compound after installing shaft.

Mainshaft & Second Speed Gear Assembly:—Mainshaft rear bearing should be .0004" tight to .0005" loose on shaft, .0002" tight to .001" loose in case. Shaft should have no perceptible endplay. Low and reverse sliding gear backlash should be .003" maximum. Snap ring on main shaft limits gear movement on shaft in low gear position.

Mainshaft Bearings (60 '39). Rear bearing inner race held on shaft by snap ring with spacer between snap ring and speedometer gear which is press fit on shaft (instead of on universal joint yoke as on 80, 90 models). Mainshaft is splined to engage end of front propeller shaft.

Second Speed Gear (1936). To remove second speed gear assembly, remove snap ring at front end, slide complete assembly off shaft. To dismantle bearing assembly, remove snap ring at rear, pull out roller bearing sleeve and bearings. When installing gear, see that rear thrust washer correctly assembled (this acts as oil feed for roller bearings).

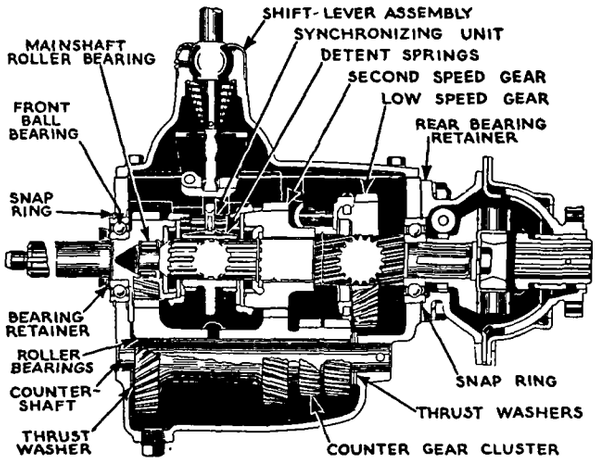
Second Speed Gear (1937-39). Bronze-bushed. Clearance between bushing and shaft should be .0005-.0025". Endplay should be .003-.013". To remove gear, remove snap ring at forward end, remove thrust washer, withdraw gear from shaft. Thrust washer tongue must be engaged in slot in shaft (elongated spline). NOTE—Do not engage thrust washer tongue in slot which extends entire length of shaft (this is an oil lead).

Second Speed Gear Snap Ring ('39). Groove for snap ring which retains gear is rounded at bottom and a second snap ring is installed in this groove to position the gear retaining snap ring.

Synchronizing Unit and Clutch Sleeve:—Cannot be dismantled or serviced (except for detent springs which are furnished separately) and should be replaced as an assembly. Endplay when assembled should be ⅛" min., 3/16" max. (cone-to-cone engagement). Less than ⅛" endplay may cause cone drag and noise in neutral, more than 3/16" endplay may cause gear clash during engagement. To check action (with transmission cover off), press down on retainer ball of second and third speed shaft to determine neutral position, note that forward motion (to engage high) is less than rearward motion (to engage second speed cone). This setting necessary to prevent drag between second speed gears which would cause noise in neutral. Clutch sleeve clearance on mainshaft should be .001-.003" backlash between clutch sleeve and mainshaft splines should be .001-.003".

1939 Type—Both drums are same size. Use extreme care to install **bronze** drum toward second speed gear and inner clutch sleeve with end marked 'S' toward second speed gear.

Main Drive Gear & Clutch Shaft Bearing:—Bearing is held on shaft by snap ring. Bearing should be .0003" tight to .0007" loose on shaft and .0002" tight to .001" loose in case. Shaft endplay should be .013" tight to .002" loose. Pilot bearing for forward end of main shaft (in main drive gear) is loose roller type. Rollers prevented from moving by snap ring.



Counter Gear Cluster:—On all models, do not remove dummy shaft used to retain loose roller bearings in gear until assembly has been installed in transmission, then drive out dummy shaft with regular shaft as it is installed. Steel thrust washer used at outer ends of roller bearings, steel spacer between rollers in gear cluster. Bearing clearance on shaft should be .0002-.0021". Endplay should be .010-.024". Make certain that bronze thrust washer installed at front end of gear cluster, bronze and steel washers at rear end with steel washer next to case.

Reverse Idler Gear:—Bushing clearance on shaft should be .0027-.0042". Endplay should be .004-.016". Make certain that bronze thrust washer installed at each end of gear.

Speedometer Gear Assembly ('38-39):—New type (without rear bearing in retainer—not interchangeable with 1937 type). Driven gear is carried in sleeve which is screwed in transmission rear bearing retainer. Driven gear and shaft is retained in sleeve by washer at outer end. Shaft endplay should be .005-.010".

BUICK-OLDS-PONTIAC TYPES

BUICK MODELS

SERIES 40 (1934 to 1939)
SERIES 50 (1934-35)

OLDSMOBILE MODELS

SIX, F-33 ('33), F-34 ('34), F-35 ('35), F-36 ('36), F-37 ('37); F-38 ('38); '60' F-39, '70' G-39 ('39)
EIGHT, L-33 ('33), L-34 ('34), L-35 ('35), L-36 ('36), L-37 ('37), L-38 ('38), '80' L-39 ('39)

PONTIAC MODELS

SIX, 701A, B (LATE '35), 36-26A, B ('36), 37-26CA ('37); 38-26DA ('38); 39-25, 39-26 ('39)
EIGHT, 605 (LATE '35), 36-28 ('36), 37-28CA ('37) 38-28DA ('38), 39-28 ('39)

NOTE:—This type transmission used on Pontiac 1935 models beginning with serial numbers as follows: 701A-6AA-19858, 701B-6AB-23423, 605-8AA-26175. **Buick 1938, Oldsmobile 1938-39.** Special automatic Self-shifting Transmission optional on these models. See separate article for data on this type.

TYPE:—Constant-mesh, synchro-mesh type with all helical gears. Main drive gear integral with clutch shaft and mounted on ball bearing which takes gear thrust. Mainshaft mounted on roller bearing (front), ball bearing (rear) which takes gear thrust. Second speed gear positioned on rear of mainshaft by locking ring at front and thrust washer at rear between gear and bearing. Sliding sleeve, which engages gears, is splined on shaft. Low speed sliding gear is splined on this sleeve at the center and is held stationary when the sleeve is shifted to engage second or high. Counter gear cluster and reverse idler gear mounted on bronze bushings on stationary shaft with thrust washer at each end.

1939 Type:—Design changed from 1938 as follows:

Shifter Mechanism—New type cable and rod actuated shifter shafts for steering column mounted gear shift lever. See Service directions below for disassembling data and separate articles on Buick, Oldsmobile, and Pontiac Transmission controls for adjustment directions.

Synchronizing Unit—Same design as for 1938 except that no detent springs are used. On Buick, aluminum synchronizing cones used for high gear end on some cars.

Rear Bearing Retainer—Rear bearing inner race positioned on shaft by snap ring with spacer between snap ring and speedometer gear which is press fit on shaft. On Oldsmobile (except 6-60) and Pontiac (except Quality 6 39-25), additional Durex bronze bushing located in bearing retainer extension housing. On Buick Model, retainer is flanged to engage front torque tube and mainshaft is splined to engage front propeller shaft.

Countershaft Bushing Spacer—Spacer not used on 1939 models (bushing oiled by lubricant openings in case at ends of counter gear).

Reverse Idler Lockpin (Buick Only)—New type locking pin used which is driven in case. Pin must be driven completely into shaft to remove gear.

Synchronizing Unit:—Consists of synchronizing cones formed integrally with main drive gear and second speed gear and drums assembled loosely on cones by snap rings. Drums engaged by detent springs assembled in splines on mainshaft (under sliding sleeve) and cams formed on ends of sliding sleeve and are driven by prongs on the drum which engage slots in the sliding sleeve. An anti-rattle spring is located within the second speed synchronizing drums (not used on 1938-39 models).

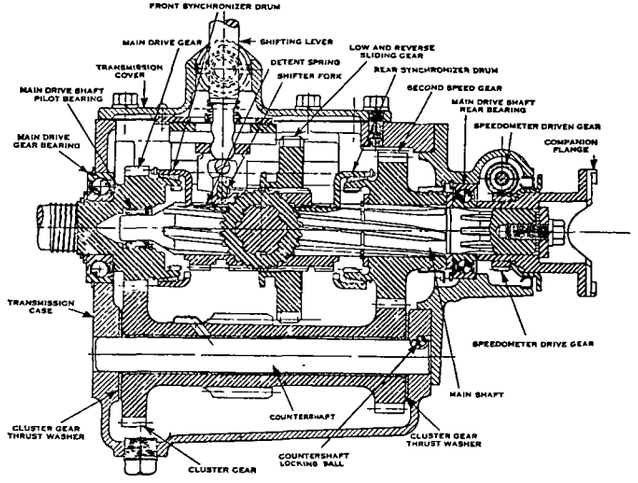
NOTE—Design similar on all models except that on models before 1938, synchronizing drums had

BUICK-OLDS-PONTIAC CONT.

three prongs and drum for second speed gear was larger (not interchangeable as on 1938-39 model). Detent springs not used on 1939 models.

SERVICING:—Disassembly (1934-38). Remove cover, interlock plates, shifter rails and forks. On Oldsmobile models, loosen universal joint flange capscrew. Take out rear retainer screws, rotate retainer clockwise to uncover rear end of countershaft, drive countershaft out to rear (do not lose locking ball in slot in rear end of shaft on 1938 models) and allow counter gear cluster to drop down in case. Pull bearing retainer and mainshaft assembly out through rear of case (slide low speed gear off sleeve and remove through top). Remove main drive gear bearing snap ring (on front end of case—see note), tap main drive gear and bearing assembly out and remove through rear end of case. Lift out counter gear cluster and thrust washers. To remove reverse idler gear, take out locking screw in lower left hand corner of case, drive shaft out, lift out gear and thrust washers.

NOTE—On Buick 1936-37 models, snap ring located under front bearing retainer which must be removed first. On 1935 and earlier models, snap ring is located in front of drive gear inside case and is removed by pinching ends of ring together to free it from slot in housing.



Disassembly (1939):—Remove transmission cover, shift rails (being careful not to lose poppet balls and springs which are under rails, shift forks and selector shaft (use tool KMO-244—Oldsmobile, J-1044—Pontiac, to remove lockscrews in shifter forks and selector shaft cams) being careful not to lose cams when selector shaft withdrawn. **Buick Note**—Selector shaft must be driven out through right side of case (with plug which seals hole)—withdrawing shaft from left side of case will damage oil seal. Remove rear bearing retainer screws, withdraw bearing retainer and mainshaft through rear of case as an assembly with the rear bearing and second speed gear, allowing the low speed gear and sliding clutch sleeve to slide off and remain in the transmission case. Lift sliding clutch and low speed gear out through top of case. Push countershaft out of case toward rear being careful not to lose locking ball in groove in shaft and case at rear end. Remove main drive gear bearing snap ring (in bearing outer race on front of case), remove main drive gear through case. Lift out counter gear cluster and thrust washers. To remove reverse idler gear, take out locking screw (Oldsmobile, Pontiac), drive locking pin in so that it is completely within shaft (Buick), remove shaft, lift gear and thrust washers out. On Buick models, remove pin from shaft and use new pin when reassembling (drive pin in so that outer end ⅝-¾" past flush surface of transmission case.

Buick Selector Shaft Installation—Install shaft through oil seal on left side of transmission case and seal hole on right side of case (originally closed by plug) with sealing compound.

Mainshaft & Bearing Assembly:—To dismantle, remove sliding sleeve and detent springs (not used on 1939 models), disengage second speed gear synchronizing drum snap ring and remove drum. On models with universal joint companion flange bolted on rear end of shaft, remove nut and companion flange. Take out second speed gear snap ring at forward end of gear, remove thrust washer and gear. Take out snap ring in bearing retainer in front of bearing, remove shaft and bearing from retainer by tapping end of shaft on wooden block. When replacing bearing, see that shielded side of bearing is toward front (next to gear) on 1939 cars without oil collector.

Mainshaft Rear Bushing (Oldsmobile 70, 80)—Durex type bronze bushing installed in rear end of rear bearing housing. Bushings cannot be reamed and new bushing should be installed whenever old bushing removed from housing. Use tool J-1060-1 to press old bushing out and driver J-1050 to install new bushing.

Mainshaft Rear Bushing (Pontiac Deluxe 6 & 8)—Durex type installed in rear end rear bearing retainer. Cannot be serviced in the field (replace rear bearing retainer if bushing worn—new bushings are line-reamed in production). Oil seal at rear of retainer can be removed by prying out with a screwdriver, use wood block as driver when installing seal. NOTE—These Durex bronze bushings must not be cleaned with degreasing compound. Oil bushing with transmission oil when reassembling.

Buick Specifications—Mainshaft rear bearing should be .0004" tight to .0005" loose (before '39), .0007" tight to .0002" loose ('39) on shaft and should be .0011" tight to .0005" loose in case (all models). Mainshaft should have no perceptible endplay. Clutch sleeve clearance and backlash on mainshaft should be .001-.003". Low and reverse sliding gear backlash should be .003" max.

Pontiac Specifications—Mainshaft rear bearing should be .0004-.0005" on shaft, .0005-.0011" in case (before '39), .0007" tight to .0002" loose on shaft and .0011" tight to .0005" loose in case ('39). Clutch sleeve clearance on shaft and backlash should be .001-.003". Low and reverse gear backlash in splines should be .003".

Synchronizing Unit:—Both synchronizing drums same size and interchangeable beginning with 1938 (see Buick '39 Note below). Drums retained on gear cones by snap ring and may be removed by expanding ring. On 1937 and previous models, make certain that anti-rattle spring installed in second speed drum.

Buick 1939 Note—Synchronizing drum installed on second speed gear must always be **bronze.** Aluminum drums used for high speed gear on some 1939 cars.

Second Speed Gear:—Held in place on shaft by steel thrust washer and snap ring at forward end, steel thrust washer (between gear and bearing) at rear end. Make certain that oil sleeve is in place on gear hub at rear end (not used on 1939 models).

Buick Specifications—Second speed gear clearance on shaft should be .0005-.0025" (before '39), .001-.0026" ('39). Gear endplay should be .005-.007" (all models).

Pontiac Specifications—Second speed gear clearance on shaft should be .0015-.0026" (before '39), .0005-.0027" ('39). Gear endplay should be .002-.006" (before '39), .000-.010" ('39).

Main Drive Gear & Clutch Shaft Bearing:—Remove high speed synchronizing drum (disengage snap ring), remove bearing retainer snap ring, washer, and bearing. On models with bearing retainer nut, remove snap ring and then back off nut (left hand thread). Where shielded type bearing used, install bearing with shielded side toward gear. Press bearing on shaft using tube against inner race, drill new hole for bearing nut lock ring if old hole does not line up.

Buick Specifications—Drive gear bearing should be .0003" tight to .0007" loose on gear, .0002" tight to .001" loose in case. Shaft endplay should be .013" tight to .002" loose. Pilot bearing for forward end of mainshaft (in drive gear hub) is loose roller type. Rollers retained by snap ring.

Pontiac Specifications—Drive gear bearing clearance should be .0003-.0007" on gear and .0002-.001" in case (before '39), .0003" tight to .0007" loose on gear and .0002" tight to .001" loose in case ('39).

Counter Gear Cluster:—When replacing this assembly, see that thrust washers installed at each end. Endplay with washers in place should be .016-.028" and clearance on shaft .0033-.005" (Buick), endplay should be .011-.019" (Pontiac). See that lock ball is in place in end of shaft and that it engages slot in case when shaft installed, use new gasket under bearing retainer (if old gasket damaged by removal).

Reverse Idler:—Clearance on shaft should be .0027-.0042" (Buick), .002-.004" (Pontiac). Endplay should be .004-.016" (Buick).

Buick 1939 Note—Shaft locked by new type pin which must be driven completely into shaft before shaft can be removed. Remove pin from shaft before reinstalling shaft in case. Use new pin and drive pin in so that outer end is ⅝-¾" past flush surface of transmission case.

BUICK-OLDSMOBILE 1938 SELF-SHIFTING TYPE

Optional Equipment On:
BUICK SPECIAL EIGHT, MODEL 38-40 (1938)
OLDSMOBILE SIX, MODEL F-38 (1938)
OLDSMOBILE EIGHT, L-37 (1937), L-38 (1938)

NOTE:—Oil Pump Change. New type single unit oil pump (same as 1939 type) used on all transmissions after Serial No. 14039. See article on 1939 type Self-shifting Transmission (following) for data on this new type oil pump.

IMPORTANT NOTE FOR TOWING CAR:—These instructions supersede previous recommendations:

To Tow Car—Disengage clutch and block in this position. Do not operate engine. Move control lever to second forward or 'high' range.

To Start Car by Towing or Pushing—Disengage clutch, place control lever in second forward or 'high' range. When car speed of 10 MPH. is reached, turn on ignition and engage clutch (engine will be driven through third gear).

1938 SELF-SHIFTING TYPE CONT.

DESCRIPTION:—Consists of an entirely self-contained unit mounted on clutch housing in place of regular transmission and made up of two separate gear systems: (1) Head Set controlled manually by shift lever under steering wheel, (2) Automatic Planetary system operated by oil pressure, controlled by shift lever, throttle lever and speed governor.

Head Set—Similar to conventional transmission and provides Reverse (Shift lever in 'R' position), Neutral (lever in 'N' or 'Off' position), Forward or Direct Drive (one speed only, head set engagement same for both 'F' positions on Buick, 'L' and 'H' positions on Oldsmobile).

Planetary System—Consists of two planetary gear reduction units (rear unit has double set of planetary gears but operates as a unit) providing four forward speeds automatically. Each planetary unit has a multiple disc clutch (engaged by oil pressure, disengaged by springs) and a brake band perated by a Servo in the bottom of the case (bands applied by springs, released by oil pressure). When the brake band is engaged and the clutch disengaged, planetary unit affords a speed reduction; when the band is released and the clutch engaged, the planetary unit is locked and affords a direct drive. All four gear ratios are secured by combinations of the two planetary units as follows:

Low—Both planetary units operating in tandem.

Second—Front unit locked, rear unit operating.

Third—Front unit operating, rear unit locked out.

Fourth—Both units locked out, straight drive.

First and second speeds are available with shift lever in first 'F' position on Buick, 'L' position on Oldsmobile (car will start in first with control lever in second 'F" or 'H' position and quickly shift to third but this practise not recommended by manufacturer). Third and Fourth or Direct Drive are available with shift lever in second 'F" position on Buick, 'H' position on Oldsmobile. Particular gear ratio engaged depends on shift lever position, car speed (governor control), and throttle position (accelerator pedal interconnected with governor linkage) so that while the transmission gear ratios normally shift up from first through second and third to fourth automatically as the car speed increases, the shifts can be delayed by a more-than-normal throttle opening and it is possible to shift back from fourth to third at will for acceleration by depressing the accelerator pedal to a position beyond the wide open throttle position (at car speeds below 58-62 MPH., above this speed throttle is locked out so that fourth or direct drive is operative regardless of throttle position).

LUBRICATION:—Check oil level in transmission case every 1000 miles. Keep oil up to full mark on oil level indicator stick (low oil level will allow air to be sucked into system). Add oil through indicator stick hole in top of case (accessible by removing one screw and lifting off inspection hole cover in center panel of front compartment floor.

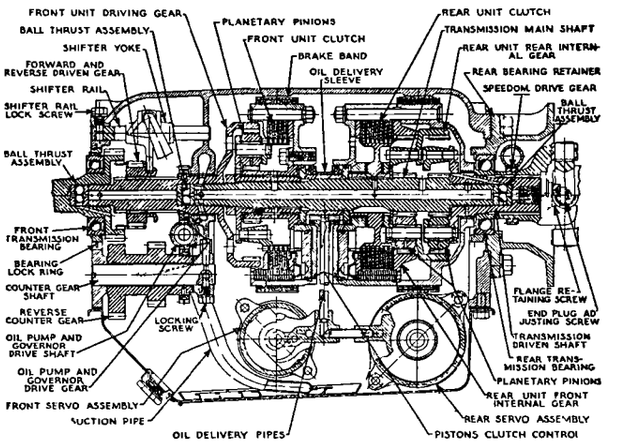
2000 Mile & 10,000 Mile Interval Servicing—At end of first 2000 miles, factory schedule calls for removal of oil pan, thorough cleaning to remove all sediment, adjustment of Servo Unit bands, refilling with new oil. Use new cork gasket when replacing pan (do not shellac gasket or use any type of sealer). Repeat at 10000 mile intervals thereafter.

Oil Recommendations:—Oil should be selected on basis of minimum temperature expected as indicated below. Drain old oil by removing plug at lower front end of case and elevating rear of car.

Capacity—3 qts. refill, 3½ qts. with pan dry.

Recommended Oil	Minimum Temperature
SAE #30	40°F. & above
SAE #20 or 20W	32°F.
SAE #20W	10°F.
SAE #10W	Minus 10°F.
SAE #10W plus 10% Kerosene	Below Minus 10°F.

ADJUSTMENT:—**Servo unit bands** should be checked and adjusted, if necessary, at end of first 2000 miles and at 10,000 mile intervals thereafter. **Throttle Control Lever** should be reset whenever transmission is removed, linkage disturbed, or when carburetor throttle linkage is changed. **Manual Control Lever** should be reset when removed and installed.



Servo Band Adjustment:—Remove floor mat and front center panel, raise car on lift or jacks, remove transmission case drain plug, drain old oil and remove oil pan. Install special gauge J-1127 on rear servo unit so that prong on gauge hooks over shoulder on servo housing and fork on gauge rests on servo plunger rod. If end of plunger rod extends less than ⅛" beyond gauge, no adjustment is required. If more than ⅛", band should be adjusted (requires two men). Use Servo Cam Release Bar J-1122 and force servo plunger into servo so that end is beyond gauge and, at the same time, loosen locknut and turn down adjusting screw on top of case to take up all slack in servo band. Remove cam release bar, re-install gauge, back off adjusting screw until rear of crown on outer end of plunger rod is flush with outer edge of gauge (plus or minus 1/32"), tighten lockscrew. **Important**—Final adjustment must be made by backing off screw, not by turning screw down (if correct position of screw is overrun when making adjustment, repeat entire procedure, do not merely turn screw down). Adjust front servo unit in same manner.

Throttle Control Lever Adjustment (Buick Models)—Revolve Cold Idle Cam on carburetor to 'hot' position. Set throttle lever stopscrew (idle speed adjustment) for 5-6 M.P.H. idling speed in third gear, close throttle against cold idle cam. Disconnect trunnion at end of throttle control lever on transmission case, move throttle control lever up until it is against stop in case, hold lever in this position, adjust trunnion on rod until pin will just enter hole in lever, lengthen rod by turning trunnion down an additional two complete turns, lock trunnion by tightening locknut on rod, connect trunnion to lever and check to see that detent spring on rod above carburetor throttle lever is at right angles to lever. Depress accelerator pedal fully (stop on lower side contacts floor mat) and note whether overtravel of detent spring on trunnion at carburetor throttle lever is ⅛". Adjust by loosening clip attaching accelerator pedal link to accelerator rod and moving clip up on rod. With correct setting, throttle control lever on transmission will reach limit of downward travel when accelerator pedal touches floor board.

(Oldsmobile Models)—Disconnect throttle control rod from throttle control lever on transmission by removing clevis pin. Depress accelerator pedal fully and block firmly against floor while adjustments are made (do not use hand throttle). Disconnect trunnion on carburetor throttle valve lever, hold throttle lever in wide open position, push accelerator rod back toward dash to limit permitted by overrun mechanism on throttle cross-shaft, hold rod in this position and adjust trunnion so that pin will just enter hole in throttle lever with light finger pressure, tighten trunnion locknut and connect accelerator rod. NOTE—Throttle cracking linkage (starter connection) must be reset after making this adjustment—see directions in Carburetor tune up data on car model page. Release accelerator pedal, rotate fast idle cam to slow or hot idle position and see that it remains in this position while remainder of adjustments are made. Install clevis pin in end of throttle control rod (for use in checking, do not connect rod to transmission throttle control lever). Move throttle control lever to rear against stop, adjust clevis on rod so that pin just rubs against rear face of lug on top of throttle control lever, lock clevis by tightening locknut, assemble rod and lever. Check by noting that slight increase in resistance felt when accelerator pedal depressed to point where throttle is wide open (if car operated, transmission will remain in fourth gear at car speeds above 15 MPH. if pedal not depressed further, but will shift immediately into third gear if pedal depressed to floor).

Manual Control Lever Adjustment (All models):—Move shift lever under steering wheel to 'N' position (Buick), 'Off' (Oldsmobile), disconnect shift lever control rod from forward-and-reverse lever (front lever on left side of transmission case). Make certain that forward-and-reverse lever is in neutral position by moving lever forward as far as possible and then back to point where one notch (detent) is felt. Adjust clevis at forward end of control rod (Buick), rear end (Oldsmobile) until clevis pin will enter hole in forward-and-revere lever without disturbing position of lever or shift lever on steering wheel, lock clevis by tightening locknut ,assemble control rod to lever. Check setting by operating shift lever on steering wheel with button held in depressed position (to cut out action of detents in lever). Move lever up and down from 'N' or 'Off' position and note point where resistance of detents in transmission is felt (resistance to motion will increase when detent leaves 'off' notch). These points should be equally distant from center off position. Move lever down until transmission click is felt indicating that it is in either forward position. Arrow on shift lever should coincide with mark on shift lever box.

SERVICING (ON THE CAR):—Servo units, Governor, Oil Pump, and Oil Pressure Regulator can be adjusted or removed and serviced without removing transmission from the car or otherwise disturbing the transmission assembly.

Servo Units:—Rear Servo can be removed without disturbing Front Servo, but whenever Front Servo

1938 SELF-SHIFTING TYPE CONT.

is taken out, the Rear Servo must be taken out first. To remove Rear Servo, with oil pan off, remove oil pressure line from pump to Front Servo, remove oil suction pipe, loosen locknuts and back off both servo band adjusting screws until bands are loose. Loosen attaching bolts to transmission case on both Servo units, remove bolts at rear Servo only. Slide rear unit toward rear of case until connecting oil pipe between units is free, lower Servo from case. When removing Front Servo, use extreme care to avoid damage to the two oil delivery pipes which enter this unit. Install Servos in same manner making certain that oil delivery pipes are in place and that brake band struts engage actuating levers properly. Adjust brake bands.

Governor Assembly:—To remove Governor, loosen clamp bolts in rear unit cam operating lever (rear lever on left side of case) and throttle control lever (lower lever). pry levers off shafts (not necessary to disconnect rods or to remove front forward-and-reverse lever). Take out bolts and remove transmission side cover. Pull out governor relay shaft upper pivot pin through top of case (pin is free fit in case and locked by side cover screws, lower pivot pin is light press fit in case but need not be removed), move shaft toward rear of transmission to disconnect linkage and clear governor. Take out attaching screws in governor flange, pull governor out of case. NOTE—Do not dismantle governor (serviced as an assembly only). Install Governor in same manner and adjust as follows:

Adjustment (Buick):—Set up dial indicator to measure governor travel (contact point on outer end of governor shaft). Set indicator at zero with governor at rest. Slowly spread governor weights by hand and note point where governor controlled valve throws to open position. Travel at this point (indicator reading) should be .200-.220". Slowly release weights and note point where valve closes. Travel should be .040-.030" from opening point (closing point more important, adjust to this dimension, compromising slightly on opening point if necessary). Adjust by changing position of inner nut on shaft (shaft slotted for screwdriver).

Adjustment (Oldsmobile):—Use dial indicator and check governor travel in same manner as on Buick (above). Travel from point where control valve opens to end of first stage (end point can be determined by decided increase in resistance felt at this point) must be equal to travel from point where control valve closes to the 'at rest' end. Adjust in same manner as on Buick. To adjust without using dial indicator, pry open lock plate fingers under outer locknut, hold inner nut with wrench, turn slotted shaft with a screwdriver in clockwise direction until control valve clicks open, then turn screw counter-clockwise until valve just clicks closed, finally turn screw additional ⅞ turn. Tighten locknut and secure lock plate. With this setting opening and closing of valve should occur near center of governor travel.

Oil Pressure Regulator Valve:—Use tool J-1125, remove oil pressure regulator valve plug and spring (spring should remain on plug as top coil is tight fit on plug body, if spring removed, replace with this tight coil up). Use tool HMO-65-6 to remove pressure regulator valve assembly from case.

Oil Pump:—To remove, take out oil pressure regulator valve (see above), remove oil pump attaching screws (six screws around edge of oil pump cover flange on right side of case, two inner screws attach pump cover to pump body and need not be disturbed), remove pump. NOTE—Pump is doweled to case and may need to be pried free, after pump is off dowel do not use excessive force which may damage bronze drive gears, if pump sticks turn propeller shaft slightly to line up double drive gears. To dismantle pump, remove two pump cover attaching screws, take off cover, invert pump and remove internal parts. To dismantle double pump driving gear assembly, press shaft out of outer drive gear (which drives small pump section). Take out pressure regulator valve body attaching bolts, remove regulator body and bronze separator plate. Reassemble in reverse order. When pressing drive gear on shaft, place .010" feeler between two gears on outer end of pump shaft, press gear on shaft until drag is felt on feeler. Make certain that both sections of pump turn freely and that pump cover gasket is in good condition. Oil pressure can be checked with gauge and should be 85 lbs. at 1000 R.P.M. (oil leaks and low pressure will cause faulty transmission operation).

REMOVAL & INSTALLATION:—Special precautions should be taken and special tools used (aligner studs J-1126, Hoist and Saddle J-1129).

Transmission Removal (Buick):—Remove rear axle (see car model 'M' page for directions), push front seat back, remove floor mat and center floor panel, disconnect speedometer cable at transmission, remove two upper transmission-to-flywheel housing bolts. Jack up car slightly at front end. Remove clutch housing underpan and clutch release yoke, disconnect rod on throttle control lever on left side of case and manual shift rod at clevis connection. Install transmission lifting tool J-1129 in front compartment, engage lifting cradle securely under transmission case and hook cables on hoist hook. Tighten hoist cable just enough to support transmission, make certain that hoist is locked, take out two remaining transmission mounting bolts, slide transmission to rear and work clutch release bearing retainer out with transmission assembly.

Transmission Removal (Oldsmobile):—Remove foot accelerator pad, floor mat and center floor pan. Disconnect speedometer cable, front propeller shaft at rear of transmission, take out two upper transmission mounting bolts. Jack up car approximately 20" at front end, 4" at rear. Free center propeller shaft bearing bracket from frame and allow bracket to drop down as far as possible (not necessary to disconnect rear universal). Remove clutch housing underpan and clutch negative return spring bracket. Disconnect throttle linkage at throttle control lever and manual shift rod at forward-and-reverse shift lever on left side of transmission case. Install hoist in front compartment, engage saddle securely under transmission, hook saddle cable to hoist making certain that front cable are looped in front of oil pump (right side), shifter shaft (left side), raise transmission slightly, make certain that hoist is locked, take out lower mounting bolts moving transmission back as left hand bolt strikes clutch throwout yoke (not necessary to remove yoke). Move transmission to rear (turn universal flange horiztonal to clear shaft).

Installation (All Models):—Shellac new gasket on front of housing, aligning oil return hole in gasket with drain hole in transmission, install aligner studs in two upper mounting bolt holes in flywheel housing. On Buick models, install clutch release bearing on retainer and place assembly in flywheel housing with gasket and spring washer (special 'waved' type No. 1304037 used instead of regular 'cupped' type). Use hoist to raise transmission and slide it forward on aligner studs being careful that weight is not allowed to rest on driven member hub.

SERVICING (ON THE BENCH):—Disassembly. Use transmission stand to hold transmission in inverted position on bench, remove oil pan (if studs replaced, use new studs of same length and use white lead on threads to prevent oil leaks). Remove control levers on side of case, remove side plate and gasket. On Buick models, remove valve body and linkage leaving capscrew in body to retain dampening valves (take out upper governor shaft pivot pin to free shaft). On Oldsmobile models, manufacturer recommends that valve control bracket and oil control unit not be disturbed under any circumstances. Remove oil pressure regulator, oil pump, and governor (see directions in first servicing section above). Disconnect oil line between pump and servo body, remove pump intake pipe and gasket. Loosen locknuts and back off servo adjusting screws on top of case until screws are free (use pry bar J-1122 to take strain while turning screws). Remove both servo mounting screws evenly and remove servos together being careful not to bend connecting tubes. Remove head set reverse idler and countershaft lockscrews, take out shafts (if shafts stick, use screwdriver in slot at forward end to turn shaft while applying pressure at rear end), mark shafts and replace in same position (shafts are same dimension but are selective fit in case and should not be interchanged). Remove reverse idler gear and counter gear cluster being careful not to lose bronze thrust washer at rear end. Use special tool J-1149 to expand snap ring on clutch gear bearing (insert tool in recess in front end of case), withdraw clutch gear and bearing assembly at front end keeping forward end tilted down to prevent loss of ball thrust bearing in gear hub. Move shifter shaft to reverse position, take out shifter shaft lockscrew, remove shaft (being careful not to lose detent ball), shifter fork, and sliding gear. On Buick, remove ball joint and universal joint (light press fit, no puller required). On Oldsmobile, loosen locknut and remove endplay adjusting screw (in center of shaft at universal yoke), remove joint flange retaining screw (use ⅞" socket holding flange with tool J-1123 meanwhile), remove flange by tapping lightly with hammer. Remove center bearing cap (reverse counter gear bracket) and rear bearing retainer (rear endplate). Rotate servo bands so that ends are at bottom of case and clamp on drums (use modified brake cylinder clamp). To lift planetary unit assembly out of case, use J-1148 (Buick), handle of J-1123 (Oldsmobile) inserted in end of driven shaft to lift assembly up slightly and to rear until driving gear shaft clears front of case, tilt front end up and lift assembly out. NOTE—Front planetary unit driving gear is free on planetary assembly and will pull off if any lifting force applied. All lifting must be at tool on rear end.

Transmission Assembly:—Reverse disassembly directions given above. When installing clutch gear make certain that ball thrust bearing is in place in hub. On Buick models, four snap ring widths are furnished to control end play at front bearing. Select widest snap ring which can be tapped into groove as follows:

Part Number	Width	Color Marking
1304060	.063"	White
1304061	.067"	Yellow
1304062	.071"	Green
1304063	.058"	Red

1938 SELF-SHIFTING TYPE CONT.

Adjust main shaft endplay after all units are installed in place with universal joint flange on and retaining screw tightened (on Oldsmobile make certain that cork oil seal on screw is in good condition) by turning adjusting screw in as far as possible and then backing screw off ⅓ turn and lock with locknut. See that clutch gear turns freely.

TROUBLE SHOOTING:—Causes of transmission troubles may be determined from following table.

Transmission Fails to Shift:

1. **From High to Low (or shift is delayed) with cold oil**—Oil is too heavy, change to lighter oil.
2. **From Fourth to Third (or pedal pressure excessive)**—Throttle control lever adjustment wrong (rod too long). See Adjustment section above.
3. **From Low (shift lever in either low or high position)**—No oil, Pressure Regulator sticking, oil pump not working, oil leaking inside case. Check oil level, see that pressure regulator valve is free in body. Check oil pump pressure.
4. **No Automatic Shift (1st to 2nd, 3rd to 4th)**—High unit or valve not working properly. Valve sticking. Governor defective or linkage binding.

Transmission Shifts incorrectly:

1. **Automatic shifts (1st to 2nd, 3rd to 4th) are erratic or occur at wrong speeds.** Governor out of adjustment. See Adjustment section above.
2. **Shift from First to Third is severe or violent**—Throttle control lever adjustment incorrect (see Adjustment section), clutch plates defective or scored. If this action noted at low speeds after high speed driving, oil may be too light.
3. **Transmission slips when shifting from First to Third. Pressure downshift (3rd to 1st) is below 4 M.P.H. with hot oil.** Throttle control lever adjustment incorrect. Clutch plates worn.
4. Same as No. 3 except that downshift is too high (10 M.P.H.). Transmission may hunt or shift rapidly between first and third. Internal oil leak in transmission allowing oil pressure to drop at high speeds.

Shift Lever will not move between High and Low while car is operating.

1. Detents in shift lever and transmission not aligned. See Manual control lever adjustment.

Transmission is Noisy:

1. **Loud chatter or rattle in transmission** with excessive accelerator pedal vibration. Air in system caused by low oil level. Check oil level.
2. **Slight buzzing noise in transmission** with light pedal vibration. Caused by oil pressure regulator when oil is cold. Not serious. May be corrected by replacing oil pressure regulator or spring, or oil pump assembly.

OLDSMOBILE 1939 SELF-SHIFTING TYPE

Optional Equipment On:

ALL MODELS (1939)

SERIAL NUMBER:—First No. 18000. All transmissions with serial numbers above 18000 are new 1939 type NOTE—New type single unit oil pump (described below) used also on 1938 units after No. 14039.

SPECIAL TOWING INSTRUCTIONS:—To tow or push cars equipped with automatic transmission, proceed as follows: Move manual shift lever to neutral position, keep ignition key turned off (clutch pedal need not be disengaged). If car will operate only in 1st speed and must be towed, rear wheels must be raised clear or drive shaft disconnected.

DESCRIPTION:—Design same as type used on 1938 cars except as follows:

Steering Column Shift Lever—New design used in conjunction with redesigned forward-and-reverse lever. All control adjustments same as for 1938.

Rear Unit Accumulator—Designed to eliminate noise or jerk when transmission shifts from third back to first gear (high range) with hot oil. Accumulator assembled in rear servo and special one way ball check valve installed in oil control unit valve body. When downshift from third to first occurs, oil in compensator system is trapped by check valve (while oil in clutch system allowed to escape freely) so that rear brake band engages gradually until clutch is disengaged. Oil pressure in compensator system is held to 100 lbs. maximum (exhausts through accumulator bleed slot when pressure exceeds 100 lbs.).

New Single Unit Oil Pump—Mounted in same manner as 1938 type, driven by gear on headset mainshaft (operates whenever rear wheels revolving). NOTE—This oil pump used on 1938 transmissions beginning with Serial No. 14039 and interchangeable with two-unit pump used on earlier models.

Oil Control Unit (Valve Assembly)—New type with check valve for Rear Accumulator control. Interchangeable with 1938 type by removing check valve

Governor—Three stage type driven by oil pump gear (in tandem with oil pump).

Mainshaft Front Pilot Bearing—New needle bearing type (changed from plain bushing).

Clutch Brake Washer—Used on all cars with single unit oil pump to prevent clutch spin. Consists of dished bronze friction washer assembled on forward end of front unit drive gear shaft within main drive gear (clutch shaft gear). See servicing data below for washer installation.

LUBRICATION:—Capacity 3 qts. (refill), 3½ qts. (dry—when pan removed and cleaned). Recommended lubricant (engine oil) for all seasons as follows:

Summer	SAE #30
Winter (Below 45° F.)	SAE #20W
Winter (Below 0° F)	SAE #10W

See preceding article for checking, cleaning, and refilling directions.

ADJUSTMENT & SERVICING:—All adjustments and servicing operations same as for 1938 cars except as noted below. *See preceding article for data.*

Governor Adjustment:—Governor controls automatic upshift from 1st to 2nd (10 MPH., 1300 RPM) and 3rd to 4th (1350 RPM., 22 MPH. with minimum throttle) at part throttle and should be adjusted so that these shifts occur at the correct speed in the first stage of the governor travel. To adjust (with transmission side cover removed to expose governor), hold inner shaft with screwdriver and turn nut on outer end of governor shaft counter-clockwise until front unit valve just clicks open, then turn nut clockwise until valve just clicks closed, finally turn nut additional ⅞ turn clockwise. This will bring shift at center of governor travel. Replace lockplate and nut and lock securely.

Oil Pump Servicing:—To remove pump, remove Pressure Regulator Valve, remove oil pump to transmission case attaching bolts (two bolts near center of cover hold pump cover on pump body and need not be removed), remove pump. NOTE—Pump is doweled on case and may need to be pried off dowel pin. With pump free of dowel, do not use force to remove pump which will damage drive gear (use bar or screwdriver to turn front universal joint slightly to line up gears which will allow pump to be pulled out easily).

Oil Pump Disassembly—Remove two pump cover to body screws, lift off cover and gasket. Press oil pump driven gear off shaft (serrated fit on shaft), remove thrust washer and snap ring, invert pump and remove gears and shaft. To disassemble relief valve, remove plug on side of pump cover, remove regulator spring and plunger, take out capscrews mounting regulator valve body on pump, valve body and bronze separator plate.

Oil Pump Assembly—Assemble pressure regulator (tighten mounting screws evenly to prevent distorting valve body) and make certain that regulator valve is free in body after installation. Insert shaft through pump body, assemble snap ring and thrust washer on shaft making certain that snap ring indexed in washer undercut, press driven gear on shaft so that it seats firmly against thrust washer, install pump idler gear on shaft, install plunger, regulator spring and plug in pump cover and make certain that brass sealing gasket in good condition. Use new cover gasket and install pump cover, check gear endplay (should be .001-.003". NOTE—Cover gaskets available in two thicknesses (.005" thick—has 1 notch in edge, .007" thick—no notch), use .005" gasket first and if shaft does not turn freely, install .007" gasket. If shaft still does not turn freely, it is out of alignment (do not use more than .007" gasket thickness under cover).

Oil Pump Pressure Test—Pump pressure should be tested before dismantling transmission when trouble experienced (such as hunting or slipping particularly in 1st to 3rd shift). To check pump pressure, use 200 lb. gauge connected to plug opening in oil pump cover and operate car as follows: With transmission oil hot, shift transmission into high range and slow car speed down until transmission shifts into 3rd speed. In 3rd gear at car speed of 15 MPH., oil pressure should not be less than 78 lbs. If pressure below this figure, check for oil leaks or weak pressure regulator valve spring (see servicing data below). If pressure is above 78 lbs. after replacing spring but transmission performance is unsatisfactory, clutch plates are worn

Pressure Regulator Valve:—Valve serviced separately (Part No. 1305224) and main and bumper springs available in package sets as follows: No. 1394616 (for Transmissions before Serial No. 18000), 1394617 (Serial No. 18000 up). Bumper (cushion) spring should be installed with tight coil on top (this end coil engages valve stem and spring should be removed from valve only for replacement). NOTE—Wrong spring will cause downshift from 3rd to 1st. to occur at higher than normal speed.

Clutch Brake Washer:—Must be used on all cars with single unit oil pump to prevent excessive clutch spin. Install washer on front unit drive gear shaft (tangs or lugs on washer engage slots in shaft) with dished and pointed face forward toward main drive gear (clutch shaft gear).

Rear Unit Accumulator:—Serviced as an assembly only (Part No. 1396935). Mounted as part of rear servo and removed and installed as an assembly

Transmission Disassembly:—Disassembled in same manner as 1938 type. Ball thrust washer in clutch shaft drive gear is retained by pilot needle bearing and snap ring (Transmission Serial No. 18000 up) and will not drop out as gear removed as on earlier models. Brake washer is used on shaft at rear of clutch shaft drive gear on all units with single unit oil pump (see Clutch Brake Washer data above). Reverse idler gear should be installed with pointed side of teeth toward front of transmission.

CADILLAC—LA SALLE FIRST TYPE TRANSMISSION

Used On:

CADILLAC V8, 355B (1932), 355C (1933), 355D (1934), SERIES 10, 20, 30 (1935), 70, 75 (1936)
CADILLAC V12, 370B (1932), 370C (1933), 370D (1934), SERIES 40 (1935), 80, 85 (1936)
CADILLAC V16, 452B (1932), 452C (1933), 452D (1934), SERIES 60 (1935), 90 (1936-37)
LA SALLE V8, 345B (1932), 345C (1933)

TYPE:—Constant-mesh, synchro-mesh type. Low speed gear is constant-mesh, reverse gear is sliding spur (low gear clutch integral with this gear). Clutch shaft mounted on ball bearing in transmission case which takes gear thrust. Mainshaft mounted on roller bearing (front), ball bearing (rear) which takes gear thrust. Second speed gear and low speed gear mounted on taper roller bearings on mainshaft as an assembly. Counter gear cluster mounted on ball bearings (1932-35), taper roller bearings (1936-37) at each end (no countershaft or thrust washers used). Gear engagement (second and high) consists of a sliding clutch sleeve splined to mainshaft which engages clutch teeth cut on inside of synchronizing cones on second speed and main drive gear.

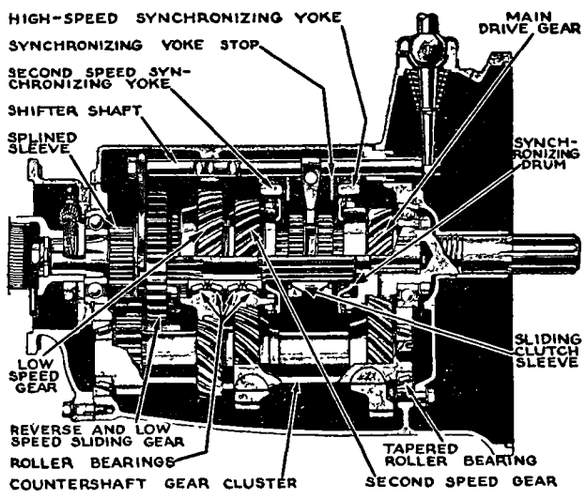
Synchronizing Units. Independent unit used for each speed (second and high). Consists of a synchronizing drum splined to the mainshaft which engages cone on gear. Drum actuated by synchronizing yoke pivoted in case. Roller on yoke contacts cam surface on shifter shaft so that yoke is rocked to engage drum and cones when shifter shaft moved to engage gear (roller mounted on plunger in oil filled dashpot and released from contact with cam by escape of oil from cylinder after synchronization completed, yoke then returned to disengaged position by return spring). Yoke pivot pins mounted on pins with eccentric adjustment in transmission case (adjusting quadrants located on outside of case).

SERVICING:—Disassembly. Remove shift lever assembly, transmission cover and shifter shaft assembly. Take out synchronizing yoke quadrant screws, remove quadrants, disconnect yoke return spring, take out yoke stop screws and stop, lift yokes out. Remove propeller shaft extension housing and shaft assembly, take out capscrew in rear end of mainshaft, remove coupling, take out mounting screws and remove speedometer drive housing (rear bearing retainer) and countershaft rear bearing washer. Remove cover on side of case over reverse idler gear, take out locking screw, pull shaft out to rear, remove reverse idler. Take out screws and remove bearing retainer on front end of transmission case. Remove capscrew and retainer on each end of countershaft, tap front end of shaft to remove rear bearing race, rear end to remove front race (roller bearing type) allowing countershaft assembly to drop down in case and unmesh gears. Remove snap ring and pull out rear mainshaft bearing. Remove snap ring and pull out clutch shaft and bearing assembly toward front (do not lose mainshaft front bearing). Pull mainshaft and gear assembly forward and remove through top of case.

Mainshaft & Gear Assembly:—To dismantle mainshaft, remove synchronizing drums and clutch sleeve at forward end, remove reverse gear and splined sleeve at rear. Low and second speed gears and bearings can then be removed from rear end of shaft.

Low & Second Speed Gear Bearing Adjustment:—Controlled by spacer washers between inner and outer bearing cups in each gear (splined sleeve acts as spacer on shaft to clamp bearings in place when assembled in case with rear coupling nut tight). Gears should turn with slight drag when installed. Adjust by dressing down both spacers slightly with emery cloth on a surface plate (if bearings loose), replace spacers (if bearings tight).

Synchronizing Yoke Assembly:—Dashpot plunger assembly can be removed from yoke cylinder. To dismantle assembly, take out piston pin linking piston and valve assembly to plunger, and valve spring retainer at lower end of valve stem.



Adjustment:—When installing yokes, install adjusting quadrants (yoke pivots) with center-line of scale on quadrant in line with reference mark on housing. To check yoke travel, remove dashpot plunger assembly, install special bar (with locating shoulder to avoid burring oil hole) in yoke cylinder, operate yoke by hand. Adjust quadrants so that yoke travel, from disengaged position against stops to engaged position of synchronizing cones is 3/32-5/32".

Main Drive Gear & Clutch Shaft Bearing:—Bearing held on clutch shaft by retainer nut and locking washer.

Reverse Idler Gear:—Clearance on shaft should be .002-.0023" (new), .004" (worn limit). Endplay .025" max. When installing new bushings, ream to diameter of .938-.939".

CADILLAC—LA SALLE SECOND TYPE TRANSMISSION

Used On:

CADILLAC, SERIES 36-60 (1936)
LA SALLE, 350 SERIES 50 ('34-35), 35-50 ('35), 36-50 ('36)

TYPE:—Constant-mesh, synchro-mesh (second and high), all helical gear type (sliding gear for low and reverse). Clutch shaft and main drive gear mounted on ball bearing which takes gear thrust. Mainshaft mounted on roller bearing (front), ball bearing (rear) which takes gear thrust. Second speed gear positioned on shaft by shoulder at rear, locking ring at front. Counter gear cluster mounted on roller bearings on stationary shaft with thrust washers at each end. Gears are engaged by sliding clutch splined to mainshaft which engages clutch teeth on inner surface of synchronizing cones on second speed and main drive gear.

Synchronizing Unit. Synchronizing drums assembled loosely on cones by snap rings in groove on cones which engage lugs on drums (waved anti-rattle spring used between drum and cone on second speed gear only). Drums are engaged by detent springs in the mainshaft splines under the sliding clutch and are driven by prongs or cams which engage the slots between the clutch teeth banks on the sliding clutch.

SERVICING:—Disassembly. Remove cover assembly, shifter shaft locking springs, interlock plates (first 1935 cars only), shifter shaft assemblies and lock balls and springs. Take off universal joint flange nut, remove flange. Remove rear bearing retainer (on 36-60 with shaft extension, additional bearing located at rear of shaft in housing). Remove countershaft toward rear allowing counter gear cluster to drop down and unmesh gears. Remove front (high speed) synchronizing drum snap ring, push main drive gear forward as much as possible, push mainshaft assembly back to disengage forward end (remove rear bearing), then remove shaft through top of case. Remove clutch shaft bearing snap ring, push assembly back and remove through top of case. To remove reverse idler gear, take out locking screw on left side of case, drive shaft out toward rear.

Mainshaft & Second Speed Gear Assembly:—Remove low speed gear at rear end of shaft, remove sliding clutch at forward end (do not lose six detent springs under clutch, note location and reassemble in same position), free second speed gear synchronizing drum snap ring, remove drum and anti-rattle spring. Remove snap ring in front of second speed gear, remove thrust washers and gear.
NOTE—When installing detent springs, see that long and short springs alternated in splines around mainshaft. Install short springs with shoulder and turned up end toward rear to engage second speed synchronizing drum, long spring in reversed direction to engage high speed drum.

Main Drive Gear & Clutch Shaft Bearing:—Bearing retained on shaft by retainer nut and lock ring. Install bearing with shielded side toward gear.
NOTE—When installing transmission, engage high gear to maintain alignment of high speed synchronizing drum in mainshaft splines (with transmission out of car, clutch sleeve is free to move sufficiently to disengage synchronizing drum cams). Check synchronizing drum before installing cover to see that cams are meshed in same splineways as the high speed detent springs.

Counter Gear Assembly:—Counter Gear roller bearings are fitted in pockets in each end of countershaft bore. When installing counter gear cluster, see that bronze thrust washer installed at front end, bronze and steel washers at rear end.

Reverse Idler Gear:—Clearance on shaft should be .002-.0035" (new), .006" (worn limit). When new bushings installed, ream to inside diameter of .877-.879". Endplay should be .019" (350), .025" (others) maximum. See that thrust washer installed at each end of gear.

CADILLAC—LA SALLE. 1937-39 TYPE

Used On:
CADILLAC V8, ALL SERIES (1937-38-39)
CADILLAC V12, SERIES 85 (1937)
CADILLAC V16, SERIES 90 (1938-39)
LA SALLE V8, SERIES 50 (1937-38-39)

IMPORTANT SERVICE NOTE:—Detent springs on first 1939 cars were .022" thick and were changed on later cars to new type .018" thick (except 39-90). To correct hard shifting complaints on first cars, install the new .018" thick springs (all cars except 39-90).

NOTE:—Transmissions on all models similar except that different length mainshaft and extension housing used on some models. Remove control gear shift (mounted on steering column below steering wheel) used on 1938-39 cars. With this type control, gears are engaged by two short shaft-and-lever assemblies on the side of the case. See separate article for complete Gear Shift Control servicing and adjusting directions.

Interlock Assembly (1939)—New type with ball seat tube installed in interlock boss in transmission case (spring located within tube, interlock ball in tube at each end). When a gear is engaged, shoulder on shifter shaft quadrant forces tube toward opposite quadrant so that lock ball seated in end of tube and prevented from releasing this shifter shaft to permit engagement of another gear.

TYPE:—Constant-mesh, synchro-mesh, all helical gear type (sliding gear for low and reverse). Main drive gear and clutch shaft mounted on ball bearing in front of case which takes gear thrust. Mainshaft mounted on roller bearing at front end and roller bearing at rear end which takes gear thrust (shaft extension integral with mainshaft with additional ball bearing at rear end of extension housing). Second speed gear positioned on mainshaft by shoulder at rear, thrust washer and snap ring at front. Counter gear cluster mounted on needle bearings on stationary countershaft with thrust washers at each end. Gears are engaged by a sliding clutch sleeve which is splined to the shaft and engages clutch teeth inside the synchronizing cones on the second speed and main drive gears.

Synchronizing Unit. Consists of two synchronizing drums mounted on the ends of three pin cams which extend through cam holes in the center ring of the clutch sleeve. Synchronizing drum assembly is centered on the clutch sleeve by detent springs which engage the notches in the pin cams. The entire assembly moves as a unit when the clutch sleeve is shifted until the synchronizing drums and cones engage, synchronizing unit then rotates (relative to clutch sleeve) until cam surfaces on clutch ring engage pin cams. Drums are driven through this engagement until synchronization is completed.

SERVICING:—Disassembly. Remove two screws in the shifter lever cap, remove shift lever (1937 models). Remove universal joint flange at the rear end of shaft extension. Take out screws in extension housing flange, remove extension housing and bearing (bearing can be tapped out with soft hammer). Remove speedometer drive gear locking ring, remove gear, take out ball in shaft which acts as gear key (ball will drop out when shaft is tapped). Remove transmission bottom cover. Pull countershaft out toward rear (coverscrew locks shaft in place), remove counter gear cluster and thrust washers. On 1937 models, use puller J-806 to remove low and reverse shifter fork pin out through filler hole in side of case, pull shifter shaft out toward front (turn shaft while withdrawing to free lock ball). Use special punch J-1051 and drive out tapered pin connecting second-and-high shifter shaft and fork. Remove ¼" pipe plug on side of case and take out shifter shaft locking balls, rod and springs. Rotate second-and-high shifter fork ½ turn and remove. Remove locking ring on clutch shaft bearing at front of case. Pull mainshaft assembly to rear and clutch shaft to front as far as possible to free mainshaft at front bearing in main drive gear. Maneuver main drive gear and clutch shaft assembly around mainshaft and withdraw through bottom of case. (1937), withdraw shaft and bearing assembly through front of case (1938-39). On 1939 models two lockscrews in front face of transmission case retaining shaft and bearing assembly must be removed first. Remove clutch sleeve and synchronizing assembly and lift out. Take off mainshaft rear bearing lock ring, push mainshaft as far forward in case as possible, use special tool J-1007 to free second speed gear lock ring, remove gear and washer, slide low and reverse gear and shifter fork off front end of mainshaft, remove mainshaft and bearing at rear. To remove reverse idler, pull shaft out toward rear (locked by cover screw), remove gear and thrust washers. On 1938-39 models, remove shifter levers on side of case, tap shifter shafts in through shifter quadrants and remove from case being careful not to lose interlock springs, balls and pins.

Mainshaft & Second Speed Gear Assembly. Cannot be installed as an assembly (to install, reverse disassembly directions above). Use new locking ring for second speed gear. Rear bearing is press fit on shaft and should be removed and installed on an arbor press. Install ball key in shaft before installing speedometer drive gear.

Shifter Shaft Assembly (1937). Install 2nd & high shifter shaft first, line up shifter fork locking pin hole, use tool J-1005 and install pin (work through shift lever hole on top of case). Use magnetic tool J-1009 and insert second-and-high shifter shaft locking ball, rod and spring, place low-and-reverse locking ball on spring, use special tool J-1008 to hold ball down and install low and reverse shifter shaft. Use tool J-1005 to install pin in low-and-reverse shifter shaft and fork. Install pipe plug in locking ball hole.

NOTE—On first transmissions, shifter lever pin (which engages notch in shifter shaft) had a square head and the notch had square sides. Second type has a tapered screw and slot. All replacement transmissions fitted with new type second-and-high shifter shaft. When installing these transmissions, check shifter lever and install new taper pin Part No.1422051 if necessary. Transmission shifter lever rattle may be corrected by installing new spring No. 1420183 and pin No. 1420200 (50, 60, 85), No. 1422110 (65, 70, 75). Install pin with hollow end under one spring coil (larger pin used on first 65, 70, 75 shifter lever must be serviced by same type).

Shifter Shaft Assembly ('38-39):—Install 2nd & high lever and shaft in neutral position making certain that shoe is properly located. Install interlock ball, pin and spring assembly in case, compress spring and locking balls with tool J-1168, install low-and-reverse shaft with sector in neutral position making certain that shoe is in place. Install new cork seals on outer ends of shafts (use tool J-1169), tap shifter levers into place on shafts while bracing inner end of sector. NOTE—Levers can be installed in two positions (10° apart) and should be placed in upper position on both shafts.

Synchronizing Unit:—Should not be dismantled and cannot be serviced except for removal of detent springs (installed directly below each pin cam and accessible without dismantling unit).

NOTE—Two types of synchronizing unit used in 1937 (second type had chamfer on high speed end of pin cams). To correct gear clash when shifting into second or high on 1937 cars, install new detent springs, Part No. 1419424.

Main Drive Gear & Clutch Shaft Bearing:—Bearing is press fit on clutch shaft. Use arbor press to remove or install (remove lock ring on shaft in front of bearing first).

Counter Gear Cluster:—Bearings are loose needle type and will fall out when shaft is removed. Use special loading tool J-1006 ('37-38), J-1184 ('39) and assemble bearings (26 rollers and retaining washer at each end) before installing counter gear. Leave tool in gear until it is pushed out by countershaft when shaft inserted. Install thrust washer at each end with steel spacer between thrust washer and case at rear. See that locking screw hole in countershaft lines up with cover screw hole so that shaft will be locked in place when cover screws installed and that gasket is in place in groove at rear end of shaft to prevent oil leaks.

Reverse Idler Gear:—Clearance on shaft should be .002-.0035" (new), .0045-.0055" (worn). When installing new bushing, ream to inside diameter of .877-.878". Endplay should be .006-.018" max.. Use special tool J-1010 to align front thrust washer when installing shaft, see that thrust washers installed at each end of gear, gasket in place in groove at rear end of shaft to prevent oil leaks, and that locking screw hole lines up with cover screw hole (shaft locked by cover screw when installed).

1939 Type—Gear mounted on steel-backed, babbitt lined bushings with steel-backed, babbitt faced thrust washers at each end.

CHEVROLET—PONTIAC TRANSMISSION

CONSTANT-MESH TYPE
CHEVROLET STANDARD, CC ('33), DC ('34), EC ('35), FC ('36)

CONSTANT-MESH, SYNCHRO-MESH TYPE
CHEVROLET MASTER, CA (1933), DA (1934), EA, ED (1935), FA, FD (1936)
CHEVROLET COMM., CB ('33), DB ('34), EB ('35), FB ('36)
PONTIAC SIX, MODELS 701A, B (EARLY 1935)
PONTIAC EIGHT, 601 ('33), 603 ('34), 605 (EARLY '35)

NOTE:—This type transmission used only on Pontiac 1935 models before these serial numbers: 701A—6AA-19858, 701B—6AB-23423, 605—8AA-26175.

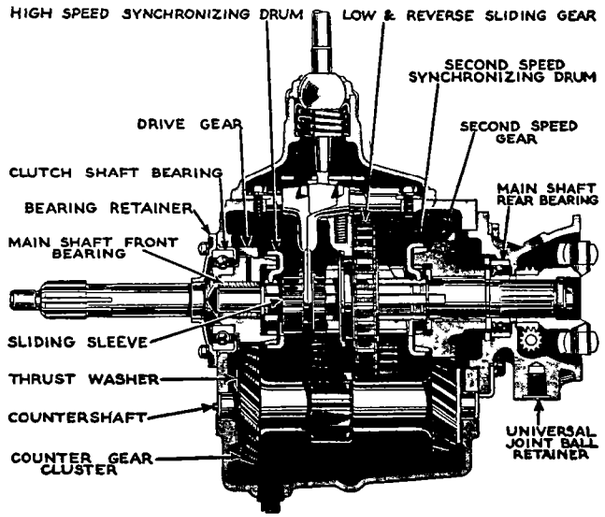
TYPE:—Constant mesh (all models), synchro-mesh (some models only), with helical gears for second speed, sliding spur gear for low and reverse. Main drive gear integral with clutch shaft and mounted on ball bearing which takes gear thrust. Mainshaft mounted on cageless roller bearing (front), ball bearing (rear) which takes gear thrust. Second speed gear positioned on shaft at rear of transmission case by washer and locking ring (front), thrust washer in front of bearing (rear). Sliding

CHEVROLET-PONTIAC CONT.

sleeve, which engages gears, is splined on shaft between drive gear at front and second speed gear at rear. Low speed sliding gear is splined on this sleeve at the center and is held stationery when the sleeve is shifted to engage second or high. Counter gear cluster and reverse idler gear mounted on bronze bushings on stationery shaft with thrust washer at each end.

Synchronizing Unit (Synchro-mesh type):—Consists of synchronizing cones formed integrally with main drive gear and second speed gear and drums positioned loosely on mainshaft by synchronizing springs. Drums are engaged by these cylindrical springs and cams formed on the ends of the sliding sleeve and are driven by prongs which engage slots in sleeve.

SERVICING:—Disassembly. Remove cover, interlock and shifter fork assemblies, speedometer driven gear and shaft. Take off universal joint capscrew and



washer, slide universal yoke off shaft. Remove universal joint ball retainer screws, turn retainer to free countershaft, drive countershaft out toward front end to permit counter gear cluster to drop down and unmesh gears. Pull mainshaft and universal joint retainer assembly out at rear disengaging front synchronizing cone, synchronizing spring, and low speed gear (remove these from above). Take out main drive gear bearing retainer screws (on front of case), remove main drive gear and bearing assembly. To remove reverse idler gear, drive out expansion plug behind shaft, remove shaft lock screw on case at rear shaft boss, drive shaft out toward rear.

Mainshaft & Bearing Assembly:—Remove sliding sleeve and press shaft out of rear bearing in universal joint ball retainer, remove gear and thrust washer. To remove bearing from retainer housing, remove lock ring at front of bearing (on Standard model, expand lock ring with wedge shaped tool). Use special tool HM-520 to remove and install synchronizing springs and second speed gear thrust washer lock ring. Thrust washer behind second speed gear should be installed with oil grooves toward gear.

Synchronizing Springs:—Not interchangeable front and rear (rear springs 1/16" wider in slots). Should be selected so that clearance between spring and spline shaft shoulder is .025" min., .035" max., when installed. Furnished in following sizes and marked for identification:

Type	Size	Marking
Rear	.282"	White
Rear	.292"	Black
Front	.173"	Red
Front	.183"	Yellow
Front	.193"	Green
Front	.203"	Blue
Front	.213"	Brown

Main Drive Gear & Clutch Shaft Bearing:—Bearing is press fit on shaft and is retained by lock ring. When installing assembly in case, tap on outer bearing race only (tapping on shaft will drive shaft through bearing, loosening oil deflector and causing a rattle). Install bearing retainer with mark 'TOP' up.

Counter Gear Cluster:—When installing new bushings, see that longer bushing placed at rear.
NOTE—On Chevrolet, bushings are diamond-bored after installation and are not furnished separately. Clearance on shaft should be .002-.004". Thrust washers formed with tang which must be aligned in case. Install shaft from front. Endplay should be .005-.025" (replace thrust washers if excessive).

CHEVROLET THREE SPEED TYPE

Used On:

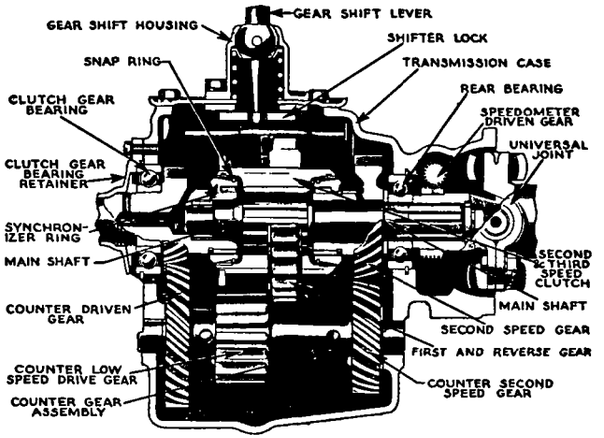
MASTER MODEL GB ('37), HB ('38), JB ('39)
MASTER DELUXE GA ('37), HA ('38), JA ('39)
HALF TON GC ('37), HC ('38), JC ('39)
¾ TON HD ('38), JD, JE ('39)
1 TON MODEL HE (1938)

NOTE:—Transmissions used on all models same except as follows:
Master Deluxe JA with Steering Column Gearshift—This transmission identical with that used on other models except for shifter mechanism in transmission case cover. See separate article on Chevrolet Transmission Control for complete adjustment and servicing data.
Half-Ton Models—Same as passenger car type except for extension on case at rear end (to make transmission interchangeable with 4 speed truck type), longer mainshaft and spacer on shaft between rear bearing and universal joint.
¾ & 1 Ton Models—Identical with half ton model except that carburized gears used which have special tooth contour. These gears must not be used with passenger car gears and may be identified as follows: **Reverse Idler Gear**—5/32" blind hole in hub between the two gears, **Counter Gear Cluster**—5/32" blind hole in hub between 15 and 22 tooth gears, **Second Speed & First-and-Reverse Sliding Gears**—5/32" blind hole on side of gears, **Clutch (Main Drive) Gear**—5/32" blind hole on shaft between gear and threaded portion (bearing must be removed to see hole).
NOTE—Transmissions with carburized gears may be identified by 'Y' or 'Z' prefix on transmission assembly number (on boss at rear of cover).

TYPE:—Constant mesh, synchro-mesh, with helical gears for second speed, sliding spur gear for low and reverse.

Synchronizing Unit:—Bronze synchronizing cones are staked in ends of sliding clutch with synchronizing rings assembled loosely within them (held by locking rings on inner ends within clutch). Synchronizing rings have prongs which engage slots on gears (between banks of clutch teeth) and revolve with gears. When clutch shifted to engage gears, ring moves toward gear until prongs strike energizing spring (in groove in gear hub) and spring resistance then engages ring with cone to effect synchronization, cone prongs then slide over spring and enter narrow wedge slots and sliding clutch engages clutch teeth on gear.

SERVICING:—Disassembly. Remove gear shift lever housing (back screws off evenly to relieve shift lever spring tension), transmission cover, interlock. Drive shifter shafts out toward front (front end of shafts .003" larger), remove shifter yokes, lock balls and springs. Remove universal joint capscrew and washer, slide joint off shaft. Remove drive gear bearing retainer screws on front of case, take off retainer. Mark main drive gear, second speed gear, and both synchronizing rings to insure reassembly in same relative positions. Use special puller, J-937,



to remove clutch shaft and main drive gear bearing, take out 14 loose rollers (mainshaft front bearing). Use special tool, J-938, installed on back of transmission case and push mainshaft out toward front (IMPORTANT—front synchronizer ring must be turned so that lug lines up between land and spline on mainshaft to avoid damage to lugs and splines), remove mainshaft from front end. Engage second speed gear and clutch sleeve, remove clutch sleeve assembly, low and reverse gear, second speed gear from case as a unit, remove second speed gear thrust washer. Expand rear bearing lock ring into case (use tool J-935), tap bearing out toward front (bearing must be removed before countershaft can be removed). Drive countershaft out toward front. To remove reverse idler, drive idler shaft lockpin into shaft (pin shorter than shaft diameter), drive out expansion plug at rear of case, remove idler shaft through this hole.

Main Gear Drive & Clutch Shaft Bearing:—Bearing retaining nut and oil-slinger are single unit with left hand thread and are staked in hole in shaft. Use special press-plate J-936 to press bearing on or off shaft. Bearing retainer mounting holes on front of case spaced irregularly to insure assembly in correct position (to align oil return holes).

CHEVROLET THREE SPEED TYPE CONT.

Clutch Sleeve & Synchronizing Rings:—To disassemble rings, turn ring until ends of ring retainer is visible through slot in sleeve, insert special pliers J-932 in slot, expand retainer to free ring, pull ring out. See that synchronizing cones are tight in sleeve (replace clutch sleeve and cone assembly if cones loose or worn). Check rings to see that they do not rock in cones.

Energizing Springs:—Use new spring whenever spring is removed. When installing springs, do not expand more than necessary to clear clutch teeth. Install springs with offset end between second and third teeth of any bank of the clutch teeth (offset prevents spring rotation).

Counter Gear Cluster:—Bushings staked in place and diamond-bored after installation. Not sold separately. Clearance on shaft .002-.004". When installing countershaft, see that thrust washers are in place at each end of counter gear cluster and that flat on forward end of shaft is horizontal and on top (flat engages clutch housing to prevent shaft turning, transmission cannot be installed unless flat properly located).

Reverse Idler Gear:—Remove old lockpin from shaft before installing, line up holes in case and shaft, use new lockpin and drive pin in so that head is approximately 1/16" beyond surface of case, peen hole to prevent pin coming out. Pin must be tight in hole to prevent oil leaks.

CHEVROLET FOUR SPEED TRUCK TYPE

Used On:

1½ TON TRUCK MODELS (1933 to 1939)
CAB OVER ENGINE MODELS VE to VH (1939)

NOTE:—This transmission optional equipment on ½ ton, ¾ ton, and 1 ton truck models.

TYPE:—Four speed, sliding spur gear type. Clutch shaft and main drive gear mounted on ball bearing at front end of transmission case. Mainshaft mounted on roller bearing at front, ball bearing at rear. Countershaft mounted on roller bearing at each end. Reverse idler gears mounted on bronze bushing on stationary shaft.

SERVICING:—Disassembly. Remove shift lever, cover, shifter shaft and fork assemblies. Lock transmission by engaging two gears at once, remove speedometer pinion, remove capscrew at rear end of shaft holding universal joint yoke on shaft, pull yoke. Take out universal joint ball retainer mounting screws, remove retainer. Take out mounting screws in main drive gear bearing retainer on front of case, drive out main drive gear and bearing toward front (use soft steel drift to avoid damage to gear teeth). Remove mainshaft front bearing, drive mainshaft and rear bearing out through rear of case, slipping off sliding gears and removing these through top of case. Drive out reverse idler gear shaft toward rear, lift out gears. Drive counter gear to rear until rear bearing clears case, remove bearing and retainer, remove counter gear assembly. Remove front bearing and plug type retainer from case by tapping on outer race.

Main Drive Gear & Mainshaft Ball Bearings:—Bearings are press fit on shaft and should be removed and installed in an arbor press (remove snap ring on clutch shaft in front of bearing before removing main drive gear bearing). When reassembling transmission see that snap rings are in place in case at either end to retain bearings.

Counter Gear Assembly:—Countershaft is integral with low speed gear and press fit in counter gear cluster. Remove and install countershaft in an arbor press.

Reverse Idler Gear:—When replacing bushings use special tool and press new bushings in, using an arbor press. Ream new bushings after installation to inside diameter of .876-.877" which will provide required clearance of .002" minimum on shaft.

CORD DRIVING UNIT (TRANSMISSION & AXLE)

Used On:

FRONT DRIVE MODEL 810 (1936), 812 (1937)

NOTE:—Driving Unit consists of a combination transmission and differential assembly in a single case (each unit in a separate compartment, must be lubricated and drained individually). Drive pinion shaft serves as countershaft (counter gear cluster splined on this shaft) and differential adjustments are disturbed by transmission disassembly. Servicing directions for both units given below.

DIFFERENTIAL UNIT.

TYPE:—Spiral bevel type. Drive from differential assembly transmitted directly to universal joint mounted on each side of driving unit by short spline shaft which is integral part of universal joint assembly (these shafts withdrawn when universals removed). Differential assembly mounted on taper roller bearings and adjusted by nuts or sleeves extending through side of case. Pinion shaft (transmission countershaft) mounted on ball bearings in transmission case.

SERVICING:—Gear Adjustment. Backlash should be .004-.008". See Differential Bearing Adjustment and Pinion Setting below.

Axle Shaft Replacement. Shafts removed with wheel assembly by driving out grooved pin at outer end of inner universal and pulling shaft out to free splined end from inner universal. Wheel bearings are double row ball type and do not require adjustment.

Inner Universal Joints. To remove (necessary when dismantling differential), take out 8 capscrews in mounting flange on side of driving unit case, withdraw universal as an assembly to free spline shaft on inner end from differential side gear. Do not lose spacer located between shafts in differential.

OVERHAUL:—Pinion Bearings. In Transmission case. See Transmission servicing directions below.

Pinion Setting:—Controlled by shims between oil pump housing and front end of driving unit case. Add shims to move pinion out or away from ring gear, remove shims to move pinion in toward ring gear.

Differential Bearing Adjustment:—Mark bearing sleeves before dismantling differential assembly, turn sleeves in to same point when reassembling. Tighten bearing cap bolts securely.

Ring Gear Backlash Adjustment:—Loosen bearing cap bolts slightly, back off one differential bearing adjusting sleeve, tighten opposite sleeve exactly same amount to avoid disturbing bearing adjustment. Backlash should be .004-.008".

TRANSMISSION UNIT.

NOTE:—Bendix electro-pneumatic transmission control is standard equipment. See separate article (Transmission Controls) for data and adjustment directions on this unit.

TYPE:—Four speed, constant mesh, synchro-mesh, helical gear type (except low and reverse), sliding spur gear (low and reverse). No direct drive, drive for each speed is from driving gear on mainshaft to driven gear of counter gear cluster splined on pinion shaft (pinion shaft takes place of conventional countershaft). Mainshaft and pinion shaft (counter gear mounting) mounted on double row ball bearing (front), single row ball bearing (rear). Gears are engaged by the sliding clutch of the synchronizing unit on the mainshaft engaging clutch teeth on the driving gear hubs (synchro-mesh gears).

Synchronizing Units. Two similar units used, front unit for second and third speeds (shifts in both directions), rear unit for fourth speed (shifts backward only). Consist of inner sleeve carrying synchronizing cups and splined to mainshaft, outer clutch unit splined to inner sleeve. Inner and outer sleeves move as a unit (spring loaded detent balls in inner sleeve engage groove in outer sleeve) until synchronizing cups engage cones on gears, when synchronization completed, outer sleeve slides on inner sleeve to engage clutch teeth on gear.

Transmission Oil Pump. Oil pump mounted in housing on front end of case and driven by countershaft. Forces oil through hollow mainshaft to gears. Shims under oil pump housing control pinion mesh. NOTE—Oil pump does not operate when transmission in neutral and engine should not be idled in neutral for long periods particularly when new (may cause mainshaft gear bushings to seize).

SERVICING:—Disassembly. Remove differential assembly (back off differential bearing adjusting sleeves to remove bearing tension before removing assembly). Place shifting mechanism in 'neutral'. Remove housing on front end of case containing shifting mechanism, and oil pump housing (do not lose shims between oil pump housing and case which control pinion mesh). Remove transmission case cover. Remove three shifter rails, interlock plungers, lock balls and springs (lock ball and spring for one lower shaft and interlock plunger between this shaft and upper shaft located at front of transmission and inserted in hole at top of case, lock ball and spring for other lower shaft and interlock ball for lower shafts at rear of transmission and inserted through hole on side of case closed by ¼" pipe plug, lock ball and spring for top shaft at rear of transmission and inserted through hole closed by hexagonal headed plug; replace these in same positions when reassembling). Mark all gears, synchronizing units, and shafts with paint to insure reassembling in same positions and meshed with same splines. Remove mainshaft locknut at forward end of case, use copper drift and drive shaft out toward rear end of case, remove mainshaft gear assembly through top of case (gears assembled on sleeve and not disturbed by removal of shaft). Remove locking nut on forward end of pinion shaft, remove speedometer and oil pump drive gear and key, use copper drift and drive shaft out toward rear of case, lift out cluster gear and sliding gear assemblies.

Reassembling:—Remove mainshaft rear bearing by tapping it out of the case and assemble on the mainshaft before installing mainshaft in case. Make certain that all parts are assembled in accordance with paint marks made before disassembly. Thrust washer on end of mainshaft gear assembly next to rear bearing should be installed with taper face toward bearing. Install shims between oil pump housing and case as required for correct pinion mesh with ring gear.

CHRYSLER—DE SOTO—DODGE FIRST TYPE TRANSMISSION

Used On:

CHRYSLER SIX CI (1932), CO (1933)
CHRYSLER EIGHT, CP (1932), CT (1933)
CHRYSLER IMP. EIGHT, CH (1932), CQ (1933)
CHRYSLER CUST. IMP., CL (1932), CL* (1933)
CHRYSLER IMP. CV ('34), CST. IMP. CW ('34) SEE NOTE
DE SOTO SIX, SC (1932), SD (1933)
DODGE SIX, DL (1932)
DODGE EIGHT, DK (1932), DO (1933)

NOTE:—All cars except CV, CW '34. Free wheeling unit mounted in a separate case bolted on the rear of the transmission case. See special Free-wheel instructions below.

Chrysler CV, CW '34. These models fitted with an Overdrive Unit bolted on the back of the transmission unit. Driven by a splined coupling from the rear of the mainshaft (unit can be removed by taking out mounting screws and withdrawing to rear to disengage splined coupling). See separate article for complete data on Overdrive Unit.

TYPE:—Constant mesh, helical gear (second and high), sliding spur gear for low and reverse (1932), helical gear (1933-34). Clutch shaft and main drive gear mounted on ball bearing. Mainshaft mounted on roller bearing (front), ball bearing (rear) and has splined extension at rear for free-wheeling unit drive. Second speed gear positioned on mainshaft by sliding clutch sleeve, adjusting washer and snap ring. Counter gear cluster mounted on roller bearings on stationary countershaft. Gears are engaged by a sliding clutch splined on the clutch sleeve which engages clutch teeth on the main drive gear and second speed gear hubs. No synchronizing unit is used.

Free-wheel Unit. Cam and roller overrunning clutch type. Inner member (cam) splined on mainshaft, outer case is integral with drive shaft and mounted on roller bearing (1932), ball bearing (1933-34) on cam at front and ball bearing in housing at rear. Free-wheeling locked out by clutch gear splined on mainshaft which engages clutch teeth cut on inner rim of case.

SERVICING:—Disassembly. Remove shifter lever and housing, transmission cover, shifter shaft and fork assemblies, free-wheeling control. Take out free-wheeling housing screws, remove unit by disengaging shaft splines from cam. Take out screw and remove countershaft and reverse idler lock plate on rear of case. Drive countershaft out toward rear to unmesh gears. Remove front bearing retainer, pull out clutch shaft, main drive gear and bearing assembly. Remove mainshaft rear bearing snap ring, shims, and washer, remove rear main bearing, then take out mainshaft assembly through top of case. Lift out counter gear cluster, being careful not to lose loose roller bearings (some models only) and thrust washers. To remove reverse idler gear, drive shaft out toward rear.

Second Speed Gear Assembly:—To remove gear, take off snap ring in front of clutch sleeves, remove shims, sleeve and gear. When assembling gear, install shims between sleeve and snap ring so that gear endplay is .002" maximum.

Mainshaft Assembly:—Endplay on mainshaft controlled by shims between main drive gear bearing outer race and bearing retainer and also between bearing inner race and snap ring on clutch shaft (forward end), spacer washer behind mainshaft front roller bearing, shims between mainshaft rear bearing inner race and snap ring and between rear bearing outer race and case (rear end). These shims must be re-installed when assembling transmission.

Counter Gear Assembly:—See that spacer installed in cluster between bearings (see note for loose roller type bearings), install bronze thrust washers at each end of shaft with spacer washer (when used) between gear cluster and rear thrust washer. Endplay should be .002".
NOTE—To assemble loose roller bearings, install arbor or dummy shaft in gear cluster, coat ends of gear with medium cup grease, install rollers (grease will hold rollers in place). Leave dummy shaft in place until gear cluster installed in transmission, then push out dummy shaft with countershaft as it is installed.

NEW PROCESS FREE WHEEL UNIT

FREE-WHEEL UNIT:—Disassembly. To remove unit from housing, take off nut on universal joint flange, pull flange and brake drum. Take off rear bearing retainer (do not lose gaskets), remove bearing snap ring, remove free-wheel unit and bearing. To disassemble unit, take out retainer ring and adjusting plate in outer case, withdraw bearing, cam, and roller assembly.

Assembly. See that roller bearing assembly installed on cam so that rotation of bearing against energizing spring pressure will locate rollers over release notches on cam lobe flats (roller assembly consists of two rollers at each cam shoe, larger roller nearest shoe, smaller roller away from shoe). Spring must be in closed channel in retainer.

Adjustment. When assembling free-wheel unit on transmission case, install gaskets between rear bearing retainer and free-wheel housing as required so that rear bearing endplay is .002".

CHRYSLER - DE SOTO - DODGE - PLYMOUTH SECOND TYPE TRANSMISSION

Used On:

CHRYSLER SIX, MODELS CA, CB (1934)
DE SOTO SIX, MODEL SE (1934) SEE NOTE
DODGE SIX, DP (1933), DR, DS (1934)
PLYMOUTH STD. 6, PC ('33), PF, PG ('34) SEE NOTE
PLYMOUTH DELUXE 6, PD (1933), PE (1934)

NOTE:—All Models. Free-wheeling unit used which is mounted on rear end of mainshaft within transmission case. See special Free-wheeling instructions below.

DeSoto Model SE. This model has a shaft extension at the rear end of the transmission case and an additional bearing in the extension housing. Serviced in the same manner as other models.

Plymouth Std. Models. Free-wheeling not used but transmission case identical with other free-wheeling models. Serviced in same manner except that free-wheeling instructions may be disregarded.

1935 & Later Models—Equipped with Warner Transmissions. See Warner Transmission articles for complete data.

TYPE:—Constant-mesh (second and high), all helical gear type. Same as type used on earlier models (see preceding article) except that free-wheeling unit mounted with transmission case.

SERVICING:—Disassembly. Remove shift lever and housing, transmission cover, shifter shaft and fork assemblies, free-wheel clutch fork (remove plug and spring in case). Take out free-wheeling drive shaft bearing retainer screws on rear end of case, withdraw entire free-wheel unit and mainshaft assembly. Take out front bearing retainer screws on front end of case, withdraw clutch shaft and main drive gear assembly. Remove countershaft lock plate screw, take off lock plate, drive countershaft out at the rear of the case using special arbor (dummy shaft) which will retain loose rollers used on shaft. Lift counter gear cluster out, taking care not to lose the loose rollers or thrust washers. To remove reverse idler gear, drive shaft out toward rear.

Mainshaft Assembly:—Free-wheeling unit must be dismantled before removing from mainshaft (see instructions below). Mainshaft endplay controlled by adjusting washer between free-wheeling cam and snap ring at rear end of shaft (mainshaft mounted on roller bearing in free-wheeling case at rear end). When installing mainshaft see that front bearing rollers are in place in main drive gear (use cup grease to hold these loose rollers in place while installing shaft).

Second Speed Gear Assembly:—To remove gear, take off snap ring, thrust washer, and shims in front of sliding clutch sleeve, remove sleeve and gear. When assembling gear, install shims between washer and sleeve so that gear endplay is .002" maximum.

Counter Gear Assembly:—See that rollers are in place in gear cluster, coat gear end with cup grease to retain rollers while installing (arbor or dummy shaft must be installed in cluster, see that spacer in place between bearings). Install thrust plate (next to gear cluster), thrust washer (next to case) at each end of gear cluster. Drive arbor out with regular countershaft, installing shaft at rear of case. Gear endplay must not exceed .005".

Gear Shift Lever Adjustment:—Check clearance between lower end of shift lever and each end of slot in shifter rail with lever in high gear position. Should be equal. Adjust by loosening locknut on adjusting screw in side of shift lever housing and turning screw.

NEW PROCESS FREE WHEEL UNIT

FREE-WHEEL UNIT:—Disassembly. To remove unit from housing, take off universal joint flange nut, pull flange, remove snap ring on bearing inside housing, pull unit out of housing. To disassemble, take out retainer ring and adjusting plate in outer case, withdraw case. To remove cam from mainshaft, remove snap ring, adjusting washer, and shims at rear end of shaft, pull cam off.

Assembly. See that shims replaced between adjusting washer and cam at rear of mainshaft (these control mainshaft endplay), and between rear bearing and snap ring in rear retainer (these control free-wheel unit endplay).

FORD, LINCOLN ZEPHYR, MERCURY TYPE

Used On:

FORD V8, PASS. & COMM'L. (1932 to 1939)
LINCOLN-ZEPHYR, ALL MODELS (1936 to 1939)
MERCURY V8, MODEL 99A (1939)

NOTE:—Ford '60' Models. Beginning with engine No. 395343 (10-11-37), tooth pitch of intermediate gears changed from 11 to 9¼. When replacing old type intermediate (second speed) gear and countergear, use new type 74-7103-B (18 tooth) Intermediate Gear and 74-7113-D (19 tooth) Countergear with new type floating bushings. Floating bushings used in countergear assembly beginning with Engine No. 460104 (12-3-37). See Counter gear Assembly below.

Ford '85' Models. Transmissions with sliding spur low-and-reverse gear used on some models. This transmission serviced in same manner as others.

Lincoln-Zephyr '38-39. Shifter shafts and lever assembly mounted in cover on side of transmission case (no opening in top of case). Serviced in same way as Ford transmissions.

TYPE:—Constant-mesh, synchro-mesh, helical gear (second & high), sliding gear (low & reverse. Clutch shaft and main drive gear mounted on ball bearing at front of case. Mainshaft mounted on roller bearing (front), ball bearing (rear). Countershaft mounted on roller bearings on stationary countershaft with thrust washer at each end. Gears are engaged by a sliding clutch sleeve (outer sleeve of synchronizing unit) which engages clutch teeth on the main drive gear and second speed gear hubs.

NOTE—Countershaft on '60' model mounted on bushings pressed in gear assembly (first cars), floating bushings (later cars). See Countergear data below.

Synchronizing Unit:—This unit consists of an inner hub splined on the mainshaft with synchronizing rings at each end and outer clutch sleeve splined on this hub. Sleeve is centered on hub by spring-loaded detent balls (mounted in holes in hub, engage groove in sleeve) so that entire synchronizing assembly moves as a unit, when clutch sleeve shifted to engage gears, until synchronizing rings engage synchronizing cones on gear hubs. Clutch sleeve then slides further to engage clutch teeth on gears (synchronizing rings prevent this engagement until synchronization completed).

Strut Type Blocking Synchronizer—Synchronizer rings are loose in ends of clutch sleeve and are actuated by struts assembled in slots in inner clutch sleeve and engaging notches in synchronizer rings. Struts are centralized in clutch sleeve assembly by the regular poppet balls and springs so that struts move with the clutch sleeves during the initial movement to engage the synchronizer rings with the cones on the gear hubs. Teeth on outer rim of synchronizer rings block or prevent gear engagement until synchronization completed when the final movement of the outer clutch sleeve causes the clutch teeth on the inner rim of the sleeve to slide through the synchronizer ring teeth to engage clutch teeth on gear hubs.

Wire Bound Strut Type Blocking Synchronizer—Same design as Strut Type (above) except that poppet balls and springs not used. A lock ring or wire is installed in outer clutch sleeve and engages notches on struts to centralize struts in sleeve.

SERVICING:—Disassembly. Remove shift lever, cover, shifter shaft and fork assembly. Take out capscrews in universal joint front yoke, remove yoke from shaft. Take out capscrews mounting universal joint housing on rear of case, remove housing. Remove locking pin and drive out countershaft. Take out bearing retainer screws on front of case, withdraw clutch shaft main drive gear and bearing assembly. Remove mainshaft rear bearing, withdraw mainshaft assembly through top of case.

Synchronizing Unit:—Can be removed from front end of mainshaft without being dismantled. If clutch sleeve is to be removed from the inner clutch hub mark both parts and reassemble in same positions, use extreme care not to lose detent balls and springs which will jump out when parts are separated.

Strut Type Synchronizer Assembly—Mark rings as well as inner and outer clutch sleeves before disassembly to insure reassembling in same relative positions. When installing struts, make certain that they engage poppet balls (Strut Type) or that locking wire engages notches in struts and is installed with hook on open end engaged between two clutch teeth on outer sleeve midway between struts (Wire Bound Strut Type). Wire Bound Strut Type Synchronizer is mounted on mainshaft as an assembly with the second speed gear as shown below.

Second Speed Gear Assembly:—Positioned on mainshaft by thrust washers at front and rear. To remove gear, insert wire through oil hole at center of gear between teeth, rotate gear until wire can be pushed through hole in bushing, depress plunger until locking key is freed, push key forward to release rear thrust washer, turn washer until prongs (engaged in slot in splines) line up with shaft splines, move washer to rear slightly. Move key back to free front washer (plunger will engage key at center position and must be depressed again to allow key to be shifted further), withdraw wire and move second speed gear back to expose front thrust washer, turn washer until prongs are freed from splines, remove washer and gear. When installing gear, make certain that both thrust washers are turned so that prongs engage slots in splines (to prevent endwise movement) and that key engages both washers (to prevent rotation). See that plunger locks key in place.

Second Speed Gear Assembly (with Wire Bound Strut Type Synchronizer):—Second speed gear and inner sleeve of synchronizer are mounted as an assembly (retained on mainshaft by snap ring at forward end of synchronizer clutch sleeve). To dismantle assembly, remove snap ring, pull clutch sleeve and gear off shaft. When reassembling, make certain that second speed gear turns freely with synchronizer assembled and snap ring installed.

Counter Gear Assembly:—When installing, see that spacer is in place in gear cluster between roller bearings (See '60' note below). Install small thrust washer at forward end with tongue engaging slot in case, large thrust washer at rear.

NOTE—On '60' models, floating bushings are used. Spacer (74-7115) must be installed on shaft between bushings.

Reverse Idler Gear:—Shaft retained by countershaft locking pin and may be removed after pin driven out.

FORD FOUR-SPEED TRUCK TYPE

Used On:

1½ TON TRUCK MODELS (1932 to 1939)
1 TON TRUCK MODELS 81U, 81T (1938)

NOTE:—This transmission optional equipment on all Commercial or half-ton models.

TYPE:—Four Speed, sliding spur gear type. Clutch shaft and main drive gear mounted on ball bearing at front end of transmission case. Mainshaft mounted on roller bearing in main drive gear at front end, ball bearing in case at rear. Counter gear cluster mounted on roller bearings on stationary countershaft. Reverse idler gears mounted on bronze bushing on stationary shaft.

SERVICING:—Disassembly. Remove shift lever, cover, shifter shaft and fork assembly. Remove universal joint cover, take out capscrew on end of shaft within universal joint yoke, pull yoke. Take out mounting screws within rear bearing retainer, remove retainer. Take out screws in bearing retainer on front end of case, remove retainer, withdraw clutch shaft main drive gear and bearing assembly. Remove mainshaft front bearing. Withdraw mainshaft and bearing assembly through rear of case, removing sliding gears through top of case. Remove countershaft and reverse idler shaft lock plate, drive out countershaft, lift out counter gear cluster. Drive out reverse idler shaft, lift out reverse idler gears.

Main Drive Gear Bearing Assembly:—Bearing locked on shaft by snap ring. See that oil baffle assembled on shaft between bearing and drive gear. When installing see that snap ring which locates bearing in case is in place in bearing hole.

Mainshaft & Rear Bearing Assembly:—Assembled in same manner as main drive gear bearing (oil baffle at inner end, located in case by snap ring in bearing hole).

Counter Gear Assembly:—Bearings positioned on shaft by spacer within gear cluster. See that locking plate installed on rear face of case to prevent countershaft movement.

LINCOLN TRANSMISSION

Used On:

ALL V12 MODELS (1932 to 1939)

TYPE:—Constant-mesh, synchro-mesh (Second and High) helical gear type with sliding helical gear for Low and Reverse. Clutch shaft and main drive gear mounted on ball bearing in front end of case. Mainshaft mounted on roller bearing at front, ball bearing at rear. Shaft extends through into free wheel case with integral free wheel cam on the rear end (cars with free wheeling). Counter gear cluster mounted on roller bearings on stationary countershaft with ball thrust washer at each end. Gears are engaged by sliding clutch sleeve (outer member of synchronizing unit) which engages clutch teeth cut on main drive gear and second speed gear hubs.

Synchronizing Unit:—This unit consists of an inner hub splined on the mainshaft with synchronizing rings at each end and outer clutch sleeve splined on this hub. Sleeve is centered on hub by spring-loaded detent balls (mounted in holes in hub, engage groove in sleeve) so that entire synchronizing assembly moves as a unit, when clutch sleeve shifted to engage gears, until synchronizing rings engage

LINCOLN CONT.

synchronizing cones on gear hubs. Clutch sleeve then slides further to engage clutch teeth on gears **Strut Type Blocking Synchronizer.** Synchronizer rings are loose and are actuated by three struts assembled in slots in inner clutch sleeve which engage notches in the rings. Struts are centered in the synchronizer assembly by the regular poppet balls and springs (ball and spring entered through hole in center of strut). Struts move with sleeves during initial movement to engage synchronizer rings. Teeth on rings block or prevent gear engagement until synchronization completed when clutch teeth on inner rim of outer clutch sleeve slide through the synchronizer ring teeth to engage clutch teeth on gear hubs.

SERVICING:—Main Drive Gear & Bearing Assembly. To remove, take off bearing retainer on front of case, withdraw assembly. Bearing retained on shaft by locking nut and locking ring. Oil baffle is assembled in front of bearing (inner ring clamped between bearing inner race and locknut on shaft, outer ring clamped between outer race and retainer).

Synchronizing Unit:—Should be removed from shaft as a unit and dismantled in special fixture, Part No. 16Z-58861. Fixture allows detent balls and springs to be removed one at a time and lessens chance of losing these parts. When installing unit, see that internal groove in inner sleeve (at end), and extended hub of outer clutch sleeve are toward front NOTE—Detent balls engage this groove in clutch hub when second speed is engaged and assist in keeping gears in mesh.

Strut Type Synchronizer. Inner and outer clutch sleeves marked by etched line. Make certain that these marks lined up when reassembling and that synchronizer rings replaced in same relative positions. See that struts engage poppet balls and springs and that balls are free in struts so that they engage groove in outer clutch sleeve. Backlash between inner and outer sleeves should be .000-.001" (selective fit). Force required to break poppets (so that outer sleeve slides on inner sleeve) should be 6-8 lbs. with struts held stationary on inner sleeve.

Second Speed Gear Assembly:—Gear mounted on taper roller bearings on mainshaft and is locked in place on bearing cup (single unit for both bearings) by locking ring screwed in gear hub at rear. Bearing cones are held in position on mainshaft by locking ring at forward end. Spacer between cones controls bearing endplay.

Counter Gear Assembly:—Countershaft retained by locking plate at rear end. Counter gear roller bearings located in gear cluster by bushing at inner end of each bearing.

LINCOLN FREE WHEEL UNIT

DESCRIPTION:—Cam and roller type. Cam or hub is integral with transmission mainshaft. Outer ring or sleeve is unit with drive shaft. Eight single rollers located in pockets in hub. Locking device consists of a sliding gear or clutch splined on the mainshaft which can be shifted to engage clutch teeth on the inner rim of the free wheel sleeve so that the drive is directly through the sleeve to the drive shaft.

OPERATION:—Similar to other roller type free wheel designs. Rollers are wedged between cam and sleeve when engine is driving rear wheels. When car is coasting, rollers move in cam pockets to clear sleeve so that drive shaft and sleeve can overrun or rotate faster than the cam which always rotates at transmission mainshaft speed.

Control Mechanism:—Consists of a control fork (which engages locking gear) positioned on free wheel shifter shaft by a spring. Free wheel control lever is linked to forward end of shaft. Locking plunger for shifting shaft is located within transmission case. Automatic lock-out for reverse consists of a pin on the control fork directly behind the low and reverse shifter rail. This pin is forced back when transmission shifted into reverse, moving the shifter fork on the shifter shaft (against spring tension) to engage the locking gear, the spring returning the shifter fork and gear to free wheeling position when transmission shifted out of reverse.

HUDSON & TERRAPLANE TYPE

Used On:

HUDSON 6 & 8, ALL MODELS (1934 to 1939)
TERRAPLANE, ALL MODELS (1932-38)

NOTE:—Transmission used with Electric Hand (optional on all models except '112') similar to standard model except for special shifter mechanism and mounting of Electric Hand units on transmission case (Power Unit, Gear Abutment Shift Rail Switch, Clutch Pedal Circuit Breaker). See article on Electric Hand for servicing and adjustment of these units. Transmission serviced in same manner as standard model below.

Handy-Shift (1939). Transmission cover has been modified to include a selector plate (sliding on two guide pins in cover) and actuated by the selector cable to shift the gear engagement shift finger back and forth between the low-reverse and second-high shifter forks at neutral, and a gear engagement lever to which the shift finger is linked. See separate article for Handy-Shift Transmission Control service data.

Electric Hand:—Bendix type transmission control optional on all models beginning with 1935. See separate article (Transmission Controls) for complete data and adjustments for this Electric Hand.

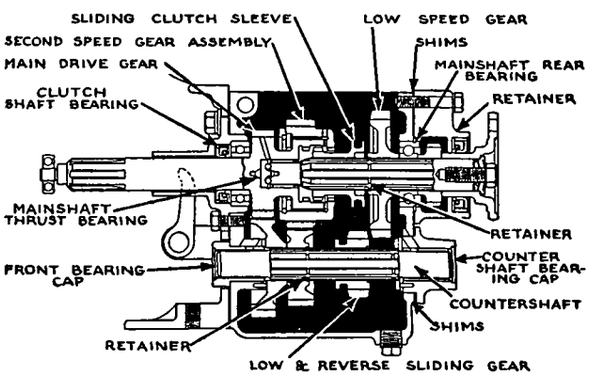
Hudson 1932-33 Models. Warner transmission used on these models. See Warner Transmission article for data.

1932-33 Terraplane Models. Transmission similar in design to later type except that Interlock Bars and Sliding Reverse Idler Gear not used (countershaft sliding gear shifted forward to engage reverse).

Hudson '112' Model. Shifter rail lock bars not used on Model 89 (1938). Single lock bar used for Second-High only on Models 90, 98 (1939).

TYPE:—Constant-mesh, helical gear (second and high), sliding spur gear (low and reverse). Main drive gear and clutch shaft mounted on ball bearing in transmission case. Mainshaft mounted on bushings (1932-33), needle bearings (1934 on) at forward end, ball bearing at rear end. Mainshaft end thrust taken by a ball thrust bearing at the forward end of the shaft. Second speed gear mounted on the main drive gear clutch hub and positioned by thrust washer at each end. Low speed gear is fixed on mainshaft by a lock ring (this gear does not move, low engaged by shifting gear on countershaft). Counter gears splined to countershaft which revolves in bushings in bearing cap at each end of transmission case. Reverse idler assembly consists of stationary gear mounted on bushings on stationary shaft and sliding gear splined to stationary gear sleeve (this gear shifted in conjunction with low speed sliding gear to engage reverse). Second and high speeds engaged by sliding clutch sleeve splined to mainshaft which engages main drive gear or second speed gear clutch teeth (within second speed gear assembly).

SERVICING:—Disassembly. Remove transmission cover and shift lever assembly. Disconnect shift rail lock bar links, remove links and lock bars. Remove clutch housing (if taken off car as assembly with transmission). Use puller J-820 and remove universal joint flange. Remove speedometer drive gear housing and gear. Remove lock ball spring caps (on shifter rail lock brackets), take out lock ball springs, balls, plungers, remove brackets (do not lose shims). Take out shifter lock screws and remove shifter rails and forks. Remove three capscrews in main drive gear bearing retainer in front of case, remove retainer (tap with soft hammer if necessary). Drive low and reverse gear on mainshaft back slightly (rear bearing will move with gear) to expose locking ring, remove locking ring using special drift J-786. Use special puller J-352 and remove main-



shaft and rear bearing through rear of case, lift low speed gear and clutch sleeve out through top of case. Remove main drive gear and second speed gear assembly out through top of case.

Reverse Gear Removal (1934-35). Take out two capscrews in shaft cap at rear of case, remove cap. Remove shift rail lock strap pivot screw on side of case (this screw locks shaft), drive shaft out toward rear, lift out gear assembly.

Reverse Gear Removal (1936-39). Take out two capscrews in reverse shaft cap on rear of case, remove cap and shaft (shaft pinned in cap). Lift out gear assembly.

Counter Gear Removal. Take out capscrews in rear bearing cap, remove bearing cap, spacer and thrust washer (do not lose shims under bearing cap flange). Use special drift J-786, insert beveled edge between countershaft drive and second gears (at front of case), separate gears, forcing countershaft back until drive gear slips off splines at forward end of shaft. Turn gear until splines butt against shaft splines (to hold shaft), insert drift through rear bearing hole in case, drive second speed driving gear forward on shaft (do not drive gear entirely off shaft). Move countershaft to one side, move low and reverse shifter lever to neutral position. Hold countershaft gears together and remove countershaft from case at the rear. Remove low and reverse intermediate shift lever stud and take out lever.

HUDSON & TERRAPLANE CONT.

Take out small Allen setscrew on right hand side of case, drive low and reverse shifter fork shaft out of case. Remove cotter pin and castellated nut on bottom of case, take out reverse gear shifter lever fulcrum, pickup lever, shifter lever, shifter, pickup plunger and plunger spring.

Main Drive Gear, Second Speed Gear & Clutch Shaft Bearing:—Mainshaft front bearing loose in main drive gear and can be lifted out (26 needle rollers for main bearing, 7 balls for thrust bearing), after mainshaft has been removed. To disassemble second speed gear, insert one jaw of lock ring remover J-449 through milled opening in gear to grip lock ring, place opposite jaw just above lock ring. Compress lock ring and lift one side out of groove, use blunt punch to tap other side out. Remove second speed gear and thrust washers. Use bearing puller J-782 to remove clutch shaft bearing from shaft, tool J-779 to re-install bearing. When replacing needle roller retaining ring use tool J-780. Second speed gear bushing (steel-backed, babbitt-lined) diamond bored and gear should be replaced if clearance excessive. Clearance should be .0005". Endplay .009". When installing this gear, place the bakelite thrust washer on first, install gear, then install outer thrust washer with babbitt face in, install retainer with gap in ring ¼ turn away from second speed gear slots, use tool J-448-5 to seat snap ring in groove. Use cup grease to hold mainshaft thrust balls and needle rollers in place until mainshaft can be entered.

Mainshaft & Low Speed Gear:—To install, assemble bearing loosely on rear of shaft, install low speed gear and sliding clutch (collar to rear) on shaft inside case, place low speed gear locking ring in groove using cup grease to hold parts in place, hold shaft firmly against thrust bearing balls, use tool J-779 to drive bearing forward on shaft (this will drive gear in place against lock ring). When installing bearing retainer, install shims between retainer and transmission case as required so that mainshaft endplay is .008-.012" (use dial indicator to check).

Counter Gear Assembly:—Use tool J-450 to remove old bushings, J-780 to install new bushings and line ream with bearing caps in place in case (expansion plugs removed). Use tool J-781 to install second gear retainer in groove. Install thrust washer on rear end of shaft, bronze spacer between thrust washer and case. Install shims between rear bearing cap and case as required so that endplay in countershaft is .005-.009" (use a dial indicator to check). Shaft clearance in bushings should be .0005".

Reverse Gear Assembly:—Remove and install bushings in an arbor press or with J-488 hand bushing press. New bushings finished to size and do not require reaming. Clearance should be .003". Install sliding gear on stationary gear sleeve with collar toward rear (1934-35), toward front (1936 on). See that locking dowel screw installed to lock shaft (1934-35) or that shaft pinned to bearing cap before cap installed on case (1936 on).

Shifter Rail Lock Bar Adjustment. Use second type with bar stock lock bars to service first type with stamped lock bars (used in 1934, early 1935 cars). When installing lock bar guides, shim between guides and case to secure .005" clearance between lock bars and outer ends of plungers. Adjust links so that bar is drawn down sufficiently to release plunger (bar slot aligned with plunger) with clutch pedal depressed one half.

NASH & LAFAYETTE 1932-38 TYPE

Used On:

LAFAYETTE, 110 ('34), 3510 ('35), 3610 ('36)
NASH, ALL MODELS (1932-38)
NASH-LAFAYETTE, 3710 (1937), 3810 (1938)

NOTE:—Warner Transmission and Warner Overdrives used on some models. See Warner Transmission articles for data on these cars.

1938 Models. Evans Vacuum type Gear Shift Control is optional. See separate article (Transmission Controls for data on this equipment). Transmissions are same design as those used on other models

TYPE:—Constant-mesh, synchro-mesh, helical gear (second and high), sliding spur gear (low and reverse). Mainshaft mounted on roller bearing in main drive gear with thrust balls in bearing recess ahead of shaft. Entire assembly mounted on taper roller bearing at each end of transmission case with bearing adjustment at rear end (shims under rear bearing retainer flange) or on ball bearings (no adjustment). Countershaft mounted on bronze or babbitted bushings on stationary shaft with thrust washers at each end.

Synchronizing Unit. Consists of synchronizing cones on hubs of main drive gear and second speed gear and drums on ends of sleeve splined to mainshaft. This sleeve is centered within the outer clutch sleeve by spring-loaded detent balls so that they slide as a unit when outer clutch sleeve is shifted to engage gears until synchronizing drums and cones engage. After synchronization completed, clutch sleeve slides further to engage gear.

SERVICING:—Disassembly. Remove shift lever, cover, shifter shaft and fork assemblies, taking care not to lose balls and springs. Remove gear bearing retainer, being careful not to lose bearing adjusting shims. Take off nut on end of countershaft, drive countershaft out. Remove bearing retainer on front end of case, withdraw clutch shaft main drive gear and bearing assembly. Withdraw mainshaft assembly.

Synchronizing Unit:—Can be removed from mainshaft without being dismantled. If unit is disassembled, mark both sleeves (to insure reassembly in same positions), and use extreme care not to lose detent balls and springs which will spring out when inner synchronizing sleeve is freed from outer clutch sleeve.

Second Speed Gear Assembly:—Gear positioned by thrust washer bearing against shoulder on mainshaft at rear (not used on all models), thrust washer turned so that prongs on inner edge engage slots in splines (locked by locking plunger and spring) at front. To remove gear, depress plunger with wire (hole provided in gear hub through which to insert wire on some models), turn front thrust washer so that prongs line up with splineways on mainshaft, remove washer and gear. When installing gear, see that washer is turned so that prongs are engaged in notches in splines and securely locked by plunger. Gear endplay controlled by thrust washer (furnished in various thicknesses).

Mainshaft & Bearing Assembly:—When installing, see that thrust plate and thrust balls are in place in mainshaft bearing pocket in main drive gear, tighten front bearing retainer screws securely and adjust taper roller bearings by installing shims as required under rear bearing retainer.

Counter Gear Assembly:—See that thrust washers are in place at each end of counter gear cluster to control endplay.

NASH 1939 TYPE

Used On:

NASH-LAFAYETTE, MODEL 3910 (1939)
NASH AMBASSADOR SIX, 3920 (1939)
NASH AMBASSADOR EIGHT, 3980 (1939)

NOTE:—Steering Column Gear Shift—See separate 'Nash Transmission Control' article for complete adjustment and servicing data for the control used with this type transmission.

Overdrive—Warner Model R6 Overdrive unit is optional equipment. Disassembly data given below for this overdrive unit. See also Warner Model R6 Overdrive service article.

TYPE:—Constant-mesh (all speeds), synchro-mesh (second and high) all helical gear type. Low and reverse gears are free to revolve on mainshaft (these gears always in mesh with countershaft gears) and are engaged by a sliding clutch sleeve splined on the mainshaft which engages clutch teeth on the gear hubs. Main drive gear (clutch shaft gear) mounted on ballbearing in front end of case. Mainshaft is mounted on pilot roller bearing in drive gear hub (at front), ball bearing in case (rear) and extends through into overdrive case. Shifter mechanism consists of a yoke on a vertical shaft within the transmission case on the right side which controls the sliding clutch sleeve (rear shaft of low-and-reverse, forward shaft for second-and-high). Detents consist of spring loaded plungers on underside of shifter plate which engage sectors on the shafts. A two-plunger interlock is located in a boss between the two shafts. Adjustment screws which serve as stops for the front (second-and-high) shaft are located in front and right sides of transmission case. A reverse lockout lever for the overdrive unit is located at the rear of the transmission case and is operated by a lever on the low-and-reverse shaft.

Synchronizing Unit (Second-and-High)—Wire-bound Strut Type Blocking design. Synchronizer rings are loose in ends of inner clutch sleeve and are actuated by struts assembled in slots in inner clutch sleeve and engaging recesses in synchronizer rings. Struts are centralized by locking wire or ring within outer clutch sleeve so that struts move with outer sleeve to engage synchronizer rings during initial movement of sleeve (inner sleeve is stationary on shaft and has no part in synchronizing operation). Teeth on outer rim of synchronizer rings block or prevent gear engagement until synchronization completed when the final movement of the outer clutch sleeve causes the clutch teeth on the inner rim of the sleeve to slide through teeth on synchronizer rings and engage clutch teeth on gear hubs.

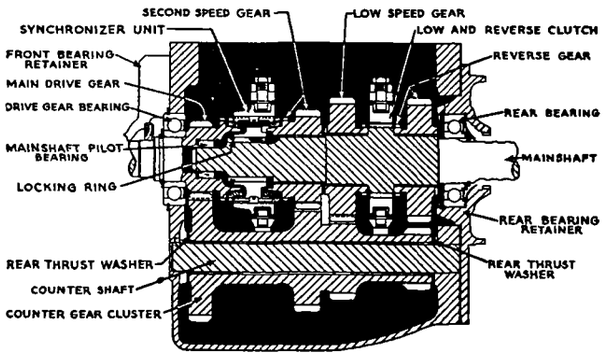
SERVICING:—Disassembly Note—Overdrive can be dismantled and removed (for work on overdrive unit only **without disturbing transmission assembly** or transmission can be disassembled (for work on transmission only) **without disturbing overdrive assembly** if disassembly directions given below are followed closely.

Overdrive Disassembly (without disturbing Transmission)—Remove companion flange at rear of overdrive case, loosen screws holding overdrive unit on rear of transmission case, move overdrive toward rear and drive shaft toward front (into overdrive case) to prevent free-wheeling unit pulling apart and use extreme care to prevent adapter

NASH 1939 TYPE CONT.

plate (rear bearing retainer) from moving away from transmission case—**if bearing retainer allowed to move ¼" toward rear, synchronizer will come apart requiring complete dismantling of transmission.** As soon as overdrive has been separated from transmission sufficiently, install one bolt to retain adapter on transmission case, remove overdrive case, pull out reverse release pin. Pull rear shaft off, using rubber band to retain free-wheel rollers, remove retaining screw and washer (in recess in free-wheel cam), remove cam and front thrust washer. Remove clutch and planet gear assembly (do not disassemble unless required—planet gears are split type and must be properly meshed in clutch gear). Sun gear is retained by snap ring on forward side of rear bearing retainer and cannot be removed without dismantling transmission.

Transmission Disassembly (without disturbing Overdrive unit):—Remove shift levers on top of transmission case, transmission cover and gasket. Install spacer or large nut on each shifter shaft, re-install shaft nuts and washers (this will prevent dis-assembly of shafts and detent and interlock plungers).



Straighten locks on fork stud nuts (on top of shaft lugs above forks), remove nuts. Lift both shafts and mounting plate out through top of case as an assembly leaving forks in case. Remove forks being careful not to drop the two fork shoes on each fork in case (remove overdrive oil trough before taking out rear fork). Remove countershaft (use mandrel SE-568 inserted through front end of case) and allow counter gear cluster to drop down in case. Remove overdrive mounting bolts on rear of transmission case, separate adapter plate (rear bearing retainer) from transmission case and withdraw complete overdrive assembly, adapter plate, and mainshaft assembly through rear of case as a unit (use bolt to hold adapter plate and overdrive case together to prevent overdrive coming apart). Disassemble mainshaft units as directed below. Take out front bearing cap mounting screws on front of case, withdraw bearing cap, main drive gear, and bearing assembly through front of case. Lift out counter gear cluster and thrust washers. To remove reverse idler gear, drive shaft out toward rear being careful not to lose key in shaft which engages transmission case.

Transmission Disassembly (Models without Overdrive):—Proceed in exactly the same manner as directed above for transmissions with overdrive and disregard all overdrive data.

Mainshaft Assembly:—Parts are assembled on each end of shaft in distinct groups (serviced separately as directed below) as follows: Reverse Gear, Rear Main Bearing, and Bearing Retainer (Rear End); Low Speed Gear, Second Speed Gear, and Synchronizer (Front End).

Reverse Gear & Rear Main Bearing—To disassemble (with overdrive removed from shaft), free snap ring on front face of retainer at bearing outer race, press shaft and bearing out of retainer toward front (retainer has oil seal or oil shedder in bearing recess and sun gear is mounted on rear face—see note below). Remove snap ring on shaft at rear of bearing, press speedometer gear (plain type transmission only) and bearing off shaft, remove snap ring (this ring holds bearing in retainer and cannot be taken off until after bearing removed from shaft), remove thrust washer and reverse gear. Assemble parts in same order and make certain that one end of bearing snap ring coincides with notch in retainer, use pry bars or screwdrivers to seat snap ring firmly in groove.
NOTE—Sun gear is splined in bearing retainer and retained by snap ring at forward end (under oil shedder). If necessary to remove sun gear, take out snap ring and pull sun gear out.

Second Speed & Low Speed Gears and Synchronizer Assembly—Entire assembly retained by snap ring on shaft in front of synchronizer unit inner sleeve. To disassemble, remove snap ring, remove synchronizer unit parts (mark rings, outer sleeve, inner sleeve to insure reassembling in same relative positions), thrust washer and key, second speed gear, thrust washer, low speed gear, low-and-reverse clutch sleeve. Reassemble in same manner and note particularly the following points: low speed gear thrust washer lug must be located in gear slot, second speed gear thrust washer must be installed with oil groove toward gear and key installed to retain washer, second speed synchronizer ring must be installed first and synchronizer assembly then driven on shaft and retained by snap ring (use sleeve No. SE-589 to install synchronizer). CAUTION—Synchronizer ring must be positioned so that notches align with struts in synchronizer sleeve or assembly will be damaged when driven on shaft. Synchronizer strut lock ring must be installed with hook on end midway between two struts and engaged between two teeth on outer clutch sleeve (synchronizer will not operate if gap in ring placed at strut so that strut is free to move endwise).
NOTE—Synchronizer assembly will be facilitated if three 2" lengths of .003" shim stock (tapered to ¾" at ends) are inserted directly above struts to retain lock wire in strut notches while spring is compressed to allow assembly of outer clutch sleeve on inner hub.

Mainshaft Installation & Endplay Adjustment—Mainshaft assembly should be installed in transmission with main drive gear (and pilot bearing) in place and counter gear cluster in case but suspended on assembling mandrel (see Counter Gear Assembly below). With high speed gear synchronizing ring in place (struts engaging notches in ring), insert mainshaft through rear of case so that forward end enters pilot bearing in main drive gear. Hold mainshaft so that rear bearing retainer is tight against rear face of case, check endplay of synchronizer bronze clutch ring. Total endplay should be .020". Adjust by installing steel shims between rear bearing retainer and transmission case (1-3 shims used normally, additional shim may be installed if necessary).

Main Drive Gear & Bearing Assembly:—Bearing retained on shaft by washer and snap ring and can be removed after snap ring has been freed. When assembling drive gear, make certain that oil seal in retainer is in good condition and saturate with engine oil, see that snap ring in place on bearing outer race, assemble in transmission case and install sufficient gaskets between retainer and case so that snap ring held firmly in place without any clearance between retainer and face of case. Mainshaft pilot bearing is retained in drive gear hub by a lock ring.

Counter Gear Assembly:—Install gears in case with thrust washers at each end (washer tongues must engage notches in case above shaft hole) using assembling mandrel SE-568 inserted through front end of case. After mainshaft assembly installed, drive countershaft in through front of case so that mandrel driven out at rear (use wire loop to lift counter gear, if necessary for shaft alignment). Shaft prevented from rotating by setscrew in forward end which engages notch in case.

Reverse Gear:—To assemble, lubricate gear, install with shoulder on gear toward front, drive shaft in from rear end so that key in shaft lines up with notch in case.

Shifter Assembly Installation & Adjustment:—Lubricate fork shoes before installing, make certain that lower ends of vertical shafts engage pivot plugs in bottom of transmission case and that shift fork stud nuts are securely locked after being tightened. Use sealing compound on gasket under shift plate and see that plate is located by two dowels on transmission case (dowel pins must not project above top surface of plate). Adjust mechanism as follows:

Low-and-Reverse Clutch—Install operating lever on upper end of shaft and check operation. With lever in neutral position (detent plunger engaging center notch on sector), outer clutch sleeve should be centered on shaft gear and fork shoes should be free in clutch groove. To adjust, loosen fork stud nut, shift position of fork in relation to lever on shaft. Tighten nut securely and lock with lock plate after adjustment completed.

Synchronizer (Second-and-High) Clutch—Install lever on forward shaft, place lever in neutral position (detent plunger engaging center notch in sector), check to see that outer clutch sleeve centered so that both synchronizer rings free and that play is equal. Adjust in same manner as low-reverse clutch by loosening fork stud nut and shifting fork in relation to shaft. Operate lever to engage second speed and check gear engagement and detent and interlock operation. Detent plunger should engage second speed notch in shaft sector and interlock plunger should be seated fully in notch with low-reverse shaft sector with slight clearance and should prevent operation of this shaft. Adjust by loosening locknut and turning limit adjustment screw on side of transmission case which limits front shaft travel. Engage high speed and check in same manner (adjusted by turning limit adjustment screw on front of case in same manner).

NASH 1939 TYPE CONT.

Overdrive lockout (Reverse release)—Lever at rear of case pivots on pivot pin which is mounted on fulcrum stud in rear of case. To check operation, place transmission in reverse gear and overdrive in conventional position. When rear shaft lever is moved, lockout pin should have slight (.005") movement.

OVERDRIVE UNIT

SERVICING:—**Assembly**—Lubricate all bearings and thrust washers with engine oil before assembling. If clutch and ring gear have been taken off ring gear, install thrust ring on front face of clutch and bronze bearing within clutch hub, wind up split half of each pinion gear 1 turn and mesh in ring gear (pinion halves are spring-loaded and this amount of tension required to eliminate backlash and insure quiet running). Use extreme care not to bend clutch pawl lock (sheet metal plate which retains pawls in position when shift collar in conventional drive position—plate must release pawls when shift collar moved to overdrive position). Install clutch and gear assembly on mainshaft, meshing planet gears with sun gear (see that snap ring in place on mainshaft at rear of sun gear to limit clutch hub movement on shaft). Install clutch pawl rear thrust washer, free-wheel cam, retaining washer, lockwasher and screw (use new lockwasher and, if necessary, new retaining washer and screw to avoid any possibility of this screw loosening in service). Install free-wheel rollers in cage (retain temporarily with rubber band), rear shaft and gear (rotate roller cage to facilitate assembly, remove rubber band as shaft cup slides over rollers), install speedometer gear on shaft. To install overdrive case, place shift collar in case so that it engages shift fork, invert transmission, install reverse lockout pin so that it engages notch in lockout lever in transmission case, install case and shift collar on overdrive shaft assembly and manipulate case so that collar engages gear teeth on rear shaft and case slides forward so that it rests on rear face of transmission case, install mounting screws. Make certain that oil seal in rear of overdrive case is in good condition and install universal joint companion flange. NOTE—Flange must be pressed on shaft and not driven in place which may damage rear bearing retainer or distort rear bearing snap ring.

ADJUSTMENT:—Manufacturer recommends that no attempt be made to adjust overdrive cut-in speed (pawl adjustment) unless accurate spring scale used to measure pawl spring tension and assure equal and correct adjustment of both pawls. Pawls are adjusted by removing plug on top of overdrive case and turning shaft so that holes in clutch collar and pawl in which adjusting screws located line up. Each screw (two screws—one for each pawl) should be adjusted equally. Turn screws in to raise cut-in point, out to lower cut-in point, being certain that both screws are adjusted equally and turned so that they interfere with the clutch collar. Cut-in speed with standard adjustment is 38-42 M.P.H.

NOTE—One pawl adjusting screw has single slot in head, opposite screw has double slot to avoid any possibility of adjusting same screw twice—shaft should be turned one-half revolution after adjusting first screw to bring second screw into line with adjusting hole).

PACKARD 'SENIOR LINE'

Used On:

EIGHT, 901, 2 ('32), 1001, 2 ('33), 1100, 1, 2 ('34) 1200, 1, 2 ('35), 1400, 1, 2 ('36)

SUPER 8, 903, 4 ('32), 1003, 4 ('33), 1103, 4, 5 ('34), 1203, 4, 5 ('35), 1403, 4, 5, ('36), 1500, 1, 2, ('37) 1603, 4, 5 ('38)

TWELVE, 905, 6 ('32), 1005, 6 ('33), 1107, 8 ('34), 1207, 8 ('35), 1407, 8 ('36), 1506, 7, 8 ('37) 1607, 8 ('38), 1707, 8 ('39)

NOTE:—**Steering Column Gear Shaft (1939).** Used on some cars. See separate article on "Transmission Control" for adjustment and servicing data. Transmission used with this type control same as on other cars except for shift mechanism.

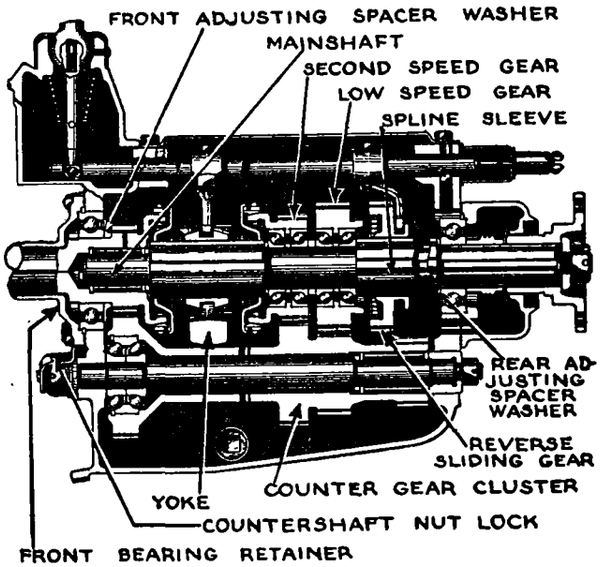
TYPE:—Constant-mesh (except reverse), synchro-mesh (second and high), sliding spur gear for reverse (this gear acts as low speed engaging clutch when shifted forward). Main drive gear mounted on ball bearing. Mainshaft mounted on roller bearing (front), ball bearing (rear). Low and second speed gears mounted on double row ball bearings on mainshaft. Counter gear cluster mounted on double row ball bearing (front), roller bearing (rear). Low gear is engaged by shifting reverse gear on mainshaft forward to engage internal clutch teeth on gear with clutch teeth on low speed gear hub. Second and high engaged by sliding clutch sleeve splined on mainshaft which engages clutch teeth on inside of synchronizing cones on gears.

Synchronizing Unit. Consists of synchronizing drums splined on mainshaft which engage synchronizing cones on gears. Drums actuated by synchronizing yoke pivoted in case. Plunger in dashpot on yoke contacts cam on shifter shaft so that yoke is rocked to engage drum and cones when shifter shaft moved to engage gear (escape of oil from dashpot allows plunger to disengage from cam after synchronization completed, yoke then returned to disengaged position by centralizing springs so that drum drawn out of engagement).

SERVICING:—Check synchronizing yoke travel (see Yoke Adjustment below) before dismantling transmission, and note this figure for yoke adjustment when assembling transmission (adjusted by installing shim of proper thickness at each end of mainshaft).

Disassembly. Remove shift lever and cover, backing switch on rear end of case, shifter shaft and fork assemblies, lock balls and springs. Take off front bearing retainer and countershaft front nut (inside clutch housing). Take off universal joint flange nut, remove flange, take out screws and remove rear bearing retainer. Remove synchronizing yoke lock plates and screws (one on each side of case), and centralizing pin (left side). Remove main drive gear bearing nut. Drive countershaft out toward rear. Remove clutch shaft and main drive gear assembly out toward front. Pull mainshaft assembly to rear until bearing clears case, align slots in sliding clutch sleeve and synchronizing yoke, remove front synchronizing drum, yoke, bronze yoke links, sliding clutch sleeve and rear synchronizing drum through top of case. Move shaft forward and remove reverse sliding gear, spline sleeve (on which reverse gear slides) through top of case. Remove mainshaft and low and second speed gear assembly through top of case. Remove counter gear cluster through top of case. To remove reverse idler gear, take out shaft lockscrew on left side of case, drive shaft out toward rear.

Mainshaft Assembly:—Low and second speed gear bearing adjustment controlled by spacer washers on shaft between inner races of bearings in each gear. These spacers furnished .1875", .1885", .1895" thick. Bearing assemblies retained by reverse sliding gear spline sleeve which acts as spacer when universal flange nut is tightened. Install thrust washer on mainshaft front bearing shoulder with taper face toward rear. Shim on mainshaft between reverse sliding gear spline sleeve and rear bearing (these spacers furnished .0725 to .1105" thick in .002" steps) used to control yoke travel in conjunction with spacer between main drive gear and front bearing furnished .222" to .256" thick in .002" steps.



Synchronizing Yoke Assembly:—Install synchronizing yoke bronze links (drum connection) on each side with relieved side up (latest type has word 'Top' cast in link at this point). See that centralizing screw is engaged between springs in yoke.

Yoke Travel & Adjustment. To check yoke travel, set up dial indicator so that finger contacts yoke at point adjacent to centralizing screw and measure yoke travel in either direction from center disengaged position. Shift transmission into second and high and note yoke travel in each case back to center. Should be .140" minimum, .160" maximum. This travel will provide correct clearance of .018" between synchronizing drums and cones. Adjust by adding or removing spacers between reverse sliding gear spline shaft and rear bearing on mainshaft, or between main drive gear and bearing at front of case (see mainshaft assembly directions above). A .006" change in spacer thickness will change yoke travel .040".

Counter Gear Cluster Assembly:—Backlash at 19 and 29 teeth gears should be .003-.004". Install countershaft with mark 'L' on flat at front end toward reverse idler.

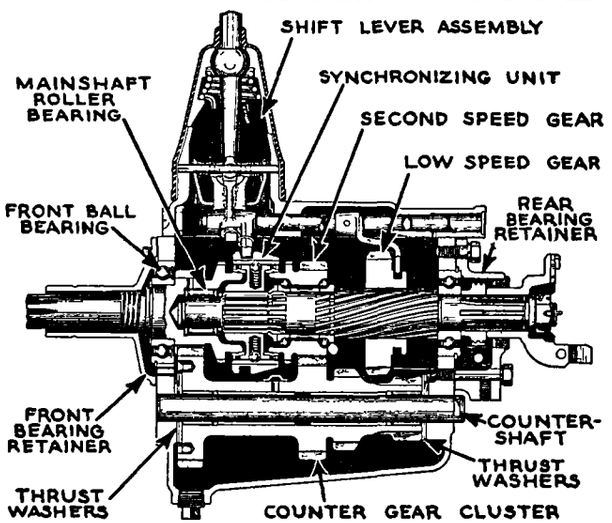
PACKARD SIX & EIGHT 1935-38 TYPE

Used On:

SIX, MODELS 115C (1937), 1600 (1938)
'120' MODELS, 120 ('35), 120B ('36), 120C ('37)
EIGHT, MODELS 1601, 1A, 2 (1938)

TYPE:—Constant-mesh, synchro-mesh, all helical gear type (sliding gear for low and reverse). Main drive gear mounted on shielded ball bearing. Mainshaft mounted on roller bearing (front), ball bearing (rear). Second speed gear mounted on double row ball bearing on mainshaft. Counter gear cluster mounted on roller bearings on stationary countershaft with thrust washer at each end. Gears are engaged by sliding clutch sleeve (outer member of synchronizing unit) which engages clutch teeth cut on main drive gear and second speed gear hubs.

Synchronizing Unit. Consists of inner sleeve with bronze synchronizing cups and splined to mainshaft, outer clutch sleeve splined on the inner sleeve. Inner and outer sleeves move as a unit



(spring loaded detent balls in inner sleeve engage groove in outer sleeve) until synchronizing cups engage cones on gears. When synchronization completed, outer clutch sleeve slides on inner sleeve to engage clutch teeth on gears.

SERVICING:—Disassembly. Remove cover, shift lever, shifter shaft and fork assembly. Mark gears, sliding clutch and synchronizing sleeves to insure reinstalling in same position on shaft. Take off universal joint flange nut, pull flange, remove speedometer pinion, rear bearing retainer, and lock plate on rear of case. Remove main drive gear bearing retainer on front of case. Drive out countershaft toward rear allowing cluster gears to drop down in case and unmesh gears. Pull main drive gear and bearing assembly out toward front. Pull mainshaft to rear until bearing is freed from case, then remove mainshaft assembly through top of case, lift out counter gear cluster.

NOTE—Gears should not be shifted with cover removed (synchro-mesh balls and springs will jump out). If this occurs, use clamp band type ring compressor or Packard Clamp ST-5014 to reinstall.

Mainshaft & Second Speed Gear:—Do not disassemble (serviced as an assembly only).

Synchronizing Unit:—Serviced as an assembly with sliding clutch sleeve. Do not disassemble. See note above for re-installing detent balls and springs.

Counter Gear Cluster:—Use tapered dummy shaft or arbor (Packard ST 5015 and 5043) to align roller bearings when installing countershaft. See that cluster gear has no perceptible endplay in case and that lugs on bronze thrust washers at each end line up with slots in case.

PACKARD SIX & EIGHT 1939 TYPE

Used On:

SIX, MODEL 1700 (1939)
'120' EIGHT, MODELS 1701, 1A, 2 (1939)
SUPER EIGHT, MODELS 1703, 3A, 5 (1939)

TYPE:—Design same as for 1938 Six and Eight except as follows:

Steering Column Gear Shift—Used on all models. See separate article on Packard Transmission Controls for complete adjusting and servicing data.

Econo-Drive (Overdrive)—Warner type overdrive unit mounted on rear of transmission case. Optional equipment on all models. ***See separate article on Warner Overdrive with Electrical Control for complete adjusting and servicing data on this unit.***

Constant-Mesh Low Gear—New type helical gear mounted on double ball bearings on main shaft (same type mounting as for second speed gear) and engaged by clutch teeth cut on inner rim of sliding spur type reverse gear (this gear acts as clutch only in engaging low speed gear).

SERVICING:—Disassembly (without Overdrive). Take off nut on rear end of mainshaft, remove universal joint flange. Take out mounting screws in rear bearing retainer, remove retainer and lockplate. Take out mounting screws and remove front bearing retainer. Drive countershaft out (see Note below), remove main drive gear and bearing through front of case. Move mainshaft assembly to rear until rear bearing free of case, tap bearing off shaft, then remove mainshaft through top of case. Lift counter gear cluster and thrust washer out. To remove reverse idler gear, drive shaft out to rear.

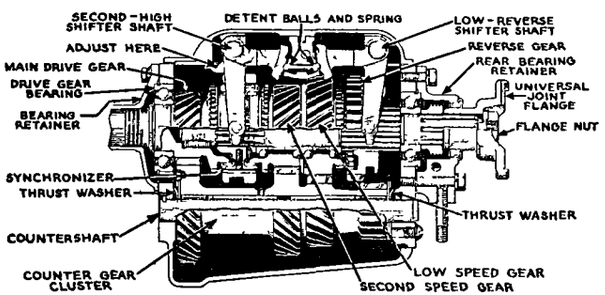
Overdrive Models. Drive countershaft out toward front (see Note below). Take out mounting screws and remove front bearing retainer, remove main drive gear and bearing through front of case. Slide synchronizer assembly off front end of mainshaft. Take out mounting screws in overdrive adapter plate. Pull entire overdrive, adapter, and mainshaft assembly out through rear of case using extreme care not to allow overdrive case to separate from adapter plate (if these parts separate, overdrive unit must be dismantled and reassembled).

Countershaft Note—Shaft must be driven out toward front (key in forward end of shaft engages slot in front end of transmission case). Use S.T. 5043 Roller bearing assembly bar to drive shaft out and leave tool in counter gear cluster to retain bearing rollers until re-installed. **Overdrive Model**—Remove overdrive case drain plug (on rear end of case at bottom) and insert S.T. 5043 tool through this hole to drive countershaft out, remove main drive gear and synchronizer unit, then pull overdrive assembly and transmission mainshaft and gears out through rear of transmission case as a unit.

Low & Second Speed Gear Assembly:—Mounted as an assembly on mainshaft (same inner race used for adjacent ball bearings in each gear) with inner races for end bearings positioned by spacers on shaft. Do not dismantle these gear assemblies.

Shifter Mechanism:—Yokes on horizontal shafts in cover engage synchronizer clutch sleeve (front shaft), low speed gear clutch and reverse gear (rear shaft) directly without intermediate linkage. Spring-loaded ball type detents are located in bracket on side of cover and engage sectors on shafts. Entire shifter mechanism located in cover and need not be dismantled when cover removed.

High-Gear Shifter Lever Travel—Clearance between lug on shifter lever and transmission case cover must be correctly set to prevent excessive lever travel which will allow synchronizer poppet balls and springs to jump out in high gear position. To adjust, shift into high gear, remove transmission cover and measure clearance between lug on forward side of lever and cover. Clearance should be .005" min., .010" max. If greater than .010", bend lug up.



OVERDRIVE UNIT

See separate article on 'Warner Type R6 Overdrive with Electrical Control' for complete servicing and adjustment data and note following points:

Transmission Mainshaft Endplay—Mainshaft should fit in overdrive adapter plate without perceptible endplay. Endplay controlled by mainshaft rear bearing front snap ring (which engages groove in adapter plate), spacer and rear snap ring behind bearing (this snap ring engages groove in shaft. These snap rings furnished in .003" steps as follows: No. 338472, 3, 4, 5 (Front Snap Ring—thinnest to thickest). No. 338458, 9, 338460, 1 (Rear Snap Ring—Thinnest to thickest).

Overdrive Unit Rear Bearing—Two types used. First type has compressible spacer sleeve on shaft between bearings with bearing pre-load controlled by universal joint flange nut on rear end of shaft. This type bearing assembly should be changed to second type (with bearing adjustment controlled by Belleville type spring washer between bearings) whenever overdrive unit disassembled or bearings removed, by installing Solid Spacer No. 341264, Belleville Spring Washer No. 341266. See Warner Overdrive (with Electrical Control) for complete disassembly directions and bearing adjustment.

CAUTION—On models with this first type bearing, universal joint flange nut must not be loosened which will disturb bearing adjustment. If bearings dismantled or adjustment lost by changing nut position, re-adjust bearings as directed in Warner Overdrive article. NOTE—On later cars with Belleville type washer between bearings, universal joint nut should be kept tight (nut does not control bearing adjustment). These cars may be identified by letter 'M' stamped on side of universal joint flange.

REO TRANSMISSION

Used On:

MODELS S, S2, S3, S4, S7 (1932-35)

NOTE:—Warner Transmissions used on other Reo models. See Warner Transmission articles for complete data.

Free-Wheel Unit—External type on rear of transmission case (1932), in transmission case (1933 on). See special free wheel data below.

TYPE:—Constant-mesh, synchro-mesh, helical gear (second and high), sliding spur gear (low and reverse). Clutch shaft and main drive gear mounted on ball bearing in front end of case. Mainshaft mounted on roller bearing (front), ball bearing (rear.) Rear bearing is carried in special bearing ring ahead of free wheel unit in case (two single row ball bearings used on drive shaft at rear of free wheel unit). Counter gear cluster mounted on bronze bushings on stationary shaft. Second and high gears engaged by sliding clutch sleeve (outer member of synchronizing unit) which engages clutch teeth on the main drive gear and second speed gear hubs.

Synchronizing Unit. Consists of synchronizing cones on gear hubs and drums at each end of sliding sleeve splined on mainshaft. This inner sleeve centered within clutch sleeve by spring loaded detent balls so that both sleeves move as a unit until synchronizing drums and cones engage. Outer clutch sleeve then slides further to engage gears.

SERVICING:—Disassembly. Remove shift lever, cover, shifter shaft and fork assemblies, taking care not to lose lock balls and springs and interlock balls at forward end of case. Remove brake band assembly and brake support on rear of case. Take off universal joint yoke nut, pull yoke. Take out countershaft and reverse idler shaft locking plate retaining screws and remove plate. Drive countershaft out toward rear allowing counter gear cluster to drop down and unmesh gears. Remove speedometer pinion, take out capscrews in rear bearing retainer, withdraw retainer, free wheel unit and drive shaft as an assembly (see free wheel data below). Withdraw free wheel clutch gear through rear of case. Take out lockscrew on left side of case which holds mainshaft rear bearing ring, withdraw ring and mainshaft assembly (including second speed gear and synchronizing unit) through rear of case. Remove bearing retainer on front end of case, withdraw clutch shaft main drive gear and bearing assembly. To remove reverse idler gears, drive shaft out toward rear.

Main Drive Gear & Bearing Assembly:—Main drive helical gear is separate part and keyed on shaft. May be pressed off shaft with bearing after bearing snap ring removed. When installing, see that straight side of gear is in or toward rear of car, that shielded side of bearing is toward gear, and that oil slinger is in place under snap ring. See that new leather oil seal installed in retainer and that retainer oil holes line up with holes in case.

Mainshaft Bearing Assembly:—Front bearing positioned by spacer between bearing and shoulder on shaft (see that this spacer in place when installing shaft). Rear bearing held on shaft by retainer ring which engages notches in splines. To remove bearing, bend down lip on washer which locks retainer, rotate retainer until prongs line up with splineways on shaft, withdraw retainer. Make certain that retainer ring engages splines and that washer lips are bent down to prevent retainer rotating when reinstalling. Bearing outer race is seated against shoulder in bearing ring and retained by snap ring at rear.

Synchronizing Unit:—Can be removed from shaft without disassembling. If unit is dismantled, mark inner and outer sleeves and reassemble in same position, use extreme care not to lose detent balls and springs which will fly out when outer clutch sleeve removed. Special assembling tool T529 will facilitate reassembly.

Second Speed Gear:—To remove second speed gear, depress plunger under front thrust washer, rotate washer until prongs on inner edge line up with splineways on shaft, withdraw washer and gear, being careful not to lose locking plunger and spring. Rear thrust washer is pinned to shaft to prevent rotation. When installing front thrust washer, see that prongs engage notches in splines and that locking plunger engages washer to prevent rotation.

Counter Gear Assembly:—See that steel spacer installed on rear end of gear cluster with pin engaging hole in gears. Bronze thrust washers should be installed with lip engaging notch in case at each end.

REO FREE WHEEL UNIT

TYPE:—Cam and roller type. Cam is splined on rear end of mainshaft. Rollers assembled between cam and outer sleeve or case which is integral with stub drive shaft. Free wheel is locked out by sliding clutch gear splined on mainshaft in front of unit which engages clutch teeth on the inner rim of the free wheel sleeve.

SERVICING:—Entire unit is matched in assembly and no parts are available. Should be replaced as a unit after removal from rear bearing retainer (bearings can be serviced independently).

Removal:—To dismantle assembly for bearing replacement, press shaft out of housing toward front open end. Take out bearing snap rings and remove bearings. Speedometer drive gear can then be lifted out.

WILLYS TRANSMISSION

Used On:

MODEL 77 (1933-34-35-36)

NOTE:—Clutch bell housing integral with transmission case and must be removed as a unit.

Willys later Models. 1937 and later Willys models equipped with Warner Transmissions. See Warner Transmission articles for complete data.

TYPE:—Sliding spur gear type (all speeds). Mainshaft mounted on bushing in main drive gear with thrust balls in bearing recess ahead of shaft (1933-35), thrust washer on shaft between shaft shoulder and main drive gear (1936). Taper roller bearing used on main drive gear at forward end of transmission and on rear end of mainshaft (entire assembly adjusted by shims under rear bearing retainer). Counter gear cluster mounted on bushings on stationary countershaft. Gears engaged by shifting sliding gears on mainshaft (clutch teeth for direct drive cut inside second speed gear).

SERVICING:—Disassembly. Remove shift lever and cover assembly, shifter shafts and forks, lock balls and springs. Take off universal joint flange nut and flange, remove speedometer gear assembly, take off rear bearing retainer (speedometer drive gear housing) and gear, being careful not to lose shims under retainer. Pull mainshaft out toward rear, disengaging low and second speed sliding gears and removing these gears through top of case. Remove bearing retainer on front of case (within bell housing), pull out main drive gear and bearing assembly toward front, being careful not to lose loose thrust balls in mainshaft bearing hole (1933-35 models only). Drive out countershaft and lift counter gear cluster out.

Bearing Adjustment:—When installing mainshaft, see that thrust balls (1933-35), washer (1936) in place at forward end of mainshaft, tighten front bearing retainer screws securely, install shims between rear bearing retainer and case as required so that mainshaft endplay is .004-.006" (1933-35), .006-.008" (1936).

BUICK TYPE

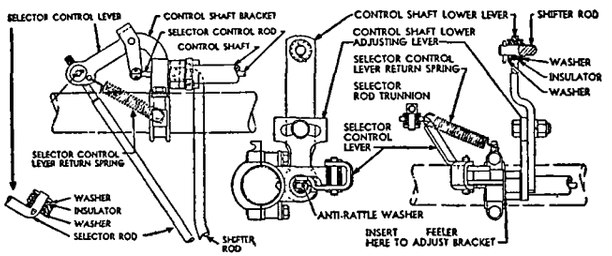
Std. Equipment On:
MODELS 40-40, 50, 60, 70, 80, 90 (1940)

TYPE:—Remote control type with steering column mounted gearshift lever. Design changed from that used on 1939 car models as follows:

Gearshift Lever—Lever pivoted in bracket on outer control shaft with inner end engaging socket assembly on upper end of selector control rod (within control shaft) so that rod is pressed down when lever raised to Low-Reverse position. Direction Signal now located in separate housing on upper end of steering column.

Control Shaft Adjustment—Adjustment provided so that gearshift lever position may be varied to suit operator and consists of double lever arrangement at lower end of control shaft on steering column (lower lever fixed on shaft, upper lever to which shift rod attached is clamped to lower lever by clamp bolt and can be changed to new position after clamp bolt loosened).

Selector Rod & Lever Assembly—Selector control rod in control shaft on steering column now linked to new type selector shaft and lever assembly in transmission by selector rod (no cable used). Adjustment consists of socket assembly threaded on upper end of selector control rod.



ADJUSTMENT:—Place gearshift lever in neutral position. Adjust lever position so that it does not contact edge of hole in housing nut in Second-High position by removing selector control lever (to which lower end of selector control rod attached) from steering column bracket and selector control rod, turning rod in or clockwise until it bottoms in control lever socket (on upper end of rod), and then backing rod out exactly 2 complete turns. Move outer selector lever on transmission case to extreme rear or Second-High position (this is small forward lever on vertical shaft). Adjust trunnion on forward end of control rod so that clearance between shift lever and edge of hole in housing nut is approximately 1/16" with rod and trunnion connected. Loosen two screws in bracket at lower end of control shaft, place .020" feeler between insulating washer and control shaft nut (directly above bracket), hold control shaft assembly in uppermost poistion, tap bracket up until feeler gauge is just gripped between washer and nut, tighten bracket screws securely.

Gearshift Lever Position—To locate shift lever for convenience of operator, loosen clamp bolt on control shaft levers (at lower end of shaft), move shift lever and control shaft assembly forward or backward to suit operator, then tighten clamp bolt. CAUTION—This adjustment is limited and shift lever must not be moved so far in either direction that it interferes with steering column jacket when gears are engaged. Check lever for full travel after making this adjustment.

SERVICING:—**Steering Column Unit**—Control shaft upper bearing is located in Direction Signal switch housing on steering gear and spring washer, insulating washer, and bearing must be assembled in correct order if dismantled. Lower bearing bracket is clamped on steering column by two bolts and bracket has locating tongue which must enter slot in column jacket (slotted hole in jacket permits bracket to be moved up or down for adjustment as directed above). When installing assembly, make certain that control shaft does not bind in rubber grommet which seals hole in dash.

Gearshift Lever—Lever bearing is spherical type installed on ball on lever and clamped in lever bracket by housing nut. To renew bearing, remove gearshift lever knob (screwed on end of lever), unscrew housing nut, slip nut and bearing off end of lever. Install bearing with smaller radius toward column bracket and lubricate all movable parts of lever and socket assembly with Lubriplate. Make certain that small anti-rattle spring installed in inner end of control lever and that spring and upper seat are in place in socket above lever end.

Idler Lever (Series 50, 70 Only)—These models have idler lever on flywheel housing which must be lubricated at regular chassis lubrication periods or more often if shifting is difficult.

Transmission Case Shifter Mechanism—Selector shaft and shifter shaft mechanism (for gear engagement) similar to type used on 1939 cars. Cross-shift selector lever and shaft (vertical shaft and small forward lever on transmission case) are new type. See separate Transmission article for disassembly and servicing directions. CAUTION—Selector shaft must be removed through right side of transmission case and installed on left side to avoid damage to oil seal. Cross-shift lever must be removed from vertical shaft before selector shaft driven out (to permit cross-shift lever to disengage from shaft).

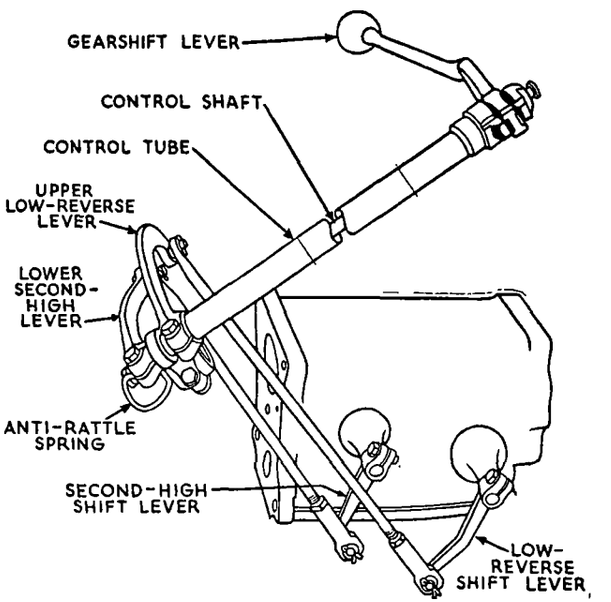
CADILLAC-LA SALLE TYPE

Std. Equipment On:
CADILLAC V8, SERIES 40-60S, 62, 72, 75 (1940)
CADILLAC V16, SERIES 40-90 (1940)
LA SALLE V8, SERIES 40-50, 52 (1940)

TYPE:—Same design as used on 1939 Cadillac and La Salle models except that hairpin type anti-rattle spring installed on lower end of control shaft on steering column (this spring not used on Cadillac 75 and 90 models).

ADJUSTMENT:—Place gearshift lever in neutral position on Second-High side (normal position). Disconnect Low-Reverse rod at rear lever on transmission case, place lever in neutral (can be checked by feel of detent balls engaging notch in lever shaft sector), adjust rod length by loosening locknut and turning rod end until gearshift lever can be lifted freely into Low-Reverse position with rod connected and without disturbing position of transmission case shift lever. NOTE—Second-High rod (connected to forward lever on transmission case) should not require adjustment. If setting has been lost, adjust this rod by placing gearshift lever in neutral, disconnect rod, place transmission case lever in neutral, then adjust rod length so that it can be connected without disturbing position of either lever. Low-Reverse rod must then be adjusted (as directed above) to insure smooth cross-over of shift lever from Second-High to Low-Reverse position at neutral.

Shifter Levers—To adjust lever positions on control tube and shaft, disconnect rods on levers, remove anti-rattle spring (not used on 75 & 90), install special tool No. J-1204 on lower end of Second-High control shaft, tighten thumbscrew on tool slightly. Loosen clampscrew on Second-High lever (lower lever), tighten thumbscrew on tool until 2 lbs. force required to move this lever back and forth (measure with spring scale attached to outer end of lever), tighten clampscrew and remove tool. NOTE—Low-Reverse (upper) lever does not require adjustment.



SERVICING:—**Disassembly**—Remove horn button or horn ring and steering wheel, remove anti-rattle spring (at lower end of control shaft). Loosen clampscrew and remove Second-High (lower) lever, loosen clampscrew on Low-Reverse (upper) lever, remove cross-over spring at upper end of control shaft. Loosen clampscrew holding upper shifter housing on steering column, lift upper housing and shifter control assembly up and off steering column. Remove pin and collar on lower end of Second-High (inner) shaft, pull this shaft out of Low-Reverse tube at upper end. Remove gearshift lever and pull Low-Reverse tube out of housing.

Reassembly—Install Low-Reverse tube in housing with lug pointing away from center, hold shift lever in position and install Second-High shaft. Place two spring washers on lower end of shaft with concave sides up and install shaft collar and pin. Push housing and shaft assembly down in place next to steering column, slip Low-Reverse lever on tube before entering assembly in lower bracket. Install two spring washers with concave side up on lower end of Second-High shaft, install lever on shaft,

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Position housing so that shift lever does not strike at any point and tighten housing clampscrew. Install steering wheel. Adjust levers and control rods as directed above. NOTE—If new Second-High shaft being installed, see directions below for positioning collar on lower end of shaft (shaft must be drilled for pin).

Lower Bracket Mounting—If lower bracket removed, make certain that clamping bolt washer on bracket engages slot in steering column. This is important to position bracket properly.

Shifter Shaft & Tube Replacement:—Adjustment between Low-Reverse (outer) tube and Second-High (inner) shaft maintained by collar on lower end of shaft. Shaft must be drilled for correct location of collar locking pin if either tube or shaft replaced. To locate collar pin hole in shaft, assemble control on bench without the two anti-rattle spring washers located between the collar and tube (upper washers). Pull shaft through tube until all clearance taken up between upper ends, place .036" feeler thickness between collar and lower end of tube, drill and ream for locking pin without disturbing position of collar (use #32 drill and ⅛" or .1245-.1255" reamer). Then assemble control as directed above making certain that spring washers properly installed.

TROUBLE SHOOTING:—Hard Shifting—Check rod and lever adjustments (above). Check clutch for incorrect pedal adjustment, dragging or spinning clutch. Check transmission for improper or low lubricant, damaged gears, worn synchronizer drums or broken detent springs.

Slipping out of Gear—Check adjustment, see that shift lever has full travel and that rod lengths correct. Check rubber connections at ends of connecting rods. Check for loose rear engine support.

CHEVROLET 1940 TYPE

Std. Equipment On:

MODELS KA, KB, KH PASS. CARS & SEDAN DELIVERY (1940)

Transmission Control design changed from type used in 1939 as described below.

SPECIAL SERVICE NOTES:—Gearshift Lever Flutter—If a 'flutter' is noticed at idle speed or in operation (may cause jumping out of High Gear at high speed), install special Vacuum Power Cylinder Valve Friction Spring, No. 3655072, as follows: Slip forward end of rubber boot off rear end of metal boot over reactionary levers, take out two bolts fastening halves of metal boot together and remove top half. Remove piston rod yoke clevis pin and disconnect piston rod yoke and valve link from reactionary levers. Pull out vacuum cylinder valve rod, snap friction spring in place on rod about midway between valve and valve rod guide with spring 'prongs' pointing out toward clevis pin yoke, reassemble rods and boot.

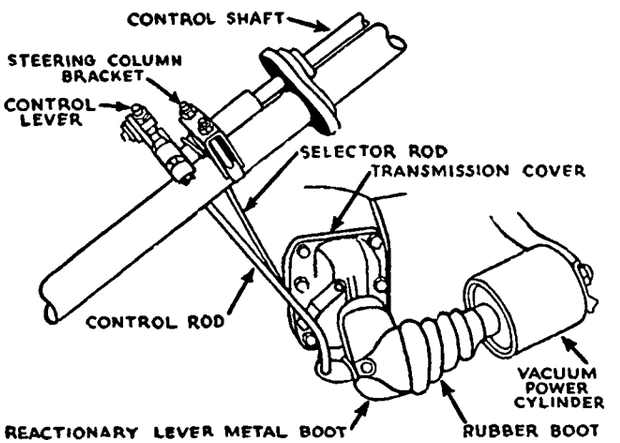
TYPE:—Design changed from 1939 type as follows: **Gearshift Lever (Steering Column Unit)**—One shaft only is used (in tubular housing on steering column) and operates both selector (cross-shift) rod and gear engagement (vacuum cylinder) rod. Gearshift lever is new type and lifts up on control shaft when lever lifted into Low-Reverse position.

Vacuum Cylinder & Linkage—Reactionary lever assembly now riveted together and covered by metal boot. Mounting changed to provide for new type side-mounted transmission shift mechanism. Vacuum cylinder operates in same manner as 1939 type. **Transmission Case Shifter Mechanism**—New type shifter mechanism mounted in side cover on transmission case. See Chevrolet Transmission article for shifter servicing data.

ADJUSTMENT:—If operation unsatisfactory or if shift mechanism dismantled for servicing, adjust as follows:

Steering Column Control Assembly—See Servicing data below for dimensions to which parts should be set up when assembled.

Selector Rod—Loosen check nut on selector rod adjustment (at lower end of steering column), pull selector rod forward as far as possible, adjust swivel on rod by screwing it up or down on rod so that distance between lower side of steering wheel and



top of gearshift lever is 1 27/32" with selector rod connected to selector control lever. Install washer and cotter pin on swivel pivot and lock adjustment by tightening selector rod check nut.

Control Rod (Gear Engagement Rod)—Set gearshift lever in horizontal position, loosen checknut on control rod. Push control rod to rear until all clearance has been taken up and note location of swivel with reference to shift control lever, then pull rod forward until all clearance has been taken up and again note swivel location. Neutral valve position is midway these two positions. Hold control rod in this neutral position, adjust swivel position on control rod (screw swivel up or down on rod) until swivel pivot just enters hole in shift control lever. Install flat washer and cotter pin on swivel pivot, lock adjustment by tightening control rod check nut.

SERVICING STEERING COLUMN UNIT:—Gearshift Lever Removal—Lever can be removed without disturbing steering column assembly by shifting into Reverse, depressing pivot pins 3/32" and then lifting up and out on lever. To remove anti-rattle spring and pivot pin spring, compress legs of pivot pin spring and lift up. When reassembling gearshift lever, coat control shaft ball with graphite grease, install anti-rattle spring in control shaft ball and over neck of control shaft, thread pivot pins on ends of spring and in holes in gearshift lever swivel, thread gearshift lever over this assembly, compress pivot pins and press down on top of lever until pivot pins snap into place.

Disassembly—Disconnect gear engagement control rod and selector rod at lower end of steering column by taking out cotter pins and removing flat washers. Remove clamp bolt on shift lever at lower end of control shaft, remove lever and spring. Remove horn button and steering wheel nut, pull steering wheel (use knockout to protect threads on shaft). Remove instrument panel steering column jacket clamp. Take out two screws in upper support on steering column jacket, pull control shaft and upper support up and out of lower support. If gearshift lever to be removed, see preceding paragraph for directions.

Lower Support Bushing Servicing—If bushing worn, press old bushing out, press new bushing in until distance from face of support to lower end of bushing is 19/64".

Reassembly—Screw gearshift lever swivel into upper support until shoulder on swivel extends approximately ⅛" above support. Install control shaft by threading it through upper support and swivel. Install gearshift lever (see above). Install lower support on steering column jacket and see that key engages slot, tighten clamp bolts just snug (excessive tightening will collapse jacket). Screw upper support up or down on swivel until clearance between lower edge of gearshift lever and top of support is 3/32-⅛". Thread toeboard grommet over control shaft, install control shaft through lower support and attach upper support to steering column by installing two screws. Install spring and lever on lower end of control shaft making certain that end of selector operating lever is engaged in slot on control shaft lever. Adjust control rod and selector rod (see Adjustment section above). Check distance from upper face of control shaft lever to lower face of lower support bracket. If distance not ¾", adjust by loosening lower support clamp bolts and moving support up or down on column jacket. CAUTION—Do not tighten support clamp bolts excessively which will collapse steering column jacket.

SERVICING TRANSMISSION LEVER LINKAGE:—Note—Reactionary lever assembly is of riveted construction and cannot be disassembled (service as an assembly).

Disassembly—Disconnect shift control rod from reactionary lever assembly, remove vacuum hose from vacuum inlet stack and slip forward end of rubber boot off rear end of metal boot. Remove two screws holding metal boot halves together, lift off outer half of boot. Take out piston rod yoke clevis pin, push cylinder rod into cylinder to disconnect it from reactionary lever, then re-install clevis pin to prevent valve adjustment being disturbed. Loosen operating lever clamp bolt, pull reactionary lever assembly off operating lever shaft, remove second half of metal boot.

Servicing—Clean reactionary lever assembly with clean gasoline, examine rubber seal at front of metal boot and replace if damaged.

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Reassembly—Coat reactionary levers lightly with graphite grease, place inner half of metal boot on operating lever shaft, thread rubber seal over idler lever, install reactionary lever assembly on operating lever shaft to point just beyond chamfered end of shaft and tighten clamp bolt. Pull piston rod forward and connect yoke and valve link to reactionary levers, install piston rod valve clevis pin. Assemble outer half of metal boot and install the two retaining screws. Slip end of rubber boot over rear end of metal boot, install vacuum hose and shift control rod.

SERVICING VACUUM CYLINDER:—Removal—Disconnect vacuum and air hose, remove outer half of metal boot and disconnect piston rod and valve links from reactionary levers (see Servicing Transmission Lever Linkage above for directions). Take off cotter pin and nut on cylinder mounting stud, remove vacuum cylinder.

Installation—Install rubber cushion and steel retainer on mounting stud, insert stud through hole in bracket and install rubber cushion, flat washer, and nut on stud in that order, tighten stud just sufficiently to allow cotterpin to be installed (mounting must be flexible). Connect piston rod yoke and valve link to reactionary levers, install vacuum and air hoses.

Vacuum Cylinder Lubrication:—Must be removed from car as directed above (cannot be lubricated on car as in 1939). Stand cylinder on mounting end, pull valve link forward to open valve, pour ½ oz. shock absorber insulating fluid into cylinder through vacuum inlet stack. Push valve rod into cylinder as far as possible, pour additional ½ oz. of fluid into vacuum inlet stack. Allow time for fluid to flow into cylinder, then work piston rod in and out several times and turn rod at same time to spread fluid over cylinder walls and piston leather.

NOTE—Cylinder can be washed out by following directions given above using 2 ozs. of fluid and draining fluid by inverting cylinder and moving valve rod until fluid flows out. Repeat until fluid drained from cylinder is clean (cylinder need not be lubricated after this process completed).

Vacuum Cylinder Valve Adjustment:—If vacuum valve adjustment disturbed by dismantling or servicing operations, adjust as follows: Disconnect piston rod and valve link from reactionary levers (see Servicing Transmission Lever Linkage above for directions). Install special adjusting bushing J1452-5 within valve link and re-install clevis pin. Run engine to provide vacuum source. Move valve link out or away from cylinder until all clearance between link and adjusting bushing is toward front of car, piston rod should move out of cylinder slowly in this position. Then move link in toward cylinder until all clearance between link and adjusting bushing toward rear of car, piston rod should move into cylinder in this position. If piston rod moves out but does not move in, valve link should be screwed out on valve rod. If piston rod moves in but does not move out, valve link should be screwed in on valve rod. To adjust, remove clevis pin and change valve link position ½ turn at a time until correct operation is secured.

Air Cleaner Servicing:—At 10000 mile intervals, remove cleaner, wash in gasoline, and dip in engine oil before re-installing.

CHRYSLER-DE SOTO-DODGE TYPE

Std. Equipment On:

CHRYSLER, MODEL C25 ROYAL & WINDSOR ('40)
CHRYSLER, C26 TRAVELER, SARATOGA, NEW YORKER (1940)
CHRYSLER, MODEL C26 CROWN IMPERIAL ('40)
DE SOTO, MODEL S7 CUSTOM & DELUXE (1940)
DODGE LUXURY LINER, D14 DELUXE, D17 CUSTOM (1940)

These Transmission Controls same as type used on corresponding 1939 cars except as noted below.

TYPE:—Same design as used on 1939 cars except as follows:

Steering Column Unit—Same as for 1939 except for construction details. Steering column upper and lower halves formed with integral flanges and bolted together with spacer between flanges to form slot for gearshift tube lever. Cross-shift selector cable is connected to lever pivoted on bracket bolted to lower steering column flange so that this lever contacts lower face of gearshift tube lever (no cable plunger used).

Transmission Case Shifter Mechanism—New design built in side cover on transmission case. Gear engagement finger or lever is mounted on vertical shaft which is connected to steering column gearshift tube lever by control rod. This gear engagement lever is normally in lower position on shaft (held down by spring on shaft above lever) in engagement with Second-High shifter shaft, and is lifted so as to engage the Low-Reverse shifter shaft by the lever on the horizontal cross-shift shaft to which the cross-shift selector cable is attached. Entire shifter mechanism is assembled in side cover and may be removed for servicing by taking out cover attaching screws. For servicing directions, see Chrysler Transmission article.

ADJUSTMENT:—Control Rod (Gear Engagement)—Disconnect control rod from lever at lower end of steering column control tube. See that transmission gears and shift lever on transmission case in neutral (can be determined by feel of detent balls engaging neutral notches in shifter shafts). Place gearshift lever approximately 10° above horizontal and hold in this position. Adjust control rod length so that it slips freely over pin on control tube lever, tighten locknut, replace cotter pin, flat washer and rubber grommet.

Selector Cable (Cross-shift)—Place gearshift lever in neutral position, see that transmission gears in neutral. Loosen locknut on selector cable at transmission selector lever (rear lever on transmission case side cover), tighten acorn nut on cable until all play removed from cable, then back off ½ turn for clearance, tighten locknut.

SERVICING:—Note—Steering gear assembly must be removed from car to permit gearshift control to be dismantled.

Disassembly—With steering gear out of car and steering wheel removed, remove steering wheel upper column bushing (use Puller C-580), remove nut on upper end of gearshift tube (special wrench C-595). Take out bolts in flanges and separate upper and lower steering gear jacket halves. Remove upper column jacket from steering gear shaft and remove control tube through lower end of jacket. Gearshift lever assembly may then be removed through slot in side of upper column jacket.

Assembly—Assemble by reversing disassembly directions given above. Do not lubricate bushings (3 used) in upper column jacket and use special drift, Tool C-581, to install upper bushing in upper end of housing. Adjust control rod and selector cable as directed above when control installed on car.

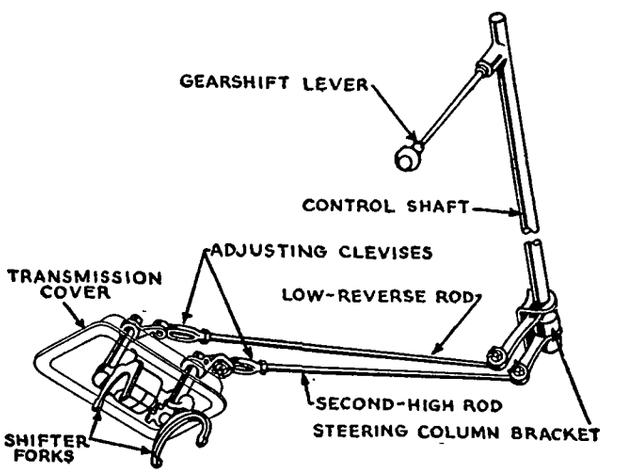
Transmission Case Shift Mechanism—See Chrysler Transmission article for servicing instructions.

FORD, LINCOLN-ZEPHYR, MERCURY TYPE

Used On:

FORD, '60' 022A, '85' 01A PASS. CARS (1940)
LINCOLN-ZEPHYR, MODEL 06H (1940)
MERCURY, MODEL 09A (1940)

TYPE:—Remote control type with steering column mounted gearshift lever. Used in connection with transmission having new type shifter mechanism on transmission case side cover which consists of separate Low-Reverse (rear) shift lever and Second-High (front) lever. Steering column unit consists of a control tube with a clutch pin at the lower end which normally engages the lower (second-high) lever on the steering column. When the gear shift lever is raised to engage Low or Reverse, the control tube is lifted up so that the clutch pin engages the upper (Low-Reverse) lever. These levers are connected to shift levers on transmission case by control rods with adjusting clevis at transmission case end.



ADJUSTMENT:—Adjustment should be checked whenever steering column position is changed or when linkage disconnected. Before making adjustments, make certain that both shift levers on transmission case are in neutral with detent balls engaging neutral notch in shifter shaft sectors (can be determined by feel with control rods disconnected). Disconnect Low-Reverse control rod at rear lever on transmission case, loosen locknut and adjust clevis on end of rod so that gearshift lever moves up and down freely (cross-shift at neutral) with control rod connected. Second-High control rod will not ordinarily require adjustment. Make certain that gearshift lever has full travel in both directions so that gears are fully engaged (detent balls should engage end notches in shifter shaft sectors with gears engaged).

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SERVICING:—Steering Column Unit—Steering column unit is mounted on steering column by retainer clamped in bracket bolted on column and can be dismantled after bracket has been loosened and retainer setscrew removed. Gearshift lever is pivoted on pin in control tube elbow and inner end engages fulcrum pin within upper end of control tube. If assembly dismantled, make certain that spring installed at lower end of fulcrum pin and that bushing and boot installed on upper end of fulcrum pin when it is reassembled. Sleeve type insulator should be installed on end of gearshift lever before lever is installed.

Transmission Case Shifter Mechanism—See Transmission article for servicing data.

GRAHAM TYPE

Used On:

MODELS 107, 108, 109 (1940)

This control same design as used on 1939 cars.

ADJUSTMENT:—Same as for 1939 models. *See 'Graham Type' Transmission Control article in Mechanical Equipment Section of manual (or 1939 Supplement) for complete instructions.*

HUDSON HANDY-SHIFT

Used On:

SIX, MODELS 40, 41, 43, 48 (1940)
EIGHT, MODELS 44, 45, 47 (1940)

This control same design as used on 1939 cars.

ADJUSTMENT & SERVICING:—Same as for 1939 models. *See 'Hudson Handy-shift' Transmission Control article in Mechanical Equipment Section of manual (or 1939 Supplement) for complete instructions.*

HUPMOBILE TYPE

Used On:

HUPMOBILE SKYLARK, MODEL R (1940)

This Control same design as used on 1939 cars.

ADJUSTMENT:—Same as for 1939 models. *See 'Hupmobile Type' Transmission Control article in Mechanical Equipment Section of manual (or 1939 Supplement) for complete instructions.*

NASH TYPE

Std. Equipment On:

NASH, SIX MODEL 4020, EIGHT MODEL 4080 (1940)
NASH-LAFAYETTE, MODEL 4010 (1940)

TYPE:—Remote control type with steering column mounted gearshift lever. Design not similar to type used on 1939 car models. Shifter lever on lower end of gearshift rod has two cone-shaped prongs which engage rubber grommets in shift levers mounted on threaded bracket on steering column, these levers being connected through rods and idler levers to shift levers on transmission case. Shifter lever is normally engaged with lower (Second-High) shift lever and is lifted up so as to disengage this lever and engage upper (Low-Reverse) shift lever when gearshift lever is moved up toward steering wheel in neutral.

ADJUSTMENT:—If overshift stops out of adjustment (caused by removal or dismantling of transmission etc.), adjust these stops as directed below first, then adjust connecting rods as follows: Install aligning pin, Tool J-1390, through holes in both shift levers and notch in mounting bracket between levers (pin will hold levers in neutral position while adjustment being made). Loosen setscrews and locknuts in connecting rod trunnions at outer end of each shift lever on transmission case cover, adjust each rod by carefully placing shift lever in neutral position (determine by feel of detent plungers engaging notch in shifter fork sector), tighten trunnion setscrew and locknut without disturbing lever position, remove aligning pin.

Overshift Stop Adjustment:—To adjust stops, loosen shift lever trunnion stopscrews so that levers can be moved freely. Move Second-High lever (front lever) to rear to engage Second Gear. Loosen locknut and back off second gear stopscrew (front screw on right hand side of case), make certain that detent plunger engaged in second gear notch in shifter fork sector (determine by feel), tighten stopscrew until very slight overshift or additional travel of lever toward rear is possible, then tighten locknut. Move Low-Reverse lever (rear lever) toward front to engage Low Gear, adjust stopscrew (rear screw on right hand side of case) in same manner as for second gear (above) to permit slight overshift of lever toward front. Then move Low-Reverse lever to rear to engage Reverse Gear, adjust reverse overshift stop (angle stop mounted on left rear transmission case cover screw) for minimum clearance with detent plunger engaged in reverse fork sector notch (stop must be parallel to lever and cover screw securely tightened). Then adjust connecting rods as directed above. NOTE—High Gear overshift stop is located within transmission case and cover must be removed to adjust this stop.

SERVICING:—Gearshift Lever—Lever pivoted on threaded bushing with fixed pivot and adjustable pivot screw. Threaded bushing turns in upper jacket tube bracket and must be installed with one full thread exposed above bracket to insure full travel and maximum bearing area of bushing threads in bracket. Lever must be securely fastened to threaded bushing by tightening adjustable screw and locked with capnut.

Shift Lever Assembly (Steering Column Unit)—Shift levers at lower end of control rod on steering column are mounted on threaded bearing tube which is mounted in lower support bracket and positioned by retaining screw and locknut in bracket. This threaded bearing tube also supports lower end of control rod and guides selector pin which allows cross-shift (up and down motion to engage one or the other shift lever) to be made only at neutral. If this assembly dismantled, screw shift levers on each end of bearing tube (one lever above bracket, other lever below bracket) with aligning pin bosses in until distance between inner faces of levers (not rubber grommets) is 1⅜". Install aligning pin through holes in both levers and notch in mounting bracket, adjust pronged shifter lever (keyed and clamped on control rod) up or down until prongs enter rubber grommets on levers and fully disengage from one lever when engaged in opposite lever, then tighten bearing tube retaining screw and locknut on side of lower support bracket. Screw on lower end of shift rod retains selector pin and limits up and down travel of control rod. This screw also retains rubber boot which seals lower end of bearing tube.

Idler Lever and Shaft—Idler levers are mounted on vertical shaft which is pivoted on crankcase flange at lower end and supported by tie rod extending to bracket on steering column at upper end. Adjust bracket on steering column so that shaft is vertical with engine idle. This mounting provides for engine movement due to torque reaction and noise is prevented by tension spring at lower end of shaft.

OLDSMOBILE HANDI-SHIFT

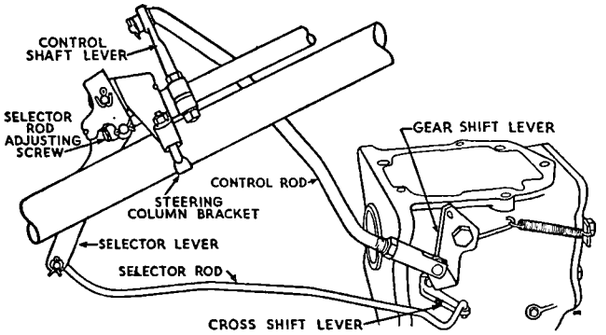
Std. Equipment On:

SIX, '60' SERIES F-40, '70' SERIES G-40 (1940)
EIGHT, '90' SERIES L-90 CUST. 8 CRUISER (1940)

TYPE:—Remote control type with steering column mounted gearshift lever. Design changed from that used on 1939 car models as follows:

Gearshift Lever—Lever now pivoted on plain pin in control shaft bracket. Pin is retained by retainer ring and entire shift lever pivot assembly is enclosed by rubber boot.

Selector Rod & Lever Assembly—Selector control rod in control shaft on steering column now connected to new type selector lever and shaft assembly in transmission by connecting rod (no cable used). Adjustment provided on lower end of selector control rod at connection to lever.



ADJUSTMENT:—Selector Rod (Cross-shift)—See that shift lever and transmission gears in neutral, check vertical distance from top of gearshift lever to lower face of steering wheel rim. This distance should be 2 11/16—2 13/16". To adjust, remove cotter pin and take out lock pin in lever which engages adjusting screw on lower end of selector rod, turn adjusting screw up to reduce lever-to-wheel distance, down to increase this distance. Install lock pin from engine side making certain that it passes through waved spring washer on inside of lever, install cotter pin.

Control Rod (Gear Engagement)—With transmission gears in neutral, gearshift lever should be approximately 1½" above horizontal position. To adjust, disconnect shift rod at lever on transmission case (upper gear engagement lever), see that this lever in neutral position (can be determined by feel of detent balls engaging notches in shifter shafts). Install special aligning gauge J-1445 over lower end of control shaft and steering column so that notch in gauge engages control shaft lever (gauge will hold gearshift lever and shaft assembly in correct neutral position which is 1½" above horizontal).

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Loosen locknut and turn adjusting clevis on transmission end of shift rod until clevis pin can just be inserted without disturbing position of transmission shift lever. Tighten locknut and connect rod, remove gauge. NOTE—This adjustment should be made each time shift rod is disconnected at either end. Improper adjustment may cause interference with brake pedal.

SERVICING:—Gearshift Lever—To remove lever, slide rubber cover toward outer edge to expose retainer ring, remove retainer ring, take out shift lever pivot pin, remove lever being careful not to lose shims and washers between lever and bracket. When reinstalling lever, make certain that anti-rattle spring in place of inner end of lever and that spring washer installed on pin on one side of lever and install shims (as required) on opposite side of lever so that lever operates freely without excessive sideplay or rattles.

Transmission Case Shifter Mechanism—Selector shaft and shifter shafts (for gear engagement) similar to type used on 1939 cars. Cross-shift selector lever and shaft (vertical shaft and small forward lever on transmission case) are new type. See Transmission article for dismantling and servicing directions. CAUTION—Selector shaft must be removed through right side of case and installed on left side to avoid damage to oil seal. Lower lever must be removed from vertical cross-shift shaft before selector shaft is driven out (to permit upper lever on shaft to disengage from selector shaft).

PACKARD TYPE

Std. Equipment On:
'110' SIX 1800, '120' EIGHT 1801,1A (1940)
'160' SUPER EIGHT MODELS 1803, 4, 5 (1940)
'180' CUSTOM SUPER EIGHT 1806, 7, 8 (1940)

This Transmission Control same as type used on corresponding 1939 car models except for construction details.

SPECIAL SERVICE CAUTION:—Always insert 3/16" lock pin aligning gauge through holes in both levers at lower end of control tube on steering column when working on engine in proximity to control rods and levers to prevent accidental gear engagement which would prevent operation of gearshift lever until gears and rods had been reset in neutral.

TYPE:—Remote control type with steering column mounted gearshift lever. Same design as used on 1939 Packard models.

ADJUSTMENT:—See that gearshift lever in neutral, install 3/16" rod through alignment holes in both levers at lower end of control tube on steering column and leave this pin in place while adjustments being made. Disconnect control rods at bellcranks, place both shifter levers on transmission case in neutral position (this can be determined by feel of detent balls engaging neutral notch on each shifter lever shaft sector within transmission). Adjust each control rod at bellcrank (loosen locknuts and turn adjusting sleeve on upper rod, adjusting clevis and locknut also provided at bellcrank end of lower rod) so that lengths are correct and rods can be connected without disturbing position of shift levers, connect rods and remove pin from alignment hole in levers.

SERVICING:—***See Packard Handi-shift article in Mechanical Equipment Section of manual (or 1939 Supplement) for data.***

PLYMOUTH TYPE

Std. Equipment On:
ROADKING MODEL P9, DELUXE MODEL P10 ('40)

This Control not similar to type used on 1939 cars.

TYPE:—Remote control type with steering column mounted gearshift lever. Design not same as type used in 1939 and consists of new steering column unit and new transmission unit as follows:

Steering Column Unit—Gearshift lever mounted on pivot stud screwed in upper support bracket on steering column and pinned to external control shaft mounted in brackets on steering column (not within column jacket as in 1939). Control shaft has cable connection (for cross-shift) and lever assembly (for gear engagement) mounted on lower end and is normally held in the upper (Second-High) position by return spring on lower end. When gearshift lever lifted up for Low-Reverse engagement, control shaft is forced down and actuates cross-shift cable which is connected to rear lever on transmission case. Control shaft lever assembly consists of a lower adjusting lever and upper idler lever to which connnecting rod is attached. Levers are clamped together by clampscrew and may be adjusted after clampscrew has been loosened.

Transmission Case Shifter Mechanism—Same design as on other Chrysler models.

ADJUSTMENT:—Control Rod (Gear Engagement)—Loosen lock bolt clamping levers together at lower end of control shaft on steering column, see that shift lever on transmission case side cover is in neutral position (can be determined by feel of detent balls engaging notches in shifter shafts). Place gearshift lever approximately 10° above horizontal and hold in this position while tightening lever clamp bolt.

Selector Cable (Cross-Shift)—Place gearshift lever in neutral position, see that transmission gears are in neutral. Loosen locknut on selector cable at transmission selector lever (rear lever on transmission case side cover), tighten acorn nut on cable until all play removed from cable, back nut off ½ turn for clearance, tighten locknut.

SERVICING:—Disassembly of Steering Column Unit—Remove horn button, horn wire, and steering wheel. Disconnect rod on lever at lower end of control shaft, disconnect selector cable and remove levers and spring from shaft. Remove attaching screws in upper support bracket on steering column—CAUTION—screws have nuts on inner end which must be held while screws taken out and then removed to prevent them dropping down in steering gear jacket which would necessitate steering gear removal from car to recover these nuts. Pull control shaft and gearshift lever assembly up and remove from car. To disassemble gearshift lever, press in on bearing pins on both sides of lever (pins assembled with spring between them), withdraw pivot stud. Drive out clevis pin and remove gearshift lever from control shaft.

Assembly—Reassemble by reversing dissembly directions given above. Make certain that spring and ball assembled in pivot stud and that flat anti-rattle installed on upper end of control shaft in gearshift lever. Adjust control rod and selector cable as directed above after control installed on car.

PONTIAC SAFETY-SHIFT

Std. Equipment On:
SPECIAL SIX 40-25, DELUXE SIX 40-26 (1940)
DELUXE EIGHT 40-28, TORPEDO EIGHT 40-29 (1940)

TYPE—Remote control type with steering column mounted gearshift lever. Design changed from that used on 1939 Pontiac cars as follows:

Selector Rod & Lever Assembly—Control shaft on steering column has special collar which engages new selector control lever assembly, this lever being connected to new type selector shaft and lever assembly in transmission by selector rod (no cable used). Adjustment provided at steering column lever assembly (double levers clamped together by bolt, outer idler lever can be shifted after bolt has been loosened).

ADJUSTMENT:—Gearshift Lever Clearance—Clearance between upper edge of control shaft upper support and shoulder on upper control shaft bearing which is screwed in the bracket must be ⅛" minimum, 5/32" maximum, to avoid interference when engaging gears. If clearance incorrect, adjust by removing gearshift lever (see Servicing data below), screw bearing in or out of support bracket.

Selector Rod (Cross-shift)—With gearshift lever in neutral on Second-High side (normal position), distance from lower edge of steering wheel rim to upper edge of gearshift lever should be 2⅞" (plus or minus ⅛"). To adjust, loosen clamp bolt holding selector control lever and selector control idler lever together (these are levers pivoted on lower suport bracket on steering column), see that selector rod and levers are in Second-High position (rod moved to rear as far as possible), place gearshift lever in correct position and tighten lever clamp bolt.

Control Rod (Gear Engagement)—With gearshift lever in neutral, lever should be approximately horizontal but can be varied approximately 1½" to suit individual operators. To adjust, loosen clamp bolt holding control shaft lever and control shaft idler lever together (these are levers mounted on lower end of control shaft on steering column), see that control rod and transmission case shifter lever are in neutral, move gearshift lever to desired position and tighten lever clamp bolt. Check to make certain that gearshift lever has full travel required for gear engagement without interference after making this adjustment.

SERVICING:—Disassembly—Remove front compartment floor mat, center floor panel, and steering wheel (use puller J-452). Remove gearshift lever using tool J-1044 to remove shift lever pins and springs and use extreme care not to lose shims and spring washer on pivot pin. Remove left hood side panel, disconnect return spring hooked to clip on lower end of control shaft, remove selector control lever pivot pin. Take out screw in lower end of control shaft, remove selector lever collar, control shaft lever and idler lever assembly from shaft. Remove screws in upper support bracket at upper end of control shaft (use Philips #2 screwdriver). Pull upper support and control shaft assembly up parallel to steering column and lift out being careful not to lose anti-rattle spring and spring cup (in upper support), flat anti-rattle spring (in lower suport).

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Reassembly—Reassemble by reversing disassembly directions given above. Make certain that anti-rattle spring installed in lower support bracket and upper support bracket (spring and cup must be installed in upper bracket before bracket mounted on steering column). Lubricate all moving parts (including anti-rattle springs) with Lubriplate before assembling. Use caster oil in insulators at rod connections in levers (oil or grease will cause insulators to swell and bind on rods).

Gearshift Lever Assembly—One anti-rattle spring washer must always be used on gearshift lever pivot pin and shims should be installed as required to take up excessive clearance so that lever operates freely without excessive play or rattles.

Transmission Case Shifter Mechanism—Selector shaft and shifter shafts (for gear engagement) similar to type used on 1939 cars. Cross-shift selector lever and shaft (vertical shaft and small forward lever on transmission case) are new type. See separate Transmission article for dismantling and servicing instructions. CAUTION—Selector shaft must be removed through right side of case and installed on left side to avoid damage to oil seal. Lower lever must be removed from vertical cross-shift shaft before the selector shaft is driven out (to permit upper lever on shaft to disengage from selector shaft).

TROUBLE SHOOTING:—Bind in Shifter Rods—Most noticeable when shifting out of low gear. Caused by control rod binding in lever at lower end of control shaft on steering column. To check, disconnect rod at control shaft lever and note position of rod end as transmission gears are shifted out of low gear by hand. Bend rod so that end will drop into hole in lever without binding.

STUDEBAKER TYPE

Std. Equipment On:

CHAMPION, MODEL 2G (1940)

COMMANDER, MODEL 10A (1940)

PRESIDENT, MODEL 6C (1940)

This Transmission Control same as type used on 1939 Champion Model (not similar to type used on 1939 Commander and President).

SPECIAL SERVICE TOOL NOTE:—New Gauge No. J-1308-A required for use in adjusting transmission shift rods on 1940 cars. Old Gauge J-1308 (used for 1939 Champion cars) can be worked over for 1940 cars by reducing over-all width across prongs from .750" to .672" by grinding equal amount (.039") off outer face of each prong and maintaining 1/16" chamfer at 45° on end of prong. With this change, gauge can be used both for 1939 Champion and all 1940 cars.

TYPE:—Remote control type with steering column mounted gearshift lever. Same design as used on 1939 Champion except that cross-over travel of control shaft and lug (up-and-down movement) has been reduced to 5/8". This requires new gauge for rod adjustment (see note above).

ADJUSTMENT:—Pry out inspection plug in engine side of control housing cover on steering column at lower end of control shaft, insert forked end of adjusting gauge J-1308-A (see service tool note above) in hole and press up on control shaft until gauge prongs enter above and below the selector lever on the control shaft which hold control levers and shaft assembly in neutral position while adjustments are being made. Disconnect both connecting rods at shift levers on side of transmission case, place each lever in neutral position (can be determined by feel of detent balls engaging neutral notch in shift lever shaft sectors). Loosen locknut and adjust clevis on transmission end of each rod so that clevis pins can be inserted without disturbing lever positions, tighten locknuts and connect rods. Remove gauge and replace inspection hole cover.

SERVICING:—If control mechanism removed from steering column, coat upper bracket pin threads and shift lever ball with Lubriplate, turn pin into upper bracket so that end of thread on pin is flush with lower face of bracket. Make certain that key on lower control housing mounting bracket engages notch in steering column. Adjust rods as directed above when control re-installed on car.

WILLYS TYPE

Used On:

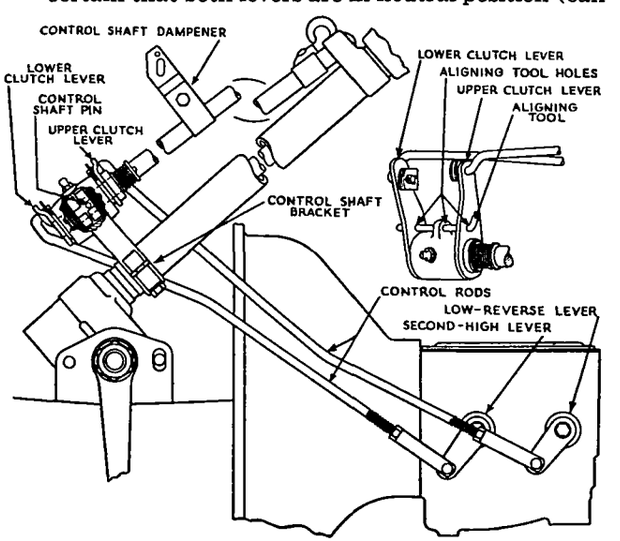
MODEL 440 DELUXE PASS. CARS (1940)—STD.

MODEL 440 OTHER CARS (1940)—OPTIONAL.

IMPORTANT NOTE ON FIRST CARS:—On first cars, if shift does not operate smoothly and positively, check adjustments and refer to Trouble Shooting data (below) for recommended corrections.

TYPE:—Remote control type with gear shift lever on control shaft under steering wheel. Shaft has dog clutch at lower end (pin in shaft engages slots in levers) by which it is engaged with upper lever (connected to rear lever on transmission case) for Low-Reverse, or lower lever (connected to front lever on transmission case) for Second-High engagement. Control rods connecting steering column levers and transmission case levers have adjusting clevises at transmission case end.

ADJUSTMENT:—Disconnect both control rods at transmission case levers by removing clevis pins, make certain that both levers are in neutral position (can



be determined by feel of detents engaging notches in shifter lever shaft sectors). Place steering column shift lever in neutral position, install aligning tool (short piece of 1/4" drill rod) through hole in each lever and hole in boss on steering column clutch housing (at lower end of control shaft) to hold levers in neutral position while adjustment being made. Loosen locknut and adjust clevis at transmission end of each control rod until clevis pin can just be inserted without disturbing position of transmission case lever. Tighten locknut and install clevis pin. Remove aligning tool. Check operation. If shaft pin strikes edges of slots in lever clutches, disconnect low-and-reverse control rod at transmission lever (rear lever) and lengthen or shorten rod slightly so that shaft pin engages both clutch slots smoothly.

SERVICING:—Removal & Installation—To remove assembly from steering column, remove steering wheel, remove floor boards, disconnect control shaft dampener at cowl. Assembly can then be removed by taking out gearshift lever and freeing housing assembly clamp bracket at lower end of steering column. When re-installing, note following points:

Clutch Clearance—Clearance between faces of shift clutches must be .015-.031" (1/64" to 1/32"). Can be checked by removing lubrication fitting on clutch housing and inserting narrow feeler gauge through this hole. If clearance not correct or if clutch assembly has been dismantled, check clutch pin clearance in slots (must not exceed .009"—replace Clutch Lever and Housing Assembly #116221 if clearance excessive) and set up levers as follows: Screw upper clutch lever in housing as far as possible, then back lever out one full turn until alignment holes line up. Then screw lower clutch lever into housing until clutch face contacts upper clutch lever face, then back off lever exactly 1/4 turn which will give correct clearance of .015-.031" between clutch faces. If alignment holes do not line up in this position, remove lower clutch lever and grind off clutch face squarely not more than .015". It is very important that lower clutch lever be backed off exactly 1/4 turn from position where it contacts upper clutch lever and that alignment holes line up in this position. If correct clearance between clutch faces cannot be secured by this method, or if control shaft clutch pin has more than .009" clearance in clutch slots, replace entire Clutch Lever and Housing Assembly #116221.

Control Shaft Bracket Position—When installing steering column assembly, see that steering gear outer casing or jacket is positioned so that gear shift control shaft clutch pin bottoms in upper clutch slot when gear shift lever and shaft is in the uppermost position (Low-Reverse). If jacket and brackets installed too far down on steering gear shaft, gear shift control shaft will bottom in upper bracket and prevent clutch pin fully disengaging from lower (Second-High) clutch slots.

Gearshift Lever Clearance—Lever sideplay at fulcrum pin must not exceed .005" (excessive play will cause rattles). To reduce sideplay, add thin washer (.005-.010") under head of fulcrum pin or grind down shoulder on pin so that it will squeeze stamping closer to lever when installed. Also see that anti-rattle trigger spring on gearshift lever has suffcient tension on lever to dampen rattles.

Control Shaft Dampener—When installing dampener, see that it is positioned on cowl so that ten-

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sion applied to shaft and that dampener cross bolt spacer short enough so that slight drag results on shaft when cross bolt is tightened.

TROUBLE SHOOTING:—Shift not smooth and positive—Adjust control rod lengths (see Adjustment above).

Shift sticks or does not disengage—Check adjustment. If adjustment does not correct trouble, check Clutch Clearance (Servicing—above) and adjust clearance or replace Clutch Lever and Housing Assembly.

Gearshift Rattles—Check Gearshift Lever Clearance and Control Shaft Dampener position (Servicing—above). NOTE—If gearshift lever breaks at the weld (first cars only) and lever can not be welded, install new Control Shaft Assembly #638022.

WARNER MODELS

Model AS1-T84E

BANTAM, SERIES 63 & SUPER FOUR 65 (1940)

Model AS1-T92

CROSLEY, MODEL A (1939-40)

Model AS3-T84D

WILLYS, SPEEDWAY MODEL 440 (1940)
WILLYS, PICK-UP 440, PANEL DELVRY. 440P ('40)

Model AS4-T84F

WILLYS, DELUXE MODEL 440 (1940)

Model AS5-T84F

STUDEBAKER CHAMPION, MODEL 2G (1940)

Model AS1-T86C

STUDEBAKER COMMANDER, MODEL 10A (1940)
STUDEBAKER PRESIDENT, MODEL 6C (1940)

Model AS9-T88—'Horizontal'.

GRAHAM SENIOR, MODELS 107, 108 (1940)

NOTE:—Steering Column Gearshifts—Standard or optional equipment on all models except Bantam, Crosley, and Willys Speedway & Commercial models. See separate 'Transmission Control' articles for servicing and adjustment data on each car model.

Overdrive—Transmissions with Overdrive optional on all Graham and Studebaker models. See following article for data on Transmissions with Overdrive.

TYPE:—Same design as used on corresponding 1939 models except for Gearshift mechanism and Synchronizer design on some models as follows:

Synchronizer Assemblies:—Type used on each car as follows (no Synchronizer on Crosley—see description of Transmission below).

Double Blocker—Double Spring Type (Studebaker T86C, Studebaker & Willys T84F)—Synchronizer Rings are free in ends of inner clutch sleeve and are actuated by three shifting plates or struts which fit in slots in the inner clutch sleeve and engage notches in the synchronizer rings. Struts are centered in outer clutch sleeve by two wire springs (within struts on either side of inner clutch web) and move with the outer clutch sleeve to engage the synchronizer rings with the cones on the gear hub. Teeth on the outer rim of the synchronizer rings block or prevent gear engagement until synchronization completed when final movement of outer clutch sleeve causes the clutch teeth on the inner rim of the clutch sleeve to slide past the synchronizer teeth and engage the clutch teeth on the gear hub. Inner clutch sleeve is stationary on shaft and does not move (retained with second speed gear by single snap ring at forward end of sleeve).

Wire Bound Strut Type Blocking Synchronizer (Graham)—Similar to double blocker type (above) except that struts are centered by single locking wire or ring in outer clutch sleeve which engages notches in center of each strut.

Poppet Ball Type (Bantam, Willys T84F)—Inner and outer clutch sleeves centered by spring-loaded poppet balls. Synchronizer rings are fixed in ends of inner clutch sleeve (inner clutch moves with outer sleeve to engage rings, second speed gear mounted separately and retained by thrust washer and locking plunger at forward end of gear).

Gearshift Mechanism (Studebaker T86C, Studebaker and Willys T84F):—Consists of two shifter shafts and lever assemblies mounted in side of transmission case, each lever operating entirely independently (rear lever for Low & Reverse, forward lever for Second & High) with forks on inner ends of shafts engaging the sliding gear (Low-Reverse) or synchronizer clutch sleeve (Second-High). Interlock and detent plungers are mounted in boss in case between shafts and engage notched sectors on each shifter shaft. NOTE—On T86C, separate detent plungers are located in holes in ends of case and are accessible after plugs which close these holes are taken out.

Graham Models—Shift lever (for gear engagement) and selector lever (cross-shift) are mounted in side cover on transmission case with conventional shifter plates or rails within the case. Cross-shift lever actuates a small lock lever which holds one or the other of the rails stationary while the other rail moves to engage the gears. Detent and interlock plungers are located between the shifter rails.

Bantam, Crosley, Willys T84D Models—These models have conventional gearshift lever mounted on top cover of transmission case.

Crosley Transmission:—This transmission is a conventional sliding spur gear type. Forward gear on mainshaft is moved backward to engage Second, forward to engage High (clutch teeth on inner rim of gear engage clutch teeth on main drive gear). Rear gear on mainshaft engages low and reverse in same manner.

SERVICING:—Serviced in same manner as previous types except for new Gearshift mechanism and Synchronizers. ***See Warner Transmission and Warner Horizontal Transmission articles in Mechanical Equipment Section of manual (or 1938 Supplement) for complete data and note the following changes:***

Disassembly:—Mark both synchronizer rings as well as inner and outer clutch sleeves of synchronizer before removal to insure reassembly in same positions. On T86C and T84F with gearshift levers in side of case, drive out shift lever shaft lockpins (in hole in lever boss on case) and pull levers out as far as possible before removing mainshaft and gears (do not do this unless transmission is being dismantled—detent balls and plungers must be reset when levers reassembled). On all models except T86C, mainshaft rear bearing is seated directly in case and synchronizer and gears must be removed through top of case (see Synchronizer and Second Speed Gear data below).

Crosley Note—On this model, no rear bearing retainer is used and bearing is held in case by lock ring on each side of bearing outer race. To remove mainshaft and bearing, remove speedometer gear snap ring, speedometer gear and key, rear bearing snap rings, rear bearing and oil retainer washer, then pull mainshaft out through rear of case.

Synchronizer Assembly (Double Blocker—Double Spring Type):—Install struts with open face toward inner clutch sleeve and hooked end of each spring wire engaged in the same strut (free end of spring will be between this strut and next strut in clockwise direction). See Second Speed Gear Assembly for installation instructions.

Wire Bound Strut Type—Install struts in inner sleeve and install lock wire so that it engages notches in struts with open end of wire midway between two struts (synchronizer will not operate if wire installed with open end at strut so that strut free to move endwise). When installing inner sleeve and strut assembly in outer sleeve, narrow strips of .003" feeler stock can be installed directly over each strut to prevent wire disengaging from strut slot when it is contracted to enter outer sleeve. CAUTION—Make certain that open end of wire is engaged between two clutch teeth in outer sleeve and remove feeler strips before assembling synchronizer on mainshaft. See Second Speed Gear Assembly below for installation instructions.

Poppet Ball Type—Synchronizer is free on shaft and can be removed as an assembly. If outer clutch sleeve removed use extreme care not to lose poppet balls and springs (will fly out when sleeve removed).

Second Speed Gear Assembly (With Double Blocker—Double Spring & Wire Bound Strut Type Synchronizers):—Gear and inner sleeve or hub of synchronizer are mounted on mainshaft as an assembly and retained by a snap ring at the forward end of the synchronizer. To disassemble, remove snap ring, withdraw synchronizer assembly and gear. When reassembling make certain that second speed gear has .003-.012" endplay with synchronizer hub pressed forward against the snap ring. On T86C, clearance between face of synchronizer ring and second speed gear must be .047" min., .055" max. On T84F, clearance between end of outer clutch sleeve and second speed gear should be .035" max. when shifted into second gear. On all models, synchronizer ring should turn freely after assembly (gears not engaged).

Gearshift (T84F, T86C):—Shifter shafts can be withdrawn through case after nut on outer end of lever has been removed and lever taken off. When reassembling shafts, see that interlock and detent plungers and springs are properly installed and engage notches in sectors on shifter shafts, install oil seal in recess in case at outer end of shafts. Coat shaft lock pins with Permatex or shellac, drive pins in so that they are ⅛-3/16" past flush.

WARNER MODELS WITH OVERDRIVE

Model AS9-T88 (Horizontal)
GRAHAM SENIOR, MODELS 107, 108 (1940)

Model AS6-T86F
STUDEBAKER CHAMPION, MODEL 2G (1940)

Model AS2-T86C
STUDEBAKER COMMANDER, MODEL 10C (1940)
STUDEBAKER PRESIDENT, MODEL 6C (1940)

TRANSMISSION CONTROL NOTE:—These models have 'kick-down' type electrical control. See Warner Overdrive Control article (following) for complete adjustment data and specifications for Solenoid, Relay, and Throttle Switch adjustment.
Steering Column Gearshift—See separate Transmission Control articles for adjustment directions on gearshift on each car model.

TYPE:—Same design as used on corresponding 1939 car models except as follows:
Synchronizer Unit (Studebaker Models)—New type Double Blocker—Double Spring Type (same as for standard transmissions without overdrive as used on these models). See preceding article for description of this synchronizer.
Gearshift Mechanism (T86C)—Same design as used on 1939-40 Champion and other Studebaker transmissions without overdrive. See preceding article for description.

SERVICING:—Same as for 1939 types except for new Synchronizer and Gearshift Mechanism (Studebaker models only) for which servicing articles are given in preceding article. *See 'Warner Transmission (With Electrical Control Overdrive)' article in Mechanical Equipment Section of manual (or 1939 Supplement) for complete instructions.*

OVERDRIVE UNIT:—See Warner Overdrive (following) for complete adjustment and servicing directions.
Cut-in Speed—With standard setting, cut-in speed should be 32-36 M.P.H. (Studebaker Champion), 28-32 M.P.H. (Studebaker Comm. & Pres.).
CAUTION—Both adjusting screws must be adjusted exactly alike.
Clutch Core Assembly Endplay—Should be .005-.010".

WARNER OVERDRIVE

Type R7B
CHRYSLER, MODELS C25, C26, C27 (1940)
DE SOTO, MODEL S7 (1940)

Type R7
GRAHAM, MODELS 107, 108 (1940)

Model AS13-R6
HUDSON 6 & 8, ALL MODELS (1940)

Model AS12-R6
NASH, 4020 SIX, 4080 EIGHT (1940)
NASH-LAFAYETTE, MODEL 4010 (1940)

Type R7
STUDEBAKER COMMANDER, MODEL 10A (1940)
STUDEBAKER PRESIDENT, MODEL 6C (1940)

Type R7A
STUDEBAKER CHAMPION, MODEL 2G (1940)

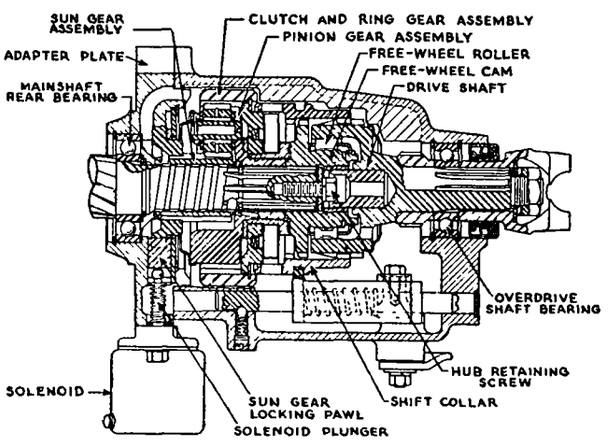
NOTE:—These Overdrive units are used in conjunction with Warner Transmissions (Graham, Studebaker) or with Transmissions built by the car manufacturer (Chrysler, De Soto, Hudson, Nash). See separate articles for Transmission servicing data.

Packard Models—Overdrive on these models is of different design (Type R9 & R9A). See separate article (following) for data on this type.

TYPE:—Same design as used on 1939 car models with sun gear normally locked in position by solenoid controlled pawl and overdrive engagement controlled by clutch pawls. When accelerator pedal depressed fully to operate 'kick-down' feature, solenoid is energized and withdraws pawl from sun gear, allowing gear to rotate freely, resulting in a direct drive from the engine to the rear wheels.

SERVICING:—Chrysler Note—Adapter plate and overdrive case are held together by three special screws inserted in holes in front face of adapter plate. Overdrive assembly must be removed from the transmission as a unit with the adapter plate and mainshaft assembly. Special tool C-577 must then be used to take out screws in adapter plate before overdrive can be disassembled.

Disassembly:—See Chrysler note above. On all models, remove speedometer drive pinion assembly, take off retaining screw and washer on rear end of driveshaft, use puller to remove universal joint companion flange (J-820 Hudson, SE-601 Nash). Remove screws and nuts holding overdrive case and adapter to transmission (on Hudson, if transmission not being disassembled, take out 2 screws holding overdrive case on adapter only, leave adapter bolted



to transmission case). Press forward on rear end of driveshaft and pull overdrive case off to rear using extreme care not to allow adapter to separate from transmission case (if transmission not being disassembled). Clutch collar will remain in overdrive case but overdrive assembly will not be disturbed otherwise (if driveshaft removed as a unit with case, overdrive will separate at free-wheel cam and free-wheel rollers will fall out). Remove clutch collar from case (if necessary, remove control fork guide rail to free the collar). Remove rear main bearing from case by taking out snap ring in front of bearing and tapping bearing out through front of case. If oil seal being replaced, remove bearing rear snap ring from case, tap oil seal out through rear of case. Lift speedometer drive gear off end of driveshaft, pull driveshaft off toward rear, using a rubber band to retain free-wheel rollers or catching rollers as they drop out. Remove capscrew, washer, and bushing on end of mainshaft, withdraw free-wheel cam, then remove clutch pawl and pinion assembly from shaft (do not pull ring gear off pinions unless these parts being dismantled, pinions are split type and must be properly wound up when meshed with ring gear). Take out mounting screws and remove kick-down solenoid, solenoid plunger assembly, and spring. Remove pinion cage stop ring from shaft directly behind sun gear. Take out sun gear retaining snap ring in adapter plate, remove mounting plate, withdraw sun gear and hub assembly, lift out sun gear pawl.

Sun Gear & Hub Assembly:—To dismantle assembly, take out snap ring in hub at forward end of gear, withdraw gear from hub. Check balk ring friction on sun gear hub. Pull required to turn balk ring in clockwise direction on hub should be 8-10 lbs. (if friction less than this amount, balk ring will not block pawl out for 'kick-down' direct drive). When reassembling sun gear and hub,see that oil slots in gear and hub are lined up.
Sun Gear Pawl & Balk Ring Clearance—Clearance between end of pawl and face of lug on balk ring should be .015" with balk ring rotated to block out pawl. If solenoid assembled, clearance can be checked by energizing solenoid so that pawl is withdrawn. Adjust by adding or removing solenoid gaskets.

Pinion Cage Assembly:—To remove pinion assembly, pull pinions out of ring gear. Assembly cannot be dismantled (oil slinger which is spun on pinion cage retains pinion shaft pins). When remeshing split type pinions in ring gear, wind up narrow half of each split pinion 1½ teeth so that marked teeth on wide and narrow halves of pinion are together, mesh ring gear with pinions held in this position.

Ring Gear & Clutch Pawl Assembly:—Take out snap ring in inner rim of ring gear, clutch pawl and core assembly from ring gear. Clutch pawl adjusting screws, washers, and springs can be removed but no further disassembly is possible (clutch core must be concentric with gear teeth and cannot be reamed sufficiently accurately in the field, parts are not furnished separately). CAUTION—If adjusting screws removed, count number of notches or 'clicks' as each screw is turned out so that screws can be replaced in exactly same position. These screws control cut-in speed (see adjustment directions below). On Hudson, turn each screw in so that head is exactly 1/16" below top edge of counterbore.
Clutch Pawl & Pinion Cage Thrust Washer—Bronze thrust washer between clutch pawl hub and pinion cage should be installed with projection on washer engaging notch on hub (washer can be retained with cup grease while assembling parts). Clutch core assembly endplay should be .005-.010" with all parts installed on mainshaft and retaining screw tight.

Overdrive Solenoid & Plunger Assembly:—See following article on Warner Overdrive Control for complete solenoid data.

Reassembly:—Use new snap rings if old rings distorted or damaged by removal, reverse disassembly directions given above and note following points: Make certain that snap ring installed on main shaft in back of sun gear assembly (this snap ring controls pinion cage endplay), see that split type pinions are correctly wound up when meshed with ring gear, pack free-wheel rollers with cup grease or use rubber band to retain rollers, start drive shaft over free-wheel rollers and cam (turn rollers and cage counter-clockwise so that rollers on low points of cam), remove rubber band and push drive shaft forward into place. See that rear bearing and oil seal properly installed in overdrive case (on Hudson,

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oil seal must protrude 7/32" beyond rear face of case), and that snap rings in place on both sides of bearing, install shift collar in case and see that it engages shift fork in case, then install case and collar on shaft assembly, guiding reverse lock-out plunger through hole in adapter plate and shift collar so that it engages teeth on free-wheel cam and clutch pawl assembly. Adjust overdrive control when transmission re-installed on car.

ADJUSTMENT:—Cut-in Speed. Should not require adjustment but can be adjusted in same manner as on previous models by removing plug on top of overdrive case, turning shaft until hole in clutch shell and adjusting screw in clutch pawl assembly (two screws—adjust in succession) line up with hole in case, and turning adjusting screw in to increase cut-in speed, out to decrease cut-in speed. Make certain that screws not turned so far as to cause interference. With standard setting, cut-in speed should be as follows:

Car Model	Cut-in Speed
Chrysler, De Soto	25 M.P.H.
Hudson	30-35 M.P.H.
Nash	33 M.P.H.
Studebaker Champion	32-36 M.P.H.
Studebaker Comm. & Pres.	28-32 M.P.H.

CAUTION—Both adjusting screws must be adjusted exactly alike. One screw marked by single slot, opposite screw marked by double slot for identification. Use care not to adjust same screw twice.

Overdrive Lock-out Control Adjustment:—To adjust lock-out control button cable, loosen clampscrew on lever on overdrive case, move control button on dash to fully 'in' position, then pull button out ⅛", make certain that overdrive case lever moved to rear as far as possible, tighten control wire clampscrew and locknut.

Reverse Lock-out Plunger (Nash Models)—Reverse lock-out pin is actuated by lever mounted on adjustable stud in rear end of transmission case. To check adjustment, place transmission gears in reverse, see that overdrive is locked out, check clearance between lock-out lever and roller on end of shift fork plate. Clearance must not exceed .005". Adjust by screwing lever mounting stud in or out of transmission case.

WARNER 1940 ELECTRICAL 'KICK-DOWN' OVERDRIVE CONTROL

Std. or Optl. Equipment On:

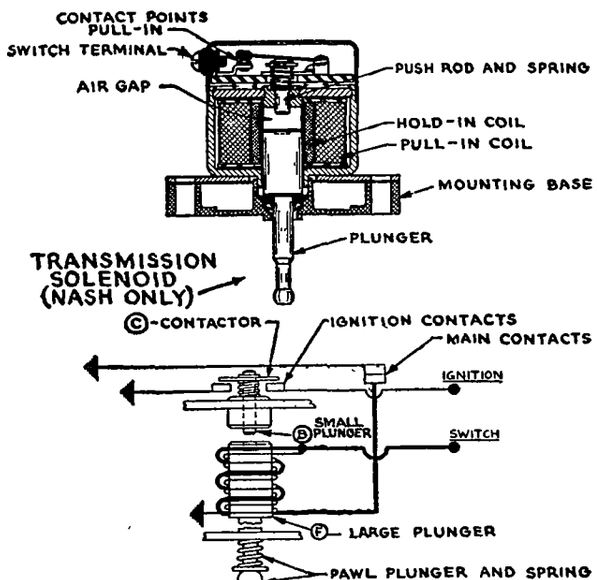
CHRYSLER, MODELS C25, C26, C27 (1940)
DE SOTO, MODEL S7 (1940)
GRAHAM, MODELS 107, 108 (1940)
HUDSON 6 & 8, ALL MODELS (1940)
NASH, SIX 4020, EIGHT 4080 (1940)
NASH-LAFAYETTE, MODEL 4010 (1940)
STUDEBAKER CHAMPION 2G, COMMANDER 10A (1940)
STUDEBAKER PRESIDENT 6C (1940)

NOTE:—This electrical 'kick-down' control is used to control the kick-down or return to direct drive on cars using Warner Overdrives. See preceding article for Overdrive servicing data.

Packard Models—Overdrive control on Packard models is of different design. See separate article (following Warner Packard Type Overdrive article) for adjustment directions on Packard models.

DESCRIPTION & OPERATION:—Same as for 1939 car models with 'kick-down' feature except as follows:

Nash Models—Transmission solenoid used on this model does not have ignition contacts or provision for cutting out ignition in order to allow solenoid to disengage sun gear pawl. Ignition control is effected by a second relay unit in the Transmission Relay case. On all cars with overdrive, the customary ignition feed wire (from ammeter to ignition switch) is omitted, and the switch feed is taken through the transmission relay Series Relay contacts. The high initial current draw of the transmission solenoid (when accelerator pedal depressed to close throttle switch contact which causes closing of transmission relay Shunt Relay contacts and allows current to flow through both transmission solenoid windings) causes the Series Relay contacts to open and opens the ignition circuit so that the



TRANSMISSION SOLENOID (ALL OTHERS)

ignition is cut out. As soon as the transmission solenoid withdraws the sun gear pawl, the bottoming of the solenoid plunger opens the solenoid contacts so that current flow through the pull-in coil is interrupted. The remaining current flow through the solenoid hold-in coil (approx. 1 ampere) is not sufficient to hold the Shunt Relay contacts open, the contacts close and ignition is restored. As soon as accelerator pedal is released (opening throttle switch contacts), transmission relay Shunt Relay contacts open and current flow through solenoid hold-in coil is interrupted. The solenoid plunger spring then causes the pawl to re-engage in the sun gear plate slot.

Other Models—Operate in same manner as in 1939 (small plunger in transmission solenoid closes ignition contacts and shorts out ignition, large plunger then withdraws pawl and opens ignition contacts so that ignition is restored).

CAR WIRING CIRCUITS:—See wiring diagram on car model 'T&E' page for complete transmission control wiring diagrams.

ADJUSTMENT:—Check and adjust throttle switch linkage on each car model as directed below whenever linkage is disconnected or disturbed by carburetor adjustment, removal of units, etc.

Chrysler, De Soto Models—Gap between switch plunger contact screw and plunger should be 3/32" with throttle valve wide open. To adjust, remove air cleaner (to observe throttle valve), open throttle until throttle valve is just wide open, loosen locknut and turn contact screw until gap is 3/32", tighten locknut.

Graham Models—Adjust position of operating block (on connecting rod linkage ballcrank and throttle valve lever) so that throttle switch plunger is depressed not more than 1/32" with throttle in wide open position. See that linkage over-travel is sufficient to close switch contacts before accelerator pedal bottoms on toeboard.

Hudson Models—Contact disc on accelerator connecting rod should just contact throttle switch plunger with throttle valve wide open. To adjust, remove air cleaner (to observe throttle valve), open throttle until valve is just wide open, loosen adjusting nuts above and below contact disc on rod, move contact disc up or down until it contacts switch plunger, tighten mounting nuts.

Nash Models—Throttle switch is mounted on dash and is cable operated. To adjust, loosen locknut and adjust switch position on mounting bracket so that contacts close when throttle is wide open and spring on carburetor throttle shaft pulley just begins to compress. Check accelerator pedal over-travel and adjust stopscrew on floor board so that pedal has sufficient travel beyond wide open throttle position to operate switch.

Studebaker Models—Depress accelerator pedal until throttle valve is just wide open and throttle lever contacts wide-open throttle stop. Hold linkage in this position, loosen locknut on switch mounting stud, turn switch in or out of mounting bracket until small shoe on idler lever (Champion, Commander), end of accelerator rod (President) just contacts switch plunger, tighten locknut.

SERVICING OVERDRIVE SOLENOID:—Removal—To remove solenoid (for transmission and overdrive removal or for servicing), take out two capscrews in mounting flange, withdraw solenoid case without disturbing base plate and plunger assembly.

CAUTION—Do not lose gaskets under solenoid assembly. These gaskets control pawl mesh and must be replaced when solenoid installed.

Servicing—No servicing required other than to keep contacts clean and parallel so as to make good electrical contact. To remove cover for contact inspection, disconnect wires, take out flat headed screw, pull cover off base. See that lower face of contact disc on plunger 'B' and contact plates (which short out ignition) are clean and smooth. Resurface main contacts (which control 'starting coil' circuit with a file, if necessary, to secure smooth parallel contact surfaces. Check contact gaps and solenoid performance (see specifications below).

FUSES:—Fuses located on Solenoid Relay to protect solenoid circuits. If solenoid does not withdraw sun gear pawl for any reason, fuse will blow so that ignition is restored and car can be driven normally except that kick-down feature will not operate.

CAUTION—Do not use fuse of any other capacity than that shown in table below (no fuse used on Graham and Nash models).

Car Model	Fuse Capacity
Chrysler, De Soto	20 ampere
Hudson	20 ampere
Studebaker	14 ampere

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Hudson Note—On first cars, fuse located in holder in relay case. After car No. 48622, fuse mounted in clip on bottom of relay.

SPECIFICATIONS:—Control System units for each car model are of various makes as follows:

Car Model	Solenoid Relay	Solenoid
Chrysler, De Soto	A-L. HR-4201	A-L. SSB-4001
Graham	R-B-M No. 4740	D-R. 1569
Hudson	A-L. HR-4201	D-R. 1569
Nash	D-R. 1116798	D-R. 1118004
Studebaker	A-L. HR-4201S	D-R. 1118001

AUTO-LITE SOLENOIDS

Small Plunger 'B'—Should close with 2.5 volts min., 4 volts max. (6 volt units), 5 volts min., 8 volts max. (12 volt units) with large plunger 'F' 3/8" from bottom.

Large Plunger 'F'—Should exert pull of 21 lbs. min. (70° F.), 15 lbs. min. (210° F.) when 3/8" from bottomed position.

Contact Gap (main contacts)—.047" plus or minus .015" with large plunger 'F' bottomed in coil.

Current Draw (At 70° F.)—'Both coils' figure is for both Holding and Starting coils together (main contacts closed). 'Holding Coil' figure is for Holding coil only (main contacts open—plunger bottomed in coil).

Six Volt Units

	Min.	Amperes	Max.	Volts
Both Coils	29.0		31.0	3
Holding Coil	1.2		1.3	6

Twelve Volt Units

Both Coils	14		15	6
Holding Coil	.55		.65	12

AUTO-LITE RELAYS

Contact Gap—.026". **Air Gap**—.012-.017" (closed).

Closing Voltage—2.5-3.5 volts (6 volt units), 5.0-7.0 volts (12 volt units).

Current Draw—Measure between 'TH.SW' and 'IGN. SW.' terminals. Current should be 1.07-1.15 amperes at 6.0 volts (6 volt units—winding resistance 5.2-5.6 ohms), .89-.93 amperes at 12.0 volts (12 volt units—winding resistance 12.9-13.5 ohms).

R-B-M RELAYS

Contacts Close—3.5-4.5 volts.

Current Draw—Approximately 3/4 ampere.

DELCO-REMY SOLENOIDS

Nos. 1569 & 1118001 (6 Volt), 1573 (12 Volt)

Small Plunger 'B'—Should close at 5.0 volts (6 volt units), 6-10 volts (12 volt units) with 3/8" gap of large plunger.

Large Plunger 'F'—Should close against 16 lbs. pull with 3/8" plunger air gap at 6.3 volts max. (6 volt units), 12.6 volts max. (12 volt units) with both coils operating.

Contact Gap (Main Contacts)—.020-.060" with large plunger 'F' bottomed in coil.

Contact Spring Tension—10-13 ounces.

Current Darw—'Both Coils' figure is for both coils together (main contacts closed), 'Holding Coil' figure is for holding coil only (main contacts open and plunger bottomed in coil).

Six Volt Units

	Amperes	Volts
Both Coils	28-34	6.0
Holding Coil	.9-1.1	6.0

Twelve Volt Units

Both Coils	24.5-27.5	12.0
Holding Coil	.6-.72	12.0

Model No. 1118004 (Nash)

NOTE—This solenoid does not have small plunger and ignition contacts. Both windings are connected to the single solenoid terminal (starting coil circuit is opened by the opening of the main contacts as the plunger bottoms in the coil, holding coil only then holds plunger in coil).

Solenoid Plunger—Should close against 16 lbs. pull with 3/8" plunger air gap at 6.3 volts maximum.

Current Draw—28-34 amperes at 6.0 volts (Both coils—main contacts closed), .9-1.1 amperes at 6.0 volts (Holding coil only—main contacts open).

DELCO-REMY RELAYS

Model No. 1116798 (Nash)

NOTE—This unit consists of two separate relays which operate as follows: **Series Relay**—Winding connected in series with shunt relay contacts. All current for solenoid goes through this winding. When armature attracted to core, contacts open and break ignition circuit (all ignition current goes through this series relay contacts). Current draw of solenoid holding coil is not sufficient to hold armature down and closing of contacts restores ignition as soon as transmission solenoid operates (which cuts out solenoid starting coil and causes solenoid current to drop from approximately 30 amperes to 1 ampere—see solenoid specifications above). **Shunt Relay**—Winding is connected in throttle switch circuit and contacts control current flow to transmission solenoid (closing of contacts when armature attracted to core completes solenoid circuit, contacts remain closed until throttle switch contacts are opened).

Series Relay Specifications.

Contacts Open (Armature attracted to core)—13.0-16.0 amperes.

Contacts Close (Armature Released)—6.0 amperes min.

Contact Gap—.030".

Shunt Relay Specifications.

Contacts Close (Armature attracted to core)—3.0-4.0 volts.

Contact Gap—.025".

Air Gap—.012" (with contacts closed).

WARNER (PACKARD TYPE) OVERDRIVE

Model AS1-R9

PACKARD '110' SIX, MODEL 1800 (1940)

PACKARD '120' EIGHT, MODELS 1801, 1A (1940)

Model AS1-R9A

PACKARD '160' SUPER 8, 1803,3A,4,5 (1940

PACKARD '180' CUST. SUPER 8, 1806,7,8 (1940)

NOTE:—This Overdrive unit used in conjunction with Packard Transmission. See Packard Transmission article for transmission servicing data.

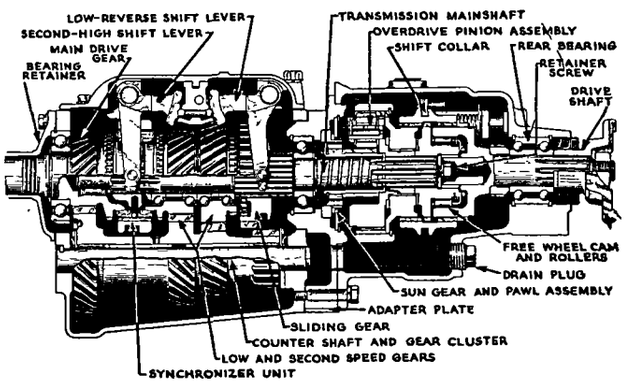
TYPE:—New design simplified unit without centrifugal clutch pawls. Ring gear mounting plate is linked directly to final drive shaft by shift collar (shift collar also engages free-wheel cam when overdrive locked out) so that engine drives rear wheels through overdrive pinion gears (when overdrive operative) or through free-wheel mechanism (for direct drive below overdrive cut-in speed and also for the 'kick-down' direct drive—drive is exactly the same in both instances).

OPERATION:—Overdrive cut-in and cut-out is controlled electrically by a solenoid which operates in exactly opposite manner from the kick-down solenoids used on 1939 Packard and other car models (solenoid plunger pushes pawl in to engage sun gear for overdrive, pulls pawl out to disengage sun gear for both direct drive below cut-in speed and for kick-down direct drive). Pawl is pushed in electrically and is pulled out by a spring within the solenoid case. *See Transmission Control article (following) for solenoid description and servicing data.*

SERVICING:—Except for omission of entire centrifugal clutch pawl assembly, and sun gear pawl guide plates, these Overdrives serviced in same manner as other Warner models. *See preceding Warner Overdrive service article for complete instructions and note following additional data:*

Driveshaft Rear Bearing (in overdrive case)—Bearing is new type double-row ball bearing which is pre-loaded in assembly so that no pre-load adjustment or special installation directions required. Bearing is retained in overdrive case by snap ring at each end of bearing outer race.

Lock-out Control Adjustment—Control knob should clear stop 1/8" with knob pushed all the way in. To adjust, loosen cable clamp on overdrive control lever, adjust cable so that lever is in full rear position.



Sun Gear Pawl Interlock Plunger—An interlock plunger installed in hole in overdrive case engages notch in side of sun gear pawl when the control button is operated to lock-out the overdrive. Plunger prevents pawl engaging sun gear. Clearance between end of interlock plunger and side of pawl should be .010" in overdrive position (pawl engaged in sun gear mounting plate slot).

Governor Switch—Switch is mounted on rear end of overdrive case and is driven by the speedometer drive gear. Remove governor switch assembly before dismantling overdrive.

ADJUSTMENT:—Cut-in speed is controlled by Governor Switch and is not adjustable except by changing governor switch springs. See Warner Overdrive Control article (following) for governor switch spring data.

WARNER (PACKARD TYPE) OVERDRIVE CONTROL

Optl. Equipment On:

PACKARD 6 & 8, ALL MODELS (1940)

DESCRIPTION:—New design, all electrical control with 'kick-down' direct drive feature. New type Transmission Solenoid is 'push type' and pushes pawl in to engage sun gear mounting plate slot (to hold sun gear stationary for overdrive) when sole-

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noid is energized. Spring in solenoid case pulls pawl out to disengage sun gear (for direct drive) when solenoid circuit is broken. Both solenoid windings (Pull-in Coil and Hold-in Coil) are energized to engage pawl for overdrive, Hold-in coil only is energized during entire period in which car is in overdrive. Solenoid is controlled by a Lock-out Switch (operated in conjunction with the lock-out control knob on the instrument panel), Governor Switch, Throttle kick-down Switch, and two unit relay (Control Relay and Timing Relay) as follows:

Lock-out Switch—Connected in series with kick-down switch and governor switch. Contacts are closed with control knob pushed in (for overdrive) and are opened when control knob pulled out (to lock-out overdrive).

Governor Switch—Centrifugal type switch mounted on rear of overdrive case and driven by speedometer drive gear. Acts as the main switch to engage overdrive (switch contacts close at cut-in speed of 22 M.P.H. and remain closed until speed drops below 17 M.P.H.). Governor switch is not adjustable and cut-in speed can be changed only by installing special switch springs (see Adjustment data below).

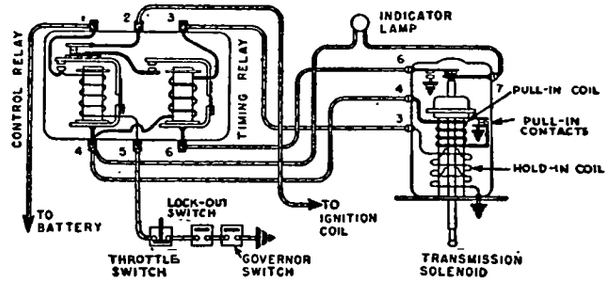
Throttle Kick-down Switch—Switch contacts are normally closed (throttle wide open or less) and are opened when the accelerator pedal is fully depressed to operate the kick-down for direct drive.

Control & Timing Relay—Consists of two units, a double contact (upper and lower contacts) Control Relay which controls the transmission solenoid circuit, and a single contact Timing Relay which controls the ignition 'cut-out' which permits the sun gear pawl to be withdrawn from the sun gear for return to direct drive (kick-down direct drive, or direct drive below cut-in speed).

OPERATION:—Overdrive Engagement—Throttle switch and lock-out switch contacts are normally closed (control knob pushed in). At cut-in speed of 22 M.P.H., governor switch contacts close which completes circuit for Control Relay winding. Control relay upper contacts open and lower contacts close which completes circuit for both pull-in and hold-in coils in transmission solenoid. This causes the solenoid plunger to bottom in the coil, compressing the pawl spring, and causing the pawl to be pushed into engagement with the sun gear mounting plate slot so that the overdrive is operative (spring engages pawl as soon as accelerator pedal released momentarily, indicator light on dash which is controlled by solenoid upper contacts will light to indicate that overdrive should be engaged, light goes out as soon as overdrive is engaged). The bottoming of the solenoid plunger in the coil opens the pull-in coil contacts in the solenoid (lower contacts) and cuts this pull-in coil out of action. The hold-in coil remains energized during the entire time the overdrive is engaged and holds the solenoid plunger bottomed in the coil.

Overdrive Disengagement—When the overdrive engages, the timing relay contacts close (this relay winding is connected in series with the solenoid hold-in coil) and the solenoid upper contacts also close, but the ignition is not cut out because the control relay upper contacts have already opened (all three sets of contacts are connected in series in the ignition cut-out or ground circuit). When the throttle switch contacts are open (when accelerator pedal depressed fully for kick-down direct drive) or governor switch contacts open (for return to direct drive at speeds below 17 M.P.H.), the control relay upper contacts close first and, since the other two sets of contacts are also closed, the ignition is shorted or cut out momentarily to allow the solenoid spring to disengage the pawl from the sun gear for direct drive. The timing relay winding circuit is opened by the opening of the control relay contacts (which occurs before the control relay upper contacts close) but the 'time delay' feature of this timing relay causes a very short interval to elapse before the timing relay contacts open. As soon as these contacts open, or when the solenoid upper contacts open (which occurs as soon as the spring pulls the pawl out of engagement), the ignition ground circuit is broken and ignition is restored (both sets of contacts protect the ignition circuit when the overdrive is not operating).

ADJUSTMENT:—Throttle Switch—Should be adjusted whenever carburetor linkage adjusted or disconnected. To check setting, remove air cleaner (to observe throttle valve), open throttle until valve is just wide open. If tappet screw on accelerator link lever does not contact throttle switch plunger at this point, adjust by loosening locknut and turning screw in or out of lever.



Governor Switch—Governor switch is not adjustable and no attempt should be made to change cut-in speed by stretching spring or shimming cover. Governors with three different springs are available for special cut-in speeds as follows:

Part No.	Cut-in Speed
355075	22 M.P.H.
347478	26 M.P.H.
354943	33 M.P.H.

FUSE:—A 30 ampere fuse is located in a fuse container in the line between the starting switch and the Solenoid Relay '1' terminal. Do not use fuse of any other capacity at this point.

SERVICING:—Overdrive Relay—This relay consists of two units which should be checked and adjusted differently as follows:

Control Relay

Air Gap—.012" (lower contacts closed), .032" (lower contacts open). Check first with armature held down so lower contacts closed, adjust by loosening two screws on hinge bracket on back of relay and raising or lowering armature, see that gap uniform across whole surface of core. Then check air gap with armature released (upper contacts closed), adjust by bending upper contact support—do not loosen hinge bracket screws.

Contact Gap—.022" (top contacts) with lower contacts held closed. Should be correct if air gaps correct (above) and contact spring not bent.

Closing Voltage—3.4-4.0 (6 volt units), 6.8-8.0 volts (12 volt units). CAUTION—This voltage will attract armature and close **lower** contacts (upper contacts open as lower contacts close). To check closing, connect battery and variable rheostat to relay terminals #1 and 5, increase voltage and note when contacts close. To adjust, bend spring hanger at upper and lower end of spiral armature spring.

Timing Relay

Air Gap—.031" with contacts open. Adjust by bending upper armature stop—**do not disturb armature hinge bracket mounting screws.**

Contact Gap—.022". Adjust by bending lower contact support.

Closing Voltage—.6-1.1 volt (6 volt units), 1.2-2.2 volts (12 volt units). To check closing, connect battery and variable rheostat to terminals #3 and 4, increase voltage and note when contacts close. Closing voltage should not exceed above figures.

'Time Delay' Action—.1-.2 seconds (between instant current flow through winding is stopped and opening of contacts). To check timing action on car, operate engine at medium speed, close **control relay** lower contacts by hand (timing relay contacts will close), release control relay contacts and note interval before timing relay contacts open (lag should be noticeable). Adjust by bending spring hangers on upper and lower end of spiral armature spring (increase spring tension to shorten time interval).

Transmission Solenoid:—Solenoid cover can be removed, for inspection and servicing, by taking off two nuts on studs on cover. CAUTION—Pawl rod must not be forced into solenoid with cover removed—this will damage contact plate flat springs. Test solenoid as follows:

Solenoid Operation Test—Plunger actuating voltage should be 4.9 volts (6 volt units), 6.8 volts (12 volt units) max. at room temperature. To check performance, block pawl rod so that it cannot move out of solenoid when plunger is actuated, remove solenoid cover, connect voltmeter, battery, and variable rheostat between terminals #3 and 4 (connect these terminals together) and ground on solenoid case. Increase voltage and note voltage reading at point where plunger is actuated.

Pull-in Coil Contact Gap—With solenoid bottomed in coil, pull-in coil contact gap should be .018-.040". Remove solenoid cover to check these contacts. See Pawl Rod Adjustment below.

Solenoid Current Draw—To check current connect battery and ammeter between #4 terminal and ground on solenoid case (Pull-in Coil), or #3 terminal and case (Hold-in Coil). This check must be made at specified voltage. 'Both Coil' figure below is for both Pull-in and Hold-in Coil together, 'Hold-in Coil' figure is for Hold-in coil only.

6 Volt Units

Both Coils.....31.0-36.0 amperes at 6.0 volts.
Hold-in Coil.....1.4-1.6 amperes at 6.0 volts.

12 Volt Units

Both Coils.....14.0-16.0 amperes at 12.0 volts.
Hold-in Coil.....1.0-1.2 amperes at 12.0 volts.

Pawl Rod Adjustment—With pawl rod assembly removed from solenoid, check length from lower face of adjusting nut on upper end of pawl rod to lower edge of plunger. This distance should be 2.022-2.037". To adjust, press down on locking spring below adjusting nut so that prong on spring clears notch in nut, turn nut on plunger. CAUTION—Use care not to distort locking spring and see that prong on spring engages notch in nut after adjustment completed.

BUICK 60, 70, 80, 90 TYPE

Used On:

BUICK, SERIES 60, 70, 80, 90 (1940)

These Transmissions same design as used on corresponding 1939 models except as noted.

TYPE:—Design has been changed from 1939 type as follows:

Shifter Mechanism—New cross-shift mechanism used consisting of vertical shaft in side of transmission case with lever on upper end engaging selector shaft so that movement of the selector lever on the transmission case (small forward lever) shifts the selector shaft sidewise in the transmission to engage the Low-Reverse or Second-High shifter rail.

Synchronizer Cones & Gears—Synchronizing cones have 7° angle and are marked 'S' for use with second speed gear. Service gears are marked '7' and must be used with these cones (do not confuse these gears with types used on previous models).

Countershaft & Reverse Idler Shaft Retainers—Shafts now retained by special grooved lockpin which is driven into hole in case so as to enter hole in shaft. Pin must be driven through into shaft before shafts can be removed and new pin must be used when shafts re-installed.

SERVICING:—Same as for previous models with exception of new disassembly directions (required because of new shifter mechanism), new Shifter Mechanism, and new Countershaft and Reverse Idler Shaft retainers. ***See 'Buick Transmission 60, 80, 90 Type' article in Mechanical Equipment Section of manual (or 1938 Supplement) for complete data and note following new instructions:***

Transmission Disassembly:—Remove cover, drive countershaft locking pin in until it is completely within shaft, use service tool J-1001 (dummy shaft) to drive countershaft out through rear of case leaving tool in countergear cluster until it is replaced in case (tool will retain bearing rollers and spacer). Take out mounting screws and remove universal joint ball and cover, remove speedometer drive pinion, take out screw in end of shaft and pull universal joint yoke, then take out mounting screws and remove rear bearing retainer. Loosen lockscrews in both shifting forks, move synchronizer drum assembly to high gear position. Move entire mainshaft assembly back until forward end clears pilot bearing in drive gear, lift shaft up and to left until fork clears collar on synchronizer, move fork to rear in case. Move shaft to right to clear Low-Reverse shifter fork, move fork forward. Remove synchronizer assembly from shaft. Take out second speed gear snap ring, slide second speed gear forward on shaft, take out low speed gear stop ring. Support gears by hand and withdraw mainshaft and bearing through rear of case. Lift out second speed and low speed gears. Remove main drive gear snap ring (on front of case), tap gear through into case and remove through top. Lift out countergear cluster being careful not to lose steel and bronze thrust washers. To remove reverse idler, drive lockpin into shaft, drive shaft out.

Shifter Mechanism:—Before removing selector shaft, remove lever on cross-shift (vertical) shaft to permit lever on upper end of this shaft to disengage from selector shaft as shaft is driven out. Remove lever on left end of selector shaft, take out locking screws in each selector cam, drive shaft out through right side of case (shaft will dislodge sealing plug in hole). This is important to avoid damage to oil seal on lever end of shaft. Inner selector shaft and lever can then be lifted out of case. When replacing this lever, make certain that spring washer, plain washer, and seal are assembled on shaft within case. When installing selector shaft, insert shaft through left side of case and close shaft hole on right side of case with sealing compound. See Transmission Control article for adjustments when replacing transmission on car.

Countershaft & Reverse Idler Retainers:—With countershaft and reverse idler shaft out of engine, remove locking pins from shaft and discard these pins (pins must not be re-used). After shafts reinstalled in transmission case, line up holes in case and shaft, install a new locking pin and drive pin in 5/8-3/4" past flush with outer surface of case.

BUICK-OLDSMOBILE-PONTIAC TYPES

Used On:

BUICK, SERIES 40-40, 50 (1940)

OLDSMOBILE 6 & 8, ALL MODELS (1940)

PONTIAC 6 & 8, ALL MODELS (1940)

These transmissions same design as used on corresponding 1939 car models except as noted below.

OLDSMOBILE NOTE:—This synchro-mesh transmission is standard equipment on all 1940 models. New type Hydra-matic Transmission (with Fluid Coupling) is optional equipment on these models. See separate article on Oldsmobile Hydra-matic Transmission for data on this type.

SPECIAL SERVICE NOTES:—Easier Shifting on 1939 Pontiac—To make shifting into Second Gear easier on 1939 cars, new type 1940 shifter shaft can be installed on these cars (new shaft has tapered section between center and end detent poppet ball grooves in shaft). To make this change, dismantle transmission and install new No. 1312495 Second-and-High Shifter Shaft and new No. 1314658 shaft Poppet Ball Spring.

Gearshift Lever stiffness complaints—To correct complaints of stiffness in lever and difficulty in moving lever toward wheel (for cross-shift), dismantle transmission and remove vertical selector lever shaft, clean shaft and hole in transmission case thoroughly and lubricate shaft and hole in case with Lubriplate when shaft re-installed (see Servicing directions below for dismantling instructions).

TYPE:—Same design as used on 1939 car models except for following changes:

Shifter Mechanism—New cross-shift mechanism consisting of a vertical shaft on side of transmission case with inner lever at upper end engaging selector shaft so that movement of selector lever on transmission case (small forward lever) shifts the selector shaft sideways in the transmission to engage the Low-Reverse or Second-High shifter rail.

Countershaft Bearings—Countergear cluster now mounted on roller bearings (loose rollers) at either end with spacer on shaft between bearings. Special service tool (dummy shaft) must be used when removing countershaft to retain bearing rollers.

Countershaft Retainer (Oldsmobile only)—Consists of a grooved lockpin (similar to reverse idler shaft pin used on other models) driven in through hole in case and shaft. Pin must be driven through into shaft before shaft can be removed and new pin must be used when shaft re-installed. NOTE—On Buick & Pontiac, shafts are retained by locking ball fitted into groove in shaft and case at rear end.

Synchronizer Cones & Gears (Buick only)—Synchronizing cones have 8° angle and must be used with new gears marked '8' (do not confuse these gears with gears used on previous models). Bronze cones must always be used with Second Speed Gear.

SERVICING:—Same as for previous models with exception of new disassembling directions (required because of new shifter mechanism). ***See 'Buick-Olds-Pontiac Type' Transmission article in Mechanical Equipment Section of manual (or 1938 Supplement) for complete data and note following new instructions:***

Transmission Disassembly:—Remove cover, remove speedometer driven gear assembly. Disconnect spring on shifter lever on left side of case. Take out rear bearing retainer screws, set transmission in high gear position (to prevent sliding sleeve and low speed gear from dropping down into case), withdraw bearing retainer, second speed gear, and mainshaft assembly through rear of case. Remove setscrews from shifter forks and selector shaft cams (use tool KMO-244), take out retainer screw and remove lever from left end of selector shaft, remove lever from lower end of vertical shaft (necessary to permit inner lever on upper end of shaft to disengage from selector shaft), drive selector shaft out through right side of case (this is important to prevent damage to oil seal on lever end of shaft), remove selector cams from case. Remove shifter rails through front end of case (Oldsmobile—welch plug in case at front end of Second-High rail must be removed also), rear of case (Pontiac), being careful not to lose detent balls and springs which are located under rails on all models. Lift out shifter forks, sliding sleeve and low speed gear. On Oldsmobile only, drive countershaft locking pin in so that it is completely within shaft. On all models, use special tool (arbor or dummy shaft) J-1334 (Buick), J-1449 (Oldsmobile & Pontiac) to drive countershaft out through rear of case, leaving tool within counter gear cluster to retain bearing rollers until shaft is replaced. Remove snap ring on main drive gear bearing (on front of case), tap main drive gear and bearing through into case and lift out. Lift countergear cluster out being careful not to lose thrust washers on either end of cluster or bearing rollers. To remove reverse idler, remove setscrew (Oldsmobile), drive locking pin through into shaft (Buick, Pontiac), then drive shaft out.

Synchronizing Unit:—No detent springs used. Synchronizer drums are retained on gears by snap rings and may be removed after snap rings are released.

Buick Note—Make certain that drum used on second speed gear is Bronze (aluminum drums used on some models for high gear).

Mainshaft & Bearing Assembly:—Second speed gear retained on shaft by snap ring at forward end and can be removed after snap ring has been taken off (use tool J-1130). To remove bearing retainer, take out bearing snap ring, tap end of shaft on wooden block. Then remove snap ring on shaft at rear of bearing, press speedometer gear, spacer and bearing off shaft (on Buick, speedometer gear is mounted on universal joint yoke which is held on end of shaft by retainer screw and washer). When installing bearing, see that shielded side is forward (toward second speed gear). Bearing should be .0007" tight to .0002" loose on shaft and .0011" tight to .0005" loose in bearing retainer.

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Mainshaft Rear Bushing (Oldsmobile G-40, L-40 only)—New type steel-backed bronze bushing used in transmission extension housing to support mainshaft. Bushing can be replaced after oil seal removed from end of housing by using tool J-1450 to remove old bushing and install new bushing. New bushings must be reamed after installation to provide .0025-.004" clearance on shaft (reamer is part of J-1450 tool set). NOTE—This new type bushing may be used for replacement on 1939 cars.

IMPORTANT INSTALLATION NOTE (OLDSMOBILE)—When transmission installed on Models G-40 & L-40, fill transmission rear bearing housing asembly with ½ pint of transmission lubricant after transmission has been installed in car and propeller shaft installed.

Rear Oil Seal (Oldsmobile)—New oil seal must be installed in rear end of rear bearing retainer whenever oil seal removed. Soak new oil seals in engine oil for 5 minutes, install seal with felt to rear using tool J-1050. NOTE—New type oil seal has shoulder which locates it in housing. This seal can be used for replacement on 1939 cars.

Rear Oil Seal (Pontiac)—Old oil seals can be removed by prying with a screwdriver. Use tool J-1323 to install new oil seals (seal has extension rim which will be damaged if tool not used).

Main Drive Gear & Bearing:—Bearing can be removed from shaft after lock ring has been removed by tapping end of shaft on wooden block. When installing bearing, see that shielded side is toward gear. Bearing should be .0003" tight to .0007" loose on shaft and .0002" tight to .001" loose in case.

Pilot Bearing (Oldsmobile Models)—Pilot bearing in flywheel consists of special Durex bushing installed with flat end in toward oil-soaked felt pad (in recess in back of bushing) and retained by sheet metal retainer pressed in outer end of bearing recess. To install new bushing, soak felt in SAE #30 engine oil, install felt, drive bushing in with J-1329 tool, install retainer using J-1329-2 adapter and J-1329 tool.

Second Speed Gear:—Clearance on shaft should be .001-.0026" (Buick), .0005-.0027" (Pontiac). Endplay should be .000-.010". When installing gear, make certain that thrust washer installed in front of gear, use special thimble J-1267 (Oldsmobile) to start snap ring on end of shaft.

Shifter Mechanism:—Selector shaft must be removed when transmission is disassembled (see Disassembly directions above). To remove shaft, use KMO-244 tool to remove shifter cam setscrews, remove lever on left end of shaft by taking out retainer screw, remove lever on lower end of cross-shift shaft (necessary to allow inner selector lever on upper end of shaft to disengage from selector shaft). Drive selector shaft out through right side of case (this is important to avoid damage to oil seal on lever end of shaft). With selector shaft out, inner selector lever and shaft can be lifted out. See that this shaft and hole in case are clean, lubricate with Lubriplate when shaft replaced being certain that spring washer, plain washer and oil seal installed on upper end of shaft within case. Install selector shaft through left side of case and use sealing compound to close hole on right side (this hole originally closed by plug which will be driven out when shaft removed. CAUTION—When installing lever on selector shaft, hold shaft with wrench to avoid damaging selector cams and make certain that lockwasher installed on lever retainer screw. This lockwasher is very important to prevent lever loosening in service.

CADILLAC-LA SALLE TYPE

Used On:

CADILLAC V8, SERIES 40-60S, 62, 72, 75 (1940)
CADILLAC V16, SERIES 40-90 (1940)
LA SALLE V8, SERIES 40-50, 52 (1940)

These Transmissions same design as used on 1939 cars.

SERVICING:—Disassembly—Remove speedometer driven gear adapter housing and gear. Take out retaining screw and remove universal joint flange on rear end of shaft, remove extension housing capscrews and pull extension housing off shaft. Remove transmission bottom cover, drive countershaft out through rear end of case, remove countergear cluster, thrust washers, and bearing rollers. Take out lockscrews in front end of case, pry main drive gear and bearing out of case toward front, remove synchronizer assembly from front end of mainshaft. Use Tool J-1007 to remove lock ring in front of second speed gear, tap mainshaft and bearings out through rear of case (second speed and low speed gears will slide off shaft and should be removed from case). Tap reverse idler shaft out through rear of case and remove reverse idler gear and thrust bearing. Loosen clamp bolts and remove levers on shifter shafts, remove shifter lever shafts through inside of case being careful not to lose interlock spring, balls, and tube.

Reassembly:—When reassembling transmission, note the following points:

Shifter Shafts & Levers—Install Second-High lever first, see that shaft in neutral position and shoe in place on inner end of shaft. Install interlock assembly, compress interlock spring and install Low-Reverse shifter shaft, see that shaft in neutral position (interlock ball engaging center notch in shaft sector) and that shoe in place on inner end of shaft. Install new cork seals on outer ends of shafts (use tool J-1169) and install levers.

Reverse Idler Gear—Start shaft in through rear of case, install rear steel backed-babbitt thrust washer on shaft with clip in washer fitting into slot in case, install new cork seal on outer end of shaft. Install gear on shaft, use pilot tool J-1010 to hold front thrust washer in position while shaft is tapped into place, see that locking screw hole in shaft and case line up (shaft locked by long cover screw which must be installed in this hole). Idler gear bushing clearance on shaft is .002-.0035" (new), .005" (worn limit). Gear endplay should be .006-.018".

Mainshaft Assembly—When installing mainshaft, hold low speed and second speed gears in position and engaging shift lever shoes, insert shaft through gears. Use tool J-1007 to install new second speed gear lock ring, tool J-1170 to install mainshaft front roller bearings in main drive gear (bearing rollers held in place by lock ring). Low speed gear backlash on mainshaft splines should be .004-.007" (new), .010" (worn limit). Synchronizer hub backlash on mainshaft splines should be .0005-.001" (new), .003" (worn limit).

Countershaft Assembly—Start countershaft through rear end of case, install needle bearings and retaining washers in countergear cluster with tool J-1184, place bronze thrust washers in position on each end of gear cluster and steel thrust washer on rear end, tap countershaft into place in gear cluster with new cork seal on end of shaft, see that locking hole in shaft and case line up (shaft locked by long cover screw which must be installed in this hole).

Extension Housing and Oil Seal—Rear bearing (in extension housing) should be tapped into place after housing installed on transmission and tool J-1354 should be used to install oil seal in rear end of extension.

CHEVROLET THREE-SPEED TYPE

Used On:

SPECIAL DELUXE KA, MASTER DELUXE KH ('40)
MASTER '85', MODEL KB (1940)
MODELS KC, KD, KE TRUCKS (1940)

These Transmissions same design as used on 1939 Cars and Trucks except as noted below.

NOTE:—Passenger Car Models—These models have new type Shifter Mechanism mounted in side cover on transmission case (no top cover used). All service replacement gears are Carburized type (same as used in Truck transmissions).

Truck Models—Same design as 1939 with conventional shift lever mounted on top cover. All gears are Carburized type (carburized gears furnished for passenger car transmission service also).

Transmission Extension (all models)—All transmissions have extension on rear end so 4 speed transmission can be installed without difficulty on truck models. NOTE—When installing 4 speed transmission on Half Ton (KC), new brake master cylinder must be installed. Special speedometer gear adapter and new speedometer gears must be installed on all models.

Vacuum Power Gearshift (Passenger Cars)—See separate Chevrolet Transmission Control article for complete adjustment, disassembly, and servicing directions.

SPECIAL SERVICE NOTES:—New Bearing Retainer (1938-39-40 Models)—A special malleable iron Clutch Gear Bearing Retainer (Front Bearing Retainer) #604227 is available and can be installed on 1938-39 Passenger cars and 1938-39-40 Trucks (½, ¾, ¾ Ton Special) with three speed transmission for severe service. This retainer will prevent lubricant loss due to cracked bearing retainers.

SERVICING:—Disassembly and servicing operations same as for previous models except for Shifter Mechanism on Passenger cars (below). ***See 'Chevrolet Three Speed Type' Transmission article in Mechanical Equipment Section of manual (or 1938 Supplement) for complete data and note new Passenger Car Shifter Mechanism servicing data as follows:***

Shifter Mechanism (Passenger Cars):—Consists of two shifter forks on 'I' beam type guide bar bolted on inner face of transmission side cover. Forks are operated by toggle lever in cover and one fork is locked by cross-shift lever while the other fork is being moved to engage gears (cross-shift lever has short arc between slots in gears).

Disassembly—With cover off transmission case, remove two bolts holding guide bar and shifter fork assembly on cover, remove assembly, lift shifter yoke lever, anti-rattle spring, and operating shaft

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out. Slide shifter forks off guide bar being careful not to lose shift lock balls and spring (in hole in guide bar under forks). Wash all parts in gasoline.

Reassembly—Install long shifter fork on guide bar with fork end toward nearest mounting screw hole, line up lock ball recess in fork with hole in guide bar, install one lock ball and spring in hole, start opposite shifter fork on guide bar, assemble other lock ball on spring, use flat tool to compress spring and slide fork into position over lock ball. Check operating shaft cork seal and retainer, replace if worn. Install operating shaft in cover, assemble anti-rattle spring and shifter yoke lever on bell crank end of operating lever, move selector (cross-shift) bell crank over center of shifter yoke lever. Press on outer end of operating shaft so that shifter yoke lever held firmly against selector lever bell crank, make certain that both shifter forks in neutral position on guide bar, then assemble guide bar and shifter fork assembly on cover with low-reverse shifter fork toward bottom (narrow side) of cover. Make certain that selector lever bell crank engages slots in shifter forks and that pins in forks engage slots in end of shifter yoke lever. Bolt guide bar to cover. CAUTION—Low-reverse sliding gear and clutch sleeve must be in neutral position when shifter mechanism installed on transmission case. See Chevrolet Vacuum Power Transmission Control article for adjustment of gearshift levers when transmission installed on car.

CHEVROLET FOUR-SPEED TRUCK TYPE

Std. Equipment On:

1½ TON TRUCK WA, WB, SCHOOL BUS WC (1940)
CAB-OVER-ENGINE TRUCK WD, WE, WF (1940)

Optional On:

½ TON KC, ¾ TON KD, ¾ TON SPEC. KE (1940)
This Transmission same design as used on 1939 Trucks.

SERVICING:—All service operations same as for previous models. *See 'Chevrolet Four Speed Truck Type' Transmission article in Mechanical Equipment Section of manual (or 1938 Supplement) for complete instructions.*

CHRYSLER-DE SOTO-DODGE-PLYMOUTH

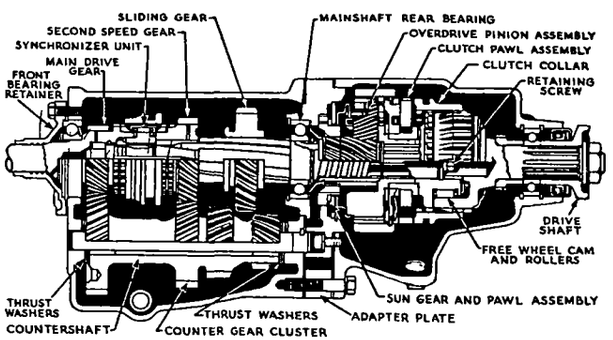
Used On:

CHRYSLER, MODEL C25 ROYAL & WINDSOR ('40)
CHRYSLER, C26 TRAVELER, SARATOGA, NEW YORKER (1940)
CHRYSLER, C27 CROWN IMPERIAL (1940)
DE SOTO, S7 CUSTOM & DELUXE (1940)
DODGE, D14 DELUXE, D17 SPECIAL (1940)
PLYMOUTH, P9 ROADKING, P10 DELUXE (1940)

OVERDRIVE TRANSMISSION NOTE:—Warner Model R7B Overdrive unit electrical 'kick-down' control is mounted on rear end of Chrysler Transmission (in place of extension housing) as Optional equipment on Chrysler C25, C26 to De Soto S7; Standard equipment on Chrysler Model C27. *See separate articles on Warner Overdrive Control for complete servicing and adjustment directions.*

TYPE:—New design, own make, constant-mesh, synchro-mesh, all helical gear type (sliding gear for low-reverse). Main drive gear and clutch shaft mounted on ball bearing in front of case (retained by retainer bolted on case). Mainshaft mounted on roller bearings (in drive gear pilot hole) at front end, ball bearing in rear of case and additional ball bearing at rear end of transmission case extension. Second speed gear retained on shaft with inner sleeve of synchronizer assembly by snap ring on shaft in front of synchronizer unit. Counter gear cluster mounted on roller bearings on stationary shaft (spacer on shaft between bearings) with thrust washer and plate on each end of cluster. Reverse idler gear mounted on roller bearings with thrust washer at each end of gear.

Synchronizing Unit—Double-blocker, double-spring type. Synchronizer rings are free in ends of inner clutch sleeve and are actuated by three shifting plates or struts fitted in slots in inner clutch sleeve which engage notches in synchronizer rings. Struts are centered in outer clutch sleeve by two wire springs (within struts on either side of inner clutch sleeve web) and move with the outer clutch sleeve to engage the synchronizer rings with the



cones on the gear hub. Teeth on the outer rim of the synchronizer rings block or prevent gear engagement until synchronization completed when final movement of outer clutch sleeve causes the clutch teeth on the inner rim of the clutch sleeve to slide past the synchronizer ring teeth and engage the clutch teeth on the gear hub. Inner clutch sleeve is stationary on shaft and does not move during synchronization and gear engagement.

SERVICING:—Overdrive Removal Note—Overdrive unit can be removed as an assembly if care is taken to see that adapter plate does not separate from overdrive case as the assembly is withdrawn from the transmission case (see disassembly directions following). If adapter is allowed to separate from overdrive case, overdrive must be disassembled and free-wheel rollers re-installed.

Disassembly:—Remove speedometer drive pinion, remove nut and washers on rear end of driveshaft, pull universal joint yoke flange and brake drum assembly. Take out two plugs on transmission side cover, remove detent balls and springs, remove cover and gear selector assembly. Unscrew shifter fork guide rail and remove guide rail through front end of case. See that gears in neutral, take out lock-screws holding shifter forks on shift rails, remove welch plug in lower shifter rail hole on front of case (collapse plug by striking in center with punch), remove shifter rails through front of case, remove plug on top of transmission case and take out interlock plunger (in hole between shift rails). On transmissions without Overdrive, take out capscrews holding extension housing on transmission case, remove extension and mainshaft assembly through rear of case using care that synchronizer assembly does not slide off shaft. On cars with Overdrive, take out capscrews holding overdrive case and adapter on transmission case, remove overdrive, adapter, and mainshaft assembly through rear of case using extreme care that overdrive does not separate from adapter plate and that synchronizer assembly does not slide off shaft. Use special arbor C-578 and soft hammer to drive countershaft out toward rear of case (remove locking key from shaft as soon as it is exposed at rear of case), allowing counter gear cluster to drop down in case. Take out mounting screws and remove main drive gear bearing retainer from front end of case, pull main drive gear and bearing assembly out toward front. Lift counter gear cluster, thrust washers, and bearing rollers out of case. To remove reverse idler, drive shaft out toward rear (remove locking key from shaft when exposed at rear of case), lift out idler gear, thrust washers, and bearing rollers. See Warner Overdrive article for Overdrive disassembly directions.

Mainshaft & Bearing Assembly:—To remove mainshaft from extension housing, take out snap ring at forward end of synchronizer unit, remove synchronizer assembly, second speed gear, and low speed gear from shaft. Remove snap ring in housing in front of bearing outer race, withdraw shaft from housing, then remove bearing, spacer, and speedometer drive gear from housing. Remove oil seal and bearing from rear end of housing (bearing is press fit in housing and is positioned by spacer on shaft—no snap rings used). When reassembling mainshaft, use new snap rings. If oil seal being replaced, soak leather in thin oil for 30 minutes and work leather with smooth bar. Seal must protrude 7/32" from end of case (use C-579 drift to install seal). If driven in too far, seal and bearing will be damaged.

Synchronizer Assembly:—Install struts or shifting plates in slots in inner clutch sleeve with open face of strut in, assemble outer clutch sleeve and synchronizer springs making certain that hooked ends of both springs engage same strut, install synchronizer rings with notches engaging ends of struts. Synchronizer assembly is retained on shaft with second speed gear by single snap ring (see Second Speed Gear below).

Second Speed Gear:—Gear endplay on shaft should be .003" min., .008" max. To install gear, place gear on shaft, install synchronizer assembly, install snap ring in groove in shaft in front of synchronizer.

CAUTION—All snap rings should be tight fit in grooves (furnished in various thicknesses).

Main Drive Gear & Bearing:—Bearing retained on shaft by snap ring and can be removed after snap ring taken out and thrust washer removed. Use snap ring when re-installing bearing. Mainshaft pilot bearing rollers are retained in drive gear recess by snap ring. Use cup grease to hold rollers in position until mainshaft is installed.

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Counter Gear Cluster:—When replacing this assembly, use arbor C-578 to position bearing rollers and pack rollers with cup grease to hold rollers in place. Install steel washer next to gear cluster at each end and bronze thrust washer between steel washer and case. Endplay should be .002" min., .008" max. Adjust by selecting washers of correct thickness (furnished in three thicknesses—'A' thinnest, 'B', 'C' thickest). Make certain that locking key is in place in slot in rear end of countershaft when shaft installed in case.

Reverse Idler Gear:—Use C-464 arbor to retain bearing rollers when idler gear being installed. See that thrust washer installed at each end of gear and that locking key is in place in rear end of shaft.

Gearshift Mechanism:—To assemble gearshift mechanism, hold shifter forks in position and insert guide rail through front end of case. Install lower shift rail, insert interlock plunger down through hole in top of case so that plunger engages groove in shift rail, then install upper shift rail (see Note below). Lock shifter forks to rails by installing lockscrews and locknuts, make certain that locking washers are crimped in place. Install welch plug in forward end of lower shift rail. CAUTION—This hole is below lubricant level and plug must be installed tightly to prevent lubricant loss. Install two C-590 cover locating pilots in cover screw holes on case, install cover and gear selector assembly, making certain that selector lever enters shifter fork slots. Install two cover capscrews, remove pilots, install remaining cover screws. Install detent balls and springs, tighten retaining plugs. *See Chrysler Transmission Control article for adjustment directions when transmission replaced on car.*

FORD, LINCOLN-ZEPHYR, MERCURY TYPE

Used On:

FORD '60' PASS. CAR, MODEL 022A (1940)
FORD '85' PASS. CAR, MODEL 01A (1940)
FORD COMM'L., MODELS 022C, 01C, 09C (1940)
FORD TRUCK, ¾ & 1 TON MODELS (1940)
LINCOLN-ZEPHYR, MODEL 06H (1940)
MERCURY, MODEL 09A (1940)

NOTE:—Four speed transmission is standard on other truck models and optional on these ¾ and 1 Ton models. See Ford Four Speed Transmission article (following) for data on this type.

TYPE:—Same design as used on corresponding 1939 car models except for new Gearshift mechanism (Passenger Cars only) and new Synchronizer unit as follows:

Gearshift Mechanism (Passenger Cars)—Consists of two independent shifting levers and shafts mounted on transmission case side cover (rear lever is Low-Reverse, forward lever Second-High). Fork on inner end of lever shaft engages gears directly and no shifter rails are used. Detent balls and interlock mechanism consist of a spring, plunger, and two balls assembled in a tube in a boss within the transmission case so that the balls engage notches in sectors on each of the shifter shafts. The entire gearshift mechanism can be removed as a unit with the side cover by disengaging the forks from the gears. CAUTION—When reassembling cover, make certain that rear fork engages low speed gear, forward fork engages outer sleeve of synchronizer unit.

Synchronizer Unit—Ball & Strut, double blocker type. On this type unit, synchronizer rings are loose in ends of inner clutch sleeve and are actuated by struts assembled in the rings. Struts are centered in clutch sleeve assembly by conventional poppet balls and springs so that struts move with the outer clutch sleeve (inner sleeve is stationary) during the initial movement to engage the synchronizer rings with the cones on the gear hubs. Teeth on outer rim of synchronizer rings block or prevent gear engagement until synchronization completed when final movement of outer clutch sleeve causes the clutch teeth on the inner rim of the sleeve to slide past the synchronizer ring teeth and engage the clutch teeth on the gear hubs. NOTE—Inner clutch sleeve is retained on mainshaft with second speed gear by single snap ring in front of clutch sleeve. This inner sleeve does not move during synchronization or gear engagement.

SERVICING:—Same as for previous models except for Synchronizer data and Passenger Car Gearshift mechanism as given below. *See 'Ford, Lincoln-Zephyr, Mercury (Own Make)' Transmission article in Mechanical Equipment Section of manual (or 1938 Supplement) for complete data and note following changes:*

Synchronizer Assembly:—To remove synchronizer unit and second speed gear from mainshaft, take out retaining snap ring in groove in shaft in front of synchronizer inner clutch sleeve, slide synchronizer assembly off shaft, remove hub spacer and second speed gear.

Synchronizer Unit—Inner and outer clutch sleeves marked by etched line to insure reassembly in same position. If unit being dismantled, use extreme care not to lose poppet balls and springs (3 each) which will spring out when outer sleeve removed. When reassembling unit, place struts in slots in inner sleeve, install springs and balls in holes in struts and sleeve, install outer sleeve (lining up marks on inner and outer sleeves), see that synchronizer ring notches engage ends of struts. Backlash between inner and outer clutch sleeves should be .000-.001". Synchronizer unit is mounted on shaft by same snap ring used to retain second speed gear.
NOTE—This type synchronizer can be distinguished from wire-bound blocking type synchronizer used on previous models by absence of shoulder on second speed end of outer clutch sleeve.

Second Speed Gear—Gear bushing not furnished separately. When installing gear on shaft, select hub spacer of correct thickness so that gear endplay (with synchronizer in place and snap ring installed) is .004-.008". This hub spacer furnished in three thicknesses—.0655-.0665" (81A-7069-A) .0705-.0715" (81A-7069-B), .0630" (81A-7069-C).

Gearshift Assembly:—To dismantle gearshift assembly, remove lockrings on shifter shaft ends of forks, remove forks from shifter shafts. Drive out locking pins in levers at outer ends of shifter shafts, withdraw shafts from inside of cover using extreme care not to lose detent balls, spring, and plunger. Reassemble shifter mechanism in same manner. See that oil seal in recess in cover at outer end of each shifter shaft is in good condition. See Ford & Lincoln-Zephyr Transmission Control article for adjustment directions when transmission installed on car.

FORD FOUR-SPEED TRUCK TYPE

Used On:

ALL TRUCK MODELS EXCEPT ¾ & 1 TON (1940)
OPTIONAL ON ¾ & 1 TON MODELS (1940)

This Transmission same design as used on previous Truck models except as noted below.

1940 CHANGES:—Rear end of transmission has been changed slightly for new type Hotchkiss drive and shaft mounted hand brake (brake drum mounted on front universal joint companion flange, brake band mounting brackets and linkage mounted on transmission case). Except for these changes, transmission is same design as used on previous models.

SERVICING:—Same as for previous models. *See 'Ford Four Speed Truck Type' Transmission article in Mechanical Equipment Section of manual (or 1938 Supplement) for complete servicing instructions.*

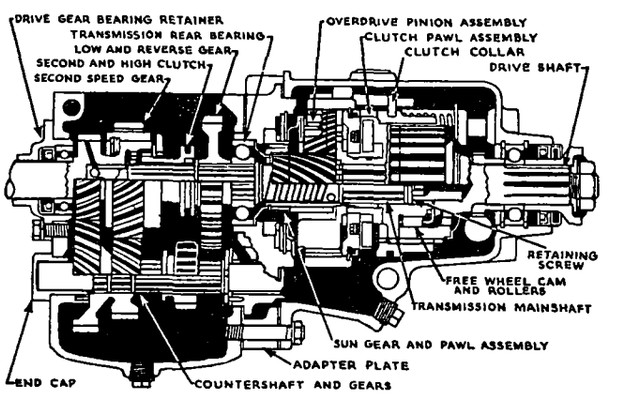
HUDSON TYPE

Used On:

HUDSON 6 & 8, ALL MODELS (1940)

This Transmission same design as used on 1939 Hudson models except as noted below.

OVERDRIVE TRANSMISSION NOTE:—Warner Overdrive, Model AS13-R6, with electrical 'kick-down' control is optional on all models (mounted on rear of transmission case). *See separate articles on Warner Overdrive and Warner Overdrive Control for complete servicing and adjustment directions.*



TYPE:—Design changed from that used in 1939 as follows:

Standard Transmission—New type low and reverse gears used (gears have thicker case hardening and longer life). Air vent now located on transmission case cover (vent is larger and has loose fitting cap). Gear ratios have been changed and Model 40 ratios are different than those on other models.

Overdrive Transmission—For overdrive, regular transmission is modified as follows: New retainer used on mainshaft low-and-reverse gear consisting of conical shaped pressed steel cap fitted over lock ring and pressed into place in groove in gear. New countershaft rear bearing cap, reverse gear cap, main shaft shift sleeve, and low-reverse shift rail used. Transmission case is heavier and oil tube is assembled in rear wall of case to convey oil to mainshaft bearing.

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SERVICING:—Except for new specifications and service tools, these transmissions serviced in same manner as previous models. *See 'Hudson & Terraplane Type' Transmission article in Mechanical Equipment Section of manual (or 1938 Supplement) for complete instructions and note following changes:*

Mainshaft Removal & Installation:—Use adapter J-778 with puller J-352 when removing mainshaft from transmission case. When shaft installed, tighten speedometer housing (rear bearing retainer) mounting screws, then install shims (as required) under main drive gear bearing retainer so that mainshaft endplay is .008-.012" measured with a dial indicator. Make certain that oil seals installed with lip on leather pointing in (toward rear on front seal, forward on rear seal).

Main Drive Gear & Second Speed Gear Assembly:—Lock ring tool remover for use in removing lock ring when disassembling second speed gear is No. J-448-1. Second speed gear endplay should be .003-.011". Second speed gear front thrust washer is now steel-backed, copper-lead faced type.

Counter Gear Removal & Assembly:—A retaining lock ring is used at front and rear of the countershaft second speed gear. Front lock ring must be removed (after gears separated with J-786 drift) before this gear can be driven forward on shaft. When installing counter gear assembly, place steel spacer on rear end of countershaft, bronze thrust washer on face of rear bushing cap (spacer and thrust washer positioned by lockring in groove in shaft in front of assembly). Countershaft endplay should be .005-.009".

Gearshift Mechanism:—See separate article on Hudson Handy Shift for adjustment directions when transmission installed on car.

LINCOLN V12 TYPE

Used On:

LINCOLN, V12 MODELS (1940)

This Transmission same design as used on previous Lincoln cars.

SERVICING:—Same as for previous models. *See 'Lincoln Transmission' article in Mechanical Equipment Section of manual (or 1938 Supplement) for complete instructions.*

NASH, NASH-LAFAYETTE TYPE

Used On:

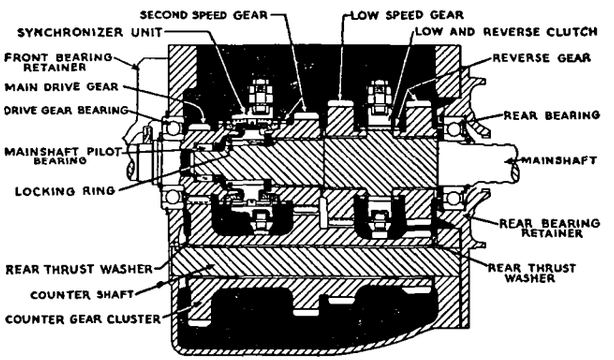
NASH, 4020 SIX, 4080 EIGHT (1940)
NASH-LAFAYETTE, MODEL 4010 (1940)
This Transmission same design as used on 1939 car models.

OVERDRIVE TRANSMISSION NOTE:—Cruising gear or Overdrive Warner Model AS12-R6, with electrical 'kick-down' control is optional equipment on all models. *See separate articles on Warner Overdrive and Warner Overdrive Control for complete servicing and adjustment directions.*

SERVICING:—Except for new Shifter Fork adjustment, Main Shaft endplay adjustment, Second Speed Gear retainer washer and plunger, Countershaft removal instructions as given below; all service operations same as for previous models. *See 'Nash (Own Make)' Transmission article in Mechanical Equipment Section of manual (or 1939 Supplement) for complete data and note following changes:*

Countershaft Removal:—To remove countershaft (this must be done before mainshaft can be withdrawn from transmission case), remove plug on lower rear face of overdrive case, insert special SE-568 countershaft pilot and washer retainer tool through this hole and hole in front end of case, drive countershaft out through front end of transmission case allowing tool to remain within counter gear cluster until it is removed from case. When installing countershaft, insert countershaft through front end of case and push tool out toward rear.

Shifter Fork Adjustment:—When installing shift mechanism mounting plate assembly, adjust shift forks before tightening shift fork nuts as follows: Use SE-612 gear spacing gauge placing narrow section of handle between low speed gear and clutch sleeve. Make certain that shifter shaft in neutral position, tighten rear shift fork nut, bend up lock plate on nut. Use two SE-612 gauges placing large end of one gauge between main drive gear and high speed synchronizer ring, second gauge between second speed gear and second speed synchronizer ring. See that shifter shaft in neutral position, tighten front shift fork nut, bend up lock plate on nut. Adjust overshift stops (see Nash Transmission Control article) before replacing transmission case cover.



Mainshaft Endplay Adjustment:—When installing rear bearing retainer, install SE-612 gauge between rear face of main drive gear and high speed synchronizer ring, install correct shim thickness between transmission case and rear bearing retainer so that, when mounting screws tightened, gauge clearance will be from .0 to .016" (if gauge tight, add additional shim). CAUTION—Rear bearing retainer must be tight when this check made.

Second Speed Gear & Synchronizer Retainer:—Second speed gear and synchronizer unit inner sleeve are retained by washer which is locked by spring-loaded plunger installed in hole in shaft. To dismantle assembly, depress plunger so that washer is freed, turn washer so that prongs line up with splines in shaft, withdraw washer, synchronizer assembly, second speed gear bronze thrust washer, spacer, second speed gear, low speed gear bronze thrust washer, and low speed gear. Use care not to lose plunger and spring in the shaft hole. Reassemble these parts in same order.

Gearshift Mechanism:—See Nash Transmission Control article for overshift stop adjustment and adjustment of gearshift mechanism when transmission re-installed on car.

OLDSMOBILE HYDRA-MATIC TYPE

Optional On:

SIX, '60' F-40, '70' G-40 (1940)
EIGHT, '90' MODEL L-40 (1940)

FLUID COUPLING NOTE:—See article on Oldsmobile Fluid Drive for description of Fluid Coupling used with this transmission. Service data for Fluid Coupling is given below.

DESCRIPTION:—The Hydra-matic Drive consists of a Fluid Coupling (replacing clutch used with conventional transmission) combined with a self-shifting transmission which differs from the type used on previous Oldsmobile models as follows:

Fluid Coupling:—Unlike other designs in that driver or impeller (rear set of vanes) is not driven directly by the engine crankshaft. The engine drives the flywheel housing (fluid coupling case bolted on flywheel) and the front planetary unit ring gear. The drive is then taken through the planetary gear set and back to the fluid coupling through a tubular shaft, through the fluid coupling, and back to the transmission through the inner intermediate or transmission mainshaft. Fluid coupling is kept filled with oil from transmission case by forward oil pump and does not require attention.

Planetary Units & Servos:—Design changed and new type Servos used to actuate units as follows:

Front Planetary Unit—Planetary unit is similar to design used on previous self-shifting transmission with actuating brake band and hydraulically operated clutch. Front Servo unit (which controls front planetary unit brake band) is new design in which brake band is applied by hydraulic pressure and is released by spring pressure. Servo unit is combined with front oil pump which is built in servo housing and has the oil pressure regulator assembly mounted on the housing also. This front servo is not adjusted in same manner as on previous models (see Adjustment instructions below).

Rear Planetary Unit—This unit is new design and consists of a single planetary gear set. It is controlled by the Rear Servo unit which is similar to previous type except that band is applied by both spring and hydraulic pressure. The usual hydraulically operated disc clutch is used (all clutches have six pistons instead of three as used on former type). Rear Servo is adjusted in same manner as former type (see Adjustment instructions below).

Reverse Planetary Unit—This unit is entirely new and replaces the "Headset' or mechanically engaged reverse gear used on former models. It consists of an additional planetary gear unit in the transmission case in back of the Rear Planetary Unit. This unit does not have the customary brake band and servo unit and is actuated by a toothed pawl in the right side of the transmission case which engages teeth on the rim of the reverse gear planetary ring gear so as to hold the ring gear stationary when the lever on the steering wheel is placed in the 'Reverse' position.

Oil Pumps & Control Valve:—Entirely new design and consist of two separate pumps as follows:

Front Oil Pump:—This pump is built-in front servo housing and is driven by a gear on the front planetary ring gear (drive gear) sleeve. It operates whenever engine is operating and supplies oil for transmission lubrication and for the Fluid Coupling. It also supplies oil for transmission operation (servo and clutch actuation) when car is first started up, this latter function being taken over by rear oil pump as soon as car speed reaches 20 MPH.

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Rear Oil Pump:—Mounted as an assembly with the Control Governor and is driven by a gear on the transmission driven shaft (in front of reverse planetary unit). At car speeds above 20 M.P.H this pump develops sufficient pressure to operate planetary gear servos and clutches. At all speeds above this point, front pump provides oil only for transmission lubrication and to keep fluid coupling case filled (fluid coupling has return pipe and control valve through which excess oil is returned to transmission case so as to provide oil circulation for temperature control).

Pressure Regulator Valve—Mounted on front servo housing. Controls oil pressure and delivery from front and rear oil pump as detailed above. See 'Checking Oil Pressure' below for oil pressure checking and servicing data.

Main Oil Control Unit—Mounted on right hand side of transmission case under side cover plate. See Servicing data below for removal and installation

Control Lever on Steering Wheel:—New design lever with four positions—High—Low—Neutral—Reverse. This lever is linked to relay lever and manual shift lever on transmission case by a control rod but does not engage gears as in former designs (no Headset used). Lever case is illuminated by small #51 bulb (see Servicing data below for bulb replacement) and detents are used to locate lever in each position. See Adjustment Section below for Manual Control Lever Linkage adjustments.

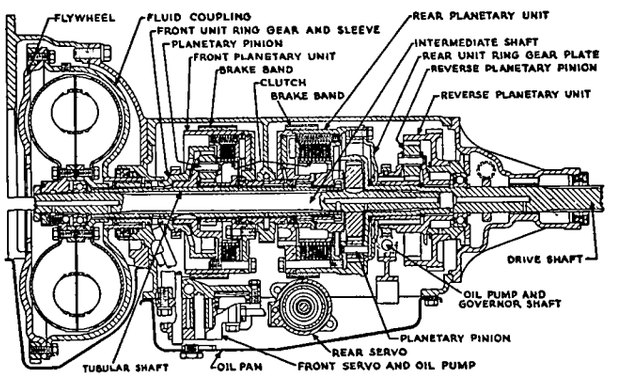
Carburetor Throttle Linkage:—Controls speed at which actual gearshifts occur and must be adjusted exactly as detailed below (see Adjustment Section).

OPERATION:—Fluid coupling provides slip at idling speed so that car does not move. When control lever on steering wheel is placed in 'High' or 'Low' position and engine is accelerated, car moves forward and shifts occur automatically as speed increases (in 'low' position, car shifts only from low to second; in 'high' position, car shifts from first to second to third to fourth or direct drive as the speed is increased), the fluid drive transmitting the engine torque with practically no slippage at speeds above idling speed. The speed at which shifts occur is controlled by the Governor with an overriding control by the accelerator linkage by which shifts are delayed or retarded with a wide open throttle so as to provide improved acceleration and power when this is desired. In normal operation the 'Low' range is not used and the lever is moved directly to 'High' position when the car is started up. In this position no further attention is required and car shifts through to direct drive at the proper speed. To reverse the car, the lever is placed in the 'Reverse' position which engages the reverse pawl so that the reverse planetary gear set ring gear is held stationary. Operation of the transmission in each gear ratio is as follows:

First or Low Gear—Brake band of front planetary gear unit is applied by hydraulic pressure and brake band of rear planetary unit is applied by spring and hydraulic pressure. Both planetary unit clutches are released (no oil pressure) and engine drives through both planetary units in tandem providing maximum gear reduction (reverse planetary unit ring gear is released and this unit does not operate).

Second Gear—Front planetary unit brake band is released by hydraulic pressure and clutch is engaged by hydraulic pressure so that this unit is locked and rotates as an assembly. Engine then drives through rear planetary gear unit only.

Third Gear—Engine drives through front planetary gear unit in same manner as for low gear (brake band applied and clutch released) and then drives both the ring gear (directly) and the sun gear (through the fluid coupling) of the rear planetary unit (brake band is released by hydraulic pressure but clutch is also engaged which is unlike low gear operation) so that a gear reduction less than either low or second gear is obtained through the rear planetary unit pinion plate and drive shaft.



Fourth Gear or Direct Drive—Both planetary gear units are locked out (brake bands released, clutches engaged) so that the engine drives straight through the transmission for direct drive to the rear wheels.

Reverse Gear—In reverse gear, the reverse gear planetary ring gear is locked (by reverse pawl engaging teeth on ring gear rim). The engine drives through the front planetary unit in the same manner as for low and then drives both the pinion plate and ring gear of the rear planetary unit (rear unit brake band released by hydraulic pressure). The rear unit ring gear drives the sun gear of the reverse planetary unit and the drive is taken through the reverse unit pinion plate to the transmission drive shaft (shaft is also driven directly by pinion plate of rear planetary unit so that final torque is combination of these two drives).

LUBRICATION:—**Capacity**—10 quarts. Use only special lubricant furnished by manufacturer and specified for use in the Hydra-matic Transmission.

CAUTION—Do not use any other type oil.

Filler Plug & Gauge—To check oil level, remove sheet metal cover under right front corner of floor mat. Check only after engine has been run, allow car to stand for a minute before noting oil level reading on level stick in filler hole in top of case. Keep oil up to 'F' mark on level stick (oil can be added through this filler hole).

Oil Pan & Screen—See Servicing directions below for oil pan removal. Clean oil screen when pan removed. CAUTION—When installing pan, make certain that copper washers used on 3 screws on left hand side and 2 screws at rear of case.

CHECKING OIL PRESSURE:—If transmission operation not satisfactory check to make certain that oil pressure sufficient for correct operation as follows:

To Check Oil Pressure—Use special service fixture J-1467 and a reliable 100 lb. oil pressure gauge. Remove plug in front of transmission side cover plate, remove plug from governor sleeve by threading standard ¼" capscrew into plug and removing plug through side cover plate hole. Assemble J-1467 fixture in place in side cover plate and governor housing using extreme care not to cause any bind in governor assembly. Assemble pressure gauge to fixture plug so that gauge can be read while car being operated. Operate car on road until transmission fluid is hot, see that control lever in high range, allow car speed to drop to 20 MPH and note gauge reading. Oil pressure must not be less than 78 lbs. at 20 MPH.

Low Oil Pressure Correction—If pressure less than 78 lbs., check for excessive oil leakage in transmission or oil regulator valve assembly, see that oil regulator valve body is tight, check for sticking regulator valve or weak valve spring (substitute new spring and recheck pressure). Inspect for leak in main control valve body or at delivery tube connections between main control valve body and governor sleeve.

ADJUSTMENT:—**Linkage**—Should be checked and adjusted, if necessary, whenever it has been disconnected or disturbed by removal of other units, carburetor adjustment, etc. Adjust as follows:

Carburetor Throttle Linkage—This linkage determines speed at which shifts occur and should be adjusted carefully. First adjust carburetor for correct idle speed and fast idle throttle opening (see Oldsmobile 'T&E' page and Carter WA-1 and WDO carburetor articles in 'C' Section for directions). Then disconnect carburetor throttle rod at carburetor, bell crank to throttle cross-shaft rod at bell crank, cross-shaft to transmission rod at transmission case lever. Install special Oldsmobile setting gauge J-1486 on bell crank, adjust trunnion on throttle rod at throttle lever so that, when rod connected and carburetor throttle valve held closed in slow idle position, rod contacts both legs of gauge. Tighten trunnion locknut, connect rod, remove gauge. Install special setting gauge J-1470 between lever on right end of cross-shaft and toeboard to establish correct clearance (CAUTION—Clearance should be 9/16"—6 cyl. cars, ⅜"—8 cyl. cars, make certain that correct end of gauge marked '6' or '8' used on each model). Press back on cross-shaft lever to make certain that gauge is against toeboard, hold carburetor throttle lever closed in slow idle position, adjust trunnion on bell-crank end of cross-shaft rod so that it enters bell-crank freely, tighten locknut, connect rod, remove gauge. Check cross-shaft stopscrew by rotating throttle cracker lever on left end of cross-shaft to limit of cross-shaft travel with carburetor throttle valve wide open, adjust stopscrew to just contact stop on cross-shaft bracket. Tighten locknut and release cross-shaft. Make certain that carburetor throttle closed in slow idle position, press back on throttle lever on side of transmission case so lever against stop, loosen locknut and adjust clevis on end of cross-shaft to transmission lever rod so that rod can be connected without disturbing position of cross-shaft or transmission lever, tighten locknut and connect rod. Check entire throttle linkage for free operation.

Manual Control Lever Linkage:—Disconnect front control rod at intermediate lever on flywheel housing, rear control rod at relay lever on side of transmission case. Set control lever on steering wheel in 'R' (Reverse) position, make certain that detent ball engages notch. Rotate intermediate lever until hole in lever lines up with hole in bracket, install special gauge J-1469 through both holes to hold lever in this position. Move manual shift lever on side of transmission case to extreme rear position (check by rotating propeller shaft by hand until

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reverse pawl is felt to engage and lever is against stop). Adjust clevis on end of rear control rod until rod can be connected without disturbing position of relay lever, tighten locknut and connect rod (make certain anti-rattle washer in place). Remove setting gauge from intermediate lever, hold manual shift lever against reverse stop (press backward on rear rod), adjust clevis on end of forward control rod until rod can just be connected without disturbing levers, tighten locknut, connect rod (make certain anti-rattle washer in place). Check to see entire control mechanism operates freely.

Servo Bands:—Oil must be drained and transmission oil pan removed for servo band adjustments. Front and rear servo bands are adjusted differently and each band must be adjusted exactly as directed below. NOTE—No band used on reverse planetary unit (pawl used which engages teeth on ring gear rim) and no adjustment required for this unit.

Front Servo Band—Remove oil pan, install special tool J-1459 over capscrew on lower side of unit to hold screw while adjustment being made. Loosen locknut, use socket wrench to tighten adjusting screw to point where drum cannot be moved in either direction, mark screw to indicate this position, back adjusting screw off exactly 8 full turns, tighten locknut taking care that adjusting screw does not turn.

CAUTION—Adjusting screw must not be backed off more or less than 8 turns, and tool J-1459 **must** be used when adjusting.

Rear Servo Band—Remove oil pan, install adjusting gauge J-1460 on bottom of servo unit. Loosen adjusting screw locknut, turn adjusting screw in until end of servo plunger is flush with outer edge of gauge (plus or minus 1/32"). Hold adjusting screw and tighten locknut.

SERVICING (ON THE CAR):—Units listed below can be serviced without removing transmission from the car. When removing and installing these units, follow instructions carefully.

Servo Units and Front Oil Pump—Drain oil and remove oil pan. Remove main oil line being certain to hold coupling in valve body while this end of line loosened to avoid damage to front connection. Remove oil pressure regulator valve and body. Remove two oil delivery pipes from front cover. Loosen rear servo adjusting screw only. Take out 4 servo to transmission case mounting screws, lift out front and rear servos and front oil pump as a unit. Adjust servos when re-installed.

Main Oil Control Valve and Body Assembly—Remove side cover on transmission case. Loosen four attaching bolts mounting oil control unit on side of case (CAUTION—withdraw bolts only far enough to free unit from case, leave bolts in holes in body to prevent body separating when removed). Slide control unit toward front of transmission to disengage oil pipes from governor unit, lift unit off using extreme care to prevent body separating. Install in same manner, tighten all screws evenly to avoid distorting case.

Rear Oil Pump and Governor Assembly—Remove main oil control unit (above). Take out attaching bolts and remove reverse linkage and pawl assembly from side of transmission case. Take out mounting bolts and remove oil pump and governor assembly through bottom of case (turn round governor weight toward front of transmission for clearance while unit being withdrawn). Install in same manner.

Transmission Case Side Cover—When installing cover see that cork gasket in place over shaft and that copper washer used on 7 lower mounting screws, install manual shift outer lever and adjust linkage as directed above.

Oil Pan—When installing oil pan, make certain that oil screen is in place, use copper washers on 3 screws on left side and 2 screws at rear of case.

Steering Column Control Lever Lamp—Lamp bulb in control lever housing is accessible for replacement by taking out 2 screws holding housing to bracket and sliding housing around so that lamp is exposed. To remove lamp, take out screw in lamp socket.

SERVICING:—Front Servo—To disassemble after removal from transmission, remove oil suction line, take out pump cover attaching bolts, remove pump cover. Remove servo pistons, springs and oil pump gear from housing. When assembling, install servo piston and sleeve in housing, slip retracting spring over piston shaft. Install oil pump idler gear. Install accumulator piston, booster spring, booster spring retainer in servo unit cover, install cover assembly in servo housing, tighten cover bolts. Install suction line making certain that gasket is in good condition. When installing servo in transmission case, see that plunger enters anchor on brake band. Adjust servo after installation.

Rear Servo—To disassemble after removal from transmission, place servo in arbor press and hold squarely in steady position on baseplate so that tension removed from spring retainer. Remove retainer screws, release pressure slowly and guide accumulator body out of servo, remove all parts. When assembling, install booster piston, booster spring, large initial spring, accumulator and piston body in servo body, centering small ring on booster spring so that it enters accumulator body freely. Hold accumulator in place on servo, install inner and outer servo springs and spring retainer. Compress assembly in arbor press and tighten spring retainer screws. Adjust servo after installation in transmission.

Fluid Coupling—To remove fluid coupling members with transmission off car, place manual shift lever in reverse position, loosen mainshaft locknut washer. Use tool KMO.334 to remove locknut retaining driven member (runner) on front end of mainshaft, slide driven member off. Remove drive member (driver) by gripping vanes with pliers at 2 diametrically opposite points and pulling forward while tapping on end of mainshaft with bronze hammer (CAUTION—do not attempt to remove drive member by pushing or pulling on flywheel cover—this will damage oil seal rings).

PACKARD TYPE

Used On:

SIX '110', MODEL 1800 (1940)
EIGHT '120', MODELS 1801, 1A (1940)
SUPER 8 '160', MODELS 1803, 3A, 4, 5 (1940)
CUST. SUPER 8 '180', MODELS 1806, 7, 8 (1940)

This Transmission same design as used on corresponding 1939 models except for new Overdrive Unit.

OVERDRIVE TRANSMISSION NOTE:—New Econodrive or Overdrive, Warner Model AS1-R9A, is optional on all models. This Overdrive unit is entirely new design with electrical control (with lock-out button in 'Overdrive' position, overdrive cut-in is controlled by governor switch and occurs automatically, overdrive may be cut out at any speed by operating the accelerator pedal control). ***See Warner (Packard Type) Overdrive article for complete servicing and adjustment directions.***

SERVICING:—Overdrive Transmission Note—Transmissions with overdrive can be disassembled without disturbing overdrive unit as follows: Remove overdrive drain plug (on lower rear end of case), transmission cover and shifter mechanism, main drive gear bearing retainer (on front of transmission case). Insert special ST-5043 roller bearing assembly bar through overdrive drain plug hole and hole in front end of case, drive countershaft out through front end of transmission case leaving the assembly bar in the counter gear cluster to retain the bearings until the gear cluster is removed. Take out two short capscrews holding adapter plate to transmission case (do not disturb screws bolting overdrive case to adapter). Remove main drive gear and bearing through front of case, slide synchronizer assembly off front end of mainshaft. Withdraw overdrive unit, adapter plate, and mainshaft assembly from rear end of transmission case as a unit. CAUTION—Do not permit adapter plate to separate from overdrive case which will require complete disassembly of overdrive.

Transmission Disassembly (Without Overdrive):—Remove transmission case cover and shifter mechanism, take off nut on rear end of shaft, pull universal joint flange, take out screws and remove rear bearing cap, remove countershaft lock plate, remove main drive gear bearing retainer on front of case. Use ST-5043 roller bearing assembly bar as a drift and drive countershaft out through front of case (leave bar in counter gear cluster to retain bearing rollers). Remove main drive gear and bearing through front of case. Move mainshaft and gear assembly to rear until rear bearing clears case, tap bearing off shaft, then remove mainshaft assembly through top of case. Lift out counter gear cluster, thrust washers, and bearing rollers. To remove reverse idler gear, drive shaft out toward rear.

Synchronizer Unit:—Conventional poppet ball and spring type. Unit can be dismantled by sliding outer clutch sleeve off inner sleeve using extreme care not to lose poppet balls and springs which will fly out (mark inner and outer sleeves and replace in same position). Use band type ring compressor or ST-5014 clamp to re-install balls and springs.

Synchronizer Travel Adjustment—Check clearance between lug on second-high shifter fork and stop on cover with shift lever in High Gear position. Clearance should be .005" min., .010" max. Adjust by bending lug. CAUTION—If clearance greater than .010", outer clutch sleeve may move too far forward which will allow synchronizer balls and springs to fly out. If this occurs, cover must be removed and synchronizer reassembled.

Mainshaft, Low & Second Speed Gear Assembly:—Both low and second speed gears are furnished as an assembly with the mainshaft and should not be removed. These gears are constant-mesh type and are mounted on double row ball bearings on shaft.

Shifter Mechanism:—Entire shifter mechanism mounted in transmission case cover and not disturbed by cover removal. When re-installing cover, make certain that shifter forks are in neutral position and that they engage sliding gear (rear fork), synchronizer clutch sleeve (forward fork).

DETROIT 200, 400, 500, 4100, 4200, 4400 SERIES

Used On:

SERIES 200, 400, 500 (PLAIN BUSHING TYPE)

Auburn Eight, 8-100, A (1932)—to Serial No. 5510.
Auburn Eight, 8-101, A (1933)—Serial Numbers 2501-2600 & 3201-3800.
DeSoto Six, Model SC (1932)
Graham Six, Model 56 (1932), 58 (1933)
Plymouth, All Models (1932)
Reo Royale, Models N-1, N-2, 52-N (1933)
Willys, Model 77 ('33-34-35-36), 37 ('37)
Willys, Pass. Cars Before #88008 (1938)

SERIES 4100 (ROLLER BEARING TYPE)

Bantam, Model 60 (1937-38-39)
Willys, Pass. Cars After #88008 (1938)
Willys, Comm. Models (1938)
Willys, 48 (1939) Pass. Cars & Trucks.
Willys-Overland, Model 39 (1939)

SERIES 4200 (ROLLER BEARING TYPE)

Chrysler Royal, C16 ('37), C18 ('38), C22 ('39)
***Chrysler Custom Imperial, CW ('34), CW* ('35)**
DeSoto Six, Model SD (1933)
DeSoto, S3 ('37), S5 ('38), S6 ('39)
Dodge Six, DP ('33), DR, DS ('34), DU ('35)
Dodge, D2 ('36), D5 ('37), D8 ('38), D11 ('39)
Graham Cavalier, Model 95 (1937).
Graham Supercharger, Models 116, 120 (1937).
Graham, Std. & Spec. Model 96 (1938-39)
Graham, Supercharger Model 97 (1938-39)
Plymouth Six, PC, PD ('33), PF, PG ('34), PJ ('35)
Plymouth, P1, P2 ('36), P3, P4 ('37), P5, P6 ('38)
Plymouth, Roadking P7, Deluxe P8 (1939)

SERIES 4400 (ROLLER BEARING TYPE)

Chrysler Imperial, Models C19 ('38), C23 ('39)
*—Used on rear shaft only, Spicer on front shaft.

NOTE:—Series 200, 400, 500. Plain bushing (not roller Bearing). Service data below applies to these models with exception of data on roller bearings.

Series 4100, 4200, 4400. Roller bearing type. These series same except for size and serviced in same manner.

DESCRIPTION:—Ball and Trunnion type with Roller Bearings. Consists of a body or housing bolted to companion flange which has two parallel ball slides machined on its inner surface. Ball head on shaft has cross pin with ball at each end which engages ball slide in housing. Ball mounted on loose rollers on pin which are retained by centering button at outer end of pin. Ball head centered by spring retained by cover (spring seat and grease retainer) clipped to housing flange. Leather boot on opposite end of housing is clamped to housing and shaft to retain grease.

DISCONNECTING UNIVERSAL:—Take out bolts which mount housing to companion flange. Do not disturb cover clipped to housing flange (cover has notation 'Do not remove cover') unless joint is to be disassembled.

SERVICING:—Disassembly—Bend back three lugs only on one side of grease cover, slide cover off sideways, push housing back on shaft, remove centering buttons and balls (CAUTION—do not lose roller bearings out of balls). Wash all parts and inspect for wear. If balls or rollers show wear, replace with complete ball and roller assembly. Check housing, raceways for ball impressions which result in backlash, replace housing if unduly worn. Press out pin in ballhead only if pin or housing is to be replaced.

Assembling—First slip housing over ballhead, press pin in place **being sure that equal amount of pin extends through each side of ballhead**—this is important. Place 1/16" washers over ends of pins, install ball and roller assemblies, finally install centering buttons with 1/64" spring washers next to pin ends. Pull housing forward to hold parts in place. Apply 1½ ozs. of fibre grease across face of balls. Install conical spring, being certain that small end of spring rests over pilot on end of ballhead, new gasket, and grease cover, bend down lugs on grease cover. When connecting universal joint, use new lockwashers and tighten nuts holding housing on companion flange securely, this is important.

NOTE—Grease capacity is 1¼ ozs. (4100, 4200), 1½ ozs. (4400).

UNIVERSAL JOINT BOOTS:—Original equipment boot is seamless type secured by a clamp on each end. To remove boot, remove clamps and cut off old boot (see Note). Install service boot which is hook-on type and can be installed without removing shaft from car, pressing metal hooks down tight to close longitudinal seam and twisting wires tight on each end.

IMPORTANT SERVICE NOTE—1937-38-39 cars are factory equipped with a boot having a leather cone extending into the housing. When removing outer cover, use care not to disturb this cone, leaving cone in place and installing new hook-on boot over it. If cone is destroyed, install special combination cone and outer boot which is available for service.

DETROIT 600, 700 SERIES

Used On:

Auburn Eight, 8-100, A (1932)—after Serial Number 5510
Auburn Eight, 8-101, A (1933)—Serial Numbers 2601-3200, 3801-5500
Auburn Eight, Salon Model 8-105 (1933)
Chrysler Eight, CP (1932), Imperial, CQ (1933)
Hupmobile Eight, F-222 ('32), F-322 ('33)
Hupmobile Eight, I-226 ('32), I-326 ('33)
Hupmobile Eight, 427-T ('34), 527-T ('35)
Pierce Arrow Eight, 836, Twelve 1236 (1933)
Studebaker 8, Pres. 82, Sp'way Pres. 92 (1933)

DESCRIPTION:—Roller bearing, split ring type. No cross used. Front yoke assembled with separate trunnion pin, rear yoke trunnion pins integral with slip yoke assembly. Bearings consist of loose rollers held in place in bearing cup by retainer (dust shield) and shoulder on yoke at open (inner) end. Bearing cups assembled over pins and retained by split ring clamped together with four bolts. Cork washer and dust cap assembled between bearing and shoulder on yoke to retain lubricant.

DISCONNECTING UNIVERSAL:—End yoke flange bolted to companion flange. Take out bolts in flange to free shaft and universals.

SERVICING:—Disassembly. Remove four ring bolts, pull ring halves apart to free bearing cups, lift bearing cups off with cork gasket and dust cap. Trunnion pin in front (slip) yoke may be pushed out if necessary.

Servicing—Thoroughly clean all parts. Examine for wear and replace all worn parts. Repack assembly with good grade lubricant.

Assembling—Reverse disassembling directions above. New cork gaskets must be used.

NOTE—When installing shaft see that arrows on shaft and universal yoke at splined joint are in alignment.

DETROIT 5150, 5200, 5350 SERIES

Used On:

SERIES 5150

Chrysler Six, Model C7 (1936)
Chrysler Airstream Eight, Model C8 (1936)
Chrysler Airflow, Model C9 (1936)
Chrysler Imperial, Model C14 (1937)
DeSoto, Airst'm S1, Airflow S2 (1936)
Hupmobile Six, 421-J, 417-W (1934)
Hupmobile Eight, 521-O ('35), 621-N ('36)
Hupmobile Eight, 825-H ('38), 925-H ('39)
Oldsmobile Six, F-34; Eight L-34 (1934)
Packard Eight, Models 1601, 1A, 2 (1938)

SERIES 5200

Reo Flying Cloud, S-2, S-3, S-4 (1933-34) SEE NOTE

SERIES 5350

Chrysler Imperial, Model C10 (1936)
Chrysler Cust. Imp. C11 ('36), C15 ('37)
Chrysler Airflow, Model C17 (1937)
Chrysler Cust. Imperial, C20 ('38), C24 ('39)
Packard Eight, 1200,1,2 ('35), 1400, 1,2 ('36)
Packard Super Eight, 1500, 1, 2 (1937)
Packard Super Eight, 1603, 4, 5 (1938)
Packard Twelve, Models 1407, 8 (1936)
Pierce Arrow Eight, 836-A, 840-A ('34), 845 ('35), 1601 ('36), 1701 ('37), 1801 ('38)
Pierce Arrow Twelve, 1240-A, 48A ('34), 1245,55 ('35), 1602, 3 ('36), 1702,3 ('37), 1802,3 ('38)

NOTE:—5200 Series joint used on these models. Roller bearing assembly retained by dovetail lock bar assembled on each yoke end. Serviced by driving out lock bars. Service data below applies to these models with exception of data on locking rings.

DESCRIPTION:—Roller bearing type. Universal has conventional cross with individual bearings on cross ends. Bearings consist of loose rollers held in place in bearing cup by retainer at open (inner) end. Bearing cups assembled directly in holes in ends of yokes and are retained by locking ring on inner face of yoke which engages recess in bearing cup. Cork washer and dustcap installed between bearing cup and shoulder on cross to retain lubricant.

DISCONNECTING UNIVERSAL:—End yoke flange is bolted to companion flange. Take out bolts in flange to free shaft and universals.

SERVICING:—Disassembly—Take out locking rings from opposite bearing cups. Tap on outer end of one bearing cup to start opposite cup out, withdraw bearing cup, tap on end of cross to start opposite bearing cup. Remove dustcap and cork gasket.

Servicing—Thoroughly clean all parts. Examine for wear and replace all worn or damaged parts. Clean out lubricant holes in cross, repack entire assembly with correct type lubricant.

Assembling—Use new cork gasket. Reverse disassembling directions above.

NOTE—When installing shaft, see that arrows on shaft and universal yoke at splined joint are lined up.

MECHANICS 1½C, 2C, 3C, 4C TYPES

Type 1½C. Used On:

**Cadillac V8, 70, 75 ('36), 75 ('37-38-39)
**Cadillac V-12, 80, 85 ('36), 85 ('37)
**Cadillac V16, 90 (1938-39)

Type 2C Used On:

Buick, 39-40, 39-60 (1939)
Nash Ambass. 6, 3720 ('37), 3820 ('38), 3920 ('39)
*Nash Ambass. 8, Model 3780 (1937).
Nash-Lafayette, 3710 ('37), 3810 ('38), 3910 ('39)
Oldsmobile Six, All Models (1936-37-38-39)
Oldsmobile Eight, All Models (1936-37-38-39)
Packard Six, 115C ('37), 1600 ('38), 1700 ('39)
**Pierce Arrow 12, 1602,3 ('36)
Pontiac Six, All Models (1937-38-39)
Pontiac Eight, All Models (1937-38-39)

Type 3C Used On:

Auburn 6, 652X,Y ('34),653 ('35), 654 ('36-37).
Auburn 8, 851 ('35), 852 ('36-37).
Auburn Schgd. 8, 851 ('35), 852 ('36-37).
Cadillac V8, All Models (1935-36-37-38-39)
Cadillac V-12, 36-80, 85 ('36), 37-85 ('37)
Cadillac V16, 90 (1938-39)
LaFayette 6, 3510 ('35), 3610 ('36).
La Salle 35-50 ('35), 36-50 ('36), 37-50 ('37).
LaSalle, 38-50 ('38), 39-50 ('39)
Nash Ambass. 6, 3520 ('35), 3620 ('36).
Nash '400', 3540, 3640 ('35), 3640-A ('36).
Nash Ambass. 8, 3580 ('35), 3680 ('36), 3780 ('38)
Nash Ambass. 8, 3880 ('38), 3980 ('39)
Oldsmobile 6, F-35 ('35); 8, L-35 ('35).
Packard 6, 1700 (1939)—With Overdrive
Packard 120 ('35), 120-B ('36), 120-C ('37).
Packard '120' 8, 1701,1A,2 (1939)
Packard Super 8, 1703,3A,5 (1939)
Studebaker 6, Dict. A ('34), 1A, 2A ('35).
Studebaker 8, Comm. B ('34), 1B ('35).
Studebaker 8, Pres. C ('34), 1C ('35).

Type 4C Used On:

Cadillac V-8, 355-D Series 10, 20 ('34), 30 ('34-35).
Cadillac V-12, 370-D Series 40 ('34-35).
Cadillac V-16, 452-D Series 60 ('34-35), 36-90 ('36), 37-90 ('37).

* —One 2C and one 3C joint used.
**—Steering column joint.

DESCRIPTION:—Roller bearing type. Universal has conventional cross with individual trunnion bearings on cross ends. Two types of trunnion bearings used: 1) Wing Type bolted to yokes or flanges by capscrew in each trunnion boss, 2) Round Type fitting directly in hole in yoke ends and retained by bushing plate clamped on bearing hole by capscrew. Trunnion bearings are cup-shaped and retain loose rollers which must be assembled before trunnion bearing installed on cross. Cork packing washers used between trunnion bearing and shoulder on cross to retain lubricant.

DISCONNECTING UNIVERSAL:—Turn down locks and take out two capscrews in opposite trunnion bearings on companion flange, wire trunnions together to prevent them coming off ends of cross (unless joint is to be disassembled), tap trunnions lightly with soft hammer to disengage drive lugs (lugs on trunnion bearing engage slot in flange and flange end is turned up to retain trunnions).

SERVICING:—Disassembly—Wing type trunnion bearings may be pulled directly off universal joint cross after mounting capscrews have been removed (do not lose loose rollers in bearing). To remove Round type trunnion bearings, shaft must be removed to the bench. Clamp yoke or drive shaft tube (at weld) in vise, take out screws and remove bearing end plates (both sides). Use flat end drift slightly smaller in diameter than bearing, drive on outer end of one bearing, driving bearing in until shoulder on cross strikes inside of yoke lug. This will start opposite bearing out. Grip this bearing in vise (use brass or copper jaws) work shaft back and forth until bearing comes out. Drive other bearing out in same manner (using drift against end of cross).

Servicing—Wash all parts in gasoline. Clean out lubricant passage in cross. Replace worn parts (examine cross journal, trunnion bearing and rollers for wear), repack all space with semi-fluid chassis lubricant or SAE. #160 oil.

Assembling—Use new cork seal or packing washers. Reverse disassembling directions above. When installing Round type bearings, tap bearings in place or if arbor press used, see that pressure is not great enough to sprink yoke ends. On Wing type bearings, use new lock plate and see that ears on lock plate turned up against capscrews after screws are securely tightened.

NOTE—When installing drive shaft, see that arrows on shaft and universal joint yoke at sliding joint line up.

MECHANICS

Used On:

Auburn 12, 12-160, 161, 165 ('32-33-34)
Hupmobile Six, Model 216 (1932)
Packard Eight, Model 901, 2 (1932)
Packard Super Eight, Model 903, 4 (1932)
Packard Twelve, Model 905, 6 (1932)
Studebaker Six, Model 56 (1933)
Studebaker Eight, Commander 73 (1933)
Stutz, SV-16, DV-32 (1932-34)

DESCRIPTION:—Oil lubricated type. No cross used. Consists of two yokes with trunnion bearings installed over yoke ends. Two threaded studs, (formed on opposite sides of bearings) fitted in holes in either housing to which nuts attached clamping housing halves together. Yoke ends bear directly on inner surface of housing. Oil tight seal obtained by ground edges on housing halves and cork washers assembled under trunnion bearings at inner end of yoke pins.

DISCONNECTING UNIVERSAL:—Take out bolts connecting yoke flange to companion flange to free shaft and universals.

SERVICING:—Disassembly—Remove two oil plugs from slip yoke half of housing, drain oil. Bend back lock plates, remove eight nuts holding housing together, tap on studs to separate halves. With halves pulled away from yokes, remove trunnion bearing, spring washer, brass ferrule and cork washer from each yoke pin.

Servicing—Thoroughly clean all parts. Examine for wear and replace all worn or damaged parts.

Assembling—Assemble halves separately. Use new cork washers and brass ferrules. Oil yoke pins, assemble cork washer, brass ferrule (with flange toward trunnion), spring washer and trunnion bearing to each yoke pin, with lock plate under nut, bolt to housing. Shellac ground edges of housing, clamp housing together with four remaining nuts, bend lock plates up against nuts. Lubricate as directed below.

Oiling—Oil plugs located on slip yoke half of housing. Turn joint to place plugs one above the other. Remove upper vent plug, remove lower plug and insert Oil Gun. Using heavy oil (not grease) fill joint until oil escapes from top hole. Replace top plug, turn joint one half revolution, withdraw oil gun and replace plug. Splined yoke with plug should be lubricated with grease. Lubricate joint every six months for normal service.

SPICER NEEDLE BEARING TYPE

Used On:

Chrysler Six, CO ('33), CA, CB ('34), C6 ('35)
Chrysler Royal Eight, CT ('33),; Air'stm CZ ('35)
Chrysler Airflow, CU, CV ('34), C1, C2, C3 ('35)
Chrysler Custom Imperial, CW ('34), CW ('35)
De Soto Airstream Six, SF ('35)
De Soto Airflow, SE ('34), SG ('35)
Graham Six, 65 ('33), 68 ('34), 73, 74 ('35), 80, 80A, 90, 90A ('36), 85 ('37)
Graham Supercharger Six, 110 ('36)
Graham Eight, 57-A, 64 ('33), 67 ('34), 72 ('35)
Graham Schgd. Eight, 67, 69 ('34), 75 ('35)
Hudson Six, Super ('33), GH ('35), 63 ('36), 73 ('37)
Hudson Six, 83 (1938), 91, 2, 3 (1939)
Hudson '112', 89 (1938), 90, 98 (1939)
Hudson Eight, LL, LT, LTS ('34), HT, HU, HHU ('35) 64, 5, 6, 7 ('36), 74, 5, 6, 7 ('37), 84, 5, 7 ('38)
Hudson Eight, Models 95, 97 (1939)
Hupmobile Six, 518-D ('35), 618-G ('36)
Hupmobile Six, 822-E (1938), 922-E (1939)
Hupmobile Skylark, Model R (1939)
La Fayette Six, Model 110 ('34)
La Salle, 350 Series 50 ('34-35)
Packard Eight, 1001, 2 ('33), 1100, 1, 2 ('34)
Packard Super Eight, 1003, 4 ('33), 1103, 4, 5 ('34), 1203, 4, 5 ('35), 1403, 4, 5 ('36)
Packard Twelve, 1005, 6 ('33), 1107, 8 ('34), 1207, 8 ('35), 1407, 8 ('36), 1506, 7, 8 ('37), 1607, 8 ('38)
Packard Twelve, Models 1707, 8 (1939)
Reo Six, S-3, 4, 7 ('34-35), 6A ('35), 6D ('36)
Studebaker Six, Dictator 3A, 4A ('36)
Studebaker Comm., Model 9A (1939)
Studebaker Champion, Model G (1939)
Studebaker Pres., 2C ('36), 3C ('37), 4C ('38), 5C ('39)
Terraplane Six, K, KS, KU ('34), G, GU ('35), 61, 62 ('36), 70, 71, 72 ('37), 80, 81, 82, 88 ('38)

*—Used on front propeller shaft, Detroit ball-and-trunnion type used on rear shaft.

DESCRIPTION:—Needle bearing type. Universal has conventional cross or spider with individual bearings on cross ends. Bearings consist of loose needle rollers held in place in bearing cup by retainer and assembled with cork gasket and dustcap between bearing cup and shoulder on cross to retain lubricant. Bearing cups fit directly in holes in yoke ends and are retained by locking ring in yoke at outer end or by bearing cap held in place on yoke end over bearing cup by two capscrews. On some models, bearing cups are bolted directly to trunnions on companion flange by 'U' bolt passing completely through flange with nuts on opposite side.

DISCONNECTING UNIVERSAL:—Take out bolts in companion flange or remove nuts on U bolts mounting bearing cups on flange and remove U bolts. When disconnecting this type see that bearing cups do not fall off universal cross.

SERVICING:—Disassembly—Remove locking rings or take out capscrews and remove bearing cups. Tap or press on outer end of one bearing cup until cup on opposite side has been forced out of yoke end. Turn universal joint over and press first bearing cup out (applying pressure on exposed end of universal cross). Bearing cups are light press fit in yoke lugs.

Servicing—Wash all parts in gasoline. Clean out lubricant holes in cross. Examine all parts for wear. Use new cork gasket when reassembling joint.

Assembly—Place cross in yoke, install needle rollers in bearing cups, assemble retainer, new cork gasket, and dustcap, pack bearing cup and lubricant passage in cross with SAE. #160 oil, insert bearing cup in yoke end on cross. Use special clamp to press bearing cups in and compress sufficiently so that locking rings can be installed. See that locking rings are firmly seated in recess in yoke. On types using bearing caps, use new lock plate under screw heads, turn up lock tang against capscrew after screws have been securely tightened. On U bolt types, see that lockwashers installed under nuts.

NOTE—When installing drive shaft, see that arrows on shaft and universal joint yoke at sliding splined joint are lined up.

SPICER G AND IG TYPES

Used On:

Chrysler Imperial, Model CH (1932)
Chrysler Cust. Imp., Models CL ('32), CL* ('33)
Dodge Six, Model DL (1932)
Dodge Eight, Models DK (1932), DO (1933)
Graham Eight, Model 57 (1932)
Hudson Super Six (1933)
Hudson Greater Eight (1932-33)
Oldsmobile Six, F-32 ('32), F-33 ('33)
Oldsmobile Eight, L-32 ('32), L-33 ('33)
Pierce Arrow Eight, Model 54 (1932)
Pierce Arrow 12, 51, 52, 53, 54 ('32), 1242, 47 ('33)
Studebaker Six, Model 56, 1932)
Studebaker President, Model 82 (1933)
Studebaker Speedway President, 91 ('32), 92 ('33)
Terraplane Six, Models K ('32), KU ('33)

DESCRIPTION:—Plain bushing type. Universal consists of journal fitted with bushings on journal ends carried by flange yoke and sleeve (splined) yoke. Two piece casing covers entire unit. Inner casing bolted to flange yoke, outer casing held on sleeve yoke by spring. Oil seal formed under inner casing by baffle cup (retained on yoke by spring) bearing against underside of casing. Cork seal on outer casing edge excludes dirt and moisture. Joint lubricated through plug on sleeve yoke and should be filled with good grade of grease.

DISCONNECTING UNIVERSAL: — Take out bolts mounting flange yoke to companion flange. Do not allow shaft to swing from one joint or edge of outer casing will be damaged causing cork seal to wear rapidly.

SERVICING:—Disassembly—Unscrew dust cap on end of sleeve yoke. Remove steel washer, felt washer, snap ring and casing spring, outer and inner casing (do not dent or distort). Baffle cap, spring and retainer can then be removed. Remove bushing lock rings, drive out bushings with flat nose punch, removing bushings on flange yoke first. Journal will be free to slip out.

Servicing—Thoroughly clean all parts. Examine for wear and replace all worn or damaged parts.

Assembling—Install journal on sleeve yoke with journal turned so that shoulders do not extend beyond yoke. Reverse disassembling directions above. Test each set of bushings after installing by moving journal. Journal must move freely. Baffle cup and spring must be free fit on yoke. Do not paint curved portion of inner casing immediately ahead of cork seal or paint ridge will cause seal to wear rapidly. After assembling fill with grease.

NOTE—When replacing joints on shaft, grease filler plug on front and rear must be in alignment.

BUICK (OWN MAKE) FIRST TYPE

Used On:

Buick Models 50, 60, 90 (1932-35)
Buick Model 80 (1932-33)

NOTE:—These models have Torque Tube drive and have a single universal within a two-piece ball housing at the rear of the transmission. Universal can be exposed by taking out ball housing flange bolts and sliding ball back on shaft. Leather boot cover used on some models.

DESCRIPTION:—Plain bushing, split ring type. No cross used. Hardened bushings installed on yoke ends and held in place by snap rings engaging recess in bushing and ring. Yokes clamped together by two-piece ring bolted with four bolts.

DISCONNECTING UNIVERSALS:—See Disconnecting Universals in following article.

SERVICING:—Disassembly. Remove four bolts from ring and separate halves. Bushings (with snap rings) can then be removed from yoke ends. Use soft nosed punch when removing bushings.

Specifications. Clearance between yokes and pins should be .0025-.0045". Backlash or clearance of driveshaft splines in splineways in universal rear yoke should be .002-.006" (32-50, 60), .001-.006" (32-80, 90), .001-.004" (all others).

Assembly. Tap bushings in place with soft nosed hammer. Assemble snap rings in grooves on bushings and bolt rings together making sure that snap rings engage grooves in clamp ring halves.

UNIVERSAL BALL HOUSING:—See Universal Ball Housing in following article for complete data.

BUICK—CADILLAC—LA SALLE (OWN MAKES)

Used On:

BUICK MODELS

Series 40 (1934-35)—SEE NOTE
Series 40 (1936-37-38)
Series 60,80,90 (1938), 80,90 (1939)

CADILLAC MODELS

V-8, Models 355-B (1932), 355-C (1933)
V-12, Models 370-B (1932), 370-C (1933)
V-16, Models 452-B (1932), 452-C (1933)

LA SALLE MODELS

V-8, Models 345-B (1932), 345-C (1933)

NOTE:—These models have Torque Tube drive and have a single universal within a ball housing at the rear of the transmission. Universal can be exposed by taking out ball housing flange bolts and sliding ball housing back on shaft.

Buick 40 (1934-35). These models have dowel lock pins retaining bushings in yokes. Dowel pins should be driven out to free bushings. All other service data below applies.

Buick 1938-39 Models. Universals have new type lubricating feed consisting of slot in bearing retainer below transmission rear main bearing (40), shelf in transmission case which collects lubricant and feeds to universal through drilled hole in bearing retainer (60, 80, 90) with larger drain holes to allow surplus lubricant to drain back to transmission case and oil groove and return hole in rear yoke bushing (this bushing installed in rear end of ball housing). This new type ball and bushing assembly may be installed on previous car models. Ball is marked 'TOP' to insure correct installation.

Buick 40, 60 (1939). These models equipped with Mechanics Model 2C needle bearing type universal. See Mechanics Universal article for data.

DESCRIPTION:—Universal has conventional cross or spider. Special hardened bearing bushings are installed individually in ends of yokes on the cross journals. Bushings are retained in yokes by locking rings (yokes are open end type and locking rings are inserted in ends to engage bushing and yoke).

DISCONNECTING UNIVERSALS:—Rear yoke is integral with stub (splined) shaft and front yoke is bolted directly on rear end of transmission main shaft (speedometer drive gear is cut on yoke shoulder and speedometer drive must be disassembled before yoke is removed). Rear axle should be removed by taking out bolts in torque tube flange at rear end of ball housing and pulling shaft out of stub shaft. If universal is to be removed, special wrench can be inserted through opening in splined shaft and mounting screw removed from front yoke, or universal can be dismounted.

SERVICING:—Disassembly—Remove locking ring from each yoke bushing. Drive out bushings with flat nosed punch inserted from opposite side of yoke being careful to keep bushing lined up with cross journal so that bearing surface will not be marred.

Buick Specifications. Clearance between cross journals and bushings should be .002-.005" (40), .0025-.004" (60, 80, 90). Bushing clearance in yoke should be .004-.006". Backlash or clearance of drive shaft splines in splineways in universal rear yoke should be .001-.004" (40), .0015-.004" (60, 80, 90).

Assembly—Tap bushings in place with soft nosed hammer, being careful to keep bushings lined up so that bearing surface on cross journals is not marred. Install locking rings.

UNIVERSAL BALL HOUSING:—Cork oil seal used at rear end of outer retainer. Inner and outer retainers and universal ball are plated. To correct oil leaks past oil seal, disconnect rear axle, remove cork oil seal, adjust ball housing by removing shims from between inner and outer retainer until joint can be moved by hand at outer end (if bar must be used, housing is too tight), re-install cork seal.

NOTE—Oil seal (at rear end of outer universal ball retainer) used on 1937-38 models consists of a Duprene rubber bonded cork oil seal and Belleville type spring washer.

CHEVROLET—PONTIAC (OWN MAKE)

CHEVROLET MODELS

Master Models CA ('33), DA ('34), EA, ED ('35), FA, FD ('36), GB ('37), HB ('38), JB ('39)
Master Deluxe, Models GA ('37), HA ('38), JA ('39)
Standard, CC ('33), DC ('34), EC ('35), FC ('36)
½ Ton, CB('33), DB('34), EB('35), FB('36), GC('37) HC ('38), JC ('39).
¾ Ton, HD ('38), JD, JE ('39)
1 Ton, Model HE (1938)
1½ Ton, O('33), P('34), Q('35), R('36), S('37), T('38) V ('39).

PONTIAC MODELS

Six, Models 701-A, B ('35), 36-26A, B ('36)
Eight, 601('33), 603('34), 605('35), 36-28 ('36)

NOTE:—These models have Torque Tube Drive with a single Universal within a ball housing at the rear of the transmission. Universal can be exposed by taking out ball housing flange bolts and sliding ball housing back on shaft.

Chevrolet (Standard Models.) These models have riveted type joint (serviced as an assembly).

Chevrolet ¾, 1, 1½ Ton Trucks. These trucks have additional universal mounted at intermediate bearing on frame. Both universals are 'cross' type with hardened steel bushings retained in yoke ends by locking rings (similar to design used on Buick models). See Buick Universal Joint article for service data on these types.

DESCRIPTION:—No cross used. Bearing journals formed directly on ends of yokes. Bearing bushings are installed individually on yoke journals and clamped in two-piece circular ring. Universal is 'split' by taking out bolts which clamp these rings together. Rear yoke is integral with stub (splined) shaft and front yoke is bolted directly on end of transmission main shaft. Speedometer drive gear is mounted on universal front yoke and speedometer drive should be disassembled before universal removed to avoid damage to gears.

REMOVAL:—Rear axle ordinarily removed by pulling torque tube and drive shaft out of splined joint at rear of universal. If universal is to be removed, special wrench can be inserted through hole in rear yoke and mounting screw removed from front yoke.

SERVICING:—No special disassembly directions required. Bearing bushings can be lifted off after bolts have been taken out of circular retainer ring. When installing bushings see that beveled side is installed toward inside of yoke. After universal joint installed on car and ball housing in place, fill ball with transmission lubricant through pipe plug on top of universal ball retainer (1933-36), through battery ground strap hole at rear of transmission case (1937-39). Front universal oiled from transmission case when car is in operation. On truck models, pressure lubricant fitting located on rear universal ball and on side of front propeller shaft housing. These fittings lubricate rear universal and front propeller shaft bushing and must be given attention at 1000 mile intervals.

SPICER (FORD) TYPE

Used On:

Ford V8, All '60' & '85' Models (1932-39)
Ford Truck, All Models (1932-39)
Lincoln-Zephyr, H('36), HB('37), 86H('38), 96H('39)
Lincoln, V12 Models (1932-39)
Mercury, Model 99-A (1939)

NOTE:—These models have Torque Tube Drive with a single universal within a ball housing at the rear of the transmission case. Ball housing flange mounting screws must be taken out and axle assembly pulled back to expose universal.

Ford Truck Models (1932-39). These models have additional universal mounted at intermediate bearing on frame cross-member. Both universals are needle bearing type (see Needle Bearing Service Note below).

NOTE—Rear yoke of front universal integral with a companion flange which is bolted to flange on splined sleeve which engages front propeller shaft. After cover screws are taken out and cover pushed back on shaft, screws can be taken out of companion flange and splined sleeve pushed back on shaft (against spring tension) to disconnect front driveshaft. This will allow transmission to be removed without disturbing intermediate universal joint or rear propeller shaft.

Lincoln-Zephyr (1938-39). Universal joint is needle bearing type. See Needle Bearing Service Note below.

DESCRIPTION:—Universal has conventional cross or spider. Special bearing bushings are installed individually in ends of yokes on cross journals. Bushings are retained in yokes by locking rings (yokes are open end type and locking rings are inserted in yoke ends to engage recess in bushing and yoke).

Needle Bearing Types. These types have loose needle bearings assembled in retainer cup or bushing which is retained in yoke end by locking ring in same manner as bushing on hardened-bushing types. Serviced in same manner except that loose needle bearings will fall out of retainer cup when removed and care must be taken not to lose them.

REMOVAL:—Rear axle ordinarily removed by pulling drive shaft out of splined joint at rear of universal after ball housing flange bolts have been taken out (rear universal yoke integral with stub splined shaft, front yoke bolted directly on end of transmission main shaft). Universal can be disassembled or removed by taking out mounting bolt in front yoke (accesible through hole in cross).

SERVICING:—Disassembly—Remove locking ring from each yoke bushing. Drive out bushings with flat nosed punch inserted from opposite side of yoke being careful to keep bushing lined up with cross journal so that bearing surface will not be marred.

NOTE—On needle bearing types take care not to loose needle bearings which will fall out of bearing retainers or bushing when removed from cross journal. Pack needle bearings with grease before installing.

Assembly—Tap bushings in place with soft nosed hammer being careful to keep bushings lined up with cross journal to avoid marring cross journals. Line up locking ring groove in yoke and bushing, install locking rings. If universal front yoke has been removed, see that transmission rear bearing is against shoulder on shaft and that yoke shoulder is against bearing. Tighten mounting screw securely and see that washer under screw head is seated in counterbore in yoke. When correctly assembled, transmission main shaft should have no endplay.

NOTE—Universal is not oiled from transmission case and should be lubricated with special universal lubricant after assembly completed.

THOMPSON TYPE

Used On:

Studebaker Dictator, Models 5A, 6A (1937).

Studebaker Six, Commander, State Commander, Models 7A, 8A (1938)

DESCRIPTION:—Rubber bushed type. Assembly consists of four rubber spools compressed within a steel cage which is riveted together. Steel bushings inset in the rubber spools serve as guides for yoke bolts. Shaft yoke and end yoke are bolted rigidly to these steel trunnions or spool bushings by bolts which pass entirely through assembly (head on universal cage side, nut on yoke side). No splined or slip joint used and shaft tube welded directly to yokes at both ends.

DISCONNECTING UNIVERSALS:—Remove nuts on bolts in end yokes (if universals to be removed with shaft), or on shaft yokes (to remove shaft only), push bolts out. Do not attempt to remove steel bushings.

SERVICING:—Universal joint cannot be disassembled and no service work is required.

INSTALLING DRIVE SHAFT:—One leg of shaft yoke at each end of drive shaft marked by punch marks (single mark at front end, double mark at rear end). Shoulder of one steel bushing in front and rear universals similarly marked. When installing shaft see that these punch marks are lined up. See that lockwashers are installed under bolt nuts and tighten bolts securely.

DETROIT 4100, 4200 SERIES

SERIES 4100

Bantam Super Four, Model 65 (1940)
Willys, 440 Spd'way, Del., Pick-Up (1940)
Willys, Model 440P Panel Delivery (1940)

SERIES 4200

①DeSoto, S7 Some Cars (1940) Except 7 Pass.
Dodge, Model D14, D17 (1940) Except 7 Pass.
Graham, Model 108, Schgr. 107 (1940)
Plymouth, Model P9, P10 (1940) Except 7 Pass.

①—Detroit Series 7200 used on some Coupes & 5 Pass. Sedans and all 7 Passenger Sedans. See Detroit 7200 Series article following.

DESCRIPTION:—Ball and Trunnion type with Roller Bearings. Consists of a body or housing bolted to companion flange which has two parallel ball slides machined on its inner surface. Ball head on shaft has cross pin with ball at each end which engages ball slide in housing. Ball mounted on loose rollers on pin which are retained by centering button at outer end of pin. Ball head centered by spring retained by cover (spring seat and grease retainer) clipped to housing flange. Leather boot on opposite end of housing is clamped to housing and shaft to retain grease.

DISCONNECTING UNIVERSAL:—Take out bolts which mount housing to companion flange. Do not disturb cover clipped to housing flange (cover has notation 'Do not remove cover') unless joint is to be disassembled.

SERVICING:—**Disassembly**—Bend back three lugs only on one side of grease cover, slide cover off sideways, push housing back on shaft, remove centering buttons and balls (CAUTION—do not lose roller bearings out of balls). Wash all parts and inspect for wear. If balls or rollers show wear, replace with complete ball and roller assembly. Check housing, raceways for ball impressions which result in backlash, replace housing if unduly worn. Press out pin in ballhead only if pin or housing is to be replaced.

Assembling—First slip housing over ballhead, press pin in place **being sure that equal amount of pin extends through each side of ballhead**—this is important. Place 1/16" washers over ends of pins, install ball and roller assemblies, finally install centering buttons with 1/64" spring washers next to pin ends. Pull housing forward to hold parts in place. Apply 1¼ ozs. of fibre grease across face of balls. Install conical spring, being certain that small end of spring rests over pilot on end of ballhead, new gasket, and grease cover, bend down lugs on grease cover. When connecting universal joint, use new lockwashers and tighten nuts holding housing on companion flange securely, this is important.

UNIVERSAL JOINT BOOTS:—Original equipment boot is seamless type secured by a clamp on each end. To remove boot, remove clamps and cut off old boot (see Note). Install service boot which is hook-on type and can be installed without removing shaft from car, pressing metal hooks down tight to close longitudinal seam and twisting wires tight on each end.

IMPORTANT SERVICE NOTE—All 1940 cars are factory equipped with a boot having a leather cone extending into the housing. When removing outer cover, use care not to disturb this cone, leaving cone in place and installing new hook-on boot over it. If cone is destroyed, install special combination cone and outer boot which is available for service.

DETROIT 7200, 7300 SERIES

SERIES 7200

Chrysler Six, Model C25 (1940)
①DeSoto, S7 Some Cars, All 7 Pass. (1940)
Dodge, Model D14 7 Passenger (1940)
Plymouth, Model P10 7 Passenger (1940)

SERIES 7300

Chrysler Eight, Models C26, C27 (1940)

①—Detroit Series 4200 used on some Coupe and 5 Passenger Sedans. See preceding article.

DESCRIPTION:—Roller bearing type. Universal has conventional cross with individual bearings on cross ends. Bearings consist of loose rollers held in place in bearing cups (propeller shaft yoke ends) and bearing blocks (companion flange ends) by retainer at open (inner) end. Bearing cups assembled directly in holes in ends of propeller shaft yoke and are retained by locking ring on inner face of yoke which engages recess in bearing cup. 2 bearing blocks (one for each end) attached to companion flange by screws and are retained by tie spring clipped to bearing block retainer assembled in groove at open (inner) end of each bearing block (spring prevents bearing blocks dropping off cross when attaching screws removed). Dust seal and seal retainer assembled between bearing cups (and blocks) and shoulder on cross to retain lubricant.

DISCONNECTING UNIVERSAL:—Bearing blocks attached to companion flange by screws. Take out screws and lockwashers in blocks to free shaft.

SERVICING:—**Disassembly**—Remove tie spring holding bearing blocks on cross. Remove bearing blocks, dust seals and retainers. Take out locking rings from bearing cups in yoke. Tap on outer end of one bearing cup to start opposite cup out, withdraw bearing cup, tap on end of cross to start opposite bearing cup. Remove dust seals and retainers.

Servicing—Thoroughly clean all parts. Examine for wear and replace all worn or damaged parts. Clean out lubricant holes in cross, repack entire assembly with correct type lubricant.

Assembling—Use new dust seals. Reverse disassembling directions above.

NOTE—When installing shaft, see that arrows on shaft and universal yoke at splined joint line up.

MECHANICS 1½C, 2C, 3C TYPES

TYPE 1½C—SEE NOTE

Cadillac V8, Model 40-75 (1940)
Cadillac V16, Model 40-90 (1940)

TYPE 2C

Nash Ambassador Six, Model 4020 (1940)
Nash-Lafayette, Model 4010 (1940)
Oldsmobile Six, '60' Model F-40, '70' G-40 ('40)
Oldsmobile Eight, '90' Model L-40 (1940)
Packard '110' 6, 1800 (1940)—Without Overdrive
Pontiac Six, Models 40-25, 40-26 (1940)
Pontiac Eight, Models 40-28, 40-29 (1940)

TYPE 3C

Cadillac V8, 40-60S, 62, 72, 75 (1940)
Cadillac V16, Model 40-90 (1940)
LaSalle V8, Models 40-50, 52 (1940)
Nash Ambassador Eight, Model 4080 (1940)
Packard '110' 6, 1800 (1940)—With Overdrive
Packard '120' 8, 1801, 1A (1940)
Packard '160' 1803,3A,4,5; '180' 1806,7,8 (1940)

NOTE:—This universal joint used on steering column.

DESCRIPTION:—Roller bearing type. Universal has conventional cross with individual trunnion bearings on cross ends. Two types of trunnion bearings used: 1) Wing Type bolted to yokes or flanges by capscrew in each trunnion boss, 2) Round Type fitting directly in hole in yoke ends and retained by bushing plate clamped on bearing hole by capscrew. Trunnion bearings are cup-shaped and retain loose rollers which must be assembled before trunnion bearing installed on cross. Cork packing washers used between trunnion bearing and shoulder on cross to retain lubricant.

Slip Joint—Oldsmobile & Pontiac—Solid propeller shaft used. Slip joint formed by splines on front universal slip yoke mating with splines on transmission mainshaft (yoke not bolted on shaft).

DISCONNECTING UNIVERSAL:—Turn down locks and take out two capscrews in opposite trunnion bearings on companion flange, wire trunnions together to prevent them coming off ends of cross (unless joint is to be disassembled), tap trunnions lightly with soft hammer to disengage drive lugs (lugs on trunnion bearing engage slot in flange and flange end is turned up to retain trunnions).

SERVICING:—Disassembly—Wing type trunnion bearings may be pulled directly off universal joint cross after mounting capscrews have been removed (do not lose loose rollers in bearing). To remove Round type trunnion bearings, shaft must be removed to the bench. Clamp yoke or drive shaft tube (at weld) in vise, take out screws and remove bearing end plates (both sides). Use flat end drift slightly smaller in diameter than bearing, drive on outer end of one bearing, driving bearing in until shoulder on cross strikes inside of yoke lug. This will start opposite bearing out. Grip this bearing in vise (use brass or copper jaws) work shaft back and forth until bearing comes out. Drive other bearing out in same manner (using drift against end of cross).

Servicing—Wash all parts in gasoline. Clean out lubricant passage in cross. Replace worn parts (examine cross journal, trunnion bearing and rollers for wear), repack all space with semi-fluid chassis lubricant or SAE. #160 oil.

Assembling—Use new cork seal or packing washers. Reverse disassembling directions above. When installing Round type bearings, tap bearings in place or if arbor press used, see that pressure is not great enough to spring yoke ends. On Wing type bearings, use new lock plate and see that ears on lock plate turned up against capscrews after screws are securely tightened.

NOTE—When installing drive shaft, see that arrows on shaft and universal joint yoke at sliding joint (on all except Oldsmobile and Pontiac) line up.

SPICER (FORD) TYPE

Used On:

Ford V8 All Passenger Cars & Comm'l (1940)
Lincoln V12 Model (1940)
Lincoln-Zephyr Model 06H (1940)
Mercury Model 09A (1940)

NOTE:—Torque tube drive used with a single universal in a ball housing at rear of transmission. Housing flange mounting screws must be taken out and axle assembly pulled back to expose universal.

Ford Trucks—Hotchkiss drive used. See Spicer Needle Bearing Type universal joints for data.

Lincoln-Zephyr—Universal is needle bearing type.

DESCRIPTION:—Conventional cross used with individual bearings on cross ends. Bushings used on Ford and Mercury, loose needle bearings assembled in retainer cap on Lincoln-Zephyr. Bushings and caps

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retained in yokes by lock rings (yokes are open end type with lock rings inserted in yoke ends to engage recess in bushing or cap and yoke).

REMOVAL:—Rear axle ordinarily removed by pulling drive shaft out of splined joint at rear of universal after ball housing flange bolts removed (front yoke bolted on end of transmission mainshaft). Universal can be removed by using special wrench through opening in splined shaft and taking bolt out of front yoke.

SERVICING:—**Disassembly.** Remove lock ring from each yoke. Drive bushings or caps out with punch (do not lose needle bearings when caps removed).

Assembling—Reverse disassembly directions above (line up lock ring groove in bushing or cap and yoke, install ring). Pack needle bearings with grease before installing. When installing front yoke, see that rear bearing against shoulder on shaft and yoke shoulder against bearing. Tighten mounting screw (see that washer under screw head seated in counterbore in yoke). Fill joint with universal lubricant.

SPICER NEEDLE BEARING TYPE

Used On:

Chevrolet, Cab-over-Engine Truck WD (1940)
Chevrolet, School Bus WC (1940)—See Note
Ford, All Truck Models (1940)
Graham, Hollywood Supercharger 109 (1940)
Hudson Six, Models 40P, 40T, 41, 43, 48 (1940)
Hudson Eight, Models 44, 45, 47 (1940)
Hupmobile Skylark, Model R (1940)
Studebaker Champion, Model 2G (1940)
Studebaker Commander, Model 10A (1940)
Studebaker President, Model 6C (1940)

NOTE:—Used on front propeller shaft, Chevrolet (Own Make) on rear shaft. See Chevrolet (Own Make) Universal Joint article following for data on rear universal.

Ford Trucks—Additional universal mounted at intermediate bearing on frame.

DESCRIPTION:—Needle bearing type. Universal has conventional cross or spider with individual bearings on cross ends. Bearings consist of loose needle rollers held in place in bearing cup by retainer and assembled with cork gasket and dustcap between bearing cup and shoulder on cross to retain lubricant. Bearing cups fit directly in holes in yoke ends and are retained by locking ring in yoke at outer end or by bearing cap held in place on yoke end over bearing cup by two capscrews. On some models, bearing cups are bolted directly to trunnions on companion flange by 'U' bolt passing completely through flange with nuts on opposite side.

Slip Joint—Studebaker Champion (Std. Trans.)—Solid propeller shaft used. Front yoke of front universal splined on transmission main shaft (not bolted).

DISCONNECTING UNIVERSAL:—Take out bolts in companion flange or remove nuts on U bolts mounting bearing cups on flange and remove U bolts. When disconnecting this type see that bearing cups do not fall off universal cross.

SERVICING:—**Disassembly**—Remove locking rings or take out capscrews and remove bearing cups. Tap or press on outer end of one bearing cup until cup on opposite side has been forced out of yoke end. Turn universal joint over and press first bearing cup out (applying pressure on exposed end of universal cross). Bearing cups are light press fit in yoke lugs.

Servicing—Wash all parts in gasoline. Clean out lubricant holes in cross. Examine all parts for wear.

Assembly—Place cross in yoke, install needle rollers in bearing cups, assemble retainer, new cork gasket, and dustcap, pack bearing cup and lubricant passage in cross with SAE. #160 oil, insert bearing cup in yoke end on cross. Use special clamp to press bearing cups in and compress sufficiently so that locking rings can be installed. See that locking rings are firmly seated in recess in yoke. On types using bearing caps, use new lock plate under screw heads, turn up lock tang against capscrew after screws have been securely tightened. On U bolt types, see that lockwashers installed under nuts.

NOTE—When installing drive shaft, see that arrows on shaft and universal joint yoke at sliding splined joint are lined up.

BUICK TYPE

Used On:

Series 40,50,60,70,80,90 (1940)

NOTE:—These models have Torque Tube drive and have a single universal within a ball housing at the rear of the transmission. Universal can be exposed by taking out ball housing flange bolts and sliding ball housing back on shaft.

DESCRIPTION:—Universal has conventional cross or spider. Special hardened bearing bushings are installed individually in ends of yokes on the cross journals. Bushings retained in yokes by dowel pins.

Lubrication—These universals have a new type lubricating feed consisting of drilled hole in top of rear bearing retainer (40, 50), by a groove in top of Low-Reverse shift rail through drilled hole in retainer (60, 70, 80, 90) with large drain holes to allow surplus lubricant to drain back to transmission case. On Series 60, 70, oil seal assembled to rear of yoke bushing (installed in rear end of ball housing). On Series 80, 90, this yoke bushing grooved allowing oil to pass through to lubricate steady rest bearing and oil seal installed to rear of this bearing. Ball is marked 'TOP' to insure correct installation.

DISCONNECTING UNIVERSALS:—Rear yoke is integral with stub (splined) shaft and front yoke is bolted directly on rear end of transmission main shaft (speedometer drive gear is cut on yoke shoulder and speedometer drive must be disassembled before yoke is removed). Rear axle should be removed by taking out bolts in torque tube flange at rear end of ball housing and pulling shaft out of stub shaft. If universal is to be removed, special wrench can be inserted through opening in splined shaft and mounting screw removed from front yoke, or universal can be dismounted.

SERVICING:—**Disassembly**—Remove dowel pins from each yoke bushing. Drive out bushings with flat nosed punch inserted from opposite side of yoke

Buick Specifications—Clearance between cross journals and bushings should be .002-.004". Bushing clearance in yoke should be .004"-.006". Backlash or clearance of driveshaft splines in splineways in universal rear yoke should be .0005-.0045".

Assembly—Tap bushings in place with soft nosed hammer, being careful to keep bushings lined up so that bearing surface on cross journals is not marred. Install dowel pins.

UNIVERSAL BALL HOUSING:—Cork oil seal used at rear end of outer retainer. Inner and outer retainers and universal ball are plated. To correct oil leaks past oil seal, disconnect rear axle, remove cork oil seal, adjust ball housing by removing shims from between inner and outer retainer until joint can be moved by hand at outer end (if bar must be used, housing is too tight), re-install cork seal.

NOTE—Cupped spring washer assembled between outer retainer and cork seal.

CHEVROLET TYPES

Used On:

Passenger Cars KA, KB, KH & Comm'l (1940)
½ & ¾ Ton Trucks KC, KD, KE (1940)
1½ Ton Truck WA, WB, School Bus WC (1940)
Cab-over-Engine Truck WE, WF (1940)

NOTE:—These models have Torque Tube Drive with a single Universal within a ball housing at the rear of the transmission. Universal can be exposed by taking out 4 retaining collar capscrews and sliding ball housing back on shaft.

¾, ¾ Special, 1½ Ton Trucks—These trucks have additional universal mounted at intermediate frame cross-member. Both universals are cross type. Front universal has hardened steel bushings retained in yoke ends by locking rings. Rear universal is a needle bearing type.

Cab-over-Engine Truck WD (107⅝" W.B.)—Hotchkiss drive used on this model with Spicer Needle Bearing Type universals front and rear. See Spicer Needle Bearing Type article for data.

School Bus WC—Same as 1½ Ton Truck (above) except that Spicer Needle Bearing Type universal used at front. See Spicer Needle Bearing Type article for data.

DESCRIPTION:—Roller bearing type (Pass. Cars, Trucks—rear), hardened steel bushing type (Truck—front). Universals have conventional cross with individual bearings on cross ends.

Hardened Steel Bushing Type—Bushings are installed individually in ends of yokes on cross and are retained in yokes by locking rings (yokes are open end type and rings are inserted in yoke ends to engage recess in bushing and yoke).

Needle Bearing Types—Two types of trunnion bearings used: 1) Wing type bolted to each yoke by two capscrews in each trunnion (used on front yoke of passenger cars only), 2) Round type fitted directly in yoke ends and retained by locking ring at inner end.

SERVICING:—**Disassembly (Passenger Cars)**—Remove 4 capscrews from universal joint ball collar, slide ball and collar back on shaft housing. Take out 4 capscrews in trunnion bearings on front yoke, remove trunnons (use care not to lose rollers—19 rollers used in each trunnion). Slide rear yoke off shaft and remove lock rings from bearings. Take off bearing caps by placing yoke in vise and driving down on center of cross with punch until cross seats on yoke, raise cross, insert 15/16" flat washer over bearing and continue to tap on cross until cap removed (do not lose rollers).

Trucks—Same as for passenger cars (above) except that hardened steel bushings in front universal must be driven out after locking rings removed. Rear universal trunnion bearings are roller type and retained by lock rings which are removed in same manner as for rear yoke on passenger cars.

Servicing—Thoroughly clean all parts. Examine for wear and replace all worn or damaged parts.

Assembling—Reverse disassembling directions above. When installing needle bearing caps, Round type should be pressed on yoke just far enough to install snap ring, Wing type caps should be fitted to openings in front yoke. Universals and front propeller shaft (trucks) should be filled with transmission lubricant. NOTE—Pack needle bearings with grease before installing.

BUICK TYPE

Used On:

BUICK, MODELS 50, 60, 90 (1932-35)
BUICK, MODEL 80 (1932-33)

TYPE:—Adjustable packing type. Packing installed under packing nut within forward end of pump housing. Shaft mounted on two bronze bushings.

SERVICING:—Lubrication. Pressure gun fitted provided on top of pump housing between bushings. Use G2½ graphite grease only.

Packing Renewal. Back off adjusting nut and install split type packing rings. Make certain that joints in rings are 120-180° apart to prevent leakage.

OVERHAUL:—Disassembly. Take out screws and remove cover plate on rear of pump body. Remove drive coupling on forward end of shaft, withdraw impeller and shaft assembly through rear end of pump housing (impeller pinned on shaft). Press out old bushings.

Clearances. Shaft clearance in bushings should be .0015-.0035". Impeller end play should be .006-.013".

BUICK & LA SALLE TYPE

Used On:

BUICK, MODEL 40 (1934-35-36)
BUICK, MODELS 60, 80, 90 (1936)
LA SALLE, 350 ('34), 35-50 ('35), 36-50 ('36)

NOTE:—LaSalle pump same design as Buick models with ball bearing (350) bushing (35,36-50) at forward end of shaft. Serviced in same manner except that on Model 350 split locking ring (behind front ball bearing) must be removed before shaft can be withdrawn. To remove locking ring, move shaft back ¼" to free ring from retaining collar.

TYPE:—Adjustable packing type. Shaft mounted on two oil-retaining bushings (40), bronze bushing at rear and sealed ball bearing at front end (60, 80, 90). Packing installed under adjusting nut in front of rear bushing within fan pulley.

SERVICING:—Packing Adjustment. New split type packing rings can be installed without dismantling pump. Make certain that joints in adjacent packing rings are placed 120-180° apart to prevent leaks.

Lubrication. On Model 40, oiler provided for each bearing. Lubricate with engine oil at 1000 mile intervals. On Models 60, 80, 90 use special G2½ water pump lubricant in rear bearing oiler. Front ball bearing is packed with lubricant and requires no attention.

OVERHAUL:—Disassembly. Take out four capscrews in fan pulley hub, remove fan and pulley. Remove rear cover on water pump housing. Impeller and pulley hub can then be removed from shaft. On Models 60, 80, 90, front ball bearing is retained in housing by snap ring at forward end. Rear bushing on this type pump is staked to prevent bushing rotating in service.

Clearances (Buick). Shaft clearance in bushings should be .0015-.0035"(40 '34-35), .0025-.004"(40 '36), .0015-.003"(60,80,90). Impeller endplay should be .006-.015" (40 '34-35), .004-.006" (40 '36), .004-.012" (60,80,90).

Clearances (LaSalle). Shaft clearance in new bushings should be .001-.0025" (rear bushing '34), .0015-.0032" (rear bushing '35-36), .0005-.0022" (front bushing '35-36). Worn limit .005" (all bushings). Impeller clearance in pump housing should be .055-.070" (new), .080" (worn limit).

BUICK 1937-38 TYPE

Used On:

40, 60, 80, 90 (1937); 80, 90 (1938)
40 (1938) BEFORE ENGINE NO. 43535259
60 (1938) BEFORE ENGINE NO. 63524449

NOTE:—Pump used on Model 40 not interchangeable with type used on Models 60, 80, 90. Packing assembly bushings and shaft are interchangeable.

Replacement Pumps. See following article for Packless type ball-bearing pump which can be used as replacement unit on these cars.

TYPE:—Self-adjusting type (no adjustment required in service). Packing is installed on shaft between bushings with spring at forward end of assembly. Bushings are special oil-retaining type and are lubricated from oil reservoir in pump body. NOTE—Pump reservoir should be filled with No. 10-W engine oil at 1000 mile intervals. Heavier oil will not feed through bushings.

OVERHAUL:—Disassembly. Remove fan blade and pulley assembly, pull hub (using puller J-679A) and remove any burrs on shaft, remove rear cover plate, withdraw impeller and shaft at rear of housing.

Bushing & Packing Assembly—Bushings must be removed in order to renew packing assembly. Use puller J-999 and pull rear bushing (leave front bushing in to pilot new rear bushing), remove packing assembly. Install new rear bushing (use tool J-684). Pull front bushing (use tool J-999) install packing assembly before installing new bushing. Lubricate all parts of packing assembly with chassis lubricant, then install in following order: two chevron packing rings with convex side toward rear bushing (insert one at a time, edgewise until past openings in body, then turn up into place), duprene rubber spacer, two additional chevron packing rings with convex side toward front, steel spring seat, packing spring, then install new front bushing (tool J-684) so that end is flush with front edge of pump body. NOTE—New bushings and packing assembly should be installed whenever either bushing is removed.

Assembly—Enter impeller and shaft assembly through rear bushing until hub end is flush with spring seat (shaft through packing but with packing spring still exposed), fill packing spring chamber with chassis lubricant, push pump shaft through into place. Press pump shaft hub on shaft leaving .004-.006" clearance between hub and pump body for end play. Use new gasket and install rear cover plate.

BUICK 1939 TYPE

Used On:

38-40 (1938) AFTER ENG. NO. 43535259
38-60 (1938) AFTER ENG. NO. 63524449
39-40, 39-60, 39-80, 39-90 (1939)

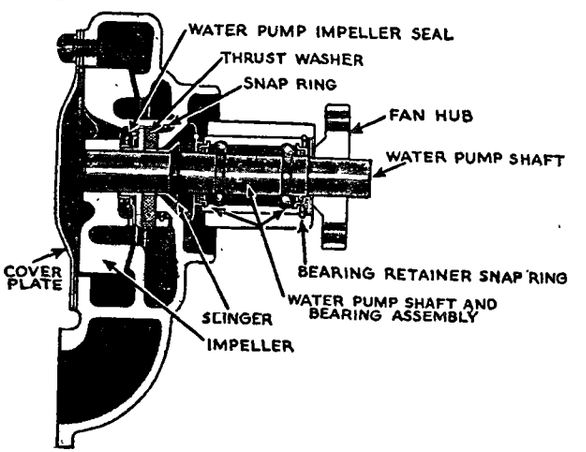
NOTE:—Replacement Pumps. This type pump furnished for replacement of other types used on earlier car models as follows (see Service directions below for installation instructions):

Model	Group No.	Part No.
40 (1934-Early 1938)	1.069	1307778
60 (1936-Early 1938)	1.069	1307779
80, 90 (1936-38)	1.069	1307779

Service Parts. Furnished in package assemblies only as follows: Package #1 Group #1.003—Impeller & Seal assembly, ball bearing and shaft assembly, and fan hub (and fan pilot ring for earlier models); Package #2 Group #1.073—Pump body, gasket, cover plate and attaching screws.

TYPE:—Ball-bearing, packless type. Seal consists of spring-loaded rubber seal and carbon block assembled in impeller hub and retained by snap ring. Bearing consists of a double row ball bearing permanently assembled on shaft (shaft serves as inner race and cannot be removed), factory lubricated and sealed (requires no attention in service). Bearing and shaft assembly retained in pump body by snap ring at forward end of bearing hub.

OVERHAUL:—Disassembly. Remove fan and fan pulley, use special puller to remove fan hub, take out rear cover screws and remove cover, remove bearing snap ring at forward end of pump body. Support pump in arbor press, press shaft out of impeller, lift impeller out, press shaft and bearing assembly out of pump body toward front.



Seal Assembly. Manufacturer recommends that seal not be disassembled (seal and impeller serviced as assembly). Carbon disc is ground convex on one surface and must be assembled with this face toward pump body.

Assembly. See that face of pump which contacts carbon seal is smooth (replace pump body if rough or burred). Use arbor press to install bearing and shaft assembly supporting pump body on press and applying pressure to bearing outer race only (do not press on shaft or bearing seal), install bearing snap ring. Press fan hub on shaft (support impeller end of shaft allowing pump to float on shaft so that bearings will not be damaged) until shaft projects beyond front face of hub exactly ⅜" (40), 3/16" (60, 80, 90). Apply small amount of cup grease to impeller end of shaft, face of pump body and face of carbon disc, press impeller on shaft so that it is flush with end of shaft (support shaft at fan hub end allowing pump to float on shaft while installing impeller).

Replacement Pump Installation Directions. Fan pilot ring must be pressed on shaft in front of fan hub to pilot fan when pump installed on 1936 and earlier models (see NOTE above). To install pilot ring, remove rear cover plate on pump, support impeller end of shaft in arbor press, press pilot ring on until it just contacts fan hub (do not disturb fan hub position). Fan hub has double set of fan mounting bolt holes to fit all fans. NOTE—Discard this pilot ring (furnished in all pump packages) when installing pump on 1937-38 models.

CADILLAC & LA SALLE TYPE

Used On:
CADILLAC V8, ALL MODELS (1932-35)
LA SALLE V8, ALL MODELS (1932-33)

TYPE:—Adjustable packing type. Packing located under adjusting nut within pump body mounting flange at rear end of pump. Shaft mounted on two bronze bushings (front bushing mounted in pocket in pump cover).

SERVICING:—Lubrication. One grease cup provided. Fill with water pump grease and turn down at 1000 mile intervals.

Packing Adjustment. Special fabric type packing used. To adjust, pull up on adjusting nut locking pin to free adjusting nut, tighten nut as much as possible, then back nut off and turn up again until it just contacts packing.

OVERHAUL:—Disassembly. Remove nuts on front cover bolts, lift off pump front cover. Withdraw impeller and shaft assembly (impeller pinned on shaft). Press out old bushings (front bushing is cupped type and must be pulled).

Assembly. Reverse disassembly directions. See that thrust washer installed between impeller and shoulder on front bushing in pump cover.

Clearances. Shaft clearance in bushings should be .001-.003" (new), .005" (worn limit). Clearance between impeller and pump housing .055-.070" (new), .080" (worn limit).

CADILLAC & LA SALLE 1937-39 TYPE

Used On:
CADILLAC V8, ALL SERIES (1936-37-38-39)
LA SALLE V8, SERIES 50 (1937-38-39)

TYPE:—Self-adjusting type (no packing adjustment required in service). Packing rings installed at each end of rear bushing with packing spring located between bushing and front packing ring. Shaft mounted on bushing at rear and sealed type ball bearing at front end.

Lubrication. Grease fitting provided for rear bushing and packing assembly. Should be filled with water pump grease (G-13) every 1000 miles (front bearing requires no attention).

OVERHAUL:—Disassembly. Remove nut and lockwasher on front of pump pulley, remove pulley and woodruff key in shaft. Remove bearing snap ring in front end of housing, push impeller to rear to expose split washer in back of front bearing, remove washer. Remove snap ring at forward end of rear bushing assembly, withdraw impeller and shaft through rear end of housing. Remove rear bushing assembly toward front noting location of spring, spring seats, bushing and packing rings to insure correct reassembly. If necessary, press front bearing out of housing toward front, press bushing out of bearing.

Bushing & Packing Assembly. To assemble packings on shaft, install special pilot, No. J-831, on end of shaft, insert shaft in pump housing, wind washer groove on shaft with string to avoid damage to packing rings. Coat packing rings with water pump grease, install packing, spring, and bushing parts in same order as removed from pump (make certain that bushing installed with grooved side toward rear packing rings).

Pump Assembly. Reverse disassembly directions given above. Make certain that split washer and snap rings correctly installed and that fan pulley key is in place in shaft before tightening pulley nut.

CADILLAC V12, V16 TYPE

Used On:
CADILLAC V-12, ALL MODELS (1934-35-36-37)
CADILLAC V-16, ALL MODELS (1934-35-36-37)

TYPE:—Self-adjusting type (no packing adjustment required). Packing is installed on shaft at outer ends of bushings with loading spring in housing between bushings. Shaft mounted on two floating bushings in housing with thrust button at impeller end (in rear face of pump body). Shaft bushings are oilite type and should be lubricated with water pump grease (G13) through pressure fitting on top of pump body.

OVERHAUL:—Disassembly. Remove nuts on front cover bolts, withdraw front cover and impeller assembly from pump body. Withdraw impeller from cover toward rear. Take out snap ring at forward end of shaft hub, remove packing rings, bushings and spring at forward end. Note order so that pump can be reassembled in same manner.

Packing & Bushing Assembly. Use special pilot J-831 installed on end of shaft and wind string on recess near end of shaft before installing packing rings to avoid damage to rings. Coat chevron packings with water pump grease, install rear packings with convex side forward, then insert rear bushing with grooved side toward packings, install spring, front bushing with convex side out, front packings with convex side out, snap ring.

Assembly. Reverse disassembly directions given above. Shaft clearance in bushings should be .001-.003" (front—new), .001-.0025" (rear—new), .005" (worn limit). Endplay should be .0065-.025" (new), .050" (worn limit).

CADILLAC V16 1938-39 TYPE

Used On:
CADILLAC V16, SERIES 90 (1938-39)

NOTE:—Two pumps used, one pump mounted at forward end of each cylinder bank. Both pumps driven in tandem with fan and generator by dual belts. Both pumps are same design and serviced in same manner.

Fan Hub Assembly Balance. Fan hub is balanced and should be marked when disassembled so that all parts will be replaced in same position (first cars). On later cars, 1/16" hole drilled through all parts and holes should be lined up when assembled.

TYPE:—Packless type with spring-loaded rubber and carbon disc seal assembled in housing in front of impeller. Shaft mounted on two sealed ball bearings in housing. Bearings require no attention in service and should not be disassembled (replace shaft and bearings as a unit).

OVERHAUL:—Disassembly. Take out four pulley capscrews and remove pulleys. Support pulley drive flange in arbor press, press impeller shaft out of flange. Remove bearing lock ring in front end of pump housing, support front end of housing in arbor press, press pump shaft out of impeller, remove shaft and bearing assembly from housing. Remove lock ring at rear end of housing, withdraw carbon seal, rubber seal, spring and spring retainers noting location so that these parts can be replaced in same position.

Seal Assembly. Coat contact surfaces of rubber seal and carbon ring with water pump grease, install front spring retainer (concave side out), spring, rear spring retainer (with shoulder in toward spring), rubber seal, and carbon seal in pump housing, install locking ring.

Pump Assembly. Reverse disassembly directions given above. When pressing impeller on shaft, see that clearance between front face of impeller and pump housing is .015" minimum, .025" maximum.

NOTE—If new pump, or rebuilt pump with new seal, leaks slightly, this may be caused by carbon seal not seating properly on face of impeller and should correct itself after short period of operation.

CHEVROLET TYPE

Used On:
CHEVROLET, ALL MODELS (1933-36)

TYPE:—Adjustable packing type. Packing consists of two pre-formed spiral-wound metallic rings assembled with a spacer between them (lubricant is fed into this space). Shaft mounted on two bushings in pump body.

SERVICING:—Packing Adjustment & Renewal. When limit of packing adjusting nut is reached, back off nut, install special split packing rings without removing old packing. When pump again requires packing, remove spacer and add packing at rear end also.

Lubrication. Fill grease cup above rear bushing with #2½ water pump grease and turn down at 1000 mile intervals. Use engine oil only in front bushing oiler.

OVERHAUL:—Disassembly. Remove fan, use special puller to remove fan pulley. Withdraw impeller and shaft assembly through rear end of pump. Use special pilot driver to press out old bushings in pump body.

Assembly. Use special pilot to press new bushings in pump body. Make certain that thrust washer is installed between impeller and pump body. See that spacer installed between the two packing sections and fill spacer recess with water pump grease.

Engine Block Baffle (1933-35 Models). Special sheet metal baffle plate installed in block behind pump impeller. If baffle removed, use special driver to install (baffle must be 1" from front face of cylinder block). This baffle not used on 1936 models.

CHEVROLET 1937-38 TYPE

Used On:
ALL MODELS (1937), FIRST CARS (1938)

NOTE:—1937 Pumps changed in production as follows:

Engine Nos. 1 to 38076. Original pumps did not have oil hole in lower part of oil reservoir in center of bore between bushings. Replace all pumps without this hole with later type.

Engine Nos. 38076 to 427405. Felt wick installed in hole in lower part of oil reservoir in center of bore between bushings. Only felt wick must be used for replacement (see Overhaul data below).

Engine Nos. 427405 Up. Copper graphite wick with spring (no spring used with felt wick) used instead of felt wick. Use only same type wick for replacement.

1938 Later Cars—Equipped with ball-bearing packless type pump. See following article for data.

TYPE:—Self-adjusting type (no packing adjustment required in service). Chevron type packing rings installed on shaft at inner end of each bushing with spring between packing ring assemblies. Bushings

CHEVROLET 1937-38 TYPE CONT.

are porous bronze type and lubricated from oil reservoir which surrounds pump body. Packing rings lubricated by oil metered by bronze oil wick in body which extends down into oil reservoir.

Lubrication. Reservoir should be kept filled with SAE. No. 20 or 20-W oil (water pumps not in service should be kept filled to prevent bushings drying out, and new bushings must be soaked in oil before being installed).

OVERHAUL:—Note. Manufacturer recommends that pump not be dismantled for servicing unless special pump packing tools (bushing and packing drivers and installing sleeve, and oil reservoir replacer) used. New 1938 tools can be used on previous pump model but 1937 tools cannot be used on 1938 water pumps.

Disassembly. Remove two flat headed screws on rear cover plate, remove plate and gasket. Place pump assembly in arbor press and press rotor shaft out of fan and pulley assembly, remove rotor and shaft through rear of pump body. Screw threaded bushing puller into inner (rear) bushing, press bushing out of housing. Remove front bushing in same manner. Remove packing rings, spring seats, and spring. To remove oil reservoir, clamp pump housing in vise (use copper jaws), drive reservoir off body using chisel with flat face. Do not disturb bronze oil wick.

Oil Wick Installation. Oil wick type may be checked by removing oil reservoir cover (see above). Use only same type wick for replacement (felt or copper-graphite—replace pumps without this wick, see note above). Install felt wick by pushing it through hole and flaring end over in bushing bore in housing. Install copper graphite wick by pressing it into hole within 1/16" of inner surface of bushing bore (use this type only in pumps with wick spring).

Bushing & Packing Assembly. Soak new bushings in light engine oil before installing. Use special bushing driver and press front bushing into pump body. Insert packing installing sleeve in rear bushing bore, install two packing rings (dip rings in 20 oil), with grooved side toward front bushing, use packing driver to press packing rings firmly against front bushing, withdraw sleeve, install spring seat (with open 'V' toward packing), spring, second spring seat (with open 'V' toward rear). Use packing sleeve and driver, install 4 ('37), 3 ('38) packing rings (dip in oil, groove side toward rear). Use bushing driver and install new rear bushing (driver pilots in front bushing) in arbor press so that rear end of bushing is flush with end of housing.

Pump Assembly. Use special driver to install oil reservoir on housing (press on in arbor press). Install new thrust washer on shaft, fill space in housing between packing rings with No. 20 oil, insert impeller and shaft, press pulley and fan assembly on shaft so that clearance or endplay is .003-.005". Install rear cover plate using new gasket and staking screws with center punch to prevent loosening.

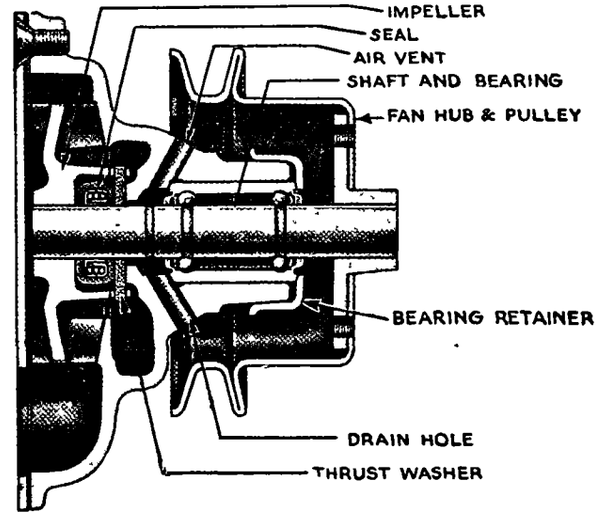
CHEVROLET 1939 TYPE

Used On:

CHEVROLET, ALL MODELS (1938-39)

NOTE:—This pump used on late 1938 cars. Interchangeable on all 1939 car and truck models provided only that special fan for each model is installed.

TYPE:—Ball bearing, packless type. Seal consists of a spring-loaded rubber seal and thrust washer assembled in impeller hub (spring and spring cups are integral part of rubber seal). Bearing consists of a double row ball bearing permanently assembled on shaft (shaft serves as inner race and cannot be moved) factory lubricated and sealed so that no lubrication required in service. Bearing and shaft assembly is retained in housing by a metal cap which is a press fit on the forward end of the housing. Pulley and impeller are press fit on shaft.



OVERHAUL:—Pump serviced only as a unit by the factory with no exchange.

Disassembly—Take out screws and remove rear cover plate. Use puller to remove fan pulley from shaft, remove bearing retainer cap. Support pump housing in arbor press, press bearing and shaft assembly out of impeller and housing toward forward end, lift off impeller and remove thrust washer and rubber seal from impeller recess. Do not attempt to remove bearing from shaft.

Seal Assembly—Install rubber seal in impeller hub (spring is integral part of seal), place thrust washer on seal with lugs on washer engaging slots in impeller so that washer bears against ground face of pump housing when impeller installed.

Assembly—Assemble pump in reverse order from disassembly. When installing pump on engine, make certain that correct fan installed for each model.

CHRYSLER TYPE

Used On:

CHRYSLER SIX, ALL MODELS (1934 to 1939)
CHRYSLER IMPERIAL, ALL MODELS (1934-37)
CHRYSLER CUST. IMP., ALL MODELS (1934-37)
DE SOTO, SE ('34), SF,SG ('35), S1 ('36), S3 ('37), S5 ('38), S6 ('39)
DODGE, ALL MODELS (1934 to 1939)
PLYMOUTH, ALL MODELS (1934 to 1939)

TYPE:—Packless type. Shaft mounted on two bushings in front of impeller. Lubricated by single lubricant fitting on upper side of housing. Seal consists of spring-loaded rubber seal and washer assembly within impeller hub on shaft.

OVERHAUL:—Disassembly. Drive out fan pulley hub pin, pull hub (use puller C-412), remove capscrews on rear cover plate and remove cover, pull impeller and shaft assembly out of pump. Drive out pin holding impeller on shaft, remove impeller and dismantle seal assembly. To remove bushings, drive front bushing pin into shaft hole to free bushing in housing, use puller C-373 and pull both bushings and thrust washer out at forward end.

Servicing—If new bushings installed, use special tool C-373 (same puller used when removing bushings) to press bushings in place. See that thrust washer installed between bushings with slotted side to rear. Bushings must be line-burnished after installation with tool C-384 (tool also refaces housing). Install locking pin in hole in housing and make certain that pin engages hole in front bushing to prevent bushing turning in service.

Assembly—With impeller assembled on shaft, install seal in following order: thrust spring (small end in), seal retainer (cupped end out), seal, seal retainer washer (glazed surface in toward seal), compress assembly and install lock ring in impeller hub. Install assembly in water pump housing making certain that thrust washer is aligned so that shaft fits properly. Press fan pulley hub on shaft so that clearance for end play between hub and front bushing is .005" (before '39), .003" ('39). Install fan hub (see Note below) and peen retaining pin flush after installing, use new gaskets between pump housing and cover and also between pump and engine block.

Seal Assembly—Lubricate seal with light engine oil and use special tool C-528 to install seal ring on shaft.

Fan Hub Installation—New fan hub must always be used when pump overhauled (old hub will not have satisfactory tight fit on shaft after having been removed. Mark location of old fan hub pin hole on end of shaft before installing new hub, drill new pin hole **at right angles** to old hole through both hub and shaft, install new pin (pin should not project from hub at either end).

Pump Housing Cover—When installing cover plate on back of pump housing, use plain washer (not lockwasher) on screw which projects through housing into water passage.

CHRYSLER BALL-BEARING TYPE

Used On:
CHRYSLER IMPERIAL, C19 ('38), C23 ('39)
CHRYSLER CUST. IMP., C20 ('38), C24 ('39)

TYPE:—Packless type with special factory-lubricated and sealed ball-bearing shaft. Seal assembly is similar to type used on other Chrysler models.
1939 Seal Assembly—Consists of a 'U' section rubber seal (with spring and spring cups located within the seal) used with the regular seal retainer washer.
OVERHAUL:—Disassembly—Use special puller C-498 to pull impeller off shaft. Take out locking ring in slot in pump housing bearing hub, withdraw shaft and bearing assembly at front end of pump housing. To disassemble seal, remove locking ring within impeller hub, withdraw seal retainer washer and seal. To remove fan hub from shaft, drive out pin, use puller C-412 and pull hub off shaft. NOTE—Do not attempt to remove bearing from shaft (bearing and seals serviced as assembly with shaft).
Servicing—If seal retainer washer face on pump body nicked or scratched, reface housing using special tool C-551 (impeller must be removed but shaft must be installed in housing to pilot refacing tool).
Seal Assembly (1938)—See preceding article on Chrysler Water Pump for complete data.
Seal Assembly (1939)—Seal is unit assembly (spring and spring cups located within rubber seal) and cannot be dismantled.
Reassembly—Install seal in impeller hub, install seal retainer washer (glazed side in toward seal) and locking ring. Install shaft and bearing assembly in pump housing, press impeller on shaft, install locking ring in pump housing slot (ring must engage at center of bearing). See Chrysler Water Pump (above) for fan hub installation data.

DE SOTO BALL BEARING TYPE

Used On:
DE SOTO, AIRFLOW MODEL S2 (1936)

TYPE:—Packless type. Shaft mounted on two ball bearings in pump housing in front of impeller. Seal assembly similar to type used on other Chrysler and De Soto models (see preceding article).
OVERHAUL:—Disassembly. Remove fan, drive out pulley hub pin, pull hub off shaft, withdraw impeller and shaft assembly through rear end of housing. To remove bearings, take out locking ring in forward end of housing in front of bearing outer race, withdraw front bearing, spacer and rear bearing.
Assembly. Install impeller and shaft (with seal assembly) in housing, install rear ball bearing on shaft and in housing so that it seats against shoulder in housing. Slide bearing spacer in place on shaft, install front bearing so that it contacts spacer, install locking ring. Install pulley and hub, pressing hub on shaft until it contacts front bearing inner race. Drill hub and shaft for locking pin, install pin and peen ends over before installing fan.

FORD TYPE

Used On:
FORD, ALL MODELS (1933-36)

TYPE:—Packless type. No packing or other type of seal used. Shaft mounted on single bronze bushing in pump housing and retained by retaining nut within fan pulley at forward end of pump housing (this nut is not a packing nut). Bushing is porous type and extends through oil reservoir in center of pump body from which oil feeds through bushing to shaft. Shaft drives impeller through tongue-and-slot coupling, impeller is free and is retained in position in housing by coil spring (first type) flat spring (later type) and thrust button which engage rear face of impeller.
Special Truck Type. Same design as above except that shorter bushing used and roller bearing mounted on forward end of shaft. Serviced in same manner as passenger car type.
SERVICING:—Lubrication. Keep oil reservoir in pump housing filled with engine oil (oil will not seep through bushing unless reservoir full). On truck type, pressure gun fitting provided for forward roller bearing.
OVERHAUL:—Disassembly. Disengage pump spring in impeller end of housing, withdraw spring and impeller. Unscrew retainer nut on forward end of housing (within fan pulley), withdraw shaft from housing. Press out old bushing.
Assembly. Reverse disassembly directions above. New bushing should be pressed in place in pump housing. See that retainer nut securely tightened.

FORD '85', LINCOLN ZEPHYR, MERCURY TYPE

Nos. 78-8501 (R.H.), 78-8502 (L.H.)
FORD V8 '85', PASS. CAR & COMM'L. ('37-39)
MERCURY V8, MODEL 99A (1939)
Nos. 79-8501 (R.H.), 79-8502 (L.H.)
FORD V8 '85' & '95' TRUCKS ('36-37-38-39)
Nos. H-8501-B (R.H.), H-8502-B (L.H.)
LINCOLN-ZEPHYR, H (1936), HB (1937)
Nos. 86H-8501-A (R.H.), 86H-8502-A (L.H.)
LINCOLN-ZEPHYR, MODEL 86H (1938)
Nos. 86H-8501-B (R.H.), 86H-8502-B (L.H.)
LINCOLN-ZEPHYR, 86H (1938), 96H (1939)

NOTE:—These pumps are similar except that '78' types (passenger car models) have porous bronze bushings and are lubricated with oil, '79' types have ball bearings packed with grease. Lincoln Zephyr (86H type) has porous bronze bushing at rear with oiler for lubrication, ball bearing at forward end packed with grease. All models serviced in similar manner except for removal of shaft and bearing assemblies (see directions for each model below).

TYPE:—Packless type with special seal assembled in recess in impeller hub (Ford), special packing cage at impeller end of shaft (Lincoln Zephyr). Bronze bushing is porous and lubricated by oil from engine oiling system (Ford), through oiler on top of pump body (Lincoln Zephyr). Ball bearings are packed with grease at assembly and require no further attention.
OVERHAUL:—Disassembly (Ford). Place pump in arbor press, press impeller and shaft assembly out of pulley (see note below for '79' types), lift off pulley and front thrust washer, remove impeller and shaft through rear of housing. Press old bushing out of housing. To dismantle seal, remove snap ring within impeller hub at forward end, remove seal parts (note order and assemble in same positions).
NOTE FOR '79' PUMPS. Shaft and bearing assembly must be pressed out of housing toward forward end (bearing seats against shoulder in housing at rear). Do not dismantle this assembly (replace as a unit).
Disassembly (Lincoln Zephyr). Remove drive pulley pin, press pulley off shaft, remove front ball bearing lock ring (in outer end of pump housing hub), remove impeller shaft pin, press shaft and bearing assembly out of pump toward front.
Seal Assembly. When installing seals, install parts in following order: Spring (large end in toward impeller), Spring Guide (tangs out), Seal Clamp Ring, Seal (with projecting face in, and lugs engaging slots in impeller hub), Thrust Washer (engage lugs in impeller hub slots), Snap Ring.
Pump Assembly. Use special tool V-247 (Ford), Z-191 (Lincoln Zephyr) to reface front and rear thrust surfaces of pump housing (necessary to prevent excessive thrust washer wear). Use special reamer Z-193 to ream bushing on Lincoln Zephyr pumps. To assemble pumps, reverse disassembly directions above. On Lincoln Zephyr, make certain that felt packing, retainer, and locking ring in place behind front ball bearing, and that front spacer and locking ring installed to retain bearing. Fill oil reservoir in pump housing with engine oil.

FORD '60' TYPE

No. 52-8501-B (R.H. & L.H.)
FORD V8 '60', FIRST CARS ONLY (1937)
No. 52-8501-C—See Note
FORD V8 '60', ALL MODELS (1937-38-39)

FORD '60' NOTE:—This pump differs from 52-8501B type (used on first '60' Engines) in that pump body is not conical (inner gasket seats against shoulder on body) and no separate retaining nut is used (outer gasket seats against pump body flange). Except for these points, all '60' pumps are serviced in same manner.

TYPE:—Packless type. Pump is special design with conical body which fits into recess in engine front cover (mounting bracket and gear cover) and is retained by large nut directly behind pulley. Pump interchangeable for right and left hand mounting. Impeller is driven by shaft through tongue-and-slot coupling and is retained by spring running through shaft to retainer button under rubber cap on forward end. Shaft mounted on bushing (rear), and ball bearing (front) which is part of shaft assembly (bearing is single row ball type with shaft serving as inner race). Pump lubricated by engine oiling system through oil lead at center of body (body sealed by gasket at each side of oil channel).
OVERHAUL:—Special service tool set recommended for pump servicing (includes spring tools to remove impeller without damaging spring and drivers to install shaft and bearing assembly).
Disassembly. Remove rubber cap on forward end of pulley, use tool S-221 to pull retainer button out slightly so that wedge S-222 can be inserted between spring coils to hold spring (do not pull spring out further than necessary to avoid stretching it), unhook retainer button, remove impeller and spring at rear end. Mount pump in S-225 holder in arbor press, press pulley off shaft, remove locking ring at forward end of body, press shaft and bearing out. Press out old bushing, ream new bushing after it is pressed in place.
Assembly—Reverse disassembly directions. When installing shaft and bearing assembly, use S-226 and S-226-B drivers as a combination to prevent damage to ball bearing. Assemble spring to impeller and use S-223 tool to pull spring through shaft so that retainer button can be assembled. Use new gaskets on body when installing pump (these gaskets seal oil channel). Tighten large retainer nut securely.

GRAHAM TYPE

Used On:

GRAHAM CAVALIER, MODELS 90, 90A (1936)
GRAHAM SUPERCHARGER, MODEL 110 (1936)

TYPE:—Packless type with spring-loaded carbon disc type seal assembled in recess in impeller hub at rear end of pump. Shaft mounted on two ball bearings assembled on shaft (spacer between bearings, assembly retained by bearing nut at rear end).

SERVICING:—Lubrication. Pressure fitting provided on top of housing. Use light chassis lubricant only (do not use water pump grease).

OVERHAUL:—Disassembly. Take out capscrews on shaft flange, remove fan and fan pulley, take out 'U' shaped snap ring at forward end of pump housing, press shaft forward out of impeller, remove shaft and bearing assembly through forward end of housing. To dismantle bearings, bend up locking washer ears, remove bearing nut on rear end of shaft, remove bearings and spacer from shaft.

Seal Assembly. Same as for other Graham models. See following article.

Assembly. Reverse disassembly directions. Make certain that locking washer ears are turned over on bearing nut before inserting shaft and bearing assembly in housing.

GRAHAM TYPE

Used On:

***GRAHAM CRUSADER, 80, 80A ('36), 85 ('37)**
GRAHAM CAVALIER, 95 (1937)
GRAHAM SUPERCHARGER, 116, 120 (1937)
GRAHAM, STD. & SPECIAL 96 (1938-39)
GRAHAM, SUPERCHARGER 97 (1938-39)

*1936 Models after Eng. No. 308875.

TYPE:—Packless type with spring-loaded rubber and carbon disc type seal assembled in recess in impeller hub at rear end of pump housing. Shaft mounted on double row ball bearing (special type assembled integrally on shaft with shaft serving as inner race, cannot be disassembled and should be replaced as a unit). Bearings are sealed type, packed with lubricant at factory and require no attention in service.

OVERHAUL:—Disassembly. Take out capscrews and remove rear cover plate, remove bearing locking wire from housing (end of locking wire visible in slot in housing hub at center of bearing assembly). Support pump housing in arbor press, press shaft out of impeller and shaft and bearing assembly out of housing toward front end.

Seal Assembly. Install seal in same order as when taken out (carbon disc next to housing, rubber seal with larger diameter against carbon disc, spring retainer with dished side toward rubber seal, spacer, and spring with large end toward rubber seal).

Pump Assembly. Reverse disassembly directions given above. Make certain that locking wire is installed to retain bearing and shaft assembly.

HUDSON & TERRAPLANE TYPE

Used On:

HUDSON, ALL MODELS (1936-37-39)
TERRAPLANE, ALL MODELS (1936-37-38)

REPLACEMENT PUMP NOTE:—Replacement pump for 1934-35 Hudson and Terraplane models is same design as following type and is serviced in same manner.

TYPE:—Packless type. Requires no adjustment in service. Seal consists of spring-loaded rubber seal and thrust washer assembled in impeller hub and retained by locking ring at forward end of hub. Shaft mounted on two bushings with lubricant reservoir in housing between bushings (single fitting on top of housing, should be filled with water pump grease). Pump assembly consists of two major parts, front housing or pump body with shaft and impeller assembly, rear impeller housing which is bolted to engine and forms pump chamber.

1939 Water Pump Seal—New cupped seal retainer is used at impeller end of rubber seal which retains rubber seal under compression so that tighter fit secured at shaft which prevents leaks at this point. Seal is installed in same manner as previous type.

1939 Later Cars—Beginning with car #40780, new impeller assembly used with new shaft seal compression spring washer (spring reversed so that small end against washer and large end against impeller). NOTE—This new Impeller Assembly No. 158937 may be installed on 1938 and early 1939 cars.

OVERHAUL:—Pump shaft is peened over at each end to retain impeller and fan hub. Manufacturer recommends use of special Tool Set J-788 consisting of special body to be bolted to pump in place of impeller housing, pullers and pushers (for bushing service), and cutter (to remove burr on shaft so that shaft can be pressed out).

Disassembly:—Remove fan and pulley, take out screws and remove impeller housing. Clamp pump upright in vise (grip fan hub in vise jaws), mount tool set body on pump, assemble cutter and thumbscrew and cut burr off shaft at impeller end (turn cutter with wrench while applying pressure with thumbscrew). Install driver and press shaft through impeller, remove shaft from forward end. Lift off impeller and baffle plate, pull old bushings (rear bushing toward rear, front bushing toward front). To dismantle seal, take out locking ring in impeller hub, lift out seal parts.

Bushing Installation—New bushings have inside diameter of .6205-.6206" which is reduced to .6185-.6190" when bushing pressed in place. Bushings cannot be reamed and special bushing pilot must be used to press bushings in (driving bushings with hammer cause bushings to collapse). Shaft clearance will be .0015-.0025" if bushings properly installed.

Assembly—Press new bushings into place. Assemble seal in following order: compression spring, seal retainer, seal, thrust washer, locking ring (see that it engages groove in impeller hub). Install shaft assembly, place baffle and new impeller assembly on shaft, peen impeller end of shaft (use ball peen hammer) until endplay as measured between pulley flange and front bushing face is .005-.009" (first type impeller), .010-.014" (with late 1939 type impeller). Assemble impeller housing on pump body, fill grease reservoir with aluminum soap base lubricant.

NOTE—Thrust face of rear bushing must be burnished smooth and flat to prevent thrust washer wear. Use burnishing tool J-733A-5 (spin burnishing tool with socket wrench with thumbscrew 'finger tight' to supply pressure, release pressure while turning tool—this is important). Bushing face must be highly polished and free from all burrs or scratches.

HUPMOBILE SIX TYPE

Used On:

HUPMOBILE SIX, 417-W, 421-J ('34), 517-W, 521-J, 518-D ('35), 618-G ('36), 822-E ('38), 922-E ('39)
HUPMOBILE SKYLARK, MODEL R (1939)

TYPE:—Adjustable packing type. Packing located under adjusting nut on pump housing (at rear of front bearing assembly) and consists of two packing sections separated by a drilled separator (separator lines up with grease channel and distributes grease to shaft). Shaft is mounted on ball bearing (front), bushing in housing (rear) and fan hub and impeller are pressed on shaft.

ADJUSTMENT:—Packing Adjustment. Turn down grease cup first, turn up packing nut until shaft is locked, then back nut off one-fourth turn, operate engine. This procedure should be repeated several times to secure good packing seat on pump shaft.

NOTE—When limit of packing adjustment nut travel is reached, nut can be backed off and special service split-packing installed without dismantling pump.

Lubrication. Fill rear bushing grease cup with water proof grease and turn down every 1000 miles. Plug in housing above front ball bearing should be removed and bearing lubricated at 20,000 miles intervals with high melting point ball bearing grease such as Keystone No. 44.

OVERHAUL:—Disassembly. Back off packing nut, remove snap ring in front of front ball bearing in forward end of pump housing. Support pump housing in arbor press, press shaft out of impeller, remove shaft and ball bearing at forward end of housing. Press old bushing out of pump housing. Remove all old pump packing and separator, clean grease out of separator groove and holes.

Assembly. Press new rear bushing into pump housing, coat new packing assemblies with heavy graphited oil before installing in housing. Front ball bearing should be packed with high melting point lubricant. Assemble by reversing disassembly directions above. Impeller and fan hub must be tight press fit on shaft and pressed on so that shaft is flush with end of hub. Install ball bearing with shielded side out toward fan and make certain that retaining snap ring is installed in front of bearing.

HUPMOBILE EIGHT TYPE

Used On:

HUPMOBILE EIGHT, 427-T('34), 527-T, 521-O('35), 621-N ('36), 825-H ('38), 925-H ('39)

TYPE:—Packless type with spring-loaded cork and bakelite seal assembled on shaft in recess in impeller. Impeller shaft mounted on two ball bearings in pump housing. Bearings are packed with grease at assembly and require attention at 40,000 mile intervals only or whenever pump disassembled.

OVERHAUL:—Disassembly. Take out screws and remove rear cover, remove nut and lockwasher on forward end of impeller shaft, remove fan and pulley hub, take out woodruff key. Remove impeller and

HUPMOBILE EIGHT CONT.

shaft assembly through rear end of housing. Take out capscrews in bearing retainer on front end of pump housing, remove retainer, bearings and bearing spacer. Disassemble seal in impeller recess on shaft (note order and replace in same position).

Seal Assembly. Thrust washer and springs are lead plated. To assemble seal, install spring with small end toward impeller, spring washer, cork seal, bakelite seal, and snap ring in impeller recess.

Pump Assembly. Install ball bearings with sealed side out, pack bearings and housing hub with Keystone #44 grease. Make certain that spacer is in place between bearings and that front bearing washer is in place in housing behind outer race.

LINCOLN V12 TYPE

Used On:

ALL V12 MODELS (1933 to 1939)

TYPE:—Adjustable packing type. Impeller is mounted on center of shaft with bronze-bushed bearing in cover plate at rear of pump. This bearing lubricated by lubricant connection in plug at rear end of shaft. Packing is installed under packing adjusting nut on forward end of pump housing behind generator (pump driven through flexible coupling by generator armature shaft).

SERVICING:—Packing Adjustment. Adjusted in usual manner by turning up packing adjusting nut.

Lubrication. Lubricate fitting on rear end of pump at 1000 mile intervals using gear lubricant.

OVERHAUL:—Disassembly. Press drive fitting off forward end of pump shaft, remove rear cover plate, withdraw impeller and shaft through rear of pump housing. Impeller is retained on shaft by pin in hub at forward end. Thrust washers on face of pump housing and cover plate are pinned in place.

Pump Assembly. Reverse disassembly directions as given above.

NASH TYPE

Used On:

NASH, ALL MODELS (1933 to 1939)
LAFAYETTE, ALL MODELS (1934-36)
NASH-LAFAYETTE, ALL MODELS (1937-38-39)

NOTE:—Pumps on all models are similar design but have slight differences in construction (cover plate at rear on some models, at front on shaft on others). All models serviced in same manner.

TYPE:—Adjustable packing type with 'floating impeller'. Pump is mounted on side of engine block and driven by flexible coupling from generator armature shaft. Packing adjusting nut provided on shaft on forward end of pump.

SERVICING:—Packing Adjustment. Adjusted in usual manner by turning up packing adjusting nut. Make adjustment with engine running and turn up nut only enough to stop leaks.

Lubrication. Pressure fittings on housing at rear of packing nut. Lubricate with water pump grease at 2000 mile intervals.

OVERHAUL:—To dismantle pump, take out screws and remove cover plate (at front or rear of pump housing), withdraw impeller and shaft. Assemble in same manner.

OLDSMOBILE & PONTIAC 1934-36 TYPE

Used On:

OLDSMOBILE SIX, F-34 ('34), F-35 ('35), F-36 ('36)
OLDSMOBILE EIGHT, L-35 ('35), L-36 ('36)
PONTIAC SIX, 701A,B ('35), 36-36A,B ('36)
PONTIAC SIX, 37-26CA ('37)—SEE NOTE
PONTIAC EIGHT, 601 ('34), 605 ('35), 36-28 ('36)
PONTIAC EIGHT, 37-28CA ('37)—SEE NOTE

NOTE:—Pontiac 1937 Models. This type pump used on first 1937 cars only. See following article for pump used on cars after Engine No. 6-262194 (Six), 8-95994 (Eight).

TYPE:—Adjustable packing type. Packing installed under adjusting nut at forward end of rear bushing (bushing threaded for nut). Shaft mounted on two bushings in housing (shoulder on rear bearing takes impeller thrust). Oilers provided for both bushings.

Pontiac 1937 Models. Special needle roller bearing used instead of bushing at forward end of pump (rollers retained by cage which serves as outer race, no inner race used). Pressure gun fitting provided to lubricate this bearing.

SERVICING:—Lubrication. Use engine oil only in oiler for each bushing (chassis lubricant in grease fitting for front bearing on 1937 Pontiac models).

Packing Replacement. Shaft must be removed from pump (see Disassembly directions below). Coat new packings and shaft with engine oil before replacing.

OVERHAUL:—Disassembly. Take out capscrews and remove fan (fan hub integral with shaft). Remove cover plate on rear face of pump housing, loosen packing nut. Support pump housing in arbor press, press shaft out of impeller, lift out impeller, remove shaft at forward end of housing. Press out old bearings (either bushing may be removed without disturbing opposite bushing). NOTE—On 1937 Pontiac, front needle bearing is retained by retainer installed in recess in housing at rear of bearing.

Servicing (Oldsmobile). If new bushings installed use tool J-613 and press rear bushing in first (tool will burnish bushing while pressing it into place). Screw packing nut in place on bushing to retain it and press tool out. Use same tool to install front bushing. Always oil burnishing portion of tool when installing bushings. Bushings should be burnished to inside diameter of .487-.488" and shaft clearance should be .0005-.002".

Servicing (Pontiac). Press new bushings in place and ream with special expansion reamer OR-108 (.483"). Shaft clearance should be .0005-.002".

Assembly. Coat both packing and shaft with engine oil, install packing and packing nut, insert shaft and press impeller on shaft until slightly more than flush with hub. Check endplay. Should be .008-.014".

OLDSMOBILE & PONTIAC 1937-39 TYPE

Used On:

OLDSMOBILE SIX, ALL MODELS (1937-38-39)
OLDSMOBILE EIGHT, ALL MODELS (1937-38-39)
PONTIAC SIX, 37-26CA ('37)—LATER CARS
PONTIAC SIX, ALL MODELS (1938-39)
PONTIAC EIGHT, 37-28CA ('37)—LATER CARS
PONTIAC EIGHT, ALL MODELS (1938-39)

NOTE:—These pumps are similar in design except for mounting of seal in pump housing. On Oldsmobile, seal assembly is held in pump housing by locking ring at rear end. On Pontiac, no locking ring is used and 'ears' on graphite washer engage slots in housing to prevent washer turning. NOTE—Washer used on 1937 type pump did not have these 'ears' and housing was not slotted.

TYPE—Packless type with special factory-lubricated and sealed ball bearing shaft. Requires no adjustment or lubrication in service. Bearing cannot be disassembled and must be replaced as unit with shaft (shaft serves as inner race). Seal consists of carbon graphite washer and spring loaded rubber sealing cup in recess in housing at impeller end

OVERHAUL:—Disassembly. Remove fan and pulley, and cover plate on rear of pump housing. Take out shaft retainer wire (bearing lock ring) in slot at top center of bearing hub on housing. Support front face of pump housing in arbor press, press shaft and bearing assembly out of impeller and housing toward front end. Remove seal assembly from housing (On Oldsmobile models, first take out locking ring in seal recess at rear of housing). If shaft and bearing assembly being replaced, press fan hub off old shaft and install on new shaft.

Servicing—If bearing retainer wire worn (indicating that bearing rotates and has excessive end thrust), or if impeller scrapes on housing due to excessive end thrust, pump assembly should be replaced. If bearing is rough or bearing seals loose in outer race so that they can be turned by hand, replace bearing and shaft assembly. Carbon washer, rubber seal, and spring are furnished as a package unit.

Assembly—Install seal assembly in pump housing in following order: inner spring cup (cupped side out), spring, outer spring cup (flange out toward seal), rubber seal (smaller diameter out, make certain that flared portion of inner spring cup enters rubber seal so that it is retained in housing when installed—see illustration), carbon washer (flat surface toward seal on Oldsmobile, polished surface toward impeller on Pontiac). Install locking ring on Oldsmobile models, see that ears on carbon washer engage slots in housing on Pontiac. Insert bearing and shaft assembly in from front, lining up retainer grooove with slot in housing (if bearing is press fit in housing, remove fan hub install bearing in arbor press applying pressure on outer race only, re-install fan hub applying pressure to impeller end of shaft and allowing housing to float on bearing so that no pressure exerted on bearing or races). Press impeller on shaft (support assembly on fan end of shaft) until clearance between rear face of impeller and face of cover plate flange on housing is 1/32" (Oldsmobile), 9/64" (Pontiac). Install shaft retainer wire through slot in housing, use new gasket and install rear cover

Installation (Oldsmobile only)—Use new rubber grommet between water pump and by-pass port in cylinder head to prevent leaks at this point when pump installed on engine. NOTE—This bypass not used on 1939 Six Cylinder Models F-39, G-39.

PACKARD 6 & 8 1935-37 TYPE

Used On:

PACKARD SIX, MODEL 115C (1937)
PACKARD 120, 120 ('35), 120B ('36), 120C ('37)

TYPE:—Adjustable packing type. Packing located under adjusting nut at forward end of rear bushing (bushing threaded for adjusting nut). Shaft mounted on two bushings inserted in pump housing. Oiler provided in housing for each bushing.

SERVICING:—Lubrication. Fill each oiler with SAE. #30 engine oil at 2000 mile intervals. Front oil reservoir has felt filler which retains oil.

Packing Renewal. Original packing is continuous ring type. When limit of adjustment reached, remove fan and pulley, backing off adjusting nut, remove old packing, install special split ring type service packing.

OVERHAUL:—Disassembly. Take out capscrews and remove fan and pulley, remove pump housing rear cover. Heat impeller in boiling water, press shaft out of impeller, remove shaft at forward end. Press out old bushings (rear bushings must be removed through rear opening, this bushing has shoulder which takes impeller thrust).

Assembly. Reverse disassembly directions. Heat impeller in boiling water before installing, press on shaft until clearance between front face of impeller and pump housing is .021-.029". Clearance between rear face of impeller hub and pump cover must be .005-.015". Use new gasket when installing cover plate.

PACKARD 6 & 8 1938 TYPE

Used On:

PACKARD SIX, SERIES 1600 (1938)
PACKARD EIGHT, SERIES 1601, 1602 (1938)

TYPE:—Packless type with special double-row ball bearing shaft. Requires no adjustment in service. Bearing and shaft must be replaced as an assembly (shaft serves as inner race and cannot be dismantled). Bearing oiled by wick in plug in lower side of pump housing (wick extends through outer race to contact shaft). Seal consists of spring loaded rubber seal and composition washer in recess in impeller hub (held by locking ring at forward end of hub).

OVERHAUL:—Disassembly. Remove fan and pulley. Unscrew oil wick plug on underside of housing, remove cover plate on rear of pump housing. Support pump housing in arbor press, press shaft and bearing assembly out of impeller and housing. To dismantle seal assembly, take out locking ring in forward end of impeller hub, withdraw seal parts.

Servicing:—Bearing and shaft must be replaced as an assembly. When renewing seal, install spring with large end out, seal with flange out, composition washer with convex side out and install locking ring in hub groove.

Assembly:—Reverse disassembly directions above. Heat impeller in water just below boiling point before installing. Press impeller on shaft until clearance between edge of vanes and housing is .030-.050". Coat gaskets with Perfect Seal Grade A paste, make certain that gasket on oil wick plug is in good condition and tighten plug securely to prevent oil leaks (fill reservoir with SAE. No. 30 engine oil).

PACKARD 6 & 8 1939 TYPE

Used On:

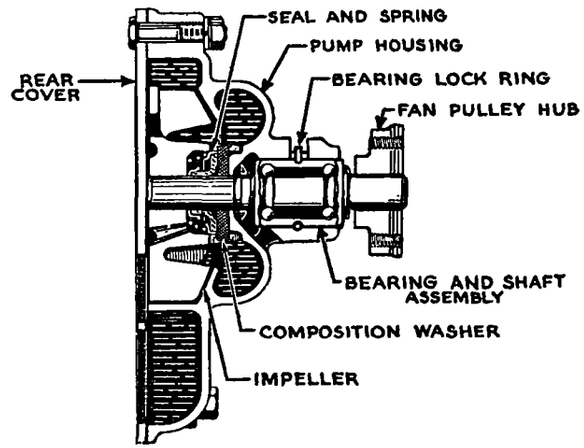
SIX, MODEL 1700 (1939)
'120' EIGHT, MODELS 1701, 1A, 2 (1939)
SUPER EIGHT, MODELS 1703, 3A, 5 (1939)

TYPE:—Packless type with ball-bearing shaft similar to 1938 design except that oiler and oil wick not used and bearing permanently packed with lubricant during assembly (no lubrication required in service).

OVERHAUL:—Note—Rebuilt pumps available from factory on 'exchange' basis. To service pumps proceed as follows:

Disassembly—Remove fan and pulley, take out bearing locking ring in slot in bearing hub on housing. Support pump housing in arbor press, press impeller off shaft, remove shaft and bearing assembly through front of housing. To remove seal, take out locking ring in impeller hub, withdraw composition thrust washer, rubber seal, spring cup and spring. NOTE—Do not remove fan pulley hub or attempt to remove bearing from shaft. Shaft, bearing, and pulley hub serviced as an assembly.

Seal Assembly—When installing seal in impeller, make certain that small end of spring in toward impeller, coat inner surface of seal with glycerine and install with larger flanged face out toward composition washer, install composition thrust washer with smooth (convex) face out toward pump housing, install locking ring.



Assembly—Install shaft and bearing assembly in pump housing making certain that locking ring groove in bearing lines up with slot in pump housing. Coat impeller end of shaft with glycerine (to prevent damage to seal when impeller pressed on. Heat impeller in water just under boiling point for 1½ minutes, press impeller on shaft until clearance between impeller vanes and housing is .030-.050". Coat pump cover gaskets with Perfect Seal Grade A gasket paste when installing cover. Make certain that bearing locking ring installed in pump housing slot.

PACKARD SENIOR LINE TYPE

Used On:

PACKARD EIGHT, ALL MODELS (1932-36)
PACKARD SUPER 8, ALL MODELS (1932-38)
PACKARD TWELVE, ALL MODELS (1932-39)

NOTE:—These pumps are similar in design except for slight differences in bearing assembly. All other servicing instructions apply equally to both models.

TYPE:—Adjustable packing type. Packing located under adjusting nut on pump cover (at rear of bearing assembly). Shaft mounted on two ball bearings in recess in housing (space between bearings forms oil reservoir and is packed with oil-soaked felt). Fan hub is integral with pulley and is keyed on shaft and held by nut at forward end.
NOTE—On 1932-35 Eight and Super Eight models, bearings are not sealed and regular leather oil seal installed at each end of bearing bore in housing to retain oil.

ADJUSTMENT:—Original packing is continuous ring type. Split type packing rings furnished for service and can be installed without removing pump shaft (back off nut and install service packing ring when limit of adjusting nut travel is reached).

Lubrication—Both bearings lubricated by single oiler on top of bearing housing. Use SAE. No. 30 (summer), 20-W (winter) engine oil.

OVERHAUL:—Disassembly. Remove fan, take off pulley retaining nut at forward end of shaft, pull pulley, remove key from shaft. Shaft and impeller can then be withdrawn toward rear. Impeller mounted on shaft by pointed setscrew in hub which controls clearance between impeller vanes and housing.

Bearing Assembly (Super Eight)—Bearings positioned by snap ring in housing at inner end of each bearing outer race (front bearing retained by cover plate on forward end of housing). Shaft endplay adjusted by using gaskets as shims under this cover plate and should be .005-.010". Rear bearing inner race is seated against shoulder on shaft at rear end, spacer installed between bearings, and assembly is clamped together by pulley hub when nut at forward end of shaft is tightened. When installing bearings, soak felt packing in housing with SAE No. 50 engine oil and make certain that packing washer installed at each end with cupped side out toward bearing.

Bearing Assembly (Twelve)—Same as for Super Eight except that snap rings not used in housing and rear bearing outer race seated against shoulder in housing (both bearings must be removed at front).

Pump Assembly—Reverse disassembly directions. See that clearance between face of impeller blades and pump body is .010-.034" (Super Eight), .025-.042" (Twelve). This clearance controlled by impeller setscrew which engages hole in shaft.

STUDEBAKER CHAMPION TYPE

Used On:

STUDEBAKER, CHAMPION MODEL G (1939)

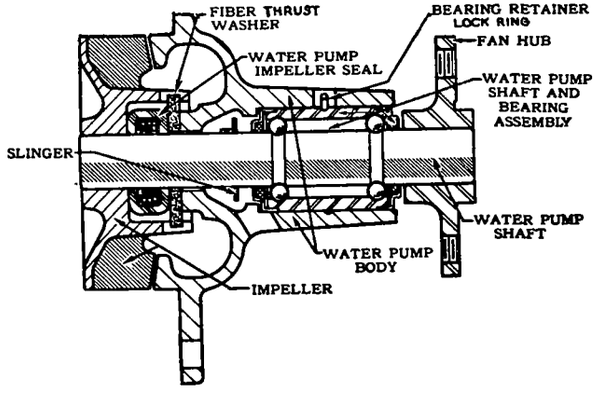
TYPE:—Packless type with spring-loaded rubber seal and fiber thrust washer assembled within recess in impeller. Shaft mounted on special sealed double row ball bearing which is an integral assembly with the shaft (bearing cannot be removed and assembly serviced as a unit). Pump requires no lubrication in service.

STUDEBAKER CHAMPION TYPE CONT.

OVERHAUL:—Disassembly—Remove bearing lock ring from slot in housing hub at center of bearing. Support housing in arbor press, press shaft and bearing assembly out of impeller and housing toward front end, lift off impeller and remove seal and thrust washer from impeller recess. Support fan hub in arbor press and press shaft out of hub. Do not attempt to remove bearing from shaft (serviced as a unit).

Seal Assembly—Spring and spring cups are located within rubber seal. Install rubber seal in impeller hub and place fiber thrust washer on rubber seal so that ears engage slots in impeller and washer contacts face of water pump housing when impeller installed.

Pump Assembly—Press fan hub on shaft so that front face is flush with end of shaft, install shaft and bearing assembly in pump housing so that groove in bearing lines up with locking ring notch in housing, install locking ring. Press impeller on shaft until clearance between edge of impeller vanes and face of housing is 1/32".



STUDEBAKER TYPE

Used On:

STUDEBAKER, ALL MODELS (1933-38)

STUDEBAKER COMM. 9A, PRES. 5C (1939)

TYPE:—Adjustable packing type. Packing located under adjusting nut at forward end of rear bushing. Shaft mounted on two bushings in pump housing (front bushing within fan pulley).

ADJUSTMENT:—Adjust packing by turning up adjusting nut (insert screwdriver between pulley and pump housing). Packing is grapho-metal ring type and requires more pressure than ordinary packing. To renew packing, thoroughly clean out old packing, install four new packing rings, one at a time, tightening adjusting nut down on each ring as it is installed. This special ring packing prevents shaft scoring (with more than ordinary adjusting nut pressure) and gives longer service.

Lubrication (Dictator 1934-35):—Special porous bronze bushings used (not drilled for lubrication). Use only SAE. #30 engine oil in oilers (one for each bushing).

Dictator 1936-37, All '38-39 Cars. Pressure gun fitting provided for front bushing (use chassis lubricant), grease cup for rear bushing (use Kasson or other water proof grease).

Commander, President 1934-37 Models. Grease cup provided at each bushing. Use Kasson or other water proof grease.

OVERHAUL:—Disassembly. Remove fan and pulley (on models where these are mounted directly on water pump shaft), take off rear cover plate on pump housing, remove nut on forward end of shaft (Dictator 1934), drive out pin on fan hub (Dictator 1935-37), press fan hub or coupling off shaft. Withdraw impeller and shaft through rear of pump housing (impeller pinned to shaft). Remove packing nut and packing, press rear bushing out to rear (see Note), front bushing out toward front end.

NOTE—On Commander & President 1933-37 models, rear bushing is inserted in blind hole in pump rear cover behind impeller.

Bushing Installation—Press new bushings in and check clearance on shaft. Should be .001-.003" (bushings need not be reamed if clearance is correct).

Assembly—Reverse disassembly directions. Make certain that thrust washer installed on shaft next to impeller before installing in pump housing. When pressing fan hub on shaft, see that clearance between hub and flange on forward bushing is .003-.005" for correct endplay. See Packing renewal instructions under Adjustment above.

Fan Hub Servicing—New fan hub should be installed whenever hub removed from water pump shaft. Hub must be tight fit on serrated end of shaft and will be loosened by removal so that tight fit cannot be secured if hub re-installed.

WILLYS TYPE

Used On:

WILLYS, ALL MODELS (1933 to 1939)

NOTE:—See Packing Installation in Servicing Section below for directions for installing new type packing on previous pump models.

TYPE:—Adjustable packing type. Packing consists of two opposed tapered packing rings assembled in recess in forward end of pump bushing and in adjusting nut. Shaft is mounted on ball bearing (front) and bronze bushing (rear). Impeller is pressed on shaft, Pulley and fan hub is keyed on shaft and retained by nut at forward end.

SERVICING:—Packing Adjustment—Adjusted in usual manner by turning up packing nut. Pumps can be packed in service by installing regular (#112367) packing between the two tapered packing halves.

Installing New Type Packing in Old Pumps:—The new style tapered packing rings (fitting in recess in forward end of bushing and in recess in packing nut) can be installed in previous type pumps by installing new Water Pump Shaft Bushing #636457 (which has recess in end for packing), Pump Packing Retainer #636459 (this is bushing to fit in packing nut and provide tapered recess for packing), Two Water Pump Packings #636458. See Overhaul data below for bushing installation.

Pump Lubrication:—Use Kasson waterproof grease in rear grease cup, engine oil in front bearing oiler. Make certain that grease reservoir around bushing is filled (requires one grease cup full of grease to fill channels when empty).

OVERHAUL:—Disassembly. Remove nut on forward end of shaft, pull fan pulley and hub, remove key in shaft. Front bearing retained in housing by end cap on pump body and positioned on shaft by spacer (front), retainer in notch on shaft (rear). Pump shaft rear bushing retained in housing by pin driven in through hole in bushing at bottom (drive pin out to free bushing). Impeller is press fit on shaft (furnished as an assembly).

Bushing Installation. Bushings furnished slightly undersize to insure good fit on worn shafts. Clearance between bushing and shaft should be .0025" minimum. Press bushing into place in pump body, drill dowel pin hole (at bottom), grease channel hole (through bushing at top), install dowel pin.

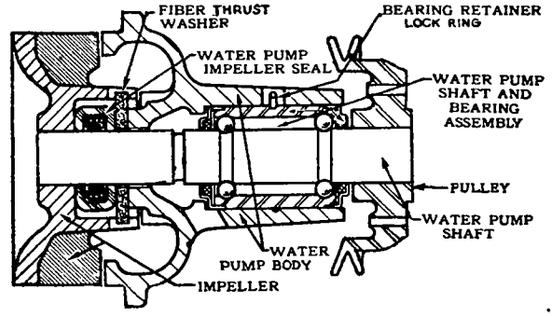
Pump Assembly. Make certain that oil seal at rear of front ball bearing is in good condition, install ball bearing with shielded side toward front. Clearance between impeller vanes and pump body should be .030" (.020" to .050") with pump assembled and fan pulley nut tight. When installing pump packings, see that wide edges are together (narrow edge of each ring in recess in bushing and packing nut).

WILLYS-OVERLAND TYPE

Used On:

WILLYS-OVERLAND, MODEL 39 (1939)

TYPE:—Packless type with special double row ball bearing shaft (shaft serves as inner race, bearing is sealed type and packed with lubricant at assembly). Shaft and bearing cannot be dismantled and serviced as an assembly. No lubrication required in service. Seal consists of spring-loaded rubber seal in recess in impeller hub and bakelite washer which bears against pump housing face.



OVERHAUL:—Disassembly—Use special W-116 puller and pull impeller off shaft, lift out bakelite seal washer. Remove bearing lock ring from slot in bearing hub on pump housing, support pump housing in arbor press, press shaft and bearing assembly out of pump housing toward forward end. To remove fan pulley from shaft, use any regular puller (special W-115 puller furnished for this purpose) to pull pulley off shaft. Do not attempt to remove bearing from shaft (shaft and bearing serviced as assembly).

Servicing—If rear face of pump housing (on which bakelite seal washer bears) is not smooth and flat, reface with special tool W-114.

Seal Assembly—Rubber seal is of 'U' section with spring in recess in seal. Install seal in recess in impeller hub, place bakelite thrust washer on seal, engaging ears on washer in slots in impeller hub.

Assembly—Reverse disassembly directions above. Make certain that bearing lock ring installed in slot in pump housing bearing hub so as to engage groove in bearing shell.

BUICK TYPE

Used On:

SERIES 40-40, 50, 60, 70, 80, 90 (1940)

This pump same design as used on 1939 Buick cars.

TYPE:—Ball-bearing, packless type. Bearing is sealed type (requires no lubrication in service).

OVERHAUL:—Same as for 1939 models. *See 'Buick Type' Water Pump article in Mechanical Equipment Section of manual (or 1939 Supplement) for complete directions and note following specifications:*

Fan Hub Position (Endplay Adjustment)—Fan hub should be pressed on shaft until distance from face of hub to end of shaft (shaft projection) is exactly 3/8" (40, 50), 3/16" (60, 70, 80, 90). This dimension same as for 1939 models.

CADILLAC-LA SALLE TYPE

Used On:

CADILLAC V8, SERIES 40-60S, 62, 72, 75 (1940)

LA SALLE V8, SERIES 40-50, 52 (1940)

V-16 TYPE

CADILLAC V16, SERIES 40-90 (1940)

These pumps same design as used on 1938-39 cars.

LUBRICATION & OVERHAUL:—Same as for previous models (no lubrication required for V-16 type). *See 'Cadillac & La Salle Type' and 'Cadillac V16 Type' Water Pump articles in Mechanical Equipment Section of manual (or 1938 Supplement) for complete instructions.*

CHEVROLET TYPE

Used On:

ALL PASSENGER CAR & TRUCK MODELS (1940)

These pumps same design as used on 1939 models.

NOTE:—Pump interchangeable on all Passenger Car and Truck models provided only that correct fan used for each model.

OVERHAUL:—All service operations same as for 1939 ball-bearing, packless type pump. *See 'Chevrolet Type' water pump article in Mechanical Equipment Section of manual (or 1939 Supplement) for complete instructions.*

CHRYSLER TYPE

Used On:

CHRYSLER, MODEL C25 ROYAL & WINDSOR ('40)

DE SOTO, MODEL S7 CUSTOM & DELUXE (1940)

DODGE LUXURY LINER, MODELS D14, D17 (1940)

PLYMOUTH, P9 ROADKING, P10 DELUXE (1940)

These pumps same design as used on corresponding 1939 car models.

TYPE:—Packless type with seal assembly located within impeller hub. Shaft mounted on two bushings in pump housing lubricated from single grease reservoir.

SERVICING:—Lubrication—Single grease fitting provided on lower left side of pump body. Keep reservoir filled with water pump grease (lubricate at 2000 mile intervals).

OVERHAUL:—Disassembly—Drive out fan pulley hub pin, pull hub using C-412 puller (discard old hub, always use new hub whenever hub removed from shaft). Take out screws and remove rear pump cover, withdraw impeller and shaft from rear end of pump body. Take out locking ring within impeller hub, withdraw seal parts. Drive out impeller pin and remove impeller from shaft (if impeller or shaft being replaced singly). To remove pump shaft bushings, drive front bushing pin through into bushing, use puller C-373 to pull both bushings out through front end of pump body.

Seal Assembly—Install seal parts on shaft within impeller hub in following order: Thrust Spring (small end in toward impeller), Seal (use special tool C528 to install seal on shaft and make certain that metal spring cup in toward spring), Seal retainer thrust washer, and locking ring (ring must engage groove in impeller hub).

Pump Assembly—Use puller C-373 to install new bushings in pump body, make certain that thrust washer installed between bushings with large diameter hole toward rear of pump, install pin in hole in pump body and front bushing. Burnish bushings and reface pump housing with special tool C-384 (insert tool through rear end of pump, turn tool evenly in clockwise direction until cut has been taken on rear face of pump housing, withdraw tool while it is still being turned—this is important as tool will leave ridge on housing if turning stopped while tool is still in contact with pump housing face). Install impeller and shaft assembly in pump, mark location of old hub pin hole on front end of shaft. Press new fan hub on shaft (never use old hubs after they have once been removed from shaft) until clearance between front face of bushing and hub is .003", drill new hole through hub and shaft at right angles to old hole location, install new locking pin. Use new gaskets when installing pump cover and when installing pump on engine.

CHRYSLER BALL-BEARING TYPE

Used On:

MODEL C26 TRAVELER, SARATOGA, NEW YORKER (1940)

MODEL C27 CROWN IMPERIAL (1940)

These pumps same design as used on corresponding 1939 car models except for new Seal Assembly.

TYPE:—Pumps are same design as used on 1939 car models except for seal assembly which is same as used on other Chrysler models (see above). No lubrication or other service operations required.

OVERHAUL:—Disassembly—Use special puller C-498 to remove impeller from shaft (back cover normally left on engine when pump removed). Remove lock ring in impeller hub and withdraw seal parts. Drive out pin in fan pulley hub and remove hub with puller C-142 (discard both impeller and hub when removed from shaft, old parts cannot be re-installed). Remove bearing lock ring from groove in pump body hub, pull shaft and bearing assembly out of housing (do not attempt to remove bearing from shaft, no inner race used and these parts furnished as an assembly).

Seal Assembly—See directions above for other Chrysler models. Always use new impeller whenever impeller removed from shaft (old impeller will not fit tightly on shaft if re-installed).

Pump Assembly—Install shaft and bearing assembly in pump body (press on outer bearing race only) so that groove in bearing is in line with groove in body and install bearing locking ring. Use special tool C-551 to reface thrust washer bearing face on pump body piloting tool on pump shaft and using tapered face (85°) first to form 5° angle face, then use opposite end of tool (straight 90°) to form flat surface 1/32" wide (this tapered face causes thrust washer to wear in quickly and results in longer life). Press new impeller and seal assembly on shaft so that endplay is .0025-.0045" (measure between fan pulley hub and front face of pump body). If fan pulley hub has been removed, press new hub on shaft, drill hub and shaft and install locking pin.

FORD-MERCURY TYPE

FORD No. 52-8501C (RH & LH)

FORD '60', ALL MODELS (1940)

78-8501 (RH), 78-8502 (LH)

FORD '85', ALL MODELS (1940) SEE NOTE

MERCURY, MODEL 09A (1940)

79-8501 (RH), 79-8502 (LH)

FORD '95' TRUCK MODELS (1940)

These pumps same design as used on 1939 models.

FORD '85' TRUCK MODEL NOTE:—This 78-8501 & 2 type pump used on all truck models with '85' engine except Cab-over-Engine models. All Cab-over-Engine models equipped with 79-8501 & 2 pumps (same as used on '95' truck models).

OVERHAUL:—Same as for previous models. *See 'Ford 60 Type' and 'Ford 85 Type' Water Pump articles in Mechanical Equipment Section of manual (or 1938 Supplement) for complete data and note following change on Ford '60':*

Ford '60' Pump Housing—Conical pump body and separate retaining nut used on first '60' only. Later models have straight cylindrical body with gaskets seated against flanges on body. Except for this change, service directions same for all '60' pumps.

GRAHAM TYPE

Used On:

MODELS 107, 108, 109 (1940)

This pump same design as used on 1939 models.

OVERHAUL:—Same as for previous models. *See 'Graham Type' Water Pump article in Mechanical Equipment Section of manual (or 1938 Supplement) for complete data.*

HUDSON TYPE

Used On:

LATE 1939 CARS—SEE NOTE

SIX, 40T TRAVELER & 40P DELUXE (1940)

SUPER SIX, MODEL 41 (1940)

COUNTRY CLUB SIX, MODEL 43 (1940)

EIGHT 44, COUNTRY CLUB EIGHT 47 (1940)

These pumps same as types used on Late 1939 models (see Note for changes over early 1939 cars).

1939 PUMP CHANGES:—First Cars—Pump used on first cars similar to 1938 except for new cup shaped seal retainer (installed in same manner as 1938 type).

Later Cars (After Car No. 40780)—New Impeller Assembly used with new shaft seal compression spring washer. On this later type pump compression spring is reversed and installed with small diameter end against spring washer and large idameter end toward impeller.

IMPORTANT NOTE—This new Impeller Assembly, Part No. 158937 can be installed on 1938 and early 1939 water pumps. See installation directions below.

OVERHAUL:—Same as for previous models except as noted below. *See 'Hudson & Terraplane Type' Water Pump article in Mechanical Equipment Section of manual (or 1938 Supplement) for complete instructions and note the following changes:*

Seal Assembly—Seal has cup shaped retainer which should be placed next to compression spring washer. Compression spring should be installed in impeller with small diameter end toward washer and large diameter end toward impeller (all 1940 and Late 1939 pumps with new impeller assembly). NOTE—On early 1939 pumps, spring was installed in reverse position with small end toward impeller.

CONTINUED ON NEXT PAGE

CONTINUED FROM PRECEDING PAGE

Whenever new impeller is installed in these early pumps, make certain that spring is correctly installed with large end toward impeller.

Pump Service Tools—Pump reconditioning tool set is J-733-S (1939 and 1940 Pumps).

Impeller Endplay—Endplay or clearance between fan pulley and face of front bushing should be .010-.014" (Late 1939 and all 1940 pumps with Impeller Assembly No. 158937) instead of .005-.009" (first 1939 pumps with old style impeller). Endplay is adjusted in same manner as on first pumps by peening end of shaft until endplay is correct.

Bushing Installation—Service bushings are furnished finished (cannot be reamed) and have an inside diameter of .6205-.6206" which is reduced to .6185-.6190" when bushings are pressed in place so that clearance on shaft is .0015-.0025".

CAUTION—Bushing pilot No. 7 (part of reconditioning tool set) must be used when pulling bushings into place. Bushings must not be driven in place (hammer blows will collapse bushings).

Burnishing Bushing—Rear bushing face must always be burnished with burnishing tool No. 8 (part of tool set) to provide highly polished surface for stainless steel thrust washer. When using burnishing tool, thumbscrew should be finger tight and must be released while tool is still being turned (if turning stopped with pressure on tool, crease will be formed on face of bushing).

LINCOLN-ZEPHYR TYPE

Used On:

LINCOLN ZEPHYR MODEL 06H (1940)

These pumps same as types used on previous Lincoln-Zephyr models except as noted below. Right and left hand pumps are not interchangeable.

IMPORTANT PUMP CHANGES:—Two different pumps used on 1940 cars as listed below. All 1940 pumps have new pump body for left hand pump only (Part No. 06H-8504) and some parts are not interchangeable between the different 1940 types.

Type 06H-8501-A (RH), 06H-8502-A (LH)—These pumps are same design as used on previous cars and parts are interchangeable except for new left hand pump body (06H-8504) and new impeller No. 06H-8512-A (used with 4 27/32" shaft H-8511-B).

Type 06H-8501-B (RH), 06H-8502-B (LH)—These pumps have new 5" shaft (06H-8511) and other new parts used with this shaft only as follows: Seal Cage No. 06H-8559 (4 prong type, old cage had 6 prongs), Thrust Washer Disc No. 06H-8557 (4 prong type, old disc had 6 prongs).

SERVICING:—Lubrication—Oiler provided for rear bushing. Lubricate with engine oil at 1000 mile intervals. Front ball bearing requires no attention.

OVERHAUL:—Disassembly—Drive out pin in pulley hub, remove pulley from shaft. Remove bearing lock ring from groove in forward end of pump body hub. Drive out pin in impeller hub, remove impeller and seal assembly from shaft. Press shaft and bearing assembly out of pump body toward front end. To dismantle shaft and bearing assembly, remove locking ring in groove in shaft directly behind bearing, take off bearing felt packing retainer and packing, press bearing off shaft.

Seal Assembly—Seal is assembled in cage which fits on shaft in front of impeller. To assemble seal, install parts in cage in following order: Packing Spring (large end seated in cage), Packing Retainer Washer or cup (cupped end out to receive packing), Seal Packing (fits in cupped end of retainer), Disc or thrust washer. NOTE—Ears on thrust washer disc engage slots in cage. Cage and disc with 6 prongs must be used with 4 27/32" shaft in "A" pumps, 4 pronged type with 5" shaft in "B" pumps

Pump Assembly—To install new bushing in pump body, press old bushing out, press new bushing in so that rear end is flush with thrust washer face in pump body, ream bushing with special reamer Z-193 and reface rear end of bushing and pump body with special tool Z-191. Install front felt retainer, felt packing, inner spacer, and lock ring on shaft behind front ball bearing, press shaft and bearing assembly in pump body, install outer spacer on shaft in front of bearing and lock ring in pump body groove. Install seal assembly and impeller on rear end of shaft, pin impeller to shaft.

NASH TYPE

Used On:

NASH-LAFAYETTE, MODEL 4010 (1940)
NASH SIX 4020, EIGHT 4080 (1940)

These pumps same design as used on corresponding 1938-39 car models.

SERVICING & OVERHAUL:—Same as for previous types. *See 'Nash Type' Water Pump article in Mechanical Equipment Section of manual (or 1938 Supplement) for complete instructions.*

OLDSMOBILE TYPE

Used On:

SIX '60' MODEL F-40, '70' MODEL G-40 (1940)
EIGHT, SERIES 90, MODEL L-40 (1940)

These pumps same as 1938-39 types except as noted below (see Note for late 1939 changes).

1939 PUMP CHANGE NOTE:—Neoprene Seal, No. 503282, installed on rear of bearing to protect bearing from moisture on all late 1939 water pumps. This seal replaced by brass moisture slinger on '40 pumps.

1940 PUMP TYPES:—These pumps same as previous types except as follows:

Brass Moisture Slinger—Consists of small cup shaped brass slinger installed on shaft at rear of ball bearing. This slinger, No. 413778, serviced separately and new slinger should be installed whenever pump is serviced. See directions below.

Fan Pulley Hub—1940 type is 1/8" shorter than type used on 1939 pumps. 1939 type hub cannot be used on these 1940 pumps.

OVERHAUL:—Same as for previous types except as noted. *See 'Oldsmobile & Pontiac Type' Water Pump article in Mechanical Equipment Section of manual (or 1938 Supplement) for complete data and note following changes:*

Pump Shaft Moisture Slinger—To install slinger, start slinger on shaft with flared end toward bearing, stand shaft and bearing assembly in arbor press with slinger end up, use special tool J-1446 to press slinger down on shaft until slight drag is felt on .025" feeler placed between end of bearing and slinger. CAUTION—This .025" clearance between slinger and bearing is necessary to secure proper protection for bearing without slinger dragging on bearing which will cause noise.

Seal Assembly—Machined seat in pump housing must be smooth and clean to insure good seating of seal. Make certain that seat not scored, clean with thinner to remove all dirt and gum, wipe dry before installing seal. Soap solution may be used to wet housing to facilitate seal installation. See that seal does not hang up on sides of casting.

Pump Bypass in cylinder head—Used on eight cylinder L-40 model only. Install new neoprene grommet in bypass hole when installing pump.

PACKARD TYPE

Used On:

'110' SIX 1800, '120' EIGHT 1801,1A (1940)
'160' SUPER EIGHT, 1803, 4, 5 (1940)
'180' CUST. SUPER EIGHT, 1806,7,8 (1940)

These pumps same as types used on 1939 models.

OVERHAUL:—Same as for 1939 type except as noted below. *See 'Packard Six & Eight' Water Pump article in Mechanical Equipment Section of manual (or 1939 Supplement) for data and note following points:*

Seal Assembly—When installing composition thrust washer of seal assembly, make certain that smoothest face is out toward pump body. Machined face of pump body on which this washer rides must replace pump body or resurface face.

Impeller Endplay—Clearance between impeller be smooth and flat. If this surface scored or rough, vanes and pump body should be .012-.074".

PONTIAC TYPE

Used On:

SPECIAL 6 40-25, DELUXE 6 40-26 (1940)
DELUXE 8 40-28, TORPEDO 8 40-29 (1940)

These pumps same as 1938-39 types except as noted below (see Note for late 1939 changes).

1939 PUMP CHANGE NOTE:—Neoprene Shield No. 503282, installed on rear of bearing to protect bearing from moisture on all cars after Eng. No. 6-502121 (Six), 8-164131 (Eight). This seal furnished with pump parts packages for installation on pumps in service. See 1940 data below for installation directions.

1940 PUMP TYPES:—These pumps same as late 1939 types (with Neoprene shield) described above.

OVERHAUL:—Same as for previous types except as noted. *See 'Oldsmobile & Pontiac Type' Water Pump article in Mechanical Equipment Section of manual (or 1938 Supplement) for data and note following:*

Shaft Bearing Shield—Neoprene shield No. 503282 should be installed on shaft with larger diameter end against bearing and small diameter end toward seal assembly (this shield used on late 1939 and all 1940 water pumps). Outer rim of shield seats in bore in pump housing and prevents moisture collecting on bearing.

STUDEBAKER TYPE

Used On:

CHAMPION, MODEL 2G (1940)
COMMANDER, MODEL 10A (1940)
PRESIDENT, MODEL 6C (1940)

These pumps same types as used on 1939 cars.

OVERHAUL:—Same as for 1938-39 pump. *See 'Studebaker Champion' and 'Studebaker Type' Water Pump articles in 1939 or 1938 Supplement for complete data.*

WILLYS TYPE

Used On:

MODEL 440 (1940) PASS. CARS & COMM'L.

This pump same as used on 1939 Willys-Overland.

OVERHAUL:—Same as for 1939 Willys-Overland (not same as Willys 48). *See 'Willys-Overland Type' Water Pump article in Mechanical Equipment Section of manual (or 1939 Supplement) for complete data.*

NATIONAL SERVICE MANUAL

1941 SUPPLEMENTS

FIELD & PRODUCTION CHANGES
NEW TYPE UNITS—SPECIAL SERVICE NOTES

BUICK

1941 MODELS

Compound Carburetion—This two-carburetor system Optl. on Series 41-40, Std. on all other 1941 Buick models. Consists of two carburetors acting together at idle speed and for full power operation (front carburetor acts alone at intermediate speeds). Refer to 1941 Carburetor Index for 'Buick Compound Carburetion' article.

Tune Up on Compound Carburetion Cars—Requires special carburetor and linkage adjustment instructions. Refer to 1941 Carburetor Index for 'Buick Compound Carburetion' article for complete data.

Carter & Stromberg Carburetors—Both carburetors used on all models. Rear carburetor on Compound Carburetion Cars (with two carburetors) is special type without Accelerating Pump, Fast Idle, Choke Valve or Automatic Choke, or Power Jet (no metering rod on Carter types). Refer to 1941 Carburetor Index for Buick (Carter) and Buick (Stromberg) Carburetors.

Carburetor Production Changes—Carburetors on Compound Carburetion cars (both Carter & Stromberg) have been changed in production. For complete data on all type carburetors, and instructions on changes to be made on first cars for improved idling and hot starting performance, refer to 1941 Carburetor Index for 'Buick Compound Carburetion,' Buick (Carter) and Buick (Stromberg) Carburetors.

Compression Ratio Change—Compression ratio changed in production on all cars with Compound Carburetion and new type head gasket used on Single Carburetor cars for approximately same compression ratio. Compression ratio on first Compound Carburetion cars can be lowered to correct spark rap. Refer to 1941 Carburetor Index for 'Buick Compound Carburetion' article for instructions.

Spark Plug Production Change—10 MM. spark plugs used on first cars changed to new type in production and new 14 MM. spark plugs used on later cars. Refer to 1941 Buick 'T&E' page or to 1941 Carburetor Index for 'Buick Compound Carburetion' article for new type 10 MM. spark plugs which should be installed in place of original plugs. Refer to 1941 Mechanical (M) Index for Buick Special Shop Notes for directions on installing of new 14 MM. spark plugs on first cars.

Sealing of Manifolds—Intake manifold gasket type changed in production and manifolds on first cars should be sealed by installing new gaskets. Refer to 1941 Carburetor Index for 'Buick Compound Carburetion' article for instructions.

Ignition Timing Mark (Series 40,50)—Flywheel has special wide mark and one edge of mark should be used when timing engines with Single Carburetor, other edge of mark when timing engines with Compound Carburetion. Refer to Ignition Timing on 1941 Buick 'T&E' page for complete instructions.

New Fireball Turbulator Top Pistons—Used on all models. New type pistons with hollow head and solid skirt (horizontal slot only). Refer to 1941 Buick 'M' pages (Mechanical Section) for complete data.

New Generator Air Scoop (Compound Carburetion Cars)—Combination heat deflector and air scoop installed on commutator end of generators on Compound Carburetion cars. Generators interchangeable on all models if correct pulley installed. Refer to 1941 Buick 'T&E' page for complete data.

New Ball Bearing Worm-and-Nut Steering Gear (All Models)—Refer to 1941 Mechanical Equipment Index for Saginaw Ball Bearing Worm-and-nut type steering gear for complete data.

New Rear Axle Shaft Retainer Washer—New type self-locking horseshoe washer (with reduced throat) used on all 1941 models. Requires special tool for removal. Refer to 1941 Mechanical Equipment Index for Buick Rear Axle article.

Two Types of Starter Controls—Different type Vacuum Switch (on carburetor) for each carburetor make. Refer to 1941 Electrical Equipment Index for 'Carter Car Starter' (Carter Carburetor), 'Delco-Remy Vacuum Switch' (Stromberg Carburetor) for complete data.

1940 & PREVIOUS MODELS

Starter Commutator Burning on Early 1940 Cars—Refer to 1941 Electrical Equipment Index for 'Delco-Remy Starters: Burn Commutator Correction' for recommended correction.

Fast Idle Setting Change on 1940 Carter Carburetors—Fast Idle Setting on Model 474-S (Series 40,50) and 448-S (Series 60,70,80,90) should be .030". Change 1940 Buick 'T&E' page and Carter WDO Dual Carburetor article in 'C' section to indicate this new setting.

Throttle Stop Dog Adjustment on 1940 Carter Carburetor 474-S (Series 40,50)—Refer to 1941 Carburetor Index for Carter WDO Dual Carburetor article and note Throttle Stop Dog Adjustment given under '1940 Special Service Notes'. On late 1940 supplements (with Throttle Stop Dog Adjustment instructions in Carter WDO Dual Carburetor article), change Adjusting Gauge number to T109-121S.

1940 Carburetor Change to Decrease Accelerator Pedal Pressure—Refer to 1941 Carburetor Index for 'Buick (Stromberg) Carburetor' and note special 1940 Service Note for new loose lever spring installation.

CADILLAC

1941 MODELS

Carter & Stromberg Carburetors—Both makes used on all models. Refer to 1941 Cadillac 'T&E' page and to 1941 Carburetor Index for Carter WDO and Stromberg AAV-26 carburetor articles.

Hydra-matic Drive Transmission—Optional on all 1941 Cadillac models. This transmission is special design and has 'Fluid Coupling'. Refer to 1941 Mechanical Equipment Index for Cadillac Hydra-matic Drive Transmission article.

Special Tune up Instructions for Hydra-matic Drive Cars—Special carburetor idle speed setting required and Hydra-matic Drive linkage must be adjusted. Refer to 1941 Cadillac 'T&E', page for tune up data and to 1941 Mechanical Equipment Index for Cadillac Hydra-matic Transmission for linkage adjustment instructions.

Special Generator on Hydra-matic Drive Cars—Refer to 1941 Cadillac 'T&E' page for complete generator data.

New Piston and Piston Pin Fitting Directions—Refer to Mechanical (M) Index for 1941 Cadillac Special Shop Notes for complete instructions.

New Propeller Shaft Slip-joint—Slip-joint is now located in transmission case extension ahead of front universal joint (one piece shaft between front and rear universal joints).

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Replacement Clutch Caution—Service clutches furnished with locking pin blocking each release lever. Pins must be removed when clutches installed in car to prevent them dropping down in clutch housing which may cause damage.
Clutch Balancing—Clutches must be balanced when installed in car for smooth operation. Refer to 1941 Mechanical (M) Index for Cadillac Special Shop Notes.
Rear Axle Pinion Bearing Caution—Do not loosen rear universal joint companion flange nut (controls pinion bearing 'pre-load'.

1940 & PREVIOUS MODELS

Replacement Clutch Caution—See Caution note for '41 Models (above) for locking pin or block removal.
1939-40 Rear Axle Pinion Bearing Caution—Rear universal joint companion flange nut controls pinion bearing 'pre-load' which will be disturbed if nut is loosened.

CHEVROLET

1941 MODELS

New Heavy Duty Truck Engine—New 235 cubic inch Heavy Duty engine Optl. on all 1½ Ton and Cab over Engine Trucks. Refer to 1941 Chevrolet Truck 'M' page for all data.
New Valves & Guides—New type valves and valve guides used on 1941 engines—not interchangeable with previous types. Refer to 1941 Chevrolet 'M' pages for complete data.
New Ignition System & Reversing Switch—New reversing switch (on starter) used in conjunction with new type Distributor, Ignition Coil and new (greater capacity) Condenser. Refer to 1941 Chevrolet 'T&E' page for complete data on ignition units and Caution in regard to use of above units on previous car models.
Reversing Switch Adjustment—First type Reversing Switch must be kept in adjustment (car will not start if adjustment incorrect). New type switch used on later cars non-adjustable. Refer to 1941 Electrical Equipment Index for 'Chevrolet Reversing Switch'.
New 10 MM. Spark Plugs—New 10 mm. small spark plugs used on 1941 models must not be tightened excessively. Refer to 1941 Chevrolet 'T&E' page for spark plug data and tightening Caution.
New 1941 Carburetors—Carburetors on 1941 models have new type granodized pump arm shaft, new type pump check valves and other changes. Refer to 1941 Carburetor Index for Carter 'W1' Carburetor.
New Clutch Driven Member (Pass. Cars)—New type used on 1941 cars and must not be used on previous models (will not release properly). Refer to 1941 Mechanical Equipment Index for Chevrolet Clutch for complete data.
Passenger Car Rear Spring Shackle Change—Design changed in production (2 types used). Refer to 1941 Mechanical 'M' Index for Chevrolet Special Shop Notes.
Shock Absorber Valve Change (Pass. Cars)—Valves on front shock absorbers changed in production to eliminate noise. Refer to 1941 Mechanical Equipment Index for 'Delco Parallel Cylinder Shock Absorber' for complete data.
Shifter Mechanism Change (Pass. Cars)—Design of shifter mechanism in transmission case cover changed so that interlock lever and shaft can be replaced separately (clamped instead of being welded together). Refer to 1941 Mechanical Equipment Section for 'Chevrolet 3 Speed Transmission'
Transmission Gear Change on Trucks—On 1941 Four Speed Transmission, gear ratios changed in production so that two different ratios will be found in service. Refer to 1941 Mechanical Equipment Index for 'Chevrolet 4 Speed Transmission' for identification markings to insure correct type gears being installed.
Hotchkiss Drive on Trucks—All 1941 Trucks (except ½ Ton) have Hotchkiss Drive and new type Propeller Shaft. Refer to 1941 Chevrolet Truck 'M' page

1940 & PREVIOUS MODELS

Starter Commutator Burning on Early 1940 Cars—Refer to 1941 Electrical Equipment Index for 'Delco-Remy Starters: Burnt Commutator Correction' for recommended correction.
Shifter Mechanism Change (1940 Pass. Cars)—Late 1940 cars have same type clamped interlock lever and shaft on transmission case as used on 1941 cars. See 1941 Note above.
Transmission High Gear Disengagement Complaints (1940 Three Speed Transmission)—Refer to 1941 Mechanical Equipment Index for 'Chevrolet 3 Speed Transmission' for recommended procedure in correcting this complaint and also for new type replacement transmission counter-gears (roller bearing type with carburized gears) now furnished for 1940 cars.
Carburetor Improvement (1940 Models)—Refer to 1941 Carburetor Index for 'Carter W1 Carburetor' for directions on installation of 1941 Float Bowl Cover (with improved granodized pump arm shaft) on 1940 carburetors to correct pump arm and shaft wear.
Axle Production Change (1940 ½ & ¾ Ton Trucks)—Refer to 1941 Mechanical Equipment Index for 'Chevrolet Rear Axle' for new method of attaching brake drum to axle shaft on late 1940 trucks (same as 1941) and for recommended correction when lubricant pumped out of first type axle vent hole (vent also changed on late 1940 trucks).
1½ Ton Truck Pinion Bearing Caution—Front pinion bearing must be properly installed (incorrect installation will cause rapid wear and failure of gears). Refer to 1941 Mechanical Equipment Index for 'Chevrolet Full Floating Rear Axle' for data.
Steering Gear Noise or 'Squawk' on 1940 Trucks—To correct noise or 'squawks' in 1940 steering gears, proceed as follows: Check adjustment as directed below and see that the correct special steering gear lubricant is used. If this does not correct trouble and steering gear binds or squawks when wheel is turned with truck standing still, remove and discard regular pitman shaft spacer #263583 and install new Pitman Shaft Bushing #266300 in its place making certain that the open ends of the oil grooves in the bushing are in toward the worm and sector. This bushing increases bearing surface for sector shaft.
NOTE—When installing this bushing, replace the following parts also which may be worn: Washer #263307, Packing #262155 & Retainer #262156.
Engine Running Backward when turned off—Refer to 1939 Carburetor Index for 'Carter W1 Carburetor' for recommended correction.
Manifold Heat Control Valve Rattle Correction—Refer to 1940 Chevrolet 'T&E' page for directions on installation of special anti-rattle spring (under Manifold Heat Control). CAUTION—Thermostatic spring tension most not be increased to correct rattles.
Caster & Kingpin Inclination (1940 KA, KH)—On 1940 Chevrolet Page M-295, Caster specification listed as Kingpin Inclination (Front Suspension data). Correct this page to read as follows: Front Suspension (KA,KH):—Kingpin Inclination—4¾° plus or minus ½°. Caster—0° plus or minus ½°, adjustable.

CHRYSLER—DE SOTO—DODGE PLYMOUTH

1941 MODELS

New Vacamatic Transmissions (Chrysler)—Vacamatic Underdrive type on Chrysler 6, Vacamatic Overdrive type on Chrysler 8. These types different designs. Refer to 1941 Mechanical Equipment Index
New Simplimatic Transmission (DeSoto)—Simplimatic Underdrive type. Entirely new design with automatic shift and 'kick-down' feature. Refer to 1941 Mechanical Equipment Index for DeSoto Transmission data.
Fluid Drive—Optional on Dodge, Chrysler Six (with Vacamatic Underdrive Transmission) and DeSoto (with Simplimatic Underdrive Transmission) as well as Std. on all Chrysler Eights. Refer to 1941 Mechanical Equipment Index for 'Chrysler Fluid Drive'.
Power Shift—Optional on all Chrysler, DeSoto, Dodge, Plymouth models. Refer to 1941 Mechanical Equipment Index for 'Chrysler Power Shift Transmission Control'.
Carburetor Changes—Carburetors changed in production on Chrysler 6, DeSoto, and Dodge with Fluid Drive. Refer to 1941 Carburetor Index for Carter (B&B) Carburetors (Chrysler, DeSoto), Stromberg BXV-3 & BXVD-3 (Dodge) for all data on each type.
Slow-Closing Throttles—Used on all Chrysler, DeSoto, and Dodge models with Fluid Drive. Chrysler 6 and DeSoto type changed in production (two types used—second type not adjustable). Refer to 1941 Carburetion Equipment Index for 'Slow-closing Throttles' for complete adjustment directions.
Plymouth Valve Timing Change—Valve Timing changed after approximately first 20000 cars. Refer to Plymouth 'T&E' or 'M' pages for complete Valve Timing data and directions on checking valve timing on first and later cars.
Chrysler 6 Vacamatic & DeSoto Simplimatic Transmission correction to prevent Ignition cutting out—Refer to 1941 Mechanical Equipment Index for Chrysler and DeSoto Transmissions for directions on installation of Interrupter Switch Insulator to prevent water splashing up on switch from road.
New Electric Convertible Top Control—Refer to 1941 Mechanical Equipment Index for 'Electric Type Convertible Top Control' for complete data.
New Front Suspension (All Models)—Design changed and new tools required for adjustments on 1941 cars. Refer to 1941 Mechanical Equipment Index for 'Chrysler Independent Suspension' for data.

1940 & PREVIOUS MODELS

1940 Auto-Lite Regulator Changes—Settings and specifications for Auto-Lite 'VRP' Regulators changed in production. Refer to 1941 Electrical Equipment Index for 'Auto-Lite Regulators—VRP & VRR Types' and note changes and new specifications which should be used in adjusting these 1940 regulators.
Starter Changes (1940 Dodge & Plymouth)—New type MZ-4062-A starter used on later cars. Specifications for this model same as for first type MZ-4062. Make this notation on 1940 Dodge & Plymouth

CONTINUED ON NEXT PAGE

FIELD & PRODUCTION CHANGES, NEW TYPE UNITS, SPECIAL SERVICE NOTES

CROSLEY

1941 MODEL

New 1941 Specifications—Engine specifications changed from 1940. Refer to 1941 Crosley 'T&E' and 'M' pages for new Compression Ratio, New Ignition Timing, tappet clearance, crankcase capacity, and other specifications.

New Rear Engine Mounting—New rear engine mounting at transmission case (used with new type drive and universal joint). Refer to 1941 Crosley 'M' page and Crosley Special Shop Ntoes.

New Propeller Shaft & Torque Tube—New design with universal joint and adapter at transmission case. Refer to 1941 Crosley 'M' page and Crosley Special Shop Notes for complete data.

FORD—MERCURY

1941 MODELS

New 4 Cylinder Commercial & Truck Models—New 4 Cylinder Engine Optl. on Commercial and Light Truck (¾ & 1 Ton) models. Refer to Ford 'T&E' and Ford Truck 'M' pages for data on this new 4 Cylinder Engine.

New 3-unit Voltage & Current Regulator—New adjustable type Regulator with separate Voltage & Current regulator units used on all 1941 models. Refer to 1941 Electrical Equipment Index for 'Ford Regulator—3 Unit Type' for complete data.

Cylinder Sleeves & Special Piston Servicing Data—Dry type cylinder sleeves used on all models. Refer to Ford 'M' pages and to 1941 Ford Special Shop Notes for sleeve data and special piston servicing data when sleeves are used.

1940 & PREVIOUS MODELS

New 3-unit Voltage & Current Regulator—New type regulator (as used on 1941 models—see note above) used in production on late 1940 cars and for replacement on all 2-unit regulators used on previous models. Refer to 1941 Electrical Equipment Index for 'Ford Regulator—3 Unit Type' for complete data.

HUDSON

1941 MODELS

Camshaft & Valve Timing Change (Model 10)—Camshaft changed in production on small 6 cylinder engine (used on Model 10) and new camshaft with different Valve Timing used on later cars. Tappet clearance must be set at different figure on cars with this new camshaft. Refer to 1941 Hudson Six 'T&E' or 'M' page for complete data.

Lighting Fuse Change—On all 1941 Models, fuse changed from 20 ampere to 30 ampere in production and new 30 ampere type should be used for replacement. Refer to 1941 Hudson 'T&E' pages for data.

New Type Transmission—New type Synchro-mesh transmission Std. on all 1941 models. Refer to 1941 Mechanical Equipment Index for 'Hudson Transmission' for complete data.

New Type Electrical Control Overdrive—New type with complete electrical control (no centrifugal clutch pawls—not like 1940 type) and 'kick-down' feature Optl. on all 1941 models. Refer to 1941 Mechanical Equipment Index for 'Hudson Overdrive'.

New Vacumotive Clutch Control—This automatic clutch control Optl. on all 1941 models. Refer to 1941 Mechanical Equipment Index for 'Hudson Vacumotive Clutch Control' for complete data and adjustment directions.

Governor Switch Changes (Overdrive & Vacumotive Clutch Control)—Governor switches changed in production to correct complaints of incorrect operation. Refer to 1941 Mechanical Equipment Index for Hudson Overdrive and Hudson Vacumotive Clutch Control articles.

New Timing Gears (all 1941 models)—New type gears with different tooth angle used (can be installed on earlier cars only as sets). Refer to 1941 Hudson 'M' pages for complete data.

Carburetor Changes (Models 11, 12, 14, 15, 17)—Carburetors changed in production (dashpot or slow-closing throttle not used on later type, Choke setting of later type changed in production). Refer to 1941 Carburetor Index for 'Carter WDO Carburetor' for complete data.

1940 & PREVIOUS MODELS

Carburetor Change to correct Throttle Sticking (1940 Models 41, 43, 44, 45, 47)—Refer to 1941 Carburetor Index for 'Carter WDO Carburetor' and note recommended procedure under 1940 Special Service Notes.

Starter Change (1940 Six Model 40, 41, 43)—Model MZ-4079A used on late cars. All data for this model same as given on 1940 Hudson Six 'T&E' page for first MZ-4079 starter.

LINCOLN

1941 MODELS

New 3-unit Voltage & Current Regulator—New adjustable type Regulator with separate Voltage and Current Regulator units used on all 1941 models. Refer to 1941 Electrical Equipment Index for 'Ford Regulator—3 Unit Type' for complete data.

New Type Electrical Control Overdrive—New type with complete electrical control (no centrifugal clutch pawls) with 'kick-down' feature Optl.on all models. Refer to 1941 Mechanical Equipment Index

New Hydro-electric Window Regulators—Std. on new Custom model. Refer to 1941 Mechanical Equipment Index for 'Hydro-electric Window Regulators' for complete data.

New Direction Signal—New type built-in steering wheel with automatic turn-off for direction signal switch. Refer to 1941 Lincoln 'T&E' page for wiring diagram or to 1941 Electrical Equipment Index for 'Direction Signals'.

1940 & PREVIOUS MODELS

New 3-unit Voltage & Current Regulator—New type regulator (as used on 1941 models—see note above) used in production on late 1940 cars and for replacement of earlier 2-unit regulator on previous models. Refer to 1941 Electrical Equipment Index for 'Ford Regulator—3 Unit Type' for complete data.

NASH

1941 MODELS

New '600' Ambassador Model—This model entirely new design with such features as: New type Independent Front Suspension, Coil Spring Rear Suspension, Delco-Remy Electrical Equipment, Carter (BB) Carburetor, Torque Tube Drive. Refer to 1941 Nash 4140 'T&E' and 'M' pages for complete data on this model.

Twin-Ignition Six Distributor Rotation Change—Distributor rotation on 1941 model reversed from previous models. Refer to 1941 Nash Model 4160 'T&E' page for new distributor data and new spark plug wiring diagram.

Carburetor Changes—Automatic choke setting changed in production on Nash 4160 & 4180 models. Refer to 1941 Carburetor Index for 'Carter WA1' and 'Carter WDO' carburetors for complete data.

Tappet Clearance Adjustment Caution (Model 4160)—Oil lead to rocker arms must be cut off by removing plug while tappet clearance being adjusted and plug must be replaced before engine put into service. Refer to 1941 Nash 4160 'T&E' or 'M' pages and see special note under Tappet Clearance Adjustment for data.

Independent Suspension Changes (4160, 4180)—New design Upper Control Arm used with Direct Acting Shock Absorbers and new shim type Caster & Camber adjustment. Refer to 1941 Mechanical Equipment Index for 'Nash Independent Suspension' for data.

Independent Suspension (4140)—Entirely new design not similar to any other type (has sliding wheel spindle on kingpin column). Refer to 1941 Mechanical Equipment Index for 'Nash 4140 Independent Suspension'.

Torque Tube Trunnion Bracket Adjustment (4140)—Must be adjusted whenever driveshaft disconnected and propeller shaft center bearing must be oiled every 5000 miles (oiler concealed by screw). Refer to 1941 Mechanical Equipment Index for 'Nash Rear Axle' for data.

1940 & PREVIOUS MODELS

1940 Auto-Lite Regulator Changes—Settings and specifications for Auto-Lite 'VRP' regulators changed in production. Refer to 1941 Electrical Equipment Index for 'Auto-Lite Regulators—VRP & VRR Types' and note changes and new specifications which should be used in adjusting these 1940 type VRP regulators.

OLDSMOBILE

1941 MODELS

Special Equipment & Settings on Cars with Hydra-matic Drive—When Hydra-matic Drive used, Special Carburetors, Generators, Ignition Timing, and Carburetor Idle Speed setting are required. Refer to Oldsmobile 6 & 8 'T&E' pages for complete data.

Hydra-matic Drive Linkage Adjustment—Entire linkage must be adjusted whenever disturbed or disconnected. Refer to 1941 Mechanical Equipment Index for 'Oldsmobile Hydra-matic Drive Transmission' for directions.

Hydra-matic Drive Interlock—New starter pedal linkage which kicks Hydra-matic Drive into Neutral position when engine is started. Refer to 1941 Mechanical Equipment Index for 'Oldsmobile Hydra-matic Drive Transmission' for adjustment directions.

Camshaft Endthrust Change (All Models)—Method of taking endthrust on camshaft changed so that no spring-loaded thrust button required though provision made for this thrust button. Refer to 1941 Oldsmobile Special Shop Notes in 'M' Section for complete data.

Timing Chain Change (8 Cyl. Engine)—Timing chain changed to new narrower (11/16") type after first 10,000 cars. Refer to 1941 Oldsmobile 'M' page

1940 & PREVIOUS MODELS

Starter Commutator Burning on Early 1940 Cars—Refer to 1941 Electrical Equipment Index for 'Delco-Remy Starters: Burnt Commutator Correction' for recommended correction.

1940 Clutch Release Bearing Change & Lubrication Instructions—Refer to 1941 Oldsmobile Special Shop Notes in 'M' Section for new type release bearing (with lubrication fitting) used on later cars and

CONTINUED ON NEXT PAGE

FIELD & PRODUCTION CHANGES, NEW TYPE UNITS, SPECIAL SERVICE NOTES

CONTINUED FROM PRECEDING PAGE

which can be installed on early 1940 and 1939 cars to correct complaints of dry or noisy clutch release bearing.

1940 Brakes (8 Cylinder Model L-40)—Brake lining width should be 2". Make this change on 1940 Oldsmobile Eight, Page M-324.

PACKARD

1941 MODELS

Auto-Lite & Delco-Remy Electrical Equipment (Six Cyl. Model)—Both makes of electrical units used on this model. Refer to Packard Six 'T&E' page for complete data.

New Clipper Model—Entirely new model with such as New Type Independent Suspension (no Torque Arms), new Battery Mounting (in engine compartment), new Carter Carburetor with Carter Car Starter (vacuum switch for accelerator pedal starting), new Hood hinge and instrument panel lock (hood hinged on both sides). Refer to 1941 Packard Clipper 'T&E' and 'M' pages for complete data.

Timing Mark Change (Six, Eight, Clipper)—Timing marks now located on vibration dampener instead of flywheel. Refer to Packard 'T&E' pages for complete Ignition & Valve Timing instructions.

New Distributors & Vacuum Spark Control (Six & Eight)—New distributors with new vacuum control linkage (timing quadrant) used on 1941 models. Refer to 1941 Packard 'T&E' pages for specifications and Timing instructions.

New Carter Carburetors (Eight & Clipper)—Refer to 1941 Carburetor Index for 'Carter WDO Carburetor' for data on these new carburetors. Refer to 1941 Electrical Equipment Index for 'Carter Car Starter' for starting vacuum switch used on Clipper.

Carburetor Change (Super Eight)—Refer to 1941 Carburetor Index for 'Stromberg Model AAV-26 Carburetor' for recommended correction for off-idle leanness on this model.

Electromatic Clutch (All Models)—Optl. on all models. New type automatic clutch with electrical control. Refer to 1941 Mechanical Equipment Index for 'Packard Electromatic Clutch Control' for adjustment and servicing data.

Hydro-electric Window Regulators (Super Eight)—Refer to 1941 Mechanical Equipment Index for 'Hydro-electric Window Regulators' for complete data.

1940 & PREVIOUS MODELS

1940 Regulator Production Changes (All Models)—New type VRP-4201A-1 (Six & Eight), VRP-4202A-1 (Super Eight) Regulators used on late 1940 cars. Specifications changed on all Auto-Lite 'VRP' Regulators. Refer to 1941 Electrical Equipment Index for 'Auto-Lite Regulators VRP & VRR Types' for data on later regulators and new specifications on first type regulators to insure latest specifications being used when these regulators are serviced.

Distributor Change (1940 Six)—New type IGC-4503 distributor used on late 1940 cars. All specifications for this distributor same as earlier IGW-4143A distributor except as follows: Cam Angle—38° closed, 22° open; Condenser Capacity—.28-.32 mfd. Make these notations on 1940 Packard Six 'T&E' page.

Spark Plug Gaps (All 1940 Models)—Spark plug gaps should be .028" (.0255-.0305"). Make this notation on all 1940 Packard 'T&E' pages (data omitted on some pages).

PONTIAC

1941 MODELS

New Type Built-in Oil Cleaner—Used on all 1941 models. Refer to 1941 Pontiac Special Shop Notes in 'M' section for description and complete servicing directions.

Carburetor Float Level Change (Six)—Refer to 1941 Pontiac Six 'T&E' page or to 1941 Carburetor Index for 'Carter WA1' carburetor for new specifications.

Transmission Shifter Change (Streamliner & Custom Models)—New single shifter lever without idler lever (replacing front and rear rods) used on later cars and furnished for service on first cars. Refer to 1941 Mechanical Equipment Index for 'Pontiac Transmission Control' for directions on installing this new type linkage.

Hard Shifting Complaints (All Models)—Refer to 1941 Mechanical Equipment Index for 'Pontiac Transmission Control' for directions on alignment of shifter rods and idler lever bracket. See also shifter linkage change above.

Steering Gear Noise Correction (Models with Std. Steering Wheel)—Refer to 1941 Mechanical Equipment Index for 'Saginaw Worm-and-roller Steering Gear' for recommended correction to prevent noise being carried up steering column.

Sticking Throttle Correction (All Models)—Refer to 1941 Carburetor Index for 'Carter WA1' carburetor for accelerator pedal rod production change and directions for adding stop on first type rod to correct throttle sticking.

1940 & PREVIOUS MODELS

Starter Commutator Burning on Early 1940 Cars—Refer to 1941 Electrical Equipment Index for 'Delco-Remy Starter: Burnt Commutator Correction' for recommended correction.

Water Pump Impeller Clearance (1939-40 Models)—Clearance between impeller and back face of pump housing should be 3/64" (not 9/64"). Refer to 1941 Mechanical Equipment Index for 'Pontiac Water Pump' and make this correction on 1939 & 1940 Pontiac Water Pump articles in previous supplements.

Oil Cleaner Installation on Previous Models—New type built-in oil cleaner as used on 1941 models (see note above) can be installed on 1939-40 Six and 1940 Eights. Refer to 1941 Pontiac Special Shop Notes in 'M' Section for complete data.

Accelerator Pedal Sticking (1940 Models)—Refer to 1941 Pontiac Special Shop Notes in 'M' Section for recommended correction.

Clutch Pedal Rattles & Special Service Pilot Bushing—Refer to 1941 Pontiac Special Shop Notes in 'M' Section for recommended correction for pedal rattle on 1940 models and for special service pilot bushing installation on 1940 and previous models.

New Piston Pin Bushings for Service—Refer to 1941 Pontiac Special Shop Notes in 'M' Section for data on new corrosion-resisting aluminum-bronze piston pin bushings being furnished for service on 1940 and previous models (these bushings used on late 1940 and all 1941 cars).

Replacement Camshaft Sprocket (1937-39 Eight)—Spacer must be discarded when service sprocket installed on these models. Refer to 1941 Pontiac Special Shop Notes for data and Engine Nos. of cars to which this data applies.

STUDEBAKER

1941 MODELS

Carter & Stromberg Carburetors (Commander & President)—Both makes used on each model—Stromberg carburetors are new models. Refer to 1941 Carburetor Index for complete data on all types.

New Carburetor (Champion)—New Carter WA1 carburetor with Automatic Choke used on 1941 Champion model. Refer to 1941 Carburetor Index for Carter WA1 Carburetor data.

Carburetor Change (President)—Refer to 1941 Carburetor Index for 'Stromberg AAV-26 Carburetor' for recommended correction for complaints of off-idle leanness on this model.

Auto-Lite Electrical Equipment (President)—New Auto-Lite electrical units used on this model. Refer to 1941 Studebaker President 'T&E' page for complete data.

Clutch Replacement Caution (President)—Service clutches furnished with spacer at driving lugs which must be removed when clutch installed. Refer to 1941 Mechanical Equipment Index for 'Inland Clutch'.

1940 & PREVIOUS MODELS

Oil Leakage at Fan Drive Pulley (1939-40 Champion)—Refer to 1941 Studebaker Special Shop Notes in 'M' Section for recommended correction.

Clutch Sticking Correction (All 1939-40 Models)—Refer to 1941 Studebaker Special Shop Notes in 'M' Section for recommended lubrication procedure and installation of new type release shaft bushings on Champion.

Correction for Ignition missing or cutting out due to water splashing from road (1939-40 Models)—Refer to 1941 Studebaker Special Shop Notes in 'M' Section for Front Fender Apron correction (Comm. & President), Fender Baffle and Engine Pan installation (Champion).

Interlock Installation to correct shifting into two gears (1939-40 Champion)—Refer to 1941 Studebaker Special Shop Notes in 'M' Section for installation of new type Interlock on all 1939 and early 1940 cars.

1940 Auto-Lite Regulator Changes—Settings and specifications for Auto-Lite 'VRP' Regulators changed in production. Refer to 1941 Electrical Equipment Index for 'Auto-Lite Regulators—VRP & VRR Types' and note changes and new specifications which should be used in adjusting these 1940 type VRP regulators.

WILLYS

New Hypoid Rear Axle (Pass. Cars)—Refer to 1941 Mechanical Equipment Index for 'Willys Hypoid Rear Axle' for complete data.

New Overdrive Transmission—Std. or Optl. on Pass. Car Models. Has special 'kick-down' feature. Refer to 1941 Mechanical Equipment Index for Warner Overdrive article.

New Adjustable Shock Absorbers—Refer to 1941 Mechanical Equipment Index for Monroe Adjustable Direct Acting Shock Absorbers for data.

Starter Changes (All Models)—Starters changed in production and new type Bendix drive used on new models. Refer to 1941 Willys 'T&E' page for data on all starter models.

Commercial Models—These models have new Atwood Clutch, Hydraulic Brakes, and Carter Carburetor. Refer to 1941 Willys 'T&E' and 'M' pages for complete data.

1941 TUNE UP & ELECTRICAL CAR MODEL INDEX

Car	Model	Year	Electrical System	Page No.
AMERICAR				See Willys
BANTAM	65 Super Four	1941	Auto-Lite	See Note
BUICK	41-40,40A,50,60,70,90	1941	Delco-Remy	T&E-1792
CADILLAC	41-60S,61,62,63,67,75	1941	Delco-Remy	T&E-1794
CHEVROLET	AG, AH Pass. Cars	1941	Delco-Remy	T&E-1796
CHEVROLET	AJ,AK,AL,AN,Y Trucks	1941	Delco-Remy	T&E-1796
CHRYSLER	C28 Royal & Windsor 6	1941	Auto-Lite	T&E-1798
CHRYSLER	C30 Saratoga & N.Y. 8	1941	Auto-Lite	T&E-1800
CHRYSLER	C33 Crown Imperial 8	1941	Auto-Lite	T&E-1800
CROSLEY	CB41	1941	Auto-Lite	T&E-1802
DE SOTO	S8 Custom & Deluxe	1941	Auto-Lite	T&E-1804
DODGE	D19 Luxury Liner	1941	Auto-Lite	T&E-1806
FORD	11A 'V8' Pass. Car	1941	Ford	T&E-1808
FORD	All Comm'l. & Trucks	1941	Ford	T&E-1808
GRAHAM	109 Hollywood Schgr.	1941	Delco-Remy	T&E-1810
GRAHAM	113 Hollywood	1941	Delco-Remy	T&E-1810
HUDSON	10, 11, 12 Six	1941	Auto-Lite	T&E-1812
HUDSON	10, 18 Business Cars	1941	Auto-Lite	T&E-1812
HUDSON	14, 15, 17 Eight	1941	Auto-Lite	T&E-1814
LINCOLN	16H Zephyr & Cont'l.	1941	Ford	T&E-1816
LINCOLN	168H Custom	1941	Ford	T&E-1816
MERCURY	19A 'V8'	1941	Ford	T&E-1818
NASH	4140 '600' Six	1941	Delco-Remy	T&E-1820
NASH	4160 Ambass. 6	1941	Auto-Lite	T&E-1822
NASH	4180 Ambass. 8	1941	Auto-Lite	T&E-1824
OLDSMOBILE	66, 76, 96 Six	1941	Delco-Remy	T&E-1826
OLDSMOBILE	68, 78, 98 Eight	1941	Delco-Remy	T&E-1828
PACKARD	1951 Clipper	1941	Auto-Lite	T&E-1830
PACKARD	1900 '110' Six	1941	Delco-Remy	T&E-1832
PACKARD	1900 '110' Six	1941	Auto-Lite	T&E-1832
PACKARD	1901,1A '120' Eight	1941	Auto-Lite	T&E-1834
PACKARD	1903,3A,4,5 '160' Super 8	1941	Auto-Lite	T&E-1836
PACKARD	1906,7,8 '180' Super 8	1941	Auto-Lite	T&E-1836
PLYMOUTH	P11, P12 & Econ.	1941	Auto-Lite	T&E-1838
PONTIAC	41-24, 25, 26 Six	1941	Delco-Remy	T&E-1840
PONTIAC	41-27, 28, 29 Eight	1941	Delco-Remy	T&E-1842
STUDEBAKER	3G Champion	1941	Auto-Lite	T&E-1844
STUDEBAKER	11A Commander	1941	Auto-Lite	T&E-1846
STUDEBAKER	7C President	1941	Auto-Lite	T&E-1848
WILLYS	441 Americar	1941	Auto-Lite	T&E-1850
WILLYS	441, 441P Comm'l.	1941	Auto-Lite	T&E-1850

BANTAM NOTE—All Bantam Model 65 (1941) Specifications and Service Data same as for 1940 model. Refer to 1940 Supplement for Bantam Model 65 (1940).

Cam Angles for Delco-Remy distributors are correct with breaker gap set midway between limits and breaker arm fibre bumper worn in (1000 miles).

Cam Angles for Auto-Lite distributors correct with gap specified by car manufacturer except in instances where special gap specified under 'Cam Angle.'

HOOD LOCK:—*See Buick Shop Notes in 'M' Section.*

SERIAL NUMBER:—First number (all Series) 1-3880108 (Flint), 2-3892008 (Calif.), 3-3897008 (Linden). On tag on right side of dash under engine hood.

ENGINE NUMBER:—First number (all Series) 4074859 with model prefix as follows: 4- (40), 5- (50), 6- (60), 7- (70), 9- (90). On right side of crankcase behind oil filter (40,50), above starter (60,70,90).

COMPRESSION:—Ratio—6.5-1 (First 40—Single Carb.), 6.4-1 (Later 40—Single Carb.), 7.0-1 (First 40,50,60, 70,90—Compd. Carb.), 6.7-1 (Later 40,50,60,70,90—Compd. Carb.). ***For Engine Nos. at which Ratio changed, and directions for lowering compression on first Compound Carburetion cars to correct complaints of spark rap, refer to 1941 Mechanical (M) Index for 1941 Buick Special Shop Notes.***

Pressure—142 lbs. (40—6.5-1 Hd.), 148 lbs. (40,50—7.0-1 Hd.), 151 lbs. (60,70,90—7.0-1 Hd.) at 1000 RPM.

VACUUM READING:—Steady 18-20" idling at 7-8 MPH.

IGNITION:—Delco-Remy Coil 1115024, 1115026 (with Radio). On engine side of dash. NOTE—Radio type has condenser mounted under coil end cover.

Ignition Current—2½ amperes idling, 4½ stopped.

Ignition Switch:—Delco-Remy No. 1116296 (40, 60, 90 LHD), 1116297 (40, 60, 90 RHD), 1116313 (50, 70 LHD), 1116314 (50, 70 RHD). Same design as 1940.

Ignition Lock—Briggs & Stratton No. 85370. Key Series—8000 to 9499. Groove—15.

Distributor Delco-Remy No. 1110801. Single breaker, 8 lobe cam, full automatic advance type with auxiliary vacuum spark control.

Breaker Gap—.015". Limits .0125-.0175".

Cam Angle or Dwell—31° closed, 14° open.

Breaker Arm Spring Tension—19-23 ozs.

Rotation—Counter-clockwise viewed from above.

Condenser—Part No. 1869704. Capacity .18-.25 mfd.

Distributor Degrees	R.P.M.	Automatic Advance Degrees	Engine R.P.M.
Start	250	3.5	500
7	400	14	800
13	1500	26	3000

Vacuum Spark Control Model 681-H. On distributor (integral type linked directly to breaker plate). Provides additional advance at speeds above 18 MPH. except when engine accelerated or operated with wide open throttle when spark retarded by return spring. **Plunger Travel**—⅛" max.

Vacuum Advance

Distr. Degrees	Eng. Degrees	Vacuum (" of HG)
Start	0°	5-7"
5-6°	10-12°	10-13"

Distributor Removal:—Mounted on right side of crankcase. To remove, disconnect vacuum line, take out 2 hold-down screws in advance arm, lift out.

FIRING ORDER:—1-6-2-5-8-3-7-4. See diagram.

SPARK PLUGS:—AC No. 106. 10 MM. (First Cars), No. 46 14 MM. (Later Cars). ***For Engines Nos. at which change made and directions on installing these new 14 MM. plugs on first cars, refer to 1941 Mechanical (M) Index for 1941 Buick Special Shop Notes.***

IMPORTANT SERVICE NOTE—No. 104 10 MM. plugs used on first cars. Should be changed to one of following types whenever found on cars in service: No. 104 with dash under 0, No. 106 with dash under 0, No. 106 without dash (all types satisfactory).

Spark Plug Gaps—.025". Limits .023-.028".

IGNITION TIMING:—Initial setting for fuel of 70 (40, 50), 76 (60, 70, 90) Octane Rating. See 'Final Ignition Setting' for fuel & operating condition correction.

	Flywheel Degrees	Piston Position
40 (1 Carburetor)	2° BTDC	.0015" BTDC.
40, 50 (2 Carb.)	4° BTDC	.0063" BTDC.
60, 70, 90 (2 Carb.)	6° BTDC	.0149" BTDC.

Timing Mark Note (40, 50)—Ignition mark is 2° serated section on flywheel. Use trailing edge of mark (4°) for 40 & 50 with Compound Carburetion or leading edge of mark (2°) for 40 with 1 Carb.

Timing (With Synchroscope)—Recommended method. Connect synchroscope to #1 spark plug, direct light on flywheel through inspection hole in right front face of housing. Idle engine at speed not greater than 350 RPM, loosen two distributor hold-down screws, rotate distributor until 'ADV' mark on flywheel (see 40, 50 note above), lines up with indicator. See Final Ignition Setting below.

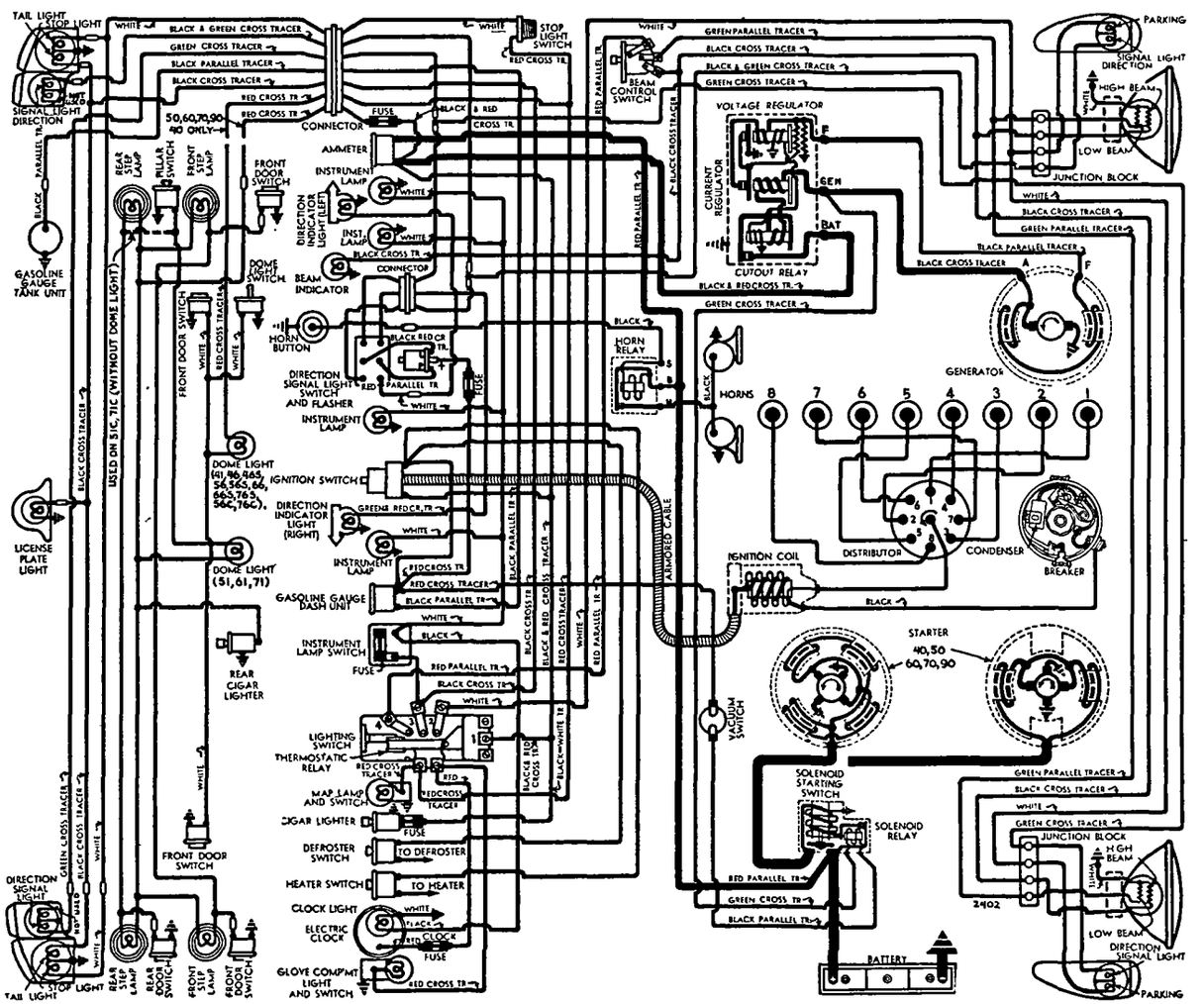
Timing (Without Synchroscope)—With #1 piston on compression, turn engine over until 'ADV' mark on flywheel (see 40,50 note above) lines up with indicator. Adjust distributor as directed above.

Final Ignition Setting—Adjust for fuel used so slight 'ping' secured accelerating with wide open throttle between 10-20 MPH. To adjust, loosen distributor hold-down screws, rotate distributor in small steps counter-clockwise (if ping too severe), clockwise (if no ping). ***See Compression Ratio change (to eliminate spark rap) above.***

CARBURETION:—Carburetor (Series 40—Single Carburetor)—Carter Type WCD Model 487-S or Stromberg Model AAV-16 Code 7-37. 1" dual downdraft ***For special Tune Up & Idle Adjustment directions, refer to Carburetor Index for 'Buick Compound Carburetion'.***

Compound Carburetion (Series 40,40A,50,60,70,90):—Two Carter Type WCD, or Stromberg Model AAV-16 & AA-1, carburetors used together. 1" dual downdraft types. ***For Carburetor Production Changes, and Special Tune Up instructions required for Compound Carburetion, refer to 1941 Carburetor Index for 'Buick Compound Caburetion' and Buick (Carter) or Buick (Stromberg) Carburetor articles.***

IMPORTANT SERVICE NOTE—For instructions on Sealing of Manifolds (first cars), Compression Ratio and Spark Plug production changes, ***refer to 1941 Carburetor Index for 'Buick Compound Carburetion.'***



Accelerating Pump Setting (Front Carburetor only on Compound Carburetion Cars)—3 holes in throttle lever (Stromberg), 2 holes in pump arm (later type Carter Compd. Carb. only) for pump link connection. Adjust as follows (#1 & 3 only on Carter): #1 (Inner—Min.) Hot weather, high-test gasoline. #2 (Center—Med.) Std. normal all year setting. #3 (Outer—Max.) Cold weather, low-test gasoline.

Float Level (All Carburetors)—Adjust as follows:

Carter—9/64" for first type float (cross-rib reinforcement), 3/16" for second type float (11 vertical rib re-inforcement & all Later Compound Carburetor models. Measure from top seam of each float to bowl cover with valve seated. *Refer to Carter 'WCD' Carburetor article in Carburetor Section for Float Level Gauge & aligning data.*

Stromberg—Fuel level 19/32" below top edge of bowl with engine idling (5 lbs. pressure) or even with bottom of inspection hole on side of bowl).

Metering Jets & Rods—*See Carter & Stromberg Jet Tables in Carburetor Section.*

Fast Idle (Front Carburetor only on Compound Carburetion Cars):—Integral (built in carburetor). *For complete data, refer to 1941 Carb. Equip. Index.*

Setting (Carter)—Back off throttle stopscrew so throttle valves closed. With choke valve tightly closed, adjust fast idle screw for .012" (487-S, 509-S, 528-S), .015" (490-S, 533-S), throttle opening (turn screw in 2½ turns from point where it just contacts high step of fast idle cam).

Setting (Stromberg)—Close choke valve against #53 drill (.0595"), adjust by bending fast idle cam connector rod so that locking lever on throttle valve shaft just clears loose lever on fast idle cam stud as throttle is opened and closed.

Automatic Choke (Front Carburetor only on Compound Carburetion Cars):—Climatic Control (Carter), AAV-16 Type (Stromberg). Built-in type. *For complete data, refer to 1941 Carb. Equip. Index.*

Setting (Carter)—Centered (index mark on cover at reference mark on housing) for all models.

Setting (Stromberg)—1 Notch Lean (40—Single Carb.), 'V' mark on cover lined up with housing mark (All Cars with Compound Carburetion).

Air Cleaner:—AC No. 1542111 (40), 1529803 (50,60,70, 90). Heavy duty oil-bath type. NOTE—Screen at forward end of air intake tube should be cleaned by blowing out with air (disconnect air tube).

Fuel Pump:—AC Type AJ. Pump Exchange Part No. 529 (40,50), 530 (60,70,90). Fuel-&-vacuum type. *For complete data, refer to 1941 Carb. Equip. Index.*

Gasoline Gauge:—AC Electric. No. 1516304 (Dash Unit), 1516277 (Tank Unit exc. 90), 1516284 (90). *For complete data, refer to 1941 Carb. Equip. Index.*

MANIFOLD HEAT CONTROL:—Thermostatic coil type. **Setting**—Coil wind-up ¼ turn at 70°F. Adjust counterweight spring clip so edge of counterweight is approx. 7/16" (40 Single Carb.), ¾" (All Compd. Carb.) past vertical centerline of counterweight pivot with valve closed (pin must prevent valve striking body when closed or open).

VALVE TIMING:—To Check—With .015" tappet clearance #2 or #7 exhaust valve should be .145" (40,50), .155" (60,70,90) open with flywheel mark 'UDC/1&8' at indicator (inspection hole in right of housing).

Tappet Clearance:—.015" All valves—engine hot.

Valve Spring Pressure:—Total (inner & outer springs) 42-52 lbs. (closed), 112-124 lbs. (open).

LUBRICATION:—Crankcase Capacity 40,50 8 qts. (dry), 6 qts. (refill). **60,70,90** 10 qts. (dry), 8 qts. (refill).

Normal Oil Pressure—45 lbs. at 35 MPH.

COOLING:—Capacity—13 qts. (40,50), 16¾ qts. (60,70, 90). Allow 1¼ qts. extra for heater.

Pressure Valve—In filler cap. Opens at 7 lbs.

Thermostat—Harrison. In cylinder head outlet. Starts to open at 148-155°F. Fully open at 173°F.

BATTERY:—Delco Model 17E2 (Std.), 17K2 (RHD.Exp). 6 volt, 17 plate, 120 Ampere Hour (20 hr. rate).

Starting Capacity—140 amperes for 20 minutes.

Zero Capacity—300 amperes for 4.5 minutes. Five second voltage—4.4 volts.

Grounded Terminal—Negative (—) to engine block.

Location—On right side under engine hood.

STARTER:—Delco-Remy 1107005 (40,50), 1107018 (40,50 RHD), 1107908 (60,70,90), 1107909 (60,70,90 RHD). **Armature**—1867897 (1107005), 820158 (1107908, 9), 810601 (1107018). **Brush Spring Tension**—24-28 ozs. **Drive**—Solenoid pinion shift & overrunning clutch. **Rotation**—Counter-clockwise at commutator end. **Cranking Engine**—(40,50) 135 RPM, 150 amperes, 4.5 volts (60,70,90) 115 RPM, 175 amperes, 5 volts.

Performance Data—1107005, 1107018

Torque	R.P.M	Volts	Amperes
0 ft. lbs.	5000	5.0	65
12 "	Lock	3.37	525

Performance Data—1107908, 1107909

0 ft. lbs.	5500	5.0	65
16 "	Lock	3.0	600

Removal:—Flange mounted on right front face of flywheel housing. To remove, remove flange screws.

Starting Switch:—Solenoid Switch No. 1542 (1107005, 1107908), 1545 (1107018, 1107909) controlled by Vacuum Switch D-R No. 1990127 (Stromberg Carb.), Carter Car Starter No. 192-11U (Carter Carb.). *For complete data, refer to 1941 Elec. Equip. Index.*

GENERATOR:—Two brush (shunt) type. Interchangeable on all models with correct pulley.

NOTE—Air scoop and heat deflector installed on commutator end on cars with Compound Carburetion.

Car Model	Delco-Remy Model	Pulley Diameter	Groove Width
40, 50	1102679	3 13/32"	11/16"
60, 70, 90	1102668	3 17/32"	15/16"

Armature—No. 1877806 (all models).

Charging Rate Adjustment—None (controlled by regulator and dependent on battery condition).

Maximum Charging Rate—32-34 amperes, 8.0 volts, 2400 RPM, 26 MPH (exc. 90), 24 MPH (90). Actual charging rate controlled by voltage regulator.

Performance Data

	Amperes	Volts	R.P.M.
Cold	30①	8.0	1825

①—Not maximum output. See Current Regulator.

Brush Spring Tension—25 ounces each.

Field Current—1.67-1.82 amperes at 6.0 volts.

Rotation—Counter-clockwise at commutator end.

Removal:—Generator pivot mounted at left front of engine. To remove, take out pivot and clamp bolts.

Belt Adjustment:—½" deflection with light pressure midway between generator and pump pulleys.

REGULATOR:—Delco-Remy 1118201. Single Core Type. Vibrating Current & Voltage regulator on dash. *For complete data, refer to 1941 Elec. Equip. Index.*

CAUTION—Check generator for grounded field coils and leads before changing regulator settings to correct High Charging Rate or High Voltage.

Cutout Relay

Cuts In—6.2-6.7 volts hot.

Cuts Out—0-4.0 ampere discharge current.

Contact Gap—.020" (same for both sets).

Air Gap—.020" (with contacts just closed).

Voltage Regulator

Setting—7.2-7.4 volts hot (operating temperature). Regulator over-compensated for temperature. Should be checked with cover in place and hot.

To Check—Connect ammeter in charging line at regulator 'BAT' terminal, voltmeter between this terminal and ground. Operate generator at 2800 RPM., adjust charging rate to 8-10 amperes (use variable rheostat or AVR set). With regulator hot (150°F.), decrease generator speed until cutout relay contacts open, then increase speed to 2800 RPM. and check hot voltage setting (above).

To Adjust—Change regulator armature spring tension slightly by bending hanger at lower end of **one spring only.** If further adjustment required, see Single Core Regulator article in Electrical Equipment Section for other (2nd.) spring adjustment.

Air Gap—.070" between center of core and armature with contacts just closing (press down on armature to open contacts, release pressure, check gap at point where contacts just close).

Current Regulator

Setting—32-34 amperes hot (operating temp.).

To Check—Remove regulator cover, connect short jumper between Voltage Regulator frame and upper contact support bracket (to short out Voltage Regulator), connect ammeter in charging line at regulator 'BAT' terminal, turn on car lights and accessories. Operate generator and increase speed until output remains constant. With regulator hot (150°F', current reading should agree with setting (above).

To Adjust—Same as for Voltage Regulator (above).

Air Gap—.080" (check same as Voltage Regulator).

LIGHTING:—Headlamps—Guide 'Sealed Beam' type. *For complete data, refer to 1941 Elec. Equip. Index.*

Headlamp Adjustment—Aim upper beam straight ahead (hot spot center 3" below lamp center hght.).

Beam Indicator—In speedometer dial. Lighted when Upper Beams in use.

Direction Signal—*Refer to 1941 Elec. Equip. Index.*

Switches

Lighting—Delco-Remy No. 1995016.

Beam Selector—Delco Remy 1997008 or 1997009.

Directional Signal—Delco-Remy No. 1995503 (LHD-Brown), 1995504 (RHD-Brown), 1995507 (LHD-Grey), 1995508 (RHD-Grey).

Defroster, Heater, Dash Light—Delco-Remy 1997744.

Glove Comp't. Light & Switch—D-R. No. 1997747.

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps	Sealed Beam	
Park & Frt. Dir. Signal	21-3	1154
Rear Direction Signal	21-3	1154
Instr., Map, Clock, Glove Compt.	1.5	55
Beam & Dir. Sig. Indicators	1	51
Stop & Tail	21-3	1154
Rear License	3	63
Courtesy (step)	15	88
Dome	6	82

THERMOSTATIC RELAY:—Delco-Remy. On lighting switch. Contacts remain closed with 30 amperes, open in 3 minutes with 42 amps. at 70°. Not adj.

FUSES:—Dome Light (50, 60, 70, 90). 30 ampere. In connector in lead on back of instrument panel.

Cigar Lighter—30 ampere. In back of lighter.

Direction Signal—14 ampere. In connector.

Instrument Lights—10 ampere. On switch.

Clock—2 ampere. In connector in clock lead.

Heater & Defroster—14 ampere. On switches.

HORNS:—Delco-Remy No. 1999519 (Low Note, right horn), 1999520 (High Note, left horn). Vibrator type, blended tone, operated by horn relay.

Type	Current (at 6 volts)	Air Gap
1999519 (low note)	19-21 amperes	.045-.049"
1999520 (high note)	17-19 amperes	.035-.039"

Horn Relay:—Delco-Remy 1116775.

Contact Gap—.025". **Air Gap**—.015" (closed).

Contacts Close—2.75-4.0 volts.

HOOD LOCK:—Alligator type. Hood lock same as 1940. Push radiator ornament back freeing both manual and safety catches.

SERIAL & ENGINE NUMBER:—First No. (60S) 6,340,001, (61) 5,340,001, (62) 8,340,001, (63) 7,340,001, (67) 9,340,001, (75) 3,340,001. Stamped on left frame side member opposite steering gear and on left side of crankcase to rear of cylinder block.

COMPRESSION:—**Ratio**—7.25-1 Std. Ratio may be lowered by installing special shims between head and block.

Pressure—182 lbs. at 1000 RPM.

VACUUM READING:—20-21" steady idling at 7-8 MPH.

IGNITION:—**Delco-Remy Coil 1115128.** On dash.

Ignition Current—2.2 amperes idling, 4.4 stopped.

Ignition Switch:—Delco-Remy No. 1116298 (60S,61,63, 67), 1116299 (62, 75), 1116309 (RHD Cars). Connected to ignition coil by armored cable.

Ignition Lock—Briggs & Stratton No. 85373. Key Series—8000 to 9499. Groove—No. 15.

Distributor Delco-Remy 1110807. Single breaker, 8 lobe cam, full automatic advance type with auxiliary vacuum spark control and manual adjustment.

Breaker Gap—.0125-.0175".

Cam Angle or Dwell—31° closed, 14° open (.015" gap).

Breaker Arm Spring Tension—19-23 ounces.

Rotation—Clockwise viewed from above.

Condenser—Part No. 1869704. Capacity .18-.25 mfd.

Automatic Advance

Distributor Degrees	R.P.M.	Engine Degrees	R.P.M
Start	500	1	1000
12	2000	24	4000

Vacuum Spark Control 1116030. On distributor (integral type linked directly to breaker plate). Provides additional advance at speeds above idling except when engine acelerated or operated with wide open throttle when spark retarded by return spring within unit. **Plunger Travel**—13/64" total.

Vacuum Advance

Distr. Degrees	Eng. Degrees	Vacuum (" of HG)
Start	0°	5.5-7.5"
9°	18°	15-18"

Manual Adjustment—Permits 10° advance or retard from center position. See Ignition Timing (below).

Removal:—Distributor mounted between cylinder banks at rear of engine. To remove, disconnect vacuum line, take out two hold-down screws in advance arm, lift distributor out.

Installation Note—Turn crankshaft to firing position for #1 cylinder, mesh distributor driven gear with driving gear on camshaft so that slot in upper end of drive shaft coupling is offset toward left or rear of engine (narrow part of coupling to left or rear). CAUTION—See that oil pump driveshaft properly lined up (pump may be damaged by pushing shaft down if not aligned).

FIRING ORDER:—1-8-7-3-6-5-4-2 with cylinders numbered as shown on diagram.

SPARK PLUGS:—AC No. 104. 10 MM. Metric.

NOTE—Use special wrench J-1275 and tighten plugs just enough for good gasket seal (do not use torque wrench with these small plugs).

Spark Plug Gaps—.025-.030".

IGNITION TIMING:—Setting as given for Ethyl fuel. See Manual Adjustment (following) for correction for fuel of other Octane Rating.

	Flywheel Degrees	Piston Position
All Engines	5° BTDC	.0114" BTDC.

Timing (With Synchroscope)—Recommended method. Disconnect vacuum line at distributor (to avoid damage to unit), clip synchroscope lead to #1 spark plug, idle engine and direct synchroscope light on timing disc behind crankshaft pulley at front of engine. Loosen advance arm clamp bolt, rotate distributor until 'IG/A' mark on timing disc (5° before top dead center mark 'C.1/6') lines up with pointer on chain case cover, tighten clamp bolt, reconnect vacuum line (hold connection with wrench while tightening), check setting for fuel used (see Manual Adjustment below).

Timing (Without Synchroscope)—Turn engine over to firing position for #1 piston (front cylinder left bank) with 'IG/A' mark on timing disc behind crankshaft pulley in line with pointer on chain case cover and distributor rotor at #1 segment in distributor cap. Adjust distributor as directed above.

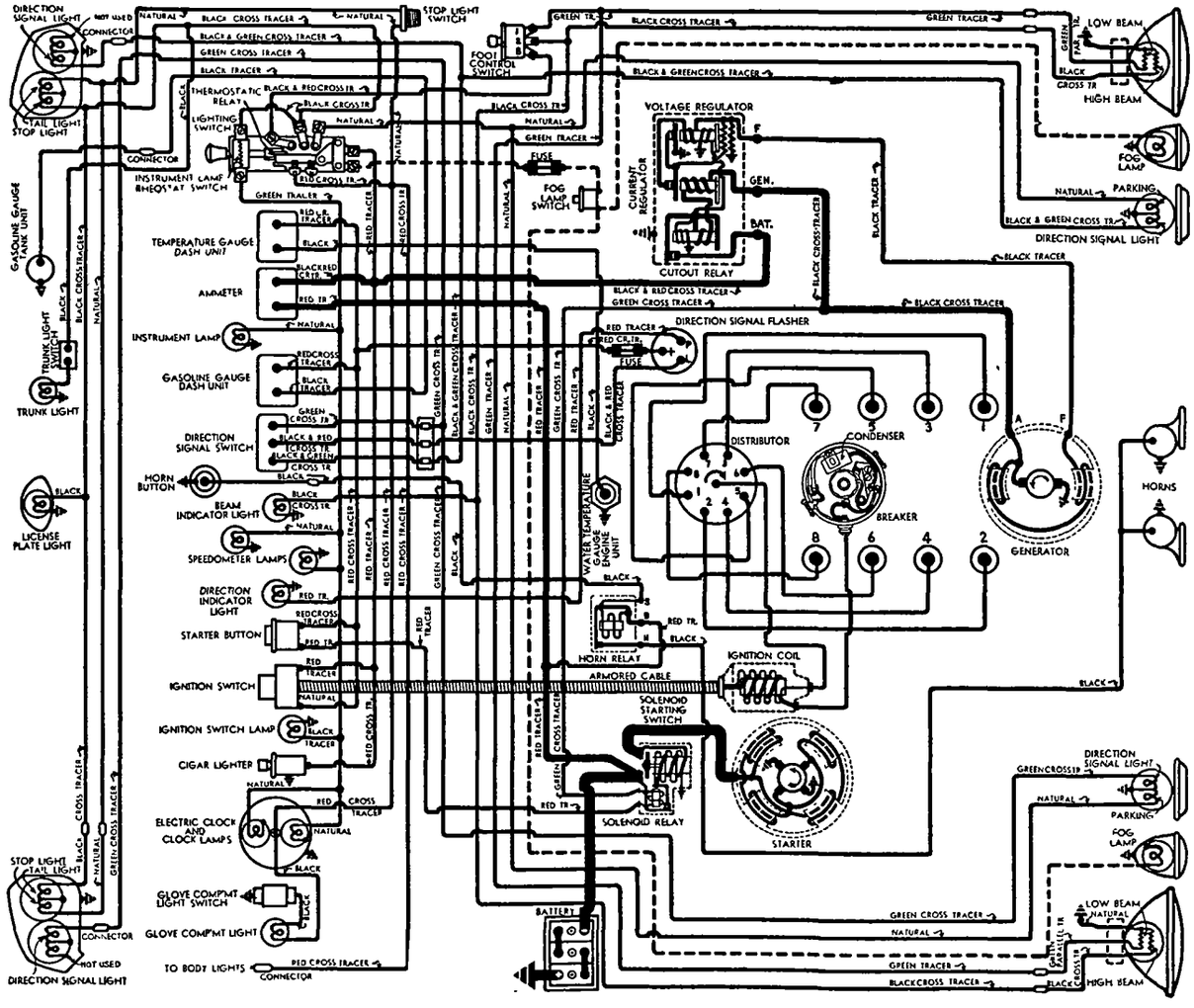
Manual Adjustment—Should be set for slight ping when accelerating engine with wide open throttle at speeds below 15 MPH. To adjust, loosen holddown screw in advance arm, rotate distributor clockwise (if ping too severe), counter-clockwise (if no ping noted) one graduation at a time. CAUTION—Check engine for faulty spark plugs, excessive carbon deposits, localized hot spots or lean carburetor setting before changing adjustment to correct pinging.

CARBURETION:—**Carburetor**—Stromberg Model AAV-26 or Carter WDO Model 506-S, 1¼" dual, downdraft type with Automatic Choke.

For complete data, refer to 1941 Carburetor Index.

Idle Adjustment (All Carburetors)—With engine warm so that choke valve wide open and fast idle inoperative, set throttle stopscrew for slow idle speed of 7-8 MPH. (Std.), exactly 375 Eng. RPM. (Hydra-matic Drive Cars). Adjust both idle screws (1 for each barrel) exactly alike so that engine idles smoothly (turn screws in for leaner mixture). Recheck idle speed. ***See Hydra-matic Drive article in Mechanical Equipment Section for linkage adjustments on cars with Hydra-matic Drive.***

Accelerating Pump Setting—On Stromberg carburetor, throttle lever has two holes for pump rod engagement. Connect rod as follows:
Inner Hole (short stroke)—Normal setting.
Outer Hole (long stroke)—for maximum discharge.
NOTE—Carter Carburetor not adjustable.



Float Level—Check each model as follows:
Carter—1/8" from top of float to machined surface (gasket seat) of bowl cover with needle valve seated (remove gasket and invert to check). Use Cadillac float level gauge J-818-5.
Stromberg—Fuel level 5/8" below top edge of bowl with engine idling (5 lbs. pressure) or even with bottom of inspection plug hole on side of bowl. Float level 1 13/32" from bottom of floats to gasket surface on bowl cover with valve seated (invert to check) or even with vertical guides of checking tool KMO-269-S-7 (Stromberg No. T-24971) with tool installed on gasket. Floats must be set alike.
Metering Jets & Rods—*See Carter & Stromberg Jet Tables in Carburetor Section for complete data.*

Fast Idle:—Integral (built-in each carburetor).
For complete data, refer to 1941 Carb. Equip. Index.
Setting (Carter)—With throttle stopscrew set for 7-8 MPH. hot or slow idle speed, close choke valve so that fast idle screw on high lobe of fast idle cam, adjust screw so that clearance between throttle stopscrew and stop on carburetor casting is .023"
Setting (Stromberg)—To check, hold throttle stopscrew against high lobe of fast idle cam, move choke valve toward closed position as far as possible, check remaining choke valve opening with #32 drill (.116"). To adjust, bend fast idle connector rod at point below choke valve for correct valve opening.

Automatic Choke:—Climatic Control (Carter), AAV-26 type (Stromberg). Built-in carburetor.
For complete data, refer to 1941 Carb. Equip. Index.
Setting (Carter)—Reference mark on thermostat cover centered on housing scale.
Setting (Stromberg)—'V' mark on thermostat cover in line with reference mark on housing.

Air Cleaner:—AC No. 1529928 (60S), 1529929 (62, 67, 75), 1529297 (61, 63). Heavy duty oil-bath type.

Fuel Pump:—AC Type. Pump exchange Part No. 521 (60S, 62, 67, 75), 522 (61, 63). Fuel-&-Vacuum
For complete data, refer to 1941 Carb. Equip. Index.

Gasoline Gauge:—AC Electric. No. 1515368 (Dash Unit), 1516269 (Tank Unit except 75), 1516155 (75).
For complete data, refer to 1941 Carb. Equip. Index.

VALVE TIMING:—To Check—Intake valve for #1 cylinder (front cylinder, left bank) opens with piston on top dead center and mark 'C.1/6' on timing disc behind crankshaft pulley in line with pointer on chain case cover.

Tappet Clearance:—None (Wilcox-Rich 'Zero-lash' hydraulic tappet take-up lifter used).
For complete data, refer to 1941 Mech. Equip. Index.

Valve Spring Pressure:—63½ lbs. at 1.926" (valve closed) 145 lbs. at 1.581" (valve open).

LUBRICATION:—Crankcase Capacity—7 qts.
Normal Oil Pressure—25 lbs. at 30 MPH.

COOLING SYSTEM:—Capacity—25 qts.
Pressure Valve—In filler cap.

Thermostat:—In radiator top tank (shutter control).
Setting—Std. type starts to open at 153-158°F, fully open at 175°F. High Reading Type (for use with heaters) starts to open at 168-173°F, fully open at 190°F. Stem travel (closed to open position) 9/16".
Shutter Adjustment & Thermostat Checking—*See Cadillac Shop Notes in 'M' Section for complete data.*

Temperature Gauge:—AC Electric. No. 1510773 (Dash Unit), No. 1510774 (Engine Unit).
For complete data, refer to 1941 Mech. Equip. Index.

BATTERY:—Delco Model 17K3. 6 volt, 17 plate, 115 Ampere Hour Capacity (20 hour rate).
Starting Capacity—137 amperes for 20 minutes.
Zero Capacity—300 amperes for 4.3 minutes. Five second voltage, 4.4 volts.
Grounded Terminal—Positive (+) to frame bracket.
Engine Ground—Strap connector from right front engine mounting bracket to frame bracket. On cars with Radio, additional ground strap connected from rear of right hand cylinder head to dash.
Location—On outside of right frame siderail at rear of engine comp't. Accessible with hood raised.
Dimensions—Length 10⅜". Width 7". Height 8 11/16".

Commercial Models—Delco 19-Q3. 6 volt, 19 plate, 125 Ampere Hour Capacity (20 hour rate).
Starting Capacity—145 amperes for 20 minutes.
Zero Capacity—300 amperes for 5.0 minutes. Five second voltage 4.5 volts.
Dimensions & Grounded Terminal—Same as 17K3

STARTER:—Delco-Remy 1107923 (except 75 RHD), 1107925 (75 RHD). Armature No. 820158.
Drive—Overrunning clutch & solenoid pinion shift.
Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—24-28 ozs. each.

Performance Data

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	5500	5.0	65
16 "	Lock	3.0	600

Removal:—Starter flange mounted on right front face of flywheel housing. To remove, take out flange mounting screws, pull starter forward and remove from below.

Starting Switch:—Delco-Remy Solenoid Switch No. 1542. Mounted on starter and controlled by Push-button Switch No. 1996009 on instrument panel.
For complete data, refer to 1941 Elec. Equip. Index.

GENERATOR:—Delco-Remy 1102661 (Std.), 1102686 (Cars with Hydramatic Drive). Armature No. 1878211. Two brush (shunt) type with current & voltage control.
Charging Rate Adjustment—No adjustment at generator. Charging rate controlled by Voltage Regulator and max. output by Current Regulator.
Maximum Charging Rate—32 amperes, 8.0 volts, 2450 RPM. or 27 MPH. (60S, 61, 62, 63), 25 MPH. (67, 75, & 62, 75 Comml.). Current Regulator Setting (with load or discharged battery). Actual charging rate controlled by Voltage Regulator (dependent on battery).

Performance Data

	Amperes	Volts	R.P.M.
Cold	30①	8.0	1750

①Not maximum output. See Current Regulator.
Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—25 ozs. each.
Field Current—1.67-1.82 amperes at 6.0 volts.

Removal:—Generator flange mounted between cylinder banks at front of engine and belt driven in tandem with water pump (separate drive belt for fan). To remove, take out flange mounting bolts.

Belt Adjustment:—Loosen generator mounting bolts, raise generator (pivots on left bolt, right bolt hole slotted) until belt deflection is ¾-⅞" midway between generator and crankshaft pulleys.
Fan Belt—Adjust to same tension by raising fan

REGULATOR:—Delco-Remy 1118202. Single Core Type. Vibrating Current & Voltage Regulator on dash.
For complete data, refer to 1941 Elec. Equip. Index.
CAUTION—Check generator for grounded field coils and leads before changing regulator settings to correct High Charging Rate or High Voltage.

Cutout Relay
Cuts In—6.2-6.7 volts hot, 800 generator RPM.
Cuts Out—0-4.0 ampere discharge current.
Contact Gap—.020" (same for both sets).
Air Gap—.020" (with contacts just closed).

Voltage Regulator
Setting—7.2-7.4 volts hot (operating temperature). Should be checked with cover in place and hot.
To Check—Connect ammeter in charging line at regulator 'BAT' terminal, voltmeter between this terminal and ground. Operate generator at 2800 RPM., adjust charging rate to 8-10 amperes (use variable rheostat or AVR set). With regulator hot (150°F.), decrease generator speed until cutout relay contacts open, then increase speed to 2800 RPM. and check hot voltage setting (above).
To Adjust—Change regulator armature spring tension slightly by bending hanger at lower end of **one spring only.** If further adjustment required, see Single Core Regulator article in Electrical Equipment Section for other (2nd.) spring adjustment.
Air Gap—.070" between center of core and armature with contacts just closing (press down on armature to open contacts, release pressure, check gap at point where contacts just close).

Current Regulator
Setting—32-34 amperes hot (operating temp.).
To Check—Remove regulator cover, connect short jumper between Voltage Regulator frame and upper contact support bracket (to short out Voltage Regulator), connect ammeter in charging line at regulater 'BAT" terminal, turn on car lights and accessories. Operate generator and increase speed until output remains constant. With regulator hot (150°F), current reading should agree with setting (above).
To Adjust—Same as for Voltage Regulator (above).
Air Gap—.080" (check same as Voltage Regulator).

LIGHTING:—Headlamps—Guide 'Sealed Beam' type.
For complete data, refer to 1941 Elec. Equip. Index.
Headlamp adjustment—Aim upper beam straight ahead (hot spot center 3" below lamp center hght).
Beam Indicator—In upper left face of speedometer dial. Lighted when Country (upper) beams in use.
Direction Signal—*Refer to 1941 Elec. Equip. Index.* Pilot light in upper right face of speedometer dial flashes when Direction Signal operating.

Switches
Lighting—Delco-Remy No. 1995015. Switch has instrument light rheostat on handle.
Beam Selector—Delco-Remy No. 1997002 (All LHD. cars), 1997009 (RHD. cars).
Direction Signal—Delco-Remy No. 1995505 (All LHD. cars), 1995506 (RHD. cars).

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps		Sealed Beam
Park & Frt. Dir. Signal	21-3	1154
Rear Direction Signal	21-3	1154
Beam & Dir. Sig. Indicators	1	51
Instrument, Clock, Radio	1.5	55
Glove Comp't., Trunk	1.5	55
Ignition Lock	1	51
Stop & Tail	21-3	1154
Rear License Plate	3	63
Dome, Quarter	15	87

FUSES:—Direction Signal—9 ampere. In connector in feed wire on back of instrument panel near Flasher.

THERMOSTATIC RELAY:—Delco-Remy. On lighting switch. Contacts remain closed with 30 amperes, open in 3 minutes with 42 amps. at 70°. Not adj.

HORNS:—Delco-Remy Model K-33-H. No. 1999537 (Low Note), 1999538 (High Note). Vibrator type, blended tone horns, operated by relay. NOTE—Horns mounted in front of radiator below filler plate.

Type	Current (at 6 volts)	Air Gap
1999537 (Low Note)	19-21 amperes	.045-.050"
1999538 (High Note)	18-20 amperes	.036-.040"

Horn Relay:—Delco-Remy No. 1116775.
Contact Gap—.025". **Air Gap**—.015" (closed).
Contacts Close—2.75-4.0 volts.

HEAVY DUTY TRUCK ENGINE:—Special 235.2 cu. in. (3 9/16" bore, 3 15/16" stroke) engine Optl. on 1½ Ton Truck. All service data same as std. engine except as noted.

FLEET (ECONOMY) MODEL:—Has special carburetor (492-S), and specifications as listed below.

HOOD LOCK:—Alligator type. Hood lock same as 1940. Pull out hood lock button on instrument panel, pull safety catch forward (under front end of hood).

SERIAL NUMBER:—First number 1001 (all models) with model prefix as follows: AG (Master Deluxe), AH (Special Deluxe), AK & AJ (½ Ton), AL & AN (¾ Ton), YR (1 & 1½ Ton), YU, YV, YW (1½ Ton Cab-over-Engine), YT (School Bus). On plate on right front floor (Pass. Cars), rear side of dash (C-O-E), right side of cowl under hood (Other Trucks).

ENGINE NUMBER:—Stamped on right side of crankcase to rear of distributor. First No. 1001 (each plant) with model prefix code letters as follows:

Model	Flint	Buffalo
AG, AH Pass. Cars & Sedan Del.	AA	AC
½ Ton	AD	AE
¾ & ¾ Ton Special	AAF	AAN
1½ Ton	AF	AN
1½ Ton (235 cu. in. Eng.)	AG	
1½ Ton C-O-E	AJ	
1½ Ton C-O-E (235 cu. in. Eng.)	AL	
Dubl Duti Panel	AM	

COMPRESSION:—**Ratio**—6.5-1 Std. 6.62-1 (Optl. 235.2 cu. in. Engine). **Pressure**—110 lbs. min. at cranking speed (all cylinders equal within 5-10 lbs).

VACUUM READING:—20-22" steady at idling speed.

IGNITION:—**Reversing Switch**—Delco-Remy No. 1997738 (1107033 Starter), D-R No. 1997752 (1107047 Starter). Mounted on starter (see diagram for connections). IMPORTANT SERVICE NOTE—See Reversing switch article for adjustment directions (car may not start if adjustment incorrect) and New Type Switch used on later cars.

For complete data, refer to 1941 Elec. Equip. Index.

Ignition Coil:—Delco-Remy No. 1115141. New type. On right side of engine near distributor.

Ignition Current—2.5 amperes idling, 4.5 stopped.

Ignition Switch:—Delco-Remy No. 1116304 (Pass. Cars), 1116315 (Can. Pass. Cars); 1116301, 1116302 (Comm'l. & Trucks); 1116291, 1116292 (Can. Comm'l & Trucks); 1116303 (Cab-over-Engine Trucks). Connected to ignition coil by armored cable.

Ignition Lock—Briggs & Stratton No. 45792. Key Series—8000 to 9499. Groove—No. 15.

Distributor Delco-Remy No. 1110090. Single breaker, 6 lobe cam, full automatic advance type with separate vacuum spark control and Octane Selector adjustment. NOTE—New type with insulated breaker plate and ground terminal for Reversing Switch

Breaker Gap—.018". Limits .015-.021".

Cam Angle or Dwell—38° closed, 22° open.

Breaker Arm Spring Tension—17-21 ozs.

Rotation—Clockwise viewed from above.

Condenser—Part No. 1882239. Capacity .28-.32 mfd. NOTE—Condenser must not be used with coil or distributor used on previous model (capacity too great).

Automatic Advance

Distributor Degrees	R.P.M.	Engine Degrees	R.P.M.
Start	300	1	600
6.5	600	13	1200
10.0	1000	20	2000
19.75	1725	39.5	3450

Vacuum Spark Control No. 1116026. Mounted on Octane Selector and linked to advance arm. Provides additional advance at speeds above idling except when engine accelerated or operated with wide open throttle when spark retarded by return spring

Plunger Travel—11/64" total.

Vacuum Advance

Distr. Degrees	Eng. Degrees	Vacuum (" of HG)
Start	0°	7" Min.
10°	20°	16-20"

Octane Selector—Adjustment on distributor provides 10° advance or retard from center '0' position. See Ignition Timing for adjustment instructions.

Removal:—Distributor mounted on right side of crankcase. To remove, loosen advance arm clamp bolt (does not disturb vacuum connections).

FIRING ORDER:—1-5-3-6-2-4. See diagram.

SPARK PLUGS:—AC No. 104. New 10 MM. Metric.

CAUTION—Do not tighten these small plugs excessively (15 ft. lbs. or finger tight plus ½-¾ turn).

Spark Plug Gaps—.040".

IGNITION TIMING:—See Octane Selector (below) for final setting dependent on fuel used.

	Flywheel Degrees	Piston Position
All Engines	5° BTDC	.0091" BTDC

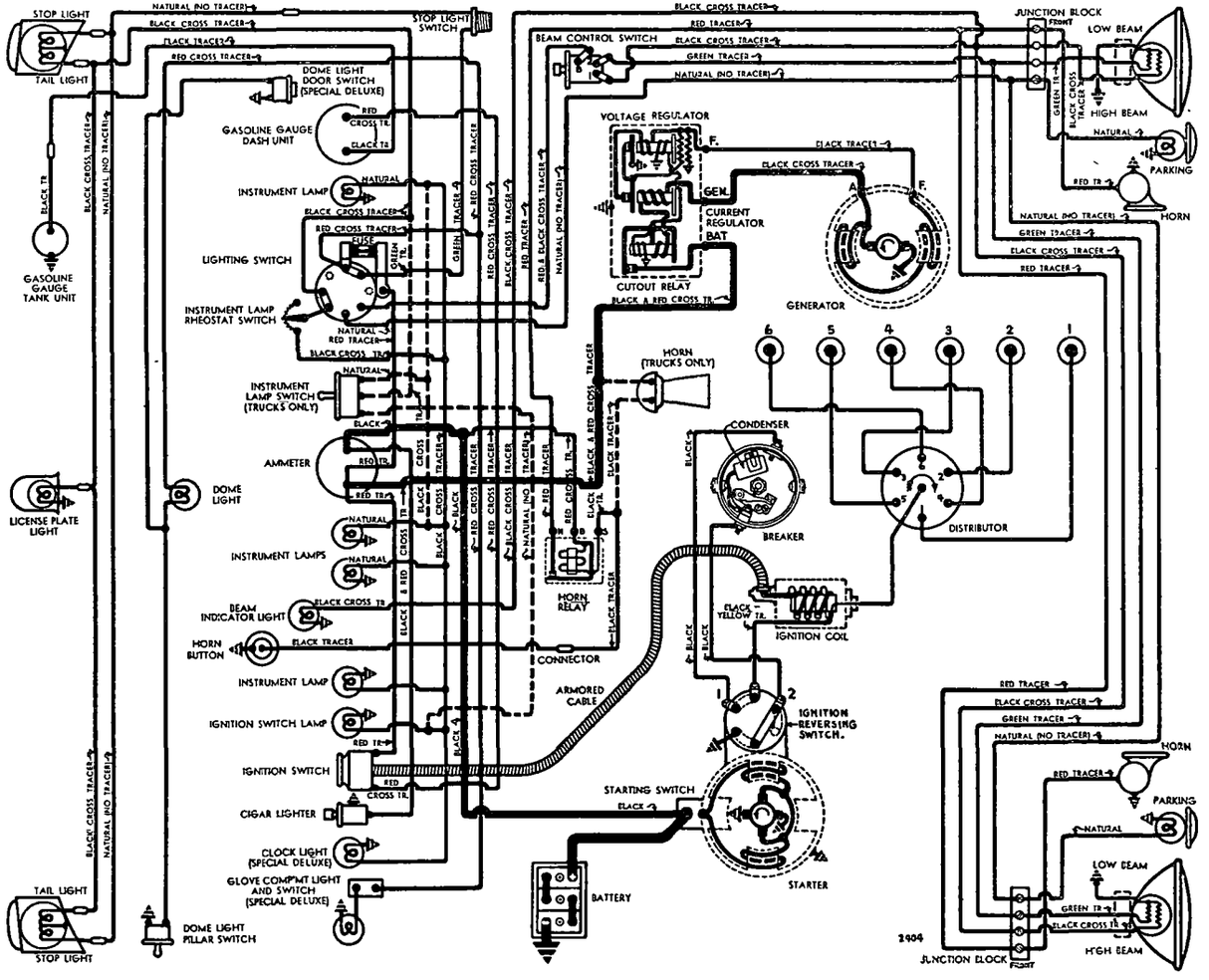
Timing (Neon Light)—Recommended method. Connect neon light to #1 spark plug, direct light on flywheel through inspection hole in right front face of housing. Set Octane Selector pointer at '0'. Idle engine, loosen advance arm clamp bolt, rotate distributor until ignition mark (steel ball insert in flywheel) lines up with pointer. Tighten clamp bolt and check Octane Selector setting.

Timing (Without Neon Light)—With #1 piston on compression, turn engine over until piston is 5° or .0091" before top dead center with ignition mark (steel ball insert in flywheel) at pointer in inspection hole in right front face of housing. Adjust distributor as directed above.

Octane Selector Setting—Set for slight ping when accelerating engine with wide open throttle. To adjust, loosen hold-down screw, move distributor and scale counter-clockwise to advance spark (if no ping), clockwise to retard spark (if too severe).

CAUTION—See that noise (like a ping) not caused by accelerator rod striking intake or exhaust manifold (at point where rod passes between manifolds).

CARBURETION:—**Carburetor**—Carter W-1 Model 483-S (Std.), 492-S (Econ. Engines). 1¼" downdraft type.



NOTE—483-S painted Black with Casting No. 421 on face of flange. 492-S Brown—Casting No. 432.

For complete data, refer to 1941 Carburetor Index.

Cab-over-Engine & Dubl Duti Panel—Carter BB, Model 489-S, 1¼" Updraft type.

For complete data, refer to 1941 Carburetor Index.

Idle Adjustment—With engine warm and choke valve wide open, set throttle stopscrew so engine idles at 450-500 RPM. Adjust idle adjusting screw so that engine fires smoothly (turn screw in for leaner mixture). Final setting should be 1-2 turns (483-S, 492-S), ½-1½ turns (489-S) out from inner seated position. Recheck idle speed.

Accelerating Pump Setting (489-S)—Throttle lever has two holes for pump link connection as follows: Inner Hole (Short Stroke)—Summer temperatures. Outer Hole (Long Stroke)—Winter temperatures.

Float Level (483-S, 492-S)—½" from top of float at free end to gasket seat on cover with valve closed (remove gasket and invert to check).

Float Level (489-S)—Top of float 1/32-1/16" below top edge of bowl (gasket removed) with valve seated.

Metering Rods & Jets—***See Carter and Carter (B&B) Jet Tables in Carburetor Section for complete data.***

Throttle Cracker:—Opens throttle ⅓ for starting.

Adjustment—With carburetor correctly set for 450-500 RPM. idle speed, loosen locknut and adjust bolt so that clearance between head of bolt and lug on starter pedal cross-shaft is ⅛", tighten locknut.

Air Cleaner:—AC No. 1529667 (Pass. Cars). Oil-wetted type Std., heavy duty oil-bath type Optl.

Fuel Pump:—AC Type AF diaphragm type Std. Replacement exchange pump No. 429.

For complete data, refer to 1941 Carb. Equip. Index.

Gasoline Gauge:—AC Electric. No. 1516293 (Dash Unit), No. 1516280 (Tank Unit—Pass. Cars).

For complete data, refer to 1941 Carb. Equip. Index.

MANIFOLD HEAT CONTROL:—Thermostatic type. Check when tuning engine. Spring should be wound up just enough to slip end over manifold pin (approx. ½ turn). CAUTION—Excessive tension may cause valve to stick, detonation, poor performance.

Anti-Rattle Spring Note—See 1940 Chevrolet T&E page for spring installation to correct rattles.

VALVE TIMING:—To Check—With tappet clearance of .006", #1 intake valve opens with piston 3° or .0032" before top dead center when point on flywheel approx. 1.158 teeth before 'U/C' mark lines up with indicator in right front face of housing.

Tappet Clearance:—.006-.008" Int., .013-.015" Exh. Hot (engine 'Normalized'). Use lower figure for ordinary service, higher figure for severe truck operation.

Fleet Economy Engines—.010" Int., .016" Exh. Hot.

All Trucks (Heavy Duty)—.010" Int., .020" Exh. Hot.

See Chevrolet Shop Notes in 'M' Section for Engine Normalizing instructions.

Valve Spring Pressure:—55 lbs. at 1 13/16" (valve closed), 128 lbs. at 1½" (valve open).

LUBRICATION:—Crankcase Capacity—5½ qts. (dry), 5 qts. (refill). **Normal Oil Pressure**—14 lbs. at 21 MPH. (Pass. Cars), 2000 RPM. (Trucks).

COOLING SYSTEM:—Capacity—14 qts. (except C-O-E), 16 qts. (with Optl. Engine), 16½ qts. (C-O-E Trucks).

Thermostat:—Harrison. In cylinder head outlet.

Setting—Begins to open at 142°F. (Std. type), 162° (All Econ. Engines & for permanent anti-freeze).

Temperature Gauge:—AC (not electric). No. 1511051.

BATTERY:—Delco Model 15X-3. 6 volt, 15 plate, 100 ampere hour capacity (20 hour rate).

Starting Capacity—120 amperes for 20 minutes.

Zero Capacity—300 amperes for 3.6 minutes. Five second voltage 4.2 volts.

Grounded Terminal—Negative (—) terminal.

Location—In engine compartment on right side (Pass. cars), under front floor on right side (Trucks).

Special Battery—Delco Model 19Q-3. 6 volt, 19 plate, 125 ampere hour capacity (20 hour rate).

Grounded Terminal & Location—Same as above.

STARTER:—Delco-Remy 1107033, 1107047 (all models), 1107038 (RHD Pass. Cars), Arm. No. 1867897 (1107033).

Drive—Overrunning clutch and manual pinion shift (1107033, 1107047), solenoid pinion shift (1107038).

Rotation—Counter-clockwise at commutator end.

Brush Spring Tension—24-28 ozs. each.

Cranking Engine—65 RPM., 150 amperes, 5.5 volts.

Performance Data

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	5000	5.0	65
12 "	Lock	3.37	525

Removal:—Starter flange mounted on right front face of flywheel housing. To remove, disconnect starting pedal linkage and Reversing Switch wires. Take out flange mounting screws, remove starter & switch.

Starting Switch (1107033, 1107047):—Delco-Remy No. 820052. On starter. Operated by starting pedal.

(1107038)—Delco-Remy Solenoid Switch No. 1546. On starter. Operated through relay in switch case by pushbutton switch No. 1996010 on instrument panel.

For complete data, refer to 1941 Elec. Equip. Index.

GENERATOR:—Delco-Remy 1102667 (Std.). Armature 1879002. Two brush type (Current&Voltage control).

Special Generators—For special service as follows: **1102677** (Door-to-door), **1106403** (City Police), **1105851** (State Police), **1106406** (Boston Police).

Charging Rate Adjustment—None. Charging rate controlled by Voltage Regulator, maximum output by Current Regulator. See Regulator data below.

Maximum Charging Rate (Std. Gen.)—38-40 amperes (cold), 7.3-7.7 volts, 2400 RPM., 25.5 MPH. (Pass. Cars). NOTE—Current Regulator limits maximum charging rate to 32-34 amperes. Actual charging rate controlled by Voltage Regulator.

Performance Date—Cold

	Amperes①	Volts	R.P.M.
1102667	30	8.0	1750
1102677	26	8.0	1450
1105851	40	8.0	1850
1106403, 6	35	8.0	1040

①—Not maximum output—See Current Regulator

Rotation—Counter-clockwise at commutator end.

Brush Spring Tension—25 ozs. each.

Field Current—1.67-1.82 amps. (1102667), 1.76-1.88 amps. (1102677), 1.82-1.94 amps. (1105851), 1.7-2.0 amps. (1106403, 1106406) at 6.0 volts.

Removal:—Generator pivot mounted at left front of engine. To remove, take out pivot and clamp bolts.

Belt Adjustment:—Swing generator away from engine until belt side play at point midway between generator and fan pulleys is 1½" (light pressure).

REGULATOR:—Delco-Remy 1118201 (1102667 Gen.), 1118233 (1102677 Gen.), 1118237 (1105851 Gen.), 1118229 (1106403, 6 Gens. with Neg. Grd.), 1118232 (1106403 Gen. with Pos. Grd.). Single Core Type. Vibrating Current & Voltage Regulator on dash.

For complete data, refer to 1941 Elec. Equip. Index.

CAUTION—Check generator for grounded field coils and leads before changing regulator settings to correct High Charging Rate or High Voltage.

Cutout Relay

Cuts In—6.2-6.7 volts hot.

Cuts Out—0-4.0 ampere discharge current.

Contact Gap—.020" (same for both sets).

Air Gap—.020" (with contacts just closed).

Voltage Regulator

Setting—7.2-7.4 volts (1118201), 7.0-7.2 volts (all others) at operating temperature (hot).

To Check—Connect ammeter in charging line at regulator 'BAT' terminal, voltmeter between this terminal and ground. Operate generator at 2800 RPM., adjust charging rate to 8-10 amperes (use variable rheostat or AVR set). With regulator hot (150°F.), decrease generator speed until cutout relay contacts open, then increase speed to 2800 RPM. and check hot voltage setting (above).

To Adjust—Change regulator armature spring tension slightly by bending hanger at lower end of **one spring only.** If further adjustment required, see Single Core Regulator article in Electrical Equipment section for other (2nd.) spring adjustment.

Air Gap—.070" between center of core and armature with contacts just closing (press down on armature to open contacts, release pressure, check gap at point where contacts just close).

Current Regulator

Setting—32-34 amperes (1118201), 34-36 (1118229, 1118232), 24-26 (1118233), 38-40 (1118237) at hot operating temperature.

To Check—Remove regulator cover, connect short jumper between Voltage Regulator frame and upper contact support bracket (to short out Voltage Regulator), connect ammeter in charging line at regulater 'BAT' terminal, turn on car lights and accessories. Operate generator and increase speed until output remains constant. With regulator hot (150°F), current reading should agree with setting (above).

To Adjust—Same as for Voltage Regulator (above).

Air Gap—.080" (check same as Voltage Regulator).

LIGHTING:—Headlamps—Guide 'Sealed Beam' type.

For complete data, refer to 1941 Elec. Equip. Index.

Headlamp Adjustment—Aim upper beam straight ahead (hot spot center 3" below lamp center height).

Beam Indicator—Dot on upper edge of speedometer dial (above '50'). Lighted when upper beams in use.

Direction Signal—***Refer to 1941 Elec. Equip. Index.***

Switches

Lighting—Delco-Remy 1994022 (Pass. Cars), 1994015 (Comm'l. & Truck), 1997718 (State Police), 1995013 (Army). NOTE—1994022 switch (Pass. Cars) has instrument light rheostat in switch handle.

Beam Selector—Delco-Remy 1997003, 1997002 (Can.),

Instrument (Comml. & Truck)—Delco-Remy 1404.

Stop Light—Delco-Remy 1997725.

Glove Comp't. Light—Delco-Remy 1997742.

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps	Sealed Beam	
Parking (Without Dir. Sig.)	3	63
Parking & Direc. Signal	21-3	1154
Instrument, Spdmtr.	1½	55
Clock, Glove Compt.	1½	55
Ign. Lock, Beam Indicator	1	51
Tail & Stop (See Note)	21-3	1154
Rear License Plate	3	63
Dome	6	82

NOTE—Separate 3 cp., No. 63 bulbs on Pickup & Sedan Dlvry (Stop light 15 cp., No. 87 on Sedan Dlvry).

FUSES:—Lighting—30 ampere. On back of light switch.

Clock—2 ampere. On clock.

HORNS:—Pass. Cars—Delco-Remy No. 1999533 (Low Note—RH.), 1999534 (High Note—LH.). Vibrator type twin horns operated by relay.

Trucks—Delco-Remy 1999801. Vibrator type single horn.

	Current (at 6 volts)	Air Gap
1999801	7-9 amperes	.027-.033"
1999533 (low note)	19-21 amperes	.044-.049"
1999534 (high note)	18-20 amperes	.034-.039"

Horn Relay (Pass. Cars):—Delco-Remy No. 1116775.

Contact Gap—.025". **Air Gap**—.015" (closed).

Contacts Close—2.75-4.0 volts.

CHRYSLER 1941

SIX, ROYAL & WINDSOR MODEL C28
AUTO-LITE ELECTRICAL SYSTEM

HOOD LOCK:—*See Chrysler Shop Notes in 'M' Section.*

SERIAL NUMBER:—On right front door hinge post. First number: Detroit—7,657,501 (Royal), 7,901,601 (Windsor), Canada—9,717,741 (Royal).

ENGINE NUMBER:—First number C28-1001. Stamped on left side of block between #1 and #2 cylinders.

COMPRESSION:—**Ratio**—6.8-1 or 6.5-1 cast-iron heads, 7.2-1 aluminum Optl. (7.2-1 std. on 7 pass.).
Pressure—140-150 lbs. at 1000 RPM or 115-125 lbs. at 125 RPM. cranking speed (for 6.8-1 head).

VACUUM READING:—Steady 18-20" idling (below 1000').

IGNITION:—**Auto-Lite Coil No. IG-4669 (Std.), IG-4671 (With Vacamatic Trans.).** Service winding (less switch and cable) IG-3224JS. Mounted on dash.
Ignition Current—2.25 amperes idling, 5 stopped.
Ignition Switch:—Mitchellock Model 30-R, No. 8794. NOTE—Switch has extra terminal for Transmission control (used with Vacamatic Transmission only).
Ignition Lock—Yale & Towne or Briggs & Stratton. B&S No. 80592. Key Series 1BP to 1000 BP. Groove 24.
Distributor Auto-Lite IGS-4113-1. Single breaker, 6 lobe cam, full automatic advance type with auxiliary vacuum spark control and manual adjustment.
Breaker Plate Identification—#7 stamped on plate
Breaker Gap—Set at .020".
Cam Angle or Dwell—38° closed, 22° open (distr. °).
Breaker Arm Spring Tension—17-20 ounces.
Rotation—Clockwise viewed from above.
Condenser—No. IG-3927A. Capacity .25-.28 mfd.

Distributor Automatic Advance		Engine	
Degrees	R.P.M.	Degrees	R.P.M.
Start	350	0	700
3	400	6	800
6	850	12	1700
9	1300	18	2600
12	1750	24	3500

Vacuum Spark Control—Integral type (on distributor, linked directly to breaker plate). Provides additional advance at speeds above idling except when engine accelerated or operated with wide open throttle (spark retarded by return spring in unit).

Vacuum Advance		
Distr. Degrees	Eng. Degrees	Vacuum (" of HG)
Start	0°	5"
1°	2°	6½"
3°	6°	9¼"
5°	10°	12⅛"
7°	14°	15"

Manual Adjustment—Provides for minor changes in ignition timing at distributor. See Ignition Timing
Distributor Removal:—Mounted on left side of crankcase. To remove, disconnect vacuum line, take out hold-down screw in lock plate. **Installation Note**—Install distributor with #1 piston in firing position (at TDC) and rotor opposite #1 segment in cap.

FIRING ORDER:—1-5-3-6-2-4. See diagram.

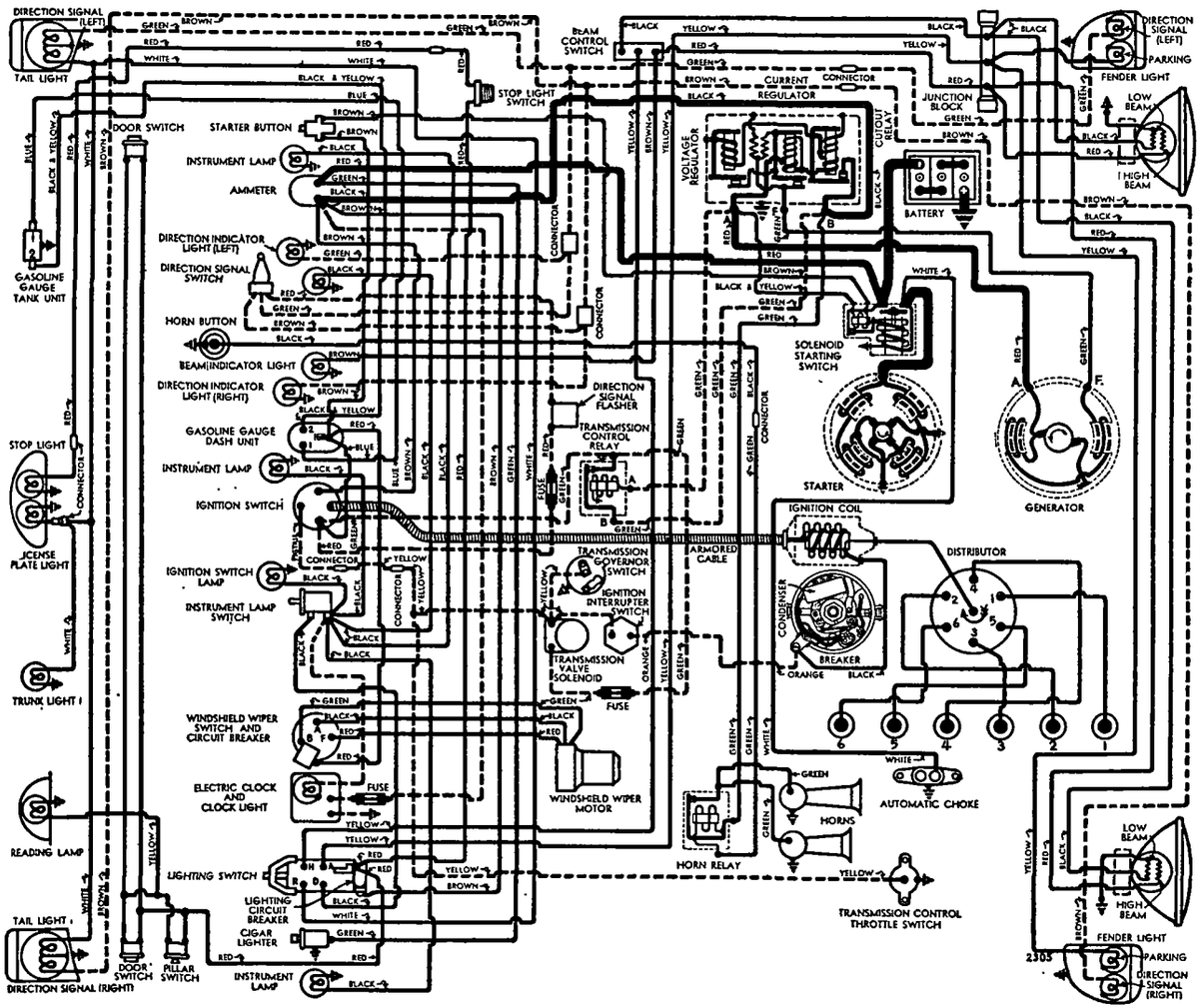
SPARK PLUGS:—Auto-Lite A-7B (Cast iron head), AL-7A (Aluminum head). 14 MM Metric type.
NOTE—Spark plug tightening tension 26-32 ft. lbs.
Spark Plug Gaps—Set at .025".

IGNITION TIMING:—Initial setting (correct for fuel of approx. 70 octane rating at low altitudes for all heads) shown below. See Manual Adjustment (following).

Flywheel Degrees	Piston Position
All Engines ..... 0° at TDC	..... 0000" at TDC.

NOTE—Impulse neutralizer marked 'DC' at TDC point with 15 (1°) graduations on either side.
Timing (Using Timing Light)—Connect timing light between distributor primary terminal and battery terminal on generator regulator. Set #1 or #6 piston in firing position (see setting above) with correct mark on impulse neutralizer aligned with pointer on chain case cover. Loosen lock-plate hold-down screw, center pointer on scale, tighten screw. Loosen lock-plate clamp bolt, rotate distributor until timing light just goes out, tighten clamp bolt. Check Manual Adjustment (following).
Timing (Using Synchroscope)—Tool C-374. Clip lead to #1 spark plug, direct light on impulse neutralizer (mark correct graduation with paint), idle engine and adjust distributor as directed above.
Manual Adjustment—Set to give slight ping from 10-30 MPH accelerating with wide open throttle from 10 MPH. To adjust, loosen lock-plate hold-down screw, move plate (not more than 4° or .007" before or after initial setting) counter-clockwise (if no ping noted), clockwise to retard spark (if ping too severe), tighten screw.

CARBURETION:—**Carburetor**—Carter (Ball & Ball) Models E6S2, E6S3, E6W1 (Std. Trans.), EA1 (Fluid Drive & Std. Trans.), E6T1, E6T2, E6U1, E6U2 (With Vacamatic Trans.). 1½" downdraft types.
For complete data, refer to 1941 Carburetor Index.
NOTE—EA1; E6T1, T2; E6U1, U2 models have dashpot (slow-closing throttle built in carburetor). Two type used (later type has solenoid control).
Idle Adjustment—With engine warm and running at slow idle speed (choke valve wide open, fast idle inoperative), set throttle stopscrew for idle speed of 6 MPH min. (Std.), 450 RPM or 4 MPH max. (Cars with Vacamatic Transmission). Adjust idle adjusting screw for smooth idle (½-1½ turns open, turn screw in for leaner mixture). Recheck idle speed.
NOTE—If vacuum gauge used, adjust for highest obtainable vacuum (see Vacuum Gauge data above).
Accelerating Pump Setting—Pump lever has three holes for pump link engagement. Set as follows:
Inner Hole (minimum stroke)—Extreme hot temperatures or altitudes above 3000 feet.
Center Hole (med. stroke)—Normal summer setting.
Outer Hole (max. stroke)—Winter temperatures.
Float Level—5/64" (all except EA1), 1/16" (EA1), from top of float (not seam) to top edge of bowl with valve seated. Check with tool C-449 (exc. EA1).
Metering Jet—*See Carter (B&B) Jet Table in Carburetor Section for complete data.*



NOTE—If lean metering jet (High Altitude calibration) used at lower altitudes for increased economy, speed and power are reduced (not recommended).

Slow-closing Throttle (EA1, E6T1, E6T2, E6U1, E6U2):
—*For complete data, refer to 1941 Carb. Equip. Index.*
Adjustment (First type only)—Turn adjusting screw above dashpot plunger in as far as possible, then back screw out 5 full turns for 7/32" stroke.

Fast Idle:—Built-in type. Not adjustable.

Automatic Choke:—Sisson Type AC-758B.
For complete data, refer to 1941 Carb. Equip. Index.

Air Cleaner:—AC #1529938 heavy duty oil-bath type.

Fuel Pump:—AC diaphragm type pump. Replacement Exchange Pump No. 505.
For complete data, refer to 1941 Carb. Equip. Index.

Gasoline Gauge:—Auto-Lite electric. No. NG-9704D (dash unit), No. NG-9329T (tank unit).
For complete data, refer to 1941 Carb. Equip. Index.

MANIFOLD HEAT CONTROL:—Thermostatic coil type. See that valve and shaft rotate freely. When installing coil, place inner end in slot in valve shaft, **wind free end up one turn only counter-clockwise** and hook end over stop.

VALVE TIMING:—**To Check**—With .014" (cold) tappet clearance #6 intake valve should open with #6 piston 12° or .063" BTDC with 12th graduation before DC mark on impulse neutralizer aligned with pointer. Reset tappet clearance at .008" hot.

Tappet Clearance:—.008" Intake, .010" Exh. (hot & idling). .002" add'l. exh. clearance desirable for sustained high speeds. NOTE—Self-locking tappet screws used. Remove right front wheel and lower wheel housing panel for access to valves.

Valve Spring Pressure:—40-45 lbs. at 1¾" (valve closed), 107-115 lbs. at 1⅜" (valve open).

LUBRICATION:—**Crankcase Capacity**—5 qts. (refill).
Normal Oil Pressure—30-45 lbs. at 30 MPH & above.

COOLING SYSTEM:—**Capacity**—18 quarts.
Thermostat—Bishop & Babcock or Fulton. In outlet on head. Starts to open 157-162°. Fully open 183°.
Temperature Gauge—Auto-Lite (Motometer) Vapor tension type. A-L Part No. H-9703.
For complete data, refer to 1941 Mech. Equip. Index.

VACAMATIC (UNDERDRIVE TYPE) TRANSMISSION CONTROL:—*For adjustments, refer to 1941 Mech. Equip. Index for 'Vacamatic Underdrive Transmission.'*

BATTERY:—**Willard Type WHT-2-17R.** 6 volt, 17 plate, 120 ampere hour capacity (20 hour rate).
Starting Capacity—152 amperes for 20 minutes.
Zero Capacity—300 amperes for 5.0 minutes. Five second voltage 4.4 volts.
Grounded Terminal—Positive (+) to engine.
Dimensions—Length 10¼". Width 7". Height 9⅜".
Location—Under hood in left fender shield.

STARTER:—**Auto-Lite MAX-4045, A. Arm. MAW-2030.**
Drive—Overrunning clutch (solenoid pinion shift).
Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—42-53 ozs. (new brushes).
Cranking Engine—125 RPM, 175 amperes, 5.4 volts.

Performance Data

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	5300	5.5	65
2.75 "	1630	5.0	200
5.5 "	970	4.5	300
8.7 "	600	4.0	400
12.0 "	300	3.5	500
16.5 "	Lock	3.	640
25.0 "	Lock	4.	880

Removal:—Flange mounted on left front face of flywheel housing. Disconnect wires (tape battery lead), remove oil filter tubes, filter and 2 starter bolts.

Starting Switch:—A-L Solenoid Switch Type SS-4703.
For complete data, refer to 1941 Elec. Equip. Index.

GENERATOR:—**Auto-Lite GDZ-4801A (Std.), GEB-4801A (City Police), GEG-4818A (City Police & Taxicab), GEG-4818B (State Police).** Two brush. With current and voltage regulation. Ventilated.
Armature Nos. GDZ-2006F (GDZ-4801A), GEB-2006F (GEB-4801A), GEG-2006F (GEG-4818B).
Charging Rate Adjustment—No adjustment at generator. Charging rate controlled by Voltage Regulator and maximum output by Current Regulator.
Maximum Charging Rate—As given in tables below reached at approx. 24 MPH (GDZ Gen.) and above with load or discharged battery (Current Regulator setting). Actual charging rate controlled by Voltage Regulator and dependent on battery condition.

Performance Data—GDZ-4801A

Cold Amperes	Volts	R.P.M.	Hot Amperes	Volts	R.P.M.
0	6.4	925	0	6.4	1000
5	6.65	1060	5	6.65	1150
10	6.85	1200	10	6.85	1290
15	7.05	1340	15	7.05	1430
20	7.3	1480	20	7.3	1590
25	7.55	1620	25	7.55	1750
30	7.8	1760	30	7.8	1980
35①	8.0	1900	35	8.0	2250

Performance Data—GEB-4801A

0	6.4	560	0	6.4	600
4	6.6	630	4	6.6	675
8	6.8	700	8	6.8	750
12	7.0	775	12	7.0	840
16	7.2	845	16	7.2	930
20	7.4	920	20	7.4	1030
24	7.6	1000	24	7.6	1140
28	7.8	1075	28	7.8	1260
32①	8.0	1150	32	8.0	1400

Performance Data—GEG-4818A, B

0	6.4	780	0	6.4	820
5	6.6	870	5	6.6	900
10	6.8	960	10	6.8	990
15	7.0	1040	15	7.0	1080
20	7.2	1130	20	7.2	1170
25	7.4	1220	25	7.4	1270
30	7.6	1310	30	7.6	1380
35	7.8	1410	35	7.8	1510
40①	8.0	1520	40	8.0	1680

①—Current regulator setting. See Regulator data.

Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—53 ounces max. (GDZ Gen.), 64-68 ozs. (GEB & GEG Gen.) with new brushes.
Field Current—1.60-1.78 amperes at 6.0 volts (all).
Motoring Current—4.16-4.60 amps. (GDZ Gen.), 4.0-4.5 amps. (GEB), 4.7-5.2 amps. (GEG) at 6.0 volts.

Removal:—Pivot mounted at left side of engine at front. To remove, take out pivot and clamp bolts.

Belt Adjustment:—Loosen pivot and clamp bolts, pull out on generator until belt is snug or 40-50 lbs. tension secured on scale attached to field frame.

REGULATOR:—**Auto-Lite VRP-4001A (GDZ Gen.), VRP-4001B (GEB Gen.), VRP-4001F (GEG Gen.).**
Current-Voltage types. In case on dash.
NOTE—For negative battery ground, VRP-4005A (GDZ Gen.), VRP-4005B (GEB), VRP-4005E (GEG)
For complete data, refer to 1941 Elec. Equip. Index.
NOTE—Regulator case cover sealed. Serviced on exchange basis if seals not broken (to remove cover).

Cutout Relay

Cuts In—6.4-6.6 volts at approx. 1000 gen. RPM (VRP-4001A,5A), 600 RPM (1B,5B), 820 RPM (1F,5E).
Cuts Out—4.8-5.6 volts (approx. 4-6 amps. disch.).
Contact Gap—.015" minimum.
Air Gap—.031-.034" with contacts open (check at hinge end of core).

Voltage Regulator

Setting—7.2-7.5 volts at 70° F. See Electrical Equipment Section for settings at other temperatures.
To Check (without breaking seals)—Connect ammeter in charging line at regulator 'B' terminal (use short heavy leads), voltmeter between 'B' terminal and ground. Operate generator at speed equivalent to 30 MPH., charging fully charged battery, until voltage is steady. Voltage reading should agree with setting given above.
To Adjust (with cover removed)—Change regulator armature spring tension by bending lower spring hanger slightly. See Electrical Equipment Section.
Contact Gap—.012" min. (armature against stop pin).
Air Gap—.048-.052" with contacts just opening.

Current Regulator

Setting (VRP-4001A, 5A)—34-36 amperes (marked '35' on cover). **(VRP-4001B, 5B)** 31-33 (marked '32' on cover). **(VRP-4001F, 5E)** 39-41 (marked '40').
To Check (without breaking seals)—Connect test meters as for voltage check (above). Operate generator at speed equivalent to 30 MPH. charging battery, turn on car lights and accessories or connect load (bank of headlamp bulbs etc.) between ammeter and battery so that generator charges at peak rate and Current Regulator operates. Current reading should agree with setting given above. If more than slight excess noted, regulator is defective.
Adjustment, Contact Gap, Air Gap—Same as for Voltage Regulator (above).

LIGHTING:—**Headlamps**—Corcoran-Brown 'Sealed Beam' type. *For data refer to Elec. Equip. Index.*
Headlamp Adjustment—Aim upper beam straight ahead (hot spot center 3" below lamp center height).
Beam Indicator—Small red light on instrument panel near speedometer. Lighted with upper beams on.
Direction Signal—*Refer to 1941 Elec. Equip. Index.*

Switches

Lighting—Chrysler No. 934519.
Beam Selector—Chrysler No. 859974.
Instrument—Chrysler No. 853371.
Direction Signal—Chrysler No. 865763, 939577.

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps		Sealed Beam
Front Dir. Sig. & Parking	21-3	1158
Instr., Glove Compt., Trunk	1½	55
Beam & Dir. Ind., Ign. Sw.	1	51
Rear Dir. Sig. & Tail	21-3	1158
Stop	21	1129
Rear License	3	63
Reading or Dome	15	87

LIGHTING CIRCUIT BREAKER:—Vibrating, thermostatic type. Mounted on lighting switch.

FUSES:—**Clock**—2 ampere. In connector behind clock.
Vacamatic Transmission Control—30 ampere. In wire fuse connector on left side of engine dash.
Direction Signal (late cars)—30 amp. Behind instr. panel in wire from ignition switch to flasher.

HORNS:—**Single**—Delco-Remy No. 1999911 (low note) 1999918 (High Note) or Auto-Lite HA-4001 Std.
Dual—Auto-Lite HO-5003 set operated by relay.
Current Draw—Approx. 7 amps. single, 35-40 dual.
Horn Relay:—Auto-Lite Model HRC-4001 (no fuse).
Contacts Close—1.5-3.0 volts. **Open**—.5 volt.
Contact Gap—.026". **Air Gap**—.016-.020" (closed).

WINDSHIELD WIPER:—**Auto-Lite EWD-5001, 5003 (Conv. Coupe).** Electric type with circuit-breaker
For complete data, refer to 1941 Mech. Equip. Index.
Circuit Breaker—Vibrating, thermostatic type. Starts to operate with current of 12 amperes.

CONVERTIBLE TOP CONTROL:—Electric type.
For complete data, refer to 1941 Mech. Equip. Index.

HOOD LOCK:—*See Chrysler Shop Notes in 'M' Section.*

SERIAL NUMBER:—On right front door hinge post. First Number 6,756,501 (Saratoga), 6,624,101 (New Yorker), 7,807,101 (Crown Imperial).

ENGINE NUMBER:—C30-1001 Up (C30), C-33-1001 (C33). On left side of block between #2 & 3 cylinders.

COMPRESSION:—**Ratio**—6.8-1. NOTE—Head material Cast Iron (Std. C30), Aluminum (Std. C33, Optl. C30). **Pressure**—150-160 lbs. at 1000 RPM or 120-130 lbs. at cranking speed of 125 RPM.

VACUUM READING:—Steady 18-20" idling (below 1000').

IGNITION:—**Auto-Lite Coil No. CE-4650.** Service winding (less switch & cable) CE-3224JS. On engine dash.

Ignition Current—2.25 amperes idling, 5 stopped.

Ignition Switch:—Mitchellock Model 24-R. No. 8052.

Ignition Lock—Yale & Towne or Briggs & Stratton. B&S No. 80592. Key Series 1BP to 1000BP. Groove #24.

Distributor Auto-Lite IGT-4103-1 (C30), IGT-4103A-1 (C33). Single breaker, 8 lobe cam, full automatic advance type with auxiliary vacuum spark control and manual adjustment (at distributor).

Breaker Plate Identification—#8 (IGT-4103-1), #6 (IGT-4103A-1) stamped on plate.

Breaker Gap—Set at .018". Limits .016-.020".

Cam Angle—27° closed, 18° open (.017" gap).

Breaker Arm Spring Tension—17-20 ounces.

Rotation—Clockwise viewed from the top.

Condenser—No. IG-3927A. Capacity .25-.28 mfd.

Automatic Advance

Distributor		Engine	
Degrees	R.P.M.	Degrees	R.P.M.
Start	350	0	700
3	400	6	800
6	850	12	1700
9	1300	18	2600
12	1750	24	3500

Vacuum Spark Control—Integral type (on distributor, linked directly to breaker plate). Provides additional advance at speeds above idling except when engine accelerated or operated with wide open throttle (spark retarded by return spring in unit).

Vacuum Advance—IGT-4103-1

Distr. Degrees	Eng. Degrees	Vacuum (" of HG)
Start	0°	5"
2°	4°	8"
4°	8°	11"
6°	12°	14"
8°	16°	17"

Vacuum Advance—IGT-4103A-1

Start	0°	5"
1°	2°	7"
3°	6°	11"
5°	10°	15"
6°	12°	17"

Manual Adjustment—Provides for minor changes in ignition timing at distributor. See Ignition Timing

Distributor Removal:—Mounted on left side of crankcase. To remove, disconnect vacuum line, take out hold-down screw in lock plate. **Installation Note**—Install distributor with #1 piston in firing position and rotor opposite #1 segment in cap.

FIRING ORDER:—1-6-2-5-8-3-7-4. See diagram.

SPARK PLUGS:—Auto-Lite A-7B (Cast iron head), AL-7A (Aluminum head). 14 MM Metric type. NOTE—Spark plug tightening tension 26-32 lbs.

Spark Plug Gaps—Set at .025".

IGNITION TIMING:—Initial setting (correct for fuel of approx. 70 octane rating at low altitudes for all heads) shown below. See Manual Adjustment (following).

	Flywheel Degrees	Piston Position
6.8-1 cast-iron head	0° at TDC	.0000" TDC
6.8-1 aluminum hd	3° BTDC.	.0038" BTDC

NOTE—Impulse neutralizer marked at TDC with 15 (1°) graduations on either side.

Timing (Using Timing Light)—Connect timing light between distributor primary terminal and battery terminal on generator regulator. Set #1 or #8 piston in firing position (see setting above) with correct mark on impulse neutralizer aligned with pointer on chain case cover. Loosen lock-plate hold-down screw, center pointer on scale, tighten screw. Loosen lock-plate clamp bolt, rotate distributor until timing light just goes out, tighten clamp bolt. Check Manual Adjustment (following).

Timing (Using Synchroscope)—Tool C-374. Clip lead to #1 spark plug, direct light on impulse neutralizer (mark correct graduation with paint), idle engine and adjust distributor (as above)

Manual Adjustment—Set to give slight ping from 10-30 MPH accelerating with wide open throttle from 10 MPH. To adjust, loosen lock-plate hold-down screw, move plate (not more than 4° or .007" before or after initial setting) counter-clockwise (if no ping), clockwise to retard spark (if too severe).

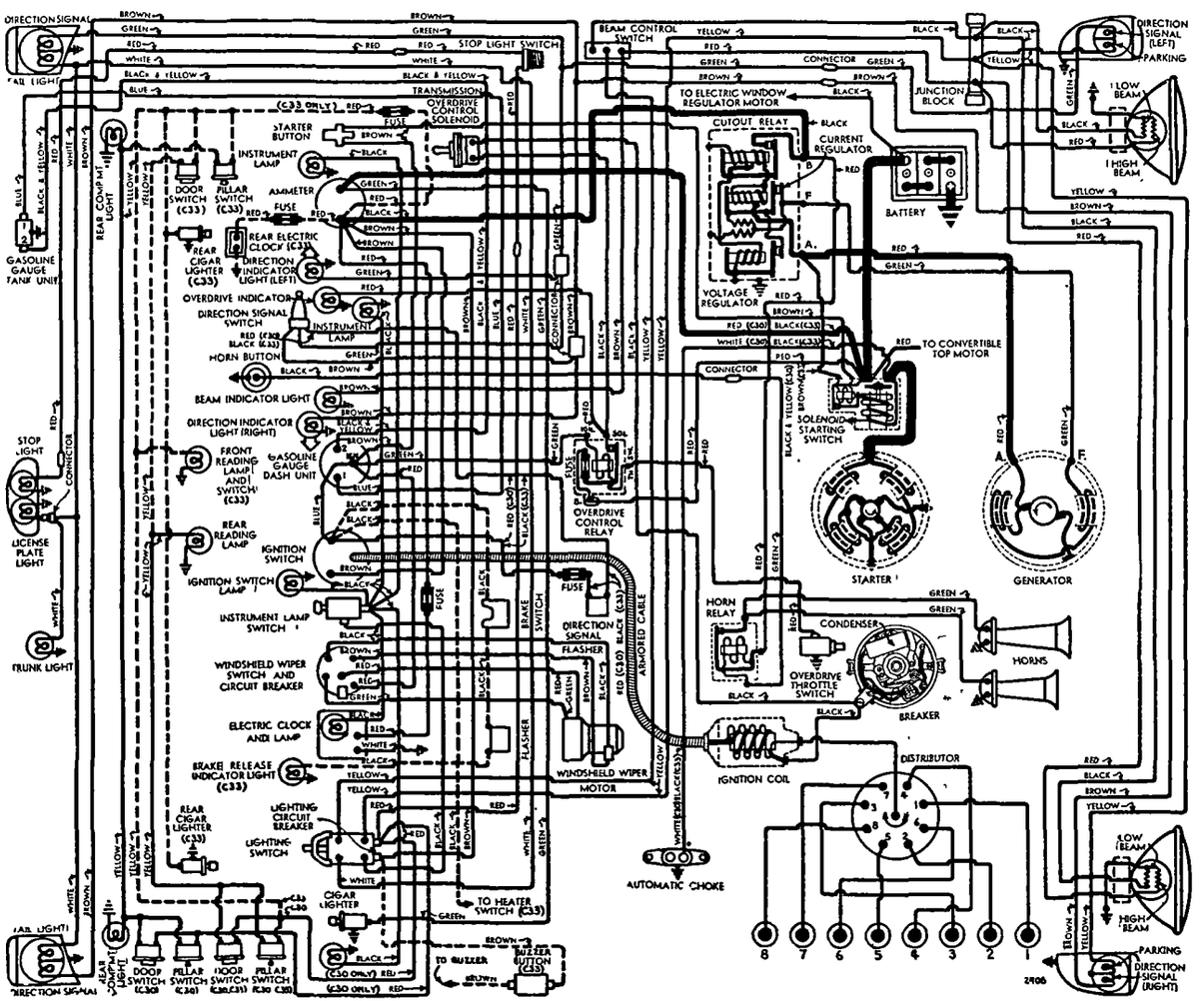
CARBURETION:—**Carburetor**—Stromberg Model AAV-2, No. 380041 (Code No. 4-103), Chrysler No. 863619. 1¼" duplex downdraft with Sisson Automatic Choke. ***For complete data, refer to 1941 Carburetor Index.***

Idle Adjustment—With engine warm and running at slow idle speed (choke valve wide open, fast idle inoperative), set throttle stopscrew for idle speed of 6 MPH. min. Adjust both idle screws (one for each barrel—adjust exactly alike) for smooth idle (turn screws in for leaner mixture). Recheck idle speed. NOTE—If vacuum gauge used, adjust for highest obtainable vacuum (see Vacuum Gauge data above).

Accelerating Pump Setting—Throttle lever has two holes for pump link engagement. Set as follows: Inner Hole (short stroke)—Extreme hot weather. Outer Hole (long stroke)—Winter temperatures.

Float Level—Fuel level 5/8" below top edge of bowl (even with bottom of sight hole on side of bowl) with engine idling (4 lbs. pressure).

Metering Jet—***See Stromberg Jet Table in Carburetor Section for complete jet data.***



Fast Idle:—Rotary cam, adjustable type.
For complete data, refer to 1941 Carb. Equip. Index.
Setting—Adjust connector rod so choke valve ⅛" open with fast idle screw against first step on cam.
Automatic Choke:—Sisson Type AC-600.
For complete data, refer to 1941 Carb. Equip. Index.
Throttle Guard (Cars with Fluid Drive):—Vacuum operated throttle kicker prevents engine stalling.
For complete data, refer to 1941 Carb. Equip. Index.
Setting—.010" clearance between cross-shaft lever adjusting screw and throttle control plunger with engine idling at correct hot or slow idling speed.
Air Cleaner:—AC #1529941 heavy duty oil-bath type
Fuel Pump:—AC diaphragm type. Replacement Exchange Part No. 514.
For complete data, refer to 1941 Carb. Equip. Index.
Gasoline Gauge:—Auto-Lite electric. No. NG-9704D (dash unit), No. NG-9330T (tank unit).
For complete data, refer to 1941 Carb. Equip. Index.
MANIFOLD HEAT CONTROL:—Thermostatic coil type. See that valve and shaft rotate freely. When installing coil, place inner end in slot in valve shaft, **wind free end up one turn only counter-clockwise**
VALVE TIMING:—**To Check**—With .011" (cold) tappet clearance #8 intake valve should open with #8 piston 6° or .0170" BTDC with 8th graduation before DC mark on impulse neutralizer aligned with pointer on chain cover. Reset tappet clearance at .008" hot.
Tappet Clearance:—.008" Intake, .010" Exh. (hot and idling). .002" add'tl. exh. clearance desirable for sustained high speeds. NOTE—Self-locking tappet screws used. Remove right front wheel and lower wheel housing panel for access to valves.
Valve Spring Pressure:—52-58 lbs. at 2 1/32" (valve closed), 129-137 lbs. at 1 21/32" (valve open).
LUBRICATION:—**Crankcase Capacity**—6 qts. (refill).
Normal Oil Pressure—30-45 lbs. at 30 MPH & above.
COOLING SYSTEM:—**Capacity**—24 quarts.
Thermostat—Bishop & Babcock or Fulton. In outlet on head. Starts to open 157-162° F. Fully open 183°.
Temperature Gauge—Auto-Lite (Motometer) Vapor tension type. Auto-Lite Part No. H-9703.
For complete data, refer to 1941 Mech. Equip. Index.
VACAMATIC (OVERDRIVE TYPE) TRANSMISSION CONTROL:—Standard C33, Optl. Equipment C30.
For complete data, refer to 1941 Mech. Equip. Index.
BATTERY:—**Willard Type WHT-2-19R.** 6 volt, 19 plate, 135 Ampere Hour capacity (20 hour rate).
Starting Capacity—171 amperes for 20 minutes.
Zero Capacity—300 amperes for 5.8 minutes. Five second voltage 4.5 volts.
Grounded Terminal—Positive (+) to engine.
Dimensions—Length 10 5/16". Width 7". Height 9⅜".
Location—Under hood in left fender shield.
STARTER:—**Auto-Lite MAX-4045, A. Arm. MAW-2030.**
Drive—Overrunning clutch (solenoid pinion shift).
Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—42-53 ozs. (new brushes).
Cranking Engine—125 RPM, 175 amperes, 5.4 volts.

Performance Data

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	5300	5.5	65
0.65 "	3300	5.5	100
2.75 "	1630	5.0	200
5.5 "	970	4.5	300
8.7 "	600	4.0	400
12.0 "	300	3.5	500
16.5 "	Lock	3.	640
25.0 "	Lock	4.	880

Removal:—Flange mounted on left front face of flywheel housing. Disconnect wires (tape battery lead), remove oil filter tubes, filter and 2 starter bolts.
Starting Switch:—A-L Solenoid Switch Type SS-4703.
For complete data, refer to 1941 Elec. Equip. Index.
GENERATOR:—**Auto-Lite GDZ-4801A (C30 Std.), GEG-4818C (C30,C33 Std.), GEG-4818A (C30 City Police), GEG-4818B (C30 State Police), GEB-4801A (C30, C33 Police).** Two brush. With current & voltage regulation. Ventilated.
Armature Nos.—GDZ-2006F (GDZ-4801A), GEB-2006F (GEB-4801A), GEG-2006F (GEG-4818B&C).
Charging Rate Adjustment—No adjustment at generator. Charging rate controlled by Voltage Regulator and maximum output by Current Regulator.
Maximum Charging Rate—35 amperes (C30 GDZ Gen.), 8.0 volts, 2200 Gen. RPM or approx. 24 MPH, 40 amperes (C33 GEG Gen.), 8.0 volts, 1700 Gen. RPM or approx. 18 MPH and above with load or discharged battery (Current Regulator setting). Actual charging rate controlled by Voltage Regulator and dependent on battery condition.

Performance Data—GEB-4801A, GEG-4818A,B
See Chrysler Model C28 page (preceding) for data.

Performance Data—GDZ-4801A

Cold			Hot		
Amperes	Volts	R.P.M.	Amperes	Volts	R.P.M.
0	6.4	925	0	6.4	1000
5	6.65	1060	5	6.65	1150
10	6.85	1200	10	6.85	1290
15	7.05	1340	15	7.05	1430
20	7.3	1480	20	7.3	1590
25	7.55	1620	25	7.55	1750
30	7.8	1760	30	7.8	1980
35①	8.0	1900	35	8.0	2250

Performance Data—GEG-4818C

0	6.4	780	0	6.4	820
5	6.6	870	5	6.6	900
10	6.8	960	10	6.8	990
15	7.0	1040	15	7.0	1080
20	7.2	1130	20	7.2	1170
25	7.4	1220	25	7.4	1270
30	7.6	1310	30	7.6	1380
35	7.8	1410	35	7.8	1510
40①	8.0	1520	40	8.0	1680

①—Current regulator setting. See Regulator data.
Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—53 ounces max. (GDZ Gen.), 64-68 ozs. (GEB & GEG Gen.) with new brushes.
Field Current—1.60-1.78 amperes at 6.0 volts (all).
Motoring Current—4.16-4.60 amps. (GDZ Gen.), 4.0-4.5 amps. (GEB), 4.7-5.2 amps. (GEG) at 6.0 volts.
Removal:—Pivot mounted at left side of engine at front. To remove, take out pivot and clamp bolts.
Belt Adjustment:—Loosen pivot and clamp bolts, pull out on generator until belt is snug or 40-50 lbs. tension secured on scale attached to field frame.
REGULATOR:—**Auto-Lite VRP-4001A (GDZ Gen.), VRP-4001B (GEB Gen.), VRP-4001F (GEG Gen.). Current-Voltage types.** In case on dash.
NOTE—For negative battery ground, VRP-4005A (GDZ Gen.), VRP-4005B (GEB), VRP-4005E (GEG)
For complete data, refer to 1941 Elec. Equip. Index.
NOTE—Regulator case cover sealed. Serviced on exchange basis if seals not broken (to remove cover).

Cutout Relay

Cuts In—6.4-6.6 volts at approx. 1000 gen. RPM (VRP-4001A,5A), 600 RPM (1B,5B), 820 RPM (1F,5E).
Cuts Out—4.8-5.6 volts (approx. 4-6 amps. disch.).
Contact Gap—.015" minimum.
Air Gap—.031-.034" with contacts open (check at hinge end of core).

Voltage Regulator

Setting—7.2-7.5 volts at 70° F. See Electrical Equipment Section for settings at other temperatures.
To Check (without breaking seals)—Connect ammeter in charging line at regulator 'B' terminal (use short heavy leads), voltmeter between 'B' terminal and ground. Operate generator at speed equivalent to 30 MPH., charging fully charged battery, until voltage is steady. Voltage reading should agree with setting given above.
To Adjust (with cover removed)—Change regulator armature spring tension by bending lower spring hanger slightly. See Electrical Equipment Section.
Contact Gap—.012" min. (armature against stop pin).
Air Gap—.048-.052" with contacts just opening.

Current Regulator

Setting (VRP-4001A, 5A)—34-36 amperes (marked '35' on cover). **(VRP-4001B, 5B)** 31-33 (marked '32' on cover). **(VRP-4001F, 5E)** 39-41 (marked '40').
To Check (without breaking seals)—Connect test meters as for voltage check (above). Operate generator at speed equivalent to 30 MPH. charging battery, turn on car lights and accessories or connect load (bank of headlamp bulbs etc.) between ammeter and battery so that generator charges at peak rate and Current Regulator operates. Current reading should agree with setting given above. If more than slight excess noted, regulator is defective.
To Adjust (with cover removed)—Same as for Voltage Regulator (above).
Contact Gap & Air Gap—Same as Voltage Regulator.
LIGHTING:—**Headlamps**—Corcoran-Brown 'Sealed Beam' type. *For data refer to Elec. Equip. Index.*
Headlamp Adjustment—Aim upper beam straight ahead (hot spot center 3" below lamp center height).
Beam Indicator—Small red light on instrument panel near speedometer. Lighted with upper beams on.
Direction Signal—*Refer to 1941 Elec. Equip. Index.*

Switches

Lighting—Chrysler No. 934519.
Beam Selector—Chrysler No. 859974.
Instrument—Chrysler No. 853371.
Direction Signal—Chrysler No. 865763, 939577.

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps		Sealed Beam
Front Dir. Sig. & Parking	21-3	1158
Instr., Glove Compt., Trunk	1½	55
Beam & Direct. Indicators	1	51
Trans'n Ind., Ign. Sw.	1	51
Hand Brake Indic. (C33)	21	1129
Rear Dir. Sig. & Tail	21-3	1158
Stop	21	1129
Rear License	3	63
Reading or Dome	15	87
Corner (C33)	6	81

LIGHTING CIRCUIT BREAKER:—Vibrating, thermostatic type. Mounted on lighting switch.
FUSES:—**Clock**—2 ampere. In connector behind clock.
Rear Clock (C33)—2 amp. Adjacent to ammeter.
Body Wiring (C33)—30 amp. Adjacent to ammeter.
Vacamatic Transmission Control—20 ampere. On relay case on left side of engine dash.
HORNS:—**Auto-Lite HC-5105 Horn Set.** Electric vibrator, air tone dual horns operated by relay.
Current Draw—Approx. 35-40 amperes.
Horn Relay:—Auto-Lite Model HRC-4001 (no fuse).
Contacts Close—1.5-3.0 volts. **Open**—.5 volt.
Contact Gap—.026". **Air Gap**—.016-.020" (closed).
WINDSHIELD WIPER:—**Auto-Lite EWD-5001, 5003 (Conv. Coupe).** Electric type with Circuit Breaker.
For complete data, refer to 1941 Mech. Equip. Index.
Circuit Breaker—Vibrating, thermostatic type. Starts to operate with current of 12 amperes.
CONVERTIBLE TOP CONTROL:—Electric type.
For complete data, refer to 1941 Mech. Equip. Index.
WINDOW REGULATORS (C33):—Hydro-electric type.
For complete data, refer to 1941 Mech. Equip. Index.

ENGINE NOTE:—Engine is two cylinder, horizontally opposed type with connecting rods on individual crankpins so that both pistons move in and out together. Cylinders fire alternately at 360° intervals (one complete revolution between firing points).

SERIAL NUMBER:—First number 390-30000. Stamped on front face of cowl below battery shelf (in engine compartment).

ENGINE NUMBER:—First number C-21000. Stamped on top center of engine block at rear of carburetor.

COMPRESSION:—**Ratio**—5.6-1 Std. No Optional ratios. **Pressure**—80 lbs. at cranking speed.

VACUUM READING:—No means of connecting gauge.

IGNITION:—**Coil Model IG-4065.** Mounted on battery shelf between battery and gasoline tank. Service Coil IG-4070.

Ignition Current—2 amperes idling, 5 stopped.

Ignition Switch:—Douglas No. 2980.

Distributor Model IGW-4142-A. Single breaker, two lobe cam, full automatic advance type.

Breaker Gap—.020".

Rotation—Clockwise viewed from the top.

Cam Angle or Dwell—46° closed, 134° open.

Breaker Arm Spring Tension—17-20 ozs.

Condenser—No. IGB-1025. Capacity .20-.25 mfds.

Automatic Advance

Distributor		Engine	
Degrees	R.P.M.	Degrees	R.P.M.
Start	300	0	600
3	480	6	960
6	650	12	1300
10	1475	20	2950
14	2300	28	2600

Removal:—Distributor mounted on top of engine on left side. To remove, take out hold-down screw in advance arm, lift distributor out.

FIRING ORDER:—1-2. Cylinders fire alternately at intervals of 360° (one complete revolution of the crankshaft).

SPARK PLUGS:—Auto-Lite A-5. 14 MM. Metric.

Spark Plug Gaps—.025".

IGNITION TIMING:—Standard setting below correct for fuel of 76 Octane Rating. See Final Adjustment (following) for correction dependent on fuel used.

To Set Timing—Turn engine over until piston reaches firing position when half-round notch in rim of flywheel is ½-⅝" ahead of small rib on top center of crankcase. Loosen advance arm clamp screw, rotate distributor until contacts just begin to open, tighten clamp screw. See that distributor cap terminal which is in line with rotor is connected to spark plug in cylinder entering power stroke (flywheel mark will be at indicator at firing point for each cylinder on alternate revolutions of the crankshaft).

Final Adjustment—If Ethyl fuel, or fuel of better than 76 Octane Rating used, loosen advance arm clampscrew and rotate distributor so as to advance timing until slight 'ping' secured when engine pulling under load.

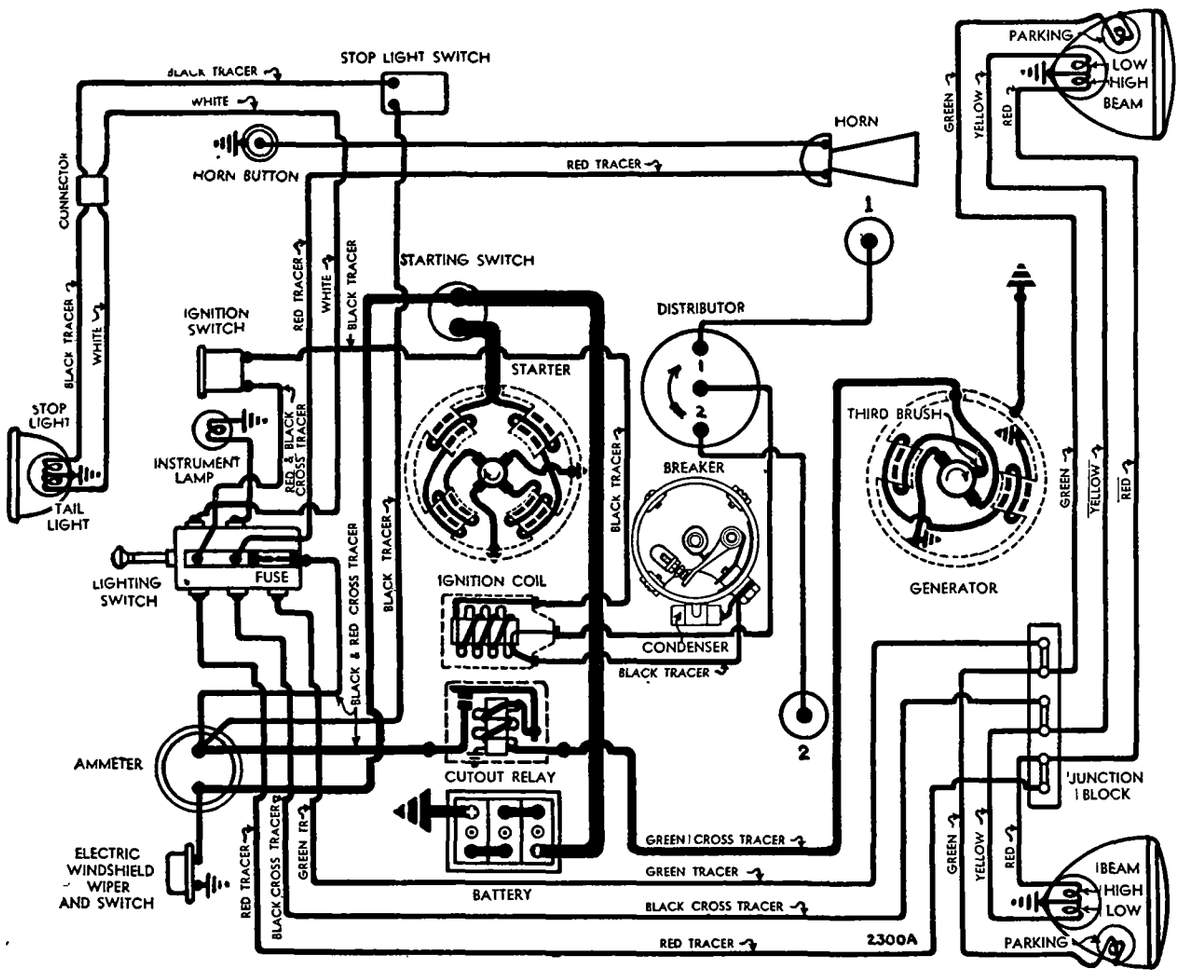
CARBURETION:—**Carburetor**—Tillotson Model DY-1A. 1", plain tube, single barrel downdraft type with low and high speed adjustments.

For complete data, refer to Carburetor Index.

ADJUSTMENT NOTE—If carburetor out of adjustment so that engine can not be warmed up, make preliminary adjustment as given below, then run engine until warm before making adjustments.

Preliminary Adjustment—Turn main (high speed) adjusting screw in or clockwise lightly until it is seated, then back adjusting screw out exactly two full turns. Turn idle (low speed) adjusting screw in or clockwise lightly until seated, then back adjusting screw out exactly one full turn. Start engine and run until thoroughly warm, then adjust as follows:

High Speed (Main) Adjustment—Open throttle so that engine runs at speed of 30-35 M.P.H. Turn main adjusting screw in or clockwise slowly (¼ turn at a time) until engine slows down due to lack of fuel, then turn adjusting screw out very slowly (⅛ turn at a time) until maximum speed is secured. Correct setting is approximately 1½-1¾ turns of the screw from the inner seated position.



Low Speed (Idle) Adjustment—Close throttle, set throttle lever stopscrew so that engine idles faster than normal. Turn idle adjusting screw in or clockwise slowly until engine begins to miss, then turn screw out until engine fires smoothly. Open throttle momentarily to clear manifold, recheck idle adjustment. Correct setting is approximately ¾-1¼ turns of the screw from the inner seated position. Adjust throttle lever stopscrew for high gear idling speed of 7 M.P.H.

Air Cleaner:—Oil-wetted type.

Fuel Pump:—AC Type R. No. GP-10208. Diaphragm type. Driven from front end of camshaft.
For complete data, refer to 1941 Carb. Equip. Index.

MANIFOLD HEAT CONTROL:—No adjustment.

VALVE TIMING:—**To Check Timing**—Intake valve should open when point on flywheel 5.5 teeth before TDC mark (half-round notch in flywheel rim) lines up with small rib cast on top center of crankcase. Exhaust closing point is 5.5 teeth past TDC mark.

Tappet Clearance:—.006-.0065" Intake, .008-.0085" Exhaust (Cold). No adjustment.

Valve Spring Pressure:—20 lbs. at 1½" (closed), 41 lbs. at 1 15/64" (open). Free length 1 27/32".

LUBRICATION:—**Crankcase Capacity**—3 quarts.
Normal Oil Pressure—30-45 lbs. (warm oil).

COOLING SYSTEM:—Air-cooled by suction fan built in flywheel. Fan capacity 700 cu. ft. per minute at 3600 R.P.M.

BATTERY:—**Auto-Lite Model AB-13.** 6 volt, 13 plate, 80 ampere hour capacity (20 hour rate).
Starting Capacity—96 amperes for 20 minutes.
Zero Capacity—300 amperes for 2.0 minutes.
Grounded Terminal—Positive (+) terminal grounded to right hand side of cowl. **Engine Ground**—Strap between engine and frame cross-member at front engine mounting on right hand side.
Location—On shelf on front of cowl in engine compartment on right hand side.
Dimensions—Length 9". Width 7". Height 8⅝".

STARTER:—**Model MZ-4077. Armature No. MZ-2085.**
Drive—Compression Type Bendix No. RCBX11-10.
Rotation—Clockwise at commutator end.
Brush Spring Tension—42-53 ozs. (new brushes).

Performance Data

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	4300	5.5	70
.65 "	2500	5.5	100
2.55 "	1325	5.0	200
4.95 "	750	4.5	300
7.65 "	220	4.0	400
7.80 "	Lock	3.0	420
11.80 "	Lock	4.0	560

Removal:—Starter cradle mounted on top of flywheel housing. To remove, take out starting motor top plate (in driver's compartment), disconnect cable, take out two bolts in starter clamp band, lift starter out.

Starting Switch:—Model SW-4001. Manual type mounted on toeboard.

GENERATOR:—**Model GBM-4619-5. Armature GBM-2066.** Third brush control type. No ventilation.
Charging Rate Adjustment—Remove commutator cover band, shift third brush by hand clockwise to increase, or counter-clockwise to decrease, charging rate. Brush held in position by friction.
Maximum Charging Rate—12 amperes, 8.0 volts.

Performance Data

Cold			Hot		
Amperes	Volts.	R.P.M'	Amperes	Volts	R.P.M.
0	6.4	850	0	6.4	900
2	6.6	960	2	6.65	1040
4	6.75	1030	4	6.9	1180
6	7.05	1160	6	7.2	1330
8	7.25	1265	8	7.4	1500
10	7.45	1380	10	7.7	1720
12	7.7	1510	12	7.9	2080
14	7.9	1740	12.45	8.0	2400
15	8.0	2300			

Rotation—Clockwise at commutator end.
Brush Spring Tension—50-60 ozs.
Field Current—3.8-4.2 amperes at 6.0 volts.
Motoring Current—5.3-5.9 amperes at 6.0 volts.

Removal:—Generator flange mounted on timing gear cover and driven directly from front end of crankshaft. To remove, disconnect lead, take out four flange mounting capscrews, remove generator from below.

CUTOUT RELAY:—**Model CB-4025.** Mounted on shelf on front of cowl between battery and gasoline tank.
For complete data, refer to Electrical Equipment Index.
Cuts In—6.5-7.25 volts.
Cuts Out—.5-2.5 ampere discharge current (after charging at 15 amperes).
Contact Gap—.015-.045".
Air Gap—.010-.030" with contacts closed.

LIGHTING:—**Headlamps**—Moto-lamp type with upper and lower beams controlled by lighting switch.
Headlamp Adjustment—Aim each headlamp so that hot spot centered on vertical line directly ahead of each lamp center and upper edge of hot spot on horizontal line at lamp center height.

Switches

Lighting—Douglas No. 5731.

Bulb Specfications

Position	Candlepower	Mazda No.
Headlights	32-21	2320C
Parking, Instrument	1.5	55
Stop & Tail	21-3	1158

FUSES:—**Lighting**—One 20 ampere. On switch.

HORN:—**Sparton.** Disc type vibrator horn.
Current—5 amperes.

HOOD LOCK—*See Chrysler Shop Notes in 'M' Section.*

SERIAL NUMBER:—On right front door hinge post. First number: Detroit—5,720,401 (Custom), 6,096,001 (Deluxe), Canada—9,373,196 (Custom).

ENGINE NUMBER:—First number S8-1001. Stamped on left side of block between #1 and #2 cylinders.

COMPRESSION:—**Ratio**—6.8-1 cast-iron hd. std., 7.2-1 aluminum hd. optl. (7.2-1 std. on 7 pass.).
Pressure—145-155 lbs. at 1000 RPM or 115-125 lbs. at 125 RPM cranking speed (for 6.8-1 head). Reading should not vary more than 10 lbs. between cyls.

VACUUM READING:—Steady 18-20" idling (below 1000').

IGNITION:—**Auto-Lite Coil No. IG-4669 (Std.), IG-4671 (with Simplimatic Trans.).** Service winding (less switch and cable) IG-3224JS. Mounted on dash.
Ignition Current—2.25 amperes idling, 5 stopped.
Ignition Switch:—Mitchellock Model 30-R, No. 8794. NOTE—Switch has extra terminal for Transmission control (used with Simplimatic Transmission only).
Ignition Lock—Yale & Towne or Briggs & Stratton. B&S No. 80592. Key Series 1BP to 1000 BP. Groove 24.
Distributor Auto-Lite IGS-4113-1. Single breaker, 6 lobe cam, full automatic advance type with auxiliary vacuum spark control and manual adjustment.
Breaker Plate Identification—#7 stamped on plate
Breaker Gap—Set at .020".
Cam Angle or Dwell—38° closed, 22° open (distr. °).
Breaker Arm Spring Tension—17-20 ounces.
Rotation—Clockwise viewed from above.
Condenser—No. IG-3927A. Capacity .25-.28 mfd.

Automatic Advance

Distributor		Engine	
Degrees	R.P.M.	Degrees	R.P.M.
Start	350	0	700
3	400	6	800
6	850	12	1700
9	1300	18	2600
12	1750	24	3500

Vacuum Spark Control—Integral type (on distributor, linked directly to breaker plate). Provides additional advance at speeds above idling except when engine accelerated or operated with wide open throttle (spark retarded by return spring in unit).

Vacuum Advance

Distr. Degrees	Eng. Degrees	Vacuum (" of HG)
Start	0°	5"
1°	2°	6½"
3°	6°	9¼"
5°	10°	12⅛"
7°	14°	15"

Manual Adjustment—Provides for minor changes in ignition timing at distributor. See Ignition Timing
Distributor Removal:—Mounted on left side of crankcase. To remove, disconnect vacuum line, take out hold-down screw in lock plate. **Installation Note**—Install distributor with #1 piston in firing position (at TDC) and rotor opposite #1 segment in cap.

FIRING ORDER:—1-5-3-6-2-4. See diagram.

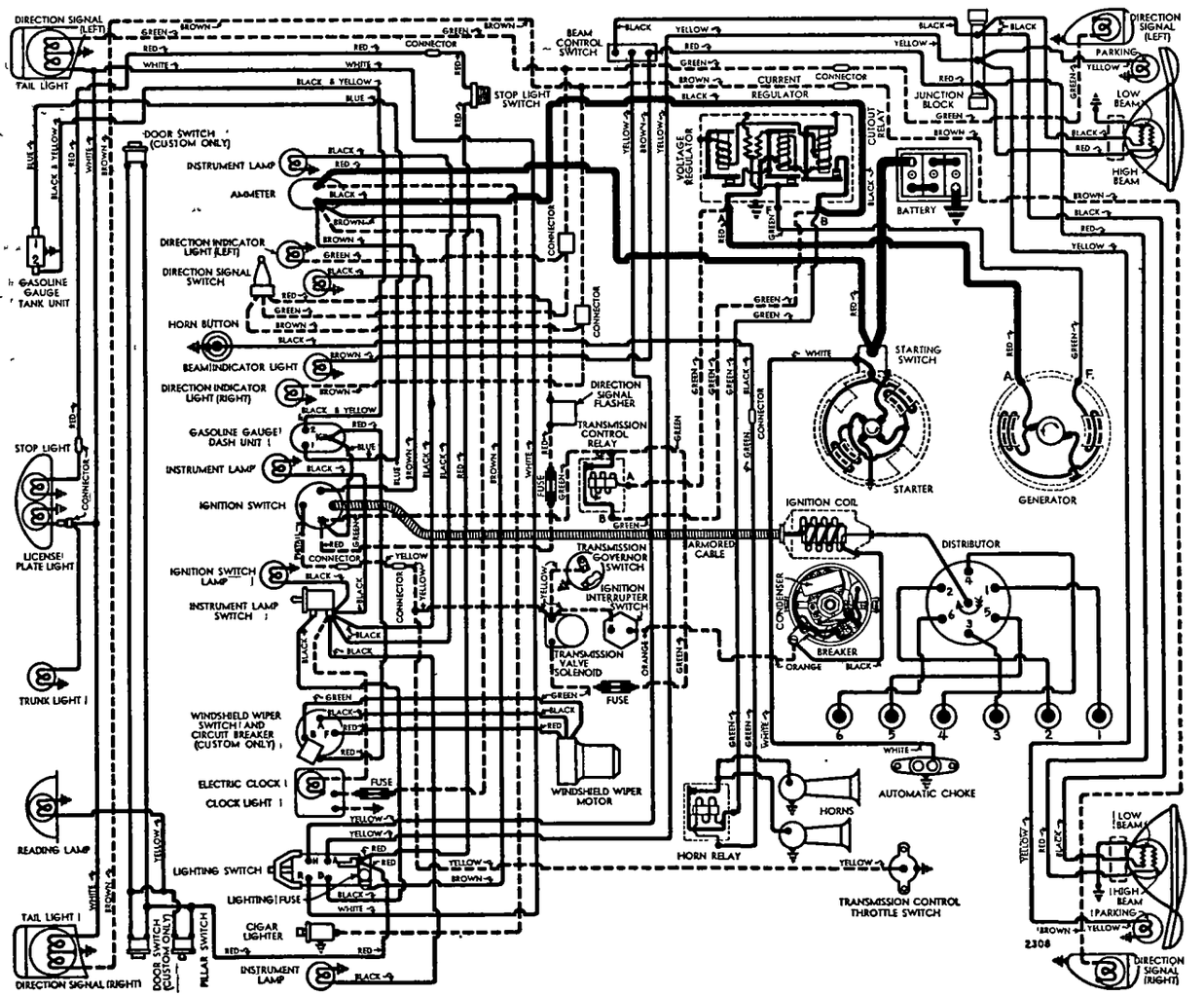
SPARK PLUGS:—Auto-Lite A-7B (Cast iron head), AL-7A (Aluminum head). 14 MM Metric type.
NOTE—Spark plug tightening tension 26-32 ft. lbs.
Spark Plug Gaps—Set at .025".

IGNITION TIMING:—Initial setting (correct for fuel of approx. 70 octane rating at low altitudes for all heads) shown below. See Manual Adjustment (following).

	Flywheel Degrees	Piston Position
All Engines	0° at TDC	.0000" at TDC.

NOTE—Impulse neutralizer marked 'DC' at TDC point with 15 (1°) graduations on either side.
Timing (Using Timing Light)—Connect timing light between distributor primary terminal and battery terminal on generator regulator. Set #1 or #6 piston in firing position (see setting above) with correct mark on impulse neutralizer aligned with pointer on chain case cover. Loosen lock-plate hold-down screw, center pointer on scale, tighten screw. Loosen lock-plate clamp bolt, rotate distributor until timing light just goes out, tighten clamp bolt. Check Manual Adjustment (following).
Timing (Using Synchroscope)—Tool C-374. Clip lead to #1 spark plug, direct light on impulse neutralizer (mark correct graduation with paint), idle engine and adjust distributor (as directed above).
Manual Adjustment—Set to give slight ping from 10-30 MPH accelerating with wide open throttle from 10 MPH. To adjust, loosen lock-plate hold-down screw, move plate (not more than 4° or .007" before or after initial setting) counter-clockwise (if no ping), clockwise to retard spark (if too severe).

CARBURETION:—**Carburetor**—Carter (Ball & Ball) Models E6N3, E6S2, E6S3 (Std. Trans.), EB1 (Fluid Drive & Std. Trans.), E6V1, E6U1, E6U2 (With Simplimatic Trans.). 1½", single barrel, downdraft types. ***For complete data, refer to 1941 Carburetor Index.***
NOTE—EB1, E6V1, E6U1, E6U2 models have dashpot (slow-closing throttle) built in carburetor. Two types used (later type has solenoid control).
Idle Adjustment—With engine warm and running at slow idle speed (choke valve wide open, fast idle inoperative), set throttle stopscrew for idle speed of 6 MPH min. (Std.), 450 RPM or 4 MPH max. (Cars with Simplimatic Transmission). Adjust idle adjusting screw for smooth idle (½-1½ turns open, turn screw in for leaner mixture). Recheck idle speed. NOTE—If vacuum gauge used, adjust for highest obtainable vacuum (see Vacuum Gauge data above).
Accelerating Pump Setting—Pump lever has three holes for pump link engagement. Set as follows:
Inner Hole (minimum stroke)—Extreme hot temperatures or altitudes above 3000 feet.
Center Hole (med. stroke)—Normal summer setting.
Outer Hole (max. stroke)—Winter temperatures.



Float Level—5/64" (all except EB1), 1/16" (EB1), from top of float (not seam) to top edge of bowl with valve seated. Check with tool C-449 (exc. EB1).
Metering Jet—*See Carter (B&B) Jet Table in Carburetor Section for complete data.*
NOTE—If lean metering jet (High Altitude calibration) used at lower altitudes for increased economy, speed and power are reduced (not recommended).
Throttle Cracker:—Not adjustable.
Slow-closing Throttle (EB1, E6V1, E6U1, E6U2):—*For complete data, refer to 1941 Carb. Equip. Index.*
Adjustment (First type only)—Turn adjusting screw above dashpot plunger in as far as possible, then back screw out 5 full turns for 7/32" stroke.
Fast Idle:—Built-in type. Not adjustable.
Automatic Choke:—Sisson Type AC-758B.
For complete data, refer to 1941 Carb. Equip. Index.
Air Cleaner:—AC #1529938 heavy duty oil-bath type.
Fuel Pump:—AC diaphragm type pump. Replacement Exchange Pump No. 505.
For complete data, refer to 1941 Carb. Equip. Index.
Gasoline Gauge:—Auto-Lite electric. No. NG-9685D (dash unit), No. NG-9329T (tank unit).
For complete data, refer to 1941 Carb. Equip. Index.

MANIFOLD HEAT CONTROL:—Thermostatic coil type. See that valve and shaft rotate freely. When installing coil, place inner end in slot in valve shaft, **wind free end up one turn only counter-clockwise**

VALVE TIMING:—To Check—With .014" (cold) tappet clearance #6 intake valve should open with #6 piston 12° or .059" BTDC with 12th graduation before DC mark on impulse neutralizer aligned with pointer. Reset tappet clearance at .008" hot.
Tappet Clearance:—.008" Intake, .010" Exh. (hot & idling). .002" add'l. exh. clearance desirable for sustained high speeds. NOTE—Self-locking tappet screws used. Remove right front wheel and lower wheel housing panel for access to valves.
Valve Spring Pressure:—40-45 lbs. at 1¾" (valve closed), 107-115 lbs. at 1⅜" (valve open).

LUBRICATION:—Crankcase Capacity—5 qts. (refill).
Normal Oil Pressure—30-45 lbs. at 30 MPH & above.

COOLING SYSTEM:—Capacity—18 quarts.
Thermostat—Bishop & Babcock or Fulton. In outlet on head. Starts to open 157-162°. Fully open 183°.
Temperature Gauge—Auto-Lite (Motometer) Vapor tension type. A-L Part No. H-9648.
For complete data, refer to 1941 Mech. Equip. Index.

SIMPLIMATIC (UNDERDRIVE TYPE) TRANSMISSION CONTROL:—*For adjustments, refer to 1941 Mech. Equip. Index for Simplimatic Underdrive Transmission.*

BATTERY:—Willard Type WHT-2-15R. 6 volt, 15 plate, 105 ampere hour capacity (20 hour rate).
Starting Capacity—133 amperes for 20 minutes.
Zero Capacity—300 amperes for 3.9 minutes. Five second voltage 4.3 volts.
Grounded Terminal—Positive (+) to engine.
Dimensions—Length 10¼". Width 7". Height 9⅜".
Location—Under hood in left fender shield.

STARTER:—Auto-Lite MAW-4019, A. Arm. MAW-2030.
Drive—Overrunning clutch (manual pinion shift).
Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—42-53 ozs. (new brushes).
Cranking Engine—125 RPM, 175 amperes, 5.4 volts.

Performance Data

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	4900	5.5	65
2.75 "	1480	5.0	200
5.45 "	820	4.5	300
8.50 "	400	4.0	400
11.55 "	110	3.5	500
11.5 "	Lock	3.	505
18. "	Lock	4.	670

Removal:—Flange mounted on left front face of flywheel housing. Disconnect wires (tape battery lead). Remove oil filter tubes, filter and 2 starter bolts.
Starting Switch:—A-L SW-2813. On starter. Manually operated by starter (pinion shift) pedal.

GENERATOR:—Auto-Lite GDZ-4801A (Std.), GEB-4801A (City Police), GEG-4818A (City Police & Taxicab), GEG-4818B (State Police). Two brush. With current and voltage regulation. Ventilated.
Armature Nos.—GDZ-2006F (GDZ-4801A), GEB-2006F (GEB-4801A), GEG-2006F (GEG-4818B).
Charging Rate Adjustment—No adjustment at generator. Charging rate controlled by Voltage Regulator and maximum output by Current Regulator.
Maximum Charging Rate—As given in tables below reached at approx. 24 MPH (GDZ Gen.) and above with load or discharged battery (Current Regulator setting). Actual charging rate controlled by Voltage Regulator and dependent on battery condition.

Performance Data—GDZ-4801A

Cold			Hot		
Amperes	Volts	R.P.M.	Amperes	Volts	R.P.M.
0	6.4	925	0	6.4	1000
5	6.65	1060	5	6.65	1150
10	6.85	1200	10	6.85	1290
15	7.05	1340	15	7.05	1430
20	7.3	1480	20	7.3	1590
25	7.55	1620	25	7.55	1750
30	7.8	1760	30	7.8	1980
35①	8.0	1900	35	8.0	2250

Performance Data—GEB-4801A

0	6.4	560	0	6.4	600
4	6.6	630	4	6.6	675
8	6.8	700	8	6.8	750
12	7.0	775	12	7.0	840
16	7.2	845	16	7.2	930
20	7.4	920	20	7.4	1030
24	7.6	1000	24	7.6	1140
28	7.8	1075	28	7.8	1260
32①	8.0	1150	32	8.0	1400

Performance Data—GEG-4818A, B

0	6.4	780	0	6.4	820
5	6.6	870	5	6.6	900
10	6.8	960	10	6.8	990
15	7.0	1040	15	7.0	1080
20	7.2	1130	20	7.2	1170
25	7.4	1220	25	7.4	1270
30	7.6	1310	30	7.6	1380
35	7.8	1410	35	7.8	1510
40①	8.0	1520	40	8.0	1680

①—Current regulator setting. See Regulator data.
Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—53 ounces max. (GDZ Gen.), 64-68 ozs. (GEB & GEG Gen.) with new brushes.
Field Current—1.60-1.78 amperes at 6.0 volts (all).
Motoring Current—4.16-4.60 amps. (GDZ Gen.), 4.0-4.5 amps. (GEB), 4.7-5.2 amps. (GEG) at 6.0 volts.
Removal:—Pivot mounted at left side of engine at front. To remove, take out pivot and clamp bolts.
Belt Adjustment:—Loosen pivot and clamp bolts, pull out on generator until belt is snug or 40-50 lbs. tension secured on scale attached to field frame.

REGULATOR:—Auto-Lite VRP-4001A (GDZ Gen.), VRP-4001B (GEB Gen.), VRP-4001F (GEG Gen.). Current-Voltage types. In case on dash.
NOTE—For negative battery ground, VRP-4005A (GDZ Gen.), VRP-4005B (GEB), VRP-4005E (GEG)
For complete data, refer to 1941 Elec. Equip. Index.
NOTE—Regulator case cover sealed. Serviced on exchange basis if seals not broken (to remove cover).

Cutout Relay

Cuts In—6.4-6.6 volts at approx. 1000 gen. RPM (VRP-4001A,5A), 600 RPM (1B,5B), 820 RPM (1F,5E).
Cuts Out—4.8-5.6 volts (approx. 4-6 amps. disch.).
Contact Gap—.015" Min. **Air Gap**—.031-.034" with contacts open (check at hinge end of core).

Voltage Regulator

Setting—7.2-7.5 volts at 70° F. See Electrical Equipment Section for settings at other temperatures.
To Check (without breaking seals)—Connect ammeter in charging line at regulator 'B' terminal (use short heavy leads), voltmeter between 'B' terminal and ground. Operate generator at speed equivalent to 30 MPH., charging fully charged battery, until voltage steady. Voltage should agree with setting.
To Adjust (with cover removed)—Change regulator armature spring tension by bending lower spring hanger slightly. See Electrical Equipment Section.
Contact Gap—.012" min. (armature against stop pin).
Air Gap—.048-.052" with contacts just opening.

Current Regulator

Setting (VRP-4001A, 5A)—34-36 amperes (marked '35' on cover). **(VRP-4001B, 5B)** 31-33 (marked '32' on cover). **(VRP-4001F, 5E)** 39-41 (marked '40').
To Check (without breaking seals)—Connect test meters as for voltage check (above). Operate generator at speed equivalent to 30 MPH. charging battery, turn on car lights and accessories or connect load (bank of headlamp bulbs etc.) between ammeter and battery so that generator charges at peak rate and Current Regulator operates. Current reading should agree with setting given above.
Adjustment, Contact Gap, Air Gap—Same as for Voltage Regulator (above).

LIGHTING:—Headlamps—Hall 'Sealed Beam' type.
For complete data, refer to 1941 Elec. Equip. Index.
Headlamp Adjustment—Aim upper beam straight ahead (hot spot center 3" below lamp center height).
Beam Indicator—Red light on upper edge of panel above speedometer. Lighted with upper beams on.
Direction Signal—*Refer to 1941 Elec. Equip. Index.*

Switches

Lighting—DeSoto No. 910506.
Beam Selector—DeSoto 859974.
Instrument—DeSoto No. 853371.
Direction Signal—DeSoto No. 865763, 910566 (RHD).

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps		Sealed Beam
Parking, Instr., Trunk	1½	55
Front Direction Signal	21	1129
Beam & Dir. Ind., Ign. Sw.	1	51
Tail (without Dir. Signal)	3	63
Rear Dir. Sig. & Tail	21-3	1158
Stop	21	1129
Rear License	3	63
Reading or Dome	15	87

FUSES:—Lighting—30 amp. On back of light switch.
Clock—2 ampere. In connector behind clock.
Simplimatic Transmission Control—30 amp. In wire fuse connector on left side of engine dash.
Direction Signal (late cars)—30 amp. Behind instr. panel in wire from ign. switch to flasher.

HORNS:—Auto-Lite HO-5003 horn set. Electric, vibrator and air note type twin horns operated by relay.
Current Draw—35-40 amperes.
Horn Relay:—Auto-Lite Model HRC-4001 (no fuse).
Contacts Close—1.5-3.0 volts. **Open**—.5 volt.
Contact Gap—.026". **Air Gap**—.016-.020" (closed).

WINDSHIELD WIPER (CUSTOM ONLY):—Auto-Lite EWD-5001, EWD-5003 (Conv. Coupe). Electric type
For complete data, refer to 1941 Mech. Equip. Index.
Circuit Breaker—Vibrating, thermostatic type. Starts to operate with current of 12 amperes.

CONVERTIBLE TOP CONTROL:—Electric type.
For complete data, refer to 1941 Mech. Equip. Index.

HOOD LOCK:—*See Chrysler Shop Notes in 'M' Section.*

SERIAL NUMBER:—On right front door hinge post. First No.: 30,342,401 (Detroit), 9,422,901 (Canada).

ENGINE NUMBER:—First number D19-1001. Stamped on left side of block between #1 and #2 cylinders.

COMPRESSION:—**Ratio**—6.5-1 cast-iron head std. **Pressure**—140-150 lbs. at 1000 RPM or approx. 113 lbs. at cranking speed (std. head). Reading should not vary more than 10 lbs. between cylinders.

VACUUM READING:—Steady 18-20" idling (below 1000').

IGNITION:—**Auto-Lite Coil No. IG-4668.** Service winding (less switch & cable) IG-3224JS. On engine dash. **Ignition Current**—2.25 amperes idling, 5 stopped. **Ignition Switch:**—Mitchellock Model 24-R, No. 8197. **Ignition Lock**—Yale & Towne or Briggs & Stratton. B&S No. 80592. Key Series 1BP to 1000BP. Groove #24. **Distributor Auto-Lite IGS-4112-1, IGS-4113-1 (Canada).** Single breaker, 6 lobe cam, full automatic advance type with auxiliary vacuum spark control and manual adjustment (at distributor). **Breaker Plate Identification**—#8 (IGS-4112-1), #7 (IGS-4113-1) stamped on plate. Maximum vacuum advance limited by slot in plate. **Breaker Gap**—Set at .020". **Cam Angle or Dwell**—38° closed, 22° open (distr. °). **Breaker Arm Spring Tension**—17-20 ounces. **Rotation**—Clockwise viewed from above. **Condenser**—No. IG-3927A. Capacity .25-.28 mfd.

Automatic Advance

Distributor Degrees	R.P.M.	Engine Degrees	R.P.M.
Start	350	0	700
3	400	6	800
6	850	12	1700
9	1300	18	2600
12	1750	24	3500

Vacuum Spark Control—Integral type (on distributor, linked directly to breaker plate). Provides additional advance at speeds above idling except when engine accelerated or operated with wide open throttle (spark retarded by return spring in unit).

Vacuum Advance—IGS-4112-1

Distr. Degrees	Eng. Degrees	Vacuum (" of HG)
Start	0°	5"
2°	4°	7¾"
4°	8°	10½"
6°	12°	13¼"
8°	16°	16"

Vacuum Advance—IGS-4113-1

Start	0°	5"
1°	2°	6½"
3°	6°	9¼"
5°	10°	12⅛"
7°	14°	15"

Manual Adjustment—Provides for minor changes in ignition timing at distributor. See Ignition Timing for adjustment.

Distributor Removal:—Mounted on left side of crankcase. To remove, disconnect vacuum line, take out hold-down screw in lock plate. **Installation Note**—Install distributor with #1 piston in firing position (at TDC) and rotor opposite #1 segment in cap.

FIRING ORDER:—1-5-3-6-2-4. See diagram.

SPARK PLUGS:—Auto-Lite A-7B (Cast iron head), AL-7A (Aluminum head). 14 MM Metric type. NOTE—Spark plug tightening tension 26-32 ft. lbs. **Spark Plug Gaps**—Set at .025".

IGNITION TIMING:—Initial setting (correct for fuel of approx. 70 octane rating at low altitudes for all heads) shown below. See Manual Adjustment (following) for minor changes for local fuel & altitudes.

Flywheel Degrees	Piston Position
All cyl. heads 0°	at TDC .0000" at TDC

NOTE—Impulse neutralizer marked 'DC' at TDC point with 15 (1°) graduations on either side.

Timing (Using Timing Light)—Connect timing light between distributor primary terminal and battery terminal on generator regulator. Set #1 or #6 piston in firing position (see setting above) with correct mark on impulse neutralizer aligned with pointer on chain case cover. Loosen lock-plate hold-down screw, center pointer on scale, tighten screw. Loosen lock-plate clamp bolt, rotate distributor until timing light just goes out, tighten clamp bolt. Check Manual Adjustment (following).

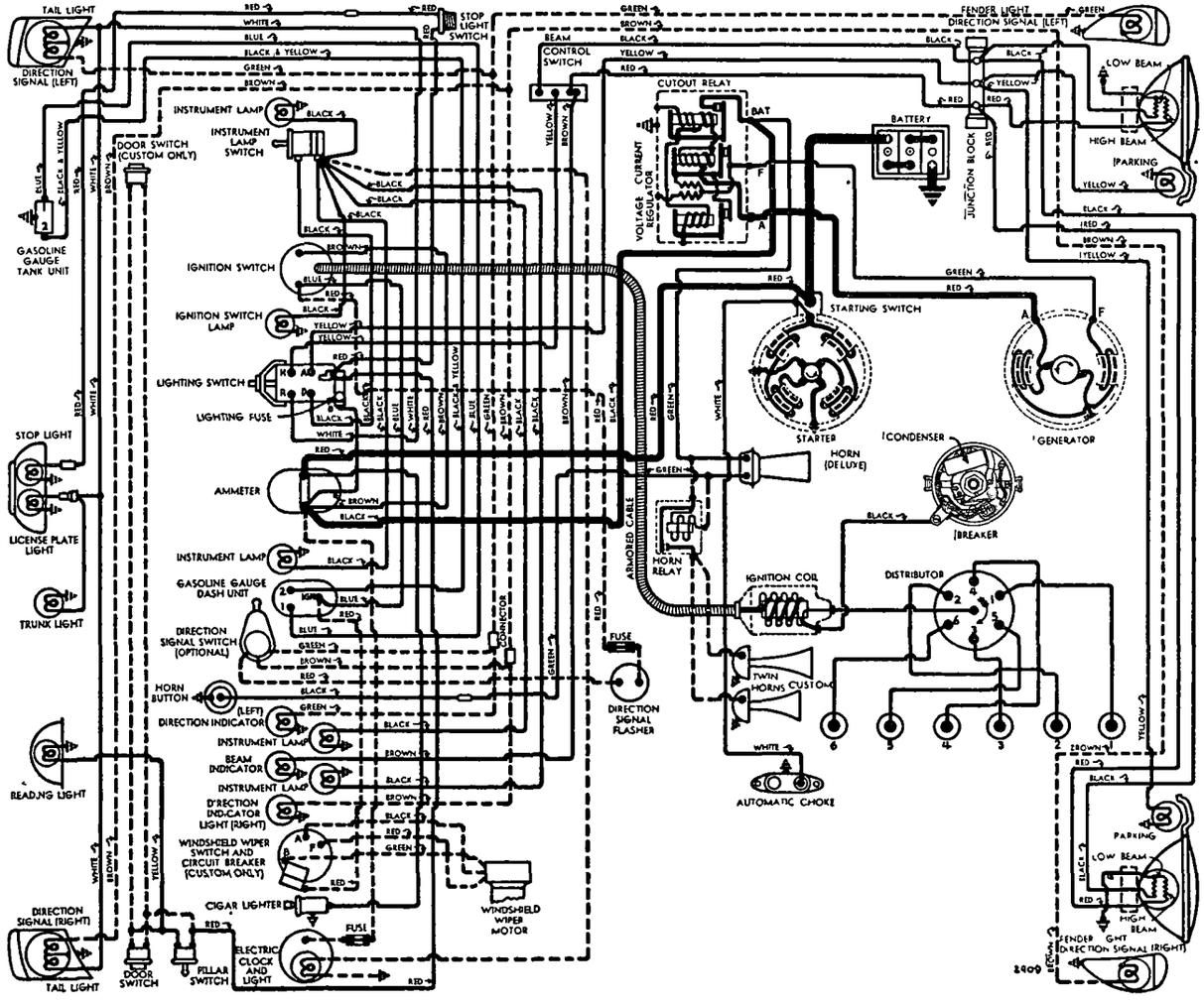
Timing (Using Synchroscope)—Tool C-374. Clip lead to #1 spark plug, direct light on impulse neutralizer (mark correct graduation with paint), idle engine and adjust distributor (as above) until mark appears in line with pointer.

Manual Adjustment—Set to give slight ping from 10-30 MPH accelerating with wide open throttle from 10 MPH. To adjust, loosen lock-plate hold-down screw, move plate (not more than 4° or .007" before or after initial setting) counter-clockwise (if no ping noted), clockwise to retard spark (if ping too severe), tighten screw.

CARBURETION:—**Carburetor**—Stromberg Model BXV-3 (Std.), BXVD-3 (with Fluid Drive). 1½" downdraft types. NOTE—BXVD-3 has special 'dashpot' or slow closing throttle device.

For complete data, refer to 1941 Carburetor Index.

Idle Adjustment—With engine warm and running at slow idle speed (choke valve wide open, fast idle inoperative), set throttle stopscrew for idle speed of 6 MPH min. Adjust idle adjusting screw for smooth idle (turn screw in for leaner mixture). Recheck idle speed. NOTE—If vacuum gauge used, adjust for maximum vacuum (see Vacuum Gauge data above). **Accelerating Pump Setting**—Pump lever has three holes for pump link engagement. Set as follows: Inner Hole (minimum stroke)—Extreme hot temperatures or altitudes above 3000 feet.
Center Hole (med. stroke)—Normal summer setting.
Outer Hole (max. stroke)—Winter temperatures.



Float Level—Fuel level 5/8" below top edge of bowl.
Metering Jet—*See Stromberg Jet Table in Carburetor Section for complete jet data.*
NOTE—If lean metering jet (High Altitude calibration) used at lower altitudes for increased economy, speed and power are reduced (not recommended).
Throttle Cracker:—Not adjustable.
Slow Closing Throttle (Dashpot) BXVD-3 Only:—*See Stromberg BXVD-3 carburetor article in Carburetor Section. Refer to 1941 Carburetor Index.*
Setting—With all slack removed from linkage, set adjusting screw on dash pot lever so that piston travel 5/16-11/32" (turn screw in to shorten stroke).
Fast Idle:—Not adjustable. Throttle stopscrew should rest on high point of cam with choke valve closed.
Automatic Choke:—Sisson Type AC-758B.
For complete data, refer to 1941 Carb. Equip. Index.
Air Cleaner:—AC #1529937 heavy duty oil bath type.
Fuel Pump:—AC diaphragm type pump. Replacement Exchange Pump No. 505.
For complete data, refer to 1941 Carb. Equip. Index.
Gasoline Gauge:—Auto-Lite electric. No. NG-9674D (dash unit), No. NG-9329T (tank unit).
For complete data, refer to 1941 Carb. Equip. Index.

MANIFOLD HEAT CONTROL:—Thermostatic coil type. See that valve and shaft rotate freely. When installing coil, place inner end in slot in valve shaft, **wind free end up one turn only counter-clockwise**

VALVE TIMING:—**To Check**—With .014" (cold) tappet clearance #6 intake valve should open with #6 piston 9° or .0343" BTDC with 9th graduation before DC mark on impulse neutralizer aligned with pointer. Reset tappet clearance at .008" hot.
Tappet Clearance:—.008" Intake, .010" Exh. (hot & idling). .002" add'l. exh. clearance desirable for sustained high speeds. NOTE—Self-locking tappet screws used. Remove right front wheel and lower wheel housing panel for access to valves.
Valve Spring Pressure:—40-45 lbs. at 1¾" (valve closed), 107-115 lbs. at 1⅜" (valve open).

LUBRICATION:—**Crankcase Capacity**—5 qts. (refill).
Normal Oil Pressure—30-45 lbs. at 30 MPH & above.

COOLING SYSTEM:—**Capacity**—15 quarts.
Thermostat—Bishop & Babcock or Fulton. In outlet on head. Starts to open 157-162°. Fully open 183°.
Temperature Gauge—Auto-Lite (Motometer) Vapor tension type. A-L No. H-9673.
For complete data, refer to 1941 Mech. Equip. Index.

BATTERY:—**Auto-Lite Type PD-1-15R.** 6 volt, 15 plate, 95 ampere hour capacity (20 hour rate).
Grounded Terminal—Positive (+) to engine.
Location—Under hood in left fender shield.

STARTER:—**Auto-Lite MZ-4089,A. Armature MZ-2108. MAW-4019,A (Canada). Armature MAW-2030.**
See 1941 De Soto S8 'T&E' page for MAW-4019 data.
Drive—Overrunning clutch (manual pinion shift).
Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—42-53 ozs. (new brushes).
Cranking Engine—150-175 amperes, 5.1 volts.

Performance Data

Torque		R.P.M.	Volts	Amperes
0	ft. lbs.	4300	5.5	70
0.65	"	2500	5.5	100
2.55	"	1325	5.0	200
4.95	"	750	4.5	300
7.65	"	220	4.0	400
7.8	"	Lock	3.0	420
11.8	"	Lock	4.0	560

Removal:—Flange mounted on left front face of flywheel housing. Disconnect wires (tape battery lead). Remove oil filter tubes, filter and 2 starter bolts.
Starting Switch:—A-L SW-2813. On starter. Manually operated by starter (pinion shift) pedal.

GENERATOR:—**Auto-Lite GDZ-4801B (Std.), GEB-4801A, GEG-4818A (City Police & Taxicab), GEG-4818B (State Police).** Two brush. With current and voltage regulation. Ventilated.
Armature Nos.—GDZ-2006F (GDZ-4801A), GEB-2006F (GEB-4801A), GEG-2006F (GEG-4818B).
Charging Rate Adjustment—No adjustment at generator. Charging rate controlled by Voltage Regulator and maximum output by Current Regulator.
Maximum Charging Rate—As given in tables below reached at approx. 24 MPH (GDZ Gen.) and above with load or discharged battery (Current Regulator setting). Actual charging rate controlled by Voltage Regulator and dependent on battery condition.

Cold Performance Data—GDZ-4801B Hot

Amperes	Volts	R.P.M.	Amperes	Volts	R.P.M.
0	6.4	925	0	6.4	1000
5	6.65	1060	5	6.65	1150
10	6.85	1200	10	6.85	1290
15	7.05	1340	15	7.05	1430
20	7.3	1480	20	7.3	1590
25	7.55	1620	25	7.55	1750
30	7.8	1760	30	7.8	1980
35①	8.0	1900	35	8.0	2250

Performance Data—GEB-4801A

0	6.4	560	0	6.4	600
4	6.6	630	4	6.6	675
8	6.8	700	8	6.8	750
12	7.0	775	12	7.0	840
16	7.2	845	16	7.2	930
20	7.4	920	20	7.4	1030
24	7.6	1000	24	7.6	1140
28	7.8	1075	28	7.8	1260
32①	8.0	1150	32	8.0	1400

Performance Data—GEG-4818A, B

0	6.4	780	0	6.4	820
5	6.6	870	5	6.6	900
10	6.8	960	10	6.8	990
15	7.0	1040	15	7.0	1080
20	7.2	1130	20	7.2	1170
25	7.4	1220	25	7.4	1270
30	7.6	1310	30	7.6	1380
35	7.8	1410	35	7.8	1510
40①	8.0	1520	40	8.0	1680

①—Current regulator setting. See Regulator data.
Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—53 ounces max. (GDZ Gen.), 64-68 ozs. (GEB & GEG Gen.) with new brushes.
Field Current—1.60-1.78 amperes at 6.0 volts (all).
Motoring Current—4.16-4.60 amps. (GDZ Gen.), 4.0-4.5 amps. (GEB), 4.7-5.2 amps. (GEG) at 6.0 volts.
Removal:—Pivot mounted at left side of engine at front. To remove, take out pivot and clamp bolts.
Belt Adjustment:—Loosen pivot and clamp bolts, pull out on generator until belt is snug or 40-50 lbs. tension secured on scale attached to field frame.

REGULATOR:—**Auto-Lite VRP-4001A (GDZ Gen.), VRP-4001B (GEB Gen.), VRP-4001F (GEG Gen.).**
Current-Voltage types. In case on dash.
NOTE—For negative battery ground, VRP-4005A (GDZ Gen.), VRP-4005B (GEB), VRP-4005E (GEG)
For complete data, refer to 1941 Elec. Equip. Index.
NOTE—Regulator case cover sealed. Serviced on exchange basis if seals not broken (to remove cover).

Cutout Relay

Cuts In—6.4-6.6 volts at approx. 1000 gen. RPM (VRP-4001A,5A), 600 RPM (1B,5B), 820 RPM (1F,5E).
Cuts Out—4.8-5.6 volts (approx. 4-6 amps. disch.).
Contact Gap—.015" min. **Air Gap**—.031-.034" with contacts open (check at hinge end of core).

Voltage Regulator

Setting—7.2-7.5 volts at 70° F. See Electrical Equipment Section for settings at other temperatures.
To Check (without breaking seals)—Connect ammeter in charging line at regulator 'B' terminal (use short heavy leads), voltmeter between 'B' terminal and ground. Operate generator at speed equivalent to 30 MPH., charging fully charged battery, until voltage steady. Voltage should agree with setting.
To Adjust (with cover removed)—Change regulator armature spring tension by bending lower spring hanger slightly. See Electrical Equipment Section.
Contact Gap—.012" min. (armature against stop pin).
Air Gap—.048-.052" with contacts just opening.

Current Regulator

Setting (VRP-4001A, 5A)—34-36 amperes (marked '35' on cover). **(VRP-4001B, 5B)** 31-33 (marked '32' on cover). **(VRP-4001F, 5E)** 39-41 (marked '40').
To Check (without breaking seals)—Connect test meters as for voltage check (above). Operate generator at speed equivalent to 30 MPH. charging battery, turn on car lights and accessories or connect load (bank of headlamp bulbs etc.) between ammeter and battery so that generator charges at peak rate and Current Regulator operates. Current reading should agree with setting given above. If more than slight excess noted, regulator is defective.
Adjustment, Contact Gap, Air Gap—Same as for Voltage Regulator (above).

LIGHTING:—**Headlamps**—Corcoran-Brown 'Sealed Beam' type. *For data refer to Elec. Equip. Index.*
Headlamp Adjustment—Aim upper beam straight ahead (hot spot center 3" below lamp center height).
Beam Indicator—Red light on upper edge of panel above speedometer. Lighted with upper beams on.
Direction Signal—*Refer to 1941 Elec. Equip. Index.*

Switches

Lighting—Dodge No. 863823.
Beam Selector—Dodge No. 859974.
Instrument—Dodge No. 903783.
Direction Signal—Dodge No. 865763.

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps		Sealed Beam
Parking, Instr., Trunk	1½	55
Front Direction Signal	21	1129
Beam & Dir. Ind., Ign. Sw.	1	51
Tail (without Dir. Signal)	3	63
Rear Dir. Sig. & Tail	21-3	1158
Stop	21	1129
Rear License	3	63
Reading or Dome	15	87

FUSES:—**Lighting**—30 amp. On back of light switch.
Clock—2 ampere. In connector behind clock.
Direction Signal (late cars)—30 amp. Behind instr. panel in wire from ign. switch to flasher.

HORNS:—**Single**—Delco-Remy No. 1999913 (low note) 1999914 high note), or Auto-Lite HA-4001 Std.
Dual—Auto-Lite HO-5003 horn set. HA-4026 (low pitch), HA-4027 (high pitch) operated by relay.
Current Draw—Approx. 7 amps. single, 35-40 dual.
Horn Relay:—Auto-Lite Model HRC-4001 (no fuse).
Contacts Close—1.5-3.0 volts. **Open**—.5 volt.
Contact Gap—.026". **Air Gap**—.016-.020" (closed).

WINDSHIELD WIPER (CUSTOM ONLY):—**Auto-Lite EWD-5001, EWD-5003 (Conv. Coupe).** Electric type with circuit-breaker on back of switch.
For complete data, refer to 1941 Mech. Equip. Index.
Circuit Breaker—Vibrating, thermostatic type. Starts to operate with current of 12 amperes.

CONVERTIBLE TOP CONTROL:—Electric type.
For complete data, refer to 1941 Mech. Equip. Index.

MODEL DESIGNATION:—Model number indicates Engine—1N(4 Cyl.); 11, 111, 114, 118 (V8 85); 19, 194, 198 (V8 95) with suffix letter indicating body type
'A'—114" WB. Passenger Cars.
'C'—112" or 118" WB. Commercial Chassis.
'D'—¾ Ton, 122" WB. Truck Chassis.
'Y'—1 Ton, 134" WB. Truck Chassis.
'W'—101", 134", 158" WB. Cab-over-Engine Trucks.
'T' & 'U'—Other Trucks & School Bus.

ENGINE HOOD NOTE:—Passenger Cars—Hood is Alligator type with release knob under instrument panel to left of steering column. To raise hood, pull out on release knob (hood will raise slightly), press in on safety catch under front edge of hood.

SERIAL & ENGINE NUMBER:—Stamped on top of clutch housing and on left frame rail (near gen.).

COMPRESSION:—Ratio—6.0-1 (4 Cyl.), 6.2-1 (V8 '85' Eng.—Pass. Cars, Comm'l., ¾ & 1 Ton), 5.9-1 (V8 '85' and '95' Eng.—Other Trucks).
Pressure—100 lbs. at 100 RPM. cranking speed.

VACUUM READING:—Steady 18-20" idling at 5-7 MPH.

IGNITION:—Coil Model 9N-12024 (4 Cyl.), 78-12024-A (V8). Part of Ignition Unit Assembly.
Resistor Unit—Connected in coil primary circuit. Mounted on Circuit Breaker Assembly No. 11A-12250 (V8 models only).
Ignition Current—4½-6 amperes (V8) with engine stopped. Ignition primary resistance 1-1⅓ ohms.
Ignition Switch:—Oakes Steering Column and Ignition Lock Assembly.

Steering Post & Ign. Lock Assem. Oakes No.	Ford No.	Ignition Switch Oakes No.
Deluxe 302448	11A-3676A	302494
Super Deluxe 302550	11A-3676B	302494
Comm'l.① 302120	01C-3676A	302461
Comm'l.② 302478	01C-3676B	302494
Sedan Del. 302575	11C-3676	302461
¾, 1 Ton..... 302120	01C-3676A	302461
Cab-over-Eng. 301790	81W-3676	302461
Other Trucks 302122	01T-3676	302461

①—Floor mtd. Gearshift. ②—Strg. Col. Gearshift.
Lock Cylinder—Hurd or Briggs & Stratton No. 80935, Ford No. 91A-3686A (With Keys).
Key Series—FK000 to FK999. **Groove**—No. 17.

Distributor (V8)—No. 78-12127 (Less Coil, Distributor Caps, and Terminal Plates):—Double breaker, 8 lobe cam type with automatic advance and Vacuum Brake Control. Same as used on preceding V8's.
Breaker Gap—.014-.016" (both sets). Use special two step feeler—.014" step 'go', .016" step 'no go'.
Cam Angle—36° closed, 9° open. For both sets operating together with correct coil-loading lead.
Breaker Arm Spring Tension—20-24 ozs.
Rotation—Clockwise viewed from drive end.
Condenser—No. 78-12300. Capacity .33-.36 mfd.

Distributor **Automatic Advance** Engine (High Vacuum or Vacuum Brake Inoperative)

Degrees	R.P.M.	Degrees	R.P.M.
Start	200	0	400
2	325	4	650
3	425	6	850
5	825	10	1650
8	1500	16	3000

Distributor (4 Cyl.)—No. 9N-12100 (Less Coil):—Same general design as V8 type (mounted on front of engine, driven from camshaft, Coil on top of unit), except 4 Cylinder type and no Vacuum Brake used.
Breaker Gap—.014-.016".
Rotation—Clockwise viewed from drive end.
Condenser—Part No. 91A-12300.

Removal:—Ignition unit mounted on front of engine. To remove, disconnect vacuum line, take off caps, take out screws in mounting flange.

FIRING ORDER:—1-2-4-3 (4 Cyl.), 1-5-4-8-6-3-7-2 (V8 Engs.). See diagram for cylinder numbering.

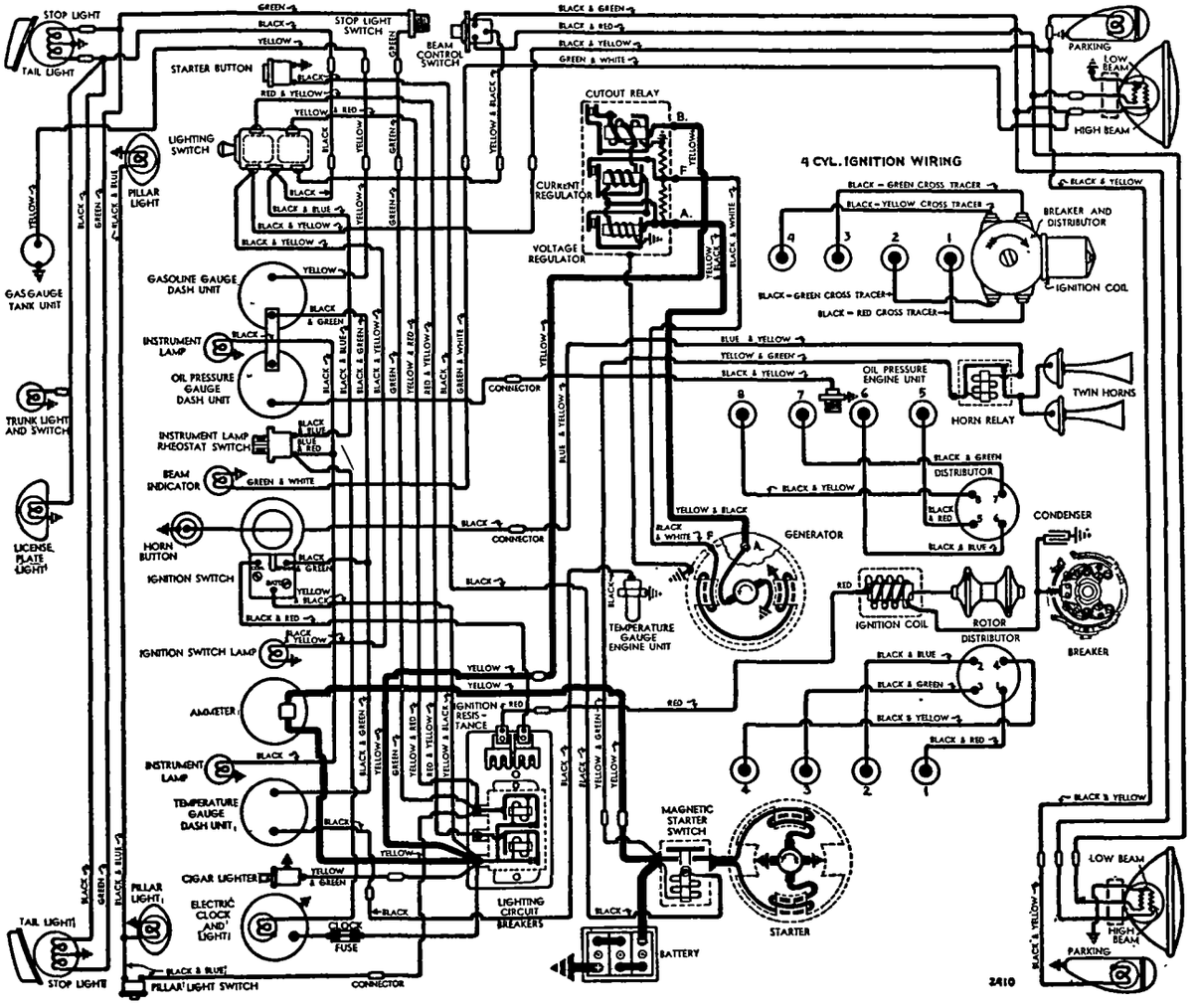
SPARK PLUGS:—Champion H-10. 14 MM. Metric.
Spark Plug Gaps—Set at .030-.034".

IGNITION TIMING:—For each engine as follows (see Vacuum Brake Setting below for adjustment depending on type of service and fuel (V8 only).

	Flywheel Degrees	Piston Position
4 Cyl. Engine	At TDC	.0000" TDC
All V8 Engines	4° BTDC	.0058" BTDC

Timing Note—Manufacturer recommends use of Laboratory Test Set with Stroboscope attachment or V-126 Timing Fixture for all ignition settings.
Timing (On Engine)—No flywheel marks provided and timing should be set with piston on top dead center. With #1 piston on top dead center entering power stroke, loosen timing adjusting screw on left hand side of ignition unit housing, place screw in retard position at lower end of slot, move screw slowly up until timing contacts begin to open, note graduation on plate under screw head which is in line with reference mark on housing, move screw up one additional graduation **on V8 Engines only.**
Vacuum Brake Setting (V8 Engines)—Should be adjusted to eliminate pinging when engine operated with load. To adjust, loosen locknut, back off adjusting screw until engine pings with load, turn screw in just enough to eliminate ping, tighten locknut. When adjusted on Stroboscope, vacuum brake should retard spark so advance 2° (distr.) at 950 RPM. or 38 MPH. with no vacuum.

CARBURETION:—Carburetor (4 Cyl.)—Marvel-Schebler Model TSX, Ford No. 9N-9510-A. Updraft type. ***For complete data, refer to 1941 Carburetor Index.***
Idle Adjustment—With engine warm, set throttle stopscrew for 5-7 MPH. idle speed. Turn idle adjusting screw in until engine rolls, then turn screw out until engine fires smoothly. Recheck idle speed.
Power (Main Metering Jet) Adjustment—Open throttle approx. ⅓, turn power adjusting screw in until engine begins to lose power and speed drops off, then turn screw out until speed picks up and



power is at maximum. Road test car and turn screw out slightly if engines falters when picking up load.
Float Level—9/32" from gasket surface on bowl cover to nearest point on float with valve seated (invert cover to check). Set both floats alike.

Carburetor (V8 Engines):—Chandler-Groves AA1, Ford No. 91A-9510-A. Dual, downdraft type.
For complete data, refer to 1941 Carburetor Index.
Idle Adjustment—With engine warm, choke valve wide open, and Fast Idle inoperative, set throttle lever stopscrew for 5-7 MPH. idling speed, turn each idle adjusting screw (one for each barrel, adjust in succession) in until engine begins to miss, then out until engine begins to roll, finally turn screw in until engine fires smoothly. Final setting should be approximately ⅝-¾ turn of screw from inner seated position. Recheck idle speed.
NOTE—Vacuum gauge recommended for idling adjustment. Set for highest steady gauge reading.
Float Level—Fuel level 11/16" plus or minus 1/32" (21/32-23/32" below top edge of float. ***See Carburetor article for float level checking data.***
Accelerating Pump Setting—Three holes provided for pump link connection as follows:
Inner (#1)—Min. stroke, Summer Temperatures.
Center (#2)—Med. stroke, Winter Temperatures.
Outer (#3)—Max. stroke, Extreme Cold Weather.

Fast Idle:—Integral type. No adjustment required.

Air Cleaner:—Ford No. 91A-9600A (except Cab-over-Engine), 81W-9600 (Cab-over-Eng. models), oil-wetted type Std. Heavy duty oil-bath type Optl.

Gasoline Gauge:—King-Seeley Electric. Ford Nos. **Dash Unit**—No. 11A-9280A (Deluxe), 11A-9280B (Super Deluxe), 11C-9280B (Sedan Dlvry.), 11C-9280A (Comm'l. & Trucks exc. C-O-E), 91A-9280A(C-O-E Trucks). **Tank Unit**—99A-9275B (Pass. Cars), 01A-9275A (Comm'l.), 01A-9275B (Sedan Dlvry.), 01Y-9275 (Panel), 01T-9275 (Trucks exc. C-O-E), 01W-9275 (C-O-E Trucks).
For complete data, refer to 1941 Carb. Equip. Index.

Fuel Pump:—AC Type R, Ford No. 68-9350 (V8), ONY-9350 (4 Cyl.). AC Replacement Pump No. 541.
For complete data, refer to 1941 Carb. Equip. Index.

VALVE TIMING:—To Check Timing—No flywheel marks or other means provided to check timing. #1 intake valve begins to open with piston at TDC.
Tappet Clearance:—.0125-.0135" all valves. No adj.
Valve Spring Pressure:—37-40 lbs. at 2.13" (valve closed), 76-80 lbs. at 1.84" (valve open).

LUBRICATION:—Crankcase Capacity—4 qts. (4 Cyl.), 5 qts. (all V8 Engines).
Normal Oil Pressure:—25 lbs. (4 Cyl.), 30 lbs. (V8).
Oil Pressure Gauge:—King-Seeley Electric. Ford Nos. **Dash Unit**—No. 11A-9273A (Deluxe), 11A-9273B (Super Deluxe), 11C-9273B (Sedan Dlvry.), 11C-9273A (Comm'l. & Trucks). **Engine Unit**—48-9278
For complete data, refer to 1941 Mech. Equip. Index.

COOLING SYSTEM:—Capacity—14 qts. (all models with 4 Cyl. Engine), 26¼ qts. (Pass. Cars), 22 qts. (Comm'l, ¾ & 1 Ton), 24 qts. (C-O-E), 23 (other Trucks).
Thermostat:—In radiator top hose (4 Cyl.), in cylinder head outlet elbows (V8—two used).
Setting—Starts to open at 145° F. Fully open 180°.
Temperature Gauge:—King-Seeley Electric. Ford Nos. **Dash Unit**—11A-10883A (Deluxe), 11A-10883B (Super Deluxe), 11C-10883B (Sedan Dlvry.), 11C-10883A (Comm'l. & Trucks). **Engine Unit**—No. 99A-10884
For complete data, refer to 1941 Mech. Equip. Index.

BATTERY:—Ford No. 01A-10655-A. 6 volt, 17 plate, 120 ampere hour capacity (20 hour rate).
Starting Capacity—150 amperes for 20 minutes.
Zero Capacity—300 amperes for 4.0 minutes.
Grounded Terminal—Positive (+) grd. to dash.
Engine Ground—Strap connector between right rear cylinder head and dash.
Dimensions—Length 10.6". Width 7.3". Height 9.2".
Location—On right side in engine compartment.

STARTER:—No. 52-11002 (4 Cyl.), 18-11002 (V8 Eng.).
Armature—52-11005 (52-11002), 18-11005 (18-11002).
Drive—Barrel type Bendix No. A-1806, Ford No. 52-11350C (52-11005). Inboard Bendix No. L11FX-10, Ford No. B-11350 (18-11002).
Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—2 lbs. each.
Cranking Engine—100 RPM., 190-215 amperes.

Performance Data

Torque	R.P.M.	Volts	Amperes
4 ft. lbs.	1070	4.6	200
8 "	660	4.3	340
12 "	300	3.65	465
14 "	Lock	3.5	500

Starting Switch:—R-B-M Model 5604, Ford No. 78-11450A. Magnetic switch mounted on dash and controlled by pushbutton on instrument panel R-B-M Model 3242, Ford No. 11A-11500 (Pass. Cars); R-B-M Model 3233, Ford No. 01A-11500A (Sedan Dlvry.), 11C-11500 (Comm'l. & Truck).
Removal:—Starter mounted on right front face of flywheel housing. To remove, take off pan at right of engine, free starter-to-oil pan support bracket, take out through-bolts on commutator end plate.

GENERATOR:—Ford Nos. for each model:

	Generator	Armature No.
Pass. Cars, Comm'l.	01A-10000B	01A-10005A
All 4 Cyl. Models	S08T-10000	01A-10005A
V8 Trucks exc. C-O-E	01A-10000B	01A-10005A
Cab-over-Eng. (C-O-E)	81T-10000A	78-10005A
	81T-10000B	78-10005B

Two brush type with vibrating Current & Voltage Regulation (new 3 unit Regulator). Ventilated.
Charging Rate Adjustment—None (see Regulator).
Maximum Charging Rate—Controlled by regulator and dependent on battery condition and load. To check generator output, disconnect generator field lead at generator, connect both generator terminals together (use short insulated wire). Use 'BRS' set or rheostat connected across battery terminals and apply load until voltage is exactly 6 volts. Connect ammeter in charging line, check output at 2 speeds given in performance table below. Restore original connections after completing test. **Do not operate generator in service with both terminals connected together. This eliminates all regulator action and will damage generator.**

Performance Data

Amperes	01A-10000B, S08T-10000	Engine RPM
Start		400
32		1100
32		3000

81T-10000A		81T-10000B	
Amperes	Eng. RPM.	Amperes	Eng. RPM.
Start	550	Start	350
28	1300	20	1050
28	3000	20	3000

Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—Approximately 28 ozs.
Field Current—2.86 amperes at 6.0 volts (01A-10000B, S08T-10000—field resistance 2.1 ohms at 70°), 2.22 amperes at 6.0 volts (81T-10000A, B—field resistance 2.7 ohms at 70°).
Removal (4 Cyl.):—Generator pivot mounted at right of engine. To remove, take out mounting bolts.
Removal (V8 Eng.):—Generator mounted on bracket between cylinder banks at front of engine, driven in tandem with water pumps by Vee belt (on Cab-over-engine Trucks, fan mounted on generator shaft To remove, loosen nut on bracket stud.
Belt Adjustment:—Loosen pivot and clamp bolts, swing generator away from engine (4 Cyl.), loosen nut on bracket mounting stud and raise generator (V8), until side movement of belt with thumb and finger pressure is 1" midway between generator and crankshaft pulley (4 Cyl.), water pump pulley (V8).

REGULATOR:—Ford No. 01A-10505C. Three-Unit Type. Consists of Cutout Relay, vibrating Voltage Regulator and vibrating Current Regulator (separate units) in single case on engine side of dash.
For complete data, refer to 1941 Elec. Equip. Index.
NOTE—Regulator case grounded through 'pigtail' to dash or separate ground wire to generator. This ground connection must be in place when regulator being operated or tested (disturbed by cover removal).

Cutout Relay

Cuts In—5.8-6.3 volts at operating temperature.
Cuts Out—8 amperes discharge current (maximum).

Voltage Regulator

Setting—6.9-7.2 volts at 70-80° F. See Ford Regulator article in Elec. Equip. Section for other temps.
Checking & Adjusting—***Refer to Electrical Equipment Index for article on 'Ford Regulator—3 Unit Type' for complete instructions.***

Current Regulator

Setting—28 amperes at 7.0 volts hot—after engine run for 5 minutes (196-200 watts maximum for continuous operation).
Checking & Adjusting—See Voltage Regulator

LIGHTING:—Headlamps—Ford Sealed Beam type. Controlled by Lighting Switch on instrument panel and Beam Selector Switch on toeboard.
For complete data, refer to 1941 Elec. Equip. Index.
Headlamp Adjustment—Aim each headlamp straight ahead with upper beam hot spot centered on horizontal line 3" below lamp center height.
Beam Indicator—At left end of speedometer dial. Lighted whenever Upper Beams in use.

Switches

Lighting—R-B-M Model 2445, Ford No. 11A-11653 (Pass. Cars), 01C-11653 (Comm'l. & Trucks exc. C-O-E), 01W-11653 (C-O-E Trucks). With wiring.
Beam Selector—R-B-M 2487. Ford No. 81A-13532.
Instrument—Ford No. 11A-13740 (Pass. Cars), 01A-13740B (Sedan Dlvry.). **Stop Light** Ford 11A-13480.

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps		Sealed Beam
Parking, Clock	1½	55
Parking (Truck)	3	63
Instrument, Ign. Lock	1	51
Beam Indicator	1	51
Dome (Pillar), Luggage Compt.	3	63
Stop & Tail	21-3	1154
Rear License	3	63

LIGHTING CIRCUIT BREAKER:—Ford No. 11A-12250 (V8). Combined with Ignition Resistor on block on dash under cowl. Consists of two separate circuit breaker units (one unit protects headlamp circuits, second unit protects other lighting circuits). Breakers are thermostatic and wound-coil type. Contacts open with current of 50 amperes and vibrate rapidly to control current.

FUSES:—Clock—2 ampere.

HORNS:—Air Electric dual horns (Pass. Cars & Sedan Dlvry.), Vibrator type Single Horn (Comm'l. & Trucks). Horn relay used with dual horns.
Horn Current—24-28 amperes (total—dual horns), 6-8 amperes (single horn).
Horn Relay:—R-B-M No. 50357, Ford No. 11A-13842B.
Contact Closing Voltage—3.5-4.5 volts.
Current Draw—Approximately ¾ ampere.

ENGINE HOOD NOTE:—Hood is Alligator type with latch at forward end. To raise hood, press toward left on hood latch handle in lower left front hood louvre, raise hood slightly, reach under lower edge of hood and release safety catch, raise hood.

SERIAL NUMBER:—First No. 700001 (109 '40), 700146 (109 '41), 900001 (113 '41). Stamped on plate on floor inside right rear door.

ENGINE NUMBER:—First No. 710001 (109 '40), 710222 (109 '41), 910001 (113 '41). On plate on right side of engine block and on Serial No. Plate (above).

COMPRESSION:—**Ratio**—6.65-1 Std. 7.0-1 & 7.25-1 Optl. **Pressure**—125 lbs. (113), 130 lbs. (109) at cranking speed (Std. Hd.).

VACUUM READING:—17" steady at idling speed.

IGNITION:—**Coil Model 1115127 (109), 1115022 (113).** On engine side of dash.

Ignition Current—2 amperes idling, 4 stopped.

Ignition Switch:—Delco-Remy Model 1116261. Connected to ignition coil by armored cable.

Ignition Lock—Chicago lock cylinder.

Distributor Model 623-S (109), 623-A (113). Single breaker, 6 lobe cam, full automatic advance type with separate auxiliary vacuum spark control.

Breaker Gap—Set at .018". Limits .018-.024".

Cam Angle or Dwell—35° closed, 25° open.

Breaker Arm Spring Tension—20 ounces.

Rotation—Counter-clockwise viewed from above.

Condenser—Part No. 829092. Capacity .18-.25 mfd.

Automatic Advance—623-A

Distributor		Engine	
Degrees	R.P.M.	Degrees	R.P.M.
Start	400	2	800
9	1400	18	2800

Automatic Advance—623-S

Start	275	2	550
3	400	6	800
8	1000	16	2000

Vacuum Spark Control Model 1116006 (623-A Dist.), 1116003 (623-S Dist.). Provides additional advance at speeds above idling except when engine accelerated or operated with wide open throttle when spark retarded by return spring within unit.

Plunger Travel—5/32" (1116006), 7/64" (1116003).

Vacuum Advance—1116006.

Dist. Degrees	Eng. Degrees	Vacuum (" of HG)
Start	0°	5-7"
5°	10°	14-18"

Vacuum Advance—1116003.

Start	0°	5-7"
5°	10°	12-16"

Distributor Removal:—Mounted on cylinder head. To remove, loosen advance arm clamp bolt and lift distributor out (not necessary to disconnect vacuum line).

FIRING ORDER:—1-5-3-6-2-4. See diagram.

SPARK PLUGS:—Champion J-10. 14 MM. Metric.

Spark Plug Gaps—.025".

IGNITION TIMING:—**Flywheel Degrees Piston Position**

109	4½° ATDC	.0088" ATDC
113	AT TDC	.0000" TDC

To Set Timing—With #1 piston on compression stroke, turn engine over until 'IGN' mark on flywheel lines up with indicator on housing (under cover on right front face of flywheel housing). Loosen advance arm clamp bolt, rotate distributor until contacts begin to open, tighten clamp bolt. See that rotor is opposite #1 segment in distributor cap.

CARBURETION:—**Carburetor (109)**—Carter WDO, Model 488-S. 1" dual, downdraft type with Climatic Control.

For complete data, refer to 1941 Carburetor Index.

Idle Setting—Both idle screws set alike and approx. ½-1¼ turns open (turn screws in for leaner mixture). Idle speed 7-8 MPH. (hot or slow idle).

Accelerating Pump Setting—Two holes provided in pump arm for connector rod engagement. Connect rod in outer hole (long radius) for maximum stroke, inner hole (short radius) for minimum stroke.

Float Level—3/16" from top of float to bowl cover with valve seated (remove gasket & invert to check).

Metering Rods & Jets—***See Carter Jet Specification Table in Carburetor Section for complete data.***

Fast Idle Setting—Set fast idle screw for .026" throttle opening with choke valve closed.

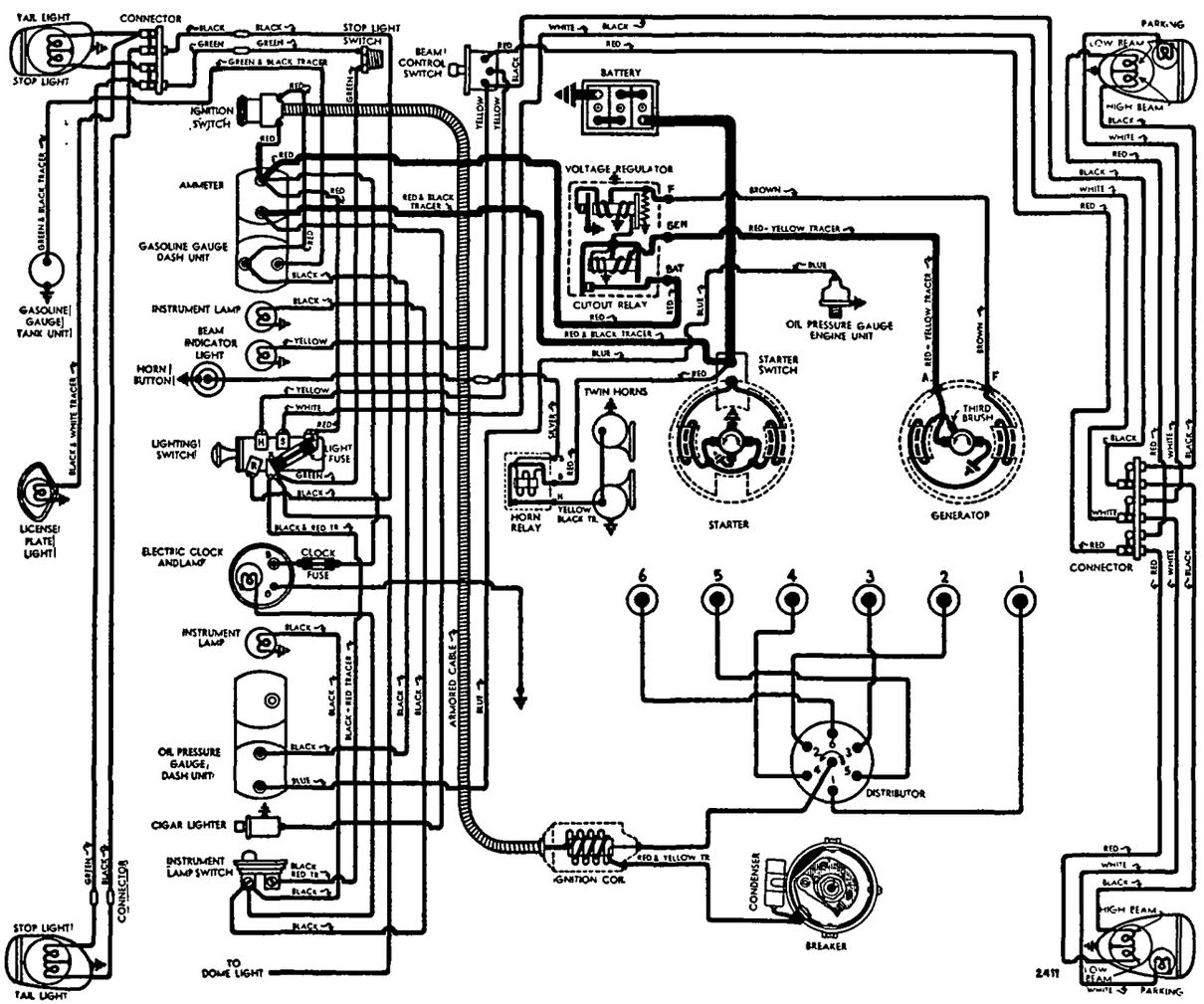
Automatic Choke Setting—Center index mark in line with reference mark on housing.

Carburetor (113):—Carter WA-1, Model 472-S, 1¼" single, downdraft type with Climatic Control.

For complete data, refer to 1941 Carburetor Index.

Idle Setting—Idle screw approx. ½-1½ turns open (turn screw in for leaner mixture). Idle speed 7-8 MPH (hot or slow idle—fast idle inoperative).

Accelerating Pump Setting—Three holes provided in pump arm (under dustcover on bowl cover) for connector rod engagement. Connect rod in inner



hole (short radius) for minimum stroke, outer (upper hole) for maximum stroke, outer (lower) hole for medium stroke.

Float Level—3/8" from top of seam at free end to top of projection on bowl cover (invert to check).

Metering Rods & Jets—*See Carter Jet Specification Table in Carburetor Section for complete data.*

Fast Idle Setting—Adjust by bending connector rod offset so choke valve opening is 5/8" with stopscrew against (not on) first step of fast idle cam.

Automatic Choke Setting—At Center Index mark.

Fast Idle:—Integral type (built-in each carb.).
For complete data, refer to 1941 Carb. Equip. Index.
Setting—See data for each carburetor (above).

Automatic Choke:—Carter Climatic Control.
For complete data, refer to 1941 Carb. Equip. Index.
Setting—See data for each carburetor (above).

Air Cleaner:—AC oil-wetted type Std., Heavy duty oil-bath type Optl.

Fuel Pump:—AC Type R, #1523731. Diaphragm type.
For complete data, refer to 1941 Carb. Equip. Index.

Gasoline Gauge:—Stewart (Stewart-Warner) Electric.
For complete data, refer to 1941 Carb. Equip. Index.

MANIFOLD HEAT CONTROL:—Model 109. Upper half of supercharger case and cross-passage between supercharger and manifold are water-jacketed for fuel mixture heating. No attention required.

Model 113. Heat control valve in manifold controlled by automatic thermostatic coil spring. No adjustment required.

VALVE TIMING:—To Check—With .012" tappet clearance, #6 exhaust valve closes with piston 4½° or .0088" past top dead center when flywheel mark 'EC-1' lines up with indicator on housing (inspection hole under cover on right front face of housing). Reset tappet clearance at .010" hot.

Tappet Clearance:—.010" all valves (hot).

Valve Spring Pressure:—44 lbs. at 1 21/32" (valve closed), 98 lbs. at 1 11/32" (valve open).

LUBRICATION:—Crankcase Capacity—5 quarts.

Normal Oil Pressure—45 lbs. at 30 M.P.H.

Oil Pressure Gauge:—Stewart (Stewart-Warner) Electric type.
For complete data, refer to 1941 Mech. Equip. Index.

COOLING SYSTEM:—Capacity—16 quarts.

Thermostat—Detroit Lubricator. In cylinder head outlet. Starts to open at 150°F. Fully open 180°.

BATTERY:—Willard Type SWB-100. 6 volt, 17 plate, 100 ampere hour capacity (20 hour rate).

Starting Capacity—120 amperes for 20 minutes.

Zero Capacity—300 amperes for 3.5 minutes at 0°. Five second voltage 4.3 volts.

Grounded Terminal—Positive (+) terminal.

Dimensions—Length 10½". Width 7⅛". Hgt. 8 7/16".

Location—Under left front seat or under rear compartment floor on left side.

Radio Battery—Willard Type HWB-110. 6 volt, 19 plate, 110 ampere hour capacity (20 hour rate).

Starting Capacity—134 amperes for 20 minutes.

Zero Capacity—300 amperes for 4.5 minutes at 0°. Five second voltage 4.4 volts.

Grounded Terminal, Dimensions, Location—Same as for Std. battery (above).

STARTER:—Model 738-T, X (RHD). Armature 823881.

Drive—Manual pinion shift (738-T), solenoid pinion shift (738-X), with overrunning clutch.

Cranking Engine—140-145 amperes, 5 volts.

Rotation—Counter-clockwise at commutator end.

Brush Spring Tension—24-28 ounces each.

Performance Data

Torque	R.P.M	Volts	Amperes
0 ft. lbs.	5000	5.0	65
12 "	Lock	3.37	525

Removal:—Flange mounted on left front face of flywheel housing. To remove, take out flange mounting screws.

Starting Switch (738-T):—Delco-Remy No. 820052. Mounted on starter field frame. Operated by pinion shift lever (starter pedal).

(738-X):—Solenoid Switch type 1546. Solenoid switch controlled through relay by push switch on instrument panel.
For complete data, refer to 1941 Elec. Equip. Index.

Solenoid Switch

Closes against 70 lbs. pull with ½" air gap drawing 65-71 amperes at 5 volts. Holds switch closed with draw of 12-14 amperes (hold-in coil only).

Solenoid Relay

Contacts Close—1.9 volts max. **Open**—1.0-1.2 volts.

Contact Gap—.035". **Air Gap**—.012" (closed).

GENERATOR:—Model 1100007. Armature No. 1966789. Fixed third brush control with external vibrating voltage regulator. Ventilated by fan on drive pulley.

Charging Rate Adjustment—Adjusted by changing voltage regulator setting. See Regulator data.
NOTE—Third brush clamped in position for maximum safe output and should not be disturbed.

Maximum Charging Rate—As given in table below. To check charging rate, connect test ammeter in charging line at regulator 'BAT' terminal, voltmeter between 'BAT' terminal and ground, ground generator 'F' terminal to eliminate regulator action.
NOTE—Do not operate generator on open-circuit. Restore original connections after completing test.

Performance Data

	Amperes	Volts	R.P.M.
Cold	26-30	8.0	3400
Hot	25-28	8.0	3600

Rotation—Counter-clockwise at commutator end.

Brush Spring Tension—25 ozs. (all brushes).

Field Current—2.3-2.6 amperes at 6.0 volts.

Removal:—Pivot mounted at left front of engine. To remove, take out pivot bolts and clamp bolt.

Belt Adjustment:—Loosen pivot bolts and clamp bolt, swing generator away from engine until belt deflection is 1" midway between generator and fan pulleys (use straightedge across pulleys).

REGULATOR:—Model 1118204 'Single Core' Type. Vibrating voltage regulator in case on dash.
For complete data, refer to 1941 Elec. Equip. Index.

CAUTION—Check generator for grounded field coils and leads before changing regulator settings to correct High Charging Rate or High Voltage.

Cutout Relay

Cuts In—6.2-6.7 volts hot.

Cuts Out—0-4.0 ampere discharge current.

Contact Gap—.020" (same for both sets).

Air Gap—.020" (with contacts just closed).

Voltage Regulator

Setting—7.2-7.4 volts hot (operating temperature). Regulator over-compensated for temperature. Should be checked with cover in place and hot.

To Check—Connect ammeter in charging line at regulator 'BAT' terminal, voltmeter between this terminal and ground. Operate generator at 2800 RPM., adjust charging rate to 8-10 amperes (use variable rheostat or AVR set). With regulator hot (150°F.), decrease generator speed until cutout relay contacts open, then increase speed to 2800 RPM. and check hot voltage setting (above).

To Adjust—Change regulator armature spring tension slightly by bending lower spring hanger for **light (left) spring or one spring only (if both springs alike).** If further adjustment required, see Single Core Regulator article in Electrical Equipment Section for heavy (or other spring) adjustment.

Air Gap—.070" between center of core and armature with contacts just closing (press down on armature to open contacts, release pressure, check gap at point where contacts just close).

LIGHTING:—Headlamps—Hall. Upper and lower beams controlled by beam selector switch on toe-board.

Headlamp Adjustment—Aim each headlamp straight ahead with high intensity spot centered on vertical line directly ahead of each lamp center and upper edge of this high intensity spot on horizontal line at lamp-center height.

Beam Indicator—In knob at right of ignition switch. Lighted when upper beams in use.

Switches

Lighting—Soreng-Manegold.

Beam Selector—R-B-M Model 1050.

Instrument—Delco-Remy No. 1997706.

Bulb Specifications

Position	Candlepower	Mazda No.
Headlights	32-32	2330
Parking	1½	55
Instrument, Beam Ind.	1	51
Stop & Tail	21-3	1158
License Plate, Dome	3	63

FUSES:—Lighting—20 ampere. In lighting switch.

Clock—SFE. 4 ampere. In clock lead.

HORNS:—Delco-Remy. Blended tone, twin horns No. 1999519 (109 Low Note), 1999520 (109 High Note), 1999531 (113 Low Note), 1999532 (113 High Note).

	Current (at 6 volts)	Air Gap
1999519, 31 (low note)	18-20	.044-.049"
1999520, 32 (high note)	19-21	.034-.039"

Horn Relay:—Delco-Remy No. 1116775.

Contact Gap—.025". **Air Gap**—.015" (closed).

C ntacts Close—2.75-4.0 volts.

HUDSON 1941

SIX, TRAVELER & DELUXE 10, SUPER SIX 11, COMMODORE 12, BUSINESS MODEL 10 & BIG BOY 18
AUTO-LITE ELECTRICAL SYSTEM

HOOD LOCK:—Reverse alligator type (same as 1940). Lock handle on instrument panel (on left side).

MODEL 10 NOTE:—3"x 5" engine optional (when this engine used **all equipment listed below for Model 11 used on these cars**). Serial No. plate carries identification prefixes as follows: **3"x4⅛" Eng.** 'T' (Traveler), 'D' (Deluxe), 'C' (Commercial). **3"x5" Engine** Additional letter 'L' thus: 'TL', 'DL', 'CL'.

SERIAL NUMBER:—First number 10101 (10), 11101 (11), 12101 (12), 18101 (18). First 2 figures indicate Model thus: 10-101. On plate on right front hoor hinge pillar post. See Model 10 Note above.

ENGINE NUMBER:—Same as Serial No. On top of cylinder block between #1 and 2 exhaust flanges.

COMPRESSION:—**Ratio**—7.25-1 (Model 10—3" x 4⅛" Eng.). 6.50-1 (11, 12, 18 & Model 10 with 3"x5" Eng.). **Pressure**—125 lbs. (7.25-1 Eng.), 120 lbs. (6.5-1 Eng.) at cranking speed of 125 RPM.

VACUUM READING:—18-21" steady idling at 600 RPM.

IGNITION:—**Coil Model IG-4098.** Mounted on dash.

Ignition Current—2.5 amperes idling, 4.5 stopped.

Ignition Switch:—Mitchellock Model 24-B, No. 8797.

Ignition Lock—Briggs & Stratton B & S No. 50184. **Key Series**—H601 to H1100. **Groove**—No. 1.

Distributor Auto-Lite IGW-4203A. Full automatic advance type with auxiliary vacuum spark control (separate unit) and Fuel Compensator adjustment.

Breaker Gap—.020".

Cam Angle or Dwell—35° closed, 25° open (distr. °).

Breaker Arm Spring Tension—17-20 ounces.

Rotation—Counter-clockwise viewed from above.

Condenser—No. IGW-3075C. Capacity .20-.25 mfd.

Distributor Degrees	R.P.M	**Automatic Advance** Degrees	Engine R.P.M.
Start	400	0	800
3	700	6	1400
6	1000	12	2000
9	1300	18	2600
11.75	1570	23.5	3140

Vacuum Spark Control—On distributor hold-down plate, linked to quadrant scale on distributor. Provides additional advance at speeds above idling except when engine accelerated or operated with wide open throttle (spark retarded by return spring within unit).

Vacuum Advance Distr. Degrees	Eng. Degrees	Vacuum (" of HG)
Start	0°	6¾"
2°	4°	7⅝"
4°	8°	8½"
6°	12°	9⅜"
7.5°	15°	10"

Fuel Compensator—Manual adjustment for octane rating of fuel used. See Ignition Timing for setting.

Distributor Removal:—Mounted at top rear of cylinder head. To remove, disconnect vacuum line, take out cyl. head stud nuts on hold-down plate.

FIRING ORDER:—1-5-3-6-2-4. See diagram.

SPARK PLUGS:—Champion Spec. J9 Hudson. 14 MM.

Optional Plugs—Champion J5 (hotter plug) for continuous low speed service or J10 Commercial (cooler plug) for continuous high speed service.

Spark Plug Gaps—.032".

IGNITION TIMING:—**Initial Setting**—½" (two spaces) BTDC. for fuel of approximately 72 Octane rating.

Flywheel Marks—'UDC.1-6/' at TDC with 4 graduations (¼" apart) ahead of this mark.

Timing—With #1 piston on compression, turn engine over until second graduation before flywheel mark 'UDC.1-6/' lines up with pointer on left front face of rear motor support above starter. Loosen vacuum advance diaphragm screw on quadrant scale, rotate distributor counter-clockwise to limit of slot, then slowly rotate clockwise until contacts begin to open, tighten diaphragm screw securely. Check Fuel Compensator Setting below.

Timing (Using Synchroscope)—Recommended by car manufacturer. Mark flywheel with white chalk or paint. Idle engine, adjust distributor (above).

Fuel Compensator Setting—Road test car (engine warm). When running at 8 MPH slight ping should occur between 10-15 MPH when accelerating with wide open throttle. To adjust, loosen vacuum unit link screw on distributor quadrant, rotate distributor one graduation on quadrant scale clockwise (if no ping), counter-clockwise (if ping too severe). **Final setting must not be more than 1" (4th graduation) before 'UDC.1-6/' flywheel mark.**

CARBURETION:—**Carburetor (10—See Note, 18).** Carter WA-1 Model 454-S (No. 298 cast on face of flange). 1¼" single barrel, downdraft type.

For complete data, refer to 1941 Carburetor Index.

Model 10 Note—Cars with 3" x 5" Eng. use 501-S dual carburetor (same as Model 11, 12 below).

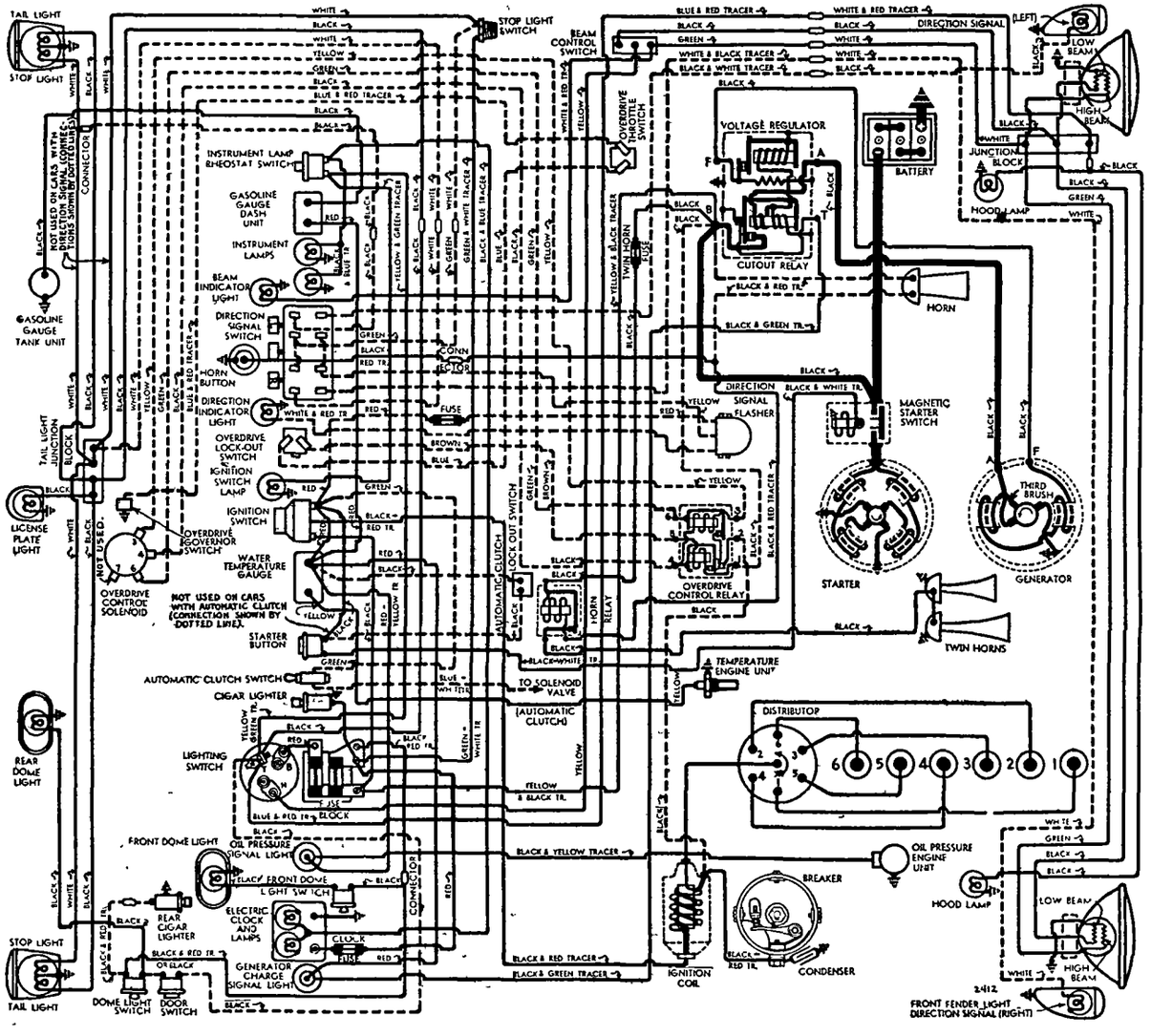
Carburetor (11, 12):—Carter dual type. ***See 1941 Hudson 8 'T&E' page following for all carburetor data.***

Idle Adjustment—With engine warm, set throttle stopscrew for 600 RPM hot or slow idle speed (fast idle inoperative), adjust idle adjusting screw so engine fires smoothly and vacuum reading at maximum (screw ¾-1½ turns open—turn screw in for leaner setting), recheck idle speed.

Accelerating Pump Setting—Pump arm has three holes for pump link engagement. Set as follows:
Lower Hole (med. stroke)—Normal setting.
Inner Hole (min.)—Hot weather or hi-test fuel.
Upper Hole (max.)—Cold weather or low-test fuel.

Float Level—⅜" from top of bowl cover projection to top of soldered seam on float at free end with valve seated (invert to check).

Metering Rods & Jets—***See Carter Jet Table in Carburetor Section for complete data.***



Fast Idle:—Integral type (part of carburetor).
For complete data, refer to 1941 Carb. Equip. Index.
Setting—Adjust by bending connecting link offset for 5/8" choke valve opening with throttle stopscrew against (not on) first step of fast idle cam.
Automatic Choke:—Carter Climatic Control.
For complete data, refer to 1941 Carb. Equip. Index.
Setting—Centered (at index mark).
Air Cleaner:—AC #1528159 (10, 18), #1528161 (11, 12) oil-wetted type std. United oil-bath type optl.
Fuel Pump:—AC Type AF (10, 18 Pass.), AP (all others). Pump Exchange Part No. 509 (10), 499 (all others). Type AJ fuel and vacuum pump Optl.
For complete data, refer to 1941 Carb. Equip. Index.
Gasoline Gauge:—King-Seeley Electric. K-S No. 8305 (Dash Unit—stamped 'G'), No. 7550 (Tank Unit).
For complete data, refer to 1941 Carb. Equip. Index.
MANIFOLD HEAT CONTROL (10, 18):—Manual type at center of manifold behind carburetor.
Setting—Arrow on valve cover pointing to 'W' cast on top of manifold **for summer and winter.**
11, 12:—Automatic thermostatic coil type. This type also used on Model 10 with dual carburetor.
VALVE TIMING:—**To Check**—With .010" tappet clearance, #1 intake valve opens 10°40' BTDC (see Note below for later Model 10 cars) or approx. 4 teeth on flywheel before 'UDC.1-6/' mark with piston .0441" (first Model 10), .0562" (11, 12) BTDC.
Model 10 Camshaft Change—On later engines (with specified tappet clearance of .010" Intake, .012" Exhaust) intake valve opens 28°30' BTDC.
Tappet Clearance:—.006" Int., .008" Exh. (hot and idling) **except later Model 10** with plate on valve cover specifying .010" Intake, .012" Exhaust Hot. Remove right front fender plate for access to valves.
See Hudson Shop Notes ('M' Section) for removal data.
Valve Spring Pressure:—40 lbs. at 2" (valve closed), 80 lbs. at 1 21/32" (valve open). Free length 2 17/64".
LUBRICATION:—**Crankcase Capacity**—4½ qts. (refill), 5½ qts. (dry). NOTE—Whenever pan installed, place 1½ qts. in upper tray, 4 qts. through filler.
Normal Oil Pressure—4-12 lbs. with hot oil.
Oil Pressure Indicator:—Hudson Teleflash indicator.
For complete data, refer to 1941 Elec. Equip. Index.
COOLING SYSTEM:—**Capacity**—13 quarts.
Thermostat—Fulton. In cylinder head outlet. Starts to open 150-155°F. Fully open 185°F. High reading type (for ethylene glycol type anti-freeze) starts to open 160-175°F. Fully open 190°F.
Temperature Gauge:—King-Seeley Electric. K-S No. 8310 (Dash Unit—stamped 'T'). 7000 (Eng. Unit). NOTE—Gauge reads HOT with ignition off.
For complete data, refer to 1941 Mech. Equip. Index.
AUTOMATIC CLUTCH CONTROL:—Electric type. Optl. NOTE—Governor Switch changed during production.
For complete data, refer to 1941 Mech. Equip. Index.
TRANSMISSION OVERDRIVE CONTROL:—New electric type (Solenoid & Governor—with 'kick-down').
For complete data, refer to 1941 Mech. Equip. Index.
Overdrive Solenoid—Delco-Remy. Hudson #163305.
Throttle Switch—Cole-Hersee. Hudson No. 162594. Adjust position of contact washer on accelerator pedal rod so that it just contacts switch plunger with carburetor throttle in wide open position.
Governor Switch—Bendix No. 162867. NOTE—Changed in production. New type has purple dots on terminals.

BATTERY:—**National, Type HT-17.** 6 volt, 17 plate, 96 ampere hour capacity (20 hour rate).
Starting Capacity—120 amperes for 20 minutes.
Zero Capacity—300 amperes for 3.5 minutes. Five second voltage—4.24 volts.
Grounded Terminal—Positive (+) to frame. **Engine Ground**—Strap (rear motor support to frame).
Dimensions—Lgth. 10 9/16". W. 7¼". Hght. 7 13/16".
Location—On left side under engine hood.

STARTER:—**Auto-Lite MZ-4092. Armature MZ-2138.**
Drive—Inboard Barrel type Bendix No. A-1684.
Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—42-53 ozs. (new brushes).
Cranking Engine—150 RPM, 125 amperes, 5.4 volts.

Performance Data

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	4300	5.5	70
2.55 "	1325	5.0	200
4.95 "	750	4.5	300
7.65 "	220	4.0	400
7.8 "	Lock	3.0	420
11.8 "	Lock	4.0	560

Removal:—On left front face of rear motor support. To remove, take out flange mounting screws.
Starting Switch:—A-L Model SS-4001. Magnetic type.
For complete data, refer to 1941 Elec. Equip. Index.

GENERATOR:—**Auto-Lite GDS-4801A (10, 18) GEC-4801A (11, 12).** Third brush control with external vibrating voltage regulation. Ventilated type.
Armature—GDF-2006F (GDS), GDZ-2006F (GEC).
Maximum Charging Rate (GDS)—32-34 amperes (cold), 8.0 volts, 2900 RPM or approx. 35 MPH.
(GEC) 39-43 amperes (cold), 8.0 volts, 3350 RPM or approx. 43 MPH. Actual charging rate controlled by Voltage Regulator and dependent on battery condition. See Regulator data following. When checking generator output, ground regulator 'F' terminal.
Charging Rate Adjustment—See Regulator. Third brush setting (GDS) 1 comm. bar minus 1 mica strip min., 1 comm. bar max. from insulated (nearest main brush). (GEC) 1 comm. bar min., 1 comm. bar plus 1 mica strip max. Adjust by shifting 3rd brush.

Performance Data—GDS-4801A

Cold			Hot		
Amperes	Volts	R.P.M.	Amperes	Volts	R.P.M
0	6.4	920	0	6.4	960
4	6.6	1050	4	6.65	1120
8	6.8	1175	8	6.9	1280
12	7.0	1300	12	7.1	1430
16	7.2	1450	16	7.35	1640
20	7.4	1600	20	7.6	1900
24	7.6	1820	24	7.8	2320
28	7.8	2075	27.5	8.0	3400
33	8.0	2900			

Performance Data—GEC-4801A

0	6.4	960	0	6.4	1040
4	6.55	1060	4	6.6	1140
8	6.7	1160	8	6.8	1280
12	6.85	1280	12	6.95	1440
16	7.0	1400	16	7.15	1600
20	7.15	1550	20	7.35	1820
24	7.25	1700	24	7.55	2090
28	7.5	1890	28	7.75	2440
32	7.65	2100	32	7.9	3000
36	7.8	2375	34	8.0	3800
41	8.0	3350			

Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—53 ozs. max. (new brushes).
Field Current—1.65-1.82 amperes (GDS), 1.60-1.78 amperes (GEC) at 6.0 volts.
Motoring Current—5.10-5.45 (GDS), 4.85-5.4 (GEC) amperes at 6.0 volts.
Removal:—Pivot mounted at left front of engine. To remove, take out pivot and clamp bolts.
Belt Adjustment:—¾" slack midway between pulleys.

REGULATOR:—**Auto-Lite VRR-4001A.** Cutout Relay and vibrating Voltage Regulator in case on dash. Cutout Relay has extra set of contacts for Generator Teleflash Indicator control. NOTE—Regulator enclosed in close-fitting metal cover on dash.
For complete data, refer to 1941 Elec. Equip. Index.
NOTE—Regulator case cover is sealed. Serviced on exchange basis if seals not broken.

Cutout Relay

Cuts In—6.4-6.6 volts, 825 RPM. 9.4 MPH.
Cuts Out—4.8-5.6 volts (approx. 4-6 amps. disch.).
Contact Gap—.015" min. ground contacts closed (ground contacts open when main contacts close).
Air Gap—.034-.038" at hinge end of core with contacts open (ground contacts closed).

Voltage Regulator

Setting—7.1-7.4 volts at 110°F.
To Check (without breaking seals)—Connect ammeter in charging line at regulator 'B' terminal, voltmeter between this terminal and ground. Operate generator at speed of 30 MPH charging battery until voltage is constant. Voltmeter reading should be within limits of 7.1-7.4 volts at 70°F. See Electrical Equipment Section for other temperatures.
To Adjust (with cover removed)—Change regulator armature spring tension by bending lower spring hanger slightly. See Electrical Equipment Section.
Contact Gap—.012" Min. (armature against stop).
Air Gap—.048-.052" with contacts just opening.

LIGHTING:—**Headlamps**—Hall 'Sealed Beam' type.
For complete data, refer to 1941 Elec. Equip. Index.
Headlamp Adjustment—Aim upper beam of each headlamp straight ahead with hot spot centered on horizontal line 3" below lamp center height.
Beam Indicator—Red pilot bulb on speedometer dial. Lighted with Country (upper) beam in use.
Direction Indicator—Optional equipment.
For complete data, refer to 1941 Elec. Equip. Index.

Switches

Lighting—Douglas. Hudson No. 147835.
Beam Selector—R-B-M Model 2484.
Instrument—R-B-M. Hudson No. 160092.

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps		Sealed Beam
Side Panel (Parking)	1½	55
Fender Lamp (see Note)	3	63
Speedometer, Elec. Clock	1½	55
Generator & Oil Signals	1½	55
Ign. Lock, Mech. Clock	1	51
Beam & Direct. Indic.	1	51
Stop & Tail	21-3	1154
Rear License	3	63
Dome	15	87

NOTE—21 cp. No. 1129 for Direction Indicator.

SIGNAL LIGHTS:—Generator Charge and Oil Pressure Indicators used. Hudson Teleflash Electric type.
For complete data, refer to 1941 Elec. Equip. Index.

FUSES:—**Lighting**—30 ampere. Lower fuse on fuse block on lower edge of instrument panel to right of steering column. **Accessory**—30 amp. Top fuse on block. NOTE—Silver-plated fuses used. 30 amp. fuse supersedes 20 ampere fuse used on early cars.
Twin Horns—30 amp. In case on engine dash.
Direction Indicator—10 amp. near speedometer.
Electric Clock—2 amp. in case behind clock.
NOTE—Feed wire for electric clock on early cars connected to fuse block 'Bat' terminal. Should be changed to Lighting Switch (see diagram).

HORNS:—**Single**—Schwarze electric. Std. on 10T, 18.
Twin—Sparton air electric type operated by relay. Fuse on dash. **(Air Gap)** .026-.030" high pitch (short), .032-.035" low pitch (long).
Horn Relay:—R-B-M Model 6004. On dash. **Contacts Close** 3-4 volts (relay upright, terminals down).

CONVERTIBLE TOP CONTROL:—Hydro-electric type.
For complete data, refer to 1941 Mech. Equip. Index.

MODEL NOTATION:

	Model	Serial Nos.
Commodore Eight	14	14101 Up
Commodore 8 Custom Coupe	15	15101 Up
Commodore 8 Custom Sedan	17	17101 Up

HOOD LOCK:—Reverse alligator type (same as 1940). Lock handle on instrument (on left side).

SERIAL & ENGINE NUMBER:—See Model Notation for first Nos. (first 2 figures indicate model thus: 14-101). Stamped on plate on right front door hinge pillar post and on top of engine block between #1 and #2 exhaust manifold flanges.

COMPRESSION:—**Ratio**—6.5-1 Std. No Optl. ratios. **Pressure**—120 lbs. at 125 RPM cranking speed.

VACUUM READING:—18-21" steady idling at 600 RPM.

IGNITION:—**Coil Model CE-4029.** Mounted on dash. Service Coil (less switch & cable) CE-3224JS.
Ignition Current—2.5 amperes idling, 4.5 stopped.
Ignition Switch:—Mitchellock Model 24-B, No. 8797.
Ignition Lock—Briggs & Stratton. B & S No. 50184.
Key Series—H601 to H1100. **Groove**—No. 1.
Distributor Auto-Lite IGP-4008A. Full automatic advance type with Fuel Compensator Adjustment.
Breaker Gap—.017".
Cam Angle or Dwell—31° closed, 14° open (dist.).
Breaker Arm Spring Tension—17-20 ounces.
Rotation—Clockwise viewed from above.
Condenser—No. IG-2671. Capacity .20-.25 mfd.

Automatic Advance

Distributor Degrees	R.P.M.	Engine Degrees	R.P.M.
Start	300	0	600
3	400	6	800
8	850	16	1700
13	1300	26	2600
17.5	1700	35	3400

Fuel Compensator—Manual adjustment for octane rating of fuel used. See Ignition Timing for setting.
Removal:—Mounted on right side of crankcase. To remove take out hold-down screws in advance arm.

FIRING ORDER:—1-6-2-5-8-3-7-4. See diagram.

SPARK PLUGS:—Champion Spec. J9 Hudson, 14 MM. **Optional Plugs**—Champion J5 (hotter plug) for continuous low speed service or J10 Commercial (cooler plug) for continuous high speed service.
Spark Plug Gaps—.032".

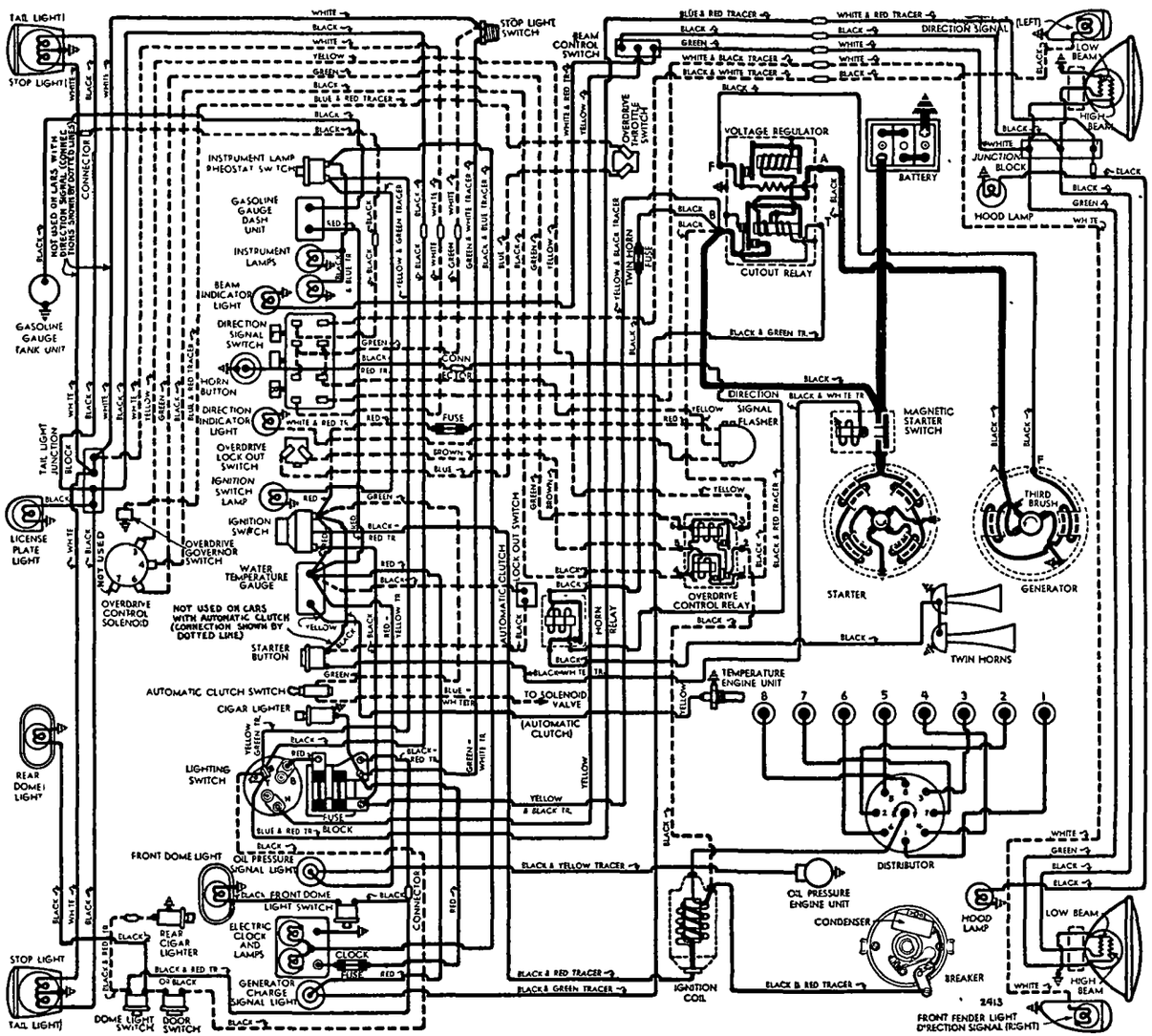
IGNITION TIMING:—Initial Setting (for 72 octane rating fuel). See Fuel Compensator setting following.

	Flywheel Degrees	Piston Position
All Engines	0° at TDC	.0000" TDC

Flywheel Marks—'UDC.1-8/' at TDC with 4 graduations (¼" apart) ahead of this mark.
Timing—With #1 piston on compression, turn engine over until piston reaches top dead center when flywheel mark 'UDC.1-8/' lines up with pointer in left front face of rear motor support. Loosen hold-down screw in advance arm, rotate distributor clockwise to limit of advance arm slot, then slowly rotate distributor counter-clockwise until contacts begin to open, tighten hold-down screw. Check Fuel Compensator setting.
Timing (Using Synchroscope)—Recommended by manufacturer. Mark flywheel with white chalk or paint, connect at #1 spark plug. Idle engine and adjust distributor as directed above.
Fuel Compensator Setting—Road test car (engine warm). When running at 8 MPH slight ping should occur between 10-15 MPH when accelerating with wide open throttle. To adjust, loosen hold-down screw, rotate distributor one graduation on scale counter-clockwise (if no ping), clockwise (if ping to severe). **Final setting must not be more than ¾" (3rd graduation) before 'UDC.1-8/' mark.**

CARBURETION (SIX—DUAL TYPE):—Carburetor—Carter Type WDO Model 461-S (before Serial & Engine No. 2150), Model 501-S (Serial & Engine No. 2150 and up). 1" dual downdraft types. #268 cast on face of carburetor flange (both carburetors). Slow closing throttle 'dashpot' device used on Model 461-S only. **These carburetors used on Six cylinder Models 11, 12, and 10 (with 3" x 5" engine).** ***Carburetor tune up data listed below for 8 cylinder Models 14, 17 applies to these Six cylinder carburetor models also.***

CARBURETION (EIGHT):—Carburetor—Carter Type WDO Model 455-S (before Serial & Engine No. 7293), Model 502-S (Serial & Engine No. 7293 and up). 1¼" dual downdraft types. #279 cast on face of carburetor flange (both carburetors). Slow closing throttle 'dashpot' device used on Model 455-S only. ***For complete data, refer to 1941 Carburetor Index.***
Idle Adjustment—With engine warm and running at slow idle speed (choke valve wide open, fast idle inoperative), set throttle stopscrew for 600 RPM idle speed. Adjust idle adjusting screws (2 used, 1 for each barrel) in succession until engine fires smoothly. Final setting should be ½-1½ (455-S, 501-S, 502-S), ¼-1¼ (461-S) turns open for each screw (turn screws in for leaner mixture) for highest reading of vacuum gauge. Recheck idle speed.
Accelerating Pump Setting—Pump lever (under dust cover at top of carburetor) has 2 holes for pump link engagement. Adjust as follows:
Outer Hole (Max. stroke)—Normal setting.
Inner Hole (Min. stroke)—If less charge required.
Float Level—3/32" (455-S, 461-S), ⅛" (501-S, 502-S) from top of float to bowl cover with needle valve seated (remove gasket and invert to check).
Metering Rods & Jets—***See Carter Jet Table in Carburetor Section for complete data.***



Fast Idle:—Integral type (part of carburetor).
For complete data, refer to 1941 Carb. Equip. Index.
Setting (455-S, 461-S)—With choke valve closed, turn fast idle screw in for .018" throttle opening.
Setting (501-S, 502-S)—With choke valve closed and fast idle screw on high lobe of fast idle cam, turn fast idle screw in until throttle opening is .045" 501-S—Six), .053" (502-S—Eight).
Automatic Choke:—Carter Climatic Control.
For complete data, refer to 1941 Carb. Equip. Index.
Setting—Centered (at index mark) for 455-S, 461-S. 1 Notch Lean for 501-S, 502-S (supersedes original 'Centered' setting on these models).
Air Cleaner:—AC #1528161 oil-wetted type Std. United heavy duty oil-bath type optional.
Fuel Pump:—AC Type AP (std.). Pump Exchange Part No. 499. Type AJ combination fuel-and-vacuum pump optional.
For complete data, refer to 1941 Carb. Equip. Index.
Gasoline Gauge:—King-Seeley Electric. K-S No. 8305 (Dash Unit—stamped 'G'), No. 7550 (Tank Unit).
For complete data, refer to 1941 Carb. Equip. Index.
MANIFOLD HEAT CONTROL:—Automatic thermostatic type. No adjustment required.
VALVE TIMING:—To Check—With .010" tappet clearance, #1 intake valve should open with #1 piston 10°40' or .0494" BTDC when a point on the flywheel approx. 3.94 teeth before 'UDC.1-8/' mark lines up with indicator in inspection hole above starter (left side). Reset tappet clearance .006" (hot and idling).
Tappet Clearance:—.006" Intake, .008" Exhaust (with engine hot and idling). Remove right front fender plate for access to valves. ***See Hudson Shop Notes ('M' Section) for fender plate removal.***
Valve Spring Pressure:—40 lbs. at 2" (valve closed), 80 lbs. at 1 21/32" (valve open). Free length 2 17/64".
LUBRICATION:—Crankcase Capacity—7 qts. (refill), 9 qts. (dry). NOTE—Whenever pan installed, place 2 qts. in upper tray, 7 qts. through filler.
Normal Oil Pressure—4-12 lbs. with hot oil.
Oil Pressure Indicator:—Hudson Teleflash indicator.
For complete data, refer to 1941 Elec. Equip. Index.
COOLING SYSTEM:—Capacity—18 quarts.
Thermostat—Fulton, By-pass type (15, 17), choke type (14), in cylinder head outlet. Starts to open 150-155°F. Fully open 185°F. NOTE—Special high temperature thermostats available for use with ethylene glycol type anti-freeze. Starts to open 165-170°F (15,17), 160-165°F (14). Fully open 195°F (15,17), 190°F (14).
Temperature Gauge:—King-Seeley Electric. K-S No. 8310 (Dash Unit—stamped'T'). 7000 (Eng. Unit). NOTE—Gauge reads HOT with ignition off.
For complete data, refer to 1941 Mech. Equip. Index.
AUTOMATIC CLUTCH CONTROL:—Electric type. Optl. NOTE—Governor Switch changed during production.
For complete data, refer to 1941 Mech. Equip. Index.
TRANSMISSION OVERDRIVE CONTROL:—New electric type (Solenoid & Governor with 'kick-down').
For complete data, refer to 1941 Mech. Equip. Index.
Overdrive Solenoid—Delco-Remy. Hudson #163305.
Throttle Switch—Cole-Hersee. Hudson No. 162594. Adjust position of contact washer on accelerator pedal rod so that it just contacts switch plunger with carburetor throttle in wide open position.
Governor Switch—Bendix No. 162867.
NOTE—Switch changed to Part No. 162867 during production (identified by purple dots on terminal screw heads & purple band around switch body).
BATTERY:—**National, Type HT-19.** 6 volt, 19 plate, 108 ampere hour capacity (20 hour rate).
Starting Capacity—135 amperes for 20 minutes.
Zero Capacity—300 amperes for 4.0 minutes. Five second voltage—4.43 volts.
Grounded Terminal—Positive (+) to frame. **Engine Ground**—Strap (rear motor support to frame).
Dimensions—Lgth. 11¾". Width 7¼". Hght. 7 13/16".
Location—On left side under engine hood.
STARTER:—Auto-Lite MAB-4100. Armature MAB-2113.
Drive—Inboard Barrel type Bendix No. A-1684.
Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—42-53 ozs. (new brushes).
Cranking Engine—150 RPM, 120-125 amperes, 5 v.

Performance Data

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	3700	5.5	60
0.6 "	1910	5.5	100
3.4 "	1100	5.0	200
6.6 "	695	4.5	300
10.15 "	420	4.0	400
15.2 "	Lock	3.0	575
21.5 "	Lock	4.0	750

NOTE—Lock torque figures correct with switch.
Removal:—On left front face of rear motor support. To remove, take out flange mounting screws.
Starting Switch:—A-L Model SS-4001. Magnetic type. Mounted on starter, controlled by switch on instrument panel. Operative only with ignition on (and clutch disengaged on cars with Automatic Clutch). Starter pushbutton Douglas. Hudson No. 147834.
For complete data, refer to 1941 Elec. Equip. Index.
GENERATOR:—Auto-Lite GEC-4801A. Armature GDZ-2006F. Third brush control with voltage regulation. Ventilated by fan on drive pulley.
Maximum Charging Rate—39-43 amperes (cold), 3350 RPM or approx. 43 MPH. Actual charging rate controlled by Voltage Regulator and dependent on battery condition. See Regulator data. When checking generator output, ground 'F' terminal to eliminate regulator action.
Charging Rate Adjustment—See Regulator data. Third brush setting 1 commutator bar minimum, 1 commutator bar plus 1 mica strip maximum, from nearest (insulated) main brush. Setting adjustable by shifting third brush.

Cold Performance Data			Hot Performance Data		
Amperes	Volts	R.P.M.	Amperes	Volts	R.P.M
0	6.4	960	0	6.4	1040
4	6.55	1060	4	6.6	1140
8	6.7	1160	8	6.8	1280
12	6.85	1280	12	6.95	1440
16	7.0	1400	16	7.15	1600
20	7.15	1550	20	7.35	1820
24	7.25	1700	24	7.55	2090
28	7.5	1890	28	7.75	2440
32	7.65	2100	32	7.9	3000
36	7.8	2375	34	8.0	3800
41	8.0	3350			

Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—53 ozs. max. (new brushes).
Field Current—1.60-1.78 amperes at 6.0 volts.
Motoring Current—4.85-5.4 amperes at 6.0 volts.
Removal:—Pivot mounted at left front of engine. To remove, take out pivot and clamp bolts.
Belt Adjustment:—Swing generator out until possible belt deflection midway between generator and fan pulley is ¾" (use straightedge across pulleys).
REGULATOR:—Auto-Lite VRR-4001A. Cutout Relay and vibrating Voltage Regulator in case on dash. Cutout Relay has extra set of contacts for Generator Teleflash Indicator control. NOTE—Regulator enclosed in tight fitting metal cover on dash.
For complete data, refer to 1941 Elec. Equip. Index.
NOTE—Regulator case cover is sealed. Serviced on exchange basis if seals not broken.

Cutout Relay
Cuts In—6.4-6.6 volts, 825 RPM. 9.4 MPH.
Cuts Out—4.8-5.6 volts (approx. 4-6 amps. disch.).
Contact Gap—.015" min. ground contacts closed (ground contacts open when main contacts close).
Air Gap—.034-.038" at hinge end of core with contacts open (ground contacts closed).

Voltage Regulator
Setting—7.1-7.4 volts at 110°F.
To Check (without breaking seals)—Connect ammeter in charging line at regulator 'B' terminal, voltmeter between this terminal and ground. Operate generator at speed of 30 MPH charging battery until voltage is constant. Voltmeter reading should be within limits of 7.1-7.4 volts at 70°F. See Electrical Equipment Section for other temperatures.
To Adjust (with cover removed)—Change regulator armature spring tension by bending lower spring hanger slightly. See Electrical Equipment Section.
Contact Gap—.012" Min. (armature against stop).
Air Gap—.048-.052" with contacts just opening.
LIGHTING:—Headlamps—Hall 'Sealed Beam' type.
For complete data, refer to 1941 Elec. Equip. Index.
Headlamp Adjustment—Aim upper beam of each headlamp straight ahead with hot spot centered on horizontal line 3" below lamp center height.
Beam Indicator—Red pilot bulb on speedometer dial. Lighted with Country (upper) beam in use.
Direction Indicator—Std. on 15, 17. Optl. on 14.
For complete data, refer to 1941 Elec. Equip. Index.

Switches
Lighting—Douglas. Hudson No. 147835.
Beam Selector—R-B-M Model 2484.
Instrument—R-B-M. Hudson No. 160092.

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps		Sealed Beam
Side Panel (Parking)	1½	55
Fender Lamp (see Note)	3	63
Speedometer, Elec. Clock	1½	55
Generator & Oil Signals	1½	55
Ign. Lock, Mech. Clock	1	51
Beam & Direct. Indic.	1	51
Stop & Tail	21-3	1154
Rear License	3	63
Dome	15	87

NOTE—21 cp. No. 1129 for Direction Indicator.
SIGNAL LIGHTS:—Generator Charge and Oil Pressure Indicators used. Hudson Teleflash Electric type.
For complete data, refer to 1941 Elec. Equip. Index.
FUSES:—Lighting—30 ampere. Lower fuse on fuse block on lower edge of instrument panel to right of steering column. **Accessory**—30 amp. Top fuse on block. NOTE—Silver-plated fuses used. 30 amp. fuse supersedes 20 ampere fuse used on early cars.
Twin Horns—30 amp. In case on engine dash.
Direction Indicator—10 amp. near speedometer.
Electric Clock—2 amp. in case behind clock.
NOTE—Feed wire for electric clock on early cars connected to battery 'B' terminal on fuse block. Car manufacturer recommends that feed be connected to accessory 'X' terminal (see diagram).
HORNS:—Sparton—Twin air electric type operated by relay. 30 amp. fuse in case on dash.
Air Gap—.026-.030" high pitch (short horn), .032-.035" low pitch (long horn).
Horn Relay:—R-B-M Model 6004. On engine dash.
Contacts Close—3 volts min., 4 volts, max.
Open—2 volts min. (relay upright, terminals down).
CONVERTIBLE TOP CONTROL:—Hydro-electric type.
For complete data, refer to 1941 Mech. Equip. Index.

HOOD LOCK:—Alligator type. Hood lock button located below instrument panel on left side.

SERIAL & ENGINE NUMBER:—Stamped on top of clutch housing (Body No. only on plate on dash).

COMPRESSION:—**Ratio**—7.0-1 Std.

Pressure—110 lbs. at cranking speed of 100 RPM.

VACUUM READING:—18-20" steady idling at 6 MPH.

IGNITION:—**Ignition Coil Ford No. H-12024** (2 coil unit in single case—part of ignition unit assembly). Mounted on distributor at front of engine.

Ignition Current—Approximately 3.2 amperes idling, 4.2 amperes stopped, per coil. Ignition primary circuit resistance 1.0-1.33 ohms.

Resistor Unit—One resistor connected in each coil primary circuit (2 used). Part of Lighting Circuit Breaker Assembly No. 16H-11624.

Ignition Switch:—Oakes steering column and ignition lock assembly. NOTE—Steering post and ignition lock assembly No. (below) includes lock cylinder and keys.

	Steering Post & Ign. Lock Assem. Oakes No.	Ford No.	Ignition Switch Oakes No.	Ford No.
Zephyr①	302490..	16H-3675A	302440..	16H-3680
Zephyr②	302545..	16H-3675B	302440..	16H-3680
Continental	302516..	16H-3675C	302440..	16H-3680
Custom Sedan	302599..168H-	3675A	302440..	16H-3680
Custom Lim.	..302565..168H-	3675B	302440..	16H-3680

①—Standard Trim; ②—Custom Trim.

Lock Cylinder—Hurd. Ford No. 16H-3686A (Zephyr—Std. Trim), 16H-3686B (Zephyr—Custom Trim, Continental, Custom Sedan & Limousine). Includes keys.

Distributor Model No. H-12127 (less coils, distributor plates and caps). Double breaker, 6 lobe cam, full automatic advance type with Vacuum Brake Control (see Ignition Timing). Same design as used on previous Lincoln-Zephyr models.

Firing Interval—Movable contacts open 37½° after fixed set with unequal intervals of 37½° and 22½° (75° & 45° crankshaft rotation) caused by 75° included angle between cylinder banks.

Breaker Gap—.014-.016" (both sets set alike).

Cam Angle or Dwell—36.5° closed, 23.5° open (each set—operate independently).

Breaker Arm Spring Tension—20-24 ozs.

Rotation—Clockwise viewed from drive end.

Condenser—No. H-12300 (2 used). Cap. .30-.34 mfd.

Automatic Advance
(High Vacuum or Vacuum Brake inoperative)

Distributor Degrees	R.P.M.	Engine Degrees	R.P.M.
Start	200	0	400
2	300	4	600
3	375	6	750
4	480	8	960
6	720	12	1440
8	950	16	1900

Distributor Removal:—Mounted on front of engine. To remove, remove generator, disconnect vacuum line and primary leads, remove distributor caps, take out 3 capscrews in mounting flange.

FIRING ORDER:—1-4-9-8-5-2-11-10-3-6-7-12. See diagram for cylinder numbering and spark plug distributor connections.

SPARK PLUGS:—Champion Type H-10. 14 MM. Metric.

Spark Plug Gaps—Set at .030-.034".

IGNITION TIMING:—See Vacuum Brake Setting below for correction dependent on fuel and operating conditions.

	Flywheel Degrees	Piston Position
All Engines	4° BTDC	.0058" BTDC.

Timing & Synchronizing Note—Manufacturer recommends use of Stroboscope & Ford Test Set for this purpose. If V-126 Timing Fixture used, refer to 1937 Lincoln-Zephyr 'T&E' page for instructions. No flywheel marks or other means provided to synchronize distributor on engine.

Timing (On Engine)—With #2 piston on top dead center (starting power stroke), loosen adjusting screw on right side of ignition unit housing, move screw down to bottom of slot, then move screw up slowly until left hand (fixed contacts) begin to open, note graduation on plate under screw head in line with reference mark on housing, move screw up one additional graduation and tighten (this provides 4° BTDC. timing).

Synchronization (Movable Contacts)—No means provided for synchronization on engine (see note above). If Stroboscope, Timing Fixture, etc. used, set movable contacts to open exactly 37½° (distributor rotation) after fixed set. To adjust, remove timing adjusting screw and plate on side of housing, turn eccentric adjusting screw (visible in slot).

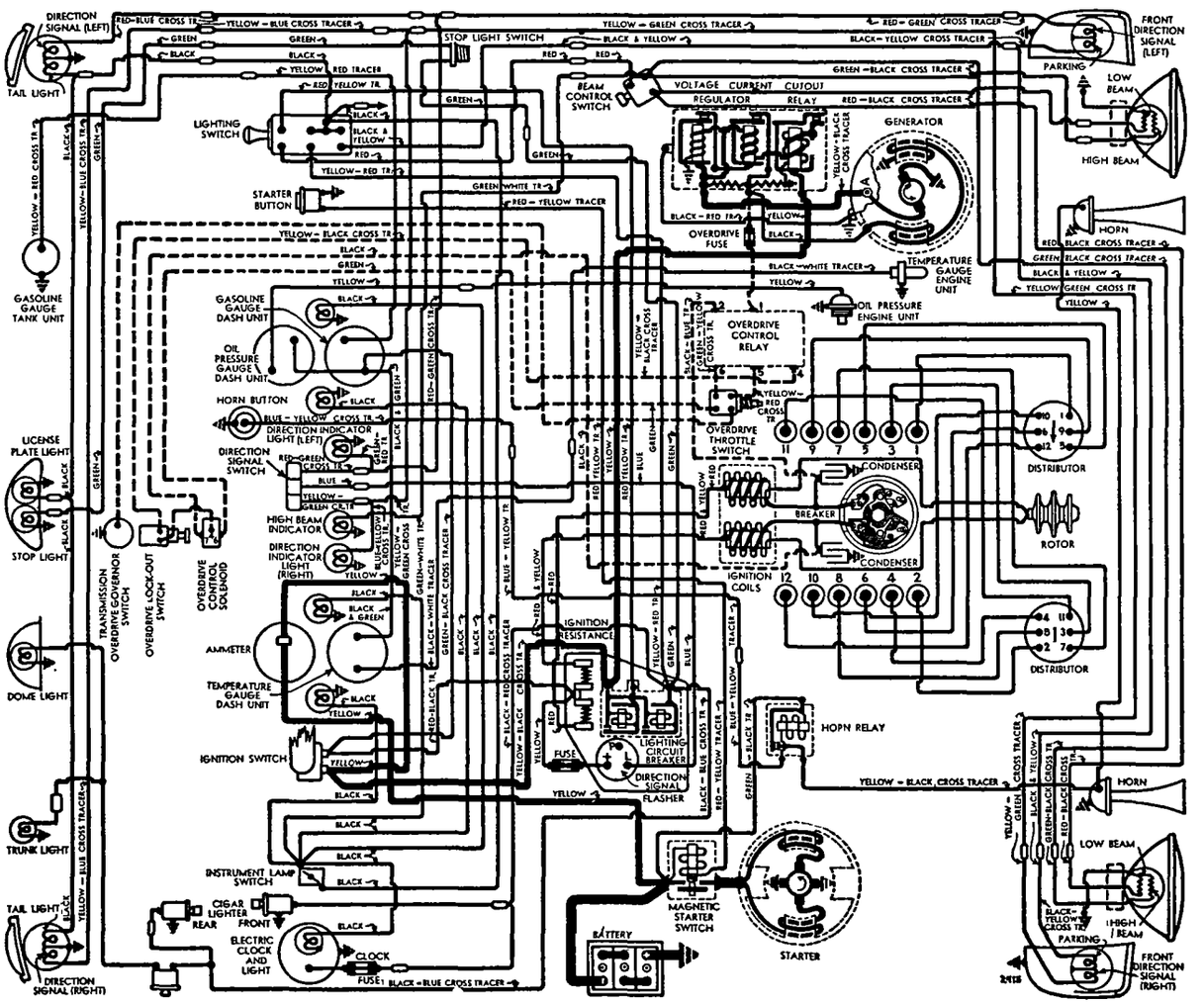
Vacuum Brake Setting:—Should be set for best performance with particular fuel and operating conditions. To adjust, loosen locknut and back off adjusting screw until engine pings when accelerated, then turn screw in just enough to eliminate this ping, tighten locknut. When adjusted on Stroboscope, vacuum brake should retard spark so that automatic advance is 2° (distr.) at 950 RPM. or 38 MPH. with no vacuum to release brake.

CARBURETION:—**Carburetor**—Chandler-Groves Model AA-1, Ford No. 06H-9510. Dual, downdraft type.

For complete data, refer to 1941 Carburetor Index.

Idle Adjustment—With engine warm, choke valve wide open and Fast Idle inoperative, set throttle lever stopscrew for 6 M.P.H. idle speed. Turn each idle adjusting screw (one for each barrel, adjust in succession) in until engine begins to miss, then out until engine begins to roll, finally turn screw in slowly until engine fires smoothly. Final setting should be approximately ⅞ turn out from the inner seated position. Re-adjust throttle stopscrew for correct idling speed of 6 MPH.

NOTE—Manufacturer recommends use of vacuum gauge for idling adjustment. Set for highest steady reading of gauge.



Float Level—Fuel level should be 19/32" plus or minus 1/32" (9/16-10/16") below top edge of bowl.
Accelerating Pump Adjustment—Three holes provided in throttle lever for pump link connection. Adjust for seasonal requirements as follows:
Inner (#1)—Min. stroke, Summer temperatures.
Center (#2)—Med. stroke, Winter temperatures.
Outer (#3)—Max. stroke, Extreme cold weather.
NOTE—Pump link locked in pump rod by snap lock. Pull link shaft out of pump rod to disengage lock.

Fast Idle:—Integral with carburetor. Operated by choke lever. No adjustment required.

Air Cleaner:—Ford No. 06H-9600-E (Zephyr), 06H-9600-D (Continental) oil-wetted type Std. No. 16H-9625 (Optl. Zephyr, Std. Custom 168H), 06H-9625-C (Optl. Continental) heavy duty oil-bath type.

Gasoline Gauge:—King-Seeley Electric. Ford No. 16H-9280 (Dash Unit—Zephyr & Custom 168H), 06H-9280-B (Dash Unit—Continental). No. 16H-9275 (Tank Unit—all models).
For complete data, refer to 1941 Carb. Equip. Index.

Fuel Pump:—AC Type R. Ford No. 68-9350. Diaphragm type. AC Replacement Exchange Pump No. 541.
For complete data, refer to 1941 Carb. Equip. Index.

VALVE TIMING:—To Check. No flywheel marks provided. If dead center position for any cylinder established on flywheel, intake valve for this cylinder should open approximately 3.24 teeth before this point with piston .0389" before top dead center.

Tappet Clearance:—None (hydraulic type lifters). Wilcox-Rich 'Zero-Lash' type.
For complete data, refer to 1941 Mech. Equip. Index.

Valve Spring Pressure:—51-57 lbs. at 2.13" (valve closed), 111-121 lbs. at 1.84" (valve open).

LUBRICATION:—Crankcase Capacity—5 quarts.
Normal Oil Pressure—40-45 lbs. at 2000 RPM.

Oil Pressure Gauge:—King-Seeley Electric. Ford No. 16H-9273 (Dash Unit—Zephyr & Custom 168H), 06H-9273-B (Dash Unit—Continental). No. 48-9278 (Engine Unit—all models).
For complete data, refer to 1941 Mech. Equip. Index.

COOLING SYSTEM:—Capacity—27 quarts.

Thermostat:—In outlet hose for each bank (2 used). Starts to open at 145° F. Fully open at 180° F.

Temperature Gauge:—King-Seeley Electric. Ford No. 16H-10883 (Dash Unit—Zephyr & Custom 168H), 06H-10883-B (Dash Unit—Continental). No. 99A-10884 (Engine Unit—all models).
For complete data, refer to 1941 Mech. Equip. Index.
NOTE—Gauge reads 'Hot' when turned off.

TRANSMISSION OVERDRIVE CONTROL:—New electric type (solenoid operated) with Governor Switch and accelerator pedal control. Direct drive 'kick-down' also controlled by accelerator pedal.
For complete data, refer to 1941 Mech. Equip. Index.
Overdrive Solenoid—Ford No. 16H-6916.
Throttle 'Kick-down' Switch—Ford No. 16H-6918-A (Zephyr & Custom), 16H-6918-B (Continental). Adjust switch so that it closes when carburetor throttle valve is wide open.
Lock-out Switch—Ford No. 16H-6917. Mounted on Overdrive case.
Governor Switch—Ford No. 16H-6919.
Control Relay—Ford No. 16H-6915.

BATTERY:—Ford No. 06H-10655-A. 6 volt, 17 plate, 120 ampere hour capacity (20 hour rate).
Starting Capacity—150 amperes for 20 minutes.
Zero Capacity—300 amperes for 4.0 minutes.
Grounded Terminal—Positive (+) grounded to cylinder head stud of right hand bank.
Location—On right side in engine compartment.
Dimensions—Length 10.6". Width 7.3". Height 9.2".

STARTER:—Ford No. 18-11002. Armature No. 18-11005.
Drive—Inboard Bendix No. L11FX-10. Ford No. B-11350.
Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—2 lbs. each.
Cranking Engine—100 RPM., 190-215 amperes.

Performance Data

Torque	R.P.M.	Volts	Amperes
4 ft. lbs.	1070	4.6	200
8 "	660	4.3	340
12 "	300	3.65	465
14 "	Lock	3.5	500

Starting Switch:—R-B-M Model 5604, Ford No. 01A-11450-A magnetic switch mounted on dash and controlled by pushbutton on instrument panel R-B-M 3234, Ford No. 16H-11500-C (Zephyr—Std. Trim), 3234-B, Ford No. 16H-11500-D (Zephyr—Custom Trim, All Continental & Custom).

Removal:—Starter mounted on right front face of flywheel housing. To remove, take off pan at right of engine, remove through-bolts on commutator end plate.

GENERATOR:—Ford No. 01A-10000-B. Armature No. 01A-10005-A. Two brush (shunt) type with vibrating type voltage and current regulation. Ventilated by fan on drive pulley.
Charging Rate Adjustment—No adjustment. See Regulator data below.
Maximum Charging Rate—Controlled by regulator and dependent on battery condition and load. To check generator output, disconnect generator field lead at generator, connect both generator terminals together (use short insulated wire). Use 'BRS' set or rheostat connected across battery terminals and apply load until voltage is exactly 6 volts. Connect ammeter in charging line, run engine, check output at 2 speeds given in performance table below. Restore original connections after completing test. **Do not operate generator in service with both terminals connected together. This eliminates all regulator action and will damage generator.**

Performance Data

Amperes	Engine R.P.M.
Start	400
32	1100
32	3000

Rotation—Counter-clockwise at commutator end.
Field Current—2.86 amperes at 6.0 volts (field resistance 2.1 ohms at 70° F.).
Brush Spring Tension—Approximately 28 ozs.

Removal:—Generator mounted on bracket between stud, raise generator up until side movement on cylinder banks at front of engine, driven in tandem with water pumps by Vee belt. To remove, loosen nut on bracket stud.

Belt Adjustment:—Loosen nut on bracket mounting belt midway between generator and water pump pulleys is 1" (thumb and finger pressure).

REGULATOR:—Ford No. 01A-10505-C4. Three-Unit type. Consists of Cutout Relay, vibrating Voltage Regulator and vibrating Current Regulator (separate units) in single case on engine side of dash.
For complete data, refer to 1941 Elec. Equip. Index.
NOTE—Regulator case is grounded through braided wire 'pigtail' or separate ground wire extending from regulator to generator frame. This ground connection must be in place when regulator being operated or tested (disturbed by removal of regulator cover).

Cutout Relay
Cuts In—5.8-6.3 volts at operating temperature.
Cuts Out—8 ampere discharge current (maximum).

Voltage Regulator
Setting—6.9-7.2 volts at 70-80° F. See Ford Regulator article in Electrical Equipment Section for voltages at other temperatures.
Checking & Adjusting—*Refer to Electrical Equipment Index for article on 'Ford Regulator—3-unit Type' for complete instructions.*

Current Regulator
Setting—28 amperes at 7.0 volts hot—after engine run for 5 minutes (196-200 watts maximum for continuous operation).
Checking & Adjusting—See Voltage Regulator

LIGHTING:—Headlamps—Ford Sealed Beam Type. Controlled by Lighting Switch on instrument panel and Beam Selector Switch on toeboard.
For complete data, refer to 1941 Elec. Equip. Index.
Headlamp Adjustment—Aim upper beam of each headlamp straight ahead with hot spot centered on horizontal line 3" below lamp center height.
Beam Indicator—Red jewel at top of instrument cluster (Zephyr & Custom), above clock (Continental) between Right & Left Direction Signal Indicators. Lighted whenever Upper Beams in use.
Direction Signal—Std. on all models (switch built in steering wheel).
For complete data refer to 1941 Elec. Equip. Index.

Switches
Lighting—R-B-M Model 2445, Ford No. 11A-11654 (Switch only). Light Switch Knob No. 16H-11661-C (all models).
Beam Selector—R-B-M Model 2486. Ford No. 16H-11653-A (Zephyr & Custom—with Horn wiring), 16H-11653-B (Continental—with Horn wiring). No. 16H-13532 (Switch only—all models).
Instrument—Ford No. 16H-13740-C (Zephyr with Std. Trim), 16H-13740-D (Zephyr with Custom Trim, all Continental & Custom).
Stop Light—Ford No. 11A-13480 (hydraulic type).
Direction Signal—Ford No. 16H-13335 (Switch Assembly).

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps		Sealed Beam
Park & Frt. Direc. Signal	21-3	1154
Instrument, Clock	1.5	55
Beam & Direc. Sig. Indicators	1	51
Tail & Rear Direc. Signal	21-3	①
Stop	21	1129
Dome & Quarter	6	81
Rear License	3	63
Trunk (Luggage Comp't.)	6	81

①—No. 1154 (Zephyr & Custom), 1158 (Continental).

LIGHTING CIRCUIT BREAKER:—R-B-M Model 6740, Ford No. 16H-11624. Combined with Ignition Resistor (twin unit) on block on dash under cowl (Direction Signal Flasher also mounted on same block). Consists of two separate circuit breaker units (one unit protects headlight circuits, second unit protects other lighting circuits) of the thermostatic and wound-coil type. Contacts open with current of 50 amperes and vibrate rapidly to control current.

FUSES:—Overdrive—20 ampere. In relay lead.
Direction Signal—20 ampere. In Flasher lead.

HORNS:—Air electric type dual horns. Ford No. 06H-13832 (Right Hand—high note), 06H-13833 (Left Hand—low note). Horns operated by horn relay.
Horn Current—24-28 amperes (total).

Horn Relay:—R-B-M Model 4750, Ford No. 96H-13842.
Contact Closing Voltage—3.5-4.5 volts.
Current Draw—Approximately ¾ ampere.

ENGINE HOOD NOTE:—Hood is Alligator Type with release knob under instrument panel to left of steering column. To raise hood, pull out on release knob (hood will raise slightly), press in on safety catch under front edge of hood, lift hood up.

SERIAL & ENGINE NUMBER:—Stamped on top of clutch housing and on left frame side member near generator.

COMPRESSION:—**Ratio**—6.3-1 Std. Cast iron hd.
Pressure—100 lbs. at cranking speed of 100 RPM.

VACUUM READING:—Steady 18-20" at 5-7 MPH.

IGNITION:—**Coil Model 78-12024-A** (part of ignition unit assembly). Mounted on top of distributor.
Resistor Unit—Connected in coil primary circuit. Mounted on Circuit Breaker Assembly No. 11A-12250.
Ignition Current—4½-6 amperes (engine stopped). Ignition primary circuit resistance 1-1⅓ ohms.
Ignition Switch:—Oakes Steering Column & Ignition Lock Assembly No. 302370 (First Cars), 302595 (After approx. Nov. 15, '40); Ford No. 19A-3676A (First), 19A-3676B (Later). Ignition Switch Oakes No. 302513 (First), 302606 (Later). NOTE—These switches same except for color of enamel on switch body.
Lock Cylinder—Hurd or Briggs & Stratton #80935. Ford No. 19A-3686A (With Keys).
Key Series—FK000 to FK999. **Groove**—No. 17.
Distributor Model 78-12127. (Less coil, distributor caps, and distributor plates). Double breaker, 8 lobe cam, full automatic advance type with Vacuum Brake Control (see Ignition Timing for adjustment). Same design as used on preceding V8 models.
Breaker Gap—.014-.016" (both sets). Use special two step feeler—.014" step 'go', .016" step 'no go'.
Cam Angle—36° closed, 9° open. For both sets operating together with correct coil-loading lead.
Breaker Arm Spring Tension—20-24 ozs.
Rotation—Clockwise viewed from drive end.
Condenser—No. 78-12300. Capacity .33-.36 mfd.

Automatic Advance
(High Vacuum or Vacuum Brake Inoperative)

Distributor Degrees	R.P.M.	Engine Degrees	R.P.M.
Start	200	0	400
2	325	4	650
3	425	6	850
5	825	10	1650
8	1500	16	3000

Removal:—Ignition unit mounted on front of engine. To remove, disconnect vacuum line, take off caps, take out screws in mounting flange.

FIRING ORDER:—1-5-4-8-6-3-7-2. See diagram for cylinder numbering order.

SPARK PLUGS:—Champion H-10. 14 MM. Metric.
Spark Plug Gaps—Set at .030-.034".

IGNITION TIMING:—For each engine as follows (see Vacuum Brake Setting below for adjustment depending on type of service and fuel used).

	Flywheel Degrees	Piston Position
All Engines	4° BTDC	.0058" BTDC.

Timing Note—Manufacturer recommends use of Laboratory Test Set with Stroboscope attachment or V-126 Timing Fixture for all ignition settings.

Timing (On Engine)—No flywheel marks provided and timing should be set with piston on top dead center. With #1 piston on top dead center entering power stroke, loosen timing adjusting screw on left hand side of ignition unit housing, place screw in retard position at lower end of slot, move screw slowly up until timing contacts begin to open, note graduation on plate under screw head which is in line with reference mark on housing, move screw up exactly one additional graduation, tighten screw. NOTE—Dead center position can be determined by inserting gauge rod in cylinder or by measuring to tops of #2 and #3 pistons (should be equal).

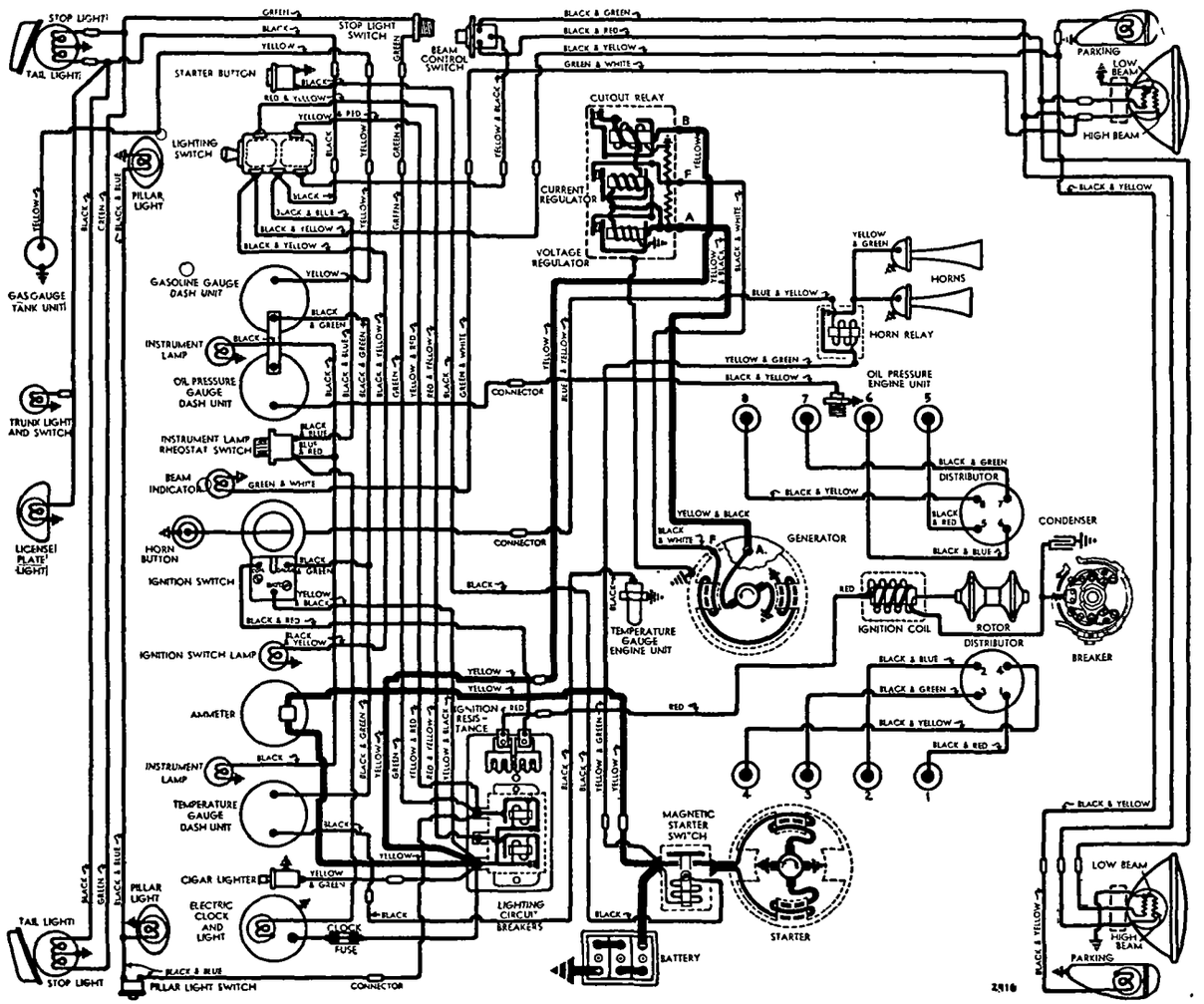
Vacuum Brake Setting:—Should be adjusted to eliminate pinging when engine operated with load. To adjust, loosen locknut, back off adjusting screw until engine pings with load, turn screw in just enough to eliminate ping, tighten locknut. When adjusted on Stroboscope, vacuum brake should retard spark so that automatic advance is 2° (distr.) at 950 R.P.M. or 38 M.P.H. with no vacuum.

CARBURETION:—**Carburetor**—Chandler-Groves Model AA-1, Ford No. 91A-9510-A. Dual, downdraft type.
For complete data, refer to 1941 Carburetor Index.

Idle Adjustment—With engine warm, choke valve wide open, and Fast Idle inoperative, set throttle lever stopscrew for 5-7 MPH. idling speed, turn each idle adjusting screw (one for each barrel, adjust in succession) in until engine begins to miss, then out until engine begins to roll, finally turn screw in until engine fires smoothly. Final setting should be approximately ⅝-¾ turn of screw from inner seated position. Readjust stopscrew for correct idling speed of 5-7 MPH.

NOTE—Vacuum gauge recommended for idling adjustment. Set for highest steady gauge reading.

Float Level—Fuel level 11/16" plus or minus 1/32" (21/32-23/32") below top edge of bowl. ***See Carburetor article (refer to Carburetor Index) for float level data and checking directions.***



Accelerating Pump Setting—Three holes provided for pump link connection as follows:

Inner (#1)—Min. stroke, Summer Temperatures.

Center (#2)—Med. stroke, Winter Temperatures.

Outer (#3)—Max. stroke, Extreme Cold Weather.

NOTE—Link locked in pump rod by snap-lock. Pull link shaft out of pump rod to disengage this lock.

Fast Idle:—Integral with carburetor. Operated by choke valve lever. No adjustment required.

Air Cleaner:—Ford No. 19A-9600-A oil-wetted type Std. Heavy Duty oil-bath type Optl.

Gasoline Gauge:—King-Seeley Electric. Ford No. 19A-9280 (Dash Unit), No. 99A-9275-B (Tank Unit).

For complete data, refer to 1941 Carb. Equip. Index.

Fuel Pump:—AC Type R. Ford No. 68-9350. Diaphragm type. AC Replacement Exchange Pump No. 541.

For complete data, refer to 1941 Carb. Equip. Index.

VALVE TIMING:—To Check Timing. No flywheel marks or other means provided to check timing. If dead center position for piston #1 is established on flywheel, intake opening for this cylinder should occur with piston on top dead center and flywheel mark at dead center point.

Tappet Clearance:—.0125-.0135" all valves. Not adj.

Valve Spring Pressure:—37-40 lbs. at 2.13" (valve closed), 76-80 lbs. at 1.84" (valve open).

LUBRICATION:—Crankcase Capacity—5 quarts.

Normal Oil Pressure—30 lbs. at 2000 RPM.

Oil Pressure Gauge:—King-Seeley Electric. Ford No. 19A-9273 (Dash Unit), No. 48-9278 (Engine Unit).

For complete data, refer to 1941 Mech. Equip. Index.

COOLING SYSTEM:—Capacity—25½ quarts.

Thermostat:—In each cylinder head outlet (2 used). Starts to open at 145° F. Fully open at 180° F.

Temperature Gauge:—King-Seeley Electric. Ford No. 19A-10883 (Dash Unit), No. 99A-10884 (Eng. Unit).

For complete data, refer to 1941 Mech. Equip. Index.

NOTE—Gauge reads 212 (Hot) with ignition off.

BATTERY:—Ford No. 01A-10655-A. 6 volt, 17 plate, 120 ampere hour capacity (20 hour rate).

Starting Capacity—150 amperes for 20 minutes.

Zero Capacity—300 amperes for 4.0 minutes.

Grounded Terminal—Positive (+) grounded to dash.

Engine Ground—Strap connector between right rear cylinder head and dash.

Dimensions—Length 10.6". Width 7.3". Height 9.2".

Location—On right side in engine compartment.

STARTER:—Ford No. 18-11002. Armature No. 18-11005.

Drive—Inboard Bendix No. L11FX-10. Ford No. B-11350.

Rotation—Counter-clockwise at commutator end.

Brush Spring Tension—2 lbs. each.

Cranking Engine—100 RPM., 190-215 amperes.

Performance Data

Torque	R.P.M.	Volts	Amperes
4 ft. lbs.	1070	4.6	200
8 "	660	4.3	340
12 "	300	3.65	465
14 "	Lock	3.5	500

Starting Switch:—R-B-M Model 5604, Ford No. 01A-11450A. Magnetic Switch mounted on dash and controlled by pushbutton on instrument panel R-B-M No. 3232, Ford No. 19A-11500.

Removal:—Starter mounted on right front face of flywheel housing. To remove, take off pan at right of engine, free starter-to-oil pan support bracket, take out through-bolts on commutator end plate.

GENERATOR:—Ford No. 01A-10000-B. Armature No. 01A-10005-A. Two brush (shunt) type with vibrating type voltage and current regulation. Ventilated by fan on drive pulley.

Charging Rate Adjustment—No adjustment. See Regulator data below.

Maximum Charging Rate—Controlled by regulator and dependent on battery condition and load. To check generator output, disconnect generator field lead at generator, connect both generator terminals together (use short insulated wire). Use 'BRS' set or rheostat connected across battery terminals and apply load until voltage is exactly 6 volts. Connect ammeter in charging line, run engine, check output at 2 speeds given in performance table below. Restore original connections after completing test.

Do not operate generator in service with both terminals connected together. This eliminates all regulator action and will damage generator.

Performance Data

Amperes	Engine R.P.M.
Start	400
32	1100
32	3000

Rotation—Counter-clockwise at commutator end.

Field Current—2.86 amperes at 6.0 volts (field resistance 2.1 ohms at 70° F.).

Brush Spring Tension—Approximately 28 ozs.

Removal:—Generator mounted on bracket between cylinder banks at front of engine, driven in tandem with water pumps by Vee belt. To remove, loosen nut on bracket stud.

Belt Adjustment:—Loosen nut on bracket mounting stud, raise generator up until side movement on belt midway between generator and water pump pulleys is 1" (thumb and finger pressure).

REGULATOR:—Ford No. 01A-10505-C. Three-Unit Type. Consists of Cutout Relay, vibrating Voltage Regulator and vibrating Current Regulator (separate units) in single case on engine side of dash.

For complete data, refer to 1941 Elec. Equip. Index.

NOTE—Regulator case is grounded through braided wire 'pigtail' or separate ground wire extending from regulator to generator frame. This ground connection must be in place when regulator being operated or tested (disturbed by removal of regulator cover).

Cutout Relay

Cuts In—5.8-6.3 volts at operating temperature.

Cuts Out—8 ampere discharge current (maximum).

Voltage Regulator

Setting—6.9-7.2 volts at 70-80° F. See Ford Regulator article in Electrical Equipment Section for voltages at other temperatures.

Checking & Adjusting—***Refer to Electrical Equipment Index for article on 'Ford Regulator—3-unit Type' for complete instructions.***

Current Regulator

Setting—28 amperes at 7.0 volts hot—after engine run for 5 minutes (196-200 watts maximum for continuous operation).

Checking & Adjusting—See Voltage Regulator (above).

LIGHTING:—Headlamps—Ford Sealed Beam Type. Controlled by Lighting Switch on instrument panel and Beam Selector Switch on toeboard.

For complete data, refer to 1941 Elec. Equip. Index.

Headlamp Adjustment—Aim upper beam of each headlamp straight ahead with hot spot centered on horizontal line 3" below lamp center height.

Beam Indicator—Red jewel on instrument panel directly above speedometer dial lighted whenever upper beams in use.

Switches

Lighting—R-B-M Model 2445, Ford No. 11A-11653 (with wiring). Light Switch Knob and Insert Ford No. 19A-11661.

Beam Selector—R-B-M Model 2487, Ford No. 81A-13532.

Instrument—Ford No. 19A-13740.

Stop Light—Ford No. 11A-13480.

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps	Sealed Beam	
Parking, Clock	1.5	55
Instrument, Ign. Lock	1	51
Beam Indicator	1	51
Dome, Luggage Comp't.	3	63
Stop & Tail	21-3	1154
Rear License	3	63

LIGHTING CIRCUIT BREAKER:—Ford No. 11A-12250. Combined with Ignition Resistor on block on dash under cowl. Consists of two separate circuit breaker units (one unit protects headlight circuits, second unit protects other lighting circuits) of the thermostatic and wound-coil type. Contacts open with current of 50 amperes and vibrate rapidly to control current.

HORNS:—Air Electric type dual horns. Ford No. 91A-13832 (High Note), 91A-13833 (Low Note). Horns operated by relay.

Horn Current—24-28 amperes (total).

Horn Relay:—R-B-M No. 50357, Ford No. 11A-13842B.

Contact Closing Voltage—3.5-4.5 volts.

Current Draw—Approximately ¾ ampere.

HOOD LOCK:—Alligator type. Hood lock handle located under left side of instrument panel. To raise hood, pull out on control handle (hood will raise slightly), reach under front edge of hood and press up on safety catch tab to free hood, lift hood up.

SERIAL NUMBER:—First No. K-5001. On plate on right side of cowl under engine hood.

Service Serial No. Note—Stamped on plate on left front door hinge pillar. First No. N4-5001.

ENGINE NUMBER:—Stamped on left side of engine block at front end. First No. 5001 (same as Serial #).

COMPRESSION:—**Ratio**—6.7-1 Std.

Pressure—120 lbs. at 350 RPM. cranking speed.

VACUUM READING:—Steady 18-20" idling at 6 MPH.

IGNITION:—**Delco-Remy Coil 1115028.** On dash.

Ignition Current—2 amperes idling, 5 stopped.

Ignition Switch:—Delco-Remy No. 1116310. Connected to ignition coil by armored cable.

Ignition Lock—Briggs & Stratton No. 45792.

Key Series—N-1201 to N-1449. Groove—No. 15.

Distributor Delco-Remy No. 1110512. Single breaker, 6 lobe cam, full automatic advance type with separate vacuum spark control and Octane Selector adjustment.

Breaker Gap—.020". Limits .018-.024".

Cam Angle or Dwell—35° closed, 25° open.

Breaker Arm Spring Tension—17-21 ozs.

Rotation—Counter-clockwise viewed from above.

Condenser—Part No. 1869705. Capacity .18-.25 mfd.

Automatic Advance

Distributor Degrees	R.P.M.	Engine Degrees	R.P.M.
Start	400	2	800
10	1200	20	2400

Vacuum Spark Control No. 1116029. Mounted on distributor mounting plate and linked to advance arm. Provides additional advance at speeds above idling except when engine accelerated or operated with wide open throttle when spark retarded by return spring within unit.

Plunger Travel—23/64" (total).

Vacuum Advance

Distr. Degrees	Eng. Degrees	Vacuum (" of HG)
Start	0°	3-5"
8½°	17°	14-17"

Removal:—Distributor mounted on left side of engine and driven by inclined shaft. To remove, loosen advance arm clamp bolt or disconnect vacuum line and take out hold-down screw in advance arm.

Installation Note—When installing distributor, crank engine to firing position for #1 cylinder (piston at TDC), see that oil pump drive gear meshed so that slot in shaft points across engine with wide half of shaft toward front (slot is offset), turn rotor to #1 segment in distributor cap, install distributor and check timing.

FIRING ORDER:—1-5-3-6-2-4. See diagram.

SPARK PLUGS:—Auto-Lite AN-7. 14 MM. Metric.

Spark Plug Gaps—.025".

IGNITION TIMING:—**Flywheel Degrees Piston Position**
All Engines .....At TDC.....000" TDC.

Timing Note—Vacuum advance must be latched out by aligning holes in advance arm and hold-down plate and inserting ⅛" pin through these holes while timing is being set.

To Set Timing—Turn engine over until #1 piston reaches top dead center on compression stroke with 'IGN/DC' mark on vibration dampener in line with pointer on chain case cover. Latch out vacuum control (see note above), loosen advance arm clamp bolt, rotate distributor until contacts begin to open, tighten clamp bolt, see that rotor at #1 segment in distributor cap, check Octane Selector setting.

Octane Selector Setting—Should be set for slight ping when accelerating with wide open throttle at speeds between 10-15 MPH. To adjust, loosen hold-down screw, rotate distributor one graduation at a time counter-clockwise (if ping too severe), clockwise (if no ping noted) until correct performance secured.

CARBURETION:—**Carburetor**—Carter (B & B) Model 513-S, 1¼" downdraft type with manual choke control.

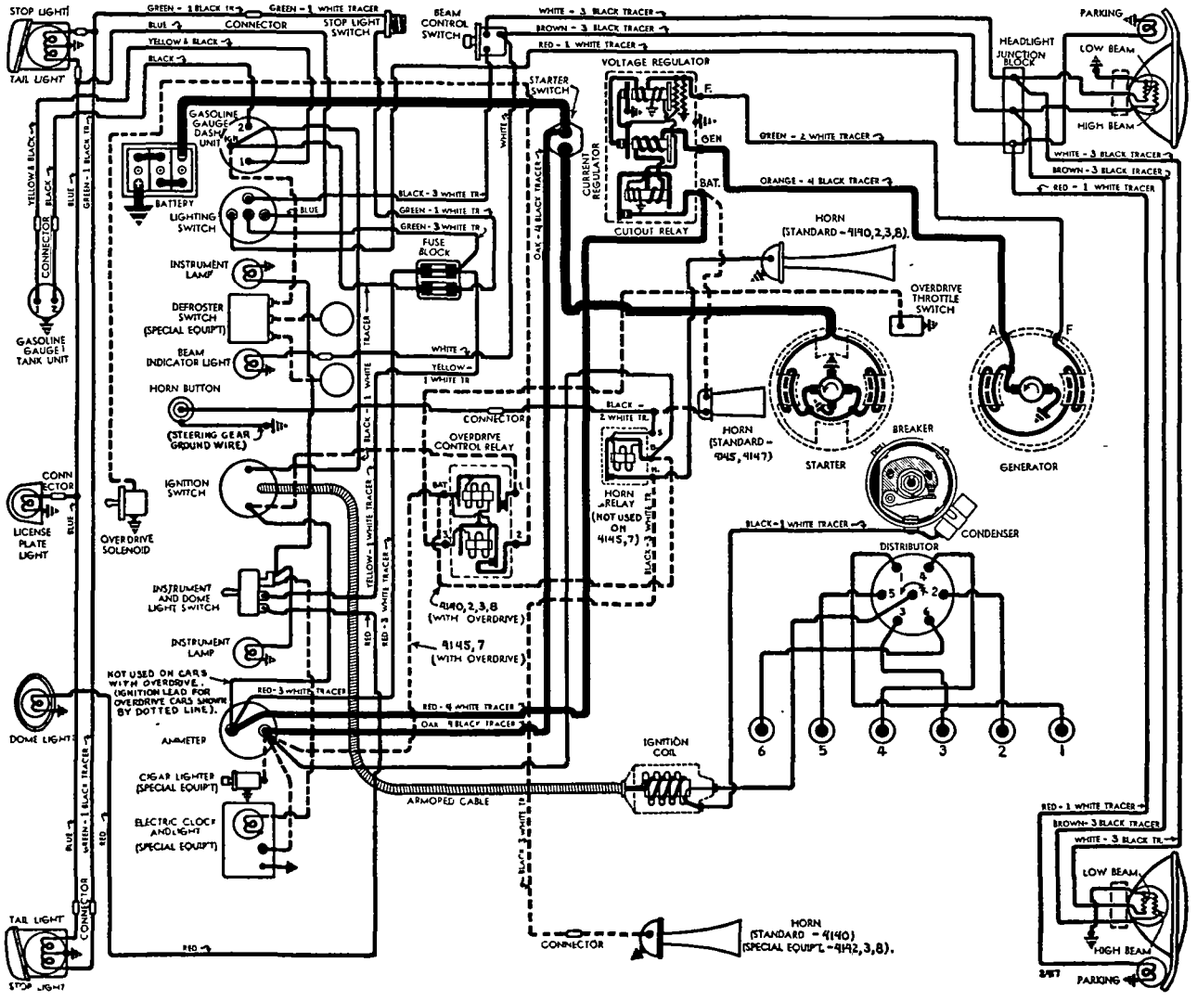
For complete data, refer to 1941 Carburetor Index.

Idle Adjustment—With engine warm and choke valve wide open, set throttle stopscrew for 6 MPH. idle speed. Adjust idle adjusting screw for smooth idle (screw ½-1¼ turns open from inner seated position—turn screw in for leaner mixture), recheck idle speed.

Accelerating Pump Setting—Throttle lever has 3 holes for pump rod link engagement as follows:
Inner (Min. stroke)—Hot Summer weather.
Center (Med. stroke)—Normal temperatures.
Outer (Max. stroke)—Cold Winter weather.

Float Level—Top of float (not soldered seam) 5/64" (plus or minus 1/64") below top edge of bowl with valve seated.

Metering Jet—***See Carter (B&B) Jet Table in Carburetor Section for complete data.***



Fast Idle:—No adjustment provided (linked to choke valve so throttle opened to fast idle position when choke valve closed).

Air Cleaner:—AC No. 1542037 oil-wetted type Std. Heavy duty oil-bath type Optl.

Fuel Pump:—AC Type W (Std.), Type AJ Fuel-&-Vacuum Pump (Cars with Overdrive). Pump Exchange Part No. 532.
For complete data, refer to 1941 Carb. Equip. Index.

Gasoline Gauge:—Auto-Lite Electric type. No. NG-9645D (Dash Unit), No. NG-9637T (Tank Unit).
For complete data, refer to 1941 Carb. Equip. Index.

VALVE TIMING:—To Check—With .015" tappet clearance, #1 intake valve opens 19° BTDC. with 'DC' mark on vibration dampener at front of engine 1 3/16" ahead of pointer on chain case cover. #1 exhaust valve closes 23° ATDC. with 'DC' mark 1 15/16" past the pointer.

Tappet Clearance:—.015" all valves. Engine Hot. NOTE—May be set at .018" max. for sustained high speed driving.

Valve Spring Pressure:—80 lbs. at 1 7/16".

LUBRICATION:—Crankcase Capacity—5 qts.
Normal Oil Pressure—25-30 lbs. at 25 MPH.

COOLING SYSTEM:—Capacity—14 qts. (1 qt. additional for heater).

Thermostat:—Fulton or Dole. In water outlet elbow on cylinder head.
Setting—Starts to open at 160°F.

Temperature Gauge:—Auto-Lite H-9706 (not elec.).

TRANSMISSION OVERDRIVE CONTROL:—Electric type with accelerator pedal operated 'kick-down' or automatic overtake.
For complete data, refer to 1941 Mech. Equip. Index.
Overdrive Solenoid—Delco-Remy Model 1118004.
Throttle Switch—Adjust switch position on mounting bracket so that contacts close with throttle valve wide open and spring on carburetor throttle valve pulley just starting to compress.
Control Relay—Delco-Remy Model 1116798.

BATTERY:—Auto-Lite CTL-1-13. 6 volt, 13 plate, 90 Ampere Hour capacity (20 hour rate).
Zero Capacity—300 amperes for 3.0 minutes.
Grounded Terminal—Positive (+) terminal to body.
Engine Ground—Separate strap connector to body.
Location—Under left front seat.

STARTER:—Delco-Remy 1109451. Armature No. 1882547.
Drive—Inboard Barrel Type Bendix No. A-2033.
Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—24-28 ozs. each.

Performance Data

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	6000	5.7	60
11.5 "	Lock	3.3	540

Removal:—Starter flange mounted on left front face of flywheel housing. To remove, take out flange mounting screws.

Starting Switch:—Mounted on toeboard and operated by clutch pedal when clutch fully disengaged.

GENERATOR:—Delco-Remy 1102684. Armature 1882588. Two brush (shunt) type with Current-voltage control.
Charging Rate Adjustment—None. Charging rate controlled by Voltage Regulator and maximum output controlled by Current Regulator. See Regulator data.
Maximum Charging Rate—32-34 amperes, 8 volts, not. Actual charging rate controlled by voltage regulator and dependent on battery condition.

Performance Data

	Amperes	Volts	R.P.M.
Cold	30①	8.0	1750

①Not maximum output. See Current Regulator.
Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—25 ozs. each.
Field Current—1.67-1.82 amperes at 6.0 volts.

Removal:—Generator cradle mounted at left side of engine with fan belt drive (water pump driven by extension of generator shaft). To remove, disconnect water pump, loosen fan belt, remove generator clamp band, lift generator out.
Belt Adjustment:—Adjust whenever belt deflection exceeds 1½" (light pressure midway between fan and generator pulley). To adjust, loosen fan mounting bracket capscrews, raise fan (pivots on one screw, other screw hole slotted) until belt deflection is ¾", tighten screws.

REGULATOR:—Delco-Remy 1118202. Single Core Type. Vibrating Current & Voltage Regulator on dash.
For complete data, refer to 1941 Elec. Equip. Index.
CAUTION—Check generator for grounded field coils and leads before changing regulator settings to correct High Charging Rate or High Voltage.

Cutout Relay

Cuts In—6.2-6.7 volts hot.
Cuts Out—0-4.0 ampere discharge current.
Contact Gap—.020" (same for both sets).
Air Gap—.020" (with contacts just closed).

Voltage Regulator

Setting—7.2-7.4 volts hot (operating temperature). Regulator over-compensated for temperature. Should be checked with cover in place and hot.
To Check—Connect ammeter in charging line at regulator 'BAT' terminal, voltmeter between this terminal and ground. Operate generator at 2800 RPM., adjust charging rate to 8-10 amperes (use variable rheostat or AVR set). With regulator hot (150°F.), decrease generator speed until cutout relay contacts open, then increase speed to 2800 RPM. and check hot voltage setting (above).
To Adjust—Change regulator armature spring tension slightly by bending hanger at lower end of **one spring only.** If further adjustment required, see Single Core Regulator article in Electrical Equipment Section for adjustment directions for the other (second) spring.
Air Gap—.070" between center of core and armature with contacts just closing (press down on armature to open contacts, release pressure, check gap at point where contacts just close).

Current Regulator

Setting—32-34 amperes hot (operating temp.).
To Check—Remove regulator cover, connect short jumper between Voltage Regulator frame and upper contact support bracket (to short out Voltage Regulator), connect ammeter in charging line at regulater 'BAT' terminal, turn on car lights and accessories. Operate generator and increase speed until output remains constant. With regulator hot (150°F), current reading should agree with setting (above).
To Adjust—Same as for Voltage Regulator (above).
Air Gap—.080" (check same as Voltage Regulator).

LIGHTING:—Headlamps—Hall 'Sealed Beam' type.
For complete data, refer to 1941 Elec. Equip. Index.
Headlamp Adjustment—Aim upper beam straight ahead (hot spot center 3" below lamp center height).
Beam Indicator—In center of speedometer dial. Lighted when Country (upper) beams in use.

Switches

Lighting—Douglas. Nash No. 3107032.
Beam Selector—Douglas.
Instrument—Douglas.

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps		Sealed Beam
Parking	3	63
Instrument, Clock	1½	55
Beam Indicator	1½	55
Stop & Tail	21-3	1158
Rear License	3	63
Dome	6	81

FUSES:—Lighting—30 ampere. On fuse block on left hand front face of dash.
Accessory—30 ampere. On fuse block.

HORNS:—Delco-Remy. No. 1999917 (Spec. 4145, 7), No. 1999565 (Deluxe 4142, 3, 8), No. 1999565 Low Note & 1999566 High Note Twin Horns (Deluxe Torpedo 4140). Deluxe Single Horn & Torpedo Deluxe Twin Horns operated by horn relay.
Deluxe 4142, 3, 8 Note—No. 1999566 High Note Horn Optl. with Std. 1999565 Low Note Horn as twin horn, blended tone equipment (Relay is Std.).

Type	Current (at 6 volts)	Air Gap
1999565 (Low Note)	19-21 amperes	.047-.052"
1999566 (High Note)	18-20 amperes	.039-.044"

Horn Relay:—Delco-Remy No. 1116775.
Contact Gap—.025". **Air Gap**—.015" (closed).
Contacts Close—2.75-4.0 volts.

HOOD LOCK:—Alligator type hood. Lock button below instrument panel on left side. To raise hood, pull out on lock control button (hood will raise slightly), reach under front edge of hood and press up on safety catch tab to release safety catch, raise hood up.

SERIAL NUMBER:—First number R-353001. Stamped on plate on right frame side member under hood.

SERVICE SERIAL NUMBER:—First number N6-45001. On 'Caution Plate' on left front door hinge post.

ENGINE NUMBER:—First number R-353001. Stamped on right side of engine block at front.

COMPRESSION:—**Ratio**—6.3-1 std. cast-iron head.
Pressure—125 lbs. at cranking speed of 350 RPM.

VACUUM READING:—Steady 18-20" idling at 7-8 MPH.

IGNITION:—**Coil Model CE-4025A (2 used).** Coils are mounted on right side of engine.
Ignition Current—2 amperes idling, 5 amperes stopped for each coil (2 used).
Ignition Switch:—Oakes Steering Column and Ignition Lock No. 302382. Ignition Switch No. 302440.
Ignition Lock—Briggs & Stratton. B & S No. 85347.
Key Series—5 digits. **Groove**—No. 1.
Distributor Auto-Lite IGE-4024. 'Twin Ignition' double breaker, 6 lobe cam, full automatic advance type with Torquematic Spark Control. Contacts open simultaneously to fire both spark plugs in each cylinder at the same instant and must be synchronized (see Ignition Timing). NOTE—Distributor rotation reversed from previous models).
Breaker Gap—Set at .020".
Cam Angle or Dwell—35° closed, 25° open (distr.). For each set of contacts (operate independently).
Breaker Arm Spring Tension—17-20 ounces.
Rotation—Clockwise viewed from above. NOTE—Rotation reversed from previous models.
Condenser—No. IG-2671 (2 used). Cap. .20-.25 mfd.

Automatic Advance

Distributor		Engine	
Degrees	R.P.M.	Degrees	R.P.M.
Start	275	0	550
3	370	6	740
7	500	14	1000
9	665	18	1330
11.5	875	23	1750

Torquematic Spark Control—Consists of cable anchored at dash and connected to distributor body by a travel limiting spring. Retards distributor through engine movement caused by torque action. Maximum retard 2½° (engine movement in excess of 2½° taken up by travel limiting spring). See Ignition Timing for setting.
Removal:—Mounted on right side of engine. To remove, take out hold-down screw in advance arm, disconnect torquematic control, lift distributor off.

FIRING ORDER:—1-5-3-6-2-4. See diagram for spark plug cable connections on distributor cap. NOTE—Rotation now clockwise (reversed from previous models).

SPARK PLUGS:—AC No. 45. 14 MM. Metric.
Spark Plug Gaps—Set at .025".

IGNITION TIMING:—Setting for all engines as follows:

Flywheel Degrees	Piston Position
6° BTDC	.0150" BTDC

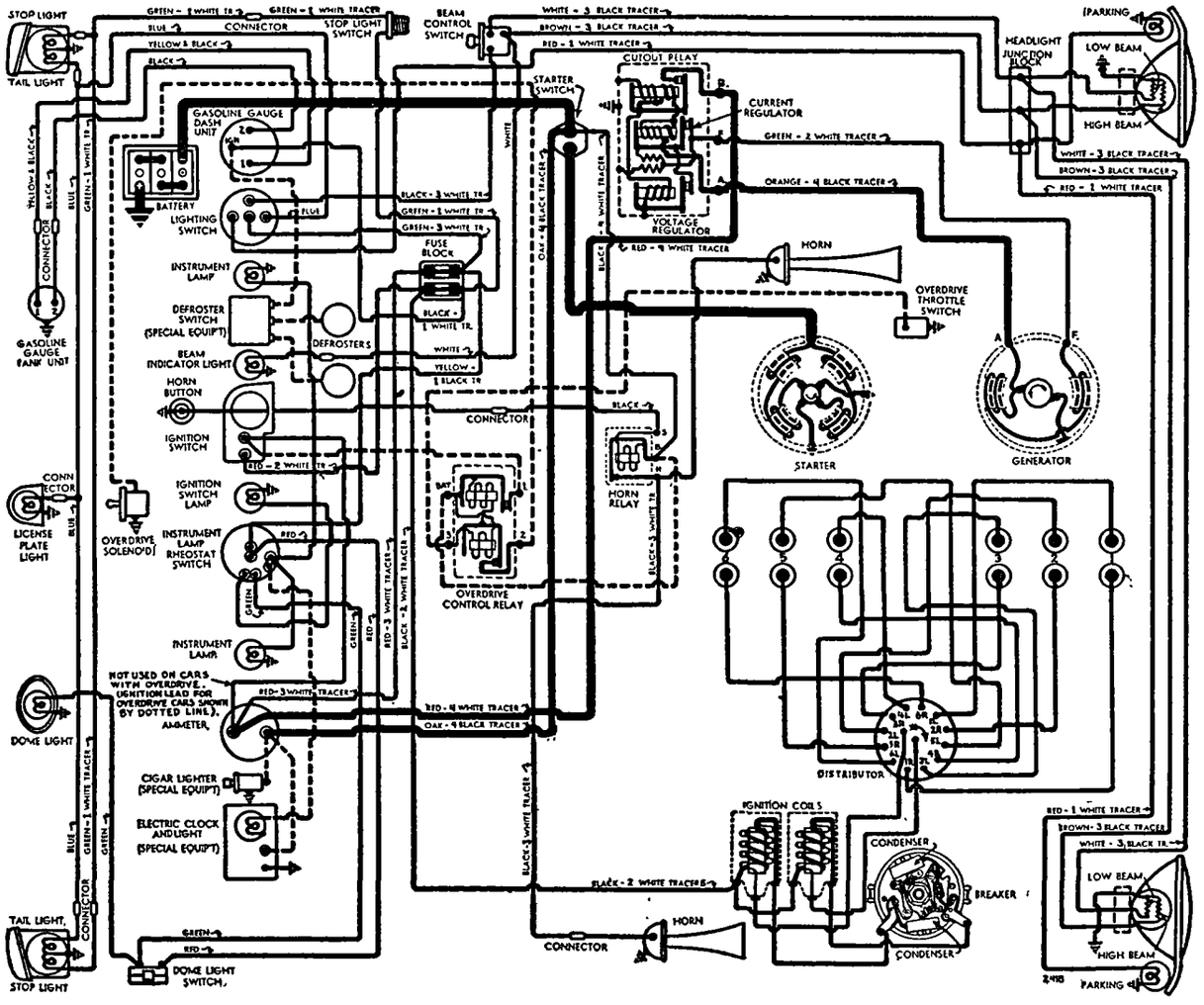
To Set Timing—Car manufacturer recommends use of Nash Timing Light SE-569. Synchronize breaker points (see Synchronization following). With Timing Light connected as for Synchronization (see below), slacken torquematic cable by loosening locknuts on anchor bracket at dash. With #1 piston on compression, turn engine over until piston is 6° or .0150" BTDC, stop when 'IGN' mark on vibration dampener lines up with pointer on chain case cover (this mark is 6° or 23/64" before top dead center mark 'DC'). Loosen advance arm clamp bolt, rotate distributor until points just break (lights go on) with stop pin (hold-down bolt and nut) in advance position in slot in advance arm, tighten clamp bolt. Adjust cable locknuts at anchor bracket on dash to leave torquematic cable without slack or tension and stop pin in advance position in slot.

Synchronization—Use Nash Timing Light SE-569 (consists of two lights—one for each set of contacts) connected between each primary terminal and ground. Turn on ignition, turn engine over until fixed points just open (light for stationary contacts on). If both lights go on, synchronization correct. If not, loosen 3 lockscrews on movable subplate, shift plate by prying with screwdriver in notch on edge of plate until this set of contacts begin to open (both lights on), tighten sub-plate lockscrews, and set Ignition Timing as directed above. If other methods used, set contacts to open simultaneously at 60° (distributor) intervals.

Torquematic Spark Control Check—Distributor must be free in bracket and cable pulleys positioned to prevent cable interference with engine. Advance spring and cable take-up spring must be properly located and spring resistance centralized. Car manufacturer recommends use of Nash Synchro Light SE-417 to check torquematic retard by means of dead center mark on vibration dampener.

CARBURETION:—**Carburetor**—Carter Type WA-1, Model 435-S (#253 cast on face of flange). Single barrel, 1¼" downdraft type.
For complete data, refer to 1941 Carburetor Index.

Idle Adjustment—With engine warm and running at slow idle speed (choke valve wide open, fast idle inoperative), set throttle stopscrew for 7-8 MPH idle speed. Adjust idle adjusting screw until engine fires smoothly (¾-1½ turns open—turn screw in for leaner mixture). Readjust idle speed.



Accelerating Pump Setting—Pump arm under dust cover at top of carburetor has three holes for pump link engagement. Set as follows:
Upper Hole (max. stroke)—Cold weather.
Lower Hole (med. stroke)—Moderate weather.
Inner Hole (min. stroke)—Hot weather.
Float Level—⅜" from projection on cover to top of soldered seam at front end of float with needle valve seated (invert to check).
Metering Rods & Jets—*See Carter Jet Table in Carburetor Section for complete data.*

Fast Idle:—Integral type (built-in carburetor).
For complete data, refer to 1941 Carb. Equip. Index.
Setting—Adjust by bending connecting link offset for ⅝" choke valve opening with stopscrew against (not on) first step of fast idle cam.

Automatic Choke:—Carter Climatic Control.
For complete data, refer to 1941 Carb. Equip. Index.
Setting—1 Notch Rich (supersedes setting of 2 Notches Rich originally specified for this model).

Air Cleaner:—AC #1529112 oil-wetted type standard. Heavy duty oil-bath type optional.

Fuel Pump:—AC Type W (Std.), Type AD Fuel-&-Vacuum Pump (Cars with Overdrive). Pump Exchange Part No. 533.
For complete data, refer to 1941 Carb. Equip. Index.

Gasoline Gauge:—Auto-Lite electric. No. NG-9645D (dash unit), No. NG-9637T (tank unit).
For complete data, refer to 1941 Carb. Equip. Index.

VALVE TIMING:—To Check—With regular running tappet clearance of .015", #1 intake valve opens 11.6° after top dead center with 'DC' mark on front flywheel 23/32" past the pointer on the chain case cover.

Valve Spring Pressure:—Total for inner and outer springs 59 lbs. (closed), 146 lbs. (open). See 'M' page for specifications on each spring.

Tappet Clearance:—.015" all valves (see Adjustment Note following) with engine hot and idling (may be set .018" max. for sustained high speed driving). ADJUSTMENT NOTE—Due to redesigned cylinder head and increased angle of engine, a new oil plug (in drilled passage in cylinder head between lead from oil filter and lead to rocker arm shafts) is used and must be removed if valves adjusted with engine running (cutting off oil supply to rocker arm shafts). IMPORTANT—Replace plug after adjusting valves to provide proper lubrication for overhead mechanism after cover installed (if plug not replaced overhead valve mechanism will not be lubricated, oil will be by-passed in head).

LUBRICATION:—Crankcase Capacity—6 quarts.
Normal Oil Pressure—25-30 lbs. at 25 MPH and above with warm oil. NOTE—Gauge not electric.

COOLING SYSTEM:—Capacity 17 qts. (18 with heater).
Thermostat:—Fulton or Dole. In water outlet elbow on cylinder head.
Setting—Starts to open 160°F.
Temperature Gauge:—Auto-Lite (Motometer) Vapor tension type. A-L No. H-9644.
For complete data, refer to 1941 Mech. Equip. Index.

TRANSMISSION OVERDRIVE CONTROL:—Electric type with accelerator pedal operated 'kick-down' or Automatic Overtake.
For complete data, refer to 1941 Mech. Equip. Index.
Overdrive Solenoid—Delco-Remy Model 1118004.
Throttle Switch—Adjust switch position on mounting bracket so that contacts close with throttle valve wide open and spring on carburetor throttle valve pulley just starting to compress.
Control Relay—Delco-Remy Model 1116798.

BATTERY:—Auto-Lite Type CTL-1-15. 6 volt, 15 plate, 105 ampere hour capacity (20 hour rate).
Starting Capacity—133 amperes for 20 minutes.
Zero Capacity—300 amperes for 3.5 minutes.
Grounded Terminal—Positive (+) grounded to body. Separate body to engine ground strap used.
Dimensions—Length & Height 9 1/16". Width 7⅛".
Location—Under front seat.

STARTER:—Auto-Lite MAB-4076. Armature MAB-2057.
Drive—Inboard Bendix Type LCD11FX-10.
Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—42-53 ozs. (new brushes).
Cranking Engine—160 RPM, 150-160 amps., 5.2 v.

Performance Data

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	3700	5.5	60
0.6 " "	1910	5.5	100
3.4 " "	1100	5.0	200
6.6 " "	695	4.5	300
10.15 " "	420	4.0	400
15.8 " "	Lock	3.0	582
22.5 " "	Lock	4.0	775

Removal:—Starter flange mounted on left front face of flywheel housing. To remove, take out flange mounting screws.

Starting Switch:—A-L #SW-4012. Mounted on body floor below clutch pedal. Operated by depressing clutch pedal fully. No adjustment required.

GENERATOR:—Auto-Lite GDZ-4806A. Armature GDZ-2079F. 2 brush type with Current-Voltage control.
Charging Rate Adjustment—No adjustment at generator. Charging rate controlled by Voltage Regulator and maximum output by Current Regulator. *See Regulator data following.*
Maximum Charging Rate—35 amperes (hot or cold), 8.0 volts, 1900 RPM (generator) and above with load or discharged battery (Current Regulator setting). Actual charging rate controlled by Voltage Regulator and dependent on battery condition.

Performance Data

Cold			Hot		
Amperes	Volts	R.P.M.	Amperes	Volts	R.P.M.
0	6.4	925	0	6.4	1000
4	6.6	1035	4	6.6	1120
8	6.75	1140	8	6.75	1235
12	6.95	1250	12	6.95	1350
16	7.15	1370	16	7.15	1460
20	7.3	1480	20	7.3	1590
24	7.5	1590	24	7.5	1730
28	7.7	1710	28	7.7	1900
32	7.9	1820	32	7.9	2090
35	8.0	1900	35	8.0	2250

Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—53 ozs. max. (new brushes).
Field Current—1.60-1.78 amperes at 6.0 volts.
Motoring Current—4.16-4.60 amperes at 6.0 volts.

Removal:—Generator cradle mounted at left side of engine with fan belt drive. Water pump driven by generator shaft extension. To remove, disconnect water pump, loosen fan belt, remove generator clamp band and lift generator off.

Belt Adjustment:—Adjust whenever belt deflection is over 1½" (when pressed lightly midway between generator and fan pulleys). To adjust, loosen two capscrews on fan bracket, lift fan up (one screw hole slotted) for ¾" belt deflection, tighten screws.

REGULATOR:—Auto-Lite VRP-4004F. Current-Voltage type. In case on left side of engine dash.
For complete data, refer to 1941 Elec. Equip. Index.
NOTE—Regulator case cover sealed. Serviced on exchange basis if seals not broken (to remove cover).

Cutout Relay

Cuts In—6.4-6.6 volts.
Cuts Out—4.8-5.6 volts (approx. 4-6 amps. disch.).
Contact Gap—.015" minimum.
Air Gap—.031-.034" with contacts open (check at hinge end of core).

Voltage Regulator

Setting—7.2-7.5 volts at 70° F. See Electrical Equipment Section for settings at other temperatures.
To Check (without breaking seals)—Connect ammeter in charging line at regulator 'B' terminal (use short heavy leads), voltmeter between 'B' terminal and ground. Operate generator at speed equivalent to 30 MPH., charging fully charged battery, until voltage is steady. Voltage reading should agree with setting given above.
To Adjust (with cover removed)—Change regulator armature spring tension by bending lower spring hanger slightly. See Electrical Equipment Section.
Contact Gap—.012" min. (armature against stop pin).
Air Gap—.048-.052" with contacts just opening.

Current Regulator

Setting—34-36 amperes (marked '35' on the cover).
To Check (without breaking seals)—Connect test meters as for voltage check (above). Operate generator at speed equivalent to 30 MPH. charging battery, turn on car lights and accessories or connect load (bank of headlamp bulbs etc.) between ammeter and battery so that generator charges at peak rate and Current Regulator operates. Current reading should agree with setting given above. If more than slight excess noted, regulator is defective.
To Adjust (with cover removed)—Same as for Voltage Regulator (above).
Contact Gap & Air Gap—Same as Voltage Regulator.

LIGHTING:—Headlamps—Hall 'Sealed Beam' type.
For complete data, refer to 1941 Elec. Equip. Index.
Headlamp Adjustment—Aim upper beam straight ahead (hot spot center 3" below lamp center height).
Beam Indicator—In center of speedometer dial. Lighted whenever Country (upper) beams in use.

Switches

Lighting—Douglas. Nash No. 3107032.
Beam Selector—Douglas.
Instrument—Douglas.

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps	Sealed Beam	
Parking	3	63
Instrument, Clock	1½	55
Beam Indicator	1½	55
Stop & Tail	21-3	1158
Rear License	3	63
Dome	6	81

FUSES:—Lighting—30 ampere. On fuse block mounted on left hand side of engine dash.
Accessory—30 ampere. On fuse block.

HORNS:—Delco-Remy. No. 1999565 (left horn—low note), No. 1999566 (right horn—high note). Vibrator type, blended tone, operated by horn relay.

Type	Current (at 6 volts)	Air Gap
1999565 (Low Note)	19-21 amperes	.047-.052"
1999566 (High Note)	18-20 amperes	.039-.044"

Horn Relay:—Delco-Remy Model 1116775.
Contact Gap—.025". **Air Gap**—.015" (closed).
Contacts Close—2.75-4.0 volts.

HOOD LOCK:—Alligator type hood. Lock button below instrument panel on left side. To raise hood, pull out on lock control button (hood will raise slightly), reach under front edge of hood and press up on safety catch tab to release safety catch, raise hood up.

SERIAL NUMBER:—First number B-110001. Stamped on plate on right frame side member under hood.

SERVICE SERIAL NUMBER:—First number N8-17001. On 'Caution Plate' on left front door hinge post.

ENGINE NUMBER:—First number B-110001. Stamped on right side of engine block at front.

COMPRESSION:—**Ratio**—6 3-1 std. cast-iron head. **Pressure**—110 lbs. at cranking speed of 350 RPM.

VACUUM READING:—Steady 18-20" idling at 7-8 MPH.

IGNITION:—**Coil Model CE-4025A (2 used).** Coils are mounted on right side of engine.
Ignition Current—2 amperes idling, 5 amperes stopped for each coil (2 used).
Ignition Switch:—Oakes Steering Column and Ignition Lock No. 302382. Ignition Switch No 302440.
Ignition Lock—Briggs & Stratton. B & S No. 85347. **Key Series**—5 digits. **Groove**—No. 1.
Distributor Auto-Lite IGK-4102. 'Twin Ignition' double breaker, 8 lobe cam, full automatic advance type with Torquematic Spark Control. Contacts open simultaneously to fire both spark plugs in each cylinder at the same instant and must be synchronized (see Ignition Timing).
Breaker Gap—Set at .017" (alike for both sets).
Cam Angle or Dwell—28° closed, 17° open (distr.). For each set of contacts (operate independently).
Breaker Arm Spring Tension—17-20 ounces.
Rotation—Clockwise viewed from above.
Condenser—No. IG-2671 (2 used). Cap. .20-.25 mfd.

Automatic Advance

Distributor		Engine	
Degrees	R.P.M.	Degrees	R.P.M.
Start	275	0	550
4	400	8	800
6	575	12	1150
9	840	18	1680
12	1100	24	2200

Torquematic Spark Control—Consists of cable anchored at dash and connected to distributor body by a travel limiting spring. Retards distributor through engine movement caused by torque action. Maximum retard 2½° (engine movement in excess of 2½° taken up by travel limiting spring). See Ignition Timing for setting.
Removal:—Mounted on right side of engine. To remove, take out hold-down screw in advance arm, disconnect torquematic control, lift distributor off.
Installation Note—When installing distributor, crank engine to firing position for #1 cylinder (piston 9° BTDC), see that oil pump and distributor drive gear meshed with camshaft gear so that oil pump drive pin (at lower end of distributor drive shaft) is crossways of the engine.

FIRING ORDER:—1-6-2-5-8-3-7-4. See diagram for spark plug cable connections on distributor cap.

SPARK PLUGS:—AC No. 45. 14 MM. Metric.
Spark Plug Gaps—Set at .025".

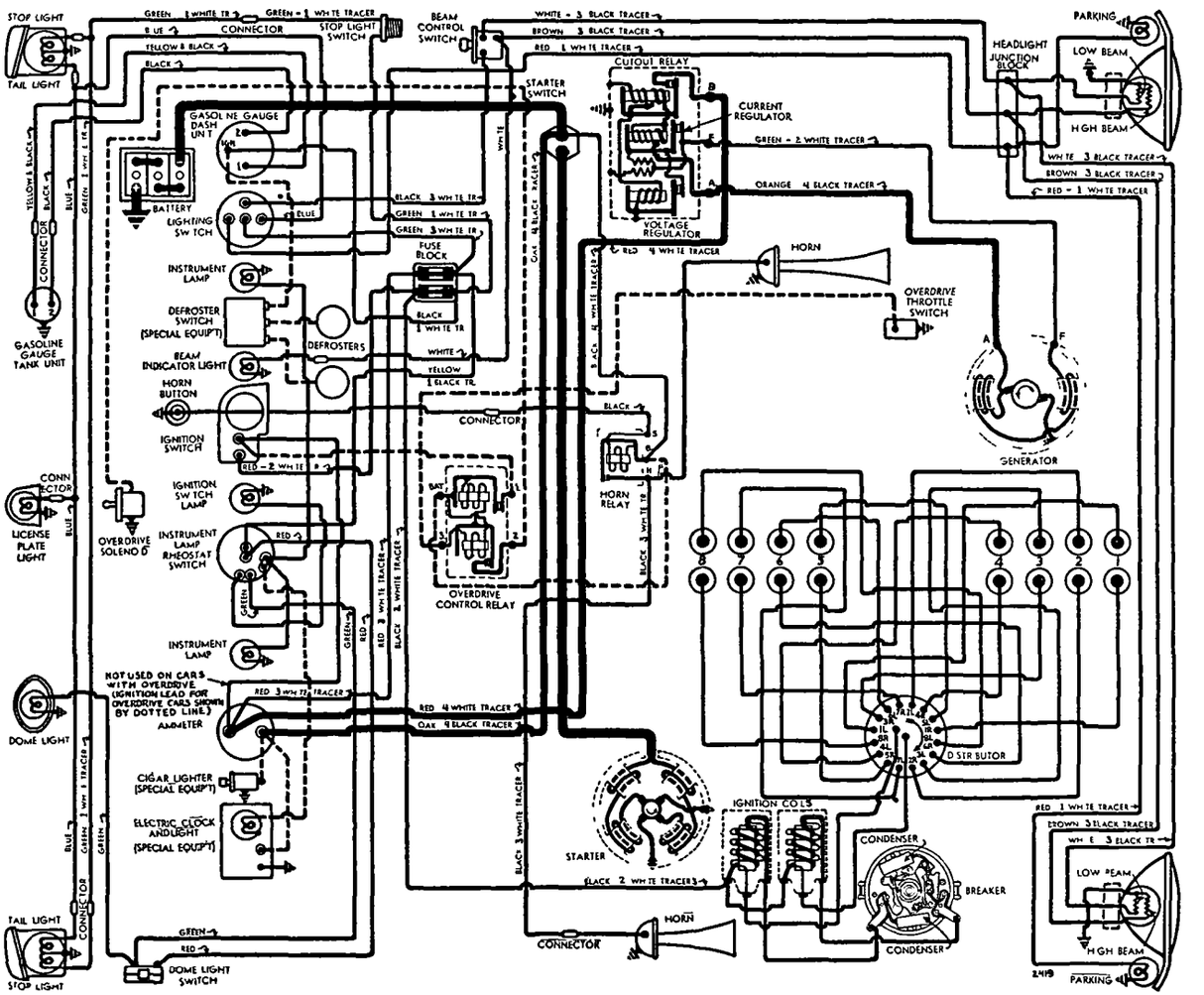
IGNITION TIMING:—Setting for all engines as follows:

Flywheel Degrees	Piston Position
9° BTDC	.0325" BTDC

To Set Timing—Car manufacturer recommends use of Nash Timing Light SE-569. Synchronize breaker points (see Synchronization following). With Timing Light connected as for Synchronization (see below), slacken torquematic cable by loosening locknuts on anchor bracket at dash. With #1 piston on compression, turn engine over until piston is 9° or .0325" BTDC, stop when 'IGN' mark on vibration dampener lines up with pointer on chain case cover (this mark is 9° or .725" before top dead center mark 'DC'). Loosen advance arm clamp bolt, rotate distributor until points just break (lights go on) with stop pin (hold-down bolt and nut) in advance position in slot in advance arm, tighten clamp bolt. Adjust cable locknuts at anchor bracket on dash to leave torquematic cable without slack or tension and stop pin in advance position in slot.

Synchronization—Use Nash Timing Light SE-569 (consists of two lights—one for each set of contacts) connected between each primary terminal and ground. Turn on ignition, turn engine over until fixed points just open (light for stationary contacts on). If both lights go on, synchronization correct. If not, loosen 3 lockscrews on movable subplate, shift plate by prying with screwdriver in notch on edge of plate until this set of contacts begin to open (both lights on), tighten sub-plate lockscrews, and set Ignition Timing as directed above. If other methods used, set contacts to open simultaneously at 45° (distributor) intervals.
Torquematic Spark Control Check—Distributor must be free in bracket and cable pulleys positioned to prevent cable interference with engine. Advance spring and cable take-up spring must be properly located and spring resistance centralized. Car manufacturer recommends use of Nash Synchro Light SE-417 to check torquematic retard by means of dead center mark on vibration dampener.

CARBURETION:—**Carburetor**—Carter Type WDO, Model 511-S (#360 cast on face of flange). 1" dual downdraft type.
For complete data, refer to 1941 Carburetor Index.



Idle Adjustment—With engine warm and running at slow idle speed (choke valve wide open, fast idle inoperative), set throttle stopscrew for 7-8 MPH idle speed. Adjust idle adjusting screw for each barrel (in sucession) until engine fires smoothly (½-1½ turns open for each screw—turn screws in for leaner mixture). Readjust idle speed.
Accelerating Pump—Pump arm under dust cover at top of carburetor has 2 holes for pump link engagement. Set as follows:
Upper Hole (max. stroke)—Cold weather.
Lower Hole (min. stroke)—Hot weather.
Float Level—3/16" from top of float to machined surface of bowl cover (remove gasket, invert to check).
Metering Rods & Jets—*See Carter Jet Table in Carburetor Section for complete data.*

Fast Idle:—Integral type (built-in carburetor).
For complete data, refer to 1941 Carb. Equip. Index.
Setting—Adjust fast idle screw for .015" throttle opening with choke valve closed.

Automatic Choke:—Carter Climatic Control.
For complete data, refer to 1941 Carb. Equip. Index.
Setting—Centered (at index mark). This setting supersedes 1 Notch Rich setting (original specification).

Air Cleaner:—AC # 1529113 oil-wetted type standard. Heavy duty oil-bath type optional.

Fuel Pump:—AC Type W (Std.), Type AD Fuel-&-Vacuum Pump (Cars with Overdrive). Pump Exchange Part No. 534.
For complete data, refer to 1941 Carb. Equip. Index.

Gasoline Gauge:—Auto-Lite electric. No. NG-9645D (dash unit), No. NG-9637T (tank unit).
For complete data, refer to 1941 Carb. Equip. Index.

VALVE TIMING:—To Check—With regular running tappet clearance of .015", #1 intake valve opens 16° after top dead center with 'DC' mark on front flywheel 1 5/16" past the pointer on the chain case cover.

Valve Spring Pressure:—Total for inner and outer springs 59 lbs. (closed), 146 lbs. (open). See 'M' page for specifications on each spring.

Tappet Clearance:—.015" all valves with engine hot and idling (may be set .018" max. for sustained high speed driving).

LUBRICATION:—Crankcase Capacity—7 quarts.
Normal Oil Pressure—25-30 lbs. at 25 MPH and above with warm oil. NOTE—Gauge not electric.

COOLING SYSTEM:—Capacity 16 qts. (17 with heater).
Thermostat:—Fulton or Dole. In water outlet elbow on cylinder head.
Setting—Starts to open 160°F.

Temperature Gauge:—Auto-Lite (Motometer) Vapor tension type. A-L No. H-9644.
For complete data, refer to 1941 Mech. Equip. Index.

TRANSMISSION OVERDRIVE CONTROL:—Electric type with accelerator pedal operated 'kick-down' or Automatic Overtake.
For complete data, refer to 1941 Mech. Equip. Index.
Overdrive Solenoid—Delco-Remy Model 1118004.
Throttle Switch—Adjust switch position on mounting bracket so that contacts close with throttle valve wide open and spring on carburetor throttle valve pulley just starting to compress.
Control Relay—Delco-Remy Model 1116798.

BATTERY:—Auto-Lite Type CTL-2-17. 6 volt, 17 plate, 120 ampere hour capacity (20 hour rate).
Starting Capacity—152 amperes for 20 minutes.
Zero Capacity—300 amperes for 4.5 minutes.
Grounded Terminal—Positive (+) grounded to body. Separate body to engine ground strap used.
Dimensions—Lgth. 10 5/16". Width 7⅛". Hgt. 9 1/16".
Location—Under front seat.

STARTER:—Auto-Lite MAB-4104. Armature MAB-2057.
Drive—Inboard Bendix Type LCD11FX-10.
Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—42-53 ozs. (new brushes).
Cranking Engine—160 RPM, 150-160 amps., 5.2 v.

Performance Data

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	3700	5.5	60
0.6 " "	1910	5.5	100
3.4 " "	1100	5.0	200
6.6 " "	695	4.5	300
10.15 " "	420	4.0	400
15.8 " "	Lock	3.0	582
22.5 " "	Lock	4.0	775

Removal:—Starter flange mounted on left front face of flywheel housing. To remove, take out flange mounting screws.

Starting Switch:—A-L #SW-4012. Mounted on body floor below clutch pedal. Operated by depressing clutch pedal fully. No adjustment required.

GENERATOR:—Auto-Lite GDZ-4803B. Armature GDZ-2079F. Two brush type with current-voltage control.
Charging Rate Adjustment—No adjustment at generator. Charging rate controlled by Voltage Regulator and maximum output by Current Regulator. *See Regulator data following.*
Maximum Charging Rate—35 amperes (hot or cold), 8.0 volts, 1900 RPM (generator) and above with load or discharged battery (Current Regulator setting). Actual charging rate controlled by Voltage Regulator and dependent on battery condition.

Performance Data

Cold			Hot		
Amperes	Volts	R.P.M.	Amperes	Volts	R.P.M.
0	6.4	925	0	6.4	1000
4	6.6	1035	4	6.6	1120
8	6.75	1140	8	6.75	1235
12	6.95	1250	12	6.95	1350
16	7.15	1370	16	7.15	1460
20	7.3	1480	20	7.3	1590
24	7.5	1590	24	7.5	1730
28	7.7	1710	28	7.7	1900
32	7.9	1820	32	7.9	2090
35	8.0	1900	35	8.0	2250

Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—53 ozs. max. (new brushes).
Field Current—1.60-1.78 amperes at 6.0 volts.
Motoring Current—4.16-4.60 amperes at 6.0 volts.

Removal:—Generator cradle mounted at left side of engine with fan belt drive. Water pump driven by generator shaft extension. To remove, disconnect water pump, loosen fan belt, remove generator clamp band and lift generator off.

Belt Adjustment:—Adjust whenever belt deflection is over 1½" (when pressed lightly midway between generator and fan pulleys). To adjust, loosen two capscrews on fan bracket, lift fan up (one screw hole slotted) for ¾" belt deflection, tighten screws.

REGULATOR:—Auto-Lite VRP-4004F. Current-Voltage type. In case on left side of engine dash.
For complete data, refer to 1941 Elec. Equip. Index.
NOTE—Regulator case cover sealed. Serviced on exchange basis if seals not broken (to remove cover).

Cutout Relay

Cuts In—6.4-6.6 volts.
Cuts Out—4.8-5.6 volts (approx. 4-6 amps. disch.).
Contact Gap—.015" minimum.
Air Gap—.031-.034" with contacts open (check at hinge end of core).

Voltage Regulator

Setting—7.2-7.5 volts at 70° F. See Electrical Equipment Section for settings at other temperatures.
To Check (without breaking seals)—Connect ammeter in charging line at regulator 'B' terminal (use short heavy leads), voltmeter between 'B' terminal and ground. Operate generator at speed equivalent to 30 MPH., charging fully charged battery, until voltage is steady. Voltage reading should agree with setting given above.
To Adjust (with cover removed)—Change regulator armature spring tension by bending lower spring hanger slightly. See Electrical Equipment Section.
Contact Gap—.012" min. (armature against stop pin).
Air Gap—.048-.052" with contacts just opening.

Current Regulator

Setting—34-36 amperes (marked '35' on the cover).
To Check (without breaking seals)—Connect test meters as for voltage check (above). Operate generator at speed equivalent to 30 MPH. charging battery, turn on car lights and accessories or connect load (bank of headlamp bulbs etc.) between ammeter and battery so that generator charges at peak rate and Current Regulator operates. Current reading should agree with setting given above. If more than slight excess noted, regulator is defective.
To Adjust (with cover removed)—Same as for Voltage Regulator (above).
Contact Gap & Air Gap—Same as Voltage Regulator.

LIGHTING:—Headlamps—Hall 'Sealed Beam' type.
For complete data, refer to 1941 Elec. Equip. Index.
Headlamp Adjustment—Aim upper beam straight ahead (hot spot center 3" below lamp center height).
Beam Indicator—In center of speedometer dial. Lighted whenever Country (upper) beams in use.

Switches

Lighting—Douglas. Nash No. 3107032.
Beam Selector—Douglas.
Instrument—Douglas.

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps		Sealed Beam
Parking	3	63
Instrument, Clock	1½	55
Beam Indicator	1½	55
Stop & Tail	21-3	1158
Rear License	3	63
Dome	6	81

FUSES:—Lighting—30 ampere. On fuse block mounted on left hand side of engine dash.
Accessory—30 ampere. On fuse block.

HORNS:—Delco-Remy. No. 1999565 (left horn—low note), No. 1999566 (right horn—high note). Vibrator type, blended tone, operated by horn relay.

Type	Current (at 6 volts)	Air Gap
1999565 (Low Note)	19-21 amperes	.047-.052"
1999566 (High Note)	18-20 amperes	.039-.044"

Horn Relay:—Delco-Remy Model 1116775.
Contact Gap—.025". **Air Gap**—.015" (closed).
Contacts Close—2.75-4.0 volts.

MODEL NOTATION:—	Model	Series
Special Six	F-41	66
Dynamic Cruiser Six	G-41	76
Custom Cruiser Six	H-41	96

HOOD LOCK:—Hood is Alligator type. To raise hood, pull out on control knob on instrument panel (hood will raise slightly), push up on 'Safety Hook' tab under front end of hood, lift hood up.

SERIAL NUMBER:—On plate on upper left corner of dash in engine compartment. First Nos.

Series	Lansing	Linden, N. J.	California
66	66-1001	66L1001	66C1001
76	76-1001	76L1001	76C1001
96	96-1001	96L1001	96C1001

ENGINE NUMBER:—First No. G-225001. Stamped on top left corner of engine block back of water pump. NOTE—Prefix on cars with Hydra-Matic Drive is 'GA'.

COMPRESSION:—Ratio—6.1-1 Std., 5.74-1 Optl.
Pressure—115 lbs. plus or minus 10 lbs. at cranking speed of 100 RPM. for Std. 6.1-1 head.

VACUUM READING:—Steady 17" min. at idling speed.

IGNITION:—Delco-Remy Coil No. 1115129. On dash.
Ignition Current—2 amperes idling, 4.5 stopped.
Ignition Switch:—Delco-Remy No. 1116305 (66, 96), 1116311 (76). Connected to ignition coil by armored cable.
Ignition Lock—Briggs & Stratton No. 45792. Key Series—8000 to 9499. Groove—No. 15.
Distributor Delco-Remy Model 647-F. Single breaker, 6 lobe cam, full automatic advance type with auxiliary vacuum spark control and Octane Selector adjustment.
Breaker Gap—.020". Limits .018-.024".
Cam Angle or Dwell—35° closed, 25° open.
Breaker Arm Spring Tension—17-21 ozs.
Rotation—Counter-clockwise viewed from above.
Condenser—Part No. 1869704. Capacity .18-.25 mfd.

Automatic Advance

Distributor Degrees	Distributor R.P.M.	Engine Degrees	Engine R.P.M.
Start	200	2	400
3	400	6	800
14	1900	28	3800

Vacuum Spark Control Model 681-P—On distributor (integral type linked directly to breaker plate). Provides additional advance at speeds above idling except when engine accelerated or operated with wide open throttle when spark retarded by return spring within unit.
Plunger Travel—3/16" total.

Vacuum Advance

Distr. Degrees	Eng. Degrees	Vacuum (" of HG)
Start	0°	5-7"
10°	20°	15.5-18.5"

Octane Selector—Adjustment permits 10° advance or retard from center '0' position. See Ignition Timing for adjustment directions.
Removal:—Distributor mounted on left side of engine. To remove, disconnect vacuum line, take out hold-down screw in advance arm.

FIRING ORDER:—1-5-3-6-2-4. See diagram.

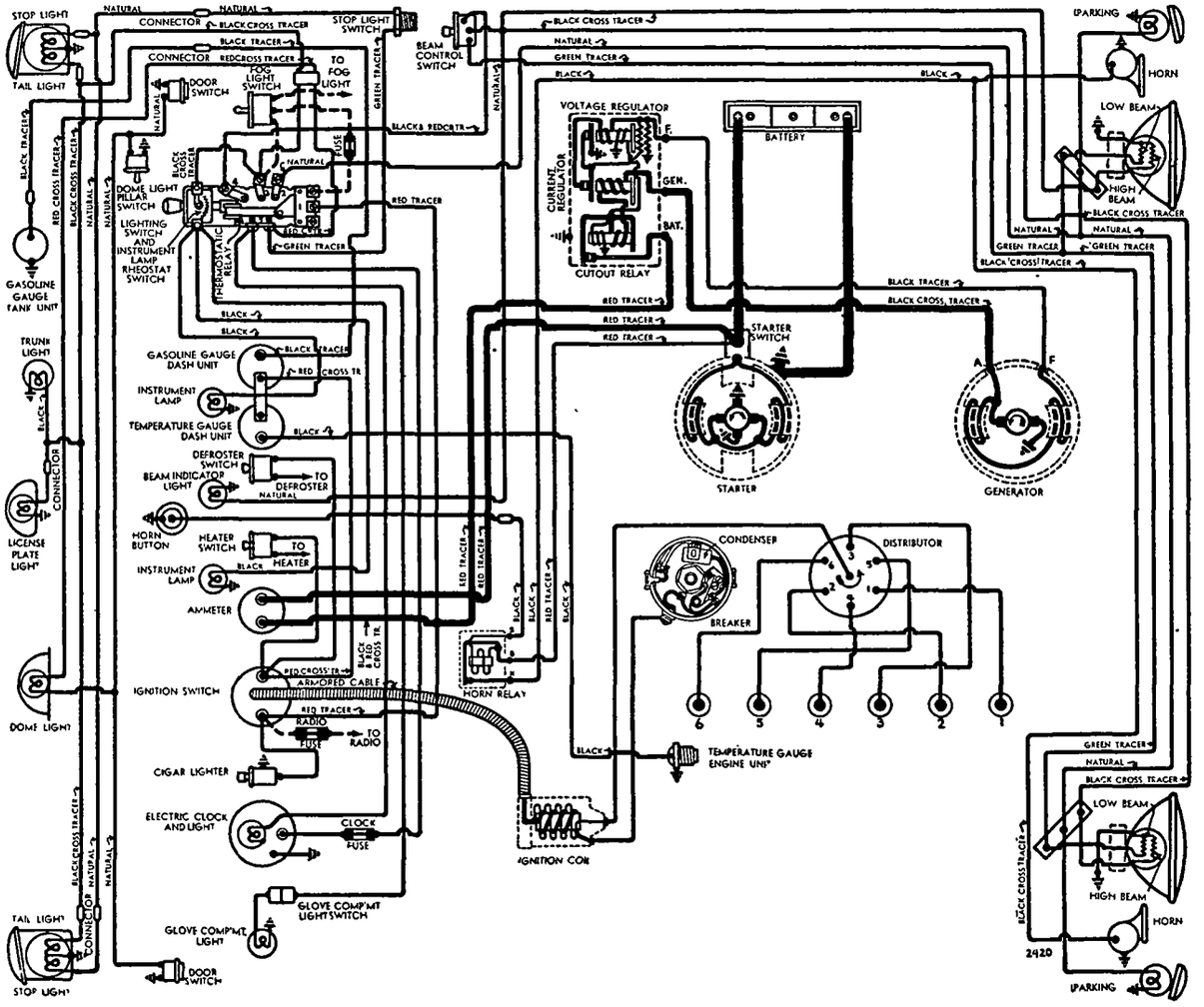
SPARK PLUGS:—AC No. 44. 14 MM. Metric.
Spark Plug Gaps—.040".

IGNITION TIMING:—See Octane Selector Setting for correction dependent on fuel used.

	Flywheel Degrees	Piston Position
Std. Trans. Cars	At TDC	.000" TDC.
Hydra-Matic Trans.		.001" BTDC.

Timing (With Synchroscope)—Recommended method. Loosen hold-down screw in advance arm, center Octane Selector scale ('0' at indicator line), tighten hold-down screw. Clip synchroscope lead to #1 spark plug, direct synchroscope light on flywheel through inspection hole in left front face of housing above starter. Idle engine, loosen advance arm clamp bolt, rotate distributor until ignition mark (steel ball insert) on flywheel lines up with indicator on housing, tighten clamp bolt, check Octane Selector setting (below).
NOTE—On cars with Hydra-Matic drive, use dial indicator and set distributor so contacts open with piston .001" before top dead center.
Timing (Without Synchroscope)—Turn engine over to firing position for #1 piston with steel ball insert in flywheel at indicator in inspection hole in left front face of flywheel housing (or with piston .001" BTDC. on cars with Hydra-Matic drive). Loosen hold-down screw in advance arm, center pointer on scale ('0' mark at indicator), tighten hold-down screw. Loosen advance arm clamp bolt, rotate distributor until contacts begin to open, tighten clamp bolt and check Octane Selector setting.
Octane Selector Setting—Set for slight ping when accelerating engine with wide open throttle at speeds below 15 MPH. To adjust, loosen distributor hold-down screw, rotate distributor clockwise toward 'Adv' end of scale (if no ping noted), counter-clockwise toward 'Ret' end of scale (if ping too severe) one graduation at a time until correct performance secured.

CARBURETION:—Carburetor—Carter WA1 Model 504-S (Std. Trans.), 481-S (Hydra-Matic Drive). 1½" downdraft type with Climatic Control.
For complete data, refer to 1941 Carburetor Index.
Idle Adjustment—With engine warm so that choke valve wide open and fast idle inoperative, set throttle stopscrew for idle speed of 425 RPM. (Std), 375 RPM. (Hydra-Matic Drive cars). Adjust idle adjusting screw for smooth idle (screw should be ½-1½ turns open from inner seated position—turn screw in for leaner mixture). Recheck idle speed. ***See 'Hydra-Matic Drive' article in Mechanical Equipment Section for throttle linkage adjustment on cars with Hydra-Matic Drive.***
Accelerating Pump Setting—Pump arm (under dust cover) has three holes for pump connector link engagement. Set as follows:
Lower (Med. Stroke)—Normal all-year setting.



Inner (Min. Stroke)—Hot weather or High Alt.
Outer (Max. Stroke)—Cold weather, low-test fuel.
Float Level—½" from top of projection on bowl cover to top of float seam at free end with valve seated (invert cover to check—use Gauge T109-83).
Metering Rods & Jets—*See Carter Jet Table in Carburetor Section for complete data.*

Throttle Cracker Adjustment:—Must be set for correct throttle opening for starting. To adjust, disconnect starter cable at starter switch, depress starter button fully (hold in this position while adjusting), loosen adjusting screw on throttle cracker cam (on accelerator linkage bellcrank on left side of engine block), adjust cam so that clearance between carburetor throttle valve stopscrew and highest step of fast idle cam is .0625-.0825" (1/16").

Fast Idle:—Integral (built-in each carburetor).
For complete data, refer to 1941 Carb. Equip. Index.
Setting—With fast idle cam in hot or slow idle position, close choke valve until throttle stopscrew is against (not on) first step of cam, adjust by bending connector rod offset so that choke valve opening is 5/8".

Automatic Choke:—Carter Climatic Control.
For complete data, refer to 1941 Carb. Equip. Index.
Setting—Mark on thermostat case centered on housing scale.

Air Cleaner:—AC No. 1529861 oil-wetted type Std., Heavy duty oil-bath type Optl.

Fuel Pump:—AC Type AJ Fuel-&-Vacuum Pump Std. Replacement Exchange Pump No. 536.
For complete data, refer to 1941 Carb. Equip. Index.

Gasoline Gauge:—AC Electric type. No. 1516298 (Dash Unit), No. 1516285 (Tank Unit).
For complete data, refer to 1941 Carb. Equip. Index.

MANIFOLD HEAT CONTROL:—Thermostatic coil type. See that valve operates freely.
Setting—Coil wind-up should be 125° (approx. ⅓ turn) at room temperature. NOTE—To check valve for correct position on shaft, use feeler gauge in slot on rear end of valve shaft. With valve closed, gauge should contact stop pin (slot 6° to left or toward engine from up-and-down position) with ⅛" clearance between valve tip and manifold. Valve welded to shaft in this position.

VALVE TIMING:—**To Check**—With tappet clearance of .0124", #1 intake valve opens 5° BTDC. with piston .0163" BTDC. and point on flywheel approx. 2 teeth before top dead center mark (steel ball insert) at indicator (inspection hole in left front face of flywheel housing). Reset tappet clearance at .008" with engine warm.

Tappet Clearance:—.008" Int., .011" Exh. Warm.

Valve Spring Pressure:—50½ lbs. at 2¼" (valve closed), 95½ lbs. at 1 15/16" (valve open).

LUBRICATION:—**Crankcase Capacity**—5 qts.
Normal Oil Pressure—30 lbs.

COOLING SYSTEM:—**Capacity**—17¾ qts.

Thermostat:—Harrison. In cylinder head outlet.
Setting—Starts to open at 152° F.

Temperature Gauge:—AC Electric type. No. 1511043 (Dash Unit), No. 1510772 (Engine Unit).
For complete data, refer to 1941 Mech. Equip. Index.

BATTERY:—**Delco Model 15E-2.** 6 volt, 15 plate, 100 Ampere Hour Capacity (20 hour rate).
Starting Capacity—120 amperes for 20 minutes.
Zero Capacity—300 amperes for 3.5 minutes. Five second voltage 4.25 volts.
Grounded Terminal—Negative (—) to Starter.
Location—On left side in engine compartment.

Police Battery Delco Model 19E-1. 6 volt, 19 plate, 130 Ampere Hour Capacity (20 hour rate).
Starting Capacity—150 amperes for 20 minutes.
Zero Capacity—300 amperes for 5.3 minutes. Five second voltage 4.55 volts.
Grounded Terminal and Location—Same as above.

STARTER:—**Delco-Remy 1107034, Armature No. 1867897 (LHD cars); 1107019, Armature 810601 (RHD cars).** NOTE—Mounting holes provided on all starters for Hydra-Matic Drive Interlock mounting (holes plugged when Hydra-Matic Drive not used). *See Hydra-Matic Drive article in Mechanical Equipment Section for Interlock adjustment.*
Drive—Overrunning clutch with manual pinion shift (LHD. 1107034), solenoid pinion shift (RHD. 1107019).
Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—24-28 ounces each.
Cranking Engine—100 RPM., 125-135 amperes, 5 volts (Summer Temperature) for LHD. starter.

Performance Data

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	5000	5.0	65
12 "	Lock	3.37	525

Removal:—Flange mounted on left front face of flywheel housing. To remove, take out mounting screws.

Starting Switch (1107034):—No. 820052. Mounted on starter. Operated by pinion shift lever.
(1107019)—Solenoid Switch No. 1546. Mounted on starter. Operated through relay (in switch case) by Pushbutton Switch No. 1996008 on instrument panel.
For complete data, refer to 1941 Elec. Equip. Index.

GENERATOR:—**Delco-Remy 1102664, Armature 1879002 (Std.), Model 1102680 (Hydra-Matic Drive Cars).** Two brush type with Current & Voltage Control.
Pulley Note—Cars with Std. Trans. (1102664 Gen.) have regular 3 9/16" pulley. Hydra-Matic Drive cars (1102680 Gen.) have smaller 3 1/16" pulley to compensate for lower engine speed (max. output reached at approx. 210 Eng. RPM. less). NOTE—This pulley can be installed on cars with 3.9-1 Axle ratio for special service if output inadequate.
Charging Rate Adjustment—None. Charging rate controlled by Voltage Regulator, maximum output by Current Regulator. See Regulator data below.
Maximum Charging Rate—33 amperes, 8.0 volts, 2400 RPM. (hot) or 23 MPH. (66), 21 MPH. (76,96) and above (Current Regulator setting) with load or discharged battery. Actual charging rate controlled by Voltage Regulator and dependent on battery condition.

Performance Data

	Amperes	Volts	R.P.M.
Cold	30①	8.0	1750

①—Not maximum output. See Current Regulator.

Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—25 ozs. each.
Field Current—1.67-1.82 amperes at 6.0 volts.

Removal:—Pivot mounted at left front of engine. To remove, take out pivot and clamp bolts.

Belt Adjustment:—Check with straightedge across pulleys. Belt deflection should be ¾" inward from straightedge with light pressure at point midway between generator and fan pulleys.

REGULATOR:—**Delco-Remy 1118201. Single Core Type.** Vibrating Current & Voltage Regulator on dash.
For complete data, refer to 1941 Elec. Equip. Index.
CAUTION—Check generator for grounded field coils and leads before changing regulator settings to correct High Charging Rate or High Voltage.

Cutout Relay

Cuts In—6.2-6.7 volts hot.
Cuts Out—0-4.0 ampere discharge current.
Contact Gap—.020" (same for both sets).
Air Gap—.020" (with contacts just closed).

Voltage Regulator

Setting—7.2-7.4 volts hot (operating temperature). Should be checked with cover in place and hot.
To Check—Connect ammeter in charging line at regulator 'BAT' terminal, voltmeter between this terminal and ground. Operate generator at 2800 RPM., adjust charging rate to 8-10 amperes (use variable rheostat or AVR set). With regulator hot (150°F.), decrease generator speed until cutout relay contacts open, then increase speed to 2800 RPM. and check hot voltage setting (above).
To Adjust—Change regulator armature spring tension slightly by bending hanger at lower end of **one spring only.** If further adjustment required, see Single Core Regulator article in Electrical Equipment Section for other (2nd.) spring adjustment.
Air Gap—.070" between center of core and armature with contacts just closing (press down on armature to open contacts, release pressure, check gap at point where contacts just close).

Current Regulator

Setting—32-34 amperes hot (operating temp.).
To Check—Remove regulator cover, connect short jumper between Voltage Regulator frame and upper contact support bracket (to short out Voltage Regulator), connect ammeter in charging line at regulater 'BAT' terminal, turn on car lights and accessories. Operate generator and increase speed until output remains constant. With regulator hot (150°F), current reading should agree with setting (above).
To Adjust—Same as for Voltage Regulator (above).
Air Gap—.080" (check same as Voltage Regulator).

LIGHTING:—**Headlamps**—Guide 'Sealed Beam' type.
For complete data, refer to 1941 Elec. Equip. Index.
Headlamp Adjustment—Aim upper beam straight ahead (hot spot center 3" below lamp center height).
Beam Indicator—Small red indicator in upper edge of speedometer. Lighted when Upper Beams in use.
Direction Signal—*Refer to 1941 Elec. Equip. Index.*

Switches

Lighting—Delco-Remy No. 1995017 (LHD Cars), No. 1995020 (RHD Cars). Switch has instrument light rheostat mounted on control knob stem.
Beam Selector—Delco-Remy No. 1997002.
Stop Light—Delco-Remy No. 1997725.

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps	Sealed Beam	
Parking	3	63
Instrument, Clock	1½	55
Beam Ind., Glove Compt.	1	51
Stop & Tail	21-3	1154
Rear License Plate	3	63
Dome	6	82

THERMOSTATIC RELAY:—On lighting switch. Contacts remain closed with 30 ampere current, open in 3 minutes with current of 42 amperes at 70° F. Limits current to 18 amperes with dead short-circuit. Not adjustable.

FUSES:—**Clock**—2 ampere. In clock lead connector.

HORNS:—**Delco-Remy No. 1999535 (Low Note), 1999536 (High Note).** Vibrator type, blended tone, twin horns operated by relay.
NOTE—Horns not marked but Low Note horn mounted on left side, High Note horn on right side, in front of radiator behind grille (mounting designed so horns cannot be interchanged).

Type	Current (at 6 volts)	Air Gap
1999535 (low note)	19-21 amperes	.045-.049"
1999536 (high note)	17-19 amperes	.035-.039"

Horn Relay:—Delco-Remy No. 1116775.
Contact Gap—.025". **Air Gap**—.015" (closed).
Contacts Close—2.75-4.0 volts.

MODEL NOTATION:—	Model	Series
Special Eight	E-41	68
Dynamic Cruiser Eight	J-41	78
Custom Cruiser Eight	L-41	98

HOOD LOCK:—Hood is Alligator type. To raise hood, pull out on control knob on instrument panel (hood will raise slightly), push up on 'Safety Hook' tab under front end of hood, lift hood up.

SERIAL NUMBER:—On plate on upper left corner of dash in engine compartment. First Nos.

Series	Lansing	Linden, N. J.	California
68	68-1001	68L1001	68C1001
78	78-1001	78L1001	78C1001
98	98-1001	98L1001	98C1001

ENGINE NUMBER:—First No. L-379001. Stamped on top left corner of engine block back of water pump. NOTE—Prefix on cars with Hydra-Matic Drive is 'LA'.

COMPRESSION:—**Ratio**—6.3-1 Std., 5.7-1 Optl.
Pressure—105 lbs. plus or minus 10 lbs. at cranking speed of 100 RPM. for Std. 6.3-1 head.

VACUUM READING:—Steady 17" min. at idling speed.

IGNITION:—**Delco-Remy Coil No. 1115129.** On dash.
Ignition Current—2 amperes idling, 4.5 stopped.
Ignition Switch:—Delco-Remy No. 1116305 (68, 98), 1116311 (78). Connected to ignition coil by armored cable.
Ignition Lock—Briggs & Stratton No. 45792. Key Series—8000 to 9499. Groove—No. 15.
Distributor Delco-Remy Model 1110802. Single breaker, 8 lobe cam, full automatic advance type with auxiliary vacuum spark control and Octane Selector adjustment.
Breaker Gap—.015". Limits .0125-.0175".
Cam Angle or Dwell—31° closed, 14° open.
Breaker Arm Spring Tension—19-23 ozs.
Rotation—Counter-clockwise at commutator end.
Condenser—Part No. 1869704. Capacity .18-.25 mfd.

Automatic Advance

Distributor Degrees	Distributor R.P.M.	Engine Degrees	Engine R.P.M.
Start	300	2.5	600
3.5	500	7	1000
15	2000	30	4000

Vacuum Spark Control Model 681-R. On distributor (integral type linked directly to breaker plate). Provides additional advance at speeds above idling except when engine accelerated or operated with wide open throttle when spark retarded by return spring within unit.
Plunger Travel—11/64" total.

Vacuum Advance

Distr. Degrees	Eng. Degrees	Vacuum (" of HG)
Start	0°	5-7"
7.5°	15°	14-17"

Octane Selector—Adjustment permits 10° advance or retard from center '0' position. See Ignition Timing for adjustment directions.
Removal:—Distributor mounted on left side of engine. To remove, disconnect vacuum line, take out hold-down screw in advance arm.

FIRING ORDER:—1-6-2-5-8-3-7-4. See diagram.

SPARKS PLUGS:—AC No. 44. 14 MM. Metric.
Spark Plug Gaps—.030".

IGNITION TIMING:—See Octane Selector Setting for correction dependent on fuel used.

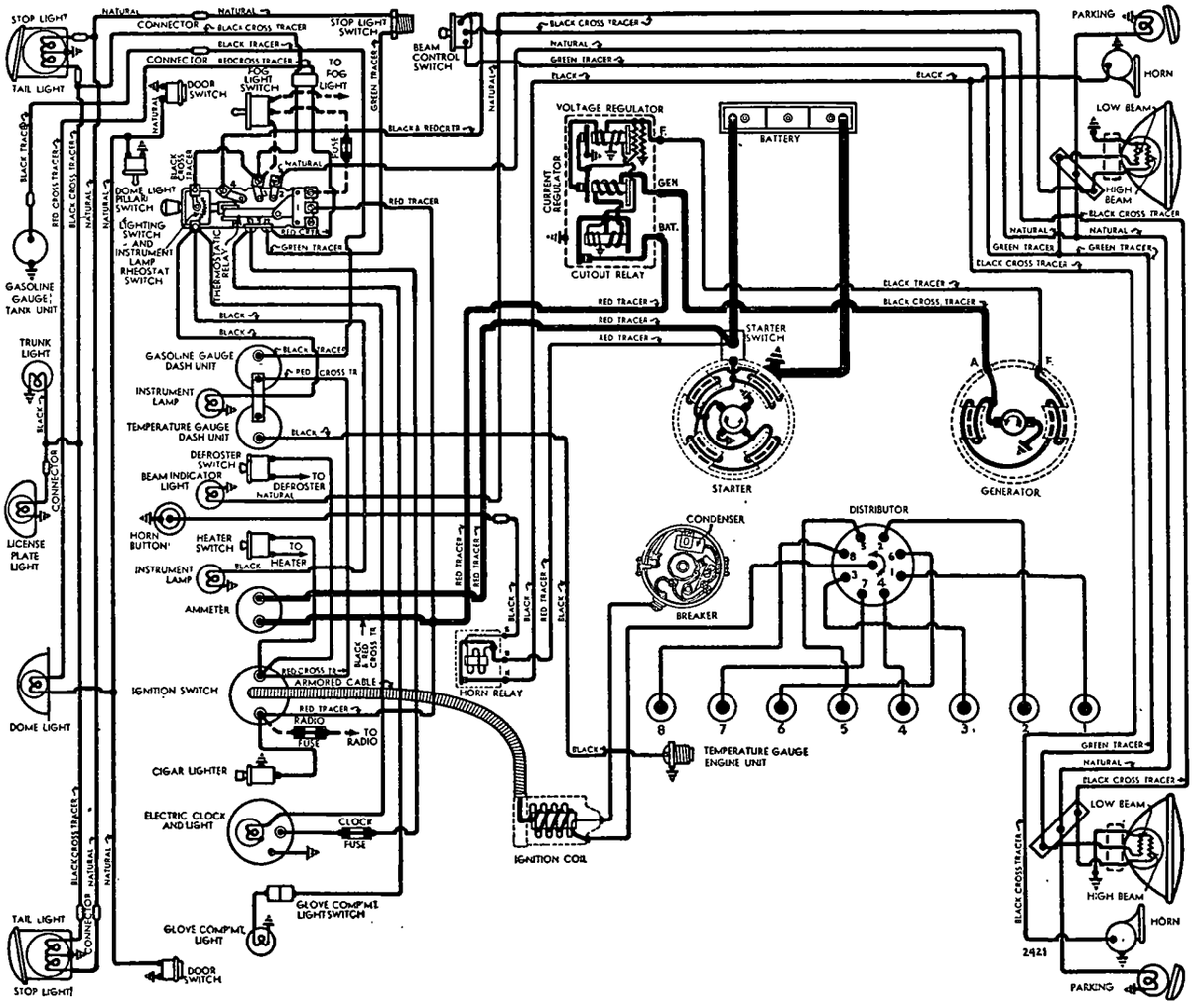
	Flywheel Degrees	Piston Position
Std. Trans. Cars	2° BTDC	.002" BTDC.
Hydra-Matic Trans.		.001" BTDC.

Timing (With Synchroscope)—Recommended method. Loosen hold-down screw in advance arm, center Octane Selector scale ('0' at indicator line), tighten hold-down screw. Clip synchroscope lead to #1 spark plug, direct synchroscope light on flywheel through inspection hole in left front face of housing above starter. Idle engine, loosen advance arm clamp bolt, rotate distributor until ignition mark (steel ball insert) on flywheel lines up with indicator on housing, tighten clamp bolt, check Octane Selector setting (below).
NOTE—On cars with Hydra-Matic drive, use dial indicator and set distributor so contacts open with piston .001" before top dead center.

Timing (Without Synchroscope)—Turn engine over to firing position for #1 piston with steel ball insert in flywheel at indicator in inspection hole in left front face of flywheel housing (or with piston .001" BTDC. on cars with Hydra-Matic drive). Loosen hold-down screw in advance arm, center pointer on scale ('0' mark at indicator), tighten hold-down screw. Loosen advance arm clamp bolt, rotate distributor until contacts begin to open, tighten clamp bolt and check Octane Selector setting.

Octane Selector Setting—Set for slight ping when accelerating engine with wide open throttle at speeds below 15 MPH. To adjust, loosen distributor hold-down screw, rotate distributor clockwise toward 'Adv' end of scale (if no ping noted), counter-clockwise toward 'Ret' end of scale (if ping too severe) one graduation at a time until correct performance secured.

CARBURETION:—**Carburetor**—Carter WDO Model 503-S (Std. Trans.), 480-S (Hydra-Matic Drive). 1¼" dual downdraft type with Climatic Control.
For complete data, refer to 1941 Carburetor Index.
Idle Adjustment—With engine warm so that choke valve wide open and fast idle inoperative, set throttle stopscrew for idle speed of 425 RPM. (Std), 375 RPM. (Hydra-Matic Drive cars). Adjust both idle adjusting screws (one for each barrel, set screws alike) for smooth idle. Screws should be ½-2¼ turns open from inner seated position (turn screws in for leaner mixture). Recheck idle speed.
See 'Hydra-matic Drive' article in Mechanical Equipment Section for throttle linkage adjustment on cars with Hydra-Matic Drive.
Accelerating Pump Setting—Not adjustable.



Float Level—3/16" from top of float to machined surface of bowl cover with valve seated (remove gasket, invert cover, use gauge T109-28 to check).
Metering Rods & Jets—*See Carter Jet Table in Carburetor Section for complete data.*

Throttle Cracker Adjustment:—Must be set for correct throttle opening for starting. To adjust, disconnect starter cable at starter switch, depress starter button fully (hold in this position while adjusting), loosen adjusting screw on throttle cracker cam (on accelerator linkage bellcrank on left side of engine block), adjust cam so that clearance between carburetor throttle valve stopscrew and highest step of fast idle cam is .0625-.0825" (1/16").

Fast Idle:—Integral (built-in each carburetor).
For complete data, refer to 1941 Carb. Equip. Index.
Setting—With choke valve closed, adjust fast idle screw for .015" throttle valve opening or for clearance of .030" (503-S), .025" (480-S) between throttle lever stopscrew and stop on carburetor casting with stopscrew set for correct hot or slow idle speed.

Automatic Choke:—Carter Climatic Control.
For complete data, refer to 1941 Carb. Equip. Index.
Setting—Mark on thermostat case centered on housing scale (503-S), 2 Notches Rich (480-S).

Air Cleaner:—AC No. 1529862 oil-wetted type Std., Heavy duty oil-bath type Optl.

Fuel Pump:—AC Type AJ Fuel-&-Vacuum Pump Std. Replacement Exchange Pump No. 535.
For complete data, refer to 1941 Carb. Equip. Index.

Gasoline Gauge:—AC Electric type. No. 1516298 (Dash Unit), No. 1516285 (Tank Unit).
For complete data, refer to 1941 Carb. Equip. Index.

MANIFOLD HEAT CONTROL:—Thermostatic coil type. See that valve operates freely.
Setting—Coil wind-up should be 160° (approx. ½ turn) at room temperature. NOTE—To check valve for correct position on shaft, use feeler gauge in slot on rear end of valve shaft. With valve closed, gauge should contact stop pin (slot 6° to left or toward engine from up-and-down position) with ⅛" clearance between valve tip and manifold. Valve welded to shaft in this position.

VALVE TIMING:—**To Check**—With tappet clearance of .0124", #1 intake valve opens at TDC. with piston on top dead center and flywheel mark 'TDC/' at indicator in inspection hole in left front face of flywheel housing beside starter. CAUTION—Steel ball insert (ignition mark) is not top dead center.
Tappet Clearance:—.008" Int., .011" Exh. Warm.
Valve Spring Pressure:—50½ lbs. at 2¼" (valve closed), 95½ lbs. at 1 15/16" (valve open).

LUBRICATION:—**Crankcase Capacity**—6 qts.
Normal Oil Pressure—30 lbs.

COOLING SYSTEM:—**Capacity**—21½ qts.
Thermostat:—Harrison. In cylinder head outlet.
Setting—Starts to open at 152° F.
Temperature Gauge:—AC Electric type. No. 1511043 (Dash Unit), No. 1510772 (Engine Unit).
For complete data, refer to 1941 Mech. Equip. Index.

BATTERY:—**Delco Model 17E-2.** 6 volt, 17 plate, 120 Ampere Hour Capacity (20 hour rate).
Starting Capacity—140 amperes for 20 minutes.
Zero Capacity—300 amperes for 4.5 minutes. Five second voltage 4.4 volts.
Grounded Terminal—Negative (—) to Starter.
Location—On left side in engine compartment.
Police Battery Delco Model 19E-1. 6 volt, 19 plate, 130 Ampere Hour Capacity (20 hour rate).
Starting Capacity—150 amperes for 20 minutes.
Zero Capacity—300 amperes for 5.3 minutes. Five second voltage 4.55 volts.
Grounded Terminal and Location—Same as above.

STARTER:—**Delco-Remy 1107922, Armature No. 1867897 (LHD cars), Model 1107924 (RHD cars).**
NOTE—Mounting holes provided on all starters for Hydra-Matic Drive Interlock mounting (holes plugged when Hydra-Matic Drive not used). *See Hydra-Matic Drive article in Mechanical Equipment Section for Interlock adjustment.*
Drive—Overrunning clutch with manual pinion shift (1107922), solenoid pinion shift (RHD. 1107924).
Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—24-28 ounces each.
Cranking Engine—100 RPM., 140-150 amperes, 5 volts (Summer Temperatures) for LHD. starter.

Performance Data—1107922

Torque	R.P.M.	Volts	Amperes
0 ft. lbs	6000	5.0	60
15 "	Lock	3.0	600

Performance Data—1107924

0 ft. lbs	5500	5.0	65
15 "	Lock	3.0	600

Removal:—Flange mounted on left front face of flywheel housing. To remove, take out mounting screws.
Starting Switch (1107922):—No. 820052. Mounted on starter. Operated by pinion shift lever.
(1107924)—Solenoid Switch No. 1546. Mounted on starter. Operated through relay (in switch case) by Pushbutton Switch No. 1996008 on instrument panel.
For complete data, refer to 1941 Elec. Equip. Index.

GENERATOR:—**Delco-Remy 1102664, Armature 1879002 (Std.), Model 1102680 (Hydra-Matic Drive Cars).** Two brush type with Current & Voltage Control.
Pulley Note—Cars with Std. Trans. (1102664 Gen.) have regular 3 9/16" pulley. Hydra-Matic Drive cars (1102680 Gen.) have smaller 3 1/16" pulley to compensate for lower engine speed (max. output reached at approx. 210 Eng. RPM. less). NOTE—This pulley can be installed on cars with 3.9-1 Axle ratio for special service if output inadequate.
Charging Rate Adjustment—None. Charging rate controlled by Voltage Regulator, maximum output by Current Regulator. See Regulator data below.
Maximum Charging Rate—33 amperes, 8.0 volts, 2400 RPM. (hot) or 23 MPH. (68), 21 MPH. (78, 98) and above (Current Regulator setting) with load or discharged battery. Actual charging rate controlled by Voltage Regulator and dependent on battery condition.

Performance Data

	Amperes	Volts	R.P.M.
Cold	30①	8.0	1750

①—Not maximum output. See Current Regulator.
Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—25 ozs. each.
Field Current—1.67-1.82 amperes at 6.0 volts.
Removal:—Pivot mounted at left front of engine. To remove, take out pivot and clamp bolts.
Belt Adjustment:—Check with straightedge across pulleys. Belt deflection should be ¾" inward from straightedge with light pressure at point midway between generator and fan pulleys.

REGULATOR:—**Delco-Remy 1118201. Single Core Type.** Vibrating Current & Voltage Regulator on dash.
For complete data, refer to 1941 Elec. Equip. Index.
CAUTION—Check generator for grounded field coils and leads before changing regulator settings to correct High Charging Rate or High Voltage.

Cutout Relay

Cuts In—6.2-6.7 volts hot.
Cuts Out—0-4.0 ampere discharge current.
Contact Gap—.020" (same for both sets).
Air Gap—.020" (with contacts just closed).

Voltage Regulator

Setting—7.2-7.4 volts hot (operating temperature). Regulator over-compensated for temperature. Should be checked with cover in place and hot.
To Check—Connect ammeter in charging line at regulator 'BAT' terminal, voltmeter between this terminal and ground. Operate generator at 2800 RPM., adjust charging rate to 8-10 amperes (use variable rheostat or AVR set). With regulator hot (150°F.), decrease generator speed until cutout relay contacts open, then increase speed to 2800 RPM. and check hot voltage setting (above).
To Adjust—Change regulator armature spring tension slightly by bending hanger at lower end of **one spring only.** If further adjustment required, see Single Core Regulator article in Electrical Equipment Section for other (2nd.) spring adjustment.
Air Gap—.070" between center of core and armature with contacts just closing (press down on armature to open contacts, release pressure, check gap at point where contacts just close).

Current Regulator

Setting—32-34 amperes hot (operating temp.).
To Check—Remove regulator cover, connect short jumper between Voltage Regulator frame and upper contact support bracket (to short out Voltage Regulator), connect ammeter in charging line at regulator 'BAT' terminal, turn on car lights and accessories. Operate generator and increase speed until output remains constant. With regulator hot (150°F), current reading should agree with setting (above).
To Adjust—Same as for Voltage Regulator (above).
Air Gap—.080" (check same as Voltage Regulator).

LIGHTING:—**Headlamps**—Guide 'Sealed Beam' type.
For complete data, refer to 1941 Elec. Equip. Index.
Headlamp Adjustment—Aim upper beam straight ahead (hot spot center 3" below lamp center height).
Beam Indicator—Small red indicator in upper edge of speedometer dial. Lighted when Country (upper) Beam in use.
Direction Signal—*Refer to 1941 Elec. Equip. Index.*

Switches

Lighting—Delco-Remy No. 1995017 (LHD Cars), No. 1995020 (RHD Cars). Switch has instrument light rheostat mounted on control knob stem.
Beam Selector—Delco-Remy No. 1997002.
Stop Light—Delco-Remy No. 1997725.

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps	Sealed Beam	
Parking	3	63
Instrument, Clock	1½	55
Beam Ind., Glove Compt.	1	51
Stop & Tail	21-3	1154
Rear License Plate	3	63
Dome	6	82

THERMOSTATIC RELAY:—On lighting switch. Contacts remain closed with 30 ampere current, open in 3 minutes with current of 42 amperes at 70° F. Limits current to 18 amperes with dead short-circuit. Not adjustable.

FUSES:—**Clock**—2 ampere. In clock lead connector.

HORNS:—**Delco-Remy No. 1999535 (Low Note), 1999536 (High Note).** Vibrator type, blended tone, twin horns operated by relay.
NOTE—Horns not marked but Low Note horn mounted on left side, High Note horn on right side, in front of radiator behind grille (mounting designed so horns cannot be interchanged).

Type	Current (at 6 volts)	Air Gap
1999535 (low note)	19-21 amperes	.045-.049"
1999536 (high note)	17-19 amperes	.035-.039"

Horn Relay:—Delco-Remy No. 1116775.
Contact Gap—.025". **Air Gap**—.015" (closed).
Contacts Close—2.75-4.0 volts.

HOOD LOCK NOTE:—Hood is one-piece, side-hinge type with instrument panel lock knobs and may be lifted from either side after lock released on that side. To raise hood, press down and back on control knob on side on which hood is to be raised, raise hood about 1", press in on safety rod (under lower edge of hood approximately 2' forward of rear of engine) to release safety catch, lift hood up and engage support prop in opening on underside of hood (prop pivoted on dash).

SERIAL NUMBER:—Stamped on plate on left side of dash under engine hood. First number 1401-2001.

ENGINE NUMBER:—Stamped on upper left side of engine block between #3 and #4 cylinders. First number D-400051.

COMPRESSION:—**Ratio**—6.85-1 Std. cast iron head. **Pressure**—118 lbs. at cranking speed.

VACUUM READING:—Steady 18-20" idling at 6 MPH.

IGNITION:—**Coil Model CE-4659.** On left hand side of engine near distributor. Service Coil CE-3224VS.
Ignition Current—2.4 amperes idling, 5 stopped.
Ignition Switch:—Mitchellock Model 24-B, No. 8781.
Ignition Lock—Briggs & Stratton. B & S No. 50184.
Key Series—P1250 to P1500. **Groove**—No. 2.
Distributor Auto-Lite IGP-4502. Single breaker, 8 lobe cam, full automatic advance type with vacuum spark control and Fuel Compensator Adjustment.
Breaker Gap—Set at .015".
Cam Angle or Dwell—27° clsd., 18° open (.017" gap).
Breaker Arm Spring Tension—17-20 ounces.
Rotation—Counter-clockwise viewed from above.
Condenser—No. IG-2671K. Capacity .20-.25 mfd.

Automatic Advance

Distributor Degrees	R.P.M.	Engine Degrees	R.P.M.
Start	250	0	500
3	525	6	1050
6	800	12	1600
9	1210	18	2420
11.5	1550	23	3100

Vacuum Spark Control—Separate unit mounted on hold-down plate and linked to adjusting quadrant on distributor. Provides additional advance at speeds above idling except when engine accelerated or operated with wide open throttle when spark retarded by return spring within unit.

Vacuum Advance

Distr. Degrees	Eng. Degrees	Vacuum (" of HG)
Start	0°	10"
1°	2°	11⅛"
3°	6°	13½"
5°	10°	15⅞"
6°	12°	17"

Fuel Compensator Adjustment—Permits 40° range of adjustment by loosening vacuum unit link screw at distributor quadrant. See Ignition Timing below.
Removal:—Distributor mounted on left side of crankcase. To remove, disconnect vacuum line, take out screw in hold-down plate, lift entire unit out.

FIRING ORDER:—1-6-2-5-8-3-7-4. See diagram.

SPARK PLUGS:—AC No. 104 or Champion Y4A. 10 MM. Metric type. NOTE—Do not use more than 50 in. lb. (10 lb. pull on 5" wrench) when tightening plugs.
Spark Plug Gaps—.028" (.0255-.0305").

IGNITION TIMING:—Standard setting listed below (see Fuel Compensator Setting following):

	Flywheel Degrees	Piston Position
All Engines	5° BTDC	.0103" BTDC

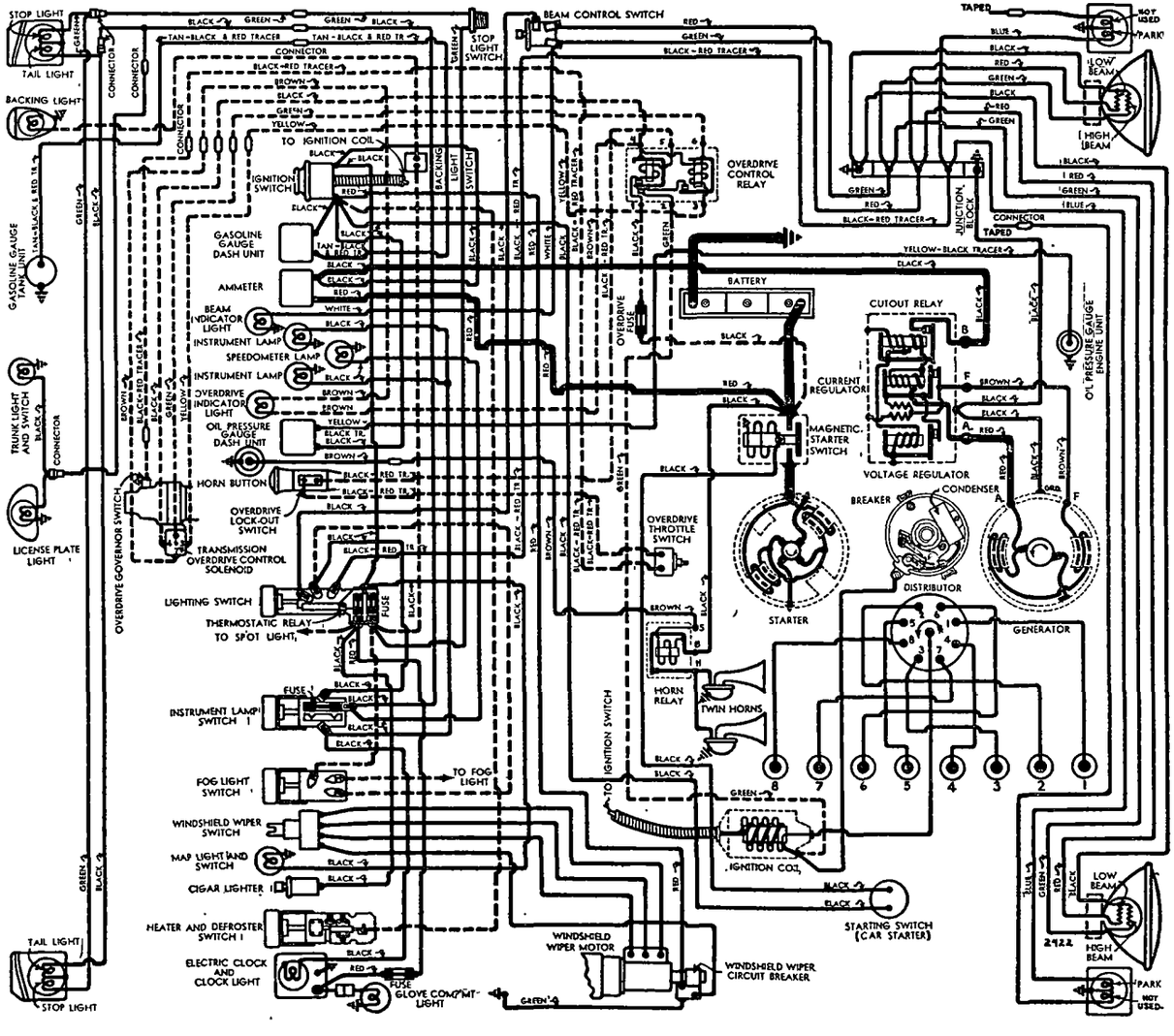
Timing Mark Note—Marks on vibration dampener at front of engine. Dampener marked '#1 UP.DC' with fifteen 1° graduations before this point.

Timing—With #1 piston on compression, turn engine over until piston reaches firing position with correct mark on dampener in line with pointer on chain case cover (see table above). Loosen vacuum unit link screw in distributor quadrant, rotate distributor until contacts begin to open, tighten screw. Check Fuel Compensator Setting (below).

Timing (Neon Timing Light)—Mark correct graduation on vibration dampener, clip neon timing light to #1 spark plug and direct light on vibration dampener, idle engine and adjust distributor as directed above.

Fuel Compensator Setting—Should be set for slight ping when accelerating engine with wide open throttle. To adjust, loosen vacuum unit link screw in distributor quadrant, rotate one graduation at a time counter-clockwise (if ping too severe), clockwise (if no ping), until correct performance secured.

CARBURETION:—**Carburetor**—Carter Type WDO, Model 512-S. 1" dual, downdraft type with Climatic Control. No. 371 cast on face of flange.
For complete data, refer to 1941 Carburetor Index.
Idle Adjustment—With engine warm and running at slow idle speed (choke valve wide open, fast idle inoperative), set throttle stopscrew for 6 MPH. idle speed. Adjust idle adjusting screw for each barrel (in succession) until engine fires smoothly (½-1½ turns open for each screw—turn screws in for leaner mixture). Readjust idle speed.
Accelerating Pump—Pump arm under dust cover at top of carburetor has two holes for pump link engagement. Set as follows:
Inner (min. stroke)—Hot weather or hi-test fuel.
Outer (max. stroke)—Cold weather or low-test fuel.



Float Level—5/32" from top of float to bowl cover with valve seated (remove gasket & invert to check).
Metering Rods & Jets—*See Carter Jet Table in Carburetor Section for complete data.*

Fast Idle:—Integral type (built-in carburetor).
For complete data, refer to 1941 Carb. Equip. Index.
Setting—Adjust fast idle screw for .030" throttle opening with choke valve closed.

Automatic Choke:—Carter Climatic Control.
For complete data, refer to 1941 Carb. Equip. Index.
Setting—Set thermostat coil housing at Index mark.

Throttle Guard (Cars with Aero-Drive):—Vacuum operated throttle kicker to prevent engine stalling when free-wheeling. Kicks in at 4 MPH., kicks out at 9 MPH.
For complete data, refer to 1941 Carb. Equip. Index.
Setting—Set gap between plunger and carburetor throttle lever at .020" (carburetor set for 6 MPH. slow idle speed), set spring tension adjusting screw 3/16" out beyond face of locknut.

Air Cleaner:—AC #1542094 oil-wetted type standard. Heavy duty oil-bath type optional.

Fuel Pump:—AC Type AH. Inverted, diaphragm type. Pump Replacement Exchange Part No. 525.
For complete data, refer to 1941 Carb. Equip. Index.

Gasoline Gauge:—Stewart (Stewart-Warner) Electric.
For complete data, refer to 1941 Carb. Equip. Index.

MANIFOLD HEAT CONTROL:—Thermostatic coil type. Make certain that valve operates freely (valve must not bind or stick). Do not oil control.

VALVE TIMING:—**To Check**—With tappet clearance of .0125", #1 intake valve opens with piston 1° or .0004" BTDC when 1st graduation before top dead center mark '#1 UP.DC' on vibration dampener lines up with pointer (permissible variation 4° either way). Reset tappet clearance at .007" hot.

Tappet Clearance:—.007" Int., .010" Exh. Warm. Adjusting screws are self-locking (no locknuts).

Valve Spring Pressure:—47-52 lbs. at 1⅝" (valve closed), 114-124 lbs. at 1 5/16" (valve open).

LUBRICATION:—**Crankcase Capacity**—6 quarts.
Normal Oil Pressure—40 lbs. at 45 MPH.

COOLING SYSTEM:—**Capacity**—17 quarts.
Pressure Valve:—In filler cap. Opens at 4½ lbs. (Std.), 12 lbs. (with Air Conditioning Equipment).
Thermostat:—Harrison. In cylinder head outlet.
Setting—Starts to open 147½°.

TRANSMISSION (ECONO-DRIVE) CONTROL:—Electric type with solenoid operated kick-down through accelerator switch and Governor Switch.
For complete data, refer to 1941 Mech. Equip. Index.
Overdrive Solenoid—Delco-Remy Model 1118005.
Overdrive Indicator Light—Green light on right side of speedometer dial. Lighted whenever overdrive is ready to engage (light goes out when accelerator pedal is released so that overdrive can engage).
Throttle Switch—Cole-Hersee. Packard No. 347496. Adjust tappet screw on throttle lever to just contact switch plunger with throttle valve wide open.
Governor Switch—Bendix No. 364782.
Control Relay—Delco-Remy Model 1116801.

BATTERY:—**Willard Type WH-2D-120 or Auto-Lite Type P-17-2R 'End-to-end' type.** 6 volt, 17 plate, 120 ampere hour capacity (20 hour rate).
Grounded Terminal—Positive (+) terminal.
Engine Ground—Strap from transmission to frame.
Location—On bracket to left of engine in engine compartment.

STARTER:—**Auto-Lite MAW-4024, Armature MAW-2128.**
Drive—Outboard Barrel Type Bendix No. A-1792.
Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—42-53 ozs. (new brushes).
Cranking Engine—125 RPM., 175 amperes, 5.1 volts.

Performance Data

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	4900	5.5	65
0.6 "	3300	5.5	100
2.75 "	1480	5.0	200
5.45 "	820	4.5	300
8.50 "	400	4.0	400
11.55 "	110	3.5	500
11.5 "	Lock	3.0	505
18.0 "	Lock	4.0	670

Removal:—Flange mounted on left front face of flywheel housing. To remove, take out flange mounting screws, lift out starter and switch assembly.
Starting Switch:—A-L Model SS-4017. Magnetic type. Mounted on starter and controlled by Carter Car Starter No. 192-11U on carburetor (accelerator pedal starting).
For complete data, refer to 1941 Elec. Equip. Index for Auto-Lite Magnetic Starter Control and Carter Car Starter.

GENERATOR:—**Auto-Lite GDZ-4801F, Armature GDZ-2006F.** Two brush type with Current & Voltage control.
Charging Rate Adjustment—No adjustment at generator. Charging rate controlled by Voltage Regulator and maximum output by Current Regulator.
Maximum Charging Rate—35 amperes, 8.0 volts hot. Actual charging rate controlled by Voltage Regulator and dependent on battery condition.

Performance Data

Cold			Hot		
Amperes	Volts	R.P.M.	Amperes	Volts	R.P.M.
0	6.4	925	0	6.4	1000
4	6.6	1035	4	6.6	1120
8	6.75	1140	8	6.75	1235
12	6.95	1250	12	6.95	1350
16	7.15	1370	16	7.15	1460
20	7.3	1480	20	7.3	1590
24	7.5	1590	24	7.5	1730
28	7.7	1710	28	7.7	1900
32	7.9	1820	32	7.9	2090
*35	8.0	1900	35	8.0	2250

*—Current Regulator setting.
Rotation—Counter-clockwise at commutator end.
Field Current—1.60-1.78 amperes at 6.0 volts.
Motoring Current—4.15-4.60 amperes at 6.0 volts.
Brush Spring Tension—53 ozs. max. (new brushes).
Removal:—Pivot mounted at left side of engine at front. To remove, take out pivot and clamp bolts.
Belt Adjustment:—50 lbs. tension on spring scale hooked to generator frame, or ½" thumb-pressure deflection midway between generator and pump pulleys.

REGULATOR:—**Auto-Lite VRP-4002C.** Current-voltage type. In case on left side of engine dash.
For complete data, refer to 1941 Elec. Equip. Index.
NOTE—Regulator case cover sealed. Serviced on exchange basis if seals not broken (to remove cover).

Cutout Relay
Cuts In—6.4-6.6 volts, 920 generator RPM (cold).
Cuts Out—4.8-5.6 volts (approx. 4-6 amps. disch.).
Contact Gap—.015" minimum.
Air Gap—.031-.034" with contacts open (check at hinge end of core).

Voltage Regulator
Setting—7.2-7.5 volts at 70° F. See Electrical Equipment Section for settings at other temperatures.
To Check (without breaking seals)—Connect ammeter in charging line at regulator 'B' terminal (use short heavy leads), voltmeter between 'B' terminal and ground. Operate generator at speed equivalent to 30 MPH., charging fully charged battery, until voltage is steady. Voltage reading should agree with setting given above.
To Adjust (with cover removed)—Change regulator armature spring tension by bending lower spring hanger slightly. See Electrical Equipment Section.
Contact Gap—.012" min. (armature against stop pin.)
Air Gap—.048-.052" with contacts just opening.

Current Regulator
Setting—34-36 amperes (marked '35' on the cover).
To Check (without breaking seals)—Connect test meters as for voltage check (above). Operate generator at speed equivalent to 30 MPH, charging battery, turn on car lights and accessories or connect load (bank of headlamp bulbs, etc.) between ammeter and battery so that generator charges at peak rate and Current Regulator operates. Current reading should agree with setting given above. If more than slight excess noted, regulator is defective.
To Adjust (with cover removed)—Same as for Voltage Regulator (above).
Contact Gap & Air Gap—Same as Voltage Regulator.

LIGHTING:—**Headlamps**—Hall 'Sealed Beam' type.
For complete data, refer to 1941 Elec. Equip. Index
Headlamp Adjustment—Aim upper beam straight ahead (hot spot center 3" below lamp center height).
Beam Indicator—Red light on left side of speedometer dial. Lighted when Country (upper) beam in use.

Switches
Lighting—Delco-Remy.
Beam Selector—Delco-Remy.

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps	Sealed Beam	
Parking	21-3①	1154
Instr., Speedometer, Clock	1½	55
Map, Aero-Drive Ind.	1½	55
Glove Comp't., Beam Ind.	1	51
Stop & Tail	21-3	1154
Rear License	3	63
Dome	6	81

①—3 cp. The 21 cp. filament is not used.

THERMOSTATIC RELAY:—**Delco-Remy.** On lighting switch. Contacts remain closed with 30 amperes, open in 3 minutes with 42 amps. at 70° F. Not adj.

FUSES:—**Stop Light, Cigar Lighter and Accessories**—Two 20 ampere. On back of lighting switch.
Instrument & Tail Light—20 ampere. In connector in Lighting Switch to Panel Light Switch feed wire.
Clock—2 ampere. In feed wire near clock.
Econo-drive—30 ampere. In relay lead near starter.
Windshield Wiper—No fuse (circuit-breaker).

HORNS:—**Sparton**—Vibrator type, air tone, twin horns operated by relay.
Horn Current—22-25 amperes (total both horns).
Horn Relay:—R-B-M Model 6006.
Contacts Close—3-4 volts (with relay upright).

WINDSHIELD WIPER:—**Stewart-Warner Series 645-E.** Electric type. NOTE—'Klixon' type circuit-breaker mounted on unit (no fuse used).
For complete data, refer to 1941 Mech. Equip. Index.

EQUIPMENT NOTE:—Both Delco-Remy & Auto-Lite Electrical Equipment are used on this model.
HOOD LOCK:—Conventional center hinge hood. Hood latch handles located on side panels.
SERIAL NUMBER:—On left side of cowl (use Eng. No.).
ENGINE NUMBER:—First No. D-1551. Stamped on left side of engine block between #2 and #3 cylinders.
COMPRESSION:—**Ratio**—6.39-1 Std., 6.71-1 Optl.
Pressure—110 lbs. at 125 RPM. (Std. Hd.).
VACUUM READING:—18-20" steady idling at 6 MPH.
IGNITION (AUTO-LITE):—**Coil Model CE-4644.** Mounted on left side of engine near distributor. Service Coil (less switch & cable) CE-3224VS.
Ignition Current—2.75 amperes idling, 5 stopped.
Ignition Switch:—Mitchellock Model 24-B, No. 8781.
Ignition Lock—Briggs & Stratton No. 50184.
Key Series—P-1250 to P-1500. Groove—No. 2.
Distributor Auto-Lite Model IGC-4505. Single breaker, 6 lobe cam, full automatic advance type with vacuum spark control and Fuel Compensator adjustment.
Breaker Gap—.020".
Cam Angle or Dwell—38° closed, 22° open.
Breaker Arm Spring Tension—17-20 ozs.
Rotation—Counter-clockwise viewed from above.
Condenser—No. IGW-3128. Capacity .28-.32 mfd.

Automatic Advance

Distributor Degrees	R.P.M.	Engine Degrees	R.P.M.
Start	300	0	600
3	590	6	1180
5	780	10	1560
7	1150	14	2300
9.5	1600	19	3200

Vacuum Spark Control—Separate unit mounted on hold-down plate and linked to adjusting quadrant on distributor. Provides additional advance at speeds above idling except when engine accelerated or operated with wide open throttle when spark retarded by return spring within unit.

Vacuum Advance

Distr. Degrees	Eng. Degrees	Vacuum (" of HG)
Start	0°	6"
4°	8°	11⅞"
7.5°	15°	17"

Fuel Compensator Adjustment—Permits 40° range of adjustment by loosening vacuum unit link screw at distributor quadrant. See Ignition Timing below.
Removal:—Distributor mounted on left side of crankcase. To remove, disconnect vacuum line, take out screw in hold-down plate, lift entire unit out.
IGNITION (DELCO-REMY):—**Coil No. 1115027.** On left side of engine. Switch connection is armored.
Ignition Current—2.75 amperes idling, 5 stopped.
Ignition Switch:—Delco-Remy No. 1116308 (Std.), 1116318 (RHD). Coil connection armored.
Ignition Lock—Briggs & Stratton No. 50184.
Key Series—P-1250 to P-1500. Groove—No. 2.
Distributor Delco-Remy No. 1110092. Single breaker, 6 lobe cam, full automatic advance type with vacuum spark control and Fuel Compensator adjustment.
Breaker Gap—.020". Limits .018-.024".
Cam Angle or Dwell—35° closed, 25° open.
Breaker Arm Spring Tension—19-23 ozs.
Rotation—Counter-clockwise viewed from above.
Condenser—Part No. 1869704. Capacity .18-.25 mfd.

Automatic Advance

Distributor Degrees	R.P.M.	Engine Degrees	R.P.M.
Start	300	1.5	600
5	700	10	1400
10.25	1600	20.5	3200

Vacuum Spark Control—Separate unit mounted on hold-down plate and linked to distributor. Provides additional advance at speeds above idling except when engine accelerated or operated with wide open throttle when spark retarded by return spring within unit.

Vacuum Advance

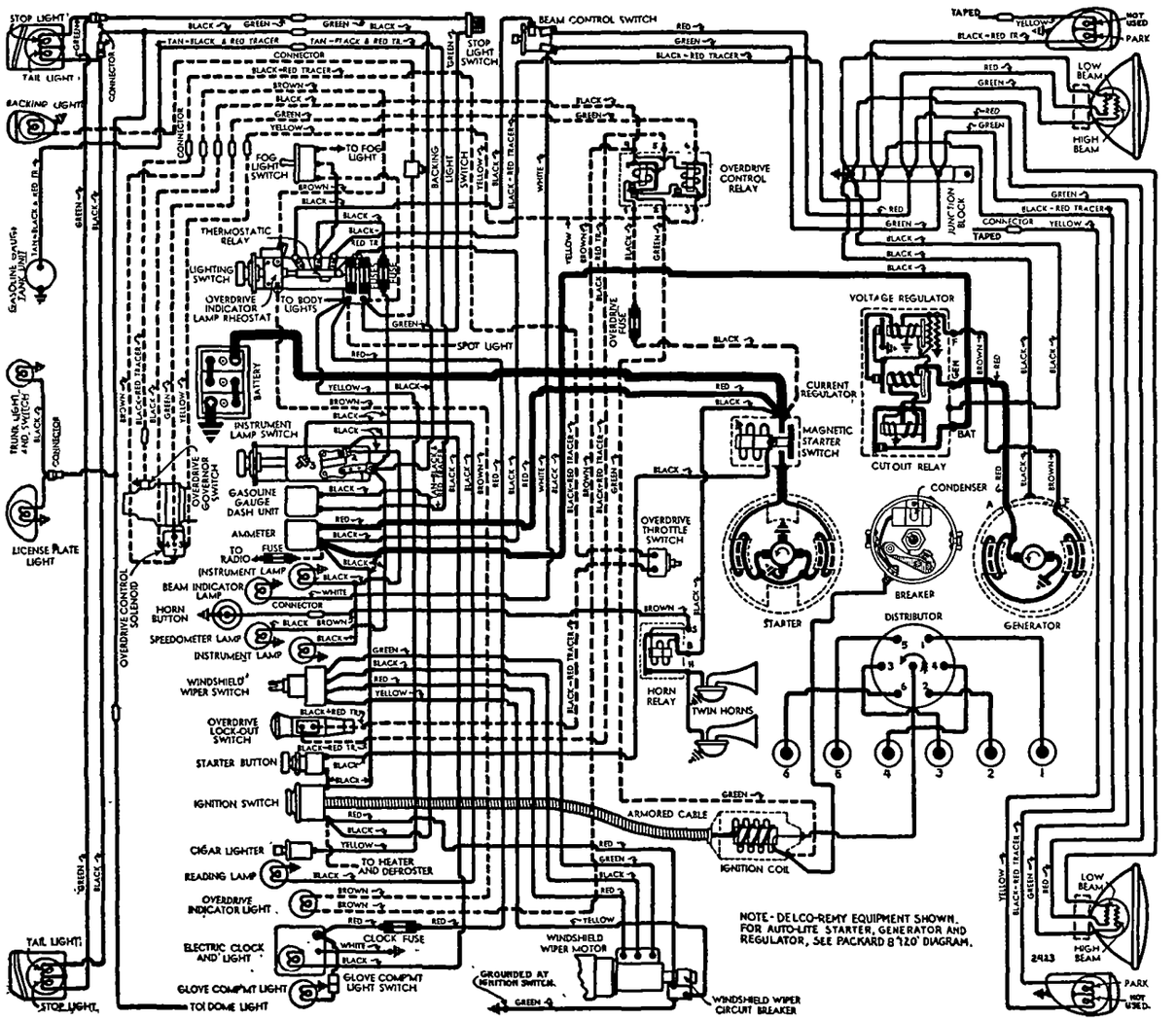
Distr. Degrees	Eng. Degrees	Vacuum (" of HG)
Start	0°	5-7"
7.5°	15°	15-19"

Fuel Compensator Adjustment—Slot in advance plate permits distributor to be advanced or retarded from center point on scale when hold-down screw loosened. See Ignition Timing for setting.
Removal:—Same as for Auto-Lite model (above).
FIRING ORDER:—1-5-3-6-2-4. See diagram.
SPARK PLUGS:—AC No. 104 or Champion Y4. 10 MM. Metric. NOTE—Do not tighten these small plugs excessively (50 in. lbs.).
Spark Plug Gaps—.028 (.0255-.0305").

IGNITION TIMING:—See Fuel Compensator setting also.

	Flywheel Degrees	Piston Position
All Engines	6° BTDC	.0149" BTDC

Timing Mark Note—Marks now on vibration dampener at front of engine. Dampener marked '#1 UP.-DC' with fifteen 1° graduations before this point.
Timing—With #1 piston on compression, turn engine over until piston reaches firing position with correct mark on dampener in line with pointer on chain case cover (see table above). Loosen vacuum unit link screw in distributor quadrant (Auto-Lite Distributors), hold-down screw in advance arm (Delco-Remy Distributors), rotate distributor until contacts begin to open, tighten screw. Check Fuel Compensator setting (below).
Timing (Neon Timing Light)—Mark correct graduation on vibration dampener, clip neon timing light to #1 spark plug and direct light on vibration dampener, idle engine and adjust distributor as directed above.



Fuel Compensator Setting—Should be set for slight ping when accelerating engine with wide open throttle. To adjust, loosen vacuum unit link screw in distributor quadrant (Auto-Lite Distributors), advance arm hold-down screw (Delco-Remy Distributors), rotate distributor one graduation at a time counter-clockwise (if ping too severe), clockwise (if no ping), until correct performance secured.

CARBURETION:—Carburetor—Stromberg Model BXOV-26 (Code 10-45). 1¼" downdraft type with Automatic Choke.

For complete data, refer to 1941 Carburetor Index.

Idle Adjustment—With engine warm so that choke valve wide open and fast idle inoperative, set throttle stopscrew for 6 MPH hot or slow idle speed. Adjust idle adjusting screw for smooth idling performance (screw should 1-1⅛ turns open from inner seated position—turn screw in for leaner mixture). Recheck idle speed.

Accelerating Pump Setting—Throttle lever has 3 holes for pump rod link connection as follows:
Inner (Min. stroke)—Hot weather or high-test fuel.
Center (Med. stroke)—Normal temperatures & fuel.
Outer (Max. stroke)—Cold weather or low test fuel.

Float Level—Fuel level ⅝" below top edge of bowl with engine idling (3 lbs. pressure).

Metering Jets—***See Stromberg Jet Table in Carburetor Section for complete data.***

Fast Idle:—Integral (operated by Automatic Choke).

For complete data, refer to 1941 Carb. Equip. Index.

Setting—To check, hold stopscrew against lowest step of fast idle cam, move choke valve toward closed position as far as possible, check choke valve opening with 11/32" drill. Adjust by bending connector rod.

Automatic Choke:—Stromberg BXOV-26 type.

For complete data, refer to 1941 Carb. Equip. Index.

Setting—'V' mark on thermostat case in line with reference mark on housing. May be varied not more than two graduations to improve warming up.

Throttle Guard (Cars with Econo-Drive):—Vacuum operated throttle kicker to prevent engine stalling when free-wheeling. Kicks in at 4 MPH, kicks out at 9 MPH.

For complete data, refer to 1941 Carb. Equip. Index.

Setting—Set gap between plunger and carburetor throttle lever at .060" (carburetor set for 6 MPH slow idle speed), set spring tension adjusting screw 3/16" out beyond face of locknut.

Air Cleaner:—AC No. 1542093 oil-wetted type Std., Heavy duty oil-bath type Optl.

Fuel Pump:—AC Type AT. Inverted, diaphragm type. Pump Replacement Exchange No. 524G.

For complete data, refer to 1941 Carb. Equip. Index.

Gasoline Gauge:—Stewart (Stewart-Warner) Electric. ***See article in Carburetion Equipment Section.***

MANIFOLD HEAT CONTROL:—Thermostatic coil type. Marke certain that valve operates freely and does not bind or stick. Do not oil control.

VALVE TIMING:—To Check—With tappet clearance of .0125", #1 intake valve opens with piston 1° or .0004" BTDC. when first graduation before top dead center mark '#1 UP.DC' on vibration dampener lines up with pointer (permissible variation 4° either way). Reset tappet clearance at .007" hot.

Tappet Clearance:—.007" Int., .010" Exh. Warm. Adjusting screws are self-locking (no locknuts). Remove plate under right front fender for access to valves.

Valve Spring Pressure:—47-52 lbs. at 1⅝" (valve closed), 114-124 lbs. at 1 5/16" (valve open).

LUBRICATION:—Crankcase Capacity—5 qts.

Normal Oil Pressure—40 lbs. at 45 M.P.H.

COOLING SYSTEM:—**Capacity**—15 qts.

Pressure Valve:—In filler cap. Opens at 4½ lbs. (Std.), 12 lbs. (with Air Conditioning Equipment).

Thermostat:—Bishop & Babcock. In cylinder head outlet. Starts to open at 147½°F.

TRANSMISSION (ECONO-DRIVE) CONTROL:—***Same as on '120' Eight. See Packard Eight page (following)***

BATTERY:—Willard Type SW-1-95. 6 volt, 15 plate, 95 Ampere Hour Capacity (20 hour rate).

Starting Capacity—117 amperes for 20 minutes.

Zero Capacity—300 amperes for 3.1 minutes. Five second voltage 4.2 volts.

Grounded Terminal—Positive (+) to frame 'X' member. **Engine Ground**—Separate strap connector from transmission to frame 'X' member.

Location—Under left front seat.

Dimensions—Length 9". Width 7". Height 8¾".

STARTER (AUTO-LITE):—Model MAW-4021 (First Cars), MAW-4024 (Later Cars). ***All data same as for Packard '120' Eight (see following page).***

STARTER (DELCO-REMY):—No. 1107037. Arm. No. 1878077.

Drive—Barrel Type Bendix No. A-1792.

Rotation—Counter-clockwise at commutator end.

Brush Spring Tension—24-28 ozs. each.

Performance Data

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	5000	5.0	65
12 "	Lock	3.37	525

Removal:—Starter flange mounted on left front face of flywheel housing. To remove, disconnect wires, take out flange mounting screws, remove starter and switch as an assembly.

Starting Switch:—Delco-Remy No. 1452. Magnetic type mounted on starter and controlled by push-button switch on instrument panel.

GENERATOR (AUTO-LITE):—Model GDZ-4801F(Std.), GEB-4802C-2 (Taxicab). ***All data same as for Packard '120' Eight (see following page).***

GENERATOR (DELCO-REMY):—No.1102682. Armature No. 1879002. Two brush (shunt) type with Current & Voltage Control.

Charging Rate Adjustment—None. Charging rate controlled by Voltage Regulator, maximum output controlled by Current Regulator. See Regulator

Maximum Charging Rate—32-34 amperes, 8.0 volts hot. Actual charging rate controlled by Voltage Regulator and dependent on battery condition.

Performance Data

	Amperes	Volts	R.P.M.
Cold	30①	8.0	1750

① Not maximum output. See Current Regulator.

Rotation—Counter-clockwise at commutator end.

Brush Spring Tension—25 ozs. each.

Field Current—1.67-1.82 amperes at 6.0 volts.

Removal:—Generator pivot mounted at left front of engine. To remove, take out pivot and clamp bolts.

Belt Adjustment:—50 lbs. tension on spring scale hooked to generator frame, or ½" thumb-pressure deflection midway between gen. and pump pulleys.

REGULATOR (AUTO-LITE):—Model VRP-4002C,D. ***All data same as Packard '120' Eight (see next page).***

REGULATOR (DELCO-REMY):—No. 1118202. Single Core Type. Current & Voltage Regulator on dash.

For complete data, refer to 1941 Elec. Equip. Index.

CAUTION—Check generator for grounded field coils and leads before changing regulator settings to correct High Charging Rate or High Voltage.

Cutout Relay

Cuts In—6.2-6.7 volts hot, 900 RPM.

Cuts Out—0-4.0 ampere discharge current.

Contact Gap—.020" (same for both sets).

Air Gap—.020" (with contacts just closed).

Voltage Regulator

Setting—7.2-7.4 volts hot (operating temperature). Should be checked with cover in place and hot.

To Check—Connect ammeter in charging line at regulator 'BAT' terminal, voltmeter between this terminal and ground. Operate generator at 2800 RPM., adjust charging rate to 8-10 amperes (use variable rheostat or AVR set). With regulator hot (150°F.), decrease generator speed until cutout relay contacts open, then increase speed to 2800 RPM. and check hot voltage setting (above).

To Adjust—Change regulator armature spring tension slightly by bending hanger at lower end of **one spring only.** If further adjustment required, see Single Core Regulator article in Electrical Equipment Section for other (2nd.) spring adjustment.

Air Gap—.070" between center of core and armature with contacts just closing (press down on armature to open contacts, release pressure, check gap at point where contacts just close).

Current Regulator

Setting—32-34 amperes hot (operating temp.).

To Check—Remove regulator cover, connect short jumper between Voltage Regulator frame and upper contact support bracket (to short out Voltage Regulator), connect ammeter in charging line at regulater 'BAT' terminal, turn on car lights and accessories. Operate generator and increase speed until output remains constant. With regulator hot (150°F), current reading should agree with setting (above).

To Adjust—Same as for Voltage Regulator (above).

Air Gap—.080" (check same as Voltage Regulator).

LIGHTING:—Headlamps—Hall 'Sealed Beam' type.

For complete data, refer to 1941 Elec. Equip. Index.

Headlamp Adjustment—Aim upper beam straight ahead (hot spot center 3" below lamp center hght.).

Beam Indicator—Red light on left side of speedometer. Lighted when Upper Beams in use.

Switches

Lighting—Delco-Remy No. 1995011 (Std.), 1995019 (With Econo-drive—has dimmer switch for Econo-drive Indicator light controlled by switch knob).

Beam Selector—Delco-Remy No. 1997001 (LHD cars), 1997002 (RHD cars).

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps		Sealed Beam
Front Fender	21-3	1154
Instr., Speed'mtr., Clock	1½	55
Front Reading, Econo Dr. Ind.	1½	55
Glove Compt., Beam Indicator	1	51
Stop & Tail	21-3	1154
Rear License	3	63
Dome	6	81

THERMOSTATIC RELAY:—Delco-Remy. On lighting switch. Contacts remain closed with 30 amperes, open in 3 minutes with 42 amps. @ 70°F. Not adj.

FUSES:—Stop Light, Cigar Lighter & Accessories—Two 20 ampere. On back of lighting switch.

Instrument & Tail Light—20 ampere. In connector in lead near ammeter.

Clock—4 ampere. In lead near clock.

Econo-drive—30 ampere. In relay lead near starter.

Windshield Wiper—No fuse (circuit- breaker).

HORNS:—Sparton. Vibrator type, air tone, twin horns operated by relay.

Horn Current—22-25 amperes (total both horns).

Horn Relay:—R-B-M Model 6006.

Contacts Close—3-4 volts (with relay upright).

WINDSHIELD WIPER:—Stewart-Warner Series 645-E. Electric type. NOTE—'Klixon' type circuit-breaker mounted on unit (no fuse used).

For complete data, refer to 1941 Mech. Equip. Index.

PACKARD 1941

'120' EIGHT, MODEL 1901, 1A
AUTO-LITE ELECTRICAL SYSTEM

SERIAL NUMBER:—On left side of cowl (use Eng. No.).
ENGINE NUMBER:—First number D-300051. On left side of engine block between #2 and #3 cylinders.
COMPRESSION:—**Ratio**—6.41-1 Std., 6.85-1 HC Optl. **Pressure**—110 lbs. (6.41-1 Std. cast-iron hd.), 118 lbs. (6.85-1 HC Optl. cast-iron hd.) at cranking speed.
VACUUM READING:—Steady 18-20" idling at 6 MPH.
IGNITION:—**Coil Model CE-4644.** On left hand side of engine near distributor. Service Coil CE-3224VS. **Ignition Current**—2.4 amperes idling, 5 stopped.
Ignition Switch:—Mitchellock Model 24-B, No. 8781. **Ignition Lock**—Briggs & Stratton. B & S No. 50184. **Key Series**—P1250 to P1500. **Groove**—No. 2.
Distributor Auto-Lite IGP-4502. Single breaker, 8 lobe cam, full automatic advance type with vacuum spark control and Fuel Compensator Adjustment. **Breaker Gap**—Set at .015". **Cam Angle or Dwell**—27° clsd., 18° open (.017" gap). **Breaker Arm Spring Tension**—17-20 ounces. **Rotation**—Counter-clockwise viewed from above. **Condenser**—No. IG-2671K. Capacity .20-.25 mfd.

Automatic Advance

Distributor Degrees	R.P.M.	Engine Degrees	R.P.M.
Start	250	0	500
3	525	6	1050
6	800	12	1600
9	1210	18	2420
11.5	1550	23	3100

Vacuum Spark Control—Separate unit mounted on hold-down plate and linked to adjusting quadrant on distributor. Provides additional advance at speeds above idling except when engine accelerated or operated with wide open throttle when spark retarded by return spring within unit.

Vacuum Advance

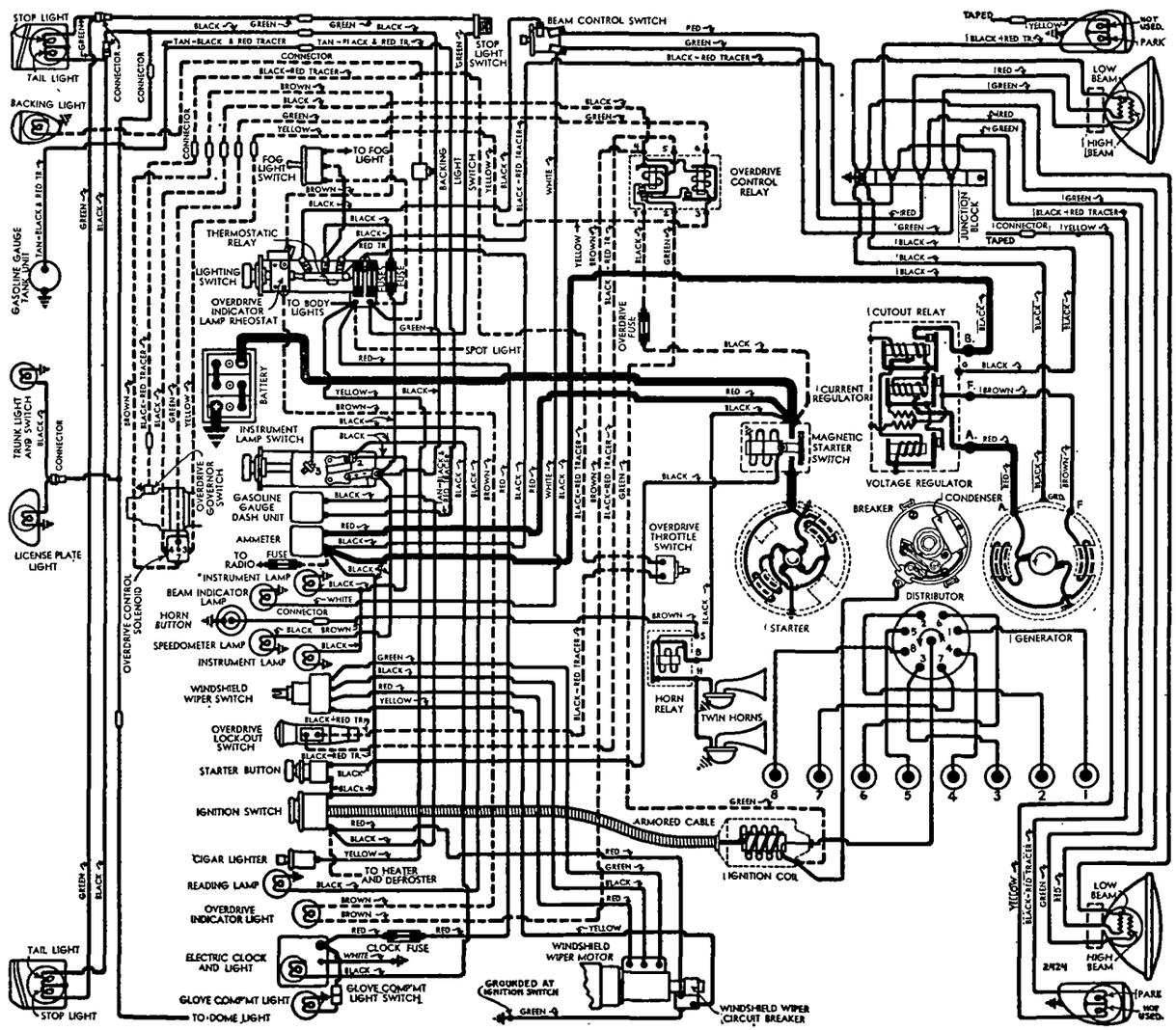
Distr. Degrees	Eng. Degrees	Vacuum (" of HG)
Start	0°	10"
1°	2°	11⅛"
3°	6°	13½"
5°	10°	15⅞"
6°	12°	17"

Fuel Compensator Adjustment—Permits 40° range of adjustment by loosening vacuum unit link screw at distributor quadrant. See Ignition Timing below.
Removal:—Distributor mounted on left side of crankcase. To remove, disconnect vacuum line, take out screw in hold-down plate, lift entire unit out.
FIRING ORDER:—1-6-2-5-8-3-7-4. See diagram.
SPARK PLUGS:—AC No. 104 or Champion Y4. 10 MM. Metric. NOTE—Do not tighten these small plugs excessively (50 in. lbs.). **Spark Plug Gaps**—.028" (.0255-.0305").
IGNITION TIMING:—Standard setting listed below (see Fuel Compensator Setting following):

	Flywheel Degrees	Piston Position
All Heads	7° BTDC	.0202" BTDC.

Timing Mark Note—Marks now on vibration dampener at front of engine. Dampener marked '#1 UP. DC' with fifteen 1° graduations before this point. **Timing**—With #1 piston on compression, turn engine over until piston reaches firing position with correct mark on dampener in line with pointer on chain case cover (see table above). Loosen vacuum unit link screw in distributor quadrant, rotate distributor until contacts begin to open, tighten screw. Check Fuel Compensator Setting (below). **Timing (Neon Timing Light)**—Mark correct graduation on vibration dampener, clip neon timing light to #1 spark plug and direct light on vibration dampener, idle engine and adjust distributor as directed above.

Fuel Compensator Setting—Should be set for slight ping when accelerating engine with wide open throttle. To adjust, loosen vacuum unit link screw distributor quadrant, rotate one graduation at a time counter-clockwise (if ping too severe), clockwise (if no ping), until correct performance secured.
CARBURETION:—**Carburetor**—Carter Type WDO, Model 478-S (#327 cast on face of flange). 1" dual downdraft type with Climatic Control.
For complete data, refer to 1941 Carburetor Index.
Idle Adjustment—With engine warm and running at slow idle speed (choke valve wide open, fast idle inoperative), set throttle stopscrew for 6 MPH. idle speed. Adjust idle adjusting screw for each barrel (in succession) until engine fires smoothly (½-1½ turns open for each screw—turn screws in for leaner mixture). Readjust idle speed.
Accelerating Pump—Pump arm under dust cover at top of carburetor has two holes for pump link engagement. Set as follows:
Inner (min. stroke)—Hot weather or hi-test fuel.
Outer (max. stroke)—Cold weather or low-test fuel.
Float level—5/32" from top of float to bowl cover with valve seated (remove gasket & invert to check).
Metering Rods & Jets—***See Carter Jet Table in Carburetor Section for complete data.***
Fast Idle:—Integral type (built-in carburetor).
For complete data, refer to 1941 Carb. Equip. Index.
Setting—Adjust fast idle screw for .030" throttle opening with choke valve closed.
Automatic Choke:—Carter Climatic Control.
For complete data, refer to 1941 Carb. Equip. Index.
Setting—Set thermostatic coil housing 1 Notch Rich.
Throttle Guard (Cars with Econo-Drive):—Vacuum operated throttle kicker to prevent engine stalling when free-wheeling. Kicks in at 4 MPH., kicks out at 9 MPH.
For complete data, refer to 1941 Carb. Equip. Index.



Setting—Set gap between plunger and carburetor throttle lever at .020" (carburetor set for 6 MPH. slow idle speed), set spring tension adjusting screw 3/16" out beyond face of locknut.

Air Cleaner:—AC #1542094 oil-wetted type standard. Heavy duty oil-bath type optional.

Fuel Pump:—AC Type AH. Inverted, diaphragm type. Pump Replacement Exchange Part No. 525.

For complete data, refer to 1941 Carb. Equip. Index.

Gasoline Gauge:—Stewart (Stewart-Warner) Electric.

For complete data, refer to 1941 Carb. Equip. Index.

MANIFOLD HEAT CONTROL:—Thermostatic coil type. Make certain that valve operates freely (valve must not bind or stick). Do not oil control.

VALVE TIMING:—**To Check**—With tappet clearance of .0125", #1 intake valve opens with piston 1° or .0004" BTDC when 1st graduation before top dead center mark '#1 UP.DC' on vibration dampener lines up with pointer (permissible variation 4° either way). Reset tappet clearance at .007" hot.

Tappet Clearance:—.007" Int., .010" Exh. Warm. Adjusting screws are self-locking (no locknuts).

Valve Spring Pressure:—47-52 lbs. at 1⅝" (valve closed), 114-124 lbs. at 1 5/16" (valve open).

LUBRICATION:—**Crankcase Capacity**—6 quarts.
Normal Oil Pressure—40 lbs. at 45 MPH.

COOLING SYSTEM:—**Capacity**—17 quarts.

Pressure Valve:—In filler cap. Opens at 4½ lbs. (Std.), 12 lbs. (with Air Conditioning Equipment).

Thermostat:—Harrison. In cylinder head outlet.
Setting—Starts to open 147½°.
NOTE—1901A equipped with radiator shutters controlled by thermostat in top radiator tank. Starts to open 135° (if cylinder head type thermostat also used, starts to open 162½°).

TRANSMISSION (ECONO-DRIVE) CONTROL:—Electric type with solenoid operated 'kick-down' through accelerator switch and governor switch.

For complete data, refer to 1941 Mech. Equip. Index.

Overdrive Solenoid—Delco-Remy Model 1118005.
Overdrive Indicator Light—Green light on right side of speedometer dial. Lighted whenever overdrive is ready to engage (light goes out when accelerator pedal is released so that overdrive can engage). See Lighting Switch under Switches (following).
Throttle Switch—Cole-Hersee. Packard No. 347946. Adjust tappet screw on throttle lever to just contact switch plunger with throttle valve wide open.
Governor Switch—Bendix No. 364782.
Control Relay—Delco-Remy Model 1116801.

BATTERY:—**Auto-Lite Type PN-17P.** 6 volt, 17 plate, 114 ampere hour capacity (20 hour rate).
Starting Capacity—135 amperes for 20 minutes.
Zero Capacity—300 amperes for 4.1 minutes.
Grounded Terminal—Positive (+) to frame.
Engine Ground—Strap from transmission to frame.
Dimensions—Length 10¼". Width 7". Height 8⅝".
Location—Under left front seat.

STARTER:—**Model MAW-4041 (early), MAW-4024 (later).**
Armature—MAW-2006 (MAW-4021), MAW-2128 (MAW-4024).
Drive—Outboard Barrel Type Bendix No. A-1718 (with MAW-4021), A-1792 (with MAW-4024 starter).
Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—42-53 ozs. (new brushes).
Cranking Engine—125 RPM, 175 amperes, 5.1 volts.

Performance Data

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	4900	5.5	65
0.6 "	3300	5.5	100
2.75 "	1480	5.0	200
5.45 "	820	4.5	300
8.50 "	400	4.0	400
11.55 "	110	3.5	500
11.5 "	Lock	3.0	505
18.0 "	Lock	4.0	670

Removal:—Flange mounted on left front face of flywheel housing. To remove, take out flange mounting screws, lift out starter and switch assembly.

Starting Switch:—A-L Model SS-4017. Magnetic type. Mounted on starter and controlled by R.B.M. #5380 pushbutton switch on instrument panel.

For complete data, refer to 1941 Elec. Equip. Index.

GENERATOR:—**Auto-Lite GDZ-4801F (Std.), GEB-4802C-2 (Police). Armature GDZ-2006F (GDZ), GEB-2006F (GEB).** Two brush types with current-voltage control.
Charging Rate Adjustment—No adjustment at generator. Charging rate controlled by Voltage Regulator and maximum output by Current Regulator.
Maximum Charging Rate—35 amperes, 8.0 volts hot. Actual charging rate controlled by Voltage Regulator and dependent on battery condition.

Performance Data—GDZ-4801F

Cold			Hot		
Amperes	Volts	R.P.M.	Amperes	Volts	R.P.M.
0	6.4	925	0	6.4	1000
4	6.6	1035	4	6.6	1120
8	6.75	1140	8	6.75	1235
12	6.95	1250	12	6.95	1350
16	7.15	1370	16	7.15	1460
20	7.3	1480	20	7.3	1590
24	7.5	1590	24	7.5	1730
28	7.7	1710	28	7.7	1900
32	7.9	1820	32	7.9	2090
*35	8.0	1900	35	8.0	2250

Performance Data—GEB-4802C-2

0	6.4	560	0	6.4	620
5	6.6	640	5	6.6	700
10	6.8	720	10	6.8	800
15	7.1	800	15	7.1	910
20	7.3	880	20	7.3	1040
25	7.5	980	25	7.5	1170
30	7.8	1080	30	7.8	1340
*35	8.0	1200	35	8.0	1520

*—Current Regulator setting.

Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—53 ozs. max. (GDZ Gen.), 64-68 ozs. (GEB Generator) with new brushes.
Field Current—1.60-1.78 amperes at 6.0 volts (all).
Motoring Current—4.15-4.60 amperes (GDZ Gen.), 4.0-4.5 amperes (GEB Generator) at 6.0 volts.

Removal:—Pivot mounted at left side of engine at front. To remove, take out pivot and clamp bolts.

Belt Adjustment:—50 lbs. tension on spring scale hooked to generator frame, or ½" thumb-pressure deflection between generator and pump pulleys.

REGULATOR:—**Auto-Lite VRP-4002C (GDZ Gen.), VRP-4002D (GEB Generator).** Current-voltage type. In case on left side of engine dash.

For complete data, refer to 1941 Elec. Equip. Index.

NOTE—Regulator case cover sealed. Serviced on exchange basis if seals not broken (to remove cover).

Cutout Relay

Cuts In—6.4-6.6 volts, 920 generator RPM (cold).
Cuts Out—4.8-5.6 volts (approx. 4-6 amps. disch.).
Contact Gap—.015" Min. **Air Gap**—.031-.034" with contacts open (check at hinge end of core).

Voltage Regulator

Setting—7.2-7.5 volts at 70° F. See Electrical Equipment Section for settings at other temperatures.
To Check (without breaking seals)—Connect ammeter in charging line at regulator 'B' terminal (use short heavy leads), voltmeter between 'B' terminal and ground. Operate generator at speed equivalent to 30 MPH., charging fully charged battery, until voltage steady. Voltage should agree with setting.
To Adjust (with cover removed)—Change regulator armature spring tension by bending lower spring hanger slightly. See Electrical Equipment Section.
Contact Gap—.012" min. (armature against stop pin).
Air Gap—.048-.052" with contacts just opening.

Current Regulator

Setting—34-36 amperes (marked '35' on the cover).
To Check (without breaking seals)—Connect test meters as for voltage check (above). Operate generator at speed equivalent to 30 MPH. charging battery, turn on car lights and accessories or connect load (bank of headlamp bulbs etc.) between ammeter and battery so that generator charges at peak rate and Current Regulator operates. Current reading should agree with setting given above. If more than slight excess noted, regulator is defective.
Adjustment, Contact Gap, Air Gap—Same as for Voltage Regulator (above).

LIGHTING:—**Headlamps**—Hall 'Sealed Beam' type.

For complete data, refer to 1941 Elec. Equip. Index.

Headlamp Adjustment—Aim upper beam straight ahead (hot spot center 3" below lamp center height).
Beam Indicator—Red light on left side of speedometer. Lighted when Country (Upper) beams in use.

Switches

Lighting—Delco-Remy No. 1995011 (Std.), 1995019 (Cars with Econo-drive—has dimmer switch for Econo-drive Indicator Light controlled by switch
Beam Selector—Delco-Remy No. 1997001 (LHD cars), 1997002 (RHD cars).

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps	Sealed Beam	
Front Fender	21-3	1154
Instr., Speed'mtr., Clock	1½	55
Front Reading, Econo Dr. Ind.	1½	55
Glove Compt., Beam Indicator	1	51
Stop & Tail	21-3	1154
Rear License	3	63
Dome	6	81

THERMOSTATIC RELAY:—**Delco-Remy.** On lighting switch. Contacts remain closed with 30 amperes, open in 3 minutes with 42 amps. @ 70° F. Not adj.

FUSES:—**Stop Light, Cigar Lighter and Accessories**—Two 20 ampere. On back of lighting switch.
Instrument & Tail Light—20 ampere. In connector in Lighting Switch to Panel Light Switch feed wire.
Clock—3 ampere. In feed wire near clock.
Econo-Drive—30 ampere. In relay lead near starter.
Windshield Wiper—No fuse (circuit-breaker).

HORNS:—**Sparton**—Vibrator type, air tone, twin horns operated by relay.
Horn Current—22-25 amperes (total both horns).
Horn Relay:—R-B-M Model 6006.
Contacts Close—3-4 volts (with relay upright).

WINDSHIELD WIPER:—**Stewart-Warner Series 645-E.** Electric type. NOTE—'Klixon' type circuit-breaker mounted on unit (no fuse used).

For complete data, refer to 1941 Mech. Equip. Index.

SERIAL NUMBER:—On left side of cowl (use Eng. No.).

ENGINE NUMBER:—First No. D-500051 ('160' 1903, 4, 5), CD-500051 ('180' 1906, 7, 8). Stamped on left side of cylinder block between #3 and #4 cylinders.

COMPRESSION:—**Ratio**—6.45-1 Std., 6.85-1 HC. Optl. Both heads are cast-iron type.

Pressure—118 lbs. at cranking speed (Std. head). 133 lbs. at 300 RPM. (Optl. 6.85-1 HC. head).

VACUUM READING:—Steady 18½" idling at 6 MPH.

IGNITION:—**Coil Model CE-4645.** On left side of engine near distributor. Service Coil CE-3224RS.
Ignition Current—2.4 amperes idling, 5 stopped.

Ignition Switch:—Mitchellock Model 24-B, No. 8779.
Ignition Lock—Briggs & Stratton. B & S No. 50184.
Key Series—P1250 to P1500. **Groove**—No. 2.

Distributor Auto-Lite IGT-4102. Single breaker, 8 lobe cam, full automatic advance type with auxiliary vacuum spark control and Fuel Compensator adj.
Breaker Plate Identification—Maximum vacuum advance limited by slot and marked by number (#5½) on plate.
Breaker Gap—Set at .015".
Cam Angle or Dwell—27° clsd., 18° open (.017" gap).
Breaker Arm Spring Tension—17-20 ounces.
Rotation—Counter-clockwise viewed from the top.
Condenser—No. IG-2671J. Capacity .20-.25 mfd.

Automatic Advance

Distributor Degrees	R.P.M.	Engine Degrees	R.P.M.
Start	250	0	500
3	475	6	950
6	700	12	1400
9	1300	18	2600
11½	1800	23	3600

Vacuum Spark Control—Integral type (on distributor, linked directly to breaker plate). Provides additional advance at speeds above idling except when engine accelerated or operated with wide open throttle (spark retarded by return spring in unit).

Vacuum Advance

Distr. Degrees	Eng. Degrees	Vacuum (" of HG)
Start	0°	7"
1°	2°	8⅝"
3°	6°	12"
4°	8°	13½"
5½°	11°	16"

Fuel Compensator—Manual adjustment at distributor providing 10° advance or retard from center '0' position. See Ignition Timing for setting.

Distributor Removal:—Mounted on left side of crankcase. To remove, disconnect vacuum line and take out hold-down screw in advance arm.

FIRING ORDER:—1-6-2-5-8-3-7-4. See diagram.

SPARK PLUGS:—AC No. 104 or Champion Y4. 10 MM. Metric. NOTE—Do not tighten these small plugs excessively (50 in. lbs.).
Spark Plug Gaps—.028" (.0255-.0305").

IGNITION TIMING:—Standard setting listed below (see Fuel Compensator Setting following):

	Flywheel Degrees	Piston Position
6.45-1 Std. hd.	3½-5° BTDC	.0053-.0110" BTDC
6.85-1 Optl. HC hd.	2½-4° BTDC.	.0027-.0070" BTDC

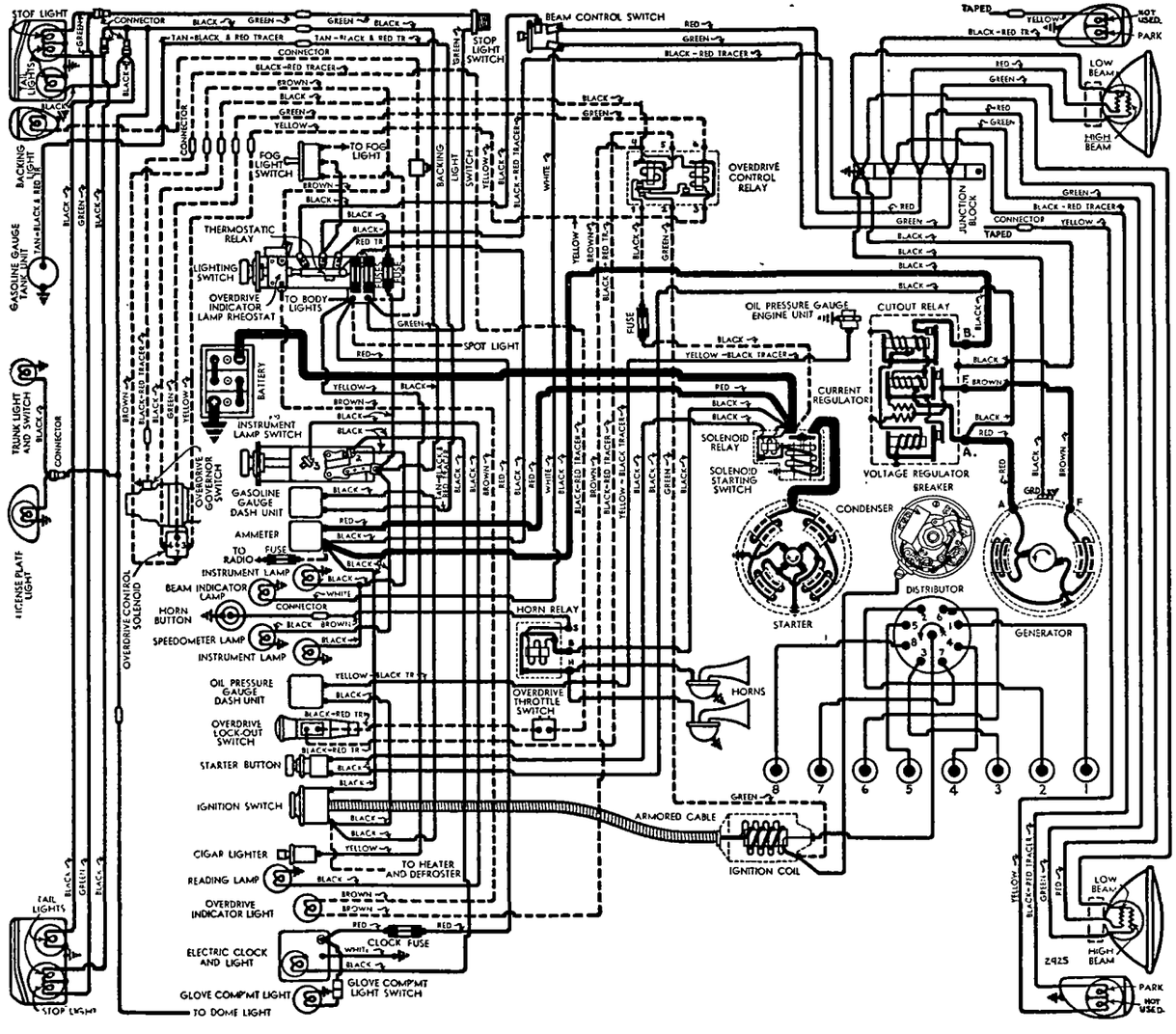
NOTE—Vibration dampener marked 'UDC' at TDC with 15 (1°) graduations before this point.

Timing—Loosen thumbnut, set Fuel Compensator pointer at '0', tighten thumbnut. With #1 piston on compression, turn engine over until piston reaches firing position (see table above), stop when correct graduation on vibration dampener at front of engine lines up with pointer on chain case cover. Loosen advance arm clamp bolt, rotate distributor until contacts begin to open, tighten clamp bolt, see that rotor opposite #1 segment in distributor cap, check Fuel Compensator setting.

Timing (Neon Timing Light)—Mark vibration dampener with white paint at proper point, idle engine below 500 RPM, adjust distributor (above).

Fuel Compensator Setting—Should be set for slight ping when accelerating with wide open throttle. To adjust, loosen thumbnut, rotate distributor counter-clockwise (if ping too severe), clockwise (if no ping noted), tighten thumbnut and recheck performance.

CARBURETION:—**Carburetor**—Stromberg Model AAV-26. No. 380037 (Code marked 10-44). 1¼" dual downdraft type with Automatic Choke.
For complete data, refer to 1941 Carburetor Index.
Idle Adjustment—With engine warm and running at slow idle speed (choke valve wide open, fast idle inoperative), set throttle stopscrew for 6 MPH idle speed. Adjust idle adjusting screw (one for each barrel) in succession until engine fires smoothly. (1-1⅛ turns open for each screw—turn screws in for leaner mixture). Readjust idle speed.
Accelerating Pump Setting—Two holes provided in throttle lever for pump link engagement as follows:
Outer (max. stroke)—Normal setting.
Inner (min. stroke)—If less charge required.
Float Level—Fuel level ⅝" below top edge of bowl with engine idling (5 lbs. pressure).
Metering Jets—***See Stromberg Jet Table in Carburetor Section for complete data.***



Fast Idle: Integral (operated by Automatic Choke).
For complete data, refer to 1941 Carb. Equip. Index.
Setting—To check, hold throttle stopscrew against high lobe of fast idle cam, move choke valve toward closed position as far as possible, check choke valve opening. Adjust by bending fast idle connector rod for 7/64" choke valve opening.
Automatic Choke:—Stromberg AAV-26 type (integral).
For complete data, refer to 1941 Carb. Equip. Index.
Setting—'V' mark on thermostat cover lined up with mark on housing. May be varied not more than 2 graduations to improve warming up.
Throttle Guard (Cars with Econo-Drive):—Vacuum operated throttle kicker to prevent engine stalling when free-wheeling. Kicks in at 4 MPH., kicks out at 9 MPH.
For complete data, refer to 1941 Carb. Equip. Index.
Setting—Set gap between plunger and carburetor throttle lever at .020" (carburetor set for 6 MPH slow idle speed), set spring tension adjusting screw 7/32" out beyond face of locknut.
Air Cleaner:—AC #1542095 oil-bath type standard.
Fuel Pump:—AC Type AJ combination fuel-&-vacuum pump. Replacement Exchange Part No. 537.
For complete data, refer to 1941 Carb. Equip. Index.
Gasoline Gauge:—Stewart (Stewart-Warner) Electric.
For complete data, refer to 1941 Carb. Equip. Index.

MANIFOLD HEAT CONTROL:—Thermostatic coil type. Make certain that valve operates freely (valve must not bind or stick). Do not oil control.

VALVE TIMING:—To Check—#1 exhaust valve closes 10° or .0438" past top dead center with hydraulic lifter dry (all oil drained out) and built up with feeler stock for zero tappet clearance.
Tappet Clearance:—None in service (Wilcox-Rich 'zero lash' hydraulic tappet take-up used).
For complete data, refer to 1941 Mech. Equip. Index.
Valve Spring Pressure:—55-61 lbs. at 1¾" (valve clsd.), 130-140 lbs. at 1 13/32" (valve open).

LUBRICATION:—Crankcase Capacity—7 quarts.
Normal Oil Pressure—50 lbs. at 45 MPH.

COOLING SYSTEM:—Capacity—20 quarts.
Pressure Valve:—In filler cap. Opens at 7 lbs. (Std.), 12 lbs. (with Air Conditioning Equipment).
Thermostat:—In cylinder head water outlet and radiator top tank (operates shutters).
Setting—Starts to open 162½° (cylinder head type), starts to open 135° (radiator shutter type).

TRANSMISSION (ECONO-DRIVE) CONTROL:—Electric type with solenoid operated 'kick-down' through accelerator switch and governor switch.
For complete data, refer to 1941 Mech. Equip. Index.
Overdrive Solenoid—Delco-Remy Model 1118005.
Overdrive Indicator Light—Green light on right side of speedometer dial. Lighted whenever overis ready to engage (light goes out when accelerator pedal is released so that overdrive can engage). See Lighting Switch under Switches (following).
Throttle Switch—Cole-Hersee, Packard No. 347496. Adjust tappet screw on throttle lever to just contact switch plunger with throttle valve wide open.
Governor Switch—Bendix No. 364782.
Control Relay—Delco-Remy Model 1116801.

BATTERY:—Auto-Lite Type PN-17P. 6 volt, 17 plate, 114 ampere hour capacity (20 hour rate).
Starting Capacity—135 amperes for 20 minutes.
Zero Capacity—300 amperes for 4.1 minutes.
Grounded Terminal—Positive (+) to frame.
Engine Ground—Strap from transmission to frame.
Dimensions—Length 10¼". Width 7". Height 8⅝".
Location—Under left front seat.

STARTER:—Auto-Lite MAX-4041. Armature MAW-2069.
Drive—Overrunning clutch (solenoid pinion shift) through reduction gears.
Rotation—Clockwise at commutator end.
Brush Spring Tension—42-53 ozs. (new brushes).

Performance Data

Torque		**R.P.M.	Volts	Amperes
0	ft. lbs.	2695	5.5	77
33.5	"	Lock	3.0	652
45.9	"	Lock	4.0	906

**—Pinion shaft R.P.M.

Removal:—Flange mounted on left front face of flywheel housing. To remove, take out flange mounting screws, lift out starter and switch assembly.
Starting Switch:—Solenoid Switch Type SS-4205. Controlled through relay by R-B-M #5380 push-button switch on instrument panel.
For complete data, refer to 1941 Elec. Equip. Index.

GENERATOR:—Auto-Lite GEA-4802A. Armature GDZ-2006F. Two brush with current-voltage control.
Charging Rate Adjustment—No adjustment at generator. Charging rate controlled by Voltage Regulator and maximum output by Current Regulator.
See Regulator data following.
Maximum Charging Rate—35 amperes (hot or cold), 8.0 volts, 1570 RPM and above with load or discharged battery (Current Regulator setting). Actual charging rate controlled by Voltage Regulator and dependent on battery condition.

Performance Data

Cold			Hot		
Amperes	Volts	R.P.M.	Amperes	Volts	R.P.M.
0	6.4	780	0	6.4	840
4	6.6	870	4	6.6	935
8	6.8	960	8	6.8	1025
12	6.95	1050	12	6.95	1120
16	7.15	1140	16	7.15	1220
20	7.3	1230	20	7.3	1320
24	7.6	1320	24	7.6	1420
28	7.7	1410	28	7.7	1550
32	7.85	1500	32	7.85	1685
35	8.0	1570	35	8.0	1800

Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—53 ozs. max. (new brushes).
Field Current—1.57-1.75 amperes at 6.0 volts.
Motoring Current—4.45-4.9 amperes at 6.0 volts.
Removal:—Pivot mounted at left front of engine. To remove, take out pivot and clamp bolts.
Belt Adjustment:—Swing generator out until 50 lb. reading secured on scale hooked to clamp bolt lug parallel to clamp link or until belt deflection midway between generator and water pump pulley is ½" with thumb pressure.

REGULATOR:—Auto-Lite VRP-4002C. Current-Voltage Type. Mounted in single case on engine side of dash.
For complete data, refer to 1941 Elec. Equip. Index.
NOTE—Regulator case cover sealed. Serviced on exchange basis if seals not broken (to remove cover).

Cutout Relay
Cuts In—6.4-6.6 volts, 780 generator RPM (cold).
Cuts Out—4.8-5.6 volts (approx. 4-6 amps. disch.).
Contact Gap—.015" minimum.
Air Gap—.031-.034" with contacts open (check at hinge end of core).

Voltage Regulator
Setting—7.2-7.5 volts at 70° F. See Electrical Equipment Section for settings at other temperatures.
To Check (without breaking seals)—Connect ammeter in charging line at regulator 'B' terminal (use short heavy leads), voltmeter between 'B' terminal and ground. Operate generator at speed equivalent to 30 MPH., charging fully charged battery, until voltage is steady. Voltage reading should agree with setting given above.
To Adjust (with cover removed)—Change regulator armature spring tension by bending lower spring hanger slightly. See Electrical Equipment Section.
Contact Gap—.012" min. (armature against stop pin).
Air Gap—.048-.052" with contacts just opening.

Current Regulator
Setting—34-36 amperes (marked '35' on the cover).
To Check (without breaking seals)—Connect test meters as for voltage check (above). Operate generator at speed equivalent to 30 MPH. charging battery, turn on car lights and accessories or connect load (bank of headlamp bulbs etc.) between ammeter and battery so that generator charges at peak rate and Current Regulator operates. Current reading should agree with setting given above. If more than slight excess noted, regulator is defective.
To Adjust (with cover removed)—Same as for Voltage Regulator (above).
Contact Gap & Air Gap—Same as Voltage Regulator.

LIGHTING:—Headlamps—Hall 'Sealed Beam' type.
For complete data, refer to 1941 Elec. Equip. Index.
Headlamp Adjustment—Aim upper beam straight ahead (hot spot center 3" below lamp center height).
Beam Indicator—Red light on left side of speedometer dial. Lighted when Country (upper) beam in use.

Switches
Lighting—Delco-Remy No. 1995011 (Std.), 1995019 (Cars with Econo-drive—has dimmer switch for Econo-drive Indicator Light controlled by switch knob).
Beam Selector—Delco-Remy No. 1997001 (LHD cars), 1997002 (RHD cars).

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps	Sealed Beam	
Front Fender	21-3	1154
Instr., Speed'mtr., Clock	1½	55
Front Reading, Econo Dr. Ind.	1½	55
Glove Compt., Beam Indicator	1	51
Stop & Tail	21-3	1154
Rear License	3	63
Dome	6	81

THERMOSTATIC RELAY:—Delco-Remy. On lighting switch. Contacts remain closed with 30 amperes, open in 3 minutes with 42 amps. @ 70° F. Not adj.

FUSES:—Stop Light, Cigar Lighter and Accessories—Two 20 ampere. On back of lighting switch.
Instrument & Tail Light—20 ampere. In connector in Lighting Switch to Panel Light Switch feed wire.
Clock—4 ampere. In feed wire near clock.
Econo-Drive—30 ampere. In relay lead near starter.
Radio—14 amp. In feed wire (factory-equipped).

HORNS:—Sparton—Vibrator type, air tone, twin horns operated by relay.
Horn Current—33-36 amperes (total both horns).
Horn Relay:—R-B-M Model 6036.
Contacts Close—3-4 volts (with relay upright).

WINDOW REGULATORS:—Hydro-electric type.
For complete data, refer to 1941 Mech. Equip. Index.

HOOD LOCK:—*See Chrysler Shop Notes in 'M' Section.*

SERIAL NUMBER:—On right front door hinge post.

	Detroit	Los Angeles	Evansville	Canada
P11	15,000,101	3,121,501	22,001,001	9,821,241
P12	11,123,001	3,269,301	20,105,001	9,616,761

ENGINE NUMBER:—P11-1001 & up (P11), P12-1001 & up (P12). On left side of block between #1 & #2 cyls. **Economy Engine Note**—Economy models (with special carburetor & rear axle ratio) marked by 'E' in Eng. No. as follows: P11-E-1001 or P12-E-1001.

COMPRESSION:—**Ratio**—6.7-1 cast-iron head std. **Pressure**—145-155 lbs. at 1000 RPM or approx. 115 lbs. at cranking speed (std. head). 10 lbs. maximum variation between cylinders.

VACUUM READING:—Steady 18-20" idling (below 1000').

IGNITION:—**Auto-Lite Coil No. IG-4661.** Service winding (less switch & cable) IG-3224JS. On engine dash. **Ignition Current**—2.25 amperes idling, 5 stopped. **Ignition Switch:**—Mitchellock Model 24-R, No. 8197. **Ignition Lock**—Yale & Towne or Briggs & Stratton. B&S No. 80592. Key Series 1BP to 1000BP. Groove #24. **Distributor Auto-Lite IGS-4111-1, IGS-4113-1 (Canada).** Single breaker, 6 lobe cam, full automatic advance type with vacuum spark control and manual adjustment. **Breaker Plate Identification**—#10 (IGS-4111-1), #7 (IGS-4113-1) stamped on plate. Maximum vacuum advance limited by slot in plate. **Breaker Gap**—Set at .020". **Cam Angle or Dwell**—38° closed, 22° open (distr. °). **Breaker Arm Spring Tension**—17-20 ounces. **Rotation**—Clockwise viewed from above. **Condenser**—No. IG-3927A. Capacity .25-.28 mfd.

Automatic Advance—IGS-4111-1

Distributor Degrees	Distributor R.P.M.	Engine Degrees	Engine R.P.M.
Start	350	0	700
3	400	6	800
6	950	12	1900
9	1500	18	3000
11	1850	22	3700

Automatic Advance—IGS-4113-1

Start	350	0	700
3	400	6	800
6	850	12	1700
9	1300	18	2600
12	1750	24	3500

Vacuum Spark Control—Integral type (on distributor, linked directly to breaker plate). Provides additional advance at speeds above idling except when engine accelerated or operated with wide open throttle (spark retarded by return spring in unit).

Vacuum Advance—IGS-4111-1

Distr. Degrees	Eng. Degrees	Vacuum (" of HG)
Start	0°	5"
2°	4°	7⅜"
5°	10°	11"
8°	16°	14⅝"
10°	20°	17"

Vacuum Advance—IGS-4113-1

Start	0°	5"
1°	2°	6½"
3°	6°	9¼"
5°	10°	12⅛"
7°	14°	15"

Manual Adjustment—Provides for minor changes in ignition timing at distributor. See Ignition Timing for adjustment.

Distributor Removal:—Mounted on left side of crankcase. To remove, disconnect vacuum line, take out hold-down screw in lock plate. **Installation Note**—Install distributor with #1 piston in firing position (at TDC) and rotor opposite #1 segment in cap.

FIRING ORDER:—1-5-3-6-2-4. See diagram.

SPARK PLUGS:—Auto-Lite A-7B. 14 MM. metric. NOTE—Spark plug tightening tension 26-32 ft. lbs. **Spark Plug Gaps**—Set at .025".

IGNITION TIMING:—Initial setting (correct for fuel of approx. 70 octane rating at low altitudes for all heads) shown below. See Manual Adjustment (following) for minor changes for local fuel & altitudes.

	Flywheel Degrees	Piston Position
All cyl. heads	0° at TDC	.0000" at TDC

NOTE—Crankshaft pulley marked 'DC' at TDC point with 15 (1°) graduations on either side.

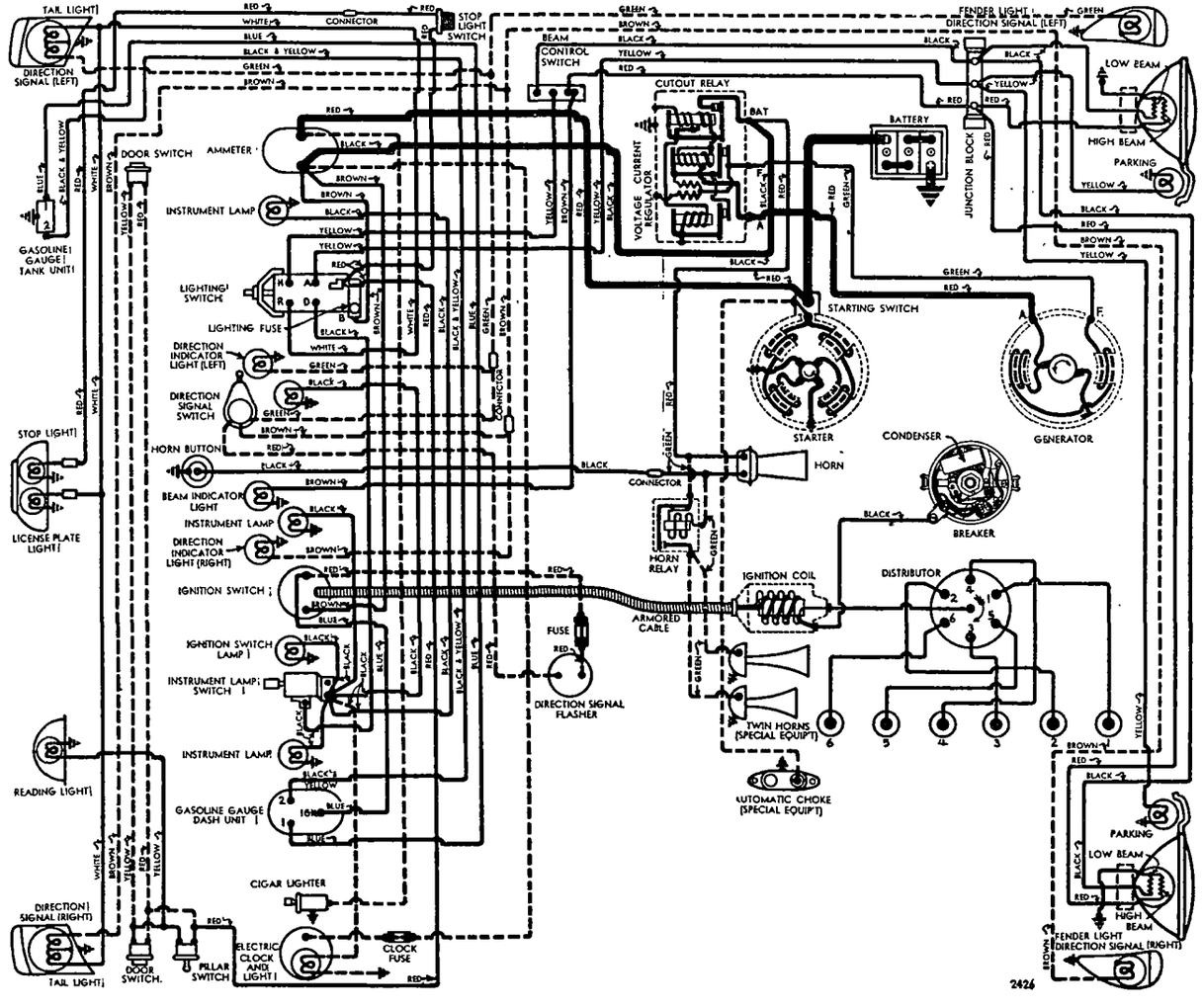
Timing (Using Timing Light)—Connect timing light between distributor primary terminal and battery terminal on generator regulator. Set #1 or #6 piston in firing position (see setting above) with correct mark on crankshaft pulley aligned with pointer on chain case cover. Loosen lock-plate hold-down screw, center pointer on scale, tighten screw. Loosen lock-plate clamp bolt, rotate distributor until timing light just goes out, tighten clamp bolt. Check Manual Adjustment (following).

Timing (Using Synchroscope)—Tool C-374. Clip lead to #1 spark plug, direct light on crankshaft pulley (mark correct graduation with paint), idle engine and adjust distributor (as above) until mark appears in line with pointer.

Manual Adjustment—Set to give slight ping from 10-30 MPH accelerating with wide open throttle from 10 MPH. To adjust, loosen lock-plate hold-down screw, move plate (not more than 4° or .007" before or after initial setting) counter-clockwise (if no ping noted), clockwise to retard spark (if ping too severe), tighten screw.

CARBURETION:—**Carburetor**—Carter (Ball & Ball) Models D6A2 (Std.), D6C2 (with Automatic Choke). 1½" single barrel, downdraft types.

For complete data, refer to 1941 Carburetor Index.



Economy Carburetor—Carter (Ball & Ball) Model B6P1. 1¼" single barrel, downdraft type.
For complete data, refer to 1941 Carburetor Index.
Idle Adjustment—With engine warm and running at slow idle speed (choke valve wide open, fast idle inoperative on D6A2 & D6C2), set throttle stopscrew for 6 MPH min. idle speed. Adjust idle adjusting screw until engine fires smoothly (½-1¼ turns open D6A2 & D6C2, ½-1½ turns open B6P1—turn screw in for leaner mixture). Readjust idle speed. NOTE—If vacuum gauge used, adjust carburetor for highest obtainable vacuum (see Vacuum Gauge data
Accelerating Pump Setting—Pump lever has three holes for pump link engagement. Set as follows: Inner Hole (minimum stroke)—Extreme hot temperatures or altitudes above 3000 feet.
Center Hole (med. stroke)—Normal summer setting.
Outer Hole (max. stroke)—Winter setting.
Float Level—5/64" from top of float (not seam) to top edge of bowl with valve seated. Use Tool C-449.
Metering Jet—***See Carter (B&B) Jet Tables in Carburetor Section for complete data.***
NOTE—If lean metering jet (High Altitude calibration) used at lower altitudes for increased economy, speed and power are reduced (not recommended).
Fast Idle:—D6A2 & D6C2 only. Not adjustable.
Throttle Cracker:—Not adjustable.
Automatic Choke:—Sisson AC-758B (on optl. D6C2).
For complete data, refer to 1941 Carb. Equip. Index.
Air Cleaner:—AC #1529937 heavy duty oil-bath type.
Fuel Pump:—AC diaphragm type pump. Replacement Exchange Pump No. 505.
For complete data, refer to 1941 Carb. Equip. Index.
Gasoline Gauge:—Auto-Lite electric. No. NG-9651D (dash unit), No. 9329T (tank unit).
For complete data, refer to 1941 Carb. Equip. Index.
MANIFOLD HEAT CONTROL:—Thermostatic coil type. See that valve and shaft rotate freely. When installing coil, place inner end in slot in valve shaft, **wind free end up one turn only counter-clockwise**
VALVE TIMING:—To Check—With .014" (cold) tappet clearance #6 intake valve should open with #6 piston **12° or .060" BTDC (Approx. first 20,000 cars), 9° or .0343" BTDC (Approx. after 20,000 cars)** with 12th graduation (first cars), 9th graduation (later cars) before DC mark on crankshaft pulley aligned with pointer. Reset tappet clearance at .008" hot.
Tappet Clearance:—.008" Intake, .010" Exh. (hot & idling). .002" add'l. exh. clearance desirable for sustained high speeds. NOTE—Self-locking tappet screws used. Remove right front wheel and lower wheel housing panel for access to valves.
Valve Spring Pressure:—40-45 lbs. at 1¾" (valve closed), 107-115 lbs. at 1⅜" (valve open).
LUBRICATION:—Crankcase Capacity—5 qts. (refill).
Normal Oil Pressure—30-45 lbs. at 30 MPH & above.
COOLING SYSTEM:—Capacity—14 quarts.
Thermostat—Bishop & Babcock or Fulton. In outlet on head. Starts to open 157-162°. Fully open 183°.
Temperature Gauge—Auto-Lite (Motometer) Vapor tension type. A-L Part No. H-9650.
For complete data, refer to 1941 Mech. Equip. Index.
BATTERY:—Auto-Lite CF-1-13 (P11), CF-1-13R (P12). 6 volt, 13 plate, 90 ampere hour (20 hour rate).
Grounded Terminal—Positive (+) to engine.
Location—Under hood in left fender shield.
STARTER:—Auto-Lite MZ-4089,A. Armature MZ-2108. MAW-4019,A (Canada). Armature MAW-2030.
See 1941 De Soto S8 'T&E' page for MAW-4019 data.
Drive—Overrunning clutch (manual pinion shift).
Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—42-53 ozs. (new brushes).
Cranking Engine—150-175 amperes, 5.1 volts.

Performance Data

Torque		R.P.M.	Volts	Amperes
0	ft. lbs.	4300	5.5	70
2.55	"	1325	5.0	200
4.95	"	750	4.5	300
7.65	"	220	4.0	400
7.8	"	Lock	3.0	420
11.8	"	Lock	4.0	560

Removal:—Flange mounted on left front face of flywheel housing. Disconnect wires (tape battery lead). Remove oil filter tubes, filter and 2 starter bolts.
Starting Switch:—A-L SW-2813. On starter. Manually operated by starter (pinion shift) pedal.
GENERATOR:—Auto-Lite GDZ-4801B (Std.), GEB-4801A, GEG-4818A (City Police & Taxicab), GEG-4818B (State Police). Two brush. With current and voltage regulation. Ventilated.
Armature Nos.—GDZ-2006F (GDZ-4801A), GEB-2006F (GEB-4801A), GEG-2006F (GEG-4818B).
Charging Rate Adjustment—No adjustment at generator. Charging rate controlled by Voltage Regulator and maximum output by Current Regulator.
Maximum Charging Rate—35 amperes (GDZ Gen.), 40 amperes (GEG Gen.), 8.0 volts, 2200 Gen. RPM (GDZ), 1680 RPM (GEG), at approx. 24 MPH (GDZ) and above with load or discharged battery (Current Regulator setting). Actual charging rate controlled by voltage regulator, dependent on battery condition.

Cold Performance Data—GDZ-4801B Hot

Amperes	Volts	R.P.M.	Amperes	Volts	R.P.M.
0	6.4	925	0	6.4	1000
5	6.65	1060	5	6.65	1150
10	6.85	1200	10	6.85	1290
15	7.05	1340	15	7.05	1430
20	7.3	1480	20	7.3	1590
25	7.55	1620	25	7.55	1750
30	7.8	1760	30	7.8	1980
35①	8.0	1900	35	8.0	2250

Performance Data—GEB-4801A

0	6.4	560	0	6.4	600
4	6.6	630	4	6.6	675
8	6.8	700	8	6.8	750
12	7.0	775	12	7.0	840
16	7.2	845	16	7.2	930
20	7.4	920	20	7.4	1030
24	7.6	1000	24	7.6	1140
28	7.8	1075	28	7.8	1260
32①	8.0	1150	32	8.0	1400

Performance Data—GEG-4818A, B

0	6.4	780	0	6.4	820
5	6.6	870	5	6.6	900
10	6.8	960	10	6.8	990
15	7.0	1040	15	7.0	1080
20	7.2	1130	20	7.2	1170
25	7.4	1220	25	7.4	1270
30	7.6	1310	30	7.6	1380
35	7.8	1410	35	7.8	1510
40①	8.0	1520	40	8.0	1680

①—Current regulator setting. See Regulator data.
Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—53 ozs. max. (GDZ Gen.), 64-68 ozs. (GEB & GEG Gen.) with new brushes.
Field Current—1.60-1.78 amperes at 6.0 volts (all).
Motoring Current—4.16-4.60 amperes (GDZ Gen.), 4.5 amps. (GEB), 4.7-5.2 amps. (GEG) at 6.0 volts.
Removal:—Pivot mounted at left side of engine at front. To remove, take out pivot and clamp bolts.
Belt Adjustment:—Loosen pivot and clamp bolts, pull out on generator until belt is snug or 40-50 lbs. tension secured on scale attached to field frame.
REGULATOR:—Auto-Lite VRP-4001A (GDZ Gen.), VRP-4001B (GEB Gen.), VRP-4001F (GEG Gen.). Current-Voltage types. In case on dash.
NOTE—For negative battery ground, VRP-4005A (GDZ), VRP-4005B (GEB), VRP-4005E (GEG) used.
For complete data, refer to 1941 Elec. Equip. Index.
NOTE—Regulator case cover sealed. Serviced on exchange basis if seals not broken (to remove cover).

Cutout Relay

Cuts In—6.4-6.6 volts at approx. 1000 gen. RPM (VRP-4001A,5A), 600 RPM (1B,5B), 820 RPM (1F,5E).
Cuts Out—4.8-5.6 volts (approx. 4-6 amps. disch.).
Contact Gap—.015" Min. **Air Gap**—.031-.034" with contacts open (measure at hinge end of core).

Voltage Regulator

Setting—7.2-7.5 volts at 70° F. See Electrical Equipment Section for settings at other temperatures.
To Check (without breaking seals)—Connect ammeter in charging line at regulator 'B' terminal (use short heavy leads), voltmeter between 'B' terminal and ground. Operate generator at speed equivalent to 30 MPH., charging fully charged battery, until voltage steady. Voltage should agree with setting.
To Adjust (with cover removed)—Change regulator armature spring tension by bending lower spring hanger slightly. See Electrical Equipment Section.
Contact Gap—.012" min. (armature against stop pin).
Air Gap—.048-.052" with contacts just opening.

Current Regulator

Setting (VRP-4001A,5A)—34-36 amperes (marked '35' on cover). **(VRP-4001F,5E)**—39-41 (marked '40').
To Check (without breaking seals)—Connect test meters as for voltage check (above). Operate generator at speed equivalent to 30 MPH. charging battery, turn on car lights and accessories or connect load (bank of headlamp bulbs etc.) between ammeter and battery so that generator charges at max. rate with regulator operating. Current reading should agree with setting above.
Adjustment, Contact Gap, Air Gap—Same as for for Voltage Regulator (above).
LIGHTING:—Headlamps—Corcoran-Brown 'Sealed Beam' type. ***For data refer to Elec. Equip. Index.***
Headlamp Adjustment—Aim upper beam straight ahead (hot spot center 3" below lamp center height).
Beam Indicator—Red light on upper edge of panel above speedometer. Lighted with upper beams on.
Direction Signal—***Refer to 1941 Elec. Equip. Index.***

Switches

Lighting—Plymouth No. 863823.
Beam Selector—Plymouth No. 859974.
Instrument—Plymouth No. 853371.
Direction Signal—Plymouth No. 865763.

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps		Sealed Beam
Park., Instr., Dir. Ind.	1½	55
Front Direction Signal	21	1129
Beam Ind., Ign. Switch	1	51
Rear Dir. Sig. & Tail	21-3	1158
Stop	21	1129
Rear License, Tail (No Sig.)	3	63
Reading or Dome	15	87

FUSES:—Lighting—30 amp. On back of light switch.
Direction Signal (late cars)—30 amp. Behind instr. panel in wire from ign. switch to flasher.
HORNS:—Single—Auto-Lite HA-4001 or Delco-Remy 1999911 (low note) or 1999918 (high). P11 Std.
Dual (Optl.)—HO-5003 (P11,12 Dom. & Can.), HO-5005 (P11,12), HO-5007 (P12 only) Horn Sets or HA-4026, 28, 30 (Low Pitch), HA-4027, 29, 31 (High Pitch) horn (P12).
Current Draw—Approx. 7 amps. single, 35-40 dual.
Horn Relay:—Auto-Lite Model HRC-4001 (no fuse).
Contacts Close—1.5-3.0 volts. **Open**—.5 volt.
Contact Gap—.026". **Air Gap**—.016-.020" (closed).

HOOD LOCK:—Hood is Alligator type with instrument panel lock. To raise hood, pull the control knob on instrument panel (hood will raise slightly), push up on Safety Catch tab under front edge of hood to release safety catch, lift hood up.

SERIAL NUMBER:—Stamped on plate on left side of dash under engine hood. First number for each model and plant as follows:

	Pontiac	Linden	California
Deluxe 41-25	P6JA-1001	L6JA-1001	C6JA-1001
Str'mlnr. 41-26	P6JB-1001	L6JB-1001	C6JB-1001
Custom 41-24	P6JC-1001	L6JC-1001	C6JC-1001

ENGINE NUMBER:—First number 6-761501. Stamped on boss on left front corner of engine block.

COMPRESSION:—**Ratio**—6.5-1 Std., 7.5-1 Optl. HC. (HC head requires Ethyl fuel at low altitudes).
Pressure—155 lbs. at 1000 RPM. or approximately 118-120 lbs. at cranking speed (Std. Head).

VACUUM READING:—18-20" steady idling at 7-8 MPH.

IGNITION:—**Delco-Remy Coil No. 1115023.** On dash.
Ignition Current—2.5 amperes idling, 4.5 stopped.
Ignition Switch:—Delco-Remy No. 1116306 (LHD), 1116312 (RHD.). Connected to coil by armored cable.
Ignition Lock Cylinder—Briggs & Stratton 45792. Key Series—8000 to 9499. Groove—No. 15.
Distributor Delco-Remy Model 647-D. Single breaker, 6 lobe cam, full automatic advance type with auxiliary vacuum control and Gaselector adjustment.
Breaker Gap—.020". Limits .018-.024".
Cam Angle or Dwell—35° closed, 25° open.
Breaker Arm Spring Tension—17-21 ozs.
Rotation—Counter-clockwise viewed from above.
Condenser—Part No. 1869704. Capacity .18-.25 mfd.

Automatic Advance

Distributor Degrees	R.P.M	Engine Degrees	R.P.M.
Start	400	4	800
8	1050	16	2100
8.5	1450	17	2900
14.25	2000	28.5	4000

Vacuum Spark Control Model 681-M. On distributor (integral type linked directly to breaker plate). Provides additional advance at speeds above idling except when engine accelerated or operated with wide open throttle when spark retarded by return spring within unit. **Plunger Travel**—9/64" total.

Vacuum Advance

Distr. Degrees	Eng. Degrees	Vacuum (" of HG).
Start	0°	7-9"
6.5°	13°	13-16"
7.5-8.5°	15-17°	16-18"

Gaselector—Manual adjustment providing 10° advance or retard from center '0' position. See Ignition Timing for Gaselector Adjustment.
Removal:—Distributor mounted on left side of engine. To remove, disconnect vacuum line, take out screw in Gaselector arm, lift distributor out.

FIRING ORDER:—1-5-3-6-2-4. See diagram.

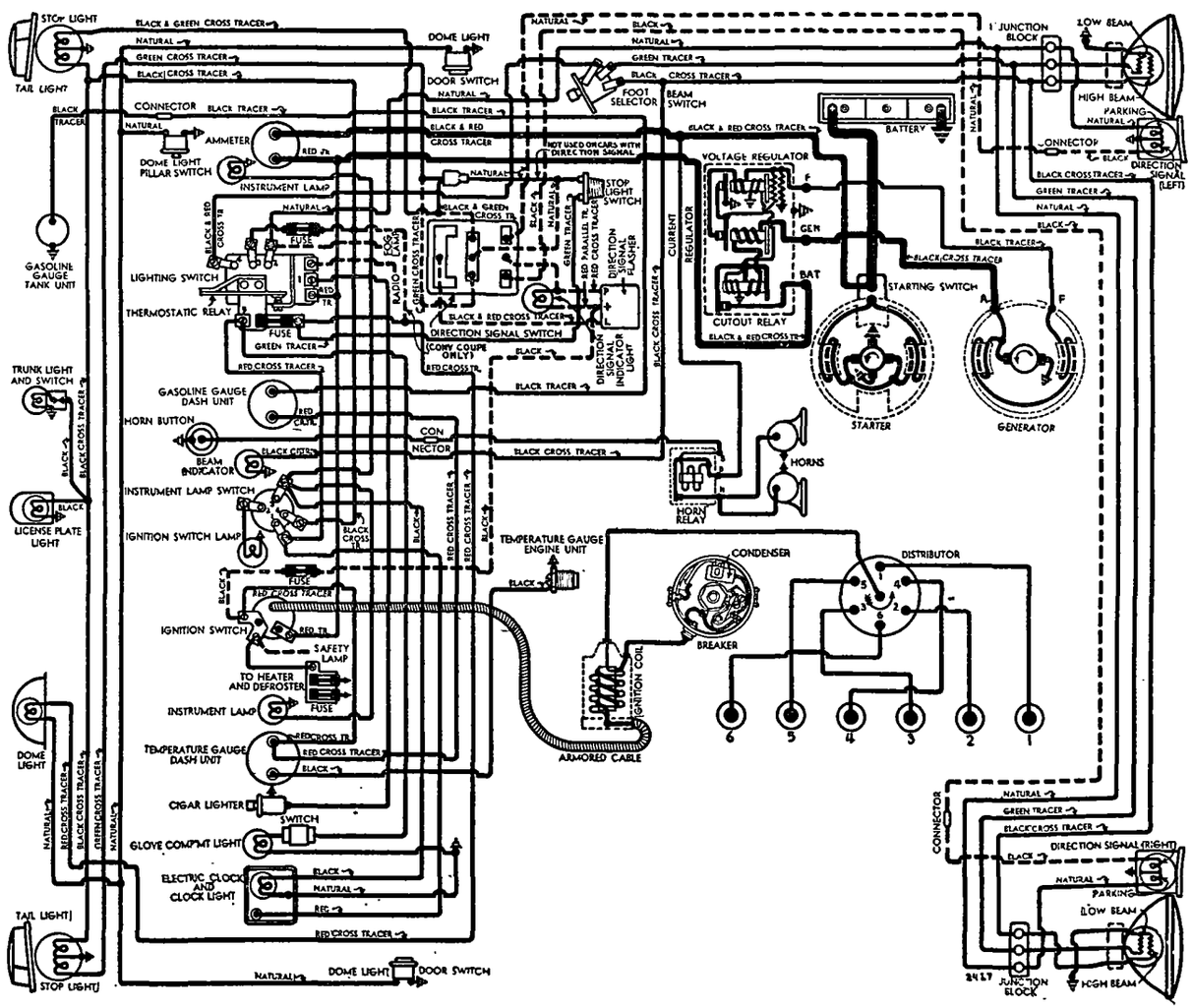
SPARK PLUGS:—AC No. 45. 14 MM. Metric.
Spark Plug Gaps—.025".

IGNITION TIMING:—Standard setting given below (regular fuel Std. Head, Ethyl fuel HC. Head). See Gaselector Setting (following) for correction and final setting.

Flywheel Degrees	Piston Position
All Engines 6° BTDC	.0138" BTDC

Timing Mark Note—Two straight lines of ignition mark '/IGN.ONE/' indicate allowable timing range of 4° on flywheel. Use first (6°) line for setting ignition (second line is 2° before top dead center mark). NOTE—Manufacturer recommends use of HM-494 Timing Light or J-578 Synchroscope for Timing.
To Set Timing (With Timing Light)—Connect timing light between distributor terminal and ground, turn on ignition. With #1 piston on compression, turn engine over until piston is 6° or .0138" before top dead center with first line of ignition mark '/IGN.ONE/' lined up with pointer in inspection hole in left front face of flywheel housing above starter. Loosen Gaselector screw, center pointer scale ('0' mark at reference line), tighten screw. Loosen advance arm clamp bolt, rotate distributor until timing lamp lights (contacts just opening), tighten clamp bolt. Check Gaselector setting.
To Set Timing (With Synchroscope)—Connect synchroscope in series with #1 spark plug, fill in first line of ignition mark '/IGN.ONE/' with chalk or white paint, direct synchroscope light on flywheel (inspection hole on left side), idle engine at 6 MPH., adjust distributor as directed above.
Gaselector Setting—Should be set to provide best performance without spark knock or ping for particular operating conditions and octane rating of fuel used. To adjust, loosen Gaselector arm screw, move arm clockwise (toward 'ADV' end of scale) to advance spark, counter-clockwise (toward 'RET' end of scale) to retard spark, tighten locking screw.

CARBURETION:—**Carburetor**—Carter WA-1 Model 494-S, 1¼" downdraft type with Climatic Control. NOTE—Casting No. 348 on face of flange.
For complete data, refer to 1941 Carburetor Index.
Idle Adjustment—With engine warm so that choke valve wide open and fast idle inoperative, set throttle stopscrew for idle speed of 7-8 MPH (450-475 RPM.). Adjust idle adjusting screw so that engine fires smoothly (turn screw in for leaner mixture). Final setting should be ½-1½ turns of screw from inner seated position. Recheck idle speed. NOTE—Vacuum gauge recommended for this adjustment
Accelerator Pump Setting—Pump arm and plunger under dustcover on top of float bowl have two holes for connector link engagement as follows:
Upper Holes (inner hole in arm, upper hole in plunger)—Short stroke for all normal service.
Lower Holes (outer hole in arm, lower hole in plunger)—Long stroke for extremely cold climates.



Float Level—½" from top of projection on cover to top of soldered seam at free end of float (remove cover and invert to check). NOTE—This setting supersedes 7/16" setting (original specification).
Metering Rod & Jet—*See Carter Jet Table in Carburetor Section for complete data.*
Accelerator Linkage Adjustment:—Must be set to provide correct 'throttle cracking' action for starting. To adjust, after carburetor set for correct 7-8 MPH. hot or slow idle speed, disconnect battery cable at starting motor (to prevent starter cranking engine), insert 9/64" drill rod (or .138" diameter round steel rod) between throttle lever stopscrew and stop, fully depress starting pedal, loosen locknut and adjust eccentric throttle cracker pin on starter motor lever so that all clearance between pin and lever on accelerator cross-shaft is taken up,
Fast Idle:—Integral type (built-in carburetor).
For complete data, refer to 1941 Carb. Equip. Index.
Setting—With fast idle cam in hot or slow idle position, close choke valve until throttle stopscrew is against (not on) first step of fast idle cam, adjust by bending connector rod offset so that choke valve opening is ⅝" (check opening with gauge T109-85).
Automatic Choke:—Carter Climatic Control.
For complete data, refer to 1941 Carb. Equip. Index.
Setting—3 notches Rich.
Air Cleaner:—AC No. 1529871 oil-wetted type Std., heavy duty oil-bath type Optl. Copper-gauze type cleaner installed on oil filler and crankcase ventilator cap (and on ventilator outlet pipe on cars with heavy duty oil-bath type air cleaner).
CAUTION—Filler cap must be installed with air opening in cap toward front of car and seam in line with groove in tube (may cause excessive oil consumption if installed backward).
Fuel Pump:—AC Type AH diaphragm type Std. Replacement exchange pump No. 496. Combination fuel-and-vacuum pump Type AJ Optl.
For complete data, refer to 1941 Carb. Equip. Index.
Gasoline Gauge:—AC Electric. No. 1516295 (Dash Unit), No. 1516316 (Tank Unit).
For complete data, refer to 1941 Carb. Equip. Index.
MANIFOLD HEAT CONTROL:—Thermostatic coil type, non-adjustable (fixed anchor pin). Counterweight should be securely clamped to shaft in approximately vertical position with valve closed (cold).
VALVE TIMING:—To Check—With .015" tappet clearance, #1 intake valve opens with piston 5° or .0096" before top dead center and first line of ignition mark '/IGN.ONE/' on flywheel slightly past indicator (left side—mark is 6° BTDC).
Tappet Clearance:—.011-.013" all valves Hot (.011" gauge 'go', .013" 'no go'). NOTE—.013" exhaust clearance recommended for sustained high speed.
Valve Spring Pressure:—56-63 lbs. at 1 29/32" (valve closed), 97-105 lbs. at 1 19/32" (valve open).
LUBRICATION:—Crankcase Capacity—6 qts.
Normal Oil Pressure—35-40 lbs. with warm oil.
COOLING SYSTEM:—Capacity—18 qts.
Pressure Valve—In filler cap. Opens at 3¾ lbs.
Thermostat:—Harrison. In cylinder head outlet.
Setting—Starts to open 151°. Fully open at 173°.
NOTE—Special thermostat (for use with permanent anti-freeze) opens at 160°.
Temperature Gauge:—AC Electric. No. 1511053 (Dash Unit), No. 1510772 (Engine Unit).
For complete data, refer to 1941 Mech. Equip. Index.
BATTERY:—Delco Type 15-EZ-W. 6 volt, 15 plate, 100 ampere hour capacity (20 hour rate).
Starting Capacity—120 amperes for 20 minutes.
Zero Capacity—300 amperes for 3.5 minutes. Five second voltage 4.25 volts.
Grounded Terminal—Negative (—) on left side of engine block. Engine Ground (Cars with Radio)—strap connector from cylinder head to steering gear
Location—On left side in engine compartment.
Police Battery Delco Model 19E-1. 6 volt, 19 plate 130 ampere hour capacity (20 hour rate).
Starting Capacity—150 amperes for 20 minutes.
Zero Capacity—300 amperes for 5.3 minutes. Five second voltage 4.55 volts.
Grounded Terminal & Location—Same as for Type 15-EZ-W above.
STARTER:—Delco-Remy 1107032, Armature No. 1867897
Drive—Overrunning clutch with manual pinion shift operated by starting pedal on toeboard.
Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—24-28 ozs. each.
Cranking Engine—200 amperes at 5 volts.

Performance Data—1107032

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	5000	5.0	65
12 "	Lock	3.37	525

Removal:—Starter flange mounted on left front face of flywheel housing. To remove, take out flange mounting screws.
Starting Switch (1107032):—No. 820052. Mounted on starter and operated by starting pedal.
GENERATOR:—Delco-Remy 1102665, Armature 1879002 (Std.), Model 1106403 (Police). Two brush type with current and voltage regulation.
Charging Rate Adjustment—None. Charging rate controlled by Voltage Regulator, maximum output by Current Regulator. See Regulator data below.
Maximum Charging Rate—30 amperes, 8.0 volts, 1700 RPM (1102665 Gen.), 1040 RPM (1106403 Gen.) and above (Current Regulator Setting) with load or discharged battery. Actual charging rate controlled by Voltage Regulator and dependent on battery

Performance Data—1102665

	Amperes	Volts	R.P.M.
Cold	30①	8.0	1750

Performance Data—1106403

Cold	35①	8.0	1040

①Not maximum output. See Current Regulator.
Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—24 ounces each.
Field Current—1.67-1.82 amperes (1102665), 1.77-2.0 amperes (1106403) at 6.0 volts.
Removal:—Generator pivot mounted on left front of engine. To remove, take out pivot and clamp bolts.
Belt Adjustment:—Belt deflection or sideplay midway between generator & pump pulley should be 1½".
REGULATOR:—Delco-Remy 1118201 (1102665 Gen.), 1118229 (1106403 Gen.). Single Core Type. Vibrating Current & Voltage Regulator in case on dash.
For complete data, refer to 1941 Elec. Equip. Index.
CAUTION—Check generator for grounded field coils and leads before changing regulator settings to correct High Charging Rate or High Voltage.

Cutout Relay

Cuts In—6.2-6.7 volts hot.
Cuts Out—0-4.0 ampere discharge current.
Contact Gap—.020" (same for both sets).
Air Gap—.020" (with contacts just closed).

Voltage Regulator

Setting—7.2-7.4 volts (1118201), 7.0-7.2 volts (1118229) hot (operating temperature). Regulator should be checked Hot and with cover in place.
To Check—Connect ammeter in charging line at regulator 'BAT' terminal, voltmeter between this terminal and ground. Operate generator at 2800 RPM., adjust charging rate to 8-10 amperes (use variable rheostat or AVR set). With regulator hot (150°F.), decrease generator speed until cutout relay contacts open, then increase speed to 2800 RPM. and check hot voltage setting (above).
To Adjust—Change regulator armature spring tension slightly by bending hanger at lower end of **one spring only.** If further adjustment required, see Single Core Regulator article in Electrical Equipment Section for other (2nd.) spring adjustment.
Air Gap—.070" between center of core and armature with contacts just closing (press down on armature to open contacts, release pressure, check gap at point where contacts just close).

Current Regulator

Setting—32-34 amperes (1118201), 34-36 amperes (1118229) hot (operating temp.).
To Check—Remove regulator cover, connect short jumper between Voltage Regulator frame and upper contact support bracket (to short out Voltage Regulator), connect ammeter in charging line at regulater 'BAT' terminal, turn on car lights and accessories. Operate generator and increase speed until output remains constant. With regulator hot (150°F), current reading should agree with setting (above).
To Adjust—Same as for Voltage Regulator (above).
Air Gap—.080" (check same as Voltage Regulator).
LIGHTING:—Headlamps—Guide 'Sealed Beam' type.
For complete data, refer to 1941 Elec. Equip. Index.
Headlamp Adjustment—Aim upper beam straight ahead (hot spot center 3" below lamp center hght.).
Beam Indicator—Pontiac emblem on face of speedometer dial. Lighted when upper beams in use.
Direction Signal—*Refer to 1941 Elec. Equip. Index.*

Switches

Lighting—Delco-Remy 1995018.
Beam Selector—Delco-Remy 1997002 (LHD cars), 465-V (RHD cars).
Instrument—Delco-Remy 1997740.
Stop Light—Delco-Remy 1997725.

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps		Sealed Beam
Park & Frt. Direc. Signal	21-3	1154
Park (Without Signal)	3	63
Instrument, Ign. Lock	1½	55
Beam & Direc. Signal Ind.	1	51
Stop & Tail	21-3	1154
Rear License Plate	3	63
Dome	6	82
Dome (Convertible)	1½	55

THERMOSTATIC RELAY:—On lighting switch. Contacts remain closed with 30 amperes, open in 3 minutes with current of 42 amperes at 70°F. Not adj.
FUSES:—Tail & Instrument Light—9 ampere. In connector in lead near lighting switch.
Stop & Dome Light—9 ampere. On lighting switch.
Heater & Defroster— 9 ampere each. On fuse block on instrument panel brace to left of ignition switch.
Direction Signal—9 ampere. In connector in feed wire between flasher and ignition switch.
Radio—9 ampere (Master), 14 ampere (Deluxe), 20 ampere (Super Deluxe type).
HORNS:—Delco-Remy No. 1999519 (Low Note), 1999520 (High Note). Vibrator type, blended tone, twin horns operated by relay.

Type	Current (at 6 volts)	Air Gap
1999519 (low note)	19-21 amperes	.045-.049"
1999520 (high note)	17-19 amperes	.035-.039"

Horn Relay:—Delco-Remy No. 1116775.
Contact Gap—.015-.020". **Air Gap**—.015" (closed). **Contacts Close**—2.5-3.5 volts.

HOOD LOCK:—Hood is Alligator type with instrument panel lock. To raise hood, pull the control knob on instrument panel (hood will raise slightly), push up on safety catch tab under front edge of hood to release safety catch, lift hood up.

SERIAL NUMBER:—Stamped on plate on left side of dash under engine hood. First number for each model and plant as follows:

Model	Pontiac	Linden	California
Deluxe 41-27	P8JA-1001....	L8JA-1001....	C8JA-1001
Streamlnr. 41-28	P8JB-1001....	L8JB-1001....	C8JB-1001
Custom 41-29	P8JC-1001...	L8JC-1001....	C8JC-1001

ENGINE NUMBER:—First Number 8-246501. Stamped on boss on left front corner of engine block.

COMPRESSION:—**Ratio**—6.5-1 Std., 7.5-1 Optl. HC. (HC. head requires Ethyl fuel at low altitudes).
Pressure—155 lbs. at 1000 RPM. or approximately 118-120 lbs. at cranking speed (Std. Head).

VACUUM READING:—18-20" steady idling at 7-8 MPH.

IGNITION:—**Delco-Remy Coil No. 1115129.** On dash.
Ignition Current—2.5 amperes idling, 4.5 stopped.
Ignition Switch:—Delco-Remy No. 1116306 (LHD), 1116312 (RHD). Connected to coil by armored cable.
Ignition Lock Cylinder—Briggs & Stratton 45792. Key Series—8000 to 9499. Groove—No. 15.
Distributor Delco-Remy No. 1110804. Single breaker, 8 lobe cam, full automatic advance type with auxiliary vacuum control and Gaselector adjustment.
Breaker Gap—.015". Limits .0125-.0175".
Cam Angle or Dwell—31° closed, 14° open.
Breaker Arm Spring Tension—19-23 ozs.
Rotation—Counter-clockwise viewed from above.
Condenser—Part No. 1869704. Capacity .18-.25 mfd.

Automatic Advance

Distributor Degrees	R.P.M.	Engine Degrees	R.P.M.
Start	400	4	800
7	1100	14	2200
8.5	1550	17	3100
14	2100	28	4200

Vacuum Spark Control Model 1116021. On distributor (integral type linked directly to breaker plate). Provides additional advance at speeds above idling except when engine accelerated or operated with wide open throttle when spark retarded by return spring within unit. **Plunger Travel**—7/32".

Vacuum Advance

Distr. Degrees	Eng. Degrees	Vacuum (" of HG)
Start	0°	7-9"
7.5	15°	14.5-17.5"
9-10°	18-20°	16-21"

Gaselector—Manual adjustment providing 10° advance or retard from center '0' position. See Ignition Timing for Gaselector adjustment.
Removal:—Distributor mounted on left side of engine. To remove, disconnect vacuum line, take out hold-down screw in Gaselector arm, lift distributor out.

FIRING ORDER:—1-6-2-5-8-3-7-4. See diagram.

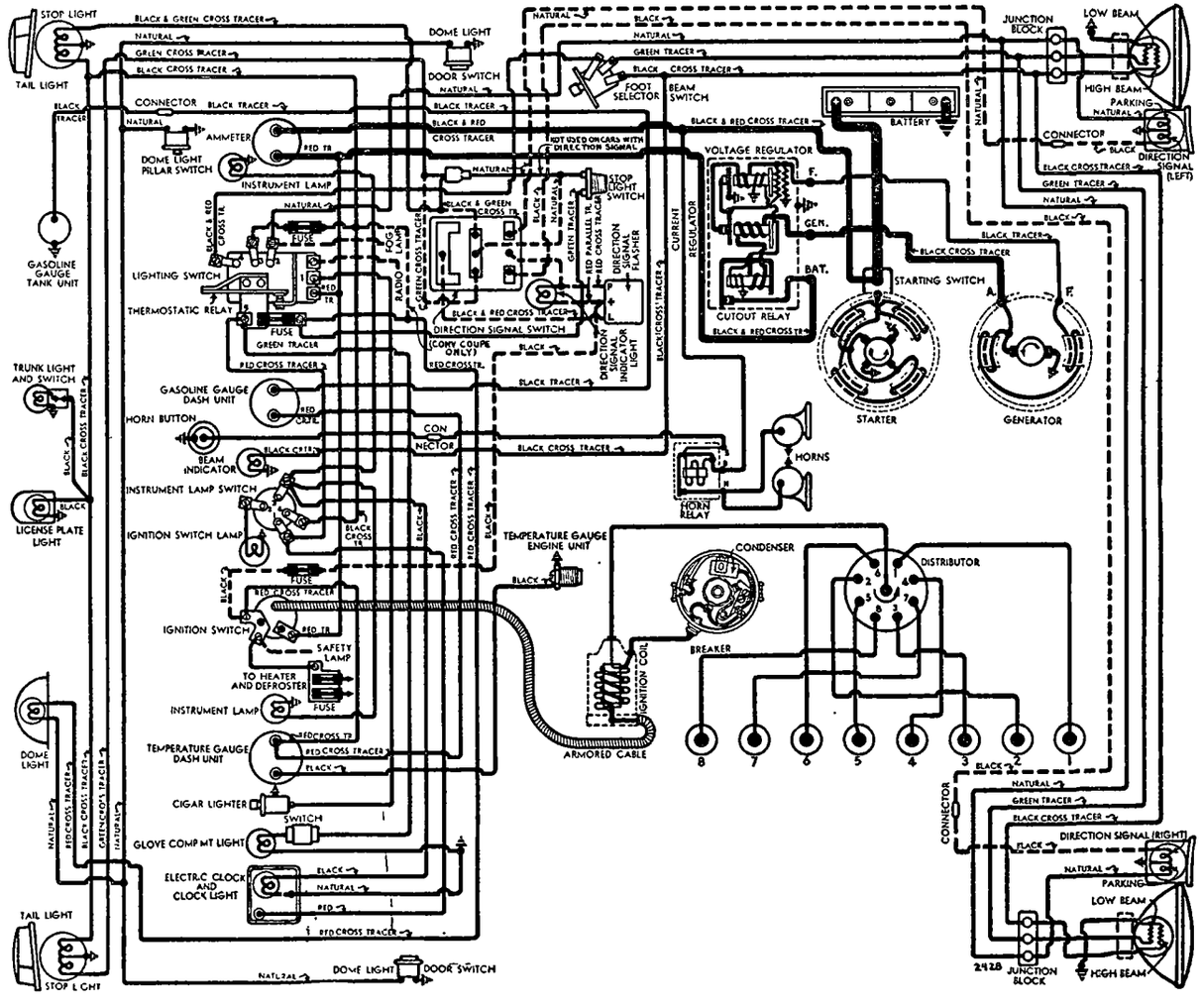
SPARK PLUGS:—AC No. 45. 14 MM. Metric.
Spark Plug Gaps—.025".

IGNITION TIMING:—Standard setting given below (regular fuel Std. Head, Ethyl fuel HC. Head). See Gaselector Setting (following) for correction and final setting.

	Flywheel Degrees	Piston Position
All Engines	6° BTDC	.0128" BTDC

Timing Mark Note—Two straight lines of ignition mark '/IGN.ONE/' indicate allowable timing range of 4° on flywheel. Use first (6°) line for setting ignition (second line is 2° before top dead center mark). NOTE—Manufacturer recommends use of HM-494 Timing Light or J-578 Synchroscope for Timing.
To Set Timing (With Timing Light)—Connect timing light between distributor terminal and ground, turn on ignition. With #1 piston on compression, turn engine over until piston is 6° or .0128" before top dead center with first line of ignition mark '/IGN.ONE/' lined up with pointer in inspection hole in left front face of flywheel housing above starter. Loosen Gaselector screw, center pointer scale ('0' mark at reference line), tighten screw. Loosen advance arm clamp bolt, rotate distributor until timing lamp lights (contacts just opening), tighten clamp bolt. Check Gaselector setting.
To Set Timing (With Synchroscope)—Connect synchroscope in series with #1 spark plug, fill in first line of ignition mark '/IGN.ONE/' with chalk or white paint, direct synchroscope light on flywheel (inspection hole on left side), idle engine at 6 MPH., adjust distributor as directed above.
Gaselector Setting—Should be set to provide best performance without spark knock or ping for particular operating conditions and octane rating of fuel used. To adjust, loosen Gaselector arm screw, move arm clockwise (toward 'ADV' end of scale) to advance spark, counter-clockwise (toward 'RET' end of scale) to retard spark, tighten locking screw.

CARBURETION:—**Carburetor**—Carter WDO Model 469-SM, 1¼" dual, downdraft type with Climatic Control. NOTE—Casting No. 306 on face of flange.
For complete data, refer to 1941 Carburetor Index.
Idle Adjustment—With engine warm so that choke valve wide open and fast idle inoperative, set throttle stopscrew for idle speed of 7-8 MPH (450-475 RPM). Adjust idle adjusting screw so that engine fires smoothly (one screw for each barrel, adjust both screws alike). Final setting for each screw should be ½-1¼ turns open from inner seated position (turn screws in for leaner mixture). Recheck idle speed. NOTE—Vacuum gauge recommended for this adjustment (see Vacuum Gauge data above).
Accelerator Pump Setting—Not adjustable.
Float Level—5/16" from top of float to machined surface of cover (remove gasket, invert to check.
Metering Rod & Jets—***See Carter Jet Table in Carburetor Section for complete data.***



Accelerator Linkage Adjustment:—Must be set to provide correct 'throttle-cracking' action for starting. To adjust, after carburetor set for correct 7-8 MPH hot or slow idle speed, disconnect battery cable at starting motor (to prevent starter cranking engine), insert .115" flat gauge between throttle lever stopscrew and carburetor stop, fully depress starter pedal, loosen locknut and adjust eccentric throttle cracker pin on starter motor lever so that all clearance between pin and lever on accelerator crossshaft taken up, tighten locknut.

Fast Idle:—Integral type (built-in carburetor).
For complete data, refer to 1941 Carb. Equip. Index.
Setting—With throttle stopscrew set for correct 7-8 MPH hot or slow idle speed, hold choke valve tightly closed, turn fast idle adjusting screw in until clearance between throttle lever stopscrew and stop on carburetor casting is .032". NOTE—This adjustment can also be made by backing off throttle stopscrew so that throttle valves tightly closed, then hold choke valve closed, turn fast idle screw in until it contacts high point of fast idle cam, then turn screw in 5/8 turn addtl. for .010" throttle opening.

Automatic Choke:—Carter Climatic Control.
For complete data, refer to 1941 Carb. Equip. Index.
Setting—2 Notches Rich.

Air Cleaner:—AC No. 1529473 oil-wetted type Std., heavy duty oil-bath type Optl. Copper gauze type cleaner installed on oil filler and crankcase ventilator cap (and in ventilator outlet pipe on cars with heavy-duty oil-bath type air cleaner). CAUTION—Filler cap must be installed with air opening in cap toward front of car and seam in line with groove in tube (may cause excessive oil consumption if installed backward).

Fuel Pump:—AC Type AJ. Diaphragm type combination fuel-and-vacuum pump.
For complete data, refer to 1941 Carb. Equip. Index.

Gasoline Gauge:—AC Electric. No. 1516295 (Dash Unit), No. 1516316 (Tank Unit).
For complete data, refer to 1941 Carb. Equip. Index.

MANIFOLD HEAT CONTROL:—Thermostatic coil type, non-adjustable (fixed anchor pin). Counterweight should be securely clamped to shaft in approximately vertical position with valve closed (cold).

VALVE TIMING:—**To Check**—With .015" tappet clearance #1 intake valve opens with piston 5° or .0089" before top dead center when first line of ignition mark '/IGN.ONE/' on flywheel is slightly past indicator (on left side—mark is 6° BTDC).

Tappet Clearance:—.011-.013" all valves Hot (.011" gauge 'go', .013" 'no go'). NOTE—.013" exhaust clearance recommended for sustained high speed.

Valve Spring Pressure:—56-63 lbs. at 1 29/32" (valve closed), 97-105 lbs. at 1 19/32" (valve open).

LUBRICATION:—**Crankcase Capacity**—6 qts.
Normal Oil Pressure—35-40 lbs. with warm oil.

COOLING SYSTEM:—**Capacity**—19½ qts.
Pressure Valve—In filler cap. Opens at 3¾ lbs.

Thermostat:—Harrison. In cylinder head outlet.
Setting—Starts to open 151°. Fully open at 173°. NOTE—Special thermostat (for use with permanent anti-freeze) opens at 160°.

Temperature Gauge:—AC Electric. No. 1511053 (Dash Unit), No. 1510772 (Engine Unit).
For complete data, refer to 1941 Mech. Equip. Index.

BATTERY:—**Delco Type 15-EZ-W.** 6 volt, 15 plate, 100 ampere hour capacity (20 hour rate).
Starting Capacity—120 amperes for 20 minutes.
Zero Capacity—300 amperes for 3.5 minutes. Five second voltage 4.25 volts.
Grounded Terminal—Negative (—) on left side of engine block. Engine Ground (Cars with Radio)—strap connector from cylinder head to steering gear
Location—On left side in engine compartment.
Police Battery Delco Model 19E-1. 6 volt, 19 plate 130 ampere hour capacity (20 hour rate).
Starting Capacity—150 amperes for 20 minutes.
Zero Capacity—300 amperes for 5.3 minutes. Five second voltage 4.55 volts.
Grounded Terminal & Location—Same as for Type 15-EZ-W above.

STARTER:—**Delco-Remy 1107921, Armature No. 1867897**
Drive—Overrunning clutch with manual pinion shift operated by starting pedal on toeboard.
Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—24-28 ozs. each.
Cranking Engine—220-225 amperes at 5 volts.

Performance Data—1107921

Torque	R.P.M	Volts	Amperes
0 ft. lbs	6000	5.0	60
16 "	Lock	3.0	600

Removal:—Starter flange mounted on left front face of flywheel housing. To remove, take out flange mounting screws.

Starting Switch (1107921):—No. 820052. Mounted on starter and operated by starting pedal.

GENERATOR:—**Delco-Remy 1102665, Armature 1879002 (Std.), Model 1106403 (Police).** Two brush type with current and voltage regulation.
Charging Rate Adjustment—None. Charging rate controlled by Voltage Regulator, maximum output by Current Regulator. See Regulator data below.
Maximum Charging Rate—30 amperes, 8.0 volts, 1700 RPM (1102665 Gen.), 1040 RPM (1106403 Gen.) and above (Current Regulator Setting) with load or discharged battery. Actual charging rate controlled by Voltage Regulator and dependent on battery

Performance Data—1102665

	Amperes	Volts	R.P.M.
Cold	30①	8.0	1750

Performance Data—1106403

Cold	35①	8.0	1040

①Not maximum output. See Current Regulator.

Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—24 ounces each.
Field Current—1.67-1.82 amperes (1102665), 1.77-2.0 amperes (1106403) at 6.0 volts.

Removal:—Generator pivot mounted on left front of engine. To remove, take out pivot and clamp bolts.

Belt Adjustment:—Belt deflection or sideplay midway between generator & pump pulley should be 1½".

REGULATOR:—**Delco-Remy 1118201 (1102665 Gen.), 1118229 (1106403 Gen.). Single Core Type.** Vibrating Current & Voltage Regulator in case on dash.
For complete data, refer to 1941 Elec. Equip. Index.
CAUTION—Check generator for grounded field coils and leads before changing regulator settings to correct High Charging Rate or High Voltage.

Cutout Relay
Cuts In—6.2-6.7 volts hot.
Cuts Out—0-4.0 ampere discharge current.
Contact Gap—.020" (same for both sets).
Air Gap—.020" (with contacts just closed).

Voltage Regulator
Setting—7.2-7.4 volts (1118201), 7.0-7.2 volts (1118229) hot (operating temperature). Regulator should be checked Hot and with cover in place.
To Check—Connect ammeter in charging line at regulator 'BAT' terminal, voltmeter between this terminal and ground. Operate generator at 2800 RPM., adjust charging rate to 8-10 amperes (use variable rheostat or AVR set). With regulator hot (150°F.), decrease generator speed until cutout relay contacts open, then increase speed to 2800 RPM. and check hot voltage setting (above).
To Adjust—Change regulator armature spring tension slightly by bending hanger at lower end of **one spring only.** If further adjustment required, see Single Core Regulator article in Electrical Equipment Section for other (2nd.) spring adjustment.
Air Gap—.070" between center of core and armature with contacts just closing (press down on armature to open contacts, release pressure, check gap at point where contacts just close).

Current Regulator
Setting—32-34 amperes (1118201), 34-36 amperes (1118229) hot (operating temp.).
To Check—Remove regulator cover, connect short jumper between Voltage Regulator frame and upper contact support bracket (to short out Voltage Regulator), connect ammeter in charging line at regulater 'BAT' terminal, turn on car lights and accessories. Operate generator and increase speed until output remains constant. With regulator hot (150°F), current reading should agree with setting (above).
To Adjust—Same as for Voltage Regulator (above).
Air Gap—.080" (check same as Voltage Regulator).

LIGHTING:—**Headlamps**—Guide 'Sealed Beam' type.
For complete data, refer to 1941 Elec. Equip. Index.
Headlamp Adjustment—Aim upper beam straight ahead (hot spot center 3" below lamp center hght.).
Beam Indicator—Pontiac emblem on face of speedometer dial. Lighted when upper beams in use.
Direction Signal—*Refer to 1941 Elec. Equip. Index.*

Switches
Lighting—Delco-Remy 1995018.
Beam Selector—Delco-Remy 1997002 (LHD cars), 465-V (RHD cars).
Instrument—Delco-Remy 1997740.
Stop Light—Delco-Remy 1997725.

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps		Sealed Beam
Park & Frt. Direc. Signal	21-3	1154
Park (Without Signal)	3	63
Instrument, Ign. Lock	1½	55
Beam & Direc. Signal Ind.	1	51
Stop & Tail	21-3	1154
Rear License Plate	3	63
Dome	6	82
Dome (Convertible)	1½	55

THERMOSTATIC RELAY:—On lighting switch. Contacts remain closed with 30 amperes, open in 3 minutes with current of 42 amperes at 70°F. Not adj.

FUSES:—**Tail & Instrument Light**—9 ampere. In connector in lead near lighting switch.
Stop & Dome Light—9 ampere. On lighting switch.
Heater & Defroster— 9 ampere each. On fuse block on instrument panel brace to left of ignition switch.
Direction Signal—9 ampere. In connector in feed wire between flasher and ignition switch.
Radio—9 ampere (Master), 14 ampere (Deluxe), 20 ampere (Super Deluxe type).

HORNS:—**Delco-Remy No. 1999519 (Low Note), 1999520 (High Note).** Vibrator type, blended tone, twin horns operated by relay.

Type	Current (at 6 volts)	Air Gap
1999519 (low note)	19-21 amperes	.045-.049"
1999520 (high note)	17-19 amperes	.035-.039"

Horn Relay:—Delco-Remy No. 1116775.
Contact Gap—.015-.020". **Air Gap**—.015" (closed).
Contacts Close—2.5-3.5 volts.

HOOD LOCK:—Alligator type hood. Button under instrument panel on left side (right side on RHD cars). Pull button out (hood will raise slightly), pull forward on safety catch under front end of hood.

SERIAL NUMBER:—First number 90101 (South Bend), 811201 (Los Angeles). Stamped on plate on left front door hinge pillar post.

ENGINE NUMBER:—First number 101201. Stamped on pad on upper left front corner of engine block.

COMPRESSION:—**Ratio**—6.5-1 std. cast-iron head.
Pressure—105 lbs. at cranking speed of 150 RPM.

VACUUM READING:—Steady 17-18" at 8 MPH idle spd.

IGNITION:—**Coil Model CE-4646.** Mounted on engine. Service coil (less switch & cable) CE-3224WS.
Ignition Current—½-1½ amps. idling, 4-5 stopped.
Ignition Switch:—Mitchellock Model 24-R, No. 8771.
Ignition Lock—Yale & Towne. Mitchell No. 8414.
Distributor Auto-Lite IGW-4154. Single breaker, 6 lobe cam, full automatic advance type with separate vacuum spark control and Octane Selector.
Breaker Gap—Set at .020".
Breaker Arm Spring Tension—17-20 ounces.
Cam Angle or Dwell—35° closed, 25° open (distr.).
Rotation—Counter-clockwise viewed from the top.
Condenser—No. IGB-1025. Capacity .20-.25 mfd.

Automatic Advance

Distributor Degrees	R.P.M	Engine Degrees	R.P.M.
Start	400	0	800
2	680	4	1360
4	975	8	1950
6	1265	12	2530
7	1400	14	2800

Vacuum Spark Control VC-4011—Mounted on hold-down plate and linked to advance plate. Provides additional advance at speeds above idling except when engine accelerated or operated with wide open throttle (spark retarded by return spring in unit).

Vacuum Advance

Distr. Degrees	Eng. Degrees	Vacuum (" of HG)
Start	0°	4"
2°	4°	5½"
5°	10°	7¾"
7°	14°	11¼"
9°	18°	14¾"

Octane Selector—Provides manual adjustment at distributor (hold-down plate marked with scale) for variation in timing depending on fuel regularly used. See Ignition Timing following for adjustment.

Distributor Removal:—Mounted on left side of engine. To remove, disconnect vacuum line, take out bolt in clamp arm, lift distributor off.

Installation Note—When installing distributor, crank engine to firing position for #1 cylinder (flywheel mark 'IGN' in line with pointer on left rear engine plate), sight down distributor shaft hole (distributor out) and see that distributor drive tongue in oil pump drive gear is parallel to and narrow half of offset toward camshaft, turn rotor to #1 segment, install distributor (insert .020" feeler between modifier control arm and clamp arm before tightening the clamp, to prevent binding), check timing.

FIRING ORDER:—1-5-3-6-2-4. See diagram.

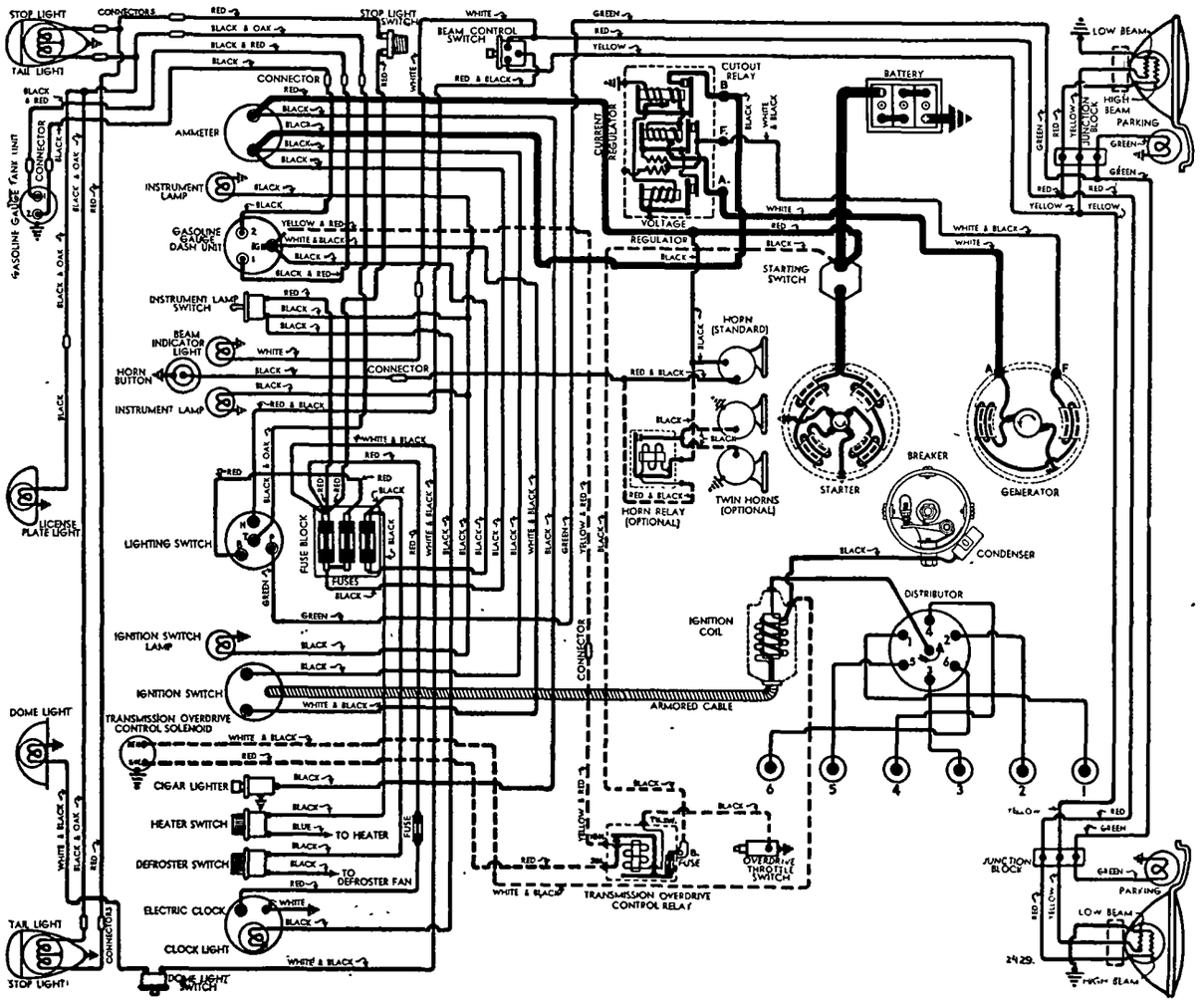
SPARK PLUGS:—Champion No. J-8. 14 MM. Metric.
Spark Plug Gaps—Set at .025".

IGNITION TIMING:—Initial setting for regular fuel (see Octane Selector Setting following for correction dependent on fuel regularly used).

Flywheel Degrees	Piston Position
2° BTDC	.0016" BTDC

Timing (with Neon Timing Light)—Neon Light No. 890 recommended. Clip Neon light lead in series with #1 spark plug, idle engine and direct Neon light on flywheel inspection hole on left rear motor support. Loosen hold-down plate screw, center scale on pointer, tighten screw. Loosen clamp arm, rotate distributor until 'IGN' mark on flywheel (approx. 13/64" before top dead center mark 'U.D.C.1-6') lines up with pointer on engine rear plate. Insert .020" feeler between modifier control arm and clamp arm before tightening clamp (to insure clearance for modifier control arm). Check Octane Selector Setting (following).
Timing (without Neon Timing Light)—Turn engine over to firing position for #1 piston with 'IGN' mark on flywheel in line with pointer on inspection hole on left rear motor support and distributor rotor at #1 segment in distributor cap. Adjust distributor as directed above.
Octane Selector Setting—After setting ignition timing (above), loosen selector hold-down screw, advance selector (move toward 'A' end of scale) until motor 'pings' when it is hot and pulling hard. Then retard (move selector pointer toward 'R' end of scale) until 'ping' just disappears.

CARBURETION:—**Carburetor**—Carter Type WA-1 Model 496-S (#356 cast on face of flange). 1¼" single barrel downdraft type with Carter Climatic Control.
For complete data, refer to 1941 Carburetor Index.



Idle Adjustment—With engine warm and running at slow idle speed (choke valve wide open, fast idle inoperative, set throttle stopscrew for 8 MPH idle speed. Adjust idle adjusting screw until engine fires smoothly (½-1½ turns open—turn screw in for leaner mixture). Readjust idle speed.
Accelerating Pump—Non-adjustable type.
Float Level—5/16" from top of projection on bowl cover to top of soldered seam on float at free end with needle valve seated (invert cover assembly to check level).
Metering Rods & Jets—*See Carter Jet Table in Carburetor Section for complete data.*

Fast Idle:—Integral type (built-in carburetor).
For complete data, refer to 1941 Carb. Equip. Index.
Setting—Adjust by bending connector rod offset for ⅝" choke valve opening with throttle stopscrew against (not on) first step of fast idle cam.

Automatic Choke:—Carter Climatic Control.
For complete data, refer to 1941 Carb. Equip. Index.
Setting—Coil housing centered (at index mark).

Air Cleaner:—AC #1529210 oil-wetted type standard. Heavy duty oil-bath type optional. Oil filler cap equipped with copper mesh type cleaner.

Fuel Pump:—AC Type AE, diaphragm type. Replacement Part No. 527.
For complete data, refer to 1941 Carb. Equip. Index.

Gasoline Gauge:—Auto-Lite electric type. No. NG-9594D (dash unit), No. NG-9197T (tank unit).
For complete data, refer to 1941 Carb. Equip. Index.

MANIFOLD HEAT CONTROL:—Thermostatic coil type. **Setting**—To test coil tension, unhook coil from pin. With valve closed (counterweight up), hooked end of coil should be approximately 90° away from pin with coil at 70°F. Replace coil if angle incorrect. If valve sticks, shaft should be lubricated with kerosene and baking soda solution (for shafts which are badly stuck, remove shaft and turn shaft down to give .005" clearance—shaft bore in manifold should not be disturbed).

VALVE TIMING:—To Check—With .020" tappet clearance #1 intake valve should open with #1 piston 15° or .0893" BTDC with flywheel mark 'IN.OP.1-6/' aligned with pointer on left rear engine plate. Reset tappet clearance at .016" (cold).

Tappet Clearance:—.016" all valves with engine cold. NOTE—Self-locking tappet screws used (no locknuts).

Valve Spring Pressure:—49-53 lbs. at 1 21/32" (valve closed), 90-94 lbs. at 1 11/32" (valve open).

LUBRICATION:—Crankcase Capacity—5 quarts.
Normal Oil Pressure—40 lbs. at 25-30 MPH.

COOLING SYSTEM:—Capacity—10½ quarts.
Thermostat:—Bishop & Babcock. In cylinder head water outlet. **Setting**—Starts to open 151-155°F.
Temperature Gauge:—Auto-Lite (Motometer) Vapor tension type. A-L Part No. H-9593.
For complete data, refer to 1941 Mech. Equip. Index.

TRANSMISSION OVERDRIVE CONTROL:—Electric type with accelerator pedal 'kick-down' control.
For complete data, refer to 1941 Mech. Equip. Index.
Overdrive Solenoid—Delco-Remy Model 1118013.
Throttle Switch—Cole-Hersee No. 1687-S. Adjust so that shoe on accelerator linkage just contacts switch plunger with throttle valve wide open.
Control Relay—Auto-Lite HR-4201S. 14 ampere fuse mounted in holder on relay.

BATTERY:—Willard, Type WHT-1-13R. 6 volt, 13 plate, 90 Ampere Hour capacity (20 hour rate).
Starting Capacity—114 amperes for 20 minutes.
Zero Capacity—300 amperes for 3.0 minutes. Five second voltage 4.1 volts.
Grounded Terminal—Positive (+) to frame.
Engine Ground—Strap at right front motor support.
Dimensions—Length 9". Width 7". Height 9⅜".
Location—On left side under engine hood.

STARTER:—Auto-Lite MZ-4090. Armature MZ-2130.
Drive—Barrel type Bendix. Special inboard type A-2033 (marked 'D' on pinion barrel).
Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—42-53 ozs. (new brushes).
Cranking Engine—160 amperes, 5.2 volts, 130 RPM.

Performance Data

Torque	R.P.M	Volts	Amperes
0 ft. lbs.	4300	5.5	70
0.65 " "	2500	5.5	100
2.55 " "	1325	5.0	200
4.95 " "	750	4.5	300
7.65 " "	220	4.0	400
7.8 " "	Lock	3.0	420
11.8 " "	Lock	4.0	560

Removal:—Starter flange mounted on right rear engine plate. To remove take out mounting bolts and lift starter off.

Starting Switch:—A-L Model SW-4011. Mounted on left side of car below clutch pedal. Operated by depressing clutch pedal fully.

GENERATOR:—Auto-Lite GDZ-4804A. Armature GDZ-2006F. Two brush type with current-voltage control.
Charging Rate Adjustment—No adjustment at generator. Charging rate controlled by Voltage Regulator and maximum output by Current Regulator.
See Regulator data following.
Maximum Charging Rate—35 amperes, 8.0 volts, 1600 gen. RPM or approx. 18.3 MPH and above with load or discharged battery (Current Regulator Setting). Actual charging rate controlled by Voltage Regulator and dependent on battery condition.

Performance Data

Cold			Hot		
Amperes	Volts	R.P.M.	Amperes	Volts	R.P.M.
0	6.4	925	0	6.4	1000
4	6.6	1035	4	6.6	1120
8	6.75	1140	8	6.75	1235
12	6.95	1250	12	6.95	1350
16	7.15	1370	16	7.15	1460
20	7.3	1480	20	7.3	1590
24	7.5	1590	24	7.5	1730
28	7.7	1710	28	7.7	1900
32	7.9	1820	32	7.9	2090
35	8.0	1900	35	8.0	2250

Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—53 ozs. max. (new brushes).
Field Current—1.60-1.78 amperes at 6.0 volts.
Motoring Current—4.16-4.60 amperes at 6.0 volts.

Removal:—Pivot mounted at left front of engine. To remove, take out pivot and clamp bolts.

Belt Adjustment:—Loosen pivot and clamp bolts, move generator out until ⅜-½" belt deflection midway between generator and fan pulleys is obtained.

REGULATOR:—Auto-Lite VRP-4004F. Current-Voltage type. In a single case mounted on engine dash.
For complete data, refer to 1941 Elec. Equip. Index.
NOTE—Regulator case cover sealed. Serviced on exchange basis if seals not broken (to remove cover).

Cutout Relay
Cuts In—6.4-6.6 volts.
Cuts Out—4.8-5.6 volts (approx. 4-6 amps. disch.).
Contact Gap—.015" minimum.
Air Gap—.031-.034" with contacts open (check at hinge end of core).

Voltage Regulator
Setting—7.2-7.5 volts at 70° F. See Electrical Equipment Section for settings at other temperatures.
To Check (without breaking seals)—Connect ammeter in charging line at regulator 'B' terminal (use short heavy leads), voltmeter between 'B' terminal and ground. Operate generator at speed equivalent to 30 MPH., charging fully charged battery, until voltage is steady. Voltage reading should agree with setting given above.
To Adjust (with cover removed)—Change regulator armature spring tension by bending lower spring hanger slightly. See Electrical Equipment Section.
Contact Gap—.012" min. (armature against stop pin).
Air Gap—.048-.052" with contacts just opening.

Current Regulator
Setting—34-36 amperes (marked '35' on the cover).
To Check (without breaking seals)—Connect test meters as for voltage check (above). Operate generator at speed equivalent to 30 MPH. charging battery, turn on car lights and accessories or connect load (bank of headlamp bulbs etc.) between ammeter and battery so that generator charges at peak rate and Current Regulator operates. Current reading should agree with setting given above. If more than slight excess noted, regulator is defective.
To Adjust (with cover removed)—Same as for Voltage Regulator (above).
Contact Gap & Air Gap—Same as Voltage Regulator.

LIGHTING:—Headlamps—Corcoran-Brown 'Sealed Beam' type. *For data, refer to Elec. Equip. Index.*
Headlamp Adjustment—Aim upper beam straight ahead (hot spot center 3" below lamp center hght.).
Beam Indicator—At top center of speedometer dial. Lighted whenever Country (upper) beam in use.

Switches
Lighting—Douglas.
Beam Selector—Delco-Remy Model 1997002.
Instrument—Douglas.

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps		Sealed Beam
Parking, Instrument	1½	55
Beam Indicator	1	51
Stop & Tail	21-3	1158
Rear License	3	63
Dome	15	87

FUSES:—Lighting—Three 20 ampere. On fuse block on back of instrument panel at center. Protects circuits as follows: **Top**—Clock, Instrument, Dome, and Stop Lamps. **Center**—Head & Tail lamps. **Lower**—Heater and Defroster.
Transmission Overdrive Control—14 amp. On relay.
Clock—2 ampere. In clock lead connector.

HORNS:—Single—Delco-Remy 1999807 standard.
Dual—Delco-Remy 1999511 (low note), 1999512 (high note), electric, air tone horns operated by relay.

Type	Current (at 6 volts)	Air Gap
1999807	7-9 amperes	.027-.033"
1999511 (low note)	19-21 amperes	.044-.049"
1999512 (high note)	18-20 amperes	.034-.039"

Horn Relay:—R-B-M Model 6003.
Contacts Close—3-4 volts (with relay upright).

STUDEBAKER 1941

COMMANDER, MODEL 11A
AUTO-LITE ELECTRICAL SYSTEM

HOOD LOCK:—Alligator type hood. Button under instrument panel on left side (right side on RHD cars). Pull button out (hood will raise slightly), pull forward on safety catch under front end of hood.

SERIAL NUMBER:—First number 4178801 (South Bend), 4811901 (Los Angeles). Stamped on plate on left front door hinge pillar post.

ENGINE NUMBER:—First number H-122201. Stamped on upper left side of cylinder block at center.

COMPRESSION:—**Ratio**—6.5-1 Std., 7.0-1 Optl. hds. **Pressure**—105 lbs. at 150 RPM (for Std. head).

VACUUM READING:—Steady 18-20" idling at 7-8 MPH.

IGNITION:—**Coil Model IG-4667.** Mounted on engine. Service coil (less switch and cable) IG-3224VS.

Ignition Current—½-1½ amps. idling, 4-5 stopped.

Ignition Switch:—Mitchellock Model 24-R, No. 8775.

Ignition Lock—Yale & Towne. Mitchell No. 8414.

Distributor Auto-Lite IGW-4101. Single breaker, 6 lobe cam, full automatic advance type with separate vacuum spark control and Octane Selector.

Breaker Gap—Set at .020".

Breaker Arm Spring Tension—17-20 ounces.

Cam Angle or Dwell—35° closed, 25° open (distr.).

Rotation—Counter-clockwise viewed from the top.

Condenser—No. IGB-1025. Capacity .20-.25 mfd.

Automatic Advance

Distributor Degrees	R.P.M.	Engine Degrees	R.P.M.
Start	400	0	800
2	600	4	1200
5	900	10	1800
8	1200	16	2400
10	1400	20	2800

Vacuum Spark Control VC-4004—Mounted on hold-down plate and linked to advance plate. Provides additional advance at speeds above idling except when engine accelerated or operated with wide open throttle (spark retarded by return spring in unit).

Vacuum Advance

Distr. Degrees	Eng. Degrees	Vacuum (" of HG)
Start	0°	3"
2°	4°	5"
3°	6°	6"
5°	10°	10"
6°	12°	12"

Octane Selector—Provides manual adjustment at distributor (hold-down plate marked with scale) for variation in timing depending on fuel regularly used. See Ignition Timing following for adjustment.

Distributor Removal:—Mounted on left side of engine. To remove, disconnect vacuum line, take out bolt in clamp arm, lift distributor off.

Installation Note—When installing distributor, crank engine to firing position for #1 cylinder ('IGN' on vibration dampener in line with pointer on timing gear cover), sight down distributor shaft hole (distributor out) and see that distributor drive tongue in oil pump drive gear is 30° from the horizontal and offset toward the top, turn rotor to #1 segment, install distributor (insert .020" feeler between modifier control arm and clamp arm before tightening the clamp, to prevent binding), check timing.

FIRING ORDER:—1-5-3-6-2-4. See diagram.

SPARK PLUGS:—Champion No. 8. 18 MM. Metric.

NOTE—Champion No. 7 or 13 (colder plugs) may be used for extremely fast driving in hot weather.

Spark Plug Gaps—Set at .025" (.0225-.0275").

IGNITION TIMING:—Initial setting for regular fuel (see Octane Selector Setting following for correction dependent on fuel regularly used).

	Flywheel Degrees	Piston Position
All Engines	2° BTDC	.0016" BTDC

Timing (with Neon Timing Light)—Neon Light No. 890 recommended. Clip Neon light lead in series with #1 spark plug, idle engine and direct light on vibration dampener (at pointer on timing gear cover). Loosen hold-down plate screw, center scale on pointer, tighten screw. Loosen clamp arm, rotate distributor until 'IGN' mark on vibration dampener lines up with pointer on timing gear cover. Insert .020" feeler between modifier control arm and clamp arm before tightening clamp (to insure clearance for modifier control arm). Check Octane Selector Setting (following).

Timing (without Neon Timing Light)—Turn engine over to firing position for #1 piston with 'IGN' mark on vibration dampener in line with pointer on timing gear cover and distributor rotor opposite #1 segment in distributor cap. Adjust distributor as directed above.

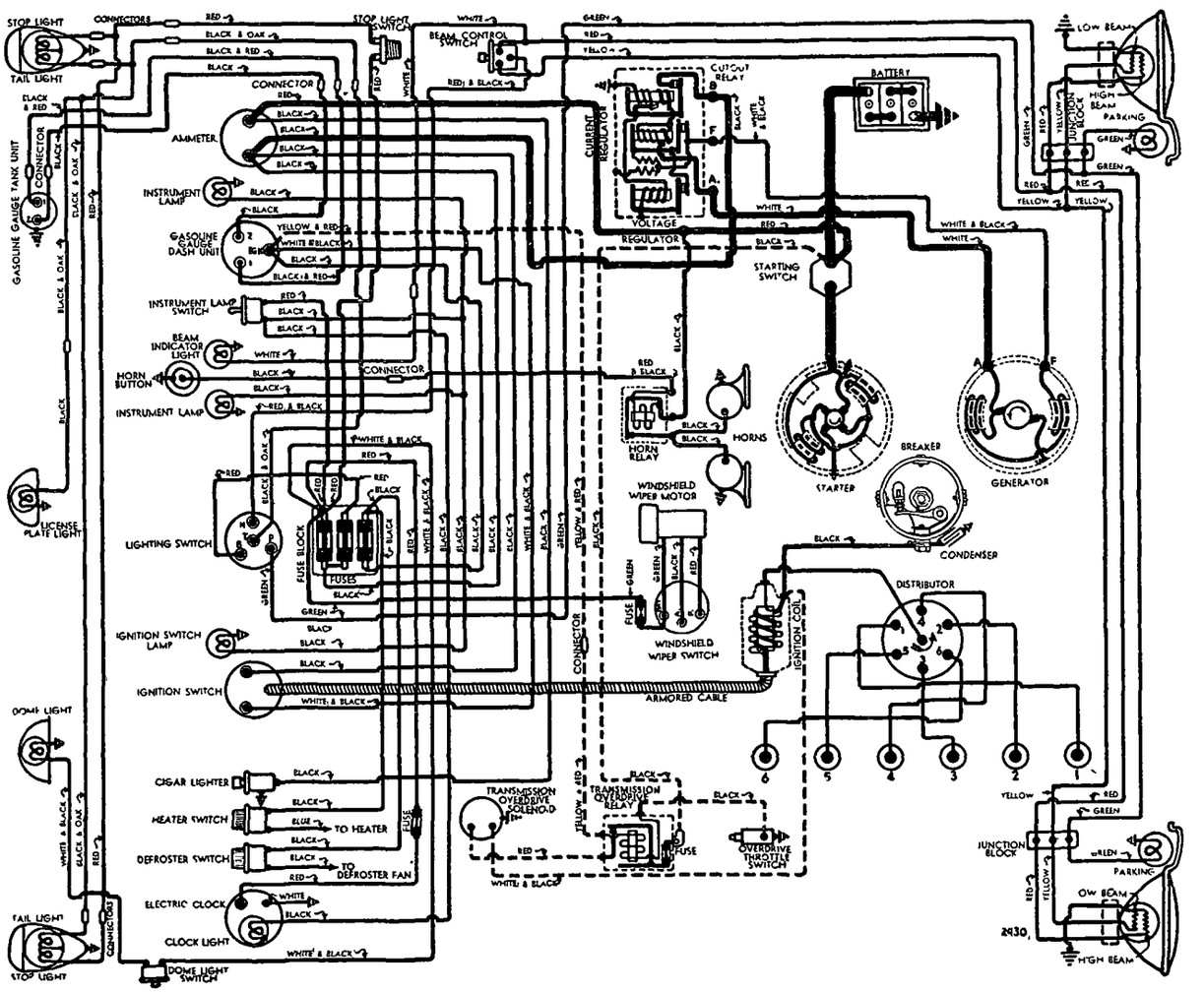
Octane Selector Setting—After setting ignition timing (above), loosen selector hold-down screw, advance selector (move toward 'A' end of scale) until motor 'pings' when it is hot and pulling hard. Then retard (move selector with pointer toward 'R' end of scale) until 'ping' just disappears.

CARBURETION:—**Carburetor**—Carter Type WA-1 Model 410-S or Stromberg Model BXOV-26 (code marked 6-98). 1¼" single barrel, downdraft types. ***For complete data, refer to 1941 Carburetor Index.***

Idle Adjustment—With engine warm and running at slow idle speed (choke valve wide open, fast idle inoperative), set throttle stopscrew for 8 MPH idle speed. Adjust idle screw until engine fires smoothly (½-1¼ turns open for Carter—turn screw in for leaner mixture). Readjust idle speed.

Accelerating Pump Setting—3 holes provided in pump arm (Carter), pump lever (Stromberg) for pump rod engagement. Set as follows:

Inner—Min.: Hot weather, hi-test gasoline.
Center—Med.: Std. all-year setting.
Outer—Max.: Cold weather, low-test gasoline.



Float Level (All Carburetors)—As follows:
Carter—¼" from top of projection on bowl cover to top of soldered seam on float at free end with needle valve seated (invert cover assembly to check).
Stromberg—Fuel level ⅝" below top edge of bowl with engine idling (3 lbs. pressure).
Metering Jets & Rods—*See Carter & Stromberg Jet Tables in Carburetor Section for data.*

Fast Idle (All Carburetors):—Integral types.
For complete data, refer to 1941 Carb. Equip. Index.
Setting (Carter)—Adjust by bending connector link offset for ⅝" choke valve opening with throttle stopscrew against (not on) first step of fast idle cam.
Setting (Stromberg)—To check, hold throttle stopscrew against lowest step of fast idle cam, close choke valve until lip of next step on cam touches screw, check valve opening with 11/32" drill. Adjust by bending connector link.

Automatic Choke (All Carburetors):—Climatic Control (Carter), BXOV-26 Type (Stromberg). Built-in carburetor.
For complete data, refer to 1941 Carb. Equip. Index.
Setting (Carter)—Set coil housing 1 Notch Rich.
Setting (Stromberg)—'R' mark on thermostat cover in line with highest projection on housing. Shift to 'M' if engine loads up or overchokes. Use 'H' setting only if highly volatile fuels used.

Air Cleaner:—AC #1528630 oil-wetted type standard. Heavy duty oil-bath type optional. Oil filler cap equipped with copper mesh type cleaner.

Fuel Pump:—AC Type AE, diaphragm type. Replacement Part No. 540.
For complete data, refer to 1941 Carb. Equip. Index.

Gasoline Gauge:—Auto-Lite electric type, No. NG-9594D (dash unit), No. NG-9659T (tank unit).
For complete data, refer to 1941 Carb. Equip. Index.

MANIFOLD HEAT CONTROL:—Thermostatic coil type.
Setting—To test coil tension, free outer end of coil from bracket on manifold. With valve closed, hooked end of coil should be approx. 90° from bracket with coil at 70°F. Replace coil if angle incorrect. If valve sticks, shaft should be lubricated with kerosene and baking soda solution (for shafts which are badly stuck, remove shaft and turn shaft down to give .005" clearance—shaft bore in manifold should not be disturbed). See that tension spring (from shaft to clip on manifold) is in place.

VALVE TIMING:—To Check—With .020" tappet clearance #1 intake valve should open with #1 piston 15° or .0942" BTDC with vibration dampener mark 'IN.OP.1-6/' aligned with pointer on timing gear cover. Reset tappet clearance at .016" (cold).
Tappet Clearance:—.016" all valves with engine cold.
Valve Spring Pressure:—54-60 lbs. at 2 3/32" (valve closed). 125-135 lbs. at 1¾" (valve open).

LUBRICATION:—Crankcase Capacity—6 quarts.
Normal Oil Pressure—40 lbs. at 25-30 MPH.

COOLING SYSTEM:—Capacity—13 quarts.
Thermostat:—Bishop & Babcock or Fulton. In cylinder head water outlet.
Setting—Starts to open 151-155°F.
Temperature Gauge:—Auto-Lite (Motometer) Vapor tension type. A-L Part No. H-9593.
For complete data, refer to 1941 Mech. Equip. Index.

TRANSMISSION OVERDRIVE CONTROL:—Electric type with accelerator pedal 'kick-down' control.
For complete data, refer to 1941 Mech. Equip. Index.
Overdrive Solenoid—Delco-Remy Model 1118013.
Throttle Switch—Cole-Hersee No. 1687-S. Adjust so that shoe on accelerator linkage just contacts switch plunger with throttle valve wide open.
Control Relay—Auto-Lite HR-4201S. 14 ampere fuse mounted in holder on relay.

BATTERY:—Willard Type WHT-1-15R. 6 volt, 15 plate, 95 ampere hour capacity (20 hour rate).
Grounded Terminal—Positive (+) grounded to frame.
Engine Ground—Strap at right front motor support.
Location—In engine compartment on left side.

STARTER:—Auto-Lite MAW-4020. Armature MAW-2091.
Drive—Outboard Barrel Type Bendix No. A-1729.
Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—42-53 ozs. (new brushes).
Cranking Engine—130 RPM, approx. 175 amperes at 5.0-5.5 volts.

Performance Data

Torque	R.P.M	Volts	Amperes
0 ft. lbs.	4900	5.5	65
0.60 "	3300	5.5	100
2.75 "	1480	5.0	200
5.45 "	820	4.5	300
8.50 "	400	4.0	400
11.55 "	110	3.5	500
11.5 "	Lock	3.0	505
18.0 "	Lock	4.0	670

Removal:—Starter flange mounted on engine rear plate, on left side. To remove, take out flange mounting screws, remove starter assembly.
Starting Switch:—A-L Model SW-4011. On left side of car below clutch pedal. Operated by depressing clutch pedal fully. RHD cars starters operated by pushbutton switch on instrument panel.

GENERATOR:—Auto-Lite GDZ-4805A. Armature GDZ-2006F. Two brush type with current-voltage control.
Charging Rate Adjustment—No adjustment at generator. Charging rate controlled by Voltage Regulator and maximum output by Current Regulator.
See Regulator data following.
Maximum Charging Rate—35 amperes, 8.0 volts, 1800 gen. RPM or approx. 20 MPH and above with load or discharged battery (Current Regulator Setting). Actual charging rate controlled by Voltage Regulator and dependent on battery condition.

Performance Data

Cold			Hot		
Amperes	Volts	R.P.M.	Amperes	Volts	R.P.M.
0	6.4	925	0	6.4	1000
4	6.6	1035	4	6.6	1120
8	6.75	1140	8	6.75	1235
12	6.95	1250	12	6.95	1350
16	7.15	1370	16	7.15	1460
20	7.3	1480	20	7.3	1590
24	7.5	1590	24	7.5	1730
28	7.7	1710	28	7.7	1900
32	7.9	1820	32	7.9	2090
35	8.0	1900	35	8.0	2250

Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—53 ozs. max. (new brushes).
Field Current—1.60-1.78 amperes at 6.0 volts.
Motoring Current—4.16-4.60 amperes at 6.0 volts.
Removal:—Pivot mounted at left front of engine. To remove, take out pivot and clamp bolts.
Belt Adjustment:—Loosen pivot and clamp bolts, move generator out until ⅜-½" belt deflection midway between generator and fan pulleys is obtained.

REGULATOR:—Auto-Lite VRP-4004F. Current-Voltage type. In a single case mounted on engine dash.
For complete data, refer to 1941 Elec. Equip. Index.
NOTE—Regulator case cover sealed. Serviced on exchange basis if seals not broken (to remove cover).

Cutout Relay
Cuts In—6.4-6.6 volts.
Cuts Out—4.8-5.6 volts (approx. 4-6 amps. disch.).
Contact Gap—.015" minimum.
Air Gap—.031-.034" with contacts open (check at hinge end of core).

Voltage Regulator
Setting—7.2-7.5 volts at 70° F. See Electrical Equipment Section for settings at other temperatures.
To Check (without breaking seals)—Connect ammeter in charging line at regulator 'B' terminal (use short heavy leads), voltmeter between 'B' terminal and ground. Operate generator at speed equivalent to 30 MPH., charging fully charged battery, until voltage is steady. Voltage reading should agree with setting given above.
To Adjust (with cover removed)—Change regulator armature spring tension by bending lower spring hanger slightly. See Electrical Equipment Section.
Contact Gap—.012" min. (armature against stop pin).
Air Gap—.048-.052" with contacts just opening.

Current Regulator
Setting—34-36 amperes (marked '35' on the cover).
To Check (without breaking seals)—Connect test meters as for voltage check (above). Operate generator at speed equivalent to 30 MPH. charging battery, turn on car lights and accessories or connect load (bank of headlamp bulbs etc.) between ammeter and battery so that generator charges at peak rate and Current Regulator operates. Current reading should agree with setting given above. If more than slight excess noted, regulator is defective.
To Adjust (with cover removed)—Same as for Voltage Regulator (above).
Contact Gap & Air Gap—Same as Voltage Regulator.

LIGHTING:—Headlamps—Corcoran-Brown 'Sealed Beam' type. *For data, refer to Elec. Equip. Index.*
Headlamp Adjustment—Aim upper beam straight ahead (hot spot center 3" below lamp center hght.).
Beam Indicator—At top center of speedometer dial. Lighted whenever Country (upper) beam in use.

Switches
Lighting—Douglas.
Beam Selector—Delco-Remy Model 1997002.
Instrument—Douglas.

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps		Sealed Beam
Parking, Instrument	1½	55
Beam Indicator	1	51
Stop & Tail	21-3	1158
Rear License	3	63
Dome	15	87

FUSES:—Lighting—Three 20 ampere. On fuse block on back of instrument panel at center. Protects circuits as follows: **Top**—Clock, Dome, Stop, Instrument Lamps and Windshield Wiper (see below). **Center**—Head & Tail lamps. **Lower**—Heater and Defroster.
Overdrive Relay—14 ampere. In clip on relay.
Windshield Wiper—14 ampere. In feed wire.
Clock—2 ampere. In clock lead connector.

HORNS:—Delco-Remy—Electric type, air tone, dual horns operated by relay.

Type	Current (at 6 volts)	Air Gap
1999511 (low note RH)	19-21 amperes	.044-.049"
1999512 (high note LH)	18-20 amperes	.034-.039"

Horn Relay:—R-B-M Model 6003.
Contacts Close—3-4 volts (with relay upright).

WINDSHIELD WIPER:—Auto-Lite Model EWD-5002. Electric type with 14 amp. fuse in feed wire.
For complete data, refer to 1941 Mech. Equip. Index.

HOOD LOCK:—Alligator type hood. Button under instrument panel on left side (right side on RHD cars). Pull button out (hood will raise slightly), pull forward on safety catch under front end of hood.

SERIAL NUMBER:—First number 7139101 (South Bend), 7803901 (Los Angeles). Stamped on plate on left front door hinge pillar post.

ENGINE NUMBER:—First number B-45001. Stamped on upper left side of cylinder block at center.

COMPRESSION:—Ratio—6.5-1 Std. cast-iron head. **Pressure**—105 lbs. at 150 RPM cranking speed.

VACUUM READING:—Steady 18-20" idling at 8 MPH.

IGNITION:—Coil Model CE-4647. Mounted on dash. Service coil (less switch and cable) CE-3224JS.
Ignition Current—½-1½ amps. idling, 4-5 stopped.
Ignition Switch:—Mitchellock Model 24-R, No. 8777.
Ignition Lock—Yale & Towne. Mitchell No. 8414.
Distributor Auto-Lite IGH-4029. Double breaker, 4 lobe cam with automatic advance and vacuum spark control (separate vacuum unit) and Octane Selector.
NOTE—Contacts must be synchronized.
Firing Interval—Movable contacts open 45° (distributor degrees) after fixed set.
Breaker Gap—Set at .020".
Cam Angle or Dwell—32° closed, 13° open (both sets operating together when properly synchronized).
Breaker Arm Spring Tension—17-20 ounces.
Rotation—Clockwise viewed from above.
Condenser—No. IGB-1025C. Capacity .20-.25 mfd.

Automatic Advance

Distributor		Engine	
Degrees	R.P.M	Degrees	R.P.M.
Start	300	0	600
3	630	6	1260
7	1070	14	2140
10	1410	20	2820
13.5	1800	27	3600

Vacuum Spark Control VC-4012—Mounted on hold-down plate and linked to advance plate. Provides additional advance at speeds above idling except when engine accelerated or operated with wide open throttle (spark retarded by return spring in unit). Max. advance 6° (distr.), 12° (eng.) with 12" of HG.
Octane Selector—Provides manual adjustment at distributor for timing variation. See Ignition Timing following for adjustment for fuel regularly used.
Distributor Removal:—Mounted on right side of cylinder head. To remove, disconnect vacuum line, take out bolt in clamp arm, lift distributor off.
Installation Note—When installing distributor, crank engine to firing position for #1 cylinder ('U.D.C1-8' mark on vibration dampener in line with pointer on timing gear cover), sign down distributor shaft hole (distributor out), groove in upper end of distributor drive shaft should be at right angles with camshaft and offset to rear, turn rotor to #1 segment, install distributor (insert .020" feeler between modifier control arm and clamp arm before tightening clamp, to prevent binding), check timing.

FIRING ORDER:—1-6-2-5-8-3-7-4. See diagram.

SPARK PLUGS:—Champion No. 8. 18 MM. Metric.
NOTE—Champion No. 7 or 13 (colder plugs) may be used for extremely fast driving in hot weather.
Spark Plug Gaps—Set at .025" .0225-.0275").

IGNITION TIMING:—Standard setting as follows (see Octane Selector Setting following for correction dependent on fuel regularly used):

Flywheel Degrees	Piston Position
0° (at TDC)	.0000" TDC

Timing (Stationary Contacts)—With #1 piston on compression, turn engine over until 'U.D.C.1-8' mark on vibration dampener lines up with pointer on timing gear cover. Loosen hold-down plate screw, center pointer on scale, tighten screw. Loosen advance arm clamp bolt, rotate distributor until contacts just open, tighten clamp bolt. Then synchronize movable contacts.

Timing (with Neon Timing Light)—Neon Light No. 890 recommended by car manufacturer. Clip Neon Light lead in series with #1 spark plug. Idle engine and adjust distributor as directed above.

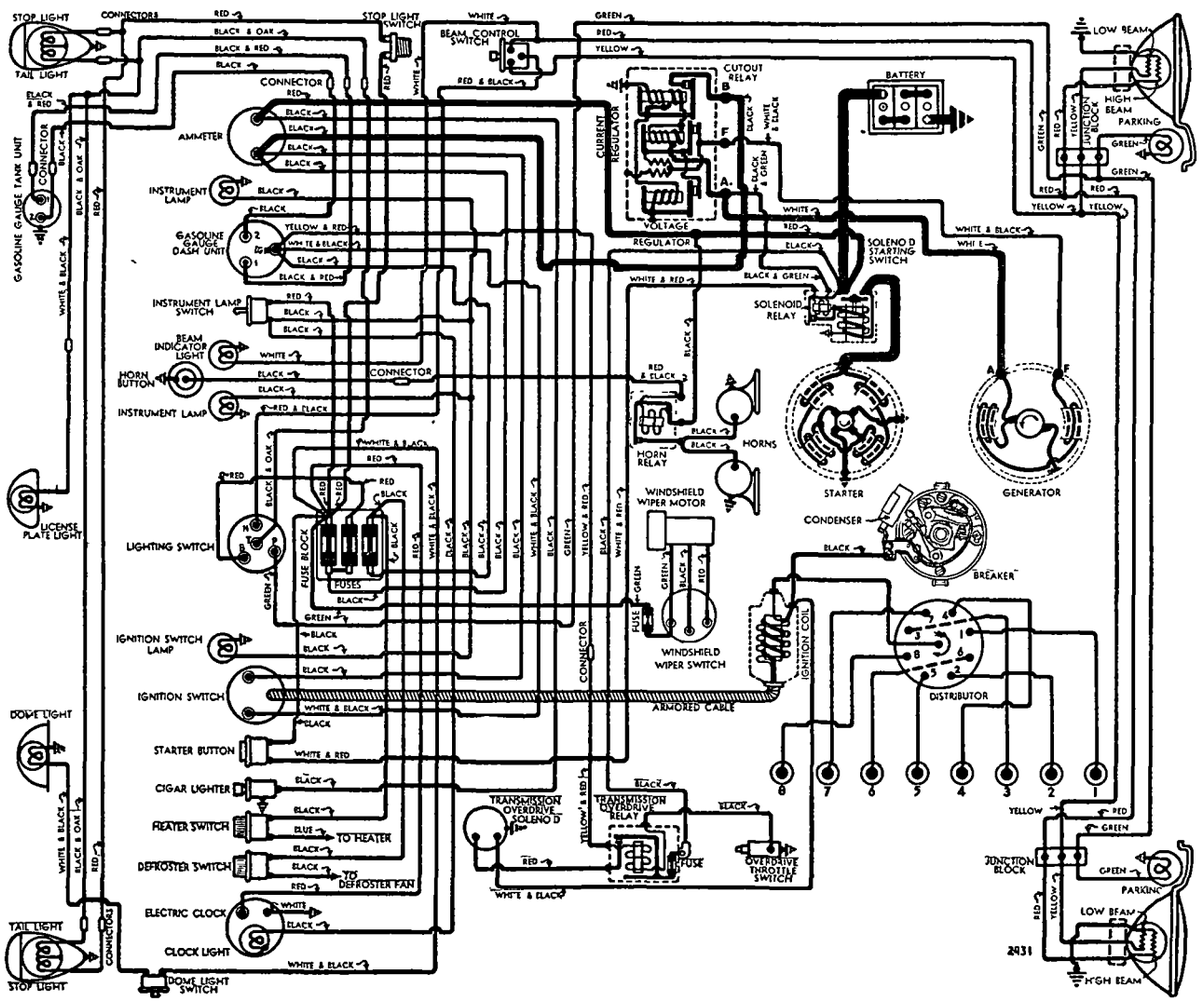
Synchronization (On Engine)—Turn engine over 90° to #6 firing position with vibration dampaner mark 'U.D.C.3-6' lined up with pointer on timing gear cover. Loosen 2 lockscrews on movable subplate carrying second set of contacts, shift subplate by placing screwdriver between knob and plate and turning screwdriver until contacts begin to open, tighten lockscrews.

Synchronization (Other Methods)—Car manufacturer recommends use of approved electrical analyzer.

Octane Selector Setting—After setting ignition timing, loosen selector screw, advance pointer toward 'A' end of scale until motor 'pings' when it is hot and pulling hard, then retard (toward 'R') until 'ping' disappears.

CARBURETION:—Carburetor—Carter Type WDO Model 409-S or Stromberg Model AAV-26. 1¼" dual, downdraft types with Automatic Choke.
For complete data, refer to 1941 Carburetor Index.

Idle Adjustment—With engine warm and running at slow idle speed (choke valve wide open, fast idle inoperative), set throttle stopscrew for 8 MPH idle speed. Adjust idle adjusting screw for each barrel (in succession) until engine fires smoothly (¼-1¼ turns open for each screw on Carter—turn screws in for leaner mixture). Readjust idle speed.



Accelerating Pump Setting—2 holes provided in both carburetors. Set as follows:
Inner Hole (min. stroke)—Normal Setting.
Outer Hole (max.)—If greater charge required.

Float Level (All Carburetors)—As follows:

Carter—3/16" from top of float to machined surface of bowl cover (remove gasket, invert to check).

Stromberg—Fuel level 5/8" below top edge of bowl with engine idling (3 lbs. pressure) or even with bottom of inspection plug hole on side of bowl.

Metering Jets & Rods—*See Carter & Stromberg Jet Tables in Carburetor Section for complete data.*

Fast Idle:—Integral (built-in each carburetor).
For complete data, refer to 1941 Carb. Equip. Index.

Setting (Carter)—Adjust fast idle screw for .018" throttle valve opening with choke valve closed.

Setting (Stromberg)—Hold throttle stopscrew against high lobe of fast idle cam, move choke valve toward closed position as far as possible, check valve opening. Adjust by bending fast idle connector rod for 7/64" choke valve opening.

Automatic Choke:—Climatic Control (Carter), AAV-26 type (Stromberg). Built-in carburetor.
For complete data, refer to 1941 Carb. Equip. Index.

Setting (Carter)—Set coil housing 1 Notch Rich.

Setting (Stromberg)—'R' mark on thermostat cover in line with highest projection on housing. Shift to 'M' if engine loads up or overchokes. Use 'H' setting only if highly volatile fuels used.

Air Cleaner:—AC #1529907 oil-wetted type standard. Heavy duty oil-bath type optional. Oil filler cap equipped with copper mesh type cleaner.

Fuel Pump:—AC Type AE, diaphragm type. Replacement Part No. 528.
For complete data, refer to 1941 Carb. Equip. Index.

Gasoline Gauge:—Auto-Lite electric type, No. NG-9594D (dash unit), No. NG-9659T (tank unit).
For complete data, refer to 1941 Carb. Equip. Index.

MANIFOLD HEAT CONTROL:—Thermostatic coil type. **Setting**—To test coil tension, free outer end of coil from bracket on manifold. With valve closed, hooked end of coil should be approx. 90° from bracket with coil at 70°F. Replace coil if angle incorrect. If valve sticks, shaft should be lubricated with kerosene and baking soda solution (for shafts which are badly stuck, remove shaft and turn shaft down to give .005" clearance—shaft bore in manifold should not be disturbed). See that tension spring (from shaft to clip on manifold) is in place.

VALVE TIMING:—**To Check**—With .020" tappet clearance #1 intake valve should open with #1 piston 15° or .0915" BTDC with vibration dampener mark 'IN.OP.1-8' aligned with pointer on timing gear cover. Reset tappet clearance at .016" (cold).

Tappet Clearance:—.016" all valves with engine cold.

Valve Spring Pressure:—54-60 lbs. at 2 3/32" (valve closed), 125-135 lbs. at 1¾" (valve open).

LUBRICATION:—**Crankcase Capacity**—8 quarts.
Normal Oil Pressure—40 lbs. at 25-30 MPH.

COOLING SYSTEM:—**Capacity**—15 quarts.

Thermostat:—Fulton. In cyl. hd. water outlet.

Setting—Starts to open 151-155°F.

Temperature Gauge:—Auto-Lite (Motometer) Vapor tension type. A-L Part No. H-9593.
For complete data, refer to 1941 Mech. Equip. Index.

TRANSMISSION OVERDRIVE CONTROL:—Electric type with accelerator pedal 'kick-down' control.
For complete data, refer to 1941 Mech. Equip. Index.
Overdrive Solenoid—Delco-Remy Model 1118013.
Throttle Switch—Cole-Hersee No. 1687-S. Adjust so that shoe on accelerator linkage just contacts switch plunger with throttle valve wide open.
Control Relay—Auto-Lite HR-4201S. 14 ampere fuse mounted in holder on relay.

BATTERY:—**Willard Type WHT-1-15R.** 6 volt, 15 plate, 95 ampere hour capacity (20 hour rate).
Grounded Terminal—Positive (+) grounded to frame.
Engine Ground—Separate strap connector.

STARTER:—**Auto-Lite MAX-4044. Armature MAW-2030.**
Drive—Overrunning clutch (solenoid pinion shift).
Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—42-53 ozs. (new brushes).

Performance Data

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	5300	5.5	65
0.65 "	3300	5.5	100
2.75 "	1630	5.0	200
5.5 "	970	4.5	300
8.7 "	600	4.0	400
12.0 "	300	3.5	500
16.5 "	Lock	3.0	640
25.0 "	Lock	4.0	880

Removal:—Flange mounted on engine rear plate at left side. To remove, take out flange mounting screws, take off starter and switch assembly.
Starting Switch:—Solenoid Switch Type SS-4702. Controlled through relay by puhsbutton on instrument panel. *For data, refer to Elec. Equip. Index.*

GENERATOR:—**Auto-Lite GDZ-4805A. Armature GDZ-2006F.** Two brush type with current-voltage control.
Charging Rate Adjustment—No adjustment at generator. Charging rate controlled by Voltage Regulator and maximum output by Current Regulator. *See Regulator data following.*
Maximum Charging Rate—35 amperes, 8.0 volts, 1800 gen. RPM or approx. 20 MPH and above with load or discharged battery (Current Regulator Setting). Actual charging rate controlled by Voltage Regulator and dependent on battery condition.

Performance Data

Cold			Hot		
Amperes	Volts	R.P.M.	Amperes	Volts	R.P.M.
0	6.4	925	0	6.4	1000
4	6.6	1035	4	6.6	1120
8	6.75	1140	8	6.75	1235
12	6.95	1250	12	6.95	1350
16	7.15	1370	16	7.15	1460
20	7.3	1480	20	7.3	1590
24	7.5	1590	24	7.5	1730
28	7.7	1710	28	7.7	1900
32	7.9	1820	32	7.9	2090
35	8.0	1900	35	8.0	2250

Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—53 ozs. max. (new brushes).
Field Current—1.60-1.78 amperes at 6.0 volts.
Motoring Current—4.16-4.60 amperes at 6.0 volts.
Removal:—Pivot mounted at left front of engine. To remove, take out pivot and clamp bolts.
Belt Adjustment:—Loosen pivot and clamp bolts, move generator out until 3/8-1/2" belt deflection midway between generator and fan pulleys is obtained.

REGULATOR:—**Auto-Lite VRP-4004F. Current-Voltage type.** In a single case mounted on engine dash.
For complete data, refer to 1941 Elec. Equip. Index.
NOTE—Regulator case cover sealed. Serviced on exchange basis if seals not broken (to remove cover).

Cutout Relay

Cuts In—6.4-6.6 volts.
Cuts Out—4.8-5.6 volts (approx. 4-6 amps. disch.).
Contact Gap—.015" minimum.
Air Gap—.031-.034" with contacts open (check at hinge end of core).

Voltage Regulator

Setting—7.2-7.5 volts at 70° F. See Electrical Equipment Section for settings at other temperatures.
To Check (without breaking seals)—Connect ammeter in charging line at regulator 'B' terminal (use short heavy leads), voltmeter between 'B' terminal and ground. Operate generator at speed equivalent to 30 MPH., charging fully charged battery, until voltage is steady. Voltage reading should agree with setting given above.
To Adjust (with cover removed)—Change regulator armature spring tension by bending lower spring hanger slightly. See Electrical Equipment Section.
Contact Gap—.012" min. (armature against stop pin).
Air Gap—.048-.052" with contacts just opening.

Current Regulator

Setting—34-36 amperes (marked '35' on the cover).
To Check (without breaking seals)—Connect test meters as for voltage check (above). Operate generator at speed equivalent to 30 MPH. charging battery, turn on car lights and accessories or connect load (bank of headlamp bulbs etc.) between ammeter and battery so that generator charges at peak rate and Current Regulator operates. Current reading should agree with setting given above. If more than slight excess noted, regulator is defective.
To Adjust (with cover removed)—Same as for Voltage Regulator (above).
Contact Gap & Air Gap—Same as Voltage Regulator.

LIGHTING:—**Headlamps**—Corcoran-Brown 'Sealed Beam' type. *For data, refer to Elec. Equip. Index.*
Headlamp Adjustment—Aim upper beam straight ahead (hot spot center 3" below lamp center hght.).
Beam Indicator—At top center of speedometer dial. Lighted whenever Country (upper) beam in use.

Switches

Lighting—Douglas.
Beam Selector—Delco-Remy Model 1997002.
Instrument—Douglas.

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps		Sealed Beam
Parking, Instrument	1½	55
Beam Indicator	1	51
Stop & Tail	21-3	1158
Rear License	3	63
Dome	15	87

FUSES:—**Lighting**—Three 20 ampere. On fuse block on back of instrument panel at center. Protects circuits as follows: **Top**—Clock, Dome, Stop, Instrument Lamps and Windshield Wiper (see below). **Center**—Head & Tail lamps. **Lower**—Heater and Defroster.
Overdrive Relay—14 ampere. In clip on relay.
Windshield Wiper—14 ampere. In feed wire.

HORNS:—**Delco-Remy**—Electric type, air tone, dual horns operated by relay.

Type	Current (at 6 volts)	Air Gap
1999511 (low note RH)	19-21 amperes	.044-.049"
1999512 (high note LH)	18-20 amperes	.034-.039"

Horn Relay:—R-B-M Model 6003.
Contacts Close—3-4 volts (with relay upright).

WINDSHIELD WIPER:—**Auto-Lite Model EWD-5002.** Electric type with 14 amp. fuse in feed wire.
For complete data, refer to 1941 Mech. Equip. Index.

HOOD LOCK:—Alligator type hood with instrument panel lock to left of light switch on Americar.

SERIAL NUMBER:—First No. 441-50001 (Americar, Plainsman, Willys Pick-up), 441P-50001 (Willys Panel Delivery). Stamped on plate on frame front cross-member (all models), and on right side of cowl under hood (Pass. Cars & Pick-up), or on right front door riser (Panel Delivery).

ENGINE NUMBER:—First number same as Serial No. Stamped on right front upper corner of engine.

COMPRESSION:—**Ratio**—6.48-1 (Americar Std.), 6.81-1 (Americar Optl. High Alt.), 7.0-1 (Americar Optl., Plainsman Std.), 6.1-1 (Pick-up & Panel Delivery).
Pressure—111 lbs. (6.48, 6.81, 7.0 Hds.), 107 lbs. (6.1-1 Head) at cranking speed of 185 RPM.
NOTE—All heads cast iron except 7.0-1 Head which is Aluminum.

VACUUM READING:—Steady 21-23" idling at 8 MPH.

IGNITION:—**Coil Model IG-4090A.** Mounted on right side of engine. Service Coil IG-4070.
Ignition Current—2.5 amperes idling, 5 amperes at 6.4 volts stopped.

Ignition Switch:—Douglas No. 2975. Coil connection not armored.
Ignition Lock—Yale & Towne.

Distributor Auto-Lite IGW-4129. Full automatic advance type with auxiliary vacuum spark control.
Breaker Gap—.020".
Cam Angle or Dwell—41° closed, 49° open (distr.).
Breaker Arm Spring Tension—17-20 ounces.
Rotation—Counter-clockwise viewed from above.
Condenser—No. IGB-1025. Capacity .20-.25 mfd.

Automatic Advance

Distributor Degrees	R.P.M	Engine Degrees	R.P.M.
Start	300	0	600
2	550	4	1100
5	930	10	1860
7	1190	14	2380
9.5	1500	19	3000

Vacuum Spark Control VC-4010. Mounted on distributor bracket and linked to advance arm. Provides additional advance at all speeds above idling except when engine accelerated or operated with wide open throttle when spark retarded by return spring within unit.

Vacuum Advance

Distr. Degrees	Eng. Degrees	Vacuum (" of HG)
Start	0°	3½"
2°	4°	5¾"
5°	10°	9¼"
8°	16°	12¾"
10°	20°	15"

Distributor Removal:—Mounted on right side of engine. To remove (without disturbing vacuum unit), loosen the advance arm clamp bolt. **Installation**

Note—If oil pump removed, turn crankshaft so that #1 piston on compression and flywheel mark 'TC-IGN' at indicator on housing, turn distributor shaft so that rotor at #1 terminal in cap, install oil pump and mesh gears so that shaft engages distributor tongue-and-slot coupling without disturbing distributor shaft position. Check ignition timing.

FIRING ORDER:—1-3-4-2. See diagram.

SPARK PLUGS:—Champion J-8 or Auto-Lite A-7F (All engines except with 7.0-1 Aluminum Head), Champion J-9 (Eng. with 7.0-1 Al. Head). 14 MM. Metric.
Spark Plug Gaps—Set at .030".

IGNITION TIMING:— **Flywheel Deg. Piston Pos.**
All engines ..... at TDC ..... .0000" TDC
Timing—With #1 piston on compression, turn engine over until piston reaches firing position (see above) with flywheel mark 'TC-IGN' centered in inspection hole in front face of engine right rear support. Loosen advance arm clamp bolt, rotate distributor until contacts begin to open (eliminate backlash in drive gears by pressing on rotor in clockwise direction), tighten clamp bolt, see that rotor is at #1 terminal in distributor cap.

CARBURETION:—**Carburetor**—Carter Type WO Model 507-S (No. 229 cast on face of flange). 1¼" single barrel, downdraft type.
For complete data, refer to 1941 Carburetor Index.

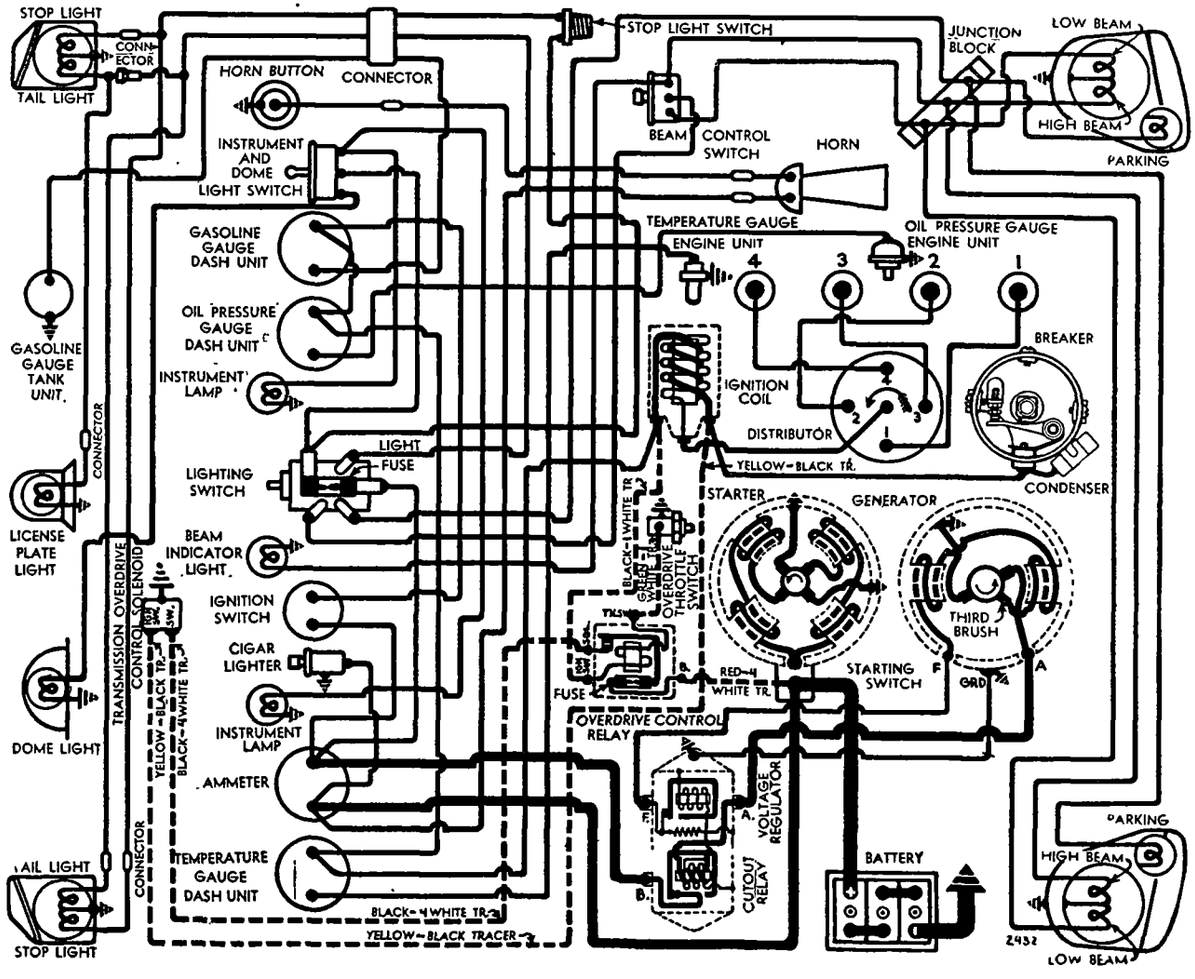
Idle Adjustment—If preliminary adjustment required (to warm up engine), turn idle adjusting screw in until just seated, then turn screw out 1¼ turns, start engine and run until warm. With engine warm, set throttle stopscrew for slightly faster than normal idling speed, turn idle adjusting screw out until engine begins to roll, then turn screw in until engine fires smoothly. Final setting should be 1-1½ turns open. Adjust throttle stopscrew for 8 MPH idle speed pulling in high gear.
Accelerating Pump—No seasonal adjustment.
Float Level—⅜" from top of float to gasket seat on cover with needle valve seated (invert to check—do not compress spring in valve stem).
Metering Rods & Jets—***See Carter Jet Table in Carburetor Section for complete data.***

Fast Idle:—Choke valve inter-connected to throttle valve to open throttle to fast idle position with choke valve in use.

Air Cleaner:—AC #1529870 oil-wetted type standard. heavy duty oil-bath type optional.

Fuel Pump:—AC Type AF, diaphragm type. Pump Replacement Part No. 538.
For complete data, refer to 1941 Carb. Equip. Index.

Gasoline Gauge:—King-Seeley Electric. K-S No. 8186 (Dash Unit), No. 8318 (Tank Unit).
For complete data, refer to 1941 Carb. Equip. Index.



MANIFOLD HEAT CONTROL:—Automatic thermostatic coil type. No adjustment required.

VALVE TIMING:—**To Check**—With .020" tappet clearance #1 intake valve should open with #1 piston 9° or .039" before top dead center when flywheel mark 'I.0' centered in inspection hole in right front side of engine rear support (¼" variation permissible). Reset tappet clearance at .014" cold.

Tappet Clearance:—.014" all valves with engine cold.

Valve Spring Pressure:—50 lbs. at 2 7/64" (valve closed), 116 lbs. at 1¾" (valve open). Spring free length 2½".

LUBRICATION:—**Crankcase Capacity**—4 quarts.

Normal Oil Pressure—40 lbs. at 30 MPH.

Oil Pressure Gauge:—King-Seeley Electric type. K-S No. 8190 (Dash Unit), No. 6425 (Engine Unit). *For complete data, refer to 1941 Mech. Equip. Index.*

COOLING SYSTEM:—**Capacity**—11¾ quarts.

Thermostat:—Harrison. In cyl. hd. water outlet.

Setting—Starts to open 148-155°F. Fully open 173°.

Temperature Gauge:—King-Seeley Electric type. K-S No. 8184 (Dash Unit), No. 7000 (Engine Unit). *For complete data, refer to 1941 Mech. Equip. Index.*

TRANSMISSION OVERDRIVE CONTROL (OPTL.):—Electric type with accelerator pedal 'kick-down' control.

For complete data, refer to 1941 Mech. Equip. Index.

Overdrive Solenoid—Delco-Remy No. 1569.

Throttle Switch—Cole-Hersee No. 9016. Adjust position of switch on bracket so that switch plunger just contacts end of accelerator rod (max. clearance 1/32") when carburetor throttle is wide open.

Overdrive Relay—Auto-Lite Model HR-4201AS.

BATTERY:—**Auto-Lite, Type AB-13.** 6 volt, 13 plate, 80 ampere hour capacity (20 hour rate).
Starting Capacity—96 amperes for 20 minutes.
Zero Capacity—300 amperes for 2.0 minutes.
Grounded Terminal—Negative (—) grounded to front frame cross-member. **Engine Ground**—Strap connector at front engine mounting on left side.
Dimensions—Length 8 15/16". Width 7". Hght. 8⅝".
Location—In engine compartment on right side.

STARTER:—**Auto-Lite—Americar & Pick-up MZ-4093 (early), MZ-4099 (later)—Panel Delivery MZ-4049 (early), MZ-4100 (later). Armature No. MZ-2089 (all).**

Drive—Two types used: Special Outboard Bendix type RC10HD used on MZ-4049 & MZ-4093 motors; Special Barrel type A-2233 used on MZ-4099 & MZ-4100 motors. **Service Note**—Later type Bendix A-2233 can be used for servicing motors originally equipped with RC10HD type Bendix.

Rotation—Counter-clockwise at commutator end.

Brush Spring Tension—42-53 ozs. (new brushes).

Cranking Engine—185 RPM, 150-175 amps., 5 volts.

Performance Data

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	4300	5.5	70
.65 "	2500	5.5	100
2.65 "	1325	5.0	200
4.95 "	750	4.5	300
7.65 "	220	4.0	400
7.8 "	Lock	3.0	420
11.8 "	Lock	4.0	560

Removal:—Starter flange mounted on right front face of rear motor support. To remove, take out two flange capscrews and one capscrew in bracket at commutator end, remove starter and switch as an assembly.

Starting Switch (MZ-4093, 4099):—Type SW-3737S. On starter, cable operated by button on instrument panel. Pull required to close switch should be 2.3 lbs. min. (at right angles to hole at end of lever). **(MZ-4049)**—Type SS-4001. Magnetic switch mounted on starter, controlled by pushbutton on instrument panel. *See article in Electrical Equipm't Section.*

GENERATOR:—**Auto-Lite GCJ-4811-A. Armature GCJ-2006-F.** Third brush control in conjunction with vibrating type voltage regulator. Ventilated by fan on drive pulley.

Maximum Charging Rate—25 amperes (cold), 8.0 volts, 2500 RPM. Actual charging rate controlled by voltage regulator and dependent on battery condition. See Regulator data below. When checking generator output, ground 'F' terminal to eliminate regulator action.

Charging Rate Adjustment—See Regulator data. Third brush setting 2 commutator bars minus 2 mica strips minimum, 2 bars minus 1 mica strip maximum from insulated (nearest) main brush. Setting adjustable by removing commutator cover band and moving third brush by hand counter-clockwise to increase, clockwise to decrease output. Maximum output given above must not be exceeded.

Performance Data

Cold			Hot		
Amperes	Volts	R.P.M.	Amperes	Volts	R.P.M.
0	6.4	760	0	6.4	850
4	6.65	920	4	6.7	1020
8	6.9	1080	8	7.0	1240
12	7.2	1240	12	7.3	1400
16	7.45	1400	16	7.6	1650
20	7.7	1580	20	7.9	2100
25	8.0	2500	22	8.0	2700

Rotation—Counter-clockwise at commutator end.

Brush Spring Tension—53 ozs. max. (new brushes).

Field Current—1.9-2.1 amperes at 6.0 volts.

Motoring Current—4.0-4.4 amperes at 6.0 volts.

Removal:—Conventional pivot mounting at right front of engine. To remove, take out pivot and clamp bolts.

Belt Adjustment:—Loosen pivot and clamp bolts, swing generator out until fan can be turned with belt stationary.

REGULATOR:—**Auto-Lite VRR-4004A. Voltage type.** In single case on engine side of dash.
For complete data, refer to 1941 Elec. Equip. Index.
NOTE—Regulator case cover sealed. Serviced on exchange basis if seals not broken (to remove cover).

Cutout Relay

Cuts In—6.4-6.6 volts.
Cuts Out—4.8-5.6 volts (approx. 4-6 amps. disch.).
Contact Gap—.015" minimum.
Air Gap—.034-.038" with contacts open (check at hinge end of core).

Voltage Regulator

Setting—7.3-7.6 volts at 70° F. See Electrical Equipment Section for settings at other temperatures.
To Check (without breaking seals)—Connect ammeter in charging line at regulator 'B' terminal (use short heavy leads), voltmeter between 'B' terminal and ground. Operate generator at speed equivalent to 30 MPH., charging fully charged battery, until voltage is steady. Voltage reading should agree with setting given above.
To Adjust (with cover removed)—Change regulator armature spring tension by bending lower spring hanger slightly. See Electrical Equipment Section.
Contact Gap—.012" min. (armature against stop pin).
Air Gap—.048-.052" with contacts just opening.

LIGHTING:—**Headlamps**—Corcoran-Brown pre-focused double filament type with upper and lower beams controlled by Beam Selector Switch on toeboard.
Headlamp Adjustment—With upper beam lighted and car 25' from screen, aim each headlamp so that beams centered on vertical line directly ahead of lamp center, and upper edge at horizontal line at lamp-center height, with lamp door and lens in place. To adjust, remove door and lens, turn 3 adjusting screws on reflector rim.
Beam Indicator—Red jewel in upper edge of speedometer dial. Lighted when upper beams in use.

Switches

Lighting—Douglas No. 5864.
Beam Selector—Douglas.
Instrument—Douglas.

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps	32-21	2320
Parking	1.5	55
Instrument, Beam Ind.	1	51
Stop & Tail	21-3	1158
Dome, License Plate	3	63

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Overdrive Control Relay—20 ampere. On Overdrive Control Relay.

HORNS:—**Schwarze.** Vibrating, disc type.
Horn Current—8 amperes.

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BUICK TYPE

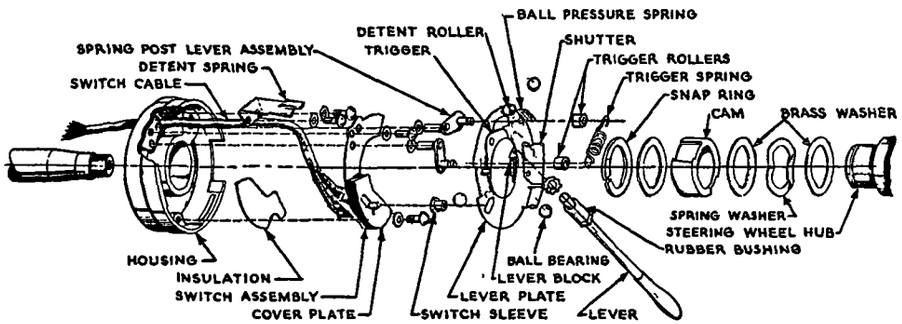
Std. Equipment On:

BUICK, SERIES 41-40, 40A, 50, 60, 70, 90 (1941)

DESCRIPTION:—Same design as used on 1940 cars, except that location of rear signal lights has been changed and these are now located in the lower section of the Stop & Tail Light assemblies on the rear of the car (Signal illuminates Red Arrow below stop and tail light on right or left side of car).

Wiring Diagram—See Buick wiring diagram on 'T&E' page for complete Direction Signal circuit wiring and fuse data.

OPERATION:—Switch is operated manually to indicate a turn, and is turned off automatically by the steering wheel movement when the turn is completed (switch can also be turned off manually if desired). If turn is made in opposite direction than that for which the switch has been set, switch is turned off automatically as the turn is begun. Switch handle should be moved in same direction as wheel is rotated for the intended turn (move handle up for left turn, down for right turn).



Control Switch—When switch is operated to indicate a turn, circuit is completed through flasher unit to right or left Front Signal Light, Rear Signal Light, and Pilot Light. If pilot light on instrument panel does not flash when switch operated, check all bulbs (pilot light will not flash if front or rear signal bulbs burned out). Operation of the switch also presses the spring-loaded pawl or trigger on the lever plate against the notched cam on the steering wheel hub. When the steering wheel is moved in the same direction to turn the car, the trigger ratchets over the notch in the cam, however when the wheel is turned in the opposite direction after the turn has been completed, the trigger engages the cam notch and the switch is carried around to the off position. The trigger is then released so that the switch is ready for further operation.

ADJUSTMENT:—Important Note—Steering wheel must be installed so that lower spoke points straight down with wheels in straight ahead position (see Saginaw Steering Gear article for servicing directions). Whenever steering wheel removed or installed, direction signal switch lever must be placed in 'off' position to prevent damage to switch assembly.

To Adjust Switch—With correct adjustment, automatic release will occur only when wheel returned to center position after being rotated at least one-third revolution. To adjust switch, set switch lever for Right Hand Turn, turn steering wheel to right until first click is heard or slight movement felt in switch lever after right hand spoke on steering wheel has passed lower center position. Hold switch lever down firmly and turn steering wheel back slowly until right hand spoke is approximately 2" past or to right of lower center position, release switch lever and return wheel to straight ahead position which will return switch to off position. This adjustment causes switch cam to shift on steering wheel hub by slipping the friction clutch. No further adjustment is required for left turn switch release (positioning cam for right turn release as above will automatically regulate left return release also).

SERVICING:—Disassembly—Make certain that switch lever set in 'off' position, remove steering wheel. Switch will then be accessible for inspection and servicing. To correct complaints of switch getting out of adjustment (adjustment changing in service), check tension of crimped steel spring washer assembled between two brass washers on steering wheel hub above switch cam). Pressure of 125-150 lbs. should be required to flatten washer to ⅛" height. Replace spring washer if pressure is less than this amount. See illustration for correct assembly of switch cam washers and other switch parts.

DIRECTION SIGNAL LAMPS & FUSE:—See Buick 'T&E' page for complete data.

CADILLAC TYPE

Std. Equipment On:

CADILLAC, SERIES 41-60S, 61, 62, 63, 67, 75 (1941)

DESCRIPTION:—New design (not same as type used on 1940 cars) with control switch built in steering wheel (switch has automatic turn-off feature) and pilot indicator light on instrument panel for Right and Left turn. Direction Signals consist of a special 21 cp. filament combined with the Parking Lamp in the front Radiator Grille (front of car), separate bulbs located above the stop & tail light bulb in the Rear Light assembly (rear of car), and pilot indicator bulb which is located in the upper right corner of the speedometer dial on the instrument panel. Flasher Unit and Direction Signal Fuse are located on the instrument panel brace near the steering column.

Control Switch—Mounted within housing below steering column with switch lever extending out to left side. Automatic shut-off mechanism consists of ratchet and cam pinned to steering column. With switch set to operate signal, steering wheel cam passes over ratchet without engaging when steering wheel rotated to turn car in that direction. When wheel is rotated back after turn completed, cam engages ratchet and turns switch off automatically.

Wiring Diagram—See Cadillac wiring diagram on 'T&E' page for complete Direction Signal circuit wiring and all light bulb and fuse data.

OPERATION:—Switch must be operated manually to indicate a turn and is turned off automatically when steering wheel straightened out after the turn is completed. Switch handle should be moved in same direction as wheel is rotated for desired turn (up for right turn, down for left turn). Operating switch completes circuit through flasher unit to Right or Left Front Signal Light, Rear Signal Light, and Pilot Indicator Light on instrument panel. All lights flash and flasher clicks audibly while operating.

SERVICING:—If instrument panel indicator light does not flash when switch operated, check all bulbs (pilot light will not flash if either front or rear signal light bulbs burned out). Flasher is sealed and cannot be serviced (replace if defective). To service switch, remove steering wheel (see Saginaw Steering Gear article for data) which will expose switch assembly.

DIRECTION SIGNAL LAMPS & FUSE:—See Cadillac 'T&E' page for all data.

CHEVROLET TYPE

Optional Equipment On:

CHEVROLET, MASTER DELUXE MODEL AG, SPECIAL DELUXE AH (1941)

Direction Signal is Guide type. See Guide Direction Signal article on next page for complete data.

CHRYSLER, DE SOTO, DODGE, PLYMOUTH TYPES

Std. Equipment On:

CHRYSLER, SIX MODEL C28, EIGHT MODELS C30, C33 (1941)

Optional On:

DE SOTO, MODEL S8 (1941)

DODGE, MODEL D19 (1941)

PLYMOUTH, MODELS P11, P12 (1941)

PRODUCTION CHANGE NOTE:—On first cars, Direction Signal feed wire was connected to lighting switch and protected by circuit breaker or fuse on switch. On later cars, Direction Signal was connected to gauge terminal of Ignition Switch and protected by a separate fuse in cartridge type fuse connector (fuse in line between ignition switch and flasher).

Chrysler C28—On some first cars, Front Direction Signal (fender mounted light) may be a single filament 21 cp. bulb (with separate Parking Light bulb directly above headlamp). On later cars, Front Direction Signal and Parking Light combined in one bulb (21-3 cp. double filament bulb) in fender light.

DESCRIPTION:—Direction Signals consist of a special 21 cp. filament combined with the parking lamp in the front fender lamps (Chrysler models), separate single filament bulbs in front fender lamps (De Soto, Dodge, Plymouth models

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with separate parking bulbs combined with headlamp assembly) at the front of the car, special 21 cp. filament combined with tail lamp at rear of car (all models—stop lamp is separate 21 cp. bulb in assembly with rear license lamp at center of body at rear), and pilot indicator lights which illuminate arrows on the instrument panel. Flasher unit is located on bottom flange of instrument panel at left side.

Control Switch—Mounted on steering column beneath steering wheel hub with switch lever extending out on left side of wheel. Switch has automatic turn-off mechanism which consists of a pronged ring pressed in the steering wheel hub which engages two specially shaped pawls on the switch when the switch is set to indicate a turn (with switch off, pawls clear prongs so that switch not operated when steering wheel is turned). When the steering wheel is rotated to turn the car in the direction for which the Direction Signal Control Switch has been set, the prongs ratchet over the switch pawl without disturbing the switch but when the steering wheel is rotated back after the turn has been completed, the prongs engage the pawl and return the switch to the off position automatically.

Wiring Diagram—See Chrysler, De Soto, Dodge, and Plymouth wiring diagrams on 'T&E' pages for complete Direction Signal wiring circuits.

OPERATION:—Switch must be operated manually to indicate a turn but is turned off automatically when steering wheel straightened out after the turn completed. Switch handle should be moved in same direction steering wheel is rotated for the desired turn (up for right turn, down for left turn). Operating the switch completes the circuit through the flasher to the right or left Front Signal Light, Rear Signal Light, and instrument panel Pilot Indicator. All lights flash until the turn has been completed. If Pilot Indicator does not flash when switch is operated, check for burned out bulbs, defective flasher, or blown fuse.

SERVICING:—Flasher Unit—Cannot be serviced, replace defective units.
Control Switch—Switch mounted on clamp attached to steering column. Clamp must be properly positioned on column so that switch pawls engage prongs on ring in steering wheel hub. If clamp disturbed, see that rim on clamp is 1/16" higher than steering wheel hub. Pronged ring should be pressed squarely in steering wheel hub with bulge in ring registering with indentation on wheel hub (this ring must be installed in steering wheel hub if Direction Signals installed on car in the field).

DIRECTION SIGNAL LAMPS & FUSE:—See Chrysler, De Soto, Dodge, and Plymouth 'T&E' pages for complete data (see Production Change Note above for differences on first cars).

HUDSON TYPE

Optional Equipment On:

HUDSON, SIX MODELS 10, 11, 12, 18; EIGHT MODELS 14, 15, 17 (1941)

DESCRIPTION:—Direction Signals consist of a special 21 cp. filament combined with the parking lamp (double filament bulb) in the Bonnet Panel Lamps (front of car), and the Stop Lights at the rear of car (stop light switch is hooked up to Direction Signal Switch so that both stop lights operate in usual manner when brake applied, one lamp only flashes when direction signal switch operated to indicate a turn). The control switch is mounted on the steering column directly below the steering wheel and has three buttons—'L' left turn, 'off' center, 'R' right turn—and an indicator bulb under a jewel below the center button which flashes while the signals are operating.

Wiring Diagram—See Hudson wiring diagrams on 'T&E' pages for complete direction signal circuit wiring and fuse data.

OPERATION:—Control is operated manually and 'L' (left) or 'R' (right) button is pressed to indicate a turn. This completes circuit through flasher, and Front & Rear Signals and indicator bulb on switch flash until the center 'off' button of the switch is pressed which releases the operating button and turns the switch off. If indicator bulb does not flash when switch operated, check for burned out bulbs.

SERVICING:—Indicator Bulb Replacement—Switch cover retained by screws concealed under button on switch case. To remove cover, pull buttons off, remove screws located on flat terminals under buttons, lift switch cover off. Take out mounting screws in switch and lift switch out. Indicator bulb and switch can then be inspected and serviced.

DIRECTION SIGNAL LAMPS & FUSE:—See Hudson 'T&E' pages for data.

LINCOLN TYPE

Std. Equipment On:

LINCOLN, ZEPHYR & CONTINENTAL 16H, CUSTOM MODEL 168H (1941)

DESCRIPTION:—Direction Signals consist of a special 21 cp. filament combined with the parking lamps in the front Fender Lamp (21-3 cp. bulb) at the front of the car, 21 cp. filament combined with tail lamps in the Rear Lamp Assembly (21-3 cp. bulb) at the rear of the car (Stop lamp is separate 21 cp. bulb in assembly with Rear License lamp at center of body in rear), and pilot indicator lamps on instrument panel. Pilot indicator lamps are mounted in top of instrument cluster (Zephyr and Custom) to right of speedometer dial (Continental). Flasher unit is mounted on Ignition Resistor and Lighting Circuit Breaker unit in back of instrument panel with fuse in connector in line between flasher and feed terminal of ignition resistor unit.

Control Switch—Built in housing on steering column below steering wheel with switch lever extending out toward left side. Switch has automatic turn-off mechanism by which switch is returned to off position when steering wheel rotated back to straight ahead position after a turn has been completed.

Wiring Diagram—See Lincoln wiring diagram on 'T&E' page for circuits.

OPERATION:—Switch must be operated manually to indicate a turn but is turned off automatically when steering wheel straightened out after turn has been completed. Switch handle should be moved in same direction steering wheel is rotated to make a desired turn (up for right turn, down for left turn). Operating the switch completes the circuit through the flasher to the right or left Front Direction Signal, Rear Signal, and Pilot Indicator on instrument panel (arrow at top of instrument cluster on Zephyr & Custom, jewel on instrument panel to right of speedometer on Continental). All lights flash until turn has been completed.

SERVICING:—If pilot indicator does not flash when switch operated to indicate a turn, check for burned out bulbs, defective flasher, or blown fuse. For access to switch, remove steering wheel.

DIRECTION SIGNAL LAMPS & FUSE:—See Lincoln 'T&E' page for all data.

OLDSMOBILE TYPE

Optional Equipment On:

OLDSMOBILE SIX, MODELS 66, 76, 96 (1941)

OLDSMOBILE EIGHT, MODELS 68, 78, 98 (1941)

Direction Signal is Guide type. See Guide Direction Signal article (following) for data.

PONTIAC TYPE

Optional Equipment On:

PONTIAC SIX, MODELS 41-24, 25, 26 (1941)

PONTIAC EIGHT, MODELS 41-27, 28, 29 (1941)

Direction Signal is Guide type. See Guide Direction Signal article (following) for data.

Optional Equipment On:
CHEVROLET, OLDSMOBILE, PONTIAC & OTHER 1941 MODELS

DESCRIPTION:—Direction Signals consist of right and left hand Front and Rear flashing lamps which light up when steering column control switch is operated to indicate that a turn is to be made. These signals operate in conjunction with a Pilot Light or indicator on the switch which serves to remind the car operator to turn off the Direction Signal after the turn has been completed in addition to indicating that the signal is operating satisfactorily.

Front Direction Signal—Consists of a 21 cp. filament combined with the parking lamp filament (21-3 cp. bulb) in the parking lights at the front of the car. When Direction Signals installed on cars in service, regular parking lights must be modified by installation of new socket designed for this double filament bulb (see Installation data below).

Rear Direction Signal—Special signal lights are not used but the regular car wiring is modified so that the direction signal flashes the right or left Stop Light. Stop lights are wired so that both stop lights operate in the usual manner when brakes are applied with the Direction Signal off, and the one stop light, which is not being flashed for a direction signal, operates as usual when the brakes are applied with the Direction Signal set to indicate a turn.

Control Switch—Direction Signal Switch is mounted in a case which is designed to be clamped on the steering column directly below the steering wheel so that the switch lever extends out toward the left hand rim of the wheel. Switch lever has three positions—Normal or Off with lever horizontal. Right Turn with lever moved up, Left Turn with lever moved down. Switch is operated manually and lever remains in any position in which it is placed.

Flasher Unit—Flasher is a sealed unit and is usually mounted on the lower flange of the instrument panel brace behind the instrument panel. Flashers cannot be serviced and should be replaced if defective.

Direction Signal Fuse—Fuse is mounted in a cartridge type holder or connector in the feed wire between the ignition switch and the flasher unit (Direction Signals connected to 'gauge' terminal of ignition switch so that they are operative only with the ignition turned on).

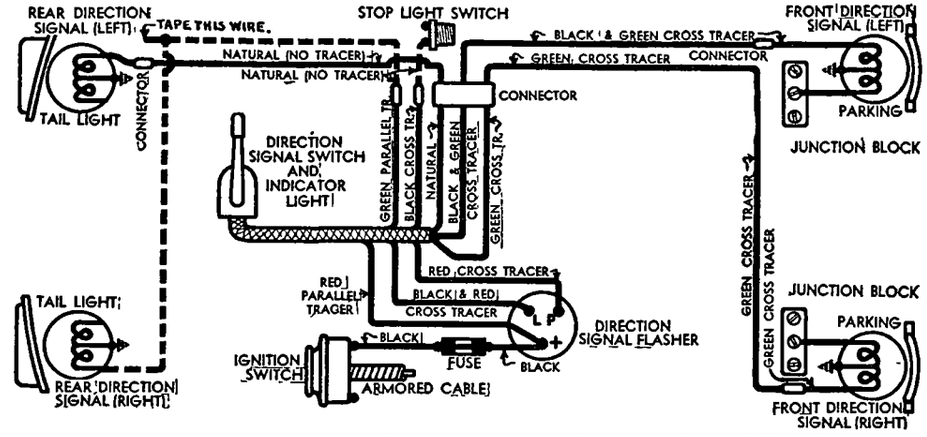
OPERATION:—Switch must be operated manually to indicate a turn and must be returned to the normal or 'off' position manually after the turn has been completed. Switch handle should be moved in same direction as steering wheel is rotated for a desired turn (up for Right Turn, down for Left Turn). Operating the switch completes the circuit through the flasher to the right or left Front Signal Light, Rear Stop Light, and Pilot Indicator Light. All lights flash until switch lever is moved to normal or off position. If Pilot Indicator does not flash when switch is operated, check for burned out bulbs, defective flasher or blown fuse.

INSTALLATION:—When installing Direction Signals on cars in service, units should be installed, and car wiring modified as directed below. ***Refer to car wiring diagram on particular car model 'T&E' page for wire colors and location of junction blocks and connectors.***

Front Direction Signal—Disconnect Parking Light wire at front junction block on hood, dismantle parking light and remove old parking bulb socket and wire, install new socket and wires furnished for each model, install new double filament signal and parking bulb (see bulb data below). Connect parking bulb lead (natural wire) to same terminal on junction block from which old parking light wires removed. On Chevrolet and Oldsmobile, connect new long wire (Natural with Green Cross Tracer) to Right Hand Signal Light wire which is same color, connect new short wire (Black and Green Cross Tracer) to Left Hand Signal Light wire, run these wires back along regular car wiring harness to dash and connect through three-way connector to same color wires in Direction Signal wiring harness (third wire runs to rear of car—see Rear Signals). On Pontiac, Direction Signal wiring harness is of sufficient length to extend to front signal lights and this harness cable should be run along regular car wiring harness and connected to signal lights as follows: Connect shorter (Natural) wire to Left Hand Signal Light (Black) wire, run longer (Black) wire across front of car and connect to same color (Black) Right Hand Signal Light wire.

Rear Direction Signal—On Chevrolet and Oldsmobile, additional wire must be run along left hand frame rail to rear of car so that Stop Lights can be connected individually to Direction Signal Switch. This wire (Natural) supplied with other signal parts. Connect forward end of wire to same color (Natural) wire in Direction Signal wiring harness through three-way connector (other wires run to front of car—see Front Signals above). Connect rear end of this wire to Left Hand Stop Light, disconnecting and taping lead in regular car wiring harness which ran to this light (on Chevrolet, disconnect connector near the left stop light; on Oldsmobile, wire must be cut and new wire soldered to light lead). Regular car wiring harness lead is used for Right Hand Stop Light and this is connected to switch at instrument panel (see Switch data). On Pontiac models, individual leads are provided for each Stop Light and it is only necessary to rearrange connections at forward end (see Switch data).

Direction Signal Switch Installation—Switch is mounted on steering column by clamp band with concealed attaching screw. Form clamp band around steering column with threaded side up, install clamp-screw loosely. Dismantle switch by taking out two lower cover screws, install switch housing on clamp band (engage band in slots in housing so that lugs and screw inside housing), position housing so that switch lever horizontal in Normal or off position, tighten clamp band screw. See that switch assembly is in off position, reassemble switch and tighten lower cover screws securely. Run switch wiring harness down along steering column to instrument panel. Mount Flasher by loosening one nut on steering column bracket below instrument panel and slipping slotted end of flasher bracket under nut. Connect switch wiring harness as follows:



Direction Signal Switch Wiring—On Chevrolet and Oldsmobile, disconnect connector joining two Natural wires under left hand corner of instrument panel (this is stop light lead of regular car wiring harness), connect the Natural wire running into body (Stop Light wire) to the Natural with Green Parallel Tracer wire of the Direction Signal wiring harness, connect the other Natural wire (Stop Light Switch wire) to the Natural with Black Cross Tracer wire of the Direction Signal wiring harness. On Pontiac, disconnect the three wires joined by a connector under left hand corner of instrument panel (Natural from Stop Light Switch, Natural with Green Cross Tracer to Right Hand Stop Light, Natural with Black & Green Cross Tracer to Left Hand Stop Light), connect these wires to same color wires of Direction Signal wiring harness. On all models, connect Flasher unit, and feed wire to ignition switch (remove fuse while making this connection) as shown on wiring diagram.

SERVICING:—No service operations required. Replace defective flasher units and burned out bulbs. To disassemble switch for replacement of Pilot Indicator bulb, take out screws in lower switch cover, withdraw cover and switch assembly.

DIRECTION SIGNAL LAMP BULBS & FUSES:—**Fuse**—9 ampere. In cartridge type holder in wire between flasher unit and ignition switch behind instrument panel.

Front Direction Signal—21-3 cp. Mazda No. 1154 (3 cp. filament used for parking light and connected to lighting switch through regular car wiring harness).
Rear Direction Signal—21-3 cp. Mazda No. 1154 (3 cp. filament used for tail light and connected to lighting switch through regular car wiring harness).
NOTE—21 cp. filament used both for Stop Light and Direction Signal.
Pilot Indicator—1½ cp. Mazda No. 55. Located in switch housing.
Flasher Unit—Mallory Type 10. Service by replacement.

GENERATOR CHARGE TELL-TALE:—The cutout relay is provided with an extra set of ground contacts above the armature and the tell-tale lamp lead is connected to this contact 'T' terminal on the regulator case. The lamp circuit is completed to ground through these contacts. See 'T&E' page wiring diagram for wiring circuit.

Operation:—The ground contacts are normally closed with the main contacts open and open when the main contacts close. When the ignition is turned on, the tell-tale lamp lights and remains lighted until the main contacts close and the generator begins to charge the battery. The lamp should not remain lighted after the car speed is brought up beyond the cut-in point (approximately 10 MPH).

Trouble Shooting:—If the tell-tale lamp does not light when ignition is turned on, ground tell-tale lamp lead 'T' terminal on regulator to the engine (not to 'B' terminal). If lamp does not light, check for burned out bulb or loose wiring connections (see 'T&E' page wiring diagram). If lamp lights (indicating that ground contacts open), main contacts are fused or armature spring is weak or broken. If tell-tale lamp does not go out at speeds above cut-in point, ground contacts are not opening when main contacts close. Check generator performance by connecting accurate test ammeter in charging line. If trouble in regulator, car manufacturer recommends that a new or replacement regulator be installed (regulator case is sealed, do not break seal).

OIL PRESSURE TELL-TALE:—The oil line check valve on the right side of the crankcase is provided with an insulated terminal pin which is grounded by the check-valve plunger when no pressure exists in the oil line. The oil pressure tell-tale lamp lead is connected to this terminal. A small hole in the check-valve plunger and a by-pass in the body allow the passage of sufficient oil so that the plunger alternately opens and closes the circuit at idling speeds, causing the tell-tale lamp to flash.

Operation:—The plunger rests normally against the pin when no pressure exists in the oil line so that the tell-tale lamp will light when the ignition is turned on. At idling speeds the plunger alternately opens and closes the circuit so that tell-tale lamp flashes. At speeds above idling (approximately 7 M.P.H.), the oil pressure holds the check-valve plunger off its seat so that the tell-tale lamp does not burn or flash.

Trouble Shooting:—If the tell-tale lamp does not light when the ignition is turned on, ground check-valve terminal to engine. If lamp does not light, replace bulb. If lamp does light, remove terminal pin and see that it is straight and clean. Take off plug on top of check-valve housing, remove plunger and see that it is clean and moves freely up and down. Examine spring above plunger. If tell-tale lamp does not flash at idling speeds, see that small hole in plunger is clean and open.

1941 SEALED BEAM HEADLAMPS

REPLACEMENT NOTE:—Two types of Sealed Beam Lamp Units are available for replacement: (1) Composite Type with metal reflector and glass lens (has conventional lamp bulb assembled in unit) and (2) All Glass Type with hard glass reflector and lens (no lamp bulb used, filaments mounted directly on reflector). ***Both types and all makes are fully interchangeable on all car models equipped with Sealed Beam Headlamps.***

DESCRIPTION:—Sealed Beam Headlamps, as used on 1940 car models, consist of a reflector, lens, and lamp filaments assembled as a single sealed unit. This excludes all dirt and moisture so that the original effciency of the lamp is retained throughout the life of the filaments. When replacement is required, the entire sealed beam unit is discarded and a new unit is installed. No attempt should be made to disassemble the sealed beam unit.

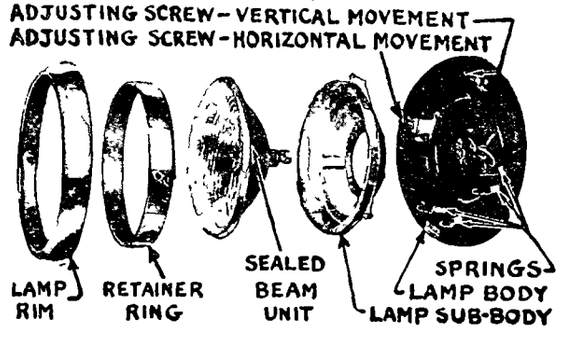
OPERATION:—Sealed Beam lamps have double "bar" type filaments (filaments parallel and slightly offset so that lower "Traffic" beam deflected slightly toward right side of road) with an upper "Country Beam" of 40-45 watts intensity and a lower "Traffic Beam" of 30-35 watts (these lamps not rated by candlepower but upper beam is approximately 50% brighter than former 32 cp. headlamps). Beams are controlled by a Beam Selector Switch on the toeboard in the usual manner.

INSTALLATION & REMOVAL:—On all cars, a sub-body or housing is provided in the headlamp for the sealed beam unit mounting. This sub-body is retained in the headlamp by the two adjusting screws and by two sets of two springs which are hooked to the sub-body diametrically across from each screw. The sealed beam unit seats directly in the sub-body and is positioned by three heavy lugs which fit into slots in the sub-body. A retainer ring is fitted over the outer edge of the sealed beam unit. This retainer ring has three lugs which engage three clamp screws on the sub-body rim so that the retainer ring and sealed beam unit are securely clamped in place when the clamp screws are tightened (on some cars a gasket is used between the retainer ring and the sealed beam unit). A lamp rim which fits over the retainer ring in such a manner as to conceal the clamp screws and adjusting screws completes the assembly.

Removing Sealed Beam Units—Remove headlamp rim (retained by one or more screws and clips). Loosen, but do not remove, three clamp screws which engage retainer ring lugs (use care not to turn adjusting screws located at top and one side of lamp). Rotate retainer ring counter-clockwise until lugs disengage from clamp screws, lift retainer ring off. Pull sealed beam unit out to disengage lugs from slots in sub-body, disconnect cable plug from clips on sealed beam unit.

Installing Sealed Beam Units—Terminal clips on sealed beam units and cable plug are designed so that plug can be connected only in correct position. Plug terminals (facing end of plug) are as follows: **Left Side**—Upper Country Beam. **Center (Top)**—Lower Traffic Beam. **Right Side**—Ground wire connected to lamp sub-body or lamp housing. When installing new sealed beam unit, connect plug, see that sealed beam unit lugs properly engage slots in sub-body, install retainer ring and rotate ring clockwise until lugs on ring engage under clamp screw heads on sub-body, tighten clamp screws securely. Then adjust headlamps as directed below.

"SEALED BEAM" HEADLAMP



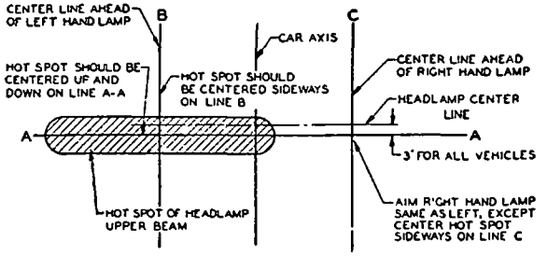
ADJUSTMENT:—All sealed beam lamp units are "prefocused" type so that the only adjustment required is to aim the lamp beam for correct horizontal and vertical position.

Headlamp Adjustment (All Cars)—Use conventional headlamp adjusting screen with vertical lines drawn directly ahead of each lamp center-line and horizontal line drawn 3" **below** and parallel to lamp center-line. Place car at 25 feet distance from screen, turn on lights and make certain that Upper Country Beam (lower filament) is lighted. Aim each headlamp as follows:

Horizontal Adjustment—With headlamp rim removed, turn adjusting screw at one side of lamp sub-body (do not confuse with retainer ring clamp-screws) until hot spot is centered on vertical line directly ahead of this lamp. Adjust other headlamp in same manner (both lamps aimed straight ahead).

Vertical Adjustment—With headlamp rim removed, turn adjusting screw at top or bottom of lamp sub-body (do not confuse with retainer ring clamp-screws) until hot spot is centered on horizontal line 3" below lamp center height. IMPORTANT—Beam may be directed downward as required by state laws, but should never be aimed higher than 3" below lamp center height.

AIMING INSTRUCTIONS



1941 CHEVROLET REVERSING SWITCH

Used On:

CHEVROLET, ALL PASSENGER CAR & TRUCK MODELS (1941)

PRODUCTION CHANGE NOTE:—Two different switch assemblies used as follows:

First Type—Reversing switch lever travel must be checked on first type switches to obtain proper switch action. A solid connecting rod used between switch lever and starter drive shift lever. See Checking and Adjustment following.

Second Type—Later type assemblies changed over first design as follows: Reversing switch is provided with a stop which limits forward motion of switch lever, providing proper travel of switch lever. A new connector link made of flat stamping with a spring loaded sliding section (preventing bending of lever) is used between switch lever and starter drive shift lever. No adjustment or checking necessary on this second type switch assembly. REPLACEMENT NOTE—Second type Reversing Switch Unit Part No. 1884827 can be installed on cars with first type switch. All parts must be replaced, switch and operating linkage. No parts interchangeable between first and second types.

1941 IGNITION NOTE:—Ignition system comprises a special Ignition Coil, special larger capacity Condenser, and a special insulated Distributor (used in conjunction with the new Reversing Switch. The distributor has a new type breaker cam with steeper angle to provide greater cam angle or dwell and more output with the new greater capacity ignition coil.
IMPORTANT—New condenser must not be used with previous type ignition coil or Distributor (capacity too great for this earlier type equipment).

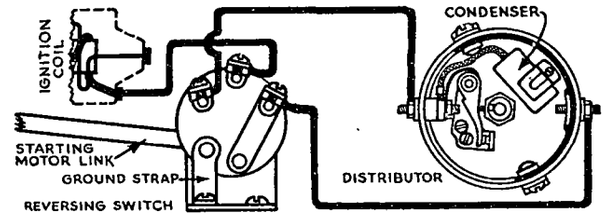
REVERSING SWITCH:—Consists of a 4 terminal switch (1 terminal grounded by strap to starter frame through switch mounting bracket) connected between the ignition coil and the distributor (special two terminal, insulated type) and operated by a link connected to the starter pinion shift lever so that the direction of current flow across the breaker contacts is reversed each time the starter is operated to start the engine. This reversal of current causes a periodic reversal of the natural tendency of the contacts to pit (one contact) and build up a cone (opposite contact) so that smoother contact surface and longer contact life is assured. This switch is used in conjunction with a special insulated distributor of the following type:

Chevrolet Distributor (Delco-Remy 1110090)—The breaker plate is insulated from the distributor housing by insulated nuts located in the breaker plate lugs so that the stationary contact is not grounded through the distributor housing in the customary manner. A second terminal is provided on the distributor housing and this terminal is connected to the breaker plate (terminal stud is screwed in breaker plate lug). Both distributor terminals are connected to the Reversing Switch and these terminals are alternately connected to the ignition coil or to ground by the successive operations of the reversing switch. See illustration for switch wiring.

IMPORTANT BATTERY CABLE NOTE:—Positive battery cable at starting switch should lead straight up from terminal so that it will not interfere with starter shift lever when it is depressed to start engine.

CHECKING & ADJUSTMENT (FIRST TYPE):—To check, turn on ignition (ammeter will indicate ignition load), slowly press down on starter pedal while watching ammeter and observe sequence of switch operations as follows: Ammeter pointer will drop back to '0' as switch begins to operate and will then indicate ignition load as switch again completes ignition circuit, switch will then 'click' as ratchet locks in closed circuit position and further movement of the pedal will cause starter to operate. Reversing switch lever must not move more than ⅛" from point where 'click' is heard to point where starter begins to operate (measure movement in horizontal direction at reversing switch). If switch lever moves more than ⅛", adjust by bending switch connecting rod at the center so as to shorten the rod slightly. Recheck operation after adjustment completed to make certain that movement is not more than ⅛".

IMPORTANT NOTE—This adjustment is important as incorrect switch rod movement may cause switch to open ignition circuit so that engine can not be started.



1941 DELCO-REMY IGNITION SWITCHES

Car Model	Ignition Coil	Ignition Switch
Buick 41-40,60,90 LHD (1941)	1115024, 1115026 (Radio)	1116296
Buick 41-40,60,90 RHD (1941)	1115024, 1115026 (Radio)	1116297
Buick 41-50, 70 LHD (1941)	1115024, 1115026 (Radio)	1116313
Buick 41-50, 70 RHD (1941)	1115024, 1115026 (Radio)	1116314
Cadillac V8, 60S,61,63,67 (1941)	1115128	1116298
Cadillac V8, 62, 65 (1941)	1115128	1116299
Cadillac V8, A11 RHD (1941)	1115128	1116309
Chevrolet AG, AH (1941)	1115141	1116304
Chevrolet Comm. & Truck (1941)	1115141	11160301, 1116302
Chevrolet C-O-E Truck (1941)	1115141	1116303
Chevrolet Can. Pass. Car. (1941)	1115141	1116315
Chevrolet Can. Com. & Trk. (1941)	1115141	1116291, 1116292
Graham Hollywood 113 (1941)	1115022	1116261
Graham Hollywd Superchgd. 109 ('41)	1115127	1116261
Nash '600' 4140 (1941)	1115028	1116310
Oldsmobile 66,68,96,98 (1941)	1115129	1116305
Oldsmobile 76, 78 (1941)	1115129	1116311
Packard Six, 1900 LHD (1941)	1115027	1116308
Packard Six, 1900 RHD (1941)	1115027	1116318
Pontiac 6, 41-24,25,26 LHD (1941)	1115023	1116306
Pontiac 6, 41-24,25,26 RHD (1941)	1115023	1116312
Pontiac 8, 41-27,28,29 LHD (1941)	1115129	1116306
Pontiac 8, 41-27,28,29 RHD (1941)	1115129	1116312

DESCRIPTION:—These switches are used with lock-extension type coils. The ignition coil lead from the switch is enclosed in an armored cable permitting coil to be mounted at a distance from the switch, usually on the engine block or engine side of the dash. An accessory terminal is provided on the switch for the gasoline gauge, radio, heater, defroster, etc., connection. The armored cable end cap on ignition coil can be disconnected as described below (see Servicing Coil).

TROUBLE SHOOTING:—Circuits through the switch can be tested with a test lamp and battery or other current source and test leads as follows: In each case test leads should be connected at points indicated and it should be noted whether test lamp lights or not.

1. Switch Off. Disconnect feed wire on switch. Test from feed terminal on switch to gasoline gauge or accessory terminal. Lamp should not light.
2. Switch On. Disconnect feed wire on switch. Test from feed terminal to gasoline gauge terminal. Lamp should light.
3. Switch On. Disconnect feed wire on switch. Test from feed terminal to breaker terminal on ignition coil. Lamp should light. If lamp does not light and previous test indicated that switch circuits were satisfactory, disconnect coil (as directed below) and test separately.
4. Switch On. Disconnect feed wire from switch and block open breaker contacts or disconnect breaker lead at coil. Test from feed terminal on switch to switch case. Lamp should not light. If lamp lights; switch, coil lead or ignition coil are grounded. Disconnect coil and test separately.

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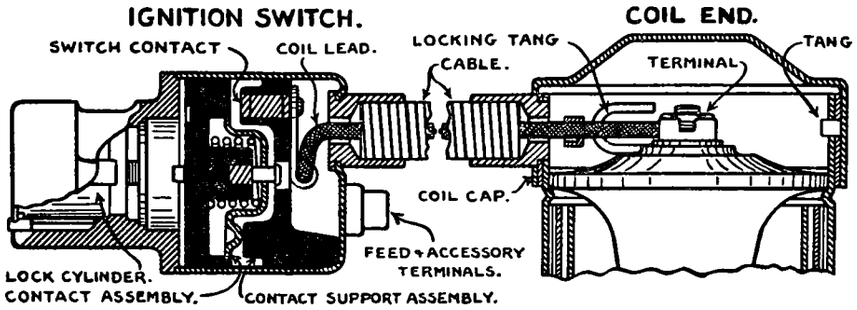
SERVICING COIL:—The armored cable end cap on ignition coil is locked in place by tang on cap which engages lock recess on coil case. Two locating lugs on cap fit in 'L' slots in coil case. To remove end cap, use special tool J-726 (a thin blade of spring steel .015"x ½"), insert tool between coil cap and case at a point approximately 1" to left of seam on coil case. The tool will press the large tang out of the groove in the coil case. Then turn cap counter-clockwise until it can be withdrawn. Disconnect coil lead wire at terminal on bottom of coil case. When installing, align locating lugs on cap with 'L' slots in coil case so that lock tang will engage lock recess in case when cap rotated in place.

1—Coil Primary Shorted. Check current draw of coil. If current exceeds 6 amperes at 6 volts, coil is probably shorted.

2—Coil Primary Grounded. Disconnect low tension lead to distributor and remove all leads at ignition switch. With switch turned on, connect 110 volt test lamp between primary coil terminal to ground (unpainted surface of case). Lamp should not light (grounded if lamp lights).

3—Coil Primary Open-Circuited. Connect 6 volt test lamp in series with low tension terminal at lower end of coil and wire to distributor. If lamp does not light with ignition switch turned on, an open-circuit is indicated.

4—Coil Secondary Grounded. Test from secondary terminal of coil to ground on coil case. Use 110 volt test lamp. Lamp should not light with coil disconnected from switch.



1941 MITCHELLOCKS

Car Model	Type	Lock Assembly	Switch and Cable	Lock Cylinder
Chrysler, C28 (1941)	30-R	8793	8794	8414
Chrysler, C30, C33 (1941)	24-R	8052	8053	8414
DeSoto, S8 (1941)	30-R	8793	8794	8414
Dodge, D19 (1941)	24-R	8197	8198	8414
Hudson 6, 10,11,12,18 (1941)	24-B	8797	8798	6095
Hudson 8, 14,15,17 (1941)	24-B	8797	8798	6095
Packard, 1900 (1941)	24-B	8781	8782	6760
Packard, 1901, 1901A (1941)	24-B	8781	8782	6760
Packard, 1903 to 1908 (1941)	24-B	8779	8780	6760
Plymouth, P11, P12 (1941)	24-R	8197	8198	8414
Studebaker, Champ. 3G (1941)	24-R	8771	8772	8414
Studebaker, Comm. 11A (1941)	24-R	8775	8776	8414
Studebaker, Pres. 7C (1941)	24-R	8777	8778	8414

DESCRIPTION:—Similar in design to previous type Mitchellocks except that terminals located on lock case cover (see illustration). Furnished in three types as follows:

'B' Type (24-B)—Has extra terminal for gasoline gauge or other accessory connection. Accessory terminal live only with switch 'on'.

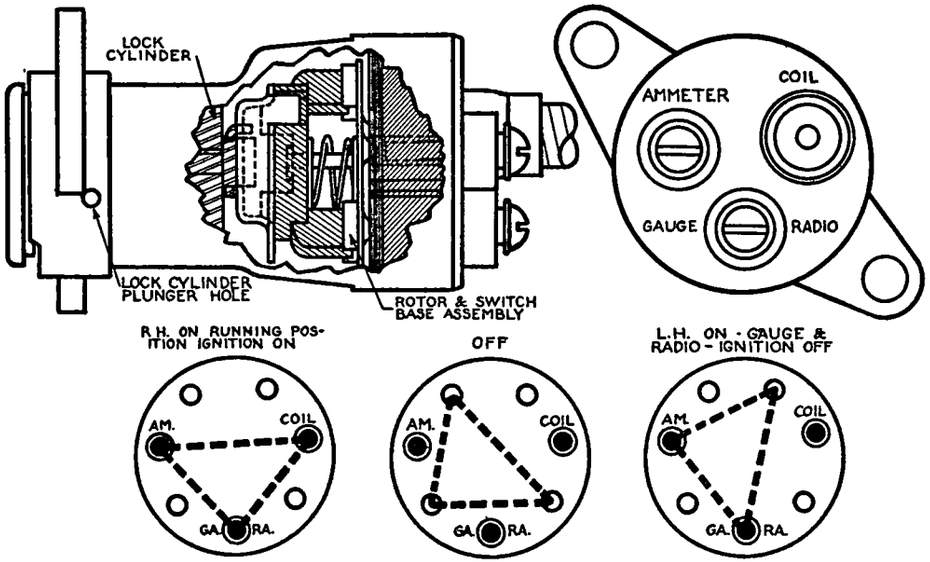
'R' Type (24-R)—Same as above but switch has two 'on' positions; one for regular running with ignition on, and a second position with accessory terminal live but ignition off. This position may be used for gasoline gauge reading with engine not running or for radio control with car parked.

'R' Type (30R)—Has additional terminal for Chrysler & DeSoto Underdrive type transmission control connection. See 1941 Chrysler Six C28 or DeSoto S8 'T&E' page for wiring connections at switch.

SERVICING:—Manufacturer recommends that no attempt should be made to service internal switch parts since duplication of original factory assembly in the field is extremely difficult. Switches which prove defective should be replaced. To remove assembly, remove lock head from instrument panel, disconnect switch wires from terminals, remove ignition coil base by bending up 4 lugs on coil case which extend over coil base and lift off cover, disconnect wire lead from coil and remove ignition switch assembly. Lock cylinders can be serviced as directed below.

Lock Cylinder:—To remove lock cylinder, remove lock head from instrument panel, disconnect ammeter lead, turn key to extreme right hand position, insert a pointed tool as far as possible into small hole in side of lock case to depress lock cylinder retainer fully, pull lightly on key to withdraw lock cylinder.

TROUBLE SHOOTING:—Test circuits through switch with lamp and test points. See description above for terminals which should be 'live' with switch key in each position. If switch circuits are completed correctly and ignition still unsatisfactory, remove ignition coil base (cable connection) by bending up 4 lugs on coil case which extend over coil base. This will expose coil terminal in base. Check circuit through switch and coil lead to this terminal. If circuit tests OK., disconnect coil, test coil and replace if necessary. If tests indicate switch defective, replace switch (see Servicing).



Vibrating Voltage & Current Regulators

Car Model	Regulator	Generator	Grd. Ter.
Chrysler C28, C30 ('41) Std.	VRP-4001A	GDZ-4801A	Pos.
	VRP-4005A	GDZ-4801A	Neg.
Chrysler C28 ('41) City Police & Taxi	VRP-4001F	GEG-4818A	Pos.
	VRP-4005E	GEG-4818A	Neg.
City Police	VRP-4001B	GEB-4801A	Pos.
	VRP-4005B	GEB-4801A	Neg.
State Police	VRP-4001F	GEG-4818B	Pos.
	VRP-4005E	GEG-4818B	Neg.
Chrysler C30, C33 ('41) Std.	VRP-4001F	GEG-4818C	Pos.
Police		Same as Chrysler C28	
De Soto S8 (1941) Std.	VRP-4001A	GDZ-4801A	Pos.
	VRP-4005A	GDZ-4801A	Neg.
Police & Taxicab		Same as Chrysler C28.	
Dodge D19 (1941) Std.	VRP-4001A	GDZ-4801B	Pos.
	VRP-4005A	GDZ-4801B	Neg.
Police & Taxicab		Same as Chrysler C28.	
Hudson All ('41) Special	VRP-4008A	GEG-4801A	Pos.
	VRP-4008B	GEA-4803B	Pos.
		GEB-4802	Pos.
Nash 4160 (1941)	VRP-4004F	GDZ-4806A	Pos.
Nash 4180 (1941)	VRP-4004F	GDZ-4803B	Pos.
Packard 6 & 8 1900, 1, 1A ('41)	VRP-4002C	GDZ-4801F	Pos.
Police & Taxicab	VRP-4002D	GEB-4802C-2	Pos.
Packard Super 8 1903 to 8 ('41)	VRP-4002C	GEA-4802A	Pos.
Plymouth P11, P12 ('41) Std.	VRP-4001A	GDZ-4801B	Pos.
	VRP-4005A	GDZ-4801B	Neg.
Police & Taxicab		Same as Chrysler C28	
Studebaker Champ. 3G (1941)	VRP-4004F	GDZ-4804A	Pos.
Studebaker Comm. 11A (1941)	VRP-4004F	GDZ-4805A	Pos.
Studebaker Pres. 7C (1941)	VRP-4004F	GDZ-4805A	Pos.

Vibrating Voltage Regulator

Hudson 6, 10, 18 (1941) Std.	VRR-4001A	GDS-4801A	Pos.
Hudson 6, 11, 12, 13 ('41) Std.	VRR-4001A	GEC-4801A	Pos.
Hudson 8, 14, 15, 17 ('41) Std.	VRR-4001A	GEC-4801A	Pos.
Willys Americar 441 (1941)	VRR-4004A	GCJ-4811A	Neg.
Willys Comm'l. 441, 441P (1941)	VRR-4004A	GCJ-4811A	Neg.

1940 PRODUCTION CHANGES & NEW REGULATOR TYPES:—On 1940 cars, Regulator specifications were changed, or new Regulators used in production as listed below. ***Mark these changes on 1940 Supplement 'T&E' Pages and Auto-Lite Regulator pages in Electrical Equipment Section of 1940 Supplement to insure latest specifications being used when servicing 1940 car models.***

VRP-4000 Series—On all units after Serial No. 5U-000001, Current Regulator Air Gap should be set at .048-.052" (same as Voltage Regulator—use same ST281-7 gauge to check air gaps on both units). On regulators before this serial number, air gap was set at .034-.038" (ST281-6 gauge).

VRP-4000 Series—Cutout Relay Air Gap should be .031-.034" and is checked with ST-281-9 Gauge. This supersedes .034-.038" air gap (ST-281-3 gauge) originally specified for these units.

VRP-4000 Series (Except Models VRP-4008A, B, C)—Voltage setting changed and all units should be set to voltage figures shown in table below. These settings supersede original settings given in 1940 Supplement.

VRP-4001B,1F,4C,4E,5B,6E,6F,7A,7B,8A,8C,9C—On these models, Resistor "2" changed after Serial No. 6U-000001 to new 13.5-16.5 ohm resistor (marked '15'). Before this serial number, this #2 resistor was 10-12 ohm (marked '11').

VRP-4100 & 4200 Series—New types—see data below. NOTE—These units used on Late 1940 cars as follows: **VRP-4201A-1**—Packard Six 1800 & Eight 1801, 1A ('40) with GEA-4801A Generator. **VRP-4202A-1**—Packard Super Eight 1803, 4, 5, 6, 7, 8 ('40) with GEA-4802A Generator.

GROUND TERMINAL NOTE:—Each type regulator designed for use with particular battery terminal grounded as noted in table above. When installing regulator, see that correct battery terminal grounded and repolarize generator (after all connections made) as follows:

Polarizing Generator—Connect jumper wire momentarily from starting switch battery connection to generator 'A' terminal (after all connections have been made). This momentary surge of current through generator windings will polarize generator for correct operation.

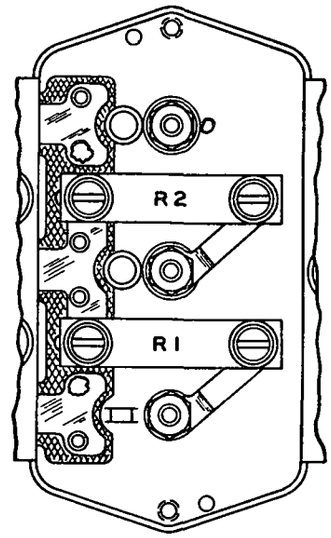
TYPE:—Vibrating type regulators similar in design to types used on 1940 car models (see 1940 Production Change Note above for changes in specifications). These regulators differ from earlier 'VRB' and 'VRD' regulators mainly in that they have the following new features:

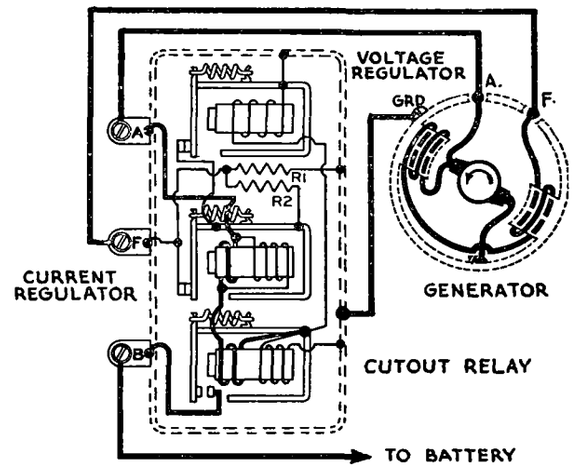
Cutout Relay—New type armature with contact mounted on spring so that armature seals against yoke after contacts close. Designed to produce wiping action of contacts.

Armature Springs (all units)—Two different type springs used. Springs on Cutout Relay and Current Regulator units have 12¾ coils while spring on Voltage Regulator unit has 14½ coils. CAUTION—Springs must not be interchanged. Make certain that correct spring used on each unit.

VRP Current Regulator Windings—Two windings used (see illustration).

CHECKING & ADJUSTMENT:—Check each unit as directed below. See that correct armature spring installed (see note above), check resistors for correct value and location, and check and adjust all gaps before making adjustments to change regulator performance. After making adjustments, always make final 'flash' test (see instructions below) and polarize generator when generator and regulator replaced on car (see Ground Terminal Note above).





CUTOUT RELAY

Model	Voltage Winding Resistance	Contact Gap	Air Gap
All VRP-4000 Series	29.8-33.0 ohms	.015" Min.	.031-.034"
All VRP-4100 Series	29.8-33.0 ohms	.015" Min.	.034-.038"
All VRP-4200 Series	29.8-33.0 ohms	.015" Min.	.034-.038"
All VRR-4000 Series	29.8-33.0 ohms	.015" Min.	.034-.038"

Winding Resistance—Use ohmeter (ST-384) to measure resistance directly, measure from regulator 'A' terminal to ground with voltage regulator lead disconnected from cutout relay yoke.

Armature Spring Note—Springs on all models have 12¾ turns.

Air Gap—Use flat gauge ST-281-9 (VRP-4000 Series only), ST-281-3 (all others) to measure between magnet core and armature at point as close to armature hinge as possible **with contacts open.** Adjust by bending armature stop and make certain that armature stop does not rub against edge of armature. NOTE—Armature 'seals' against yoke after contacts close and air gap must be measured with contacts open.

Contact Gap—Check with feeler gauge. Gap must not be less than .015" but may exceed this figure in service. With correct adjustment, contacts will close and armature will then 'seal' against yoke. CAUTION—If contact gap too large, contacts will not close before armature seals against yoke (armature must have further travel to effect this sealing).

Model	Contacts Close	Contacts Open
All 'VRP' Types	6.4-6.6 volts	①4.8-5.6 volts
All 'VRR' Types	6.4-6.6 volts	②4.8-5.6 volts

①—Discharge current will be approximately 4-6 amperes (VRP-4000 Series), 7-8 amperes (VRP-4100, 4200 Series).

②—Discharge current will be approximately 4-6 amperes.

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Closing Voltage—Connect ammeter in charging line at regulator 'B' terminal, connect voltmeter between 'A' terminal and ground. Operate generator and increase speed slowly until contacts just close **but without sealing against yoke,** note voltmeter reading at this point (NOTE—a 2000 ohm earphone connected between 'B' terminal and ground may be used to check closing, a click will be heard as the contacts close). To adjust, use tool ST-283 and adjust armature spring tension by bending lower spring hanger. Increase spring tension to increase closing voltage, lower spring tension to decrease voltage. CAUTION—Closing voltage must always be set .5 volts less than Voltage Regulator setting (contacts will not close if closing voltage higher than regulator setting).

Opening Voltage or Amperage—Connect meters as for Closing Voltage Check (above), decrease generator speed slowly and note voltmeter (or ammeter) reading as contacts open. Adjust by changing contact gap (see above).

VOLTAGE REGULATOR

Model	Winding Resistance	Contact Gap	Air Gap
All 'VRP' Types	10.8-12.0 ohms	.012" Min.	.048-.052"
All 'VRR' Types	10.8-12.0 ohms	.012" Min.	.048-.052"

Winding Resistance—Use Ohmeter (ST-284) to measure resistance directly. Measure between lead (disconnect lead from cutout relay yoke) and ground.

Armature Spring Note—Springs on all models have 14½ turns.

Air Gap—Use pin gauge ST-281-7 and measure at point next to stop pin on contact side with contacts just opening. Test air gap by connecting test lamp and battery between 'F' terminal and ground. Insert low limit pin gauge, depress armature by hand, lamp should dim or go out. Repeat test with high limit pin gauge. Lamp should remain lighted. To adjust air gap, loosen screw holding upper contact bracket, use tool ST-282 to raise bracket (to increase gap), tap top of bracket to lower contact (to decrease gap), tighten screw. See that contact spring is straight and parallel with armature.

Contact Gap—Check gap with feeler gauge while holding armature down against stop pin (CAUTION—do not press on contact spring, press down on armature evenly on both sides of spring). Gap may vary in service, if gap variation too great stop pin is wrong length and unit should be replaced.

Model	Voltage Setting	Model	Voltage Setting
VRP—4001A,B,C,D,E,F	Table 3	VRP—4008A,B,C	Table 2
VRP—4002A,B,C,D; 3A,B	Table 3	VRP—4009A,B,C,D	Table 3
VRP—4004A,B,C,D,E,F,G,H	Table 3	VRP—4101A,2A,3A,4A,5A	Table 1
VRP—4005A,B,C,D,E	Table 3	VRP—4201A-1, 2A-1	Table 4
VRP—4006A,AP,B,C,D,E,F,G	Table 3	VRR—4001A,B	Table 2
VRP—4007A,B,C,D	Table 3	VRR—4002A,B; 3A,4A,5A	Table 1

Voltage Setting Tables

Table 1. Temp.	Volts	Table 2. Temp.	Volts	Table 3. Temp.	Volts	Table 4. Temp.	Volts
50°	7.51	50°	7.63	50°	7.41	50°	7.44
60°	7.48	60°	7.57	60°	7.38	60°	7.39
70°	7.45	70°	7.50	70°	7.35	70°	7.35
80°	7.42	80°	7.43	80°	7.32	80°	7.31
90°	7.39	90°	7.38	90°	7.29	90°	7.27
100°	7.37	100°	7.31	100°	7.27	100°	7.22
110°	7.34	110°	7.24	110°	7.24	110°	7.18
120°	7.31	120°	7.17	120°	7.21		

NOTE—Allowable variation in all voltage settings is plus or minus .15 volts

Voltage Setting Check—Connect ammeter in charging line at regulator 'B' terminal (ammeter must read to 1 ampere and internal resistance must not exceed .01 ohm, use short heavy leads for connections), connect voltmeter between regulator 'B' terminal and ground (meter must read to .1 volt). Make certain that car battery is fully charged with gravity reading of 1.275-1.280 (substitute fully charged battery if car battery run down). Run engine at speed equivalent to 30 MPH for at least 15 minutes with generator charging battery to bring regulator up to operating temperature. Then note voltmeter reading which should agree with table above. NOTE—Single earphone of 2000 ohm or greater resistance connected between 'F' terminal and ground is recommended in checking regulator operation.

Adjustment—Use tool ST-283 to vary armature spring tension by bending arm at lower end of spring. Increase spring tension to increase voltage, decrease tension to decrease voltage. Replace cover and recheck performance.

CURRENT REGULATOR

NOTE—Data below applies to 'VRP' types only with separate Current Regulator. Disregard this data for 'VRR' Regulators used with third brush generators.

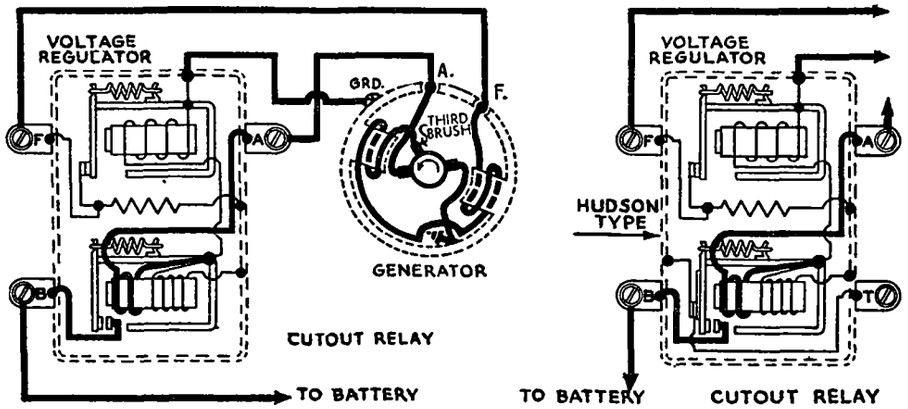
Model	Current Setting	Contact Gap	Air Gap
All VRP-4000 Series	See Table	.012" Min.	①.048-.052"
All VRP-4100 Series	See Table	.012" Min.	.048-.052"
All VRP-4200 Series	See Table	.012" Min.	.034-.038"

①—After Serial No. 5U-000001. Before this No., Air Gap was .034-.038".

Armature Spring Note—All armature springs have 12¾ turns except VRP-4100 Series after Serial No. 12T-000001 which are 10¾ turns.

Air Gap—To check gap, use pin gauge ST-281-6 (VRP-4000 Series before No. 5U-000001 and all VRP-4200 Series), pin gauge ST-281-7 (VRP-4000 Series After No. 5U-000001 and all VRP-4100 Series). Check and adjust gap in same manner as on Voltage Regulators (see instructions above).

Contact Gap—Check in same manner as Voltage Regulator (above).



Current Setting

Model	Max. Amperes	Model	Max. Amperes
VRP-4001A	34-36	VRP-4006A, 6AP	29-31
VRP-4001B	31-33	VRP-4006B, 6G	24-26
VRP-4001C	27-29	VRP-4006C	27-29
VRP-4001D	29-31	VRP-4006D	19-21
VRP-4001E	24-26	VRP-4006E	31-33
VRP-4001F	39-41	VRP-4006F	39-41
VRP-4002A, 2C, 2D	34-36	VRP-4007A	31-33
VRP-4002B	27-29	VRP-4007B	39-41
VRP-4003A, 3B	34-36	VRP-4007C	34-36
VRP-4004A, 4F	34-36	VRP-4007D	29-31
VRP-4004B, 4H	29-31	VRP-4008A	39-41
VRP-4004C	31-33	VRP-4008B	34-36
VRP-4004D	27-29	VRP-4008C	31-33
VRP-4004E	39-41	VRP-4009A	29-31
VRP-4004G	24-26	VRP-4009B	27-29
VRP-4005A	34-36	VRP-4009C	39-41
VRP-4005B	31-33	VRP-4009D	19-21
VRP-4005C	24-26	VRP-4101A, 2A	21-23
VRP-4005D	27-29	VRP-4103A, 4A, 5A	19-21
VRP-4005E	39-41	VRP-4201A-1, 2A-1	34-36

Current Setting Check—Connect test meters and heat regulator as directed for Voltage Regulator Check (above). Then connect load in excess of rated capacity of regulator at point between regulator and battery (use bank of headlamp bulbs, or turn on all lights and accessories). Note ammeter reading with Current Regulator operating. Generator output must be within 5% of rated capacity stamped on regulator cover as shown in table above.

Adjustment—Same as Voltage Regulator (above). Use ST-283 tool.

FINAL 'FLASH' TEST:—After adjusting Cutout Relay, Voltage Regulator, or Current Regulator, final flash test should be made after regulator cover replaced, by operating generator and noting regulator performance immediately.

CONTINUED ON PAGE EE-456

These regulators Standard or Optional Equipment on following car models:

Vibrating Voltage Regulator

Car Model	Regulator	Generator	Grd. Ter.
Graham Hollywood 109, 113 ('41)	1118204	1100007	Pos.

Vibrating Voltage & Current Regulator

Car Model	Regulator	Generator	Grd. Ter.
Buick 40, 50 (1941)	1118201	1102679	Neg.
Buick 60, 70, 90 (1941)	1118201	1102668	Neg.
Buick 40 ('41) City Police②	1118229	1106404	Neg.
Buick All ('41) State Police	1118237	1105852	Neg.
Cadillac All (1941)	1118202	1102661	Pos.
Cadillac All (1941)③	1118202	1102686	Pos.
Chevrolet All (1941)	1118201	1102667	Neg.
Chevrolet City Police ('41)	1118229	1106403	Neg.
	1118232	1106403	Pos.
Chevrolet State Police ('41)	1118237	1105851	Neg.
Chevrolet Boston Police ('41)	1118229	1106406	Neg.
Chevrolet Door-to-Door Dlvry. ('41)	1118233	1102677	Neg.
①Dodge City Police (1941)	1118232	1106403	Pos.
①Dodge State Police (1941)	1118238	1105851	Pos.
①Ford City Police (1941)	1118232	1106405	Pos.
①Ford State Police (1941)	1118238	1105853	Pos.
①Mercury City Police (1941)	1118232	1106405	Pos.
①Mercury State Police (1941)	1118238	1105853	Pos.
Nash '600' 4140 (1941)	1118202	1102684	Pos.
Oldsmobile All (1941)	1118201	1102664	Neg.
Oldsmobile All (1941)③	1118201	1102680	Neg.
Oldsmobile City Police ('41)	1118229	1106403	Neg.
Oldsmobile State Police ('41)	1118237	1105851	Neg.
Packard Six 1900 (1941)	1118202	1102682	Pos.
①Plymouth City Police (1941)	1118232	1106403	Pos.
①Plymouth State Police (1941)	1118238	1105851	Pos.
Pontiac All (1941)	1118201	1102665	Neg.
Pontiac City Police (1941)	1118229	1106403	Neg.
Pontiac State Police (1941)	1118237	1105851	Neg.

①—Accessory Equipment. ②—With Single Carburetor only.
③—Cars with Hydra-matic Drive Transmission.

IMPORTANT SERVICE NOTE:—For High Charging Rate and High Voltage complaints, always check generator for grounded field coils or grounded leads before changing regulator settings. To check, disconnect lead from regulator 'F' terminal with generator operating. If output drops off, trouble is in regulator. If output does not drop off, trouble is in generator and generator should be inspected for grounded field coils or leads.

Open Circuit Caution—Generator must never be operated on open circuit which will damage Generator or Regulator and cause burnt generator windings or regulator windings, burnt field resistance, or fused contacts. If these conditions found in service, check wiring circuits for open circuits or high resistance and correct before re-installing generator or regulator.

Regulator Seals—Regulator covers are sealed to indicate they are adjusted to original factory specifications. Warranty is void if unit is damaged by improper servicing (adjustments may be made by competent operators).

GROUND TERMINAL NOTE:—Each regulator designed to be used on cars with a particular battery terminal grounded as shown in table above. When installing regulator, make certain that correct battery terminal is grounded and always repolarize generator whenever generator or regulator has been disconnected.

Polarizing Generator—After generator and regulator connected, connect jumper lead between regulator 'BAT' and 'GEN' terminals momentarily. This will allow momentary flow of current through generator windings and cause generator to assume correct polarity for operation on car.

TYPE:—These Single Core Regulators are similar in design to types used on 1940 car models and have the following features:

Windings—All windings for each unit (Cutout Relay, Voltage Regulator, Current Regulator) are wound on a single core.

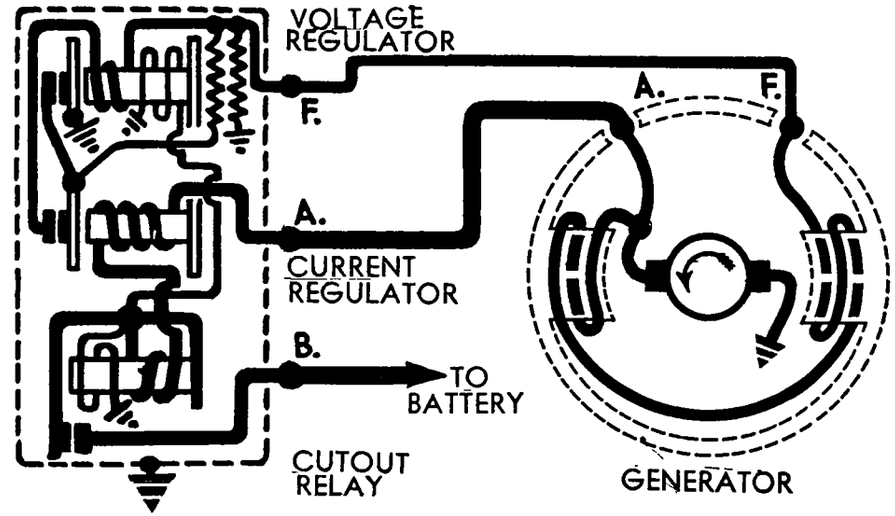
Cutout Relay—Has double contacts. Both sets of contacts must be set so as to open and close together.

Regulator Armature Springs—Two springs of equal weight used on both Voltage Regulator and Current Regulator units. Adjustments are made normally on one spring only. Special directions are required for adjustment of second spring (required only when new springs installed or when unit is badly out of adjustment).

Regulator Contacts—Lower movable contact mounted directly on upper surface of armature (spring type mounting not used).

CHECKING REGULATOR & GENERATOR PERFORMANCE:—To quickly locate trouble on the car, make the following tests before removing the generator or regulator for further testing and adjustment on the bench. Check battery condition with hydrometer, note whether battery low (discharged) or high (fully charged), operate engine and note charging rate as follows:

Fully Charged Battery & Low Charging Rate—This indicates that Voltage Regulator is operating normally. To check Current Regulator operation, connect test ammeter in charging line at regulator 'BAT' terminal, use starter motor to crank engine for about 15 seconds (disconnect high tension lead to prevent engine starting) to bring battery down, then run engine at medium speed, turn on all lights and accessories to start Current Regulator operating and not ammeter reading which should agree with current regulator setting (see table below). As soon as generator replaces current used in starting, charging rate should taper off to original low rate.



Fully Charged Battery & High Charging Rate—Check battery temperature (charging rate will be higher with hot battery). If charging rate excessive, operate generator at medium speed with ammeter in charging line at regulator 'BAT' terminal and note ammeter reading as follows: Disconnect lead from regulator 'F' terminal. This opens field circuit and generator output should drop off (indicating that trouble is in regulator). If output does not drop off, disconnect this lead at generator 'F' terminal. If this causes output to drop off, this lead is grounded in harness and should be replaced. If output does not drop off, check generator for grounded field leads or windings. If trouble is located in regulator, reconnect field lead at regulator 'F' terminal, remove regulator cover, depress voltage regulator armature so as to open regulator contacts manually. If output drops off, regulator has not been functioning correctly and should be adjusted. If output does not drop off, check field circuit within regulator for shorts or grounds, see that all insulators in place and that both voltage and current regulator contact support bushings and insulators are properly installed (see Servicing data below).

Discharged Battery & Low Charging Rate or No Output—Check entire charging circuit for loose connections, damaged or broken wires, and short-circuits. If entire charging circuit in good condition and no high resistance in circuit, ground regulator 'F' terminal and operate generator, increase speed slowly and note generator output (CAUTION—Do not operate generator at excessive speed —generator is operated with no regulation when 'F' terminal is grounded and output may cause generator to burn out if speed increased excessively). If output increases with speed, regulator is defective and should be checked for incorrect setting or dirty or burnt contacts. If output does not increase beyond a few amperes, check generator for grounded or open field coils, dirty or burnt commutator, defective armature or brushes. If no output is noted, quickly disconnect lead from regulator 'GEN' terminal and flash this lead to ground. If no spark is noted, generator is defective. If spark occurs, check Cutout Relay for contacts not closing (burnt contacts, open shunt winding, high voltage setting, or grounds).

CAUTION—Do not operate generator more than momentarily with lead disconnected from regulator 'GEN' terminal. This is open-circuit operation and will damage generator or regulator if continued more than momentarily.

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ADJUSTMENT:—Check all specifications for each unit first and adjust each unit as follows:

CUTOUT RELAY

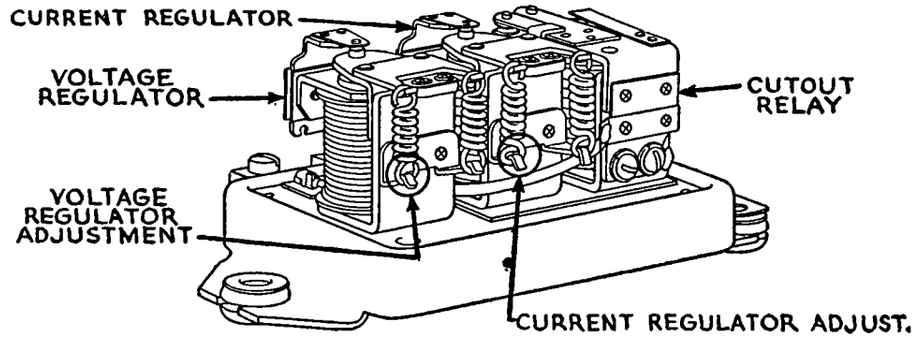
Model	Cut-in Setting Volts (Hot)	Cut-out Setting Disch. Amperes	Contact Gap	Air Gap
1118201 to 8	6.2-6.7	0-4.0	.020"	.020"
1118209, 10	12.4-13.4	0-4.0	.020"	.020"
1118211, 12, 13	6.2-6.7	0-4.0	.020"	.020"
1118214	12.4-13.4	0-4.0	.020"	.020"
1118215, 16	6.2-6.7	0-4.0	.020"	.020"
1118217 to 20	12.4-13.4	0-4.0	.020"	.020"
1118221, 22, 23	6.2-6.7	0-4.0	.020"	.020"
1118224	6.3-6.9	0-4.0	.020"	.020"
1118225	12.4-13.4	0-4.0	.020"	.020"
1118226	6.2-6.7	0-4.0	.020"	.020"
1118227, 28	12.4-13.4	0-4.0	.020"	.020"
1118229 to 34	6.2-6.7	0-4.0	.020"	.020"
1118235, 39	12.4-13.4	0-4.0	.020"	.020"
1118236, 37, 38	6.2-6.7	0-4.0	.020"	.020"

Cut-in Setting Note—Check only with unit HOT (at operating temperature).
Contact Gap—Adjust by bending upper armature stop (see Air Gap adjustment). Both contacts must have same gap so as to open and close together.
Air Gap—Check with armature pressed down so contacts just close. If both sets of contacts do not close simultaneously, bend spring fingers until they do. To adjust air gap, loosen two screws on hinge bracket at back of relay, raise or lower armature and hinge assembly.
Cut-in Voltage & Cut-out Amperage—To check, connect ammeter in charging line at regulator 'BAT' terminal, voltmeter between 'GEN' terminal and ground. Operate generator and gradually increase speed until relay contacts close, note voltmeter reading. Decrease speed slowly and note reverse current reading on ammeter when contacts open. To adjust closing voltage, bend spring post down (to decrease voltage), up (to increase voltage).

VOLTAGE REGULATOR

Model	Voltage Setting Volts (Hot)	Model	Volts (Hot)
1118201 to 6	7.2-7.4	1118221, 22, 23	7.0-7.2
1118207, 8	7.0-7.2	1118224	7.4-7.6
1118209, 10	14.0-14.2	1118225, 27, 28	14.0-14.2
1118211, 12	7.0-7.2	1118226, 29, 30	7.0-7.2
1118213	7.2-7.4	1118231	7.2-7.4
1118214	14.0-14.2	1118232, 33, 34	7.0-7.2
1118215, 16	7.0-7.2	1118235, 39	14.0-14.2
1118217 to 20	14.0-14.2	1118236, 37, 38	7.0-7.2

Important Note—Regulator over-compensated for temperature and must be checked only when hot and with cover in place (setting higher when cold).
Checking Voltage Setting—Connect ammeter and variable resistance of 'AVR' set in charging line at regular 'BAT' terminal, or disconnect charging line and ground the 'BAT' terminal through ¾ ohm fixed resistance (6 volt units), 1½ ohm fixed resistance (12 volt units). Resistance must be capable of carrying 10 amperes and must not change in value during temperature changes. Connect voltmeter between 'BAT' terminal and ground. Operate generator and increase speed to point where rated output normally produced (see car model 'T&E' page for generator data), adjust variable resistance of 'AVR' set so that charging current is 8-10 amperes (not required if fixed resistance method used). When regulator reaches operating temperature (150° or very hot to the touch) with regulator cover in place, cycle generator by decreasing speed to point where relay contacts open, then increase speed to original figure and note voltmeter reading. Adjust regulator if voltage not correct as shown in table above.
CAUTION—Do not change setting to correct High Voltage without first checking generator for grounded fields—see 'Important Service Note' above.
Adjustment—Bend spring hanger at lower end of **one spring only** down to increase spring tension and raise voltage setting, or up to decrease tension and lower voltage setting. If correct adjustment can not be secured on one spring, or if new springs are being installed, adjust second spring as follows:
Spring Adjustment—With one spring disconnected, connect voltmeter between regulator 'GEN' terminal and ground. Open regulator contacts by hand (press down on regulator armature), operate generator and slowly increase speed until voltmeter reading is 3 volts (6 volt units), 6 volts (12 volt units), release armature. Adjust spring tension by bending hanger at lower end of spring which is connected until voltage is 4 volts (6 volt units). Then connect second spring and adjust this spring as directed under 'Adjustment' above (do not touch first spring when making this final adjustment).
Contact Servicing—Contact points must be clean (dirty or oxidized points will cause reduced generator output and rundown batteries). To clean or surface contacts, remove upper contact support and service each contact separately. Use a thin, fine-cut contact file and file each point separately using great care not to file smaller rounded point excessively. If flat point has a cavity, use a 'spoon' or 'riffler' file to clean cavity out so that good contact secured between contact points (do not file contact excessively to remove cavities). When reinstalling upper contact support, make certain that all insulators correctly installed and adjust air gap. CAUTION—Do not use sandpaper or emery cloth
Air Gap—.070" measured at center of core with contacts just closing.
Air Gap Adjustment—To check, press armature down and allow it to come back until contacts just close, measure air gap at center of core with armature in this position. To adjust, loosen two screws on upper contact support bracket, move bracket up or down being careful to keep contacts lined up.



CURRENT REGULATOR

NOTE—Data below applies only to 3 unit Regulators (with separate Current Regulator Unit). Disregard this current regulator data when adjusting 2 unit Regulators (no Current Regulator) used with third-brush generators.

Model	Current Setting Amperes	Model	Amperes
1118201, 2	32-34	1118222, 23	34-36
1118207, 8	28-30	1118224	12.5-13.5
1118209, 10	16-18	1118225	14-16
1118211, 12	38-40	1118226, 29	34-36
1118214	24-26	1118230	26-28
1118215, 16	22-24	1118232	34-36
1118217	19-21	1118233, 34	24-26
1118218	7-9	1118235, 39	9-11
1118219	24-26	1118236	26-28
1118220	12-13	1118237, 38	38-40
1118221	26-28		

Important Note—On units with steel armature spring hinges, regulators are over-compensated for temperature and must be checked only when hot (have higher setting when cold). Units with bronze armature spring hinges operate at same value both cold and hot.
Checking Current Setting—Remove regulator cover and connect short jumper from voltage regulator frame to upper contact support bracket (this will short out voltage regulator while current regulator being checked). Connect ammeter in charging circuit at regulator 'BAT' terminal. Turn on lights, radio and other accessories (to provide load which will bring current regulator into operation), operate generator and increase speed until output remains stationary. With regulator at operating temperature (150° or very hot to the touch) and cover in place, ammeter reading should agree with setting given above.
CAUTION—Do not change setting to correct High Charging Rate without checking generator first for grounded fields—See "Important Service Note" above.
Adjustment—Bend spring hanger at lower end of **one spring only** down to increase tension and increase current setting, up to decrease tension and decrease current setting. If adjustment cannot be secured on one spring, or new springs are installed, proceed as follows:
Spring Adjustment—With one spring disconnected, operate generator at medium speed, adjust hanger at lower end of spring until output is regulated at approximately half rated output (17 amperes on 1118201,2). Then connect second spring and adjust this spring as directed above (do not touch first spring when making this final adjustment).
Contact Servicing—Same as for Voltage Regulator (above).
Air Gap—.080" measured at center of core with contacts just closing.
Air Gap Adjustment—Same as for Voltage Regulator (above).

Car	Generator	Regulator
Ford, All V8 Cars & Trucks	01A-10000-B	01A-10505-C
Ford, 4 Cylinder Truck	S08T-10000	01A-10505-C
Lincoln, All Models	01A-10000-B	01A-10505-C4
Mercury, Model 19A	01A-10000-B	01A-10505-C

PRODUCTION CHANGE NOTE:—Regulators with several minor differences will be found in service as follows:

Regulator Ground Lead—On some regulators, ground lead consists of a braided pigtail connected to a lug on the regulator case by which the regulator is grounded directly to the engine dash. The regulator case ground lug is attached to the regulator case by the cover rivet and this ground connection is disturbed by removal of the regulator cover. On other regulators, the ground connection consists of a separate wire which is connected to the regulator case and grounded to a terminal screw on the generator frame. CAUTION—Ground lead must be in place when regulators are tested. If ground disturbed by removal of regulator cover, re-install ground lead before making regulator tests.

Regulator Wiring Color Code—On some regulators, wire colors are marked on regulator cover adjacent to terminals. See car model wiring diagrams in 'T&E' section for wire colors and regulator connections on all models.

1940 PRODUCTION NOTE:—These new 3-unit Regulators were used on late 1940 Ford, Lincoln, and Mercury (after July) and are also furnished as Service Replacement for the earlier 2-unit type regulator. All data given below applies to 1940 and earlier cars with this new 3-unit regulator.

TYPE:—New design 3-unit (Cutout Relay, Voltage Regulator, Current Regulator) regulator with separate voltage and current regulator units (these units were combined on previous 2-unit regulators). Regulators are vibrating type and charging rate is normally controlled by Voltage Regulator. Current Regulator operates when current reaches value in excess of rated capacity and limits current to this figure. Both regulators operate in the same manner by cutting the resistance in and out of the field circuit and control the generator output by regulating the field current. Cutout Relay is compensated for temperature by means of a bi-metal clip on the armature spring so that the cut-in voltage is held constant throughout the normal temperature range.
SERVICE CAUTION—Ford Generators and Regulators are not wired in same manner as units of other makes and cannot be operated in conjunction with units of other makes. Always operate Ford Generators & Regulators together.

CHECKING & ADJUSTMENT:—When checking regulator on the car, test Battery, Charging Circuit, and Regulator in order and exactly as described below. Regulator should be at normal operating temperature (car should be operated for approximately 5 minutes to bring generator and regulator up to operating temperature).

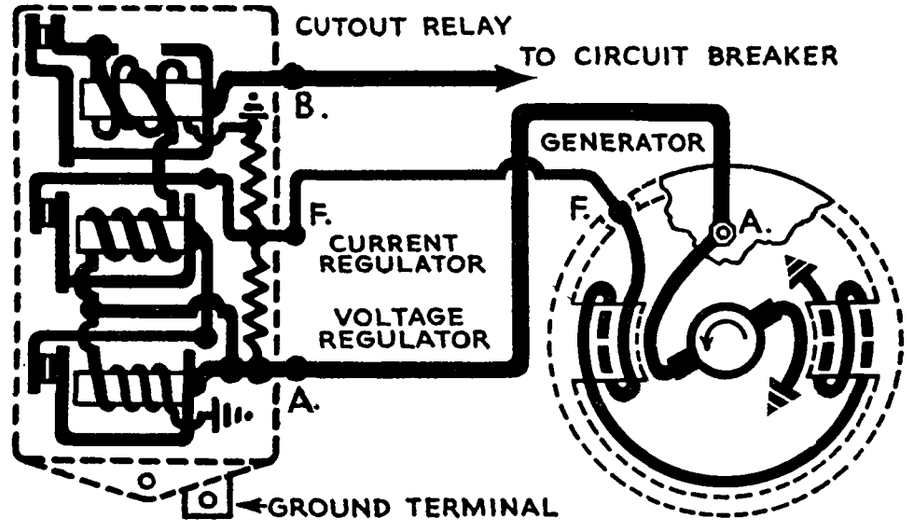
Battery:—Check battery with 'BRS' attachment and Ford Test Set. If battery tests less than 70%, recharge battery or install fully charged battery.

Charging Circuit:—Check entire circuit for high resistance as follows: Operate engine at 1250 RPM. with generator charging battery (use HI-TAC tachometer and Ford Test Set to set engine speed or see Service Note on Engine Speed below). Use 3-volt voltmeter test leads, connect one lead to positive post of battery, other lead to generator frame or positive (grounded) main brush. Voltmeter reading must not exceed .1 volt (Ford Test Set 'B' scale reading of 4). Then check resistance between generator and regulator by connecting one voltmeter lead to generator 'A' terminal, other lead to regulator 'A' terminal (armature terminal). Note voltmeter reading (or 'B' scale reading on Ford Test Set), then shift voltmeter lead from regulator 'A' terminal to regulator 'B' terminal (battery terminal) without disturbing lead at generator 'A' terminal. Voltmeter or Ford Test Set 'B' scale reading must not be more than 6 times previous reading (from generator to regulator 'A' terminals). Then shift voltmeter lead to negative post of battery (without disturbing lead on generator 'A' terminal), voltmeter or Ford Test Set 'B' scale reading must not be more than 6½ times first reading (from generator to regulator 'A' terminals). If voltmeter readings too high (indicating high resistance in charging circuit), correct this condition by cleaning and tightening terminals or replacing wiring before checking and adjusting regulator.

Regulator:—Regulator should be checked by 'fixed resistance' method which requires a special ¾ ohm fixed resistance capable of carrying 10 amperes and which does not change in value due to temperature changes. A special Heyer 'BABAE' ¾ ohm resistance unit is available for this purpose. To install resistor, disconnect charging line at regulator 'B' terminal (leave this lead disconnected while tests being made), connect ¾ ohm resistor to regulator 'B' terminal and ground opposite end of resistor. Then check and adjust regulator as directed below. NOTE—With this ¾ ohm resistor connected between regulator and ground, generator output is approximately 10 amperes.

CAUTION—Regulator is grounded through braided pigtail connected to regulator cover rivet or by separate ground wire from regulator case to generator frame. Ground connection must always be in place when generator and regulator are operated. If ground wire disturbed by removal of regulator cover, **make certain that regulator is grounded whenever generator and regulator are being operated.**

Relay Cut-in Voltage—Connect 15 volt voltmeter between generator 'A' terminal and ground. Start engine and slowly increase speed until cutout relay contacts close (pointer will drop back slightly as points close). Check by repeating test several times, note voltmeter reading. Cut-in voltage should be



5.8-6.3 volts at operating temperature. To adjust, remove regulator cover (see Service Note below for cover rivet removing tool), bend bi-metal at lower end of cutout relay armature spring in to increase tension and raise cut-in voltage, out to decrease tension and lower cut-in voltage.

NOTE—If idling speed is higher than cut-in point, it will be necessary to back off throttle stopscrew and lower idling speed below cut-in point before the above test can be made. If idling speed changed in this manner, make certain that speed is reset at 500 Eng. RPM. (5-7 MPH.) after tests completed.

Voltage Regulator Setting—Re-install regulator cover and make certain that regulator case grounded (if ground pigtail disturbed by cutout relay adjustment above). Connect 15 volt voltmeter between regulator 'B' terminal and ground. Operate generator at 2300 RPM. using HI-TAC tachometer and Ford Test Set to set engine speed at correct figure in table below (or see Service Note on Engine Speed below). Note voltmeter reading which will be voltage regulation point. Voltage should be 6.9-7.2 volts (46-48 on Ford Test Set 'B' Scale) with regulator at 70-80° F. (temperature after 5 minutes operation). See Service Note Table below for voltages at other temperatures. If voltage is not within these limits, regulator should be replaced. See Service Note on adjustment below.

Engine Speed Table (for 2300 Generator RPM).

Generator Pulley Size	Engine-Generator RPM Ratio	Engine RPM.
3.0"	1.82	1250
3.44"	1.57	1468
3.5"	1.52	1510
3.53"	1.48	1550
3.85"	1.35	1700
4.2"	1.25	1840

Current Regulator Setting—With engine running at same speed as for Voltage Regulator test (above), connect '90' ammeter in charging line at regulator 'B' terminal (connect one ammeter lead to regulator 'B' terminal,

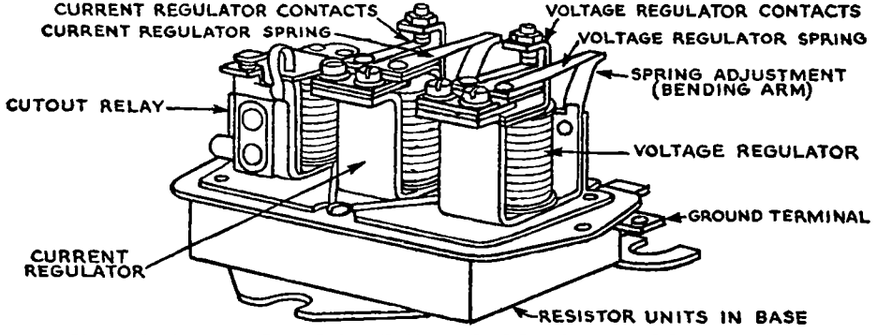
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other lead to charging line previously disconnected from this terminal, make certain that ¾ ohm fixed resistance disconnected by removing resistor ground lead), turn on headlamps and close starter switch so that starter runs free (to supply load and cause current regulator to operate), note ammeter reading which will be current regulation point. Current should be 28 amperes at 7.0 volts with regulator hot (after engine has been run for 5 minutes. IMPORTANT NOTE—This 28 ampere setting at 7.0 volts is equivalent to 196-200 watts generator output which should not be exceeded for continuous operation.

Cutout Relay Reverse Current—After checking Current Regulator (above) and without disturbing test connections, slowly decrease engine speed until ammeter indicates discharge 'reverse' current through cutout relay (On Ford Test Set, meter plug should be reversed in socket when charging current reading drops to approximately 5 amperes or 5.5 on the 'B' scale so that discharge current can be read on dial). Note ammeter reading at instant contacts open (pointer will drop to zero with contacts open). Reverse current must not exceed 8 amperes.

SERVICE NOTES:—Regulator Cover Removing Tool—Regulator cover is fastened on by a rivet to the regulator frame flange at either end. On some models, one rivet also attaches the ground pigtail terminal. A special tool (combination punch and rivet set) is available with which the cover rivets can be easily removed (to remove cover for adjustments) and installed when cover is replaced. CAUTION—Always make certain that ground lead pigtail or wire is properly attached when cover is installed.



Voltage & Current Regulator Setting & Adjustment—Adjustments are not recommended on Voltage & Current Regulators. These units have adjustable spring post or 'bending arm' which controls regulating voltage and current. Bending this post or arm in so as to increase spring tension will increase voltage or current setting, bending arm out so as to decrease spring tension will decrease voltage or current setting. Air Gap for both Voltage & Current Regulators is approximately .047-.050".

Voltage Regulator Setting—Regulating voltage depends on temperature and if regulator is not at 70-80° when being tested (as directed above), voltage should agree with following table for temperature ranges as noted.

Voltage Setting

Temperature (°F.).	Volts
50°	7.0-7.3
60°	6.92-7.25
70°	6.85-7.2
80-90°	6.8-7.1
100°	6.75-7.05
110-130°	6.7-7.0
140-150°	6.65-6.95
160-180°	6.6-6.9

Setting Engine Speed—Manufacturer recommends that tachometer (HI-TAC tachometer and Ford Test Set) be used to determine engine speed when checking and adjusting regulator. However, if tachometer not available, approximate engine RPM. can be determined from the car speedometer by running the engine with transmission in high gear (rear wheels blocked up) at a car speed (speedometer reading) which will depend on the Tire Size and Rear Axle Ratio and can be calculated as follows: Multiply the 'Tire Revolutions per Mile' (see table below) by the 'Rear Axle Ratio' (see table below), divide this amount by 60 to determine 'Engine Revolutions per mile per hour' as indicated on car speedometer. Note desired Engine RPM in table under 'Voltage Regulator Setting' above (RPM depends on size of generator pulley), divide this RPM figure by the previously calculated 'Engine Revolutions per mile per hour' figure. The result will be the speedometer reading at which the engine should be run in high gear to secure the desired Engine RPM for regulator testing and adjusting.

Tire Revolutions per Mile

Tire Size	Rev. per Mile	Tire Size	Rev. per Mile
5:50x16 (4 ply)	772	6:50x20 (8 ply)	620
6:00x16 (4 ply)	740	7:00x16 (4 ply)	713
6:00x16 (6 ply)	734	7:00x16 (6 ply)	710
6:00x18 (4 ply)	696	7:00x20 (8 ply)	592
6:00x18 (6 ply)	688	7:00x20 (10 ply)	597
6:00x20 (6 ply)	636	7:50x20 (8 ply)	573
6:00x20 (8 ply)	636	7:50x20 (10 ply)	568
6:50x16 (4 ply)	722	7:50x18 (10 ply)	602
6:50x16 (6 ply)	730	8:25x20 (10 ply)	553
6:50x20 (6 ply)	616	9:00x18 (10 ply)	559

1941 Models	Rear Axle Ratios (Std. & Optl.)	Axle Ratio
Ford V8 Passenger Car & Commercial		4.11, 3.54, 3.78
Ford 4 Cylinder Commercial		4.55
Ford ¾ & 1 Ton Truck		4.11, 4.857
Ford 4 Cyl. ¾ & 1 Ton Truck		6.666
Ford 148½" WB. Bus		6.666, 5.83
Ford All Other V8 Trucks		6.666, 5.83, 5.14
Lincoln Zephyr, Continental, Custom		4.44
Mercury		3.54, 3.78, 4.11

NOTE—For earlier car models, see Rear Axle data on 'M' pages in manual.

1941 AUTO-LITE REGULATORS

CONTINUED FROM PAGE EE-452

REGULATOR RESISTORS:—One resistance unit used on 'VRR' regulators, two used on 'VRP' models (see VRP illustration for resistor locations). Resistors should be checked for correct resistance by testing with ohmeter (ST-284). CAUTION—Remove one resistor at a time to avoid interchanging units. Use extreme care to replace resistors in exact original location.

Voltage-Current Regulator Resistors

Model	Mark —R1— Ohms	Mark — R2 — Ohms
VRP-4001A	38 — 36-40	7 — 6.5-7.5
VRP-4001B, 1F	60 — 57-63	15① — 13.5-16.5
VRP-4001C	30 — 28-32	7 — 6.5-7.5
VRP-4001D, 1E	60 — 57-63	11 — 10-12
VRP-4002A, 2C	38 — 36-40	7 — 6.5-7.5
VRP-4002B	30 — 28-32	7 — 6.5-7.5
VRP-4002D	60 — 57-63	15 — 13.5-16.5
VRP-4003A, 3B	38 — 36-40	7 — 6.5-7.5
VRP-4004A, 4F, 4G, 4H	38 — 36-40	7 — 6.5-7.5
VRP-4004B	60 — 57-63	11 — 10-12
VRP-4004C, 4E	60 — 57-63	15① — 13.5-16.5
VRP-4004D	30 — 28-32	7 — 6.5-7.5
VRP-4005A	38 — 36-40	7 — 6.5-7.5
VRP-4005B	60 — 57-63	15① — 13.5-16.5
VRP-4005C	60 — 57-63	11 — 10-12
VRP-4005D	30 — 28-32	7 — 6.5-7.5
VRP-4005E	60 — 57-63	15 — 13.5-16.5
VRP-4006A, 6AP, 6B, 6D	60 — 57-63	11 — 10-12
VRP-4006C, 6G	30 — 28-32	7 — 6.5-7.5
VRP-4006E, 6F	60 — 57-63	15① — 13.5-16.5
VRP-4007A, 7B	60 — 57-63	15① — 13.5-16.5
VRP-4007C, 7D	38 — 36-40	7 — 6.5-7.5
VRP-4008A, 8C	60 — 57-63	15① — 13.5-16.5
VRP-4008B	38 — 36-40	11 — 10-12
VRP-4009A, 9D	60 — 57-63	11 — 10-12
VRP-4009B	30 — 28-32	7 — 6.5-7.5
VRP-4009C	60 — 57-63	15① — 13.5-16.5
VRP-4101A, 2A	30 — 28-32	None
VRP-4103A, 4A	60 — 57-63	11 — 10-12
VRP-4105A	60 — 57-63	30 — 28-32
VRP-4201A-1, 2A-1	38 — 36-40	7 — 6.5-7.5

①—After No. 6U-000001. Before this No., R2 was marked 11 (10-12 ohms).

Voltage Regulator Resistors

Model	Mark	Ohms
VRR-4001A, 2A	30	28-32
VRR-4001B, 2B, 3A, 4A, 5A	20	19-21

POSITIVE PINION SHIFT TYPES

Car Model	Starting Switch	Starter
De Soto, Model S8 (1941)	SW-2813	MAW-4019
Dodge, Model D19 (1941)	SW-2813	MZ-4089
Dodge, Canadian Models (1941)	SW-2813	MAW-4019
Plymouth, P11, P12 (1941)	SW-2813	MZ-4089
Plymouth, Canadian Models (1941)	SW-2813	MAW-4019

TYPE:—Consists of a manually operated pinion shift on starting switch (linked to starting pedal on toeboard). Starting switch is mounted on starter field frame and is operated by a knob on the shift lever after the pinion has been meshed with flywheel (adjustment provided to insure pinion being meshed before switch closes).

CHECKING & ADJUSTMENT:—Check starter armature endplay, pinion position and clearance (single adjustment) as follows:

Pinion Position when disengaged—With pinion at rest, distance from outer face of mounting flange on pinion housing to outer end of pinion should be 1 11/32" plus 1/64" or minus 5/32".

Pinion Clearance when engaged—With pinion fully meshed in flywheel (full travel of shift lever), clearance between outer end of pinion and face of thrust washer next to outer pinion housing bearing should be 5/64" plus or minus 1/64". To adjust, turn button on outer end of starting switch plunger in or out on plunger (press down on spring to free button which is locked in position by outer end of spring).

Armature Endplay—Armature endplay should be .005" minimum, .030" maximum. Adjust by inserting MU-54 thrust washer of correct thickness between the MAD-96 thrust washer and the commutator end plate. These thrust washers furnished as follows: MU-54—1/32", MU-54A—1/64", MU-54B—3/64".

Switch Travel—Plunger travel between at rest position and closed position should be approximately 5/32".

Checking Switch Action—Switch action can be checked by slipping special steel spacer (square stock 1" wide, 3/4" thick, with 5/8" slot in the 1" face) on armature shaft between pinion and thrust washer at pinion housing outer bearing. With spacer in place, switch should close when pressure applied to outer end of pinion shift lever.

SOLENOID PINION SHIFT TYPES

Car Model	Solenoid Switch	Starter
Chrysler 6, Model C28 (1941)	SS-4703	MAX-4045
Chrysler 8, C30, C33 (1941)	SS-4703	MAX-4045
Packard Super 8, 1903 to 8 (1941)	SS-4205	MAX-4041
Studebaker President, 7C (1941)	SS-4702	MAX-4044

PACKARD NOTE:—Packard Super 8 starter is a reduction gear type unit with solenoid operated pinion on reduction gear shaft which is driven at 14/29 armature speed. Grease plug provided on drive end of starter through which gear compartment can be packed with heat-resisting grease. Solenoid Switch unit is similar to types use on other starters and is serviced in the same manner.

TYPE:—Solenoid type combined starting switch and pinion shift (with control relay mounted in solenoid case) mounted on the starter field frame. Types used on 1941 car models are similar in design to units used on corresponding 1940 cars (Chrysler type has new design shift lever and protective boot on outer end of solenoid plunger—no shift mechanism cover being used on this type).

CHECKING & ADJUSTMENT:—Check starter armature endplay, pinion position and clearance (single adjustment), solenoid performance and relay specifications as follows:

Solenoid Winding Tests—Shunt and series windings together should draw 34-38 amperes at 3.0 volts. Shunt coil only should draw 14-16 amperes at 6.0 volts

Solenoid Relay Specifications

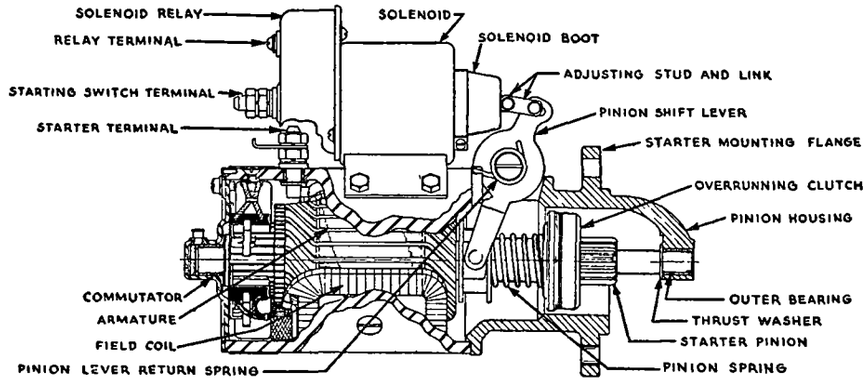
Contacts Close—3.5-4.5 volts. **Contacts Open**—1.5-2.5 volts.
Contact Gap—.025-.035". **Coil Resistance**—7.5-8.3 ohms at 77° F.

Pinion Position when disengaged—With pinion at rest, distance between outer face of mounting flange on pinion housing to outer end of pinion should be 15/16" (MAX-4041), 19/32" (MAX-4044), 1 11/32" (MAX-4045) plus 1/64" or minus 5/32". Adjusted by changing solenoid plunger stud position (below).

Pinion Clearance when engaged—With switch closed and plunger fully bottomed in core (press in on plunger when making this test), clearance between end of pinion and thrust washer next to outer pinion housing bearing should be 5/64" plus or minus 1/64". To adjust, remove pin in plunger link and turn stud in or out of plunger.

Armature Endplay—Armature endplay must be .005" minimum, .030" maximum. Adjust by inserting MU-54 thrust washer of correct thickness between the MAD-96 thrust washer and the commutator end plate. These thrust washers furnished as follows: MU-54—1/32", MU-54A—1/64", MU-54B—3/64".

Checking Switch Action—Switch action can be checked by slipping special steel spacer (square stock 1" wide, 3/4" thick, with 5/8" slot in the 1" face) on armature shaft between pinion and thrust washer at pinion housing outer bearing. With spacer in place, switch plunger should bottom and switch contacts should close with normal voltages.



TROUBLE SHOOTING:—**Pinion fails to engage or disengage properly.** Check for interference between shift yoke and collar at open end of yoke where curved section passes over rim on collar. Binding of yoke on collar at this point should be corrected by filing yoke at point where interference occurs. Check for binding of yoke shoes on mounting pins which causes shoes to turn and bind in collar. Correct by cleaning all dirt from between shoes and yoke, lubricate shoe pins and make certain that yoke shoes installed with curved side toward pinion end of starter clutch. Check for binding of yoke assembly on yoke fulcrum pin due to paint or dirt on pin. Clean yoke pin and yoke sleeve thoroughly, examine return spring on pin. If this does not correct trouble, replace yoke assembly.

Flywheel ring gear teeth damaged by pinion. May be caused by too early closing of starting switch contacts which will result in starter operating before pinion has been meshed with flywheel. Check pinion position (see specifications above). Switch contacts should close approximately 3/16" plunger travel before plunger bottoms in solenoid core.

MAGNETIC SWITCH TYPES

Car Model	Switch Type	Starter
Hudson 6, 10, 11, 12, 13, 18 (1941)	SS-4001	MZ-4092
Hudson 8, 14, 15, 17 (1941)	SS-4001	MAB-4100
Packard Clipper, Model 1951 (1941)	SS-4017	MAW-4021,24
Packard 6, Model 1900 (1941)	SS-4017	MAW-4021,24
Packard 8, Model 1901, 1A (1941)	SS-4017	MAW-4021,24
Willys Comm'l., 441P Panel (1941)	SS-4001	MZ-4049, MZ-4100

NOTE:—**Packard Clipper**—This switch used with Carter Car Starter. See separate article for complete data on this Carter Car Starter.

TYPE:—Consists of a magnetic switch mounted on the starter field frame and controlled by a pushbutton switch on the instrument panel. The feed wire for the pushbutton and switch is normally connected to the 'gauge' side of the ignition switch so that the starter is operative only with the ignition turned on. These switches used only on starters with Bendix drives.

PERFORMANCE:—**Closing & Opening Voltages**—Initial contact of switch should occur with terminal voltage of not more than 4.0 volts and switch plunger should bottom with voltage of not more than 5.25 volts. Switch contacts open with voltage of .75 volt minimum, 2.0 volts maximum.

Coil Winding—Winding has resistance of 1.82-2.06 ohms at 70° F. and current draw is 2.9-3.3 amperes at 6.0 volts.

CHECKING & ADJUSTMENT:—Check switch performance (see performance specifications above). No adjustment of the switch is required.

NOTE—Switch can be operated by hand by removing small metal cap on end of switch case and pressing in on switch plunger.

MANUAL PINION SHIFT TYPES

Car Model	Starting Switch	Starter
Chevrolet, All Models (1941)	820052	1107033
Graham, 109, 113 (1941)	820052	738-T
Oldsmobile, All Sixes (1941)	820052	1107034
Oldsmobile, All Eights ('41)	820052	1107922
Pontiac, All Sixes (1941)	820052	1107032
Pontiac, All Eights (1941)	820052	1107921

DESCRIPTION:—These starters have a pinion assembly and shift lever similar to that used on Solenoid Pinion Shifts but the shift lever is connected through linkage to the starting pedal so that the pinion is positively engaged with the flywheel teeth when the starting pedal is depressed. The starting switch is mounted on the starter field frame and switch plunger is depressed by lug on shift lever to close switch contacts and operate starter after pinion has been meshed with the flywheel.

SERVICING:—No servicing required and no adjustments provided. Switch contacts should not close until after pinion has been meshed (except when pinion teeth butt against flywheel teeth in which case compression of spring between shift collar and overrunning clutch on pinion sleeve will allow switch contacts to close and revolve pinion to meshing position). Return spring on shift lever should have sufficient tension to disengage pinion promptly when starting pedal is released.

Pinion Assembly. Same as types used on Solenoid Pinion Shift Starters (see below). The compression spring and collar can be serviced but no attempt should be made to dismantle or service overrunning clutch.

SOLENOID PINION SHIFT TYPES

SOLENOID SWITCHES (WITH PUSHBUTTON CONTROL)

Car Model	Solenoid Switch	Starter	Pushbutton No.
Cadillac, A11 (1941)	1542	1107923	1996009
Cadillac, 75 RHD. (1941)	1542	1107925	1996009
Chevrolet, RHD. Pass. Cars ('41)	1546	1107038	1996010
Graham, 109, 113 RHD. (1941)	1546	738-X	
Oldsmobile, Six RHD. (1941)	1546	1107019	1996008
Oldsmobile, Eight RHD. (1941)	1546	1107924	1996008
Pontiac, All RHD. (1941)	1546	727-S	1996012

SOLENOID SWITCHES (WITH VACUUM SWITCH CONTROL)

Buick, 41-40, 50 (1941)	1542	1107005	1990127①
Buick, 41-40, 50 RHD. ('41)	1542	1107018	1990127①
Buick, 41-60, 70, 90 (1941)	1542	1107908	1990127①
Buick, 41-60, 70, 90 RHD. ('41)	1545	1107909	1990127①

①—Used on cars with Stromberg Carburetors only. Cars with Carter Carburetors have Carter Car Starter No. 192-11U.

NOTE:—Chevrolet, Graham, Oldsmobile, Pontiac LHD. Models—These models have Manual Pinion Shift (starting pedal) type starter control. See separate article for data on this manual pinion shift type.

TYPE:—Solenoid type combined starting switch and pinion shift (with control relay in solenoid case) mounted on the starter field frame with the solenoid plunger linked to the pinion shift lever. Types used on 1941 car models are similar in design to types used on corresponding 1940 cars.

PERFORMANCE:—Solenoid Switch—Solenoid should close (bottom in core) against 70 lb. pull with ½" gap drawing 65-71 amperes at 5 volts. While closed, current should be 12-14 amperes (hold-in coil only).

Relay Specifications (1542, 1545, 1546)

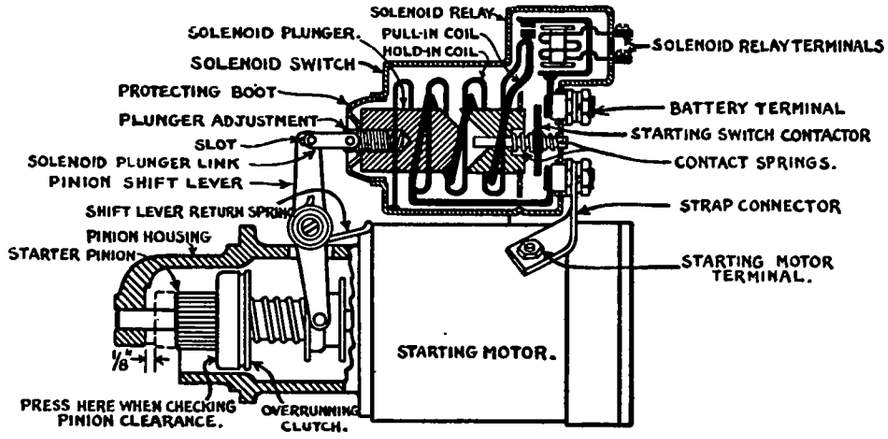
Contacts Close—1.9 volts maximum. **Contacts Open**—1.0-1.2 volts.
Contact Gap—.035" (.025-.045"). **Air Gap**—.012" (contacts closed).

CHECKING & ADJUSTMENT:—Check Solenoid and Relay performance (see specifications above). Adjust solenoid plunger link for correct pinion clearance as follows:

Solenoid Setting—Clearance between end of pinion and inner face of starter pinion housing should be 3/16" (solenoid plunger bottomed in core). Adjustment will be simplified if lead disconnected at terminal on starter field frame (so starter will not spin) and relay contacts closed so that plunger is drawn into coil core. Press back on pinion to take up backlash in overrunning clutch, remove solenoid plunger link pin, adjust link (by turning link stud in plunger) until pin can just be inserted at forward end of shift lever slot.

Cadillac Note—On these starters, pinion travel (from disengaged or at rest position to fully engaged position with solenoid plunger bottomed in core should be 23/32" to 25/32".

SERVICING:—Pinion Assembly & Spring—Pinion assembly same type as used on previous models (may be identifed by groove in pinion teeth approximately ⅛" from clutch shell). Compression spring must have tension of at least 34 lbs. when compressed to 1". To remove spring, press shift collar down on pinion sleeve to compress spring until lock ring on end of sleeve is exposed, remove lock ring. Spring and collar can be serviced but no attempt should be made to dismantle overrunning clutch mechanism. Clutch is packed with high melting point grease and pinion assembly should not be cleaned by any method which may remove this lubricant.



Shift Lever Return Spring—Return spring on shift lever should have tension of 9-12 lbs. (start of travel), 28-35 lbs. (end of travel). Weak spring may cause sluggish disengagement particularly in cold weather or if shaft is gummy.

MAGNETIC SWITCH TYPES

Car Model	Switch Type	Starter
Packard '110' Six, 1900 (1941)	1452	1107037

TYPE:—Consists of a magnetic switch mounted on the starter field frame and controlled by a pushbutton switch on the instrument panel. The feed wire for the switch is connected to the 'gauge' terminal of the ignition switch so that the starter is operative only with the ignition turned on. Starter used with this type switch is equipped with a Bendix Drive.

PERFORMANCE:—Operating Voltage—Switch contacts should remain closed with voltage reduced to .7 volts (.54-.65 ampere current draw).
Current Draw—3.1-3.7 amperes at 4.0 volts.

CHECKING & ADJUSTMENT:—Check switch performance (see specifications above). No adjustment of the switch is normally required.
NOTE—Switch can be operated by hand by pressing in on switch plunger after small metal cap on end of switch case is removed.

Model **Used On:**

1990127—BUICK, SERIES 41-40, 50, 60, 70, 90 ('41) WITH STROMBERG CARBURETORS.

TYPE:—Same design as used on 1940 Buick models with Stromberg carburetors. Switch is 'direct operated' type and is mounted directly on the carburetor (front carburetor of Compound Carburetion cars) with the switch rotor mounted directly on the carburetor throttle valve shaft.

DESCRIPTION:—This Vacuum Switch is of the 'direct operated type' with contact rotor mounted directly on end of throttle valve shaft within switch body (switch assembly mounted directly on carburetor casting at end of throttle shaft by two screws). Vacuum chamber is formed within top cover plate and is connected to the manifold below the throttle valve by a channel extending through the top cover, switch body, and carburetor casting. Diaphragm is clamped between switch body and top cover and consisted of a riveted assembly including spring cup (spring sits in cup and is positioned by recess in top cover) and combination guide pin and lockout plunger (which moves in guides formed in switch body). The internal circuit through the switch is completed from one contact spring through the contact rotor to the opposite contact spring (mounted on the lockout lever).

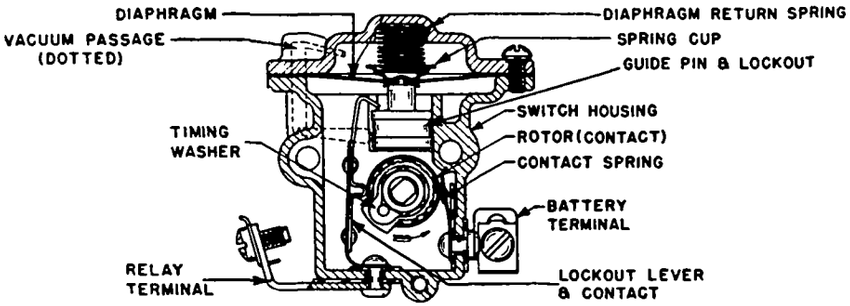
OPERATION:—With the engine not running (no vacuum) and the throttle valve closed, lockout will free lockout lever (diaphragm pressed down by return spring) but lockout lever and contact will be held away from contact plate on contact rotor by insulating knob on rotor. When the throttle is opened to start the engine, contact rotor turns with throttle valve shaft and as soon as insulating knob is turned away from the lockout lever, the contact spring on the lever contacts the rotor and completes the circuit through the switch. As soon as vacuum is developed in the manifold, diaphragm attempts to move upward but is prevented from doing so by hook on upper end of lockout lever which engages top of lockout plunger. When throttle is closed (to idle engine after it has started), insulating knob on contact rotor presses out on lockout lever and frees lockout plunger, diaphragm then moves up and lockout engages lockout lever so that the contact spring is held away from the contact rotor while the engine is running. When engine is stopped, the closing of the throttle valve lifts the lockout lever from the lockout (this Unlatch Action occurs 17-23° from closed throttle position) and diaphragm and lockout plunger drop down into position for a new start.

ADJUSTMENT:—No adjustment ordinarily required. Switch is "timed" for correct throttle position when contacts closed by timing washer assembled on face of contact rotor which positions rotor on throttle valve shaft. Timing can be checked, and new washers installed to change timing as follows:

Switch Timing Check:—See that carburetor throttle lever stopscrew set for correct 8 MPH. hot or slow idle speed. Take out screws and remove side cover plate on switch. Start engine, close throttle, then open throttle until clearance between throttle stopscrew and highest step of fast idle cam is ¼" (cam in fast idle position—engine must be cold), stop engine without disturbing throttle position. Place mirror so that switch guide pin and lockout visible from left side of car, close throttle slowly by lightly tapping on hand throttle lever until guide pin and lockout releases, then measure clearance between stopscrew and fast idle cam with cam in fast idle position. Clearance should be 3/64" minimum, 3/32" maximum. If less than 3/64" timing washer should be replaced by one having a **higher number.** If more than 3/32", timing washer should be replaced by one having **lower number.** See directions below.

Switch Action Check (On Car):—See that carburetor throttle lever stopscrew set for correct 8 MPH. hot or slow idle speed. Start engine, close throttle then open throttle until clearance between throttle stopscrew and highest step of fast idle cam is ¼" (cam in fast idle position—engine cold), stop engine. Tap throttle closed until clearance between stopscrew and cam is exactly 3/64" (use extreme care not to close throttle further, if clearance less than 3/64", repeat entire procedure). Start engine by opening throttle from this position. Repeat this test several times. Engine should start each time. If engine does not start more than once, timing washer should be replaced with one having a **higher number.** After making above test for minimum clearance between fast idle cam and stopscrew, check for maximum clearance as follows. Repeat test instructions given above except that clearance between fast idle cam and stopscrew should be set at not less than ⅛". Engine should not start from this position. If engine starts, timing washer should be replaced with one having **a lower number** and first test (for minimum clearance) should be repeated.

Timing Washers:—Washer has slot which engages flat on throttle shaft and lug which engages hole in contact rotor (rotor is free on shaft and is positioned by timing washer). Washer marked by number on side opposite rotor lug and furnished with lug in different positions for smaller or larger stopscrew-to-fast idle cam clearance (washer with higher number will increase clearance, lower number decrease clearance). Washer number indicates angular degrees of



throttle shaft rotation and washers are furnished in 3° steps. Select correct washer by means of tests given above and install washer as follows:

Timing Washer Installation. Take out screws in side cover on switch, remove cover and gasket. Remove nut on end of throttle valve shaft within switch, remove lockwasher and timing washer (if contact rotor removed, make certain that steel washer installed on shaft behind rotor). Install timing washer being careful to see that lug engages hole in contact rotor, install lockwasher and tighten nut, replace cover and gasket. Recheck switch timing.

CAUTION—Cover gasket is felt and is designed to provide necessary 'breathing' action required by diaphragm movement. This gasket must always be installed under side cover and no other type gasket should be used

SERVICING:—No servicing required. If top cover removed (for diaphragm replacement), make certain that return spring properly seated in cover recess and spring cup on diaphragm and that vacuum channel in top cover and switch body line up. When installing new parts, always check switch timing and install correct timing washer as directed above.

CAUTION:—Always connect wire with red cross tracers (hot lead) to terminal on front of switch to prevent lock-out lever being short-circuited if it should be bent back against housing during timing operation.

1940 DELCO-REMY STARTERS

NOTE:—When burnt commutators are found on starters used on early 1940 cars, starter should be inspected for improper armature coil connections at commutator bar risers and this condition corrected as follows:

CHECKING STARTER:—Carefully examine all armature leads at point where they are soldered to commutator bar risers (pay particular attention to inner or underneath leads) for evidence of improper soldering and poor bond between leads and commutator bars.

CORRECTING TROUBLE:—Remove armature, carefully resolder all leads to commutator bar risers. Turn down commutator. When reassembling starter, check brushes to make certain that they are free and not binding, see that pigtail leads are correctly attached and free so that they do not hold brush off commutator. Check brush spring tension (see car model 'T&E' page for specifications). CAUTION—Too little brush spring tension will cause arcing and burnt commutator, excessive tension will cause rapid wear.

Time Allowance—Time required for complete repair (resoldering armature and turning down commutator) is 1½ hours (including removal of starter from car), 1 hour (when starter off engine).

CARTER MODEL No. 192-11U

BUICK, SERIES 41-40,40A,50,60,70,90 (1941)—WITH CARTER CARBURETORS. PACKARD, CLIPPER MODEL 1951 (1941)

NOTE:—Buick—Carter Car Starter or Vacuum Switch is built in Model WCD Type carburetors (front carburetor only on Compound Carburetion Cars) which are used on these cars. Switch assembly must be removed before the carburetor throttle valve shaft can be taken out (when carburetor being disassembled).

Packard—Carter Car Starter is used in conjunction with a Magnetic Switch (Auto-Lite Model SS-4017) mounted on the starter. Starter is equipped with a Bendix drive. See Auto-Lite Starter Controls—'Magnetic Switches' for switch data.

DESCRIPTION & OPERATION:—Plunger type switch mounted on carburetor body casting and operated by steel ball which engages switch plunger and flat on carburetor throttle valve shaft when engine is not running. Depressing accelerator pedal to open throttle forces switch plunger up until 'W' shaped contact spring on upper end completes circuit between two brass contact blocks in the switch cap. When the engine begins to fire, switch ball is drawn up out of engagement by manifold vacuum (ball blocks vacuum passage as long as engine is running) so that switch is inoperative. When engine stops, throttle must be closed momentarily to allow switch ball to drop down between throttle shaft and switch plunger.

ADJUSTMENT:—Checking Vacuum Switch Timing. Use special Carter tool T109-155S (see Note) consisting of scale clamped on choke housing and indicator arm fastened on throttle lever. Connect test lamp in switch circuit to check switch closing. Rotate fast idle cam to hot or slow idle position, back off throttle lever stopscrew so that throttle valves are tightly closed. Loosen setscrew and set indicator arm opposite '0' on the 'WCD' scale of the gauge. Open throttle lever and note gauge reading when switch closes (test lamp will light). Gauge reading should be between 30° and 40°. Adjust by adding (if throttle opening more than 40°), removing (if throttle opening less than 30°) square brass adjusting shims located on bakelite guide block under 'W' shaped contact spring (these shims have square hole which engages tongue on guide block, do not confuse these shims with round spring seat washer which seats on middle leg of contact spring).

Carter Tool T109-155S Note—This tool similar to tool No. T109-121S used to check Carter Car Starter on Buick Series 40 (1939) Carter Carburetors and this earlier T109-121S gauge can be used to check 1941 cars if it is brought up to date by installation of following parts: T109-156 Swivel Block Screw, T109-159S Coil Housing Clamp Assembly. NOTE—If T109-121S gauge is used, refer to upper 'WDO' scale (new T109-151S gauge has upper scale marked 'WCD-WDO').

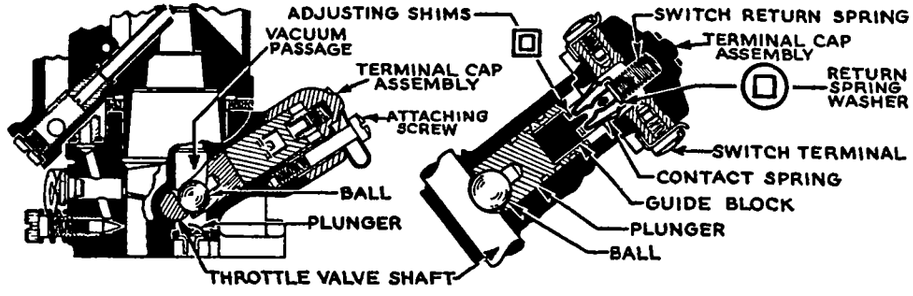
Checking Switch Without Gaug . If tool not available, rough check can be made on car by measuring clearance between machined surface of stop boss on carburetor throttle base and nearest edge of throttle stop arm. Distance should be 23/64" minimum, 27/64" maximum when switch closes.

SERVICING:—Removal & Disassembly. Disconnect and tape leads on switch terminals (wire with red tracer on terminal nearest engine is 'hot' with ignition turned on). Remove switch terminal cap attaching screw, hold-down clip, switch cap, withdraw return spring, guide block and contact spring assembly, switch plunger and ball. Be careful not to lose spring seat washer (on contact spring) or adjusting shims (on guide block under contact spring).

Servicing. Clean switch ball, plunger, cylinder, carburetor vacuum chamber and inlet screen, throttle valve shaft flat with gasoline. Check 'W' contact spring and switch return spring. Replace these parts if dimensions incorrect.

'W' Contact Spring—Distance across spring at widest part (across outer contact legs) should be 7/16" plus or minus 1/32" with spring seat washer seated on middle leg of spring.
Return Spring—Free length of spring should be 11/16-¾" and pressure of 32 ozs. should be required to compress spring to ⅜" length.

Reassembly. When installing switch plunger make certain that lip on inner end of plunger is down toward manifold (lip will prevent ball engaging on flat of shaft if installed incorrectly). See that adjusting shims are in place under contact spring, and spring seat washer seated on middle leg of contact spring. Make certain that return spring enters socket in switch cap and that boss on cap enters counterbore on casting. Do not oil any part of switch mechanism. Connect wire with red tracer (hot wire) to terminal nearest engine (away from throttle stopscrew).



1941 CARBURETOR CAR MODEL INDEX

NOTE: *Two Separate Indexes* are provided for CARBURETORS. The CARBURETOR INDEX directs you to Each Carburetor *Type*. The CARBURETOR CAR MODEL INDEX to the CARBURETOR *installed on each Car Model.*

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AMERICAR	441	1941		See Willys	
BANTAM	65 Super Four	1941	Zenith	61A5	C-248
BUICK	All Models	1941	Compound Carburetion		C-223
BUICK	40 Std.	1941	Carter	487-S	C-226
BUICK	40 Std.	1941	Stromberg	AAV-16	C-225
BUICK	40 Optl.,50..Early	1941	Carter WCD	509-S & 510-S	C-226
BUICK	40 Optl.,50...Late	1941	Carter WCD	528-S & 529-S	C-226
BUICK	40 Optl., 50	1941	Stromberg	AAV-16 & AA-1	C-225
BUICK	60,70,90 .....Early	1941	Carter WCD	490-S & 491-S	C-226
BUICK	60,70,90 .....Late	1941	Carter WCD	533-S & 534-S	C-226
BUICK	60,70,90	1941	Stromberg	AAV-16 & AA-1	C-225
CADILLAC	60S,61,62,63,67,75	1941	Carter WDO	506-S	C-234
CADILLAC	60S,61,62,63,67,75	1941	Stromberg	AAV-26	C-244
CHEVROLET	Pass.Cars&Trks.	1941	Carter W1	483-S	C-229
CHEVROLET	C-O-E Trucks	1941	Carter (BB)	489-S	C-238
CHEVROLET	AJDubl-Dut.Trk.	1941	Carter (BB)	489-S	C-238
CHEVROLET	With Econ. Eng.	1941	Carter W1	492-S	C-229
CHRYSLER	C28 Standard	1941	Carter (B&B)	E6S2,S3,W1	C-239
CHRYSLER	C28 Fluid Dr.	1941	Carter (B&B)	EA1	C-239
CHRYSLER	C28 Vac. Trans.	1941	Carter (B&B)	E6T1,T2,U1,U2	C-239
CHRYSLER	C30, C33	1941	Stromberg	AAV-2	C-243
CROSLEY	CB41	1941	Tillotson	DY-1A	C-247
DE SOTO	S7 Standard	1941	Carter (B&B)	E6N3,S2,S3	C-239
DE SOTO	S7 Fluid Dr.	1941	Carter (B&B)	EB1	C-239
DE SOTO	S7 Simpli. Trans.	1941	Carter (B&B)	E6V1,U1,U2	C-239
DODGE	D19 Std.	1941	Stromberg	BXV-3	C-246
DODGE	D19 Fluid Drive	1941	Stromberg	BXVD-3	C-246
FORD	V8 Models	1941	Ch. Groves	AA-1	C-241
FORD	4 Cyl. Truck	1941	Marvel-Schebler	TSX	C-242
GRAHAM	109 H'wd. Schgr.	1941	Carter WDO	488-S	C-234
GRAHAM	113 H'wd.	1941	Carter WA1	472-S	C-230
HUDSON	10, 18	1941	Carter WA1 Vacm	454-S	C-230
HUDSON	11, 12 .....Early	1941	Carter WDO Vacm	461-S	C-234
HUDSON	11, 12 .....Late	1941	Carter WDO Vacm	501-S	C-234
HUDSON	14,15,17 .... Early	1941	Carter WDO Vacm.	455-S	C-234
HUDSON	14,15,17 .....Late	1941	Carter WDO Vacm.	502-S	C-234
LINCOLN	16H Zephyr&Contl.	41	Ch. Groves	AA-1	C-241
LINCOLN	168H Custom	1941	Ch. Groves	AA-1	C-241
MERCURY	19A	1941	Ch. Groves	AA-1	C-241
NASH	4140 '600'	1941	Carter (B&B)	513-S	C-239
NASH	4160 Amb. 6	1941	Carter WA1 Vacm	435-S	C-230
NASH	4180 Amb. 8	1941	Carter WDO	511-S	C-234
OLDSMOBILE	66,76,96 Six Std.	1941	Carter WA1 Vacm	504-S	C-230
OLDSMOBILE	66,76,96 Six Spec.	1941	Carter WA1 Vacm	481-S	C-230
OLDSMOBILE	68,78,98 8 Std.	1941	Carter WDO Vacm	503-S	C-234
OLDSMOBILE	68,78,98 8 Spec.	1941	Carter WDO Vacm	480-S	C-234
PACKARD	1951 Clipper	1941	Carter WDO Vacm	512-S	C-234
PACKARD	1900 Six	1941	Stromberg	BXOV-26	C-245
PACKARD	1901,1A Eight	1941	Carter WDO Vacm.	478-S	C-234
PACKARD	1903,3A,4,5 Spr.8.	1941	Stromberg	AAV-26	C-244
PACKARD	1906,7,8 Super 8	1941	Stromberg	AAV-26	C-244
PLYMOUTH	P11, P12	1941	Carter (B&B)	D6A2, D6C2	C-239
PLYMOUTH	P11, P12 Econ.	1941	Carter (B&B)	B6P1	C-239
PONTIAC	41-24,25,26 Six	1941	Carter WA1	494-S	C-230
PONTIAC	41-27,28,29 8	1941	Carter WDO	469-SM	C-234
STUDEBAKER	3G Champion	1941	Carter WA1 Vacm	496-S	C-230
STUDEBAKER	11A Comm.	1941	Carter WA1 Vacm.	410-S	C-230
STUDEBAKER	11A Comm.	1941	Stromberg	BXOV-26	C-245
STUDEBAKER	7C President	1941	Carter WDO	409-S	C-234
STUDEBAKER	7C President	1941	Stromberg	AAV-26	C-244
WILLYS	441 Americar	1941	Carter WO	507-S	C-233
WILLYS	441,441P Comml.	1941	Carter WO	507-S	C-233

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IMPORTANT SPECIAL SERVICE NOTES & PRODUCTION CHANGES:—The following production changes should be incorporated on earlier engines, and the specification changes listed below should be kept in mind when servicing or tuning up Compound Carburetion Engines as follows:

Compression Ratio Change:—New cylinder heads (combustion chamber milled out .032" for greater volume) for lower compression ratio used on all Compound Carburetion Engines with the following engine numbers: Series 40,50—No. 4208629 to 4210399 and all engines after No. 4215901, Series 60,70,90—All Engines after No. 4197602. See table below for gasket data and compression ratio of engines with each type head.

Series 40 (With Single Carburetor)—Same cylinder head as used on Compound Carburetion Engines (above) used on this model on all engines after Engine No. 4220016. New thinner cylinder head gasket used with this new head so that compression ratio approximately unchanged. See table below for compression ratio and gasket data.

	1st Type Head		2nd Type Head	
Car Model	**Ratio**	**Gasket No.**	**Ratio**	**Gasket No.**
40 (Single Carburetor)	6.5-1	1321396 (.070")	6.4-1	1323288 (.050")
40, 50 (Compd. Carb.)	7.0-1	1320433 (.015")	6.7-1	1320433 (.015")
60, 70, 90 (Compd. Carb.)	7.0-1	1320436 (.015")	6.7-1	1320436 (.015")

Lowering Compression Ratio of First Compound Carburetion Engines—To correct spark rap, compression ratio of first Compound Carburetion Engines with 7.0-1 compression ratio may be lowered by installation of special thicker head gaskets as follows: **Series 40,50**—Install No. 1323288 gasket (.050" thick—this is production gasket used on later Series 40 engines with Single Carburetor) which will lower compression ratio to 6.67-1. **Series 60, 70, 90**—Install No. 1297992 gasket (this is 1940 gasket and is .050" thick) which will lower compression ratio to 6.68-1. ***Refer to Mechanical Equipment Index for Buick Special Shop Notes for Gasket Installation directions.***

Spark Plug Change:—10 MM. spark plugs (as used on first engines) changed in production, and new 14 MM. spark plugs used on later engines as follows: **10 MM. Spark Plugs**—Original type spark plugs, No. 104 (without dash under 0) as used on engines before approximately Nov. 1, 1940, should be changed to any of the following types: No. 104 (with dash under 0), No. 106 (with dash under 0), or No. 106 (without dash) or new type 14 MM. spark plugs may be installed (to correct complaints of spark plugs fouling and causing uneven engine operation). ***Refer to Mechanical Equipment Index for Buick Special Shop Notes for 14 MM. Spark Plug Installation directions.***

14 MM. Spark Plugs—These new AC No. 46, 14 MM. type spark plugs used on all engines with following Engine Numbers: **Series 40 (Single Carburetor)**—No. 4306734 to 4309599 and all engines after No. 4316800. **Series 40, 50 (Compound Carburetion)**—No. 4306735 to 4309599 and all engines after No. 4312638, **Series 60, 70, 90 (Compound Carburetion)**—All Engines after No. 4287873.

Intake Manifold Gasket Change:—Vellumoid gaskets used on first engines and new steel gasket used on later engines as listed below. Use only new type steel gasket for service replacement.

Vellumoid Intake Manifold Gaskets—Used on all Engines before the following engine numbers (see Manifold Sealing below for production change and sealing of manifolds on first cars): **Series 40 (Single Carburetor)**—Before Engine No. 4240254, **Series 40, 50 (Compound Carburetion)**—Before No. 4246537, **Series 60, 70, 90 (Compound Carburetion)**—Before No. 4231957. Cars on which three thin gaskets, or one thick gasket, are used (marked with white stripe 1" wide on front leg of manifold) will operate satisfactorily but steel gasket only should be used for service replacement. First cars with single thin gasket should be sealed as follows:

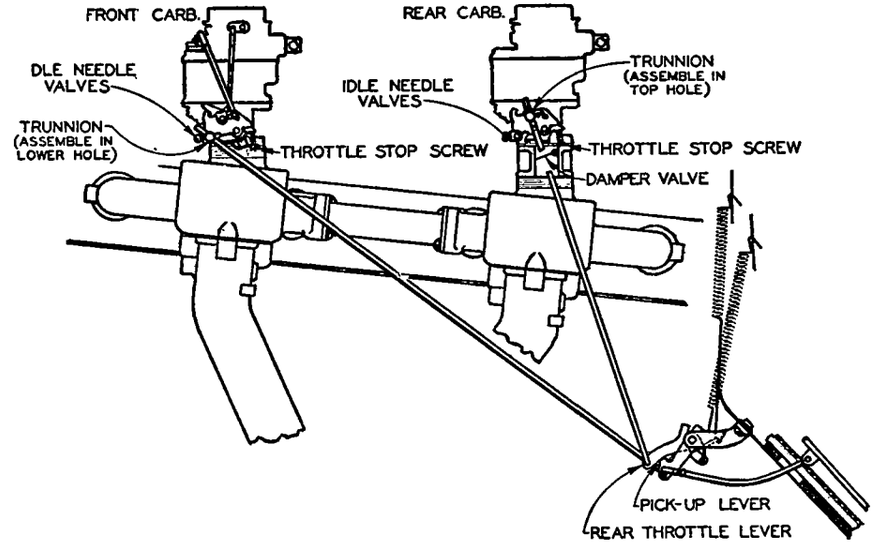
Manifold Sealing—On all cars before following engine numbers: No. 4159081 (Series 40, 50 Compound Carburetion), No. 4120022 (Series 60, 70, 90 Compound Carburetion); on which single thin (1/64") vellumoid intake manifold gasket is used (engine will be marked with white stripe 1" wide on front leg of manifold if gasket correction has been made in service), manifold should be sealed by installation of new service steel gasket (as used on later engines) to correct leaks which may develop at operating temperatures and under driving conditions (leaks may not be apparent while tuning up engine). This change can also be made on Single Carburetor Engines if desired (trouble is less likely to be encountered on these engines). To install this new gasket, remove intake manifold, install gasket between cylinder head and each branch of manifold. Tighten both intake manifold and exhaust manifold securely to cylinder head, then tighten intake manifold to exhaust manifold. Check both carburetor mounting bolt nuts for tightness, retighten all manifold nuts after engine is warm.

Steel Intake Manifold Gasket—Used on all engines after following engine numbers: **Series 40 (Single Carburetor)**—No. 4240254, **Series 40, 50 (Compound Carburetion)**—No. 4246537, **Series 60, 70, 90 (Compound Carburetion)**—No. 4231957. This steel gasket should be used for all service replacements. See Manifold Sealing data (above) for gasket installation data.

Carter Carburetor Changes (Compound Carburetion Cars):—New carburetors used on all models with Compound Carburetion with following engine numbers: **Series 40, 50**—No. 4349790 to 4351799 and all engines after No. 4356175, **Series 60, 70, 90**—All Engines after No. 4329468. These new models should be used to replace all first type carburetors on engines before these numbers. ***Refer to Buick (Carter) Carburetor article for complete data.***

Carter Carburetor Float Level Change—New type float used after approximately November 1, 1940 (beginning with carburetors marked 'LO' in second square of brass inspection tag on carburetor). Float level should be 9/64" for first type float (with cross-rib reinforcement), 3/16" for second type float (with eleven vertical-rib reinforcement). See Carter 'WCD' dual carburetor article for complete float level checking instructions.

Stromberg Carburetor Changes (Compound Carburetion Cars):—Carburetors have been changed in production and new Code Numbers used to indicate these changes as listed in Carburetor Equipment List below. Changes can be incorporated in first type carburetors to correct off-idle leanness and to improve idling performance and hot starting as follows:



Code 7-42 & 7-39 (Front Carburetors)—Special service throttle valves, Part No. 382698, can be installed on these models and all changes outlined for later 7-42A and 7-39A carburetors (following) should also be made on these carburetors.

Code 7-42A, 7-39A (Front), 7-43, 7-41 (Rear) Carburetors—Front carburetors only (7-42A, 7-39A) have new type throttle valve, No. 382600. All carburetors should be changed by installing new Idle Tube and reworking Idle Air Bleed, Secondary Idle Discharge Hole, and Float Bowl Vent to same specifications as later carburetors listed below. ***Refer to Buick (Stromberg) Carburetor article (following) and see 'Special Service Notes & Production Changes' for directions.***

Code 7-42B, 7-39B (Front), 7-43A, 7-41A (Rear) Carburetors—These models have all changes incorporated as listed above for earlier models. No changes required for these carburetors.

Code 7-46, 7-44 (Front), 7-47, 7-45 (Rear) Carburetors—These carburetors used after approximately April 15, 1941. Same design as immediately preceding models (above) except for slight difference in Float Bowl Vent. No changes required for these models.

SERIES 40 NOTE:—This model regularly equipped with single dual carburetor (Carter 'WCD' or Stromberg AAV-16 as listed below). Compound Carburetion is Optl. and data below applies to this model when so equipped.

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CARBURETOR EQUIPMENT:—All models equipped with either two Carter or two Stromberg Carburetors as follows:

SINGLE CARBURETOR

Car Model	Carter	Stromberg
41-40 Std.	WCD Model 487-S	AAV-16 Code 7-37

COMPOUND CARBURETION
Carter Carburetors (All Type WCD)

	Series 40,40A,50		Series 60,70,90	
	Front	Rear	Front	Rear
First	509-S	510-S	490-S	491-S
Later	528-S	529-S	533-S	534-S

Stromberg Carburetors (Model AAV-16 Front, AA-1 Rear)

First Type	Code 7-42	Code 7-43	Code 7-39	Code 7-41
Second Type	Code 7-42A	Code 7-43	Code 7-39A	Code 7-41
Third Type	Code 7-42B	Code 7-43A	Code 7-39B	Code 7-41A
Latest Type	Code 7-46	Code 7-47	Code 7-44	Code 7-45

NOTE—See Special Service Notes & Production Changes (above) for differences in these models and changes to be made in first carburetors.

Stromberg Code Number—Code number is stamped on bowl cover directly above fuel level inspection plug.

Rear Carburetor Note—These carburetors are similar to front or main carburetors except that they have Idle System and Main Nozzle System only (No Fast Idle, Accelerating Pump, Economizer, or Automatic Choke.

COMPOUND CARBURETION DESCRIPTION:—Consists of two dual carburetors installed on one dual manifold so that the inner barrel of both carburetors feeds the inner branch of the manifold (Cylinders 3, 4, 5, 6) and the outer barrel of both carburetors feeds the outer branch of the manifold (Cylinders 1, 2, 7, 8). Carburetor throttle valves are connected to the accelerator pedal by an overrunning type of linkage so that only the front carburetor throttle valves open (front carburetor operates alone) until a position is reached corresponding to 75 MPH. car speed. At this point, the rear carburetor throttle valves also open and both carburetors operate together and feed equally when wide open throttle position is reached. The rear carburetor has an automatic damper valve below the throttle valve and controlled by a counterweight. This valve is opened by the air flow through the carburetor and controls the manner in which the rear carburetor cuts in when car is operated with wide open throttle (see Full Throttle Operation below). Damper valve is a loose fit so that rear carburetor idles in the customary manner with this damper valve closed.

OPERATION:—The damper valve below the rear carburetor causes the carburetors to operate differently on Part and Full Throttle as follows:

Part Throttle Operation:—For closed throttle idling and car speeds up to 22 MPH, idling systems of both carburetors operate together (damper valve clearance allows rear carburetor to operate even though valve is closed). As accelerator pedal is depressed, throttle valve of front carburetor only opens and this carburetor operates alone until a car speed of 75 MPH. is reached. At this point, the accelerator linkage opens the rear carburetor throttle valve so that when wide open throttle position is reached both carburetors are feeding equally to provide maximum power (rear carburetor damper valve opened by air flow).

Full Throttle Operation:—If accelerator pedal is fully depressed for wide open throttle operation at low car speeds, damper valve controls manner in which rear carburetor cuts in as follows: At speeds below 15 MPH. main metering system of front carburetor operates normally but damper valve prevents main metering system of rear carburetor operating. At 15-20 MPH., damper valve begins to open and rear carburetor main metering system begins to operate. At 35-40 MPH., damper valve is wide open and both carburetors feed equally.

ADJUSTMENT:—When tuning up engine, all of the following points should be checked before the carburetors are adjusted. Then adjust carburetors as directed below.

Spark Plug Type & Gaps—Make certain that latest type 14 MM. spark plugs, AC No. 46, or correct type 10 MM. plugs (see Spark Plug change data under 'Special Service Notes & Production Changes' above) installed on engine. Set spark plug gaps at .028".

Compression Ratio—If spark rap being corrected, see that correct type cylinder head gasket installed. See Compression Ratio change data in 'Special Service Notes & Production Changes' above.

Intake Manifold Gasket and Sealing of Manifold (First Cars)—If manifold removed, make certain that latest type steel gasket used when manifold installed. On first cars with single thin (1/64") vellumoid gasket, this gasket should be replaced by new steel gasket to seal manifold. See Intake Manifold Gasket data in 'Special Service Notes & Production Changes' above for directions. NOTE—On first engines, where manifold has been sealed by installation of three thin gaskets or one thick gasket, a white stripe 1" wide will be found on front leg of intake manifold to indicate this change.

Valve Tappet Clearance or Lash—Tappet clearance for all valves should be set at .015" with engine warmed up and water and oil at normal operating temperature. IMPORTANT—In cold weather, if engine is warmed up in the shop, water and oil temperatures will not be uniform and tappet clearance should be set as follows: Warm up engine by idling for about 15 minutes. Then set tappet clearance at .017" for all valves. This will result in clearance of approximately .015" with engine at road operating temperature.

Ignition Timing—Check and adjust ignition timing as directed on Buick 'T&E' page. If Synchroscope used to time ignition, carburetor throttle stopscrews should be backed off so that engine idles at slowest possible speed. CAUTION—Engine speed must not be greater than 375 RPM (7 MPH, road speed) when using a Synchroscope for ignition timing (automatic advance will cause error in results if engine idled at faster speed). Ignition mark on 40 & 50 engines is a broad yellow mark and ignition must be timed at leading edge of this mark for correct 4° BTDC ignition timing (trailing edge of mark is used for 2° BTDC ignition timing for 40 Engine with Single Carburetor).

Manifold Heat Control Valve & Rear Carburetor Damper Valve—Make certain that these valves operate freely and do not stick or bind in any position.

Carburetor Throttle Linkage—Floor mat must be in place when linkage adjusted (mat serves as stop for pedal in wide open position). Carburetors should be cold (if carburetors warm, hold de-loader cam in position so that it contacts carburetor lever as throttle is opened while making adjustments). Adjust front carburetor throttle rod length by changing trunnion position on rod so that throttle valves and throttle lever are in wide open position with accelerator pedal depressed to floor mat (de-loader must be in operation so that normal load exerted on throttle rod), make certain that throttle rod trunnion installed in lower hole on lever. Adjust rear carburetor throttle rod length in same manner so that rear carburetor throttle valves are also wide open with accelerator pedal depressed to floor mat, make certain that throttle rod trunnion is installed in upper hole on lever. CAUTION—When making these adjustments, accelerator pedal should be depressed while sitting in driver's seat (reaching through car door will cause pedal to strike raised portion of floor and result in incorrect adjustment). Rear carburetor rod should be disconnected while adjusting front carburetor rod and should be prevented from striking engine pan which will interfere with adjustment (rod can be looped up by rubber band). De-loader can be placed in operation to apply normal load on linkage while making adjustment by holding choke valves in closed position. After rods adjusted, see that both rods operate freely, do not bind or interfere with return springs, and that rods operate freely and return to fully closed position (bend both legs of cotter pin in rear throttle trunnion toward front of car to prevent interference with throttle lever ear). If throttles do not return to closed position, check lower ends of throttle return springs to see if they are contacting lower side of levers attached to dash brackets, and if necessary, hook both return springs in upper hole on dash.

CARBURETOR ADJUSTMENT:—Float Level—Make certain that float level is even with bottom of inspection hole on side of float bowl (remove inspection plug). See Production Change Note above and refer to Carter 'WCD' Carburetor and Stromberg AAV-16 Carburetor articles for complete float level checking and adjustment instructions.

Idle Adjustment—Engine must be thoroughly warmed up so that automatic choke and fast idle inoperative when adjustment made. Hot or slow idle speed should be set at 450 RPM. (8-10 MPH. depending on axle ratio). To secure equal adjustment for both carburetors, proceed as follows: Back off both stopscrews so that throttle valves completely closed (if engine idles too fast with valves closed, valves are not centered—See Carter & Stromberg carburetor articles for throttle valve setting data), turn stopscrew on one carburetor in until engine just begins to increase speed, then turn stopscrew on second carburetor in until engine again begins to increase speed. Carburetors are then equalized and final adjustment for correct idle speed should be made by turning both stopscrews in exactly equal amount. To set idle adjusting screws (fuel mixture adjustment), first set all adjusting screws (two screws for each carburetor) exactly alike by turning each screw in until it is lightly seated then back screw out exactly 1⅛ turn (Carter Carburetors—first type), ¾ turn (Carter Carburetors—2nd type, All Stromberg Carburetors). Make final adjustment by turning all screws in evenly 1/16 turn and noting performance, then turn screws back to original position and 1/16" turn further out and again note performance. Finally set all screws alike at point within this range at which best performance is secured.

Accelerating Pump, Fast Idle, Automatic Choke & Other Adjustments—See Carter 'WCD' and Stromberg AAV-16 carburetor articles for complete data.

SINGLE CARBURETOR

Series 41-40 (1941) Std. ..... **AAV-16 Code 7-37**

COMPOUND CARBURETION

	Series 41-40, 40A, 50		Series 41-60, 70, 90	
	AAV-16 (Front)	AA-1 (Rear)	AAV-16 (Front)	AA-1 (Rear)
First Type	7-42	7-43	7-39	7-41
Second Type	7-42A	7-43	7-39A	7-41
Third Type	7-42B	7-43A	7-39B	7-41A
Latest Type	7-46	7-47	7-44	7-45

NOTE:—Code Number Identification Mark—Code Number is stamped on bowl cover directly above fuel level inspection plug and can be used to identify each model.

Compound Carburetion—Optl. on Series 41-40, Std. on all other models. Consists of two carburetors (AAV-16—front, AA-1—rear) on each engine. See separate article on 'Buick Compound Carburetion' for description and complete service data on engines with Compound Carburetion.

Carter Carburetors—Carter 'WCD' dual carburetors also used on these car models. See Carter 'WCD' Carburetor article for data on these types.

Delco-Remy Vacuum Switch—Switch for starter control is mounted on carburetor and operated by throttle valve shaft. *See Delco-Remy Vacuum Switch article in Electrical Equipment Section for adjustment and servicing data.*

SPECIAL SERVICE NOTES & PRODUCTION CHANGES:—Code 7-42 & 7-39 (First type Front Carburetors)—If slight off-idle leanness develops on cars with these carburetors, this can be corrected by installing special service throttle valves, Part No. 382698, 7¾° type notched valves which provide same idle hole clearance of .010" as later 7-42A & 7-39A models with new No. 382600 throttle valve (this 382600 valve must not be installed on these 7-42 & 7-39 carburetors). Also make changes listed below for 7-42A and 7-39A carburetors to bring these 7-42 and 7-39 models up to later 7-42B and 7-39B specifications.

Code 7-42A & 7-39A (Front Carburetors), 7-43 & 7-41 (Rear Carburetors)—Front carburetors only (7-42A & 7-39A) have new type, Part No. 382600, 6° notched throttle valves and new Idle Hole clearance of .010". For better idling performance and improved hot starting, all of these carburetors (front & rear) should have the following new parts installed or jet and air bleed holes changed as follows: Idle Tube—#65 Part No. 382806 (was #70 Part No. P-19424), Idle Air Bleed in Main Body—#65 (7-42A & 7-43), #60 (7-39A & 7-41), (was #70 on all models), Secondary (upper) Idle Discharge Hole—#58 (was #60), and new External Float Bowl Vent (drilled hole in carburetor casting—not used on carburetors originally). Make these changes as follows:

Idle Tube—Dismantle carburetor and remove air horn and float bowl cover assembly (see Servicing directions below). Unscrew old idle tubes and install new type tubes as specified above.

Idle Air Bleed—With carburetor dismantled for Idle Tube replacement (above), use wire drill in pin vise (#65 drill for Series 40,50 Code 7-42A & 7-43 Carburetors, #60 drill for Series 60,70,90 Code 7-39A & 7-41 Carburetors) and drill out idle air bleed hole (in boss in float bowl adjacent to idle tube) by hand. NOTE—Air bleed provided for each barrel, both holes must be enlarged.

Secondary Idle Discharge Hole—Remove welch plugs in holes on rear side of throttle body directly across from idle holes. Use #58 drill (all models) in pin vise, insert drill through hole from which welch plug removed and drill out the secondary or upper idle discharge hole in the carburetor wall. NOTE—Both welch plugs must be removed and idle hole in each barrel of each carburetor must be enlarged.

Float Bowl Vent—On all carburetors, prick punch center of boss to left (facing gasoline inlet connection) and above gasoline inlet connection on air horn and bowl cover casting, drill hole at this point with #46 drill (all models) so it connects with bowl vent channel in casting for additional external vent.

Code 7-43B & 7-39B (Front Carburetors), 7-43A & 7-41A (Rear Carburetors):—These models include all changes as listed above for Code 7-42A, 7-39A, 7-43, 7-41 models (New Idle Tube, new size Idle Air Bleed and Secondary Idle Discharge Hole, new External Bowl Vent). Equivalent to latest types (below).

Code 7-46 & 7-44 (Front Carburetors), 7-47 & 7-45 (Rear Carburetors):—These models are same as Code 7-43B, 7-39B, 7-43A, 7-41A models listed above except that External Float Bowl Vent is slightly different design and either of these latest designs should operate satisfactorily on Compound Carburetion engines.

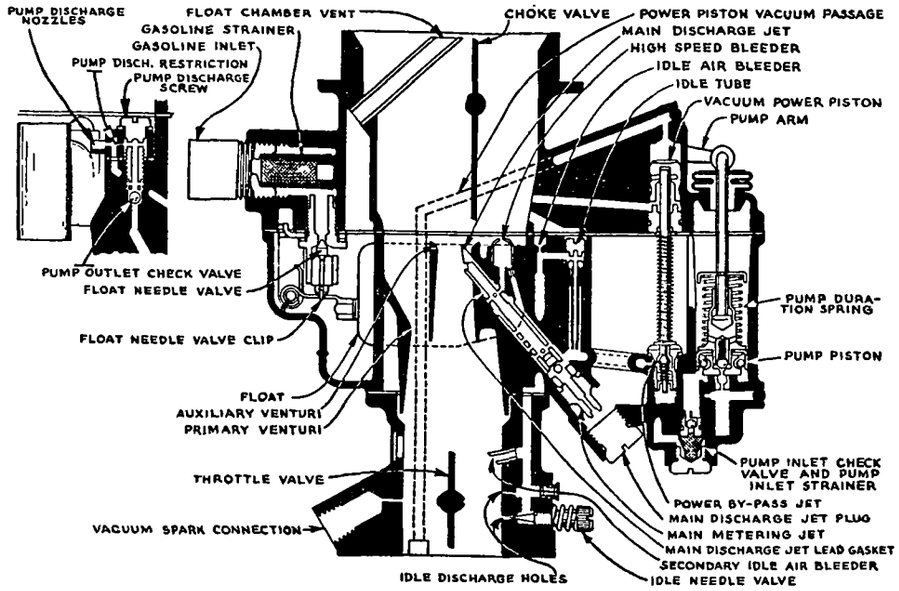
Engine Changes:—For data on new type Spark Plugs, Compression Ratio change, Manifold Gasket change and Sealing of Manifolds on first cars, refer to preceding article on Buick Compound Carburetion.

TYPE:—Model AAV-16. Aircraft type, duplex, downdraft carburetor. Similar to design of AAV-16 and AAV-26 carburetors used on preceding Buick models. This carburetor has built-in Fast Idle and Automatic Choke. Refer to Carburetion Equipment Index for 'Stromberg AAV-16, AAV-26 Automatic Choke' for complete servicing and adjustment directions.

Model AA-1. These rear carburetors (used on Compound Carburetion cars only) are basically the same as the front carburetors (AAV-16) but do not have Vacuum Economizer (power by-pass jet), accelerating pump, choke valve and automatic choke, fast idle, or vacuum switch mounting provision. See separate article on Buick Compound Carburetion for description of manner in which these carburetors supplement front carburetors for Compound Carburetion.

IDLE ADJUSTMENT (ALL MODELS):—Compound Carburetion Models—Engines should be checked for correct spark plugs and sealing of manifold, and other tune up operations performed (valve tappet clearance adjustment, ignition timing, etc.) before carburetors are adjusted and carburetors must be adjusted exactly as specified to secure equalized operation. *See Buick Compound Carburetion article for complete Adjustment directions.*

Series 41-40 with Single Carburetor—See adjustment directions in Buick Compound Carburetion article for tune up operations which should be performed before carburetor is adjusted. Then adjust carburetor as follows: With engine warmed up so that choke valve wide open and engine idling at hot or slow idle speed (Automatic Choke & Fast Idle inoperative), set throttle stopscrew so that engine idles at 450 RPM (8-10 MPH, depending on gear ratio). Set both idle adjusting screws (one for each barrel, adjust exactly alike) so that engine idles smoothly (turn screws in for leaner mixture, out for richer mixture). Recheck idle speed.



METERING JETS:—Metering jets are non-adjustable type located under plug at lower end of main nozzles. See Stromberg Jet Specification Table for data.

ACCELERATING PUMP (AAV-16):—Same type as used on other AAV carburetor (operated by throttle lever through walking-beam connector, piston spring-loaded on plunger stem with duration spring to prolong pump discharge).

Pump Capacity—With pump rod connected in center hole on throttle lever (medium stroke), capacity should be 11-15 cc. per 10 strokes when operated fast (all models), 15-19 cc. per 10 strokes when operated slowly (Series 40 single carburetor), 16-20 cc. per 10 strokes when operated slowly (all other models). Use T-24972 Pump Capacity Burrette Gauge to check pump capacity.

Pump Seasonal Adjustment—Throttle lever has three holes for pump connector rod engagement. Medium stroke (with rod connected in center hole) is standard for use with regular fuel. If carburetor is lean on acceleration, connect rod in outer hole for maximum stroke, if carburetor charge is too rich or engine loads up on acceleration, connect rod in inner hole for minimum stroke.

VACUUM ECONOMIZER (AAV-16):—Consists of vacuum piston controlled power by-pass valve similar to design used on other AAV carburetor models. No adjustment required.

Setting—Vacuum piston opens valve with manifold vacuum of 5-6" of HG (mercury) corresponding to car speed of 65-70 MPH.

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FAST IDLE & CHOKE RELEASE (AAV-16):—Consists of a start-aid loose lever and fast idle cam assembly (spring connected) mounted on the carburetor so that the cam serves as a stop for the throttle stopscrew. Cam is linked to choke valve by connector rod and is rotated to the fast idle position (stopscrew on highest step of cam) when the choke valve closes for cold starting. As the engine warms up and the choke valve opens, fast idle cam rotates (with stopscrew resting on successively lower steps of cam) so that the throttle valves close to the hot or slow idle position with the engine warmed up.

Adjustment—Close choke valve on #53 drill rod (.0595"), open and close throttle valve and note if ear on locking lever on throttle valve shaft clears lug on loose lever on fast idle cam stud. Adjust by bending connector rod near upper end so that locking lever ear and loose lever lug just clear.

Choke Release (Unloader) Adjustment—Hold throttle valve wide open, check choke valve opening by inserting 11/64" drill rod (Tool T-25057) between edge of valve and air horn wall. Adjust by bending ear of throttle lever which engages lug on fast idle cam so that choke valve opening is .156-.187".

FLOAT LEVEL (ALL MODELS):—**Fuel Level**—Should be 19/32" below top edge of float bowl (gasket removed) with engine idling (5 lbs. pressure) or even with lower edge of inspection hole on side of bowl (remove plug to check level)

Float Level—To check float level (with bowl cover and float assembly removed), invert cover, install float level checking gauge T-24971 on gasket. Tops of floats should be 3/64" above tops of vertical guides on gauge (Series 40 Single Carburetor), 1/32" below tops of gauge guides (All Compound Carburetion Carburetors) and sides of float should be tangent to gauge guides without any drag (this is important to prevent floats dragging on sides of float bowl). Adjust by bending float arm. Use care to secure equal setting for both floats.

Float Needle Valve & Seat—Part No. P-22499 (40 Single Carburetor), P-22498 (All Compound Carburetion Carburetors). Furnished as matched sets only. When installing, see that needle valve is clipped to float lever.

Float Bowl Vent—Bowl is vented to outside through opening in air horn wall directly below air cleaner collar (Series 40 Single Carburetor), through vent tube in air horn below air cleaner for 'balanced' operation (All Compound Carburetion Carburetors).

THROTTLE VALVE SETTING (ALL MODELS):—Throttle valves on Compound Carburetion Front Carburetors changed in production (See Special Service Note above) and throttle valve setting is different on each type. CAUTION—When special service throttle valves installed on first (Code 7-42 and 7-39) carburetors, throttle valve setting is same as later (Code 7-42A and 7-39A) carburetors with new type throttle valves. To check throttle valve location, insert #60 drill in idle port, measure from drill to edge of throttle valve with valves tightly closed (stopscrew backed off). Setting for each model as follows:

Carburetor	Code No.	Throttle Valve	Idle Port
AAV-16 (40 Single Carb.)	7-37	P-24684-5°	.022"
AAV-16 (Compd. Carb.)①	7-42, 7-39	382246-6°	.022"
AAV-16 (Compd. Carb.)②	7-42, 7-39	382698-7¾°	.010"
AAV-16 (Compd. Carb.)	7-42A,B; 7-39A,B	382600-6°	.010"
AAV-16 (Compd. Carb.)	7-46, 7-44	382600-6°	.010"
AA-1 (Compd. Carb.) Rear	7-43,A; 7-41,A	382246-5°	.022"
AA-1 (Compd. Carb.) Rear	7-47, 7-45	382246-5°	.022"

①—With original throttle valve. ②—With new service replacement valve. NOTE—All Idle Port figures are plus or minus .004".

Vacuum Spark Port (AAV-16 only)—To check vacuum spark control port location, insert #58 drill in port, measure from drill to edge of throttle valve with valves tightly closed (stopscrew backed off). Distance should be .041" (40 Single Carb.), .080" (All Compd. Carburetion Carbs.) plus or minus .004".

CHOKE (AAV-16):—Stromberg Automatic type. ***See article on Stromberg Automatic Choke, AAV-16, AAV-26 type in Carburetion Equipment Section for complete data.***

Choke Setting—Inverted 'V' mark on thermostat cover should be set 1 Notch Lean (clockwise) on Series 40 Single Carburetor, at reference mark on housing (centered) on all Compound Carburetion Carburetors. Setting may be varied not more than two notches to improve warming up performance under special operating conditions (as when highly volatile fuels used). To adjust, loosen three cover attaching screws, rotate cover. CAUTION—When assembling heat tube connection, use extreme care not to use excessive pressure which may cause cover to shift and change choke setting.

NOTE—Thermostat cover assembly marked '6' for identification.

SERVICING (ALL MODELS):—Serviced in same manner as Stromberg AAV-26 models (see Model AAV-26 article for complete instructions). Model AA-1 does not have choke system, accelerating pump, or vacuum economizer.

SERVICE PARTS:—Gasket Set—No. J-5656-G (40 Single Carburetor), No. 382398 (AAV-16 Compd. Carburetors), No. 382399 (AA-1 Compd. Carburetors).

CARTER DUAL TYPE WCD

SINGLE CARBURETOR

Series 41-40 (1941) Std. Equipment.....Model 487-S

COMPOUND CARBURETION

Car Model	Front Carburetor First Cars	Front Carburetor Later Cars①	Rear Carburetor First Cars	Rear Carburetor Later Cars①
Series 41-40,40A,50	509-S	528-S	510-S	529-S
Series 41-60,70,90	490-S	533-S	491-S	534-S

①—Used on all cars with following Engine Numbers: **Series 40,40A,50**—No. 4349790 to 4351799 and all engines after No. 4356175. **Series 60,70,90**—All Engines after No. 4329468. These models used to replace first carburetors.

SPECIAL SERVICE NOTES & PRODUCTION CHANGES:—Engine Changes (New type Spark Plugs, Compression Ratio change, Manifold Gasket change, and Sealing of Manifolds on first cars—Refer to preceding article on Buick Compound Carburetion for complete data and instructions.

Carburetor Production Change—Carburetor models used on later cars (see Equipment List above) are used to replace carburetors used on first cars.

Float Level Change (First Carburetors)—Two float types used with different float settings for each type. With first type float (which has cross-rib reinforcement) before approximately Nov. 1, 1940, float level should be set at 9/64". Carburetors after Nov. 1, 1940 (beginning with carburetors marked 'LO' in second square of brass inspection tag on carburetor) have new float with 11 vertical-rib reinforcements and float level should be set at 3/16". See Float Level section below for checking and adjustment directions.

Carter Car Starter—Switch for starter control built-in on Models 487-S, 490-S, 509-S, 528-S, 533-S. ***Refer to Electrical Equipment Index for 'Carter Car Starter' for complete adjustment and servicing data.***

COMPOUND CARBURETION NOTE:—Compound Carburetion (with two carburetors) is Optl. on Series 41-40, Std. on all other Buick models. See preceding article on 'Buick Compound Carburetion' for description and complete service data on engines with Compound Carburetion.

Stromberg Carburetors—These models also use Stromberg Model AAV-16 and AA-1 carburetors. See Stromberg AAV-16 Carburetor article for complete data

TYPE:—Models 487-S, 490-S, 509-S, 528-S, 533-S. Plain tube, dual, downdraft type. Differ from other Carter Vacumeter type dual carburetors mainly in that they have a new design concentric float bowl and double float, new permanently assembled main nozzles, high pressure type spring operated accelerating pump, and built-in Carter Car Starter (vacuum switch for starting motor control). Conventional plunger type anti-percolators are not used but carburetor is fitted with Fast Idle and Climatic Control (automatic choke). ***See Carter Climatic Control article in Carburetion Equipment Section for automatic choke servicing data.***

Models 491-S,510-S,529-S,534-S (Rear Carburetor of Compound Carburetion). These models are basically the same as the front carburetor models but do not have metering rods (metering jet only used), accelerating pump, choke valve, Fast Idle, Climatic Control, or Carter Car Starter. See article on Buick Compound Carburetion (preceding) for description of manner in which these carburetors supplement the front carburetors of Compound Carburetion engines.

IDLE ADJUSTMENT (ALL MODELS):—Compound Carburetion Models—Engines should be checked for correct spark plugs and sealing of manifold, other tune up operations (valve tappet clearance adjustment, ignition timing, etc.), performed before carburetors are adjusted, and carburetors must be adjusted exactly as specified to secure equalized operation. ***See Adjustment instructions in Buick Compound Carburetion article (preceding) for complete instructions.***

Series 41-40 with Single Carburetor (487-S)—See Adjustment Instructions in Buick Compound Carburetion article (preceding) for tune up operations which should be performed before carburetor is adjusted. Then adjust carburetor as follows: With engine thoroughly warmed up so that choke valve wide open and engine idling at hot or slow idle speed (Automatic Choke and Fast Idle inoperative), set throttle stopscrew for idling speed of 450 RPM. (8-10 MPH. depending on gear ratio). Set both idle adjusting screws (one for each barrel, adjust screws exactly alike) so that engine idles smoothly. Screws should be set ½-1½ turns open from inner seated position and should be turned in for leaner mixture. Recheck idle speed.

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PERFORMANCE:—Should be satisfactory if idling adjustment correctly made. Special lean metering rods furnished for special operating conditions (see Carter Jet Specification table for complete data). IMPORTANT—Special metering rod for Altitude use only is furnished in conjunction with a special altitude metering jet which should be installed in rear carburetor at same time to insure balanced operation of both carburetors.

ACCELERATING PUMP (487-S, 490-S, 509-S, 528-S, 533-S):—High pressure type with spring operated lever. Seasonal adjustment provided only on 528-S, 533-S.

Seasonal Adjustment (528-S, 533-S)—Pump arm on bowl cover (under dust cover) has two holes for pump link engagement. Connect link in inner hole (short radius) for short stroke and minimum discharge, outer hole (long radius) for long stroke and maximum discharge.

Pump Stroke Adjustment—See table below for correct plunger travel (from closed throttle to wide open position). To check stroke, back off throttle stopscrew so that throttle valves tightly closed, take out screws and remove dust cover, place pump gauge T109-117S (see Note below) in inverted position on upper edge of dust cover boss on carburetor so that lip on lower end of indicator arm rests on top surface of connector link in upper end of pump plunger stem. Note gauge reading. Open throttle wide and again note gauge reading. Difference between two readings is pump stroke (in 64th of an inch) and should agree with specifications in table below. To adjust stroke, bend connector rod slightly at lower angle near throttle lever. CAUTION—When checking stroke on Models 528-S, 533-S, make certain that pump link properly connected for correct stroke as indicated in table.

Car Model	Carburetor	Pump Stroke	Pump Link Connection
40 Std.	487-S	21/64"	Not Adjustable
All Compd. Carb. (First)	490-S, 509-S	21/64"	Not Adjustable
40,40A,50 Compd. (Later)	528-S	16/64" (¼")	Long Stroke
60,70,90 Compd. (Later)	533-S	14/64" (7/32")	Short Stroke

Pump Gauge Note—All pump gauges after Sept. 15, 1940 have new type indicator arm with gauging lips on both ends as required when checking these models. Earlier T109-117S gauges can be brought up to date by installing this new type indicator arm, Part No. T109-153.

METERING ROD ADJUSTMENT (487-S, 490-S, 509-S, 528-S, 533-S):—Metering rods are controlled by a single spring-loaded vacuum piston (rods held down in metering jets for maximum economy by manifold vacuum, and lifted out of jets by spring for acceleration and full power operation when vacuum decreases as throttle is opened). Lip on metering rod arm (on pump operating lever shaft which is linked to throttle lever) acts as stop for vacuum piston link and insures correct metering rod position for particular throttle opening. Metering rod setting should be checked whenever rods removed or changed and when carburetor is overhauled.

Metering Rod Setting—To check metering rods, take out retaining screws and remove dust cover, disconnect metering rod springs and remove both rods, install one metering rod gauge, T109-152 (2.440"), in place of rods. With throttle stopscrew backed off so that throttle valves tightly closed, press down lightly on vacuum piston link. Clearance between shoulder of notch on gauge and part of vacuum piston link on which metering rods hang should be less than .005" and lip of vacuum piston link should rest on lip of metering rod arm on pump operating lever shaft. To adjust, bend lip of metering rod arm until it contacts lip on vacuum piston link. Remove gauge, re-install metering rods, connect springs, install dust cover and reset throttle stopscrew.

FLOAT LEVEL (ALL MODELS):—Fuel Level—Should be even with lower edge of fuel level inspection hole on side of float bowl (remove inspection plug).

Float Level (487-S, 490-S, 491-S, 509-S, 510-S)—Two different settings used. On float with cross-rib reinforcement (before Nov. 1, 1940), distance from float seam (measured at top center—both sides equal) to lower edge of bowl cover should be 9/64" (Gauge T109-160) with needle valve seated. On carburetors after Nov. 1, 1940 (beginning with carburetors marked 'LO' on brass inspection tag) with float with 11 vertical-rib reinforcement, float level should be 3/16" (T109-162) measured as above. Floats must be checked both laterally and vertically to insure correct height and to prevent dragging on sides of bowl as follows: With bowl cover assembly removed, remove gasket, invert cover so that needle valve is seated, place correct gauge (T109-160 or T109-162) directly under floats with notched portions of gauge fitted over machined surface of casting. Floats should just touch vertical sides of gauge and just clear horizontal portion. Adjust by bending float arm (do not bend floats) and use extreme care to secure same setting on both floats.

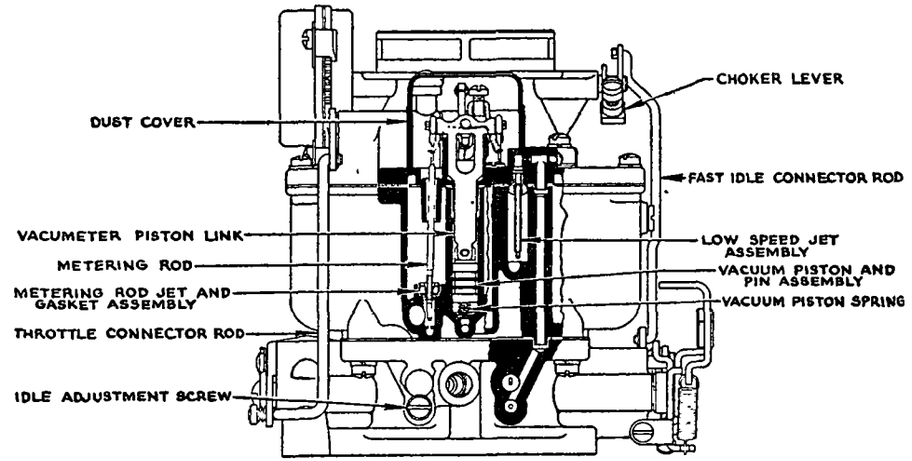
Float Level (528-S, 529-S, 533-S, 534-S)—Float level should be 3/16". Use Gauge No. T109-162, check and adjust floats in same manner as on first models with second type float (above).

Needle Valve & Seat—Furnished only in matched sets, Part No. 25-80S (487-S, 490-S, 491-S, 509-S), No. 25-105S (528-S, 529-S, 533-S, 534-S). Intake hole size is #42 drill. NOTE—No. 25-105S needle valve is push-pull' type.

Bowl Vent (Model 487-S)—Bowl is vented to outside atmosphere by ¼" diameter hole in bowl cover and air horn casting.

Bowl Vent (Models 490-S, 509-S)—Bowl is vented to air horn for 'balanced' operation by 7/32" inside diameter balance vent tube which opens into air horn.

Bowl Vent (Models 528-S, 529-S, 533-S, 534-S)—Balance types with 7/32" inside diameter and secondary .125" diameter vent to air horn. Bowl is also vented to outside atmosphere by #35 drill hole (early production), two #47 drill holes (late production).



THROTTLE VALVE SETTING:—Install valves with trademark (small 'c' in circle) toward manifold and on idle port side of bore, use new screws and install screws loosely. With throttle stopscrew backed off, tap valves lightly with screwdriver to centralize them in bore, then tighten attaching screws.

Idle Port Opening—On all models, idle port opening should be .067-.073" above top edge of throttle valve with valve closed tightly.

Vacuum Spark Port Height—Bottom of vacuum spark port should be .046-.050" (487-S), .035-.039" (490-S, 509-S, 528-S, 533-S) above valve. NOTE—This vacuum spark port not used on Compound Carburetion rear carburetors (491-S, 510-S, 529-S, 534-S).

FAST IDLE (487-S, 490-S, 509-S, 528-S, 533-S):—Consists of a fast idle cam and trip lever assembly. The cam engages the fast idle screw on the throttle shaft dog and collar assembly. Cam trip lever is linked to the choke valve shaft by a connector rod so that the cam is rotated to the fast idle position when the choke valve closes for cold starting. As the choke valve opens, trip lever is revolved and spring returns fast idle cam to off position and throttle valves return to hot or slow idle speed position (controlled by stopscrew).

Adjustment—With choke valve tightly closed, adjust fast idle screw so that clearance between throttle valve and carburetor bore on side opposite port is .012" (487-S), .015" (490-S, 533-S), .012" (509-S, 528-S). When adjusting, back off throttle stopscrew, then back off fast idle adjusting screw until it just contacts high point of fast idle cam (choke valve closed and fast idle cam in fast idle position), finally turn fast idle screw in 2½ turns (all models) which will provide correct throttle opening. Reset throttle stopscrew for correct hot or slow idle speed.

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CHOKE (487-S, 490-S, 509-S, 528-S, 533-S):—Carter Climatic Control. Refer to Carburetion Equipment Index for 'Carter Climatic Control' for complete servicing and adjustment directions. NOTE—No choke valve or choke mechanism used on Compound Carburetion rear carburetors (491-S, 510-S, 529-S, 534-S).

Choke Setting—Reference mark on thermostat coil housing should be centered on scale on choke housing (all models).

Unloader:—Consists of an ear on the throttle lever which engages fast idle cam so as to open choke valve when throttle valve is opened wide.

Adjustment—Two separate adjustments required as follows: First, loosen screw on choke valve shaft lever, insert .010" feeler between lip on fast idle cam and boss on carburetor flange casting, hold choke valve tightly closed and tighten lever screw. Secondly, with throttle valves wide open, adjust unloader lip on throttle lever so that choke valve opening or clearance between upper edge of choke valve and air horn wall is 3/16" (use T109-28 gauge for all models).

SERVICING (487-S, 490-S, 509-S, 528-S, 533-S):—**Disassembly**—With Climatic Control tubing connection disconnected and carburetor off engine, remove choke shaft lever and fast idle connector rod. Take out attaching screws and remove air horn and Climatic Control as an assembly. Remove thermostat coil and housing assembly (do not remove coil from housing), gasket, baffle plate, choke valve, choke piston lever, link and shaft assembly, and vacuum piston (use care not to lose piston pin). Take out attaching screws and remove pump jet and housing assembly, lift off air horn gasket, remove dust cover, gasket, throttle connector rod, pump connector link, strainer nut and gasket, and strainer. Take out attaching screws and remove bowl cover assembly, lift out vacuum piston spring. CAUTION—Do not make any attempt to remove nozzles from body casting. Remove float pin, take out float assembly and needle valve and seat assembly. Turn vacuum piston ¼ turn to free it from piston link. Raise piston link and, at same time, turn pump arm and countershaft so that link is free, remove link. Remove low speed jets and bowl cover gasket. Remove pin spring on end of pump countershaft and loosen metering rod arm screw, slide countershaft and lever assembly out, dismantle pump and metering rod arm parts. Hold plunger guide down, remove plunger guide screw, plunger guide and pump plunger assembly, plunger spring and strainer (invert carburetor). Remove pump intake ball and retainer cap by inserting soft brass pin through hole in bottom of cylinder and tapping retainer out. Remove pump discharge passage plug, pump discharge check plug, and discharge needle, metering rod jets and gaskets. Invert carburetor, take out retaining screws and remove body flange and switch as an assembly. Hold switch firmly against casting, remove terminal cap clip and screw, disassemble switch and remove switch ball, use care not to lose small square adjusting washers, remove switch strainer and retainer ring. Remove throttle shaft arm, throttle valves and throttle centering screw, slide throttle valve shaft out, remove fast idle cam and trip lever assembly. Remove idle adjusting screws, springs, and idle port plugs.

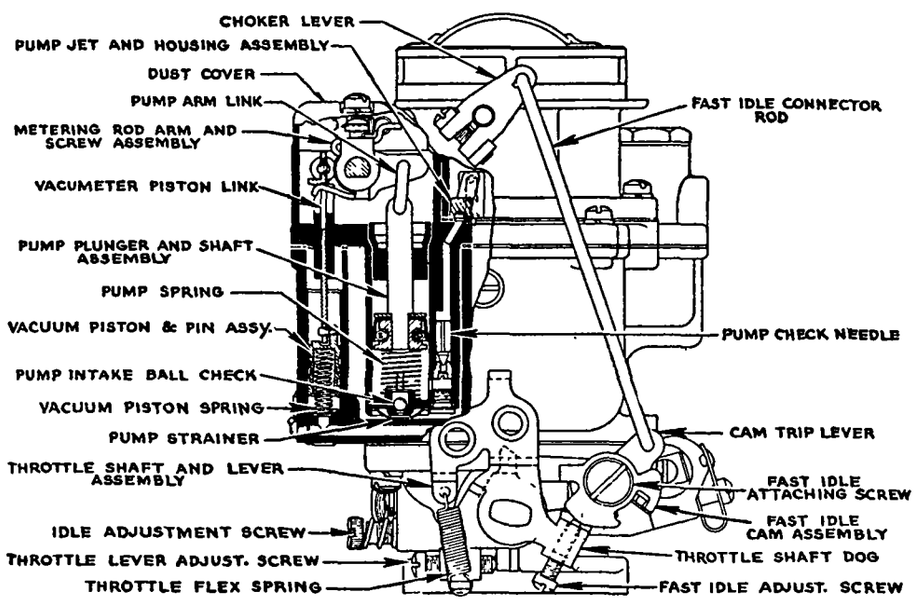
Servicing—Wash all parts in gasoline except thermostatic coil and housing assembly and switch parts. Blow out all jets and passages in carburetor castings with air, scrape carbon from throttle body bore and flange. Replace all worn or damaged parts. Soak new Intake Needle Seat Gasket, Pump Relief Plug Gasket, and Metering Rod Jet Gasket in 90 proof denatured alcohol for 20 minutes, install on part and allow to dry before installing in carburetor.

Reassembly—Use all new gaskets (see Service Parts list below) and observe following cautions when assembling carburetor: Install throttle valves as directed under 'Throttle Valve Setting' above, make certain that throttle centering screw installed and check throttle valve position. Use new idle port rivet plugs. Check float level, metering rod setting, Accelerating Pump stroke, Fast Idle, Unloader, and Choke setting. Adjust carburetor when reinstalled on engine. NOTE—See article on 'Carter Car Starter' in Electrical Equipment Section for complete switch servicing data and see article on 'Carter Climatic Control' in Carburetion Equipment Section for servicing data on these units.

SERVICING (491-S, 510-S, 529-S, 534-S):—These rear carburetors serviced in same manner as front carburetors (above) except that disassembly is simplified by fact that no metering rods, choke system, or accelerating pump used.

Disassembly—Take out attaching screws and remove air horn, remove strainer nut and gasket, and strainer. Take out attaching screws and remove bowl cover assembly. Remove float pin, float and lever assembly, intake needle and seat assembly, and bowl cover gasket. Remove both low speed jet assemblies, body flange assembly and gasket. CAUTION—Do not attempt to remove main nozzles—these are permanently installed in carburetor casting. Take out attaching screws and remove body flange casting and gasket. Remove throttle valves, throttle centering screw, throttle shaft and lever assembly. Remove idle adjusting screws, springs, and idle port rivet plugs.

SERVICE PARTS:—Gasket Assortment—No. 154 (487-S, 490-S, 509-S, 528-S, 533-S), No. 155 (491-S, 510-S, 529-S, 534-S).



483-S—CHEVROLET, ALL PASS. CARS & TRUCKS (1941)—SEE NOTE

492-S—CHEVROLET, ALL MODELS WITH ECON. ENG. (1941)—SEE NOTE

NOTE:—Carburetors may be identified by casting number on face of flange as follows: 421 (483-S), 432 (492-S); and by carburetor body color which is Black (483-S), Brown (492-S).

Economy Model 492-S—This carburetor has special jet calibration (see Carter Jet Specification Table for complete data) and stop pin which limits throttle opening to approximately 60 MPH.

Cab-over-Engine Trucks & Dubl-Duti Panel—These models equipped with Carter BB Model 489-S Updraft type carburetor. See separate article for data on this updraft carburetor.

SPECIAL SERVICE NOTES:—Installing 1941 Bowl Cover Assembly on 1940 Carburetors to reduce pump arm and countershaft wear. This new bowl cover which has granodized pump shaft pressed in as part of cover may be installed on 1940 carburetors. Install all of following parts to make this change: Carburetor Bowl Cover #605312, Pump Arm #839522, Pump Connecting Link #839525, Plunger Assembly #839528, Throttle Connector Rod (select proper rod), Antirattle Spring #839539, Anti-rattle Spring Retainer #839540. IMPORTANT—Use regular bakelite metering rod hole cover and metering rod hole cover stop from 1940 carburetor when installing above bowl cover (see 1940 Chevrolet Carburetor data) and remove flat spring from inside of dust cover to permit assembly. Saturate felt wick in lever yoke with light engine oil and check metering rod setting when installation completed.

Chevrolet Running Backward (when key turned off)—To correct these complaints, check idle speed and set stopscrew for speed not to exceed 7 MPH. Check throttle valve and make certain that it is not sticking, check throttle valve spring tension. Check manifold heat control valve and thermostatic spring. Make certain that valve is not binding and that spring is wound up not more than enough to slip free end over manifold pin (approx. ½ turn).

TYPE:—Balanced bowl type similar to carburetor used on 1940 Chevrolet models except for following changes: Carburetor throat increased to 1½" with same size (1¼") main venturi as in 1940. Low speed jet well has been lowered and jet is fed through drilled passage opening through side of jet. One idle air bleed only is used (this air by-pass increased in size and second by-pass discontinued) and an additional idle discharge port is located above the throttle valve. Balance passages in air horn have been increased in size and opening above choke valve consists of brass tube pressed in casting. New type float bowl cover used with new granodized pump shaft pressed in place and lubricated by felt oil wick (not necessary to pack screw hole with graphite grease as on previous models). Accelerating pump has new rectangular plunger stem and is furnished as an assembly with shaft, guide and leather. Pump outlet check valve is a brass disc (was bakelite) and must not be interchanged with the former bakelite type. Throttle connector rod upper end is flattened for new type anti-rattle coil spring and lock (flat anti-rattle spring riveted inside dust cover not used). Choke valve has machined angle on each end so that valve seats solidly against air wall and back-fire spring protection device not used (spring type semi-automatic feature continued).

IDLE ADJUSTMENT:—Adjust only with engine warmed up so that choke valve is wide open and fast idle inoperative. Idle adjusting screw controls fuel mixture and should be turned in for leaner mixture, out for richer mixture. Approximate setting is 1-2 turns of screw out from inner seated position (both models). Idle speed controlled by throttle lever stopscrew and should be set for 400 RPM idle speed with engine warm. See car model 'T&E' page for complete tune up instructions.

PERFORMANCE:—Should be satisfactory if idling adjustment and accelerating pump adjustment correctly made. See Carter Jet Specification Table for standard jet calibration and recommended changes for special operating conditions (lean metering jets, etc.).

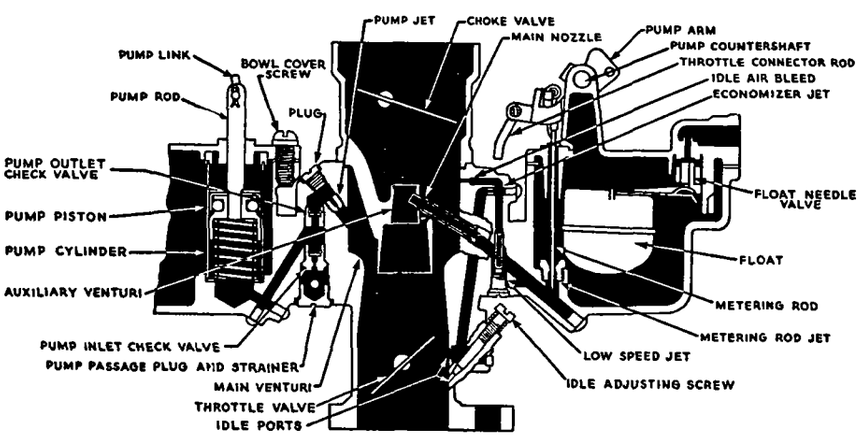
ACCELERATING PUMP:—Low pressure type positively actuated by throttle lever. Fuel is drawn into pump cylinder through intake check valve and strainer when throttle is closed and is discharged through outlet check valve and pump jet in wall of mixing chamber when throttle opened for acceleration.

IMPORTANT SERVICE NOTE—Pump outlet check valve is a brass disc type and must not be interchanged with bakelite type check valve used on former carburetors (use of bakelite check valve on 1941 carburetor, or brass check valve on 1940 carburetor, will upset carburetor calibration). Pump arm on countershaft lubricated by felt oil wick which should be saturated with light engine oil when carburetor overhauled.

Adjustment—Pump stroke is not adjustable.

METERING ROD (ECONOMIZER):—Metering rod and jet assembly meters all fuel for main nozzle (stepped and tapered rod is lifted out of jet as throttle is opened to provide greater fuel flow through jet to nozzle). Metering rods can be changed for special operating conditions such as high altitudes. See Carter Jet Specification Table for standard and special lean metering rods for each model. Check and adjust metering rods whenever rods removed and replaced

Metering Rod Adjustment (Chevrolet)—Take out dust cover screw, remove dust cover, remove pin spring, turn metering rod ¼ turn to disengage it from pump arm pin, lift rod out being careful not to lose the rod spring and disc. Back off throttle stopscrew so that throttle valve tightly closed, install metering rod gauge T109-25 (2.795") in place of rod being careful that gauge is vertical and tapered end seats in metering rod jet. If metering rod pin does not rest on bottom of notch on gauge with pump arm connector rod centered freely in pump arm hole, remove connector rod and bend until this setting secured. Remove gauge and re-install metering rod, make certain that disc in place on rod and that pin spring properly connected.



FLOAT LEVEL:—To check float level, remove bowl cover and float assembly, invert cover, remove gasket, measure from gasket seat on cover to top of float at free end. Distance should be ½" (plus or minus 1/64").

Float Travel—Float travel from open to closed position should be ½". To check travel, measure distance from cover to top of float at free end with float hanging freely from cover. Distance should be 1". Adjust by bending two float stops slightly with small pliers.

Needle Valve & Seat—Furnished only in matched sets, Part No. 25-33S—#48 intake hole (all models).

THROTTLE VALVE SETTING:—When installing valves, use new attaching screws and install screws loosely, tap valve lightly to centralize it in bore, then tighten attaching screws securely.

Setting—Check with stopscrew backed off so that throttle valve tightly closed. Top of lower idle port should be .044-.048" above top edge of throttle valve and bottom of Vacuum Spark Port should be .000-.004" above top of valve with throttle valve closed tightly. Shims furnished .002" thick (2-93), .005" thick (2-94) to correct throttle valve position.

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CHOKE:—Choke valve is butterfly type with offset angled valve which seats solidly in air horn when closed to prevent damage due to back fire. Choke is semi-automatic type (choke valve shaft linked to lever by coil spring) so that valve automatically positions itself for correct choke action during warming up period.

SERVICING:—**Disassembly**—Take out attaching screw and remove dust cover, remove lock on upper end of connector rod by pushing lock in and turning it 90°, remove lock and anti-rattle spring. Disconnect metering rod spring, remove metering rod, using care not to lose metering rod disc. Remove accelerating pump link. Take out bowl cover screws, remove bowl cover assembly, disassemble float, remove float needle valve and seat. Remove pump plunger, plunger spring, and metering rod jet. Loosen three air horn screws, remove main nozzle passage plug and nozzle screw plug. Reach down through air horn with screwdriver and press on 'D' section of nozzle to force nozzle out of 'D' section of main venturi (CAUTION—do not press on end of main nozzle). Take out air horn screws and remove air horn. Remove low speed jet, accelerating pump passage plug and pump check valves, pump jet passage plug and pump jet, idle adjusting screw and idle passage plug. If necessary to remove throttle valve or choke valve, take out attaching screws.

Servicing—Wash all parts in clean gasoline, blow out all passages with compressed air, check idle ports and idle air bleed for carbon deposits. Inspect metering rod, metering rod jet, low speed jet, pump jet and check valves, and pump plunger for wear or damage. See that choke valve operates freely. Inspect main nozzle for burrs on end (CAUTION—Do not dismantle nozzle assembly which consists of inner nozzle pressed in outer nozzle). Replace all worn or damaged parts.

Reassembly—Use all new gaskets (see Parts List below), soak needle seat gasket and metering rod jet gasket in denatured alcohol for 15 minutes, install gaskets on parts and allow to dry before installing in carburetor. Install all parts in reverse order to disassembly directions above and note following special instructions and cautions:

Throttle & Choke Valves—Install choke valve with trademark 'C' upward, throttle valve with trademark toward idle port side, use new attaching screws and install screws loosely, tap valve lightly to centralize it in bore, then tighten attaching screws securely.

Nozzle Assembly—Install air horn screws loosely, make certain that copper gasket in place on nozzle, invert carburetor and drop nozzle into place with flat portion of 'D' section of nozzle in line with 'D' section of primary venturi, install nozzle screw plug securely, tighten air horn screws. Check nozzle position by measuring from inner diameter of primary venturi to end of nozzle. Distance should be .210-.230" and is adjusted by the copper gaskets on the nozzle. Use new copper gasket when installing nozzle passage plug.

Low Speed Jet—Jet must seat securely in casting. To check seating, install jet, then remove jet and inspect for complete bearing around top end of jet. If bearing not complete, install new jet.

Air Horn—Make certain that small fibre gasket in place at balance passage when installing air horn. This gasket is very important to insure correct 'balanced' performance of carburetor.

Adjustments—Check metering rod setting, float level and travel (see directions above), adjust carburetor when re-installed on engine.

SERVICE PARTS:—**Gasket Set**—No. 138A (all models). **Repair Package**—No. 1089 (483-S), 1091 (492-S).

TROUBLE SHOOTING:—**Engine stalls or idling performance unsatisfactory**—Check idle adjusting screw and throttle stopscrew setting. Remove low speed jet tube and clean with compressed air, check tube seat in carburetor (tube must be tight in casting at top and bottom). Remove idle adjusting screw, clean idle passage with air.

Acceleration Unsatisfactory—Disassemble and examine accelerating pump for damaged or worn plunger leather, cracked or corroded pump cylinder, bent pump arm, gummed or sticking check valves, loose or leaking check valves, clogged pump jet or passages (clogged jet or passages will be noticed by increased resistance on foot throttle).

Carburetor 'loads'—Check float level and adjust if incorrect.

TYPE WA1

***472-S—GRAHAM, HOLLYWOOD MODEL 113 (1941)**
***454-S—HUDSON SIX, MODELS 10, 18 (1941)**
435-S—NASH AMBASS. 6, MODEL 4160 (1941)
***504-S—OLDSMOBILE 6, MODELS F-41, G-41, H-41 (1941)—STD. TRANS.**
***481-S—OLDSMOBILE 6, ABOVE MODELS WITH HYDRA-MATIC DRIVE TRANS.**
494-S—PONTIAC SIX, MODELS 41-24, 25, 26 (1941)
***496-S—STUDEBAKER CHAMPION, MODEL 3G (1941)**
***410-S—STUDEBAKER COMMANDER, MODEL 11A (1941)**

*—Vacumeter Type Carburetor.

NOTE:—**Graham Hollywood Supercharger Model 109**—This model has a Carter Dual 'WDO' carburetor. See following article for Carter 'WDO' data.

Hudson, Nash, Oldsmobile, Pontiac, Studebaker Eights—These models have Carter 'WDO' dual carburetors. See following article for 'WDO' data.

Studebaker Commander—This model also uses Stromberg BXOV-26 carburetor. See separate article for data on Stromberg BXOV-26 carburetors.

SPECIAL SERVICE NOTES & PRODUCTION CHANGES:—**Nash Loading or Warming up slowly**—Check hot air tubing. See that tubing not kinked at bends or pinched at point where it enters coil housing. See that tube tight in coil housing and hot air stove connection.

Hudson Models—Carburetors are installed with **eight** gaskets between carburetor and mounting pad on manifold. When installing carburetor, place four gaskets between manifold and heat deflector, four additional gaskets between deflector and carburetor. NOTE—Governor plate is installed between two top gaskets on new cars during breaking in period—when governor plate removed, gasket between plate and carburetor must be replaced so that total of four gaskets used between heat deflector and carburetor.

Pontiac Throttle Sticking Correction (First Cars)—On first cars with accelerator pedal rod which does not have stop at bend, rod may be forced into hole in bracket and cause throttle to stick if cross-shaft bracket and pedal rod alignment not correct. Correct this by installing thin washer on end of rod against bend and soldering washer in place. Pedal rods on later cars have stop formed on rod at this point. Check accelerator pedal alignment and shim with washers under anchor stud so that pedal rod aligned with exact center of hole in toeboard.

Studebaker Champion—To correct complaints of insufficient heat at Climatic Control, which will cause choke valve to be slow in opening as engine warms up, make certain that Heat Tube is not bottoming in pocket in exhaust manifold. It is recommended that heat tube end be cut at an angle so that tube can not bottom in pocket and close off passage in tube.

TYPE:—Same design as previous WA1 models (Standard & Vacumeter Types) with Climatic Control (Automatic Choke), Fast Idle, Anti-Percolator, Unloader, and Choke Valve Lock. See Climatic Control article in Carburetion Equipment Section for complete servicing directions on Climatic Control.

Hudson Model 454-S—This model has special 'Trip Lever' mounted on fast idle link which must be checked after fast idle and other adjustments are made. See Trip Lever Adjustment below.

IDLING ADJUSTMENT:—Adjust carburetor only with engine warmed up and idling at hot or slow idling speed with choke valve wide open and fast idle inoperative. Idle adjusting screw controls fuel mixture and should be turned in for leaner mixture, out for richer mixture. Approximate settings are shown in table below. Idle speed is controlled by throttle lever stopscrew. See car model 'T&E' page for complete carburetor tune up data on each car model.

Car Model	Carburetor	Idle Screw Setting	Idle Speed
Graham 113	472-S	½-1½ turns open	7-8 MPH.
Hudson 6	454-S	¾-1½ turns open	600 RPM.①
Nash 6	435-S	¾-1½ turns open	7-8 MPH.
Oldsmobile 6	504-S, 481-S	½-1½ turns open	②
Pontiac 6	494-S	¾-1¾ turns open	7-8 MPH.③
Studebaker Champ.	496-S	½-1½ turns open	8 MPH.
Studebaker Comm.	410-S	½-1¼ turns open	8 MPH.

①—7½-8 MPH. (4 1/9-1 Axle), 6½-7 MPH. (4 5/9-1 Axle), 6-6½ MPH. (4⅞-1 Axle).
②—6 MPH. or 425 Eng. RPM. (504-S—Std. Trans.), 375 RPM. (481-S—Hydra-matic Drive).
③—450-475 Engine RPM.

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ACCELERATING PUMP:—All models except Pontiac 494-S, Studebaker 496-S. Pump is low pressure type and is positively operated by throttle lever through arm and countershaft assembly on bowl cover. Countershaft arm has three holes for pump link engagement to provide varied pump stroke for seasonal requirements.

Pontiac 494-S, Studebaker Champ. 496-S—Pumps are low pressure (Pontiac), high pressure (Studebaker) and are operated by a spring-loaded arm (pump arm and pump operating lever linked by coil spring). Pontiac type is adjustable (two holes provided in both pump arm and pump plunger stem). No adjustment provided on Studebaker 496-S carburetor.

Pump Seasonal Adjustment—Three holes provided in pump arm on countershaft for pump link connection (except Pontiac—2 holes in both arm and pump stem). Inner hole provides minimum stroke, lower hole medium stroke, outer hole maximum stroke. See tune up data on car model 'T&E' page for recommended setting and seasonal changes. This adjustment accessible after taking out screw and removing dust bowl cover.

Pump Stroke Adjustment:—To check pump plunger travel, back off throttle lever stopscrew so that throttle valve closes tightly, adjust pump connector link for correct pump stroke as shown in 'Pump Setting' column of table below (see Pump Adjustment above for this connector link adjustment). Install Universal Pump Stroke Gauge T109-117S on ridged portion of bowl cover so that projecting portion of gauge rests on top surface on connector link at pump shaft. Hold gauge vertical and note reading, then open throttle wide and again note reading. Difference between these two readings is pump stroke (in sixty-fourths of an inch) and should agree with 'Pump Stroke' figure in table below. To adjust, bend throttle connector rod at lower angle near throttle lever. CAUTION—Check metering rod adjustment (disturbed by this adjustment).

Pump Gauge Change Note—All T109-117S pump gauges after Sept. 15, 1940, have new indicator arm with gauging lips on both ends. This new indicator arm, Part No. T109-153, can be installed on previous gauges to bring them up to date.

Car Model	Carburetor	Pump Stroke	Pump Setting
Graham 113	472-S	19/64"	Medium Stroke
Hudson 6	454-S	12/64"	Short Stroke
Nash 6	435-S	27/64"	Long Stroke
Oldsmobile 6	504-S, 481-S	20/64"	Medium Stroke
Pontiac 6	494-S	18/64"	Short Stroke
Studebaker Champ.	496-S	11/64"	Non-Adj.
Studebaker Comm.	410-S	18/64"	Medium Stroke

METERING ROD (ECONOMIZER):—Metering rod and jet assembly meters all fuel for main nozzle (stepped and tapered rod is lifted out of jet as throttle is opened and provides greater fuel flow through jet to nozzle). Metering rods can be changed for special operating conditions such as high altitudes. See Carter Jet Specification Table for standard and leaner-than-standard metering rod calibrations. Check and adjust Metering Rod whenever rods removed and replaced or when pump stroke setting is changed.

Vacumeter Type Note—On these types, metering rod is linked to vacuum piston stem so that rod is controlled by vacuum piston within limits determined by throttle valve opening (lug on pump arm serves as stop for lip on piston link to prevent vacuum piston pulling metering rod down in jet beyond correct point for the particular throttle opening). These models adjusted in special manner (see instructions below).

Metering Rod Adjustment (except Vacumeter Types)—Take out screw and remove dust cover on float bowl cover. Unhook metering rod spring, disengage metering rod from arm on pump shaft, lift out rod being careful not to lose metering rod disc. Install gauge No. T109-102 (2.468") in place of metering rod making certain that gauge seats in metering rod jet and is held vertical. Back off throttle lever stopscrew so that throttle valve tightly closed. Clearance between pin in arm on pump shaft and shoulder of notch in gauge should be less than .005" and gauge should not drag on pin. Adjust by bending arm (use extreme care not to bend lower portion of arm to which throttle connector link is attached—this will disturb pump stroke setting). Remove gauge, install metering rod and disk, connect metering rod spring.

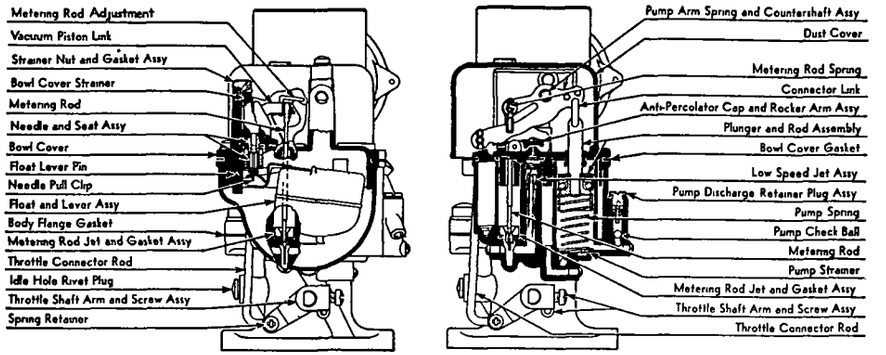
Metering Rod Adjustment (Vacumeter Type)—Remove metering rod (hung on pin on upper end of vacuum piston link) being careful not to lose metering rod disk. Install gauge No. T109-102 (2.468") in place of metering rod making certain that gauge seats in metering rod jet and is held vertical. Back off throttle stopscrew so that throttle valve tightly closed. Press down lightly on vacuum piston link at point directly over piston. Clearance between pin on piston link and shoulder of notch in gauge should be less than .005" and gauge should not drag on pin. Adjust by bending lip on piston link so that it contacts lug on pump arm (use special tool T109-105). Remove gauge, install metering rod and disc, connect metering rod spring.

ANTI-PERCOLATOR:—Saxophone Key Type. Consists of a main nozzle vent in the bowl cover controlled by a leather-faced, felt-backed metal cap which opens the vent when the throttle is closed to prevent any percolating discharge from the nozzle. The cap must be seated to close the vent when the throttle is opened beyond idling position.

Adjustment—Crack throttle open by inserting special gauge No. T109-29 (use .030" end for Graham 472-S, Hudson 454-S, Pontiac 494-S, Studebaker 496-S and 410-S; .020" for Nash 435-S, Oldsmobile 504-S and 481-S) between edge of valve and carburetor wall on side opposite idle port. Bend anti-percolator rocker arm (use special tool T109-105) so that clearance between lip on rocker arm and pump arm is .005-.015" (use feeler gauge to check this clearance).

NOTE—T-109-29 Gauge used for both .020" and .030" settings.

Pontiac Note—Anti-percolator may also be adjusted after throttle stopscrew has been set for 7 MPH idle speed (turn screw in until it just contacts lowest step of fast idle cam, then turn screw in additional ½ turn) by rotating fast idle cam until stopscrew rests on highest step of arm and then bending the anti-percolator rocker arm until clearance between arm and pump arm is .005".



FLOAT LEVEL:—To check float level, remove float bowl cover, invert cover, measure from top edge of machined projection on cover at free end of float to top of soldered seam. See table below for float level on each model. Adjust by bending lip of float lever at valve needle.

Car Model	Carburetor	Float Level
Graham 113	472-S	3/8"
Hudson 6	454-S	3/8"
Nash 6	435-S	3/8"
Oldsmobile 6	504-S, 481-S	½"
Pontiac 6	494-S	½"①
Studebaker Champ.	496-S	5/16"
Studebaker Comm.	410-S	¼"

①—Supersedes 7/16" setting originally specified for this model.

Float Travel—Should be ½" (all models). To check, hold float bowl in normal position, note drop at free end of float. To adjust, bend two small float stop lips at hinge end of float.

Float Needle Valve & Seat—Furnished only in matched sets as follows:

Car Model	Carburetor	Part Number	Intake Hole
Graham 113	472-S	25-42S	#38
Hudson 6	454-S	25-33S	#48
Nash 6	435-S	25-34S	#46
Oldsmobile 6	504-S, 481-S	25-75S	#46
Pontiac 6	494-S	25-42S	#38
Studebaker Champ.	496-S	25-42S	#38
Studebaker Comm.	410-S	25-34S	#46

THROTTLE VALVE SETTING:—When installing valves, see that trademark is up and on idle port side, install screws loosely, tap valve lightly to centralize it in bore, tighten screws securely. See that throttle valve stopscrew is backed off so that valve closes tightly, check throttle valve setting as shown in table below

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(idle ports are slotted type). Vacuum port height is distance from top of valve to bottom of port. Shims furnished .002" thick (2-93), .005" thick (2-94) to correct throttle valve position.

Car Model	Carburetor	Idle Port Opening	Vacuum Port Height
Graham 113	472-S	133-.137"	①.029-.034"
Hudson 6	454-S	120-.124"	.021-.029"
Nash 6	435-S	137-.141"	None
Oldsmobile 6	504-S, 481-S	136-.140"	.022-.027"
Pontiac 6	494-S	107-.111"	.022-.027"
Studebaker Champ.	496-S	②.010-.014"	③.055-.060"
Studebaker Comm.	410-S	②.010-.014"	①.054-.059"

①—Top of port above throttle valve.
②—Port opening below valve (above valve on all other models).
③—Top of port above valve for late production only. On early models, top of port is .045-.055" above valve.

FAST IDLE:—Consists of a fast idle cam pivoted directly above the throttle lever so as to serve as a stop for the throttle stopscrew and linked to the automatic choke mechanism. See Climatic Control article in Carburetion Equipment Section for complete servicing directions.

Adjustment—To check, turn fast idle cam to normal or slow idle speed position, tighten throttle lever stopscrew until it just seats against cam, rotate cam until stopscrew is against first step of cam (screw must not be on step), check clearance between lower edge of choke valve and air horn wall (use tool T109-85—all models). Distance should be 5/8". To adjust, use tool T109-41 and bend offset portion of fast idle link.

TRIP LEVER:—Hudson Model 454-S—Should be adjusted after all other choke linkage adjustments have been made. This trip lever not used on other carburetor models.

Adjustment—Hold choke valve tightly closed with pin on fast idle cam resting at bottom of slot in fast idle link. Bend trip lever stop on fast idle link so that clearance between fast idle cam and lip on trip lever is .010".

CHOKE:—Plain type offset valve. See Climatic Control article in Carburetion Equipment Section for automatic choke servicing data.

Setting—Thermostatic coil housing should be set so that reference mark centered on scale on piston housing for all models except those listed in table below, and should be rotated counter-clockwise (Rich) or clockwise (Lean) for these special models as shown. To adjust, loosen two thermostatic coil housing attaching screws, rotate housing.

Car Model	Carburetor	Choke Setting
Nash 6	435-S	①1 Notch Rich
Pontiac 6	494-S	3 Notches Rich
Studebaker Comm.	410-S	1 Notch Rich
All Others		Centered

①—Supersedes setting of 2 Notches Rich originally specified for this model.

Unloader—Consists of a cam on the throttle lever which opens the choke valve (through fast idle linkage) when throttle is held wide open to correct flooding. To check, hold throttle wide open, check clearance between lower edge of choke valve and air horn wall. See table below for correct clearance and checking gauge on each model. To adjust, bend cam on throttle lever (use Tool T109-41).

Car Model	Carburetor	Gauge No.	Choke Valve Clearance
Graham 113	472-S	T109-83	1/2"
Hudson 6	454-S	T109-81	7/16"
Nash 6	435-S	T109-82	31/64"
Oldsmobile 6	504-S	T109-81	7/16"
Oldsmobile 6	481-S	T109-80	3/8"
Pontiac 6	494-S	T109-106	7/32"
Studebaker Champ.	496-S	T109-31	1/4"
Studebaker Comm.	410-S	T109-31	1/4"

Choke Valve Lock—Prevents choke valve closing when throttle valve held wide open. To adjust, hold choke and throttle valves wide open, bend lip at lower end of fast idle link so that clearance between lip and lock on throttle lever is 1/32" (use tool T109-105).

TROUBLE SHOOTING:—Poor Idling Performance—If engine stalls while idling, low speed performance is unsatisfactory, or correct adjustment cannot be secured, remove idle tube (low speed jet) and clean with compressed air or install new tube. See that tube seats tightly at shoulder. Remove idle adjusting screw and clean low speed channels with air. If idle is rich, check metering rod linkage for binding and see that rod is not rubbing on dust cover. On Vacumeter types, see that vacuum piston is clean and operates freely.

Poor Acceleration—Check pump seasonal adjustment and pump stroke. Remove and clean or replace pump jet. Examine pump for damaged or worn plunger leather, loose plunger, corrosion or dirt in pump cylinder, ball check valves sticking or leaking. If plunger removed from cylinder, use loading tool when re-installing to avoid damaging plunger leather. On vacumeter types, make certain that vacuum piston is clean and operates freely in cylinder, examine spring under piston.

Carburetor Loads Up or Performance is Poor—Check and adjust float level. See that correct type metering rod installed (replace metering rod and jet as an assembly—check metering rod setting when installed). On vacumeter types, see that vacuum piston operates freely and vacuum channel open and clean.

SERVICING:—Disassembly—Take out attaching screw and lockwasher, remove dust cover. Remove fast idle cam screw and fast idle cam. Take out air horn attaching screws (two screws on top, one beneath Climatic Control housing), remove air horn and gasket. Take out retainer screws, remove thermostatic coil and housing assembly, piston housing strainer. Take out choke valve screws and remove choke valve. Loosen screw on choke lever and link assembly 4 full turns, pry lip on lever away from shaft with screwdriver. Revolve choke shaft counter-clockwise to free piston from cylinder and remove assembly (CAUTION Do not remove pin holding piston housing and air horn casting together—these parts line-reamed at factory and must be kept in alignment). Remove pin spring, spring retainer, and spring from throttle connector rod and remove rod. Remove pin spring and connector link from pump arm. Remove low speed passage plug and gasket assembly (located next to anti-percolator cap). Take out bowl cover screws and remove bowl cover assembly intact. On Vacumeter types, remove vacuum piston spring from cylinder in casting, disconnect piston from link by turning piston 1/4 turn, remove piston link and metering rod from bowl cover and disassemble rod and link, using care not to lose metering rod disc. On non-Vacumeter types, remove metering rod and disc, using care not to lose disc or damage spring, remove pump arm and collar assembly and pump operating lever and countershaft assembly by revolving 1/2 turn. On all models, remove float, needle and seat assembly, strainer nut and gasket, and strainer. Take out pin and remove anti-percolator cap and rocker arm assembly and spring. Remove pump plunger and rod assembly, take out strainer and check ball in lower end of pump cylinder. Remove low speed jet assembly, nozzle passage plug, nozzle retainer plug, and nozzle (use tool T109-55). CAUTION—Make certain that small nozzle gasket removed from nozzle passage. Remove metering rod jet and gasket assembly. Remove pump jet passage plug and pump jet. Remove pump discharge ball retainer and check ball. Remove body flange (lower casting) gaskets and insulator, idle adjusting screw and spring, and idle port rivet plug. Remove throttle shaft arm and shaft assembly, take out throttle valve screws, remove throttle valve and shaft and lever assembly.

Servicing—Wash all parts in clean gasoline (except thermostatic coil and housing assembly and cork parts), blow out all passages with compressed air, scrape carbon from casting bore, examine jets and metering rods and replace all worn parts.

Reassembly—Use all new gaskets (see Parts List below), group all low speed circuit, high speed circuit, float, pump, and choke circuit parts together to insure correct re-installation. Install parts in reverse order of disassembly directions given above and note following special instructions and cautions: When installing throttle valve, use new attaching screws, install valve with trademark up and on idle port side of bore, install screws loosely, tap valve lightly to centralize it in bore and then tighten attaching screws. Centralize choke valve in same manner and check operation by making certain that choke valve falls open freely of own weight. When installing nozzle, make certain that new gasket used, install nozzle with flat side up. See that low speed jet seats firmly in casting at shoulder. Check and adjust metering rod, anti-percolator setting, pump stroke, float level, fast idle and choke setting, throttle valve setting as directed above. Adjust carburetor when re-installed on engine.

SERVICE PARTS:—Gasket Set & Repair Packages—Furnished for each model as follows:

Carburetor	Gasket Set	Repair Package
Graham 113 472-S	No. 139A	
Hudson 6 454-S	No. 139 A	No. 1078
Nash 6 435-S	No. 139A	No. 1065
Oldsmobile 6 504-S, 481-S	No. 157	
Pontiac 6 494-S	No. 146	
Studebaker Champ. 496-S	No. 159	
Studebaker Comm. 410-S	No. 160	

507-S—WILLYS AMERICAR, MODEL 441 (1941)
WILLYS COMMERCIAL, PICKUP 441, PANEL DELIVERY 441P (1941)

TYPE:—Same design as Carter 'WO' model used on 1940 Willys models.

ADJUSTMENT:—Adjust only with engine warmed up and choke valve wide open (fast idle inoperative). Idle adjusting screw controls fuel mixture and should be turned in for leaner mixture, out for richer mixture. Approximate settings 1¼ turns (½-1½ turns) of screw from inner seated position. Idle speed controlled by throttle lever stopscrew and should be set for 8 MPH. speed in high gear. See car model 'T&E' page for complete tune up data.

PERFORMANCE:—Should be satisfactory if Idling Adjustment and pump stroke setting correct. See Carter Jet Specification Table for standard jet calibrations and special lean metering rods for special operating conditions such as high altitudes. See Trouble Shooting.

ACCELERATING PUMP:—High pressure type (spring operated). Operated by throttle lever through spring connection between pump operating lever and pump arm (under dust cover on bowl cover). Fuel is drawn into pump cylinder through strainer and inlet ball check valve when throttle is closed and is discharged through outlet ball check valve and pump jet location in side of mixing chamber above main venturi when throttle is opened for acceleration. Pump is not adjustable for seasonal changes.

Pump Stroke Adjustment—To check pump plunger travel, remove dust cover on float bowl cover, install Universal Pump Stroke Gauge T109-117S on raised portion of bowl cover so that gauge is vertical and projecting ear rests on top surface of pump shaft. Back off throttle lever stopscrew so that throttle valve tightly closed, note gauge reading. Open throttle wide and again note gauge reading. Difference between two readings is pump stroke (in sixty-fourths of an inch) and should be 14/64". To adjust, use special bending tool T109-41 to bend throttle connector link at lower angle near throttle lever.
CAUTION—Check metering rod setting (disturbed by this adjustment).

METERING ROD (ECONOMIZER):—Metering rod and jet assembly meters fuel for main nozzle and rod is operated by throttle lever in same manner as on other Carter models. Metering rod mounting on pump operating lever is new and consists of a pin locked in place in a slotted hole in the pump arm by a nut. Metering rods can be changed for special operating conditions such as high altitudes. See Carter Jet Specification Table for standard and lean metering rod calibrations. Check and adjust metering rod whenever rods removed and replaced or when pump stroke setting is changed.

Metering Rod Adjustment—Disconnect choke linkage, take out air horn attaching screws, remove air horn and dust cover. Unhook metering rod spring, remove metering rod being careful not to lose disk on rod at bowl cover. Insert special gauge, T109-26 (2.718") in place of metering rod so that tapered end is seated in metering rod jet and gauge is vertical. Back off throttle lever stopscrew so that throttle valve closes tightly. Metering rod pin on pump operating rod should be even with shoulder of notch in gauge. To adjust, loosen pin nut, shift pin on arm, tighten nut securely (use special wrench T109-76). Remove gauge, install metering rod and disk, install pin spring, connect metering rod spring.

FLOAT LEVEL:—**Note**—Float needle valve stem is hollow and has a spring installed in this hole to take up clearance between valve and float level.

Float Level—To check, remove bowl cover and float assembly, invert cover, turn gasket so that machined surface of bowl cover is exposed, measure distance from this machined surface to top of float at free end (see Caution below). Distance should be ⅜". To adjust, bend lip of float lever at point where it contacts needle valve (do not bend float arm).
CAUTION—Use extreme care not to compress spring in needle valve stem when checking float level (will cause incorrect setting). Allow float to hang freely on inverted cover.

Float Travel—To check, hold bowl cover and float assembly in normal position. Free end of float should drop ½". Adjust by bending two small float stop lips at hinge end of float.

Needle Valve & Seat—No. 25-93S (matched Set). Intake Hole size #53.

CHOKE:—Offset type valve with poppet type relief valve. Check choke linkage to see that choke valve closed when control button on instrument panel pulled out and open with control button pushed in (engine not running—choke control is semi-automatic and spring-loaded).

Fast Idle:—Consists of an interconnecting linkage between the choke valve lever and throttle valve lever so that throttle valve is opened to fast idle position with choke valve closed. Should not require adjustment.

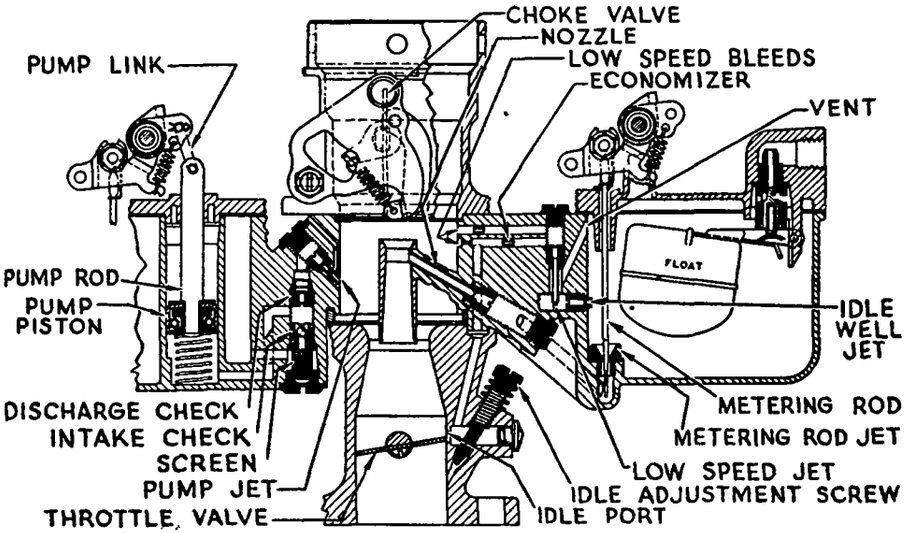
THROTTLE VALVE SETTING:—When installing valves, back off throttle lever stopscrew, see that trademark on valve is on idle port side, use new attaching screws and install screws loosely, tap valve lightly to centralize it in carburetor bore, tighten screws securely, check valve setting.

Setting—With throttle valve closed tightly (stopscrew backed off), idle port opening (below lower edge of valve) should be .010-.014" and top of Vacuum spark port .042-.048" above upper edge of valve when valve tightly closed

TROUBLE SHOOTING:—**Poor Idling Performance**—If motor stalls while idling, low speed performance is unsatisfactory, or if correct idling adjustment cannot be secured, remove idle well plug and gasket assembly and allow fuel to drain from bowl which will flush out idle well jet. Remove idle well jet and clean with compressed air, remove low speed jet and clean with air, see that jet seats gasoline tight at shoulder in casting when replaced. Check carburetor wall at throttle valve edge for carbon deposits. Remove idle adjusting screw and clean out idle passages with air.

Poor Acceleration—Check pump stroke. Remove and clean or replace pump jet. Examine pump for damaged or worn plunger leather, loose plunger or bent pump arm, sediment or corrosion in pump cylinder, sticking or leaking ball check valves. If pump plunger removed from cylinder, use loading tool to install plunger to avoid damage to plunger leather.

Carburetor Loads up or Performance is Poor—Check float level, see that correct type metering rod installed and check metering rod setting.



SERVICING:—**Disassembly**—Remove choke connector link and spring, take out attaching screws and remove air horn assembly. Remove idle well plug and gasket assembly, remove idle well jet. Remove throttle shaft arm and connector rod. Take out screws and remove bowl cover assembly, disassemble parts on bowl cover. Remove low speed jet plug and gasket, low speed jet, idle adjusting screw and spring, metering rod jet and gasket assembly, nozzle passage plug and gasket, nozzle retainer plug, nozzle (use tool T109-55). Take out body casting flange attaching screws, remove flange casting and throttle valve assembly. Remove pump strainer plug and gasket, strainer, inlet ball check valve assembly, outlet ball check valve assembly. Remove pump jet passage plug and gasket, and pump jet. Remove idle port rivet plug. Take out throttle valve attaching screws, remove valve, withdraw shaft and lever assembly. Remove choke control bracket assembly from air horn, take out choke valve attaching screws, remove valve, withdraw choke valve shaft and lever assembly.

Servicing:—Clean body castings and all parts in gasoline, blow out all passages in castings and all jets with compressed air, dry all parts with air before reassembling. Check all parts for wear, see that they agree with specifications (see Carter Jet Specification Table), replace all worn parts.

Reassembly:—Use all new gaskets (soak metering jet gasket and needle seat gasket in 90 proof alcohol for 15 minutes, install on part and allow to dry before using). Reassemble by reversing disassembly directions above and note:

Nozzle Installation—Use new gasket. Use special tool T109-55 to install nozzle and make certain that flat side of nozzle is upward.

Low Speed Jet—Make certain that hole at lower end is open, work jet into seat by moving it back and forth, make certain that jet seats tightly in casting and install jet plug and gasket.

Choke Valve—Centralize valve in air horn by tapping valve lightly before tightening attaching screws.

***506-S—CADILLAC V8, SERIES 41-60S, 61, 62, 63, 67, 75 (1941)**
488-S—GRAHAM, HOLLYWOOD SUPERCHARGER MODEL 109 (1941)
***461-S—HUDSON SIX, MODELS 11, 12 (1941)—FIRST 2050 CARS.**
***501-S—HUDSON SIX, MODELS 11, 12 (1941)—AFTER FIRST CARS.**
***455-S—HUDSON EIGHT, MODELS 14, 15, 17 (1941)—FIRST CARS.**
***502-S—HUDSON EIGHT, MODELS 14, 15, 17 (1941)—AFTER FIRST CARS.**
511-S—NASH AMBASS. 8, MODEL 4180 (1941)
***503-S—OLDSMOBILE 8, MODELS E-41, J-41, L-41 (1941)—STD. TRANS.**
***480-S—OLDSMOBILE 8, ABOVE MODELS WITH HYDRA-MATIC DRIVE**
***512-S—PACKARD CLIPPER, MODEL 1951 (1941)**
***478-S—PACKARD '120' 8, MODELS 1901, 1A (1941)**
469-SM—PONTIAC EIGHT, MODELS 41-27, 28, 29 (1941)
409-S—STUDEBAKER PRESIDENT, MODEL 7C (1941)

*—Vacumeter type Carburetor.

1940 SPECIAL SERVICE NOTES:—Throttle Stop Dog Adjustment (Buick 474-S)—Should be adjusted before adjusting Unloader. Use Gauge T109-121S to check throttle opening (See Carter Car Starter in Electrical Equipment Section for gauge data). With choke valve open, close throttle valve, then close choke valve and adjust lip on throttle stop dog (on throttle shaft) to contact throttle stop with throttle opening of 44° Minimum, 55° Maximum, from tightly closed position.

Hudson Throttle Sticking Correction—To correct complaints of sticking throttle caused by binding between throttle connector rod and throttle lever or pump arm on 455-S, 461-S carburetors, remove and discard original throttle connector rod (No. 115-52), install new Throttle Connector Rod No. 115-65 and Throttle Connector Rod Washer No. 136-37. NOTE—This washer must be used with the new rod.

Pontiac Throttle Sticking Correction—Refer to Pontiac Shop Notes in 'M' Section for recommended accelerator linkage adjustment.

NOTE:—Cadillac, Studebaker Models—Stromberg carburetors also used on these models. Refer to Stromberg Model AAV-26 Carburetor article for data.
Hudson 6 & 8 (First Cars)—Carburetors used on first cars are same types as used on corresponding 1940 models (with dashpot or slow closing throttle device). New carburetor models used on later cars do not have this dashpot.
Packard Clipper (512-S)—This model has Carter Car Starter No. 192-11U built-in carburetor. Refer to Carter Car Starter in Electrical Equipment Section.

1941 SPECIAL SERVICE NOTES:—Pontiac Throttle Sticking Correction—Refer to Carter WA1 article for recommended correction (same as for Six).

Hudson (All Models)—Carburetors are installed with **eight** gaskets between carburetor and mounting pad on manifold. When installing carburetor, place four gaskets between manifold and heat deflector, four additional gaskets between deflector and carburetor. NOTE—Governor plate is installed between two top gaskets on new cars during breaking in period—when governor plate removed, gasket between plate and carburetor must be replaced so that total of four gaskets used between heat deflector and carburetor.

TYPE:—Same design as previous Carter WDO dual models (Standard and Vacumeter types) with Climatic Control (automatic choke), Fast Idle, Anti-Percolator, Unloader and Choke Valve Lock. See Climatic Control article in Carburetion Equipment Section for complete servicing directions on these units.

IDLING ADJUSTMENT:—Adjust carburetor only with engine warmed up and idling at hot or slow idling speed (choke valve wide open, fast idle inoperative). Idle adjusting screw provided for each carburetor barrel. Screws control fuel mixture and should be turned in for leaner mixture, out for richer mixture and both screws just be adjusted exactly alike. See table below for approximate settings on each car model. Idle speed controlled by throttle lever stopscrew and should be set for speed shown in table. See car model 'T&E' page for complete carburetor tune up instructions on each car model.

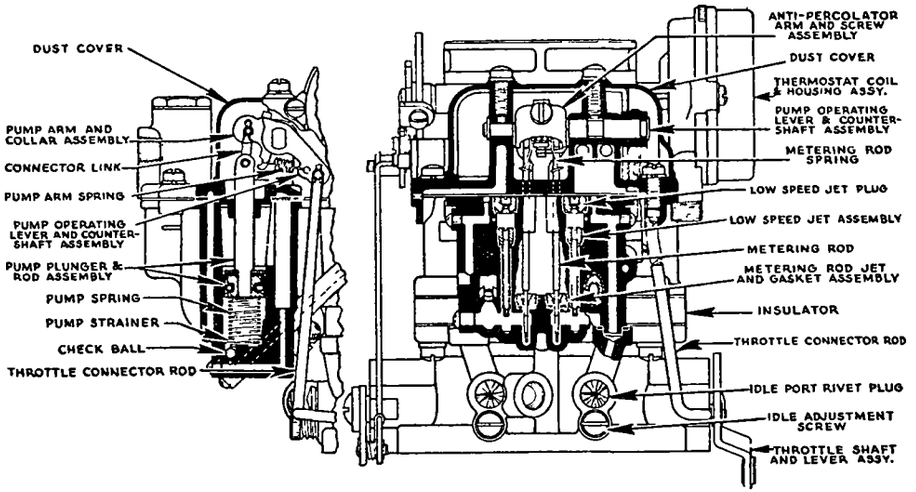
Car Model	Carburetor	Idle Screw Setting	Idle Speed
Cadillac V8	506-S	½-1½ turns open	7-8 MPH④
Graham 109	488-S	½-1¼ turns open	7-8 MPH.
Hudson 6	461-S, 501-S	¼-1¼ turns open	600 RPM.①
Hudson 8	455-S, 502-S	½-1½ turns open	600 RPM.①
Nash	511-S	½-1½ turns open	7-8 MPH.
Oldsmobile 8	503-S, 480-S	½-2¼ turns open	②
Packard 8	478-S, 512-S	½-1½ turns open	6 MPH.
Pontiac 8	469-SM	¼-1¼ turns open	7-8 MPH.③
Studebaker 7C	409-S	¼-1¼ turns open	8 MPH.

①—7½-8 MPH. (4 1/9-1 Axle), 6½-7 MPH. (4 5/9-1 Axle), 6-6½ MPH. (4⅞-1 Axle).
②—6 MPH. or 425 Eng. RPM. (503-S—Std. Trans.), 375 RPM. (480-S—Hydra-matic Drive). ③—450-475 Eng. RPM.
④—For Std. Transmission. Set at 375 Eng. RPM on cars with Hydra-matic Drive.

PERFORMANCE:—Should be satisfactory if Idling Adjustment and Accelerating Pump Setting correct. See Carter Jet Specification Table for standard jet calibrations and special lean metering rods (for special operating conditions). Both metering rods must be same size and adjusted alike. See Trouble Shooting below.

METERING ROD (NON-VACUMETER TYPES):—Fuel metered by stepped metering rods (separate rod and jet used for each carburetor barrel) which are raised in metering rod jets as throttle is opened to permit greater fuel flow to nozzles. Metering rods used for both barrels must be same size and must be adjusted alike. Metering rods can be changed for special operating conditions such as high altitude (see Carter Jet Specification Table for standard and special lean metering rods). Setting should be checked whenever metering rods removed and replaced or when pump stroke setting is adjusted.

Metering Rod Removal—On models with integral air horn and dust cover, remove this assembly to expose pump countershaft and metering rods (on models with separate dustcover, take out two retaining screws and remove dust cover only). Remove pin spring from metering rod pin, slide pin out being careful not to lose metering rod springs, lift out metering rods and springs. Remove metering rod discs (on some models, discs held in place by retainer which must first be removed by taking out brass retainer screw). On models where retainer not used, use care not to lose discs.



Metering Rod Setting—Back off throttle lever stopscrew so that throttle valves tightly closed, loosen anti-percolator arm screw. Install metering rod gauge (see table below for each model) in place of each metering rod, making certain that gauges seat in metering rod jets and are vertical. Install metering rod pin and pin spring in metering rod arm. Press down lightly on pump arm. Pin should rest on shoulders of notches in both gauges (bend arm slightly to equalize if necessary) with clearance of less than .005" between pin and each gauge. Tighten anti-percolator arm screw. Remove gauges and metering rod pin, install metering rods and disks, springs, pin and pin spring, hook metering rod springs on rods.

CAUTION—Anti-percolator must be checked after this adjustment completed.

Car Model	Carburetor	Metering Rod Gauge No.	Length
Graham 109	488-S	T109-113	2.280"
Nash 4180	511-S	T109-113	2.280"
Pontiac 8	469-SM	T109-27	2.359"
Studebaker 7C	409-S	T109-27	2.359"

METERING ROD (VACUMETER TYPES):—Fuel for nozzles metered by metering rod and jet (independent rod and jet for each nozzle). Metering rods operated by single vacuum piston with throttle control (stop pin on pump arm limits piston travel so that metering rod lifted in accordance with throttle opening). No adjustment provided but metering rods can be changed to secure leaner-than-standard fuel mixture to compensate for special fuel or high altitude conditions (both rods must be same size and should be changed as a unit). Check metering rod setting whenever rods removed and replaced or when pump stroke setting is adjusted.

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To Remove Metering Rods—Take out screws and remove dust cover or remove air horn and dust cover assembly (where these parts integral—see Service data for removal instructions). Remove pin spring from metering rod pin and slide pin from vacuum piston link being careful not to bend metering rod spring. Lift out metering rods, remove metering rod discs (on some models discs held in place by retainer which must first be removed by taking out brass retainer screw). On models where retainer not used, use care not to lose discs.

To Check Metering Rods—Back off throttle stopscrew so that throttle valves tightly closed. Install metering rod gauge (see table below) in place of one metering rod making certain that tapered end of gauge is seated in metering rod jet. Install metering rod pin in piston link, press piston and link down until metering rod pin contacts lip on anti-percolator arm. With piston down and throttle valve seated, clearance between metering rod pin and shoulder of notch in gauge should be less than .005". To adjust, bend lip on anti-percolator arm.

To Install Metering Rods—Make certain that discs are in place under disc retainer and that pin spring and metering rod springs are properly connected.

Car Model	Carburetor	Metering Rod Gauge No.	Length
Cadillac V8	506-S	T109-113	2.280"
Hudson 6	461-S, 501-S	T109-113	2.280"
Hudson 8	455-S, 502-S	T109-113	2.280"
Oldsmobile 8	503-S, 480-S	T109-113	2.280"
Packard 8	478-S, 512-S	T109-113	2.280"

ACCELERATING PUMP:—High pressure type with spring operation (pump operating lever and pump arm linked by small coil spring) except Studebaker Model 409-S which is Low Pressure type. Inlet ball check valve located in bottom of pump cylinder, outlet ball check valve under retainer plug in main body casting.

Pump Seasonal Adjustment—On some models, pump arm (under dust cover) has two or three holes for pump rod link connection to provide varied pump stroke for seasonal pump requirements. See car model 'T&E' page for recommended settings and seasonal changes.

Pump Stroke Adjustment—On models with integral air horn and dust cover, remove this assembly to expose pump countershaft and connector link (on models with separate dust cover, take out two retaining screws and remove dust cover only). Back off throttle lever stopscrew so that throttle valves tightly closed, check pump seasonal adjustment (connector link must be engaged in hole for correct stroke as shown in table below). Install Universal Pump Stroke Gauge T109-117S on rim of bowl cover at plunger shaft so that projection on gauge rests on top surface of connector link at pump shaft. Note gauge reading with throttle closed, then open throttle wide and again note gauge reading. Difference between two readings is pump stroke (in sixty-fourths of an inch) and should agree with figure shown in table below. Adjust by bending throttle connector rod at lower angle near throttle lever (use bending tool T109-75).

CAUTION—Check metering rod setting and anti-percolator adjustment after adjusting pump stroke.

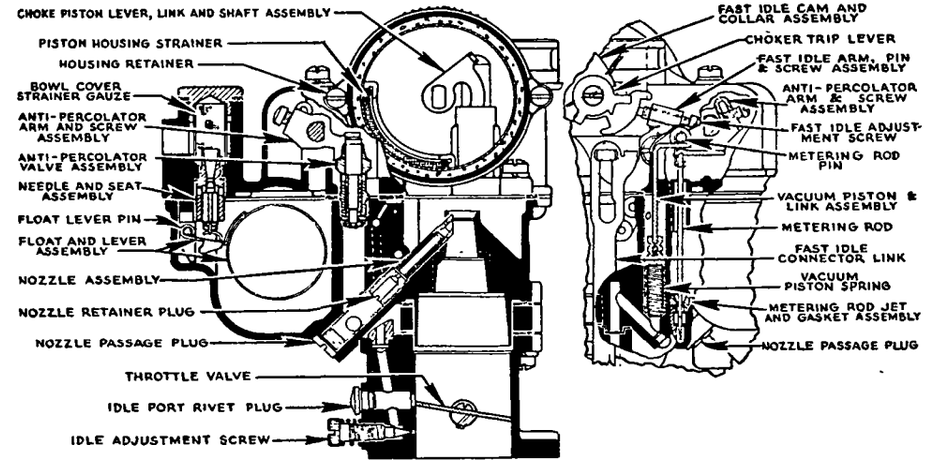
Pump Gauge Change Note—All T109-117S pump gauges after Sept. 15, 1940 have new indicator arm with gauging lips on both ends. This new indicator arm, Part No. T109-153, can be installed on previous gauges to bring them up to date.

Car Model	Carburetor	Pump Stroke	Pump Setting
Cadillac V8	506-S	26/64"	Non-adj.
Graham 109	488-S	22/64"	Short Stroke
Hudson 6	461-S, 501-S	18/64"	Long Stroke
Hudson 8	455-S, 502-S	18/64"	Long Stroke
Nash 8	511-S	32/64"	Long Stroke
Oldsmobile 8	503-S, 480-S	19/64"	Non-adj.
Packard 8	478-S, 512-S	14/64"	Short Stroke
Pontiac 8	469-SM	19/64"	Non-adj.
Studebaker 7C	409-S	16/64"	Long Stroke

ANTI-PERCOLATOR:—Plunger Type (All Models). Consists of a vent above each main jet well controlled by spring-loaded plunger type valves. Valves are opened by anti-percolator arm connected to throttle when throttle valves are closed to vent nozzles and prevent any 'percolating' discharge when carburetor is hot. Valves must be closed when throttle is opened (incorrect adjustment will cause flat spots).

Adjustment—Make this adjustment after metering rod setting and pump stroke setting have been adjusted (use extreme care not to disturb these settings). On models with integral air horn and dust cover, remove this assembly to expose anti-percolators (on models with separate dust cover, take out two retaining screws and remove dust cover only). Back off throttle lever stopscrew so that throttle valves tightly closed. On models listed in table below, insert special gauge (or feeler gauge of thickness listed) between anti-percolator stems and lips on anti-percolator arms—**do not use any gauge on other models.** Bend lips so that center of indicator line on each anti-percolator stem is flush with top of anti-percolator plug. Use extreme care to secure same adjustment on both anti-percolator units.

Car Model	Carburetor	Checking Gauge	Thickness
Cadillac V8	506-S	T109-72	.015"
Packard 8	478-S, 512-S	T109-72	.015"
Studebaker 7C	409-S		.010"
All Others		None	None



FLOAT LEVEL:—To check float level (with bowl cover assembly removed), remove cover gasket, invert cover, measure from machined gasket seat on cover to top of float (check at both ends of float—settings must be alike). See table below for float level and special checking gauge for each model. To adjust, bend lip on float level at point where it contacts valve needle (do not bend float or arm).

Car Model	Carburetor	Float Level	Checking Gauge
Cadillac V8	506-S	1/8"	
Graham 109	488-S	3/16"	T109-28
Hudson 6 & 8	461-S, 455-S	3/32"	
Hudson 6 & 8	501-S, 502-S	1/8"	
Nash 8	511-S	3/16"	T109-28
Oldsmobile 8	503-S, 480-S	3/16"	T109-28
Packard 8	478-S, 512-S	5/32"	T109-154
Pontiac 8	469-SM	5/16"	T109-107
Studebaker 7C	409-S	3/16"	T109-28

Needle Valve & Seat—Furnished only in matched sets as shown in table below. When installing assembly on Oldsmobile and Pontiac carburetors, see that clip on needle valve engages float lever.

Car Model	Carburetor	Part Number	Intake Hole Size
Cadillac V8	506-S	25- 98S	#38
Graham 109	488-S	25- 59S	#38
Hudson 6	461-S, 501-S	25- 59S	#38
Hudson 8	455-S, 502-S	25- 59S	#38
Nash 8	511-S	25- 59S	#38
Oldsmobile 8	503-S, 480-S	25-100S	#38
Packard 8	478-S, 512-S	25- 98S	#38
Pontiac 8	469-SM	25- 74S	#38
Studebaker 7C	409-S	25- 59S	#38

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THROTTLE VALVE SETTING:—Install valves with trademark 'C' toward idle port side, use new attaching screws, install screws loosely, tap valves lightly to centralize them in bore, then tighten screws securely. Check valve setting with throttle lever stopscrew backed out so that valves tightly closed. Idle port figure is distance from top edge of valve to top of idle port. Vacuum spark port figure is distance from top edge of valve to top (or bottom as noted) of vacuum spark port. Shims furnished .002" thick (2-93), .005" thick (2-94) for throttle valve setting adjustment.

Car Model	Carburetor	Idle Port Opening	Vacuum Spark Port
Cadillac V8	506-S	.135-.141"	②.033-.037"
Graham 109	488-S	.162-.168"	②.038-.042"
Hudson 6	461-S, 501-S	.108-.112"	②.029-.033"
Hudson 8	455-S, 502-S	.133-.137"	None
Nash 8	511-S	.140-.146"	None
Oldsmobile 8	503-S, 480-S	.144-.150"	②.029-.033"
Packard 8	478-S, 512-S	.135-.141"	①.009-.013"
Pontiac 8	469-SM	.140-.146"	②.052-.056"
Studebaker 7C	409-S	③ .009-.015"	②.029-.033"

①—Bottom of port above top of valve. ②—Top of port above top of valve.
③—Opening below lower edge of valve.

FAST IDLE:—Consists of a fast idle lever linked to the throttle valve lever and mounted directly below the fast idle cam on the choke valve shaft. To adjust, hold choke valve tightly closed, adjust fast idle arm screw so that clearance between throttle valve and carburetor wall on side opposite idle port is correct as shown in table below (use special checking gauge inserted between throttle valve and wall to check opening).

Car Model	Carburetor	Throttle Opening	Checking Gauge
Cadillac V8	506-S	.023"	T109-149
Graham 109	488-S	.026"	T109-114
Hudson 6 & 8	461-S, 455-S	.018" (See Note)	T109-44
Hudson 6	501-S	.045"	
Hudson 8	502-S	.053"	
Nash 8	511-S	.015"	T109-44
Oldsmobile 8	503-S, 480-S	.015"	T109-44
Packard 8	478-S, 512-S	.030"	T109-29
Pontiac 8	469-SM	.010"	See Note
Studebaker 7C	409-S	.018"	T109-44

Note—Gauge No. T109-44 used for both .015" and .018" settings.

Hudson Note—On Carburetor Models 461-S, 455-S, fast idle can be adjusted as follows: With throttle stopscrew set for correct slow idle speed of 600 RPM., open throttle so that clearance between stopscrew and stop on carburetor casting is .030", hold in this position, close choke valve, turn fast idle adjusting screw in until it just contacts fast idle cam.

Oldsmobile Note—With correct fast idle setting, clearance between throttle valve stopscrew and stop on carburetor casting should be .030" (503-S), .025" (480-S) with choke valve closed and fast idle screw on high lobe of fast idle cam.

Pontiac Note—Fast idle can also be adjusted as follows: Back off throttle stopscrew so that throttle valves tightly closed, hold choke valve closed, back off fast idle adjusting screw so that it clears high lobe of fast idle cam, then turn screw in until it barely drags on cam, and finally turn screw in ⅝ additional turn to provide correct .010" throttle opening. With this fast idle setting, clearance between throttle lever stopscrew and stop on carburetor casting will be .032" with stopscrew set for correct hot or slow idle speed of 7-8 MPH.

CHOKE:—Carter Climatic Control (automatic choke) is standard. See article in Carburetion Equipment Section for complete servicing and adjusting directions.

Setting—Thermostatic coil housing reference mark should be centered on mark on piston housing (for all models except those shown in table below) or should be rotated counter-clockwise (Rich), clockwise (Lean), the correct number of notches from the center mark as follows:

Car Model	Carburetor	Choke Setting
Hudson 6 & 8	501-S, 502-S	①1 Notch Lean
Nash 8	511-S	②Centered
Oldsmobile 8	480-S only	2 Notches Rich
Packard 8	478-S only	1 Notch Rich
Pontiac 8	469-SM	2 Notches Rich
Studebaker 7C	409-S	1 Notch Rich
All Others		Centered

①—Supersedes Centered setting originally specified for these models.
②—Supersedes 1 Notch Rich setting originally specified for this model.

Unloader:—Consists of a lip on the throttle connector which engages the choke trip lever on the choke valve shaft so that the choke valve is opened when the throttle is wide open. To adjust, hold throttle valve wide open, bend lip on fast idle connector link so that clearance between upper edge of choke valve and air horn wall is correct as shown in table below (use specified gauge to check this opening).

Car Model	Carburetor	Unloader Gauge No.	Clearance
Cadillac V8	506-S	T109-39	13/64"
Graham 109	488-S	T109-31	¼"
Hudson 6	461-S, 501-S	T109-31	¼"
Hudson 8	455-S, 502-S	T109-31	¼"
Oldsmobile 8	503-S	T109-31	¼"
Oldsmobile 8	480-S	T109-28	3/16"
Packard 8	478-S, 512-S	T109-28	3/16"
Pontiac 8	469-SM	T109-28	3/16"
Studebaker 7C	409-S	T109-28	3/16"

Choke Valve Lock:—With unloader properly adjusted, choke valve will be locked in wide open position with throttle valves wide open. Choke valve will be released when throttle valves closed.

TROUBLE SHOOTING:—Same as for other Carter models (see preceding article).

SERVICING (ALL TYPES):—Disassembly—Take out screws and remove dust cover (on models where dust cover is separate part), remove fast idle arm and screw assembly using care not to damage fast idle arm spring, remove air horn assembly (one screw located within air horn beneath choke valve—use care not to lose discharge ball check located in this screw hole). Disconnect throttle connector rod at both ends, remove bowl cover and metering rod assembly (on Vacumeter Types, vacuum piston and link is part of this assembly and will come out with bowl cover), remove pump plunger spring and vacuum piston spring (Vacumeter Types). Remove metering rod pin, remove metering rods and spring using care not to lose discs on metering rods (on some models discs located under retainer which must be removed before discs can be taken out). Remove anti-percolator units (use tool T109-66). Remove strainer from pump cylinder (strainer will drop out when carburetor is inverted), remove pump intake check ball retainer (use tool T109-56) and check ball. Remove pump jet plugs and pump jets (on some models, jets are pressed in place and should not be removed—merely clean jets while in place). Take out retainer plug and remove pump discharge check ball (in air horn attaching screw hole). Remove low speed jet bleeder plugs and low speed jets (use tool T109-60 to remove jets), remove metering rod jet assemblies (use special screwdriver tool T109-58). Remove body flange assembly (lower casting) and rubber gaskets under float bowl. Remove nozzle passage plugs and nozzle retainer plugs (use tool T109-58), remove nozzles (use tool T109-55 with T109-90 handle). Remove idle adjusting screws. Remove throttle shaft arm attaching screw, remove washer and throttle shaft arm with fast idle link and spring. Remove throttle valve screws, throttle valves, throttle centering screw, and throttle shaft and lever assembly. Remove float pin, take out float assembly, remove needle valve and seat assembly (use tool T109-61). Remove connector link from pump arm, loosen anti-percolator arm screw and pin spring, slide pump arm and shaft assembly out. Remove bowl cover strainer nut, gasket and strainer. Remove thermostatic coil and housing assembly, lift out screen, remove choke trip lever screw from shaft, lift off trip lever washer and fast idle cam. Remove choke valve screws, take out choke valve. Turn choke lever to free piston from cylinder, remove lever and piston assembly using care not to lose piston pin.

Servicing—Wash all parts in clean gasoline (except cork gaskets and thermostatic coil and housing assembly), blow out all passages with compressed air, scrape carbon from casting bores, examine jets and metering rods, replace all worn or damaged parts.

Reassembly—Use all new gaskets (see Parts List below), group all low speed circuit, high speed circuit, pump, choke, and float circuit parts to insure correct re-installation. Install parts in reverse order to disassembly directions given above and note following special instructions and cautions: When installing throttle valves, use new attaching screws, install valves with trademark 'C'

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toward manifold and on idle port side of carburetor bore, install screws loosely, tap valves lightly to centralize them in the carburetor bore and then tighten attaching screws. To install nozzles, make certain that old gaskets have been removed from casting, install nozzles with flat side up and use new gaskets and retainer plugs. Center choke valve before tightening attaching screws and make certain that valve does not bind at any point (valve should fall open of own weight when correctly installed). Check and adjust metering rods, anti-percolator setting, pump stroke, float level, fast idle and choke setting, throttle valve setting as directed above. Adjust carburetor when re-installed on engine.

SERVICE PARTS:—Gasket Set & Repair Packages—Furnished for each model as follows:

Carburetor	Gasket Set	Repair Package
Cadillac V8 ..... 506-S	No. 144B	
Graham 109 ..... 488-S	No. 149	
Hudson 6 ..... 461-S	No. 142A	No. 1080
Hudson 6 ..... 501-S	No. 149	
Hudson 8 ..... 455-S	No. 142A	No. 1079
Nash 8 ..... 511-S	No. 145	
Oldsmobile 8 ..... 503-S, 480-S	No. 158	
Packard 8 ..... 478-S	No. 156	No. 1092
Pontiac 8 ..... 469-SM	No. 134	No. 1086
Studebaker 7C 409-S	No. 161	

1941 CARTER DOWNDRAFT CARBURETOR JET SPECIFICATIONS

Car Model	Yr.	Carb. No.	Marking	Metering Rod Standard Part No.	1 Size Lean Marking	1 Size Lean Part No.	2 Sizes Lean Marking	2 Sizes Lean Part No.	Met. Rod Jet Size	Met. Rod Jet Part No.	Main Nozzle Size	Main Nozzle Part No.	Low Spd. Jet Tube Size	Low Spd. Jet Tube Part No.	Pump Jet Size	Pump Jet Part No.
BUICK 40	1941	487-S	655-57	75-459	665-59	75-488	675-59	75-489⑪	.082"	120-65S	—	⑩	#68	11-171S	#73	48-98S
BUICK 40,40A,50㉜	Early '41	509-S	72-60	75-492	73-62	75-503	70-56	75-491⑭	.086"	120-121S	—	⑩	#70	11-176S	#73	48-105S⑬
BUICK 40,40A,50㉝	Early '41	510-S	—	—	—	—	—	—	.0492"	120-143S	—	⑩	#70	11-176S	—	—
BUICK 60,70,90㉜	Early '41	490-S	675-54	75-473	69-56	75-490	70-56	75-491⑭	.086"	120-121S	—	⑩	#70	11-176S	#73	48-98S
BUICK 60,70,90㉝	Early '41	491-S	—	—	—	—	—	—	.0531"	120-141S	—	⑩	#70	11-176S	—	—
BUICK 40,40A,50㉜	Late '41	528-S	72-60	75-492	73-62	75-503	70-56	75-491⑭	.08575"	120-149S	—	⑩	#65	11-177S	#74	48-110S㉖
BUICK 40,40A,50㉝	Late '41	529-S	—	—	—	—	—	—	.0492"	120-143S	—	⑩	#65	11-177S	—	—
BUICK 60,70,90㉜	Late '41	533-S	675-54	75-473	69-56	75-490	70-56	75-491⑭	.086"	120-121S	—	⑩	#65	11-177S	#74	48-113S㉚
BUICK 60,70,90㉝	Late '41	534-S	—	—	—	—	—	—	.0531"	120-141S	—	⑩	#65	11-177S	—	—
CADILLAC V8	1941	506-S	67-54	75-422⑨	68-55	75-423	—	—	.086"	120-121S	①	12-259	#71	11-161S	#72	—
CHEVROLET All	1941	483-S	67-46	75-485	68-49	75-517	—	—	.093"	120-115S	⑮	⑧12-274S	.035"	11-173S	#72	48-43
CHEVROLET Econ (V)	1941	492-S	645-46	75-508	—	75-518	—	—	.0845"	120-49S	⑮	⑧12-282S	#72	11-147	#72	48-43
GRAHAM 109	1941	488-S	755-54	75-470	76-56	75-482	77-58	75-483	.0935"	120-137S	⑫	12-248	#68	11-160S	#71	48-90
GRAHAM 113	1941	472-S	72-40	75-452	—	—	—	—	.099"	120-95S	㊱	12-268	#68	11-160S	#67	48-89
HUDSON 10, 18	1941	454-S	72-44	75-407	74-46	75-410	76-48	75-411㉓	.096"	120-17S	㉒	12-261	#70	11-163S	#70	48-87
HUDSON 11, 12	Early 1941	461-S	63-52	75-404	64-53	75-414	65-54	75-415㉗	.082"	120-65S	⑫	12-248	#69	11-162S	#74	—
HUDSON 11, 12	Late 1941	501-S	615-47	75-467	625-48	75-474	635-49	75-475③	.082"	120-65S	⑫	12-277	#71	11-161S	#74	—
HUDSON 14, 15, 17	Early 1941	455-S	625-46	75-405	635-47	75-418	645-48	75-419㉘	.086"	120-121S	⑫	12-248	#66	11-167S	#74	—
HUDSON 14, 15, 17	Late 1941	502-S	61-44	75-466	62-45	75-478	63-46	75-479④	.086"	120-121S	⑫	12-248	#69	11-162S	#74	—
NASH Amb. 6 4160	1941	435-S	76-40	75-372	77-48	75-384	78-53	75-385	.0995"	120-133S	⑯	12-249	#65	11-165S	#70	48-58
NASH Amb. 8 4180	1941	511-S	74-61	75-500	755-64	75-501	76-66	75-502	.09055"	120-139S	⑫	12-248	#68	11-160S	#72	48-61
OLDSMOBILE 66, 76, 96	1941	504-S	7625-53	75-487	—	75-512	—	75-513⑰	.1015"	120-15S	⑥	⑧12-280S	#70	11-170S	#72	48-72
OLDSMOBILE 66, 76, 96	1941	481-S⑱	7625-53	75-487	—	75-512	—	75-513⑰	.1015"	120-15S	⑥	⑧12-280S	#70	11-170S	#72	48-72
OLDSMOBILE 68, 78, 98	1941	503-S	72-51	75-486	725-51	75-509	73-53	75-510⑤	.089"	120-103S	⑥	⑧12-227S	#71	11-161S	#72	—
OLDSMOBILE 68, 78, 98	1941	480-S⑱	72-51	75-486	725-51	75-509	73-53	75-510⑤	.089"	120-103S	⑥	⑧12-227S	#71	11-161S	#72	—
PACKARD 8 1901, 1A	1941	478-S	64-47	75-451	—	75-519	—	75-520	.0846"	120-125S	⑦	12-262	#70	11-163S	#70	—
PACKARD 8 1951	1941	512-S	64-47	75-451	—	75-519	—	75-520	.0846"	120-125S	⑦	12-262	#70	11-163S	#70	—
PONTIAC 6 41-24,25,26	1941	494-S	715-38	75-472	—	75-521⑳	—	75-522㉑	.0995"	120-133S	㉛	12-260	#69	11-162S	#75	48-99
PONTIAC 8 41-27,28,29	1941	469-SM	705-52	75-443	715-537	75-444	727-56	75-445	.089"	120-103S	②	12-265	#71	11-149S	#70	48-63
STUDEBAKER Ch. 3G	1941	496-S	685-43	75-484	70-46	75-493	715-50	75-494⑲	.098"	120-67S	#44	12-278	#64	11-174S	#72	48-61
STUDEBAKER 6 11A	1941	410-S	705-425	75-337	72-46	75-330	73-50	75-331	.098"	120-67S	#45	12-239	#67	11-168S	#70	48-58
STUDEBAKER 8 7C	1941	409-S	70-47	75-312	71-49	75-321	72-51	75-322	.0885"	120-107S	#30㉙	12-212	#70	11-157S	#73	48-60
WILLYS 441, 441P	1941	507-S	695-55	75-497	㉕	—	—	—	.078"	120-79S	.096"	12-255	#70㉔	11-163S	#73	48-84

①—Closed Tip. Top hole .037" (45° angle), Lower hole .071" (60° angle).
②—Closed Tip. Top hole #75 (45° angle), Lower hole #52 (60° angle).
③—Three Sizes Lean—645-50. Part No. 75-476.
④—Three Sizes Lean—64-47. Part No. 75-480.
⑤—Three Sizes Lean—735-55. Part No. 75-511.
⑥—Inner Nozzle #31, Outer Nozzle .110".
⑦—Closed Tip. Top hole .028" (45° angle), Lower hole .0635" (70° angle).
⑧—Nozzle Assembly (Inner & Outer Nozzle).
⑨—Supersedes No. 75-471.
⑩—Nozzle installed permanently in carburetor. Do not remove.
⑪—High altitude only.
⑫—Closed Tip. Top hole #70 (45° angle), Lower hole #52 (60° angle).
⑬—Was 48-98S.
⑭—Altitude only. When installed, special Altitude Metering Jet must be installed in Rear Carburetor. These jets furnished in package with Altitude Metering Rod (for Front Carburetor) as follows: 75-516U (509-S & 510-S carburetors), 75-515U (490-S & 491-S carburetors).
⑮—Inner Nozzle .120", Outer Nozzle .125".
⑯—Closed Tip. Top hole #75 (45° angle), Lower hole #49 (70° angle).
⑰—Three Sizes Lean—Part No. 75-514.
⑱—Used on cars with Hydra-Matic Drive only.
⑲—For 12,000 foot altitude only—73-54. Part No. 75-495.
⑳—Supersedes No. 75-506 (71-44). ㉑—Supersedes No. 75-507 (72-48).
㉒—Closed Tip. Top hole #75 (45° angle), Lower hole #48 (70° angle).
㉓—Three Sizes Lean—78-50. Part No. 75-412.
㉔—Idle Well Jet #61 drill. Part No. 43-67.
㉕—No. 75-498 for Altitude only.
㉖—Supersedes No. 48-108S.
㉗—Three Sizes Lean—66-55. Part No. 75-416.
㉘—Three Sizes Lean—655-49. Part No. 75-420.
㉙—Nozzle retainer plug size #52 drill.
㉚—Supersedes No. 48-112S.
㉛—Closed Tip. Top hole #65 (45° angle), Lower hole #46 (60° angle).
㉜—Front Carburetor (Compound Carburetion).
㉝—Rear Carburetor (Compound Carburetion).
㊱—Closed Tip. Top hole .021" (45° angle), Lower hole .0945" (70° angle).

489-S—CHEVROLET TRUCKS, CAB-OVER-ENGINE MODELS YU, YV, YW ('41) CHEVROLET DUBL-DUTI, MODEL AJ (1941)

TYPE:—Plain tube, updraft type with throttle operated accelerating pump and vacuum operated 'step-up' or economizer. Similar to type used on previous Cab-over-Engine and Dubl-Duti truck models.

IDLE ADJUSTMENT:—Idle adjusting screw controls fuel discharge from upper (closed throttle) idle discharge port and should be turned in for leaner mixture, out for richer mixture. Approximate setting is ½-1½ turns of the screw out from inner seated position and should be adjusted only with engine warmed up and idling at hot or slow idle speed with choke valve wide open. Idle speed controlled by throttle lever stopscrew and should be set for 300-375 RPM idle speed. See car model 'T&E' page for complete tune up instructions.

PERFORMANCE:—Should be satisfactory if idling adjustment and accelerating pump setting correct. Main metering jet is fixed type and special Lean or Rich jets are furnished for special operating conditions. See Carter BB Jet Specification Table (below) for complete jet specifications.

ACCELERATING PUMP:—Low pressure, delayed action type. Operated by throttle lever. Pump piston is positioned on pump plunger stem by a spring which is compressed when throttle is closed and pump piston is drawn upward in cylinder, the cylinder then being filled by fuel from the bowl flowing through the pump intake check valve. When throttle is opened for acceleration, spring forces piston down on stem and fuel is discharged through outlet check valve into main nozzle fuel passage.

Adjustment—Two holes provided in throttle lever and pump link to provide seasonal adjustment. Inner hole (Summer setting) provides minimum stroke of 9/16", outer hole (Winter setting) maximum stroke of 1". See car model 'T&E' page for recommended seasonal adjustment.

VACUUM STEP-UP (ECONOMIZER):—Consists of a step-up valve assembly controlled by a vacuum piston. Vacuum piston is normally held at top of stroke by manifold vacuum so that valve is closed. At high speed or when engine operated with wide open throttle with reduced manifold vacuum, spring above piston forces piston and push rod down so that step-up valve is opened and additional fuel is allowed through the valve directly to the main nozzle. This fuel is metered by the power orifice or step-up jet screwed in the lower end of the step-up valve assembly and does not pass through the main metering jet.

Vacuum Step-up Spring—Part No. 61-60.

FLOAT LEVEL:—Top of float (not soldered seam) should be 1/32-1/16" below top edge of float bowl with needle valve seated. To check float level, remove bowl cover and gasket, measure with straightedge across top of bowl. To adjust float level, bend float lever lip slightly (do not bend float arm).

Needle Valve & Seat—Part No. 25-44S. Triangular type. Furnished as matched set only. Intake hole size #38.

CHOKE:—Choke valve is butterfly type with poppet type relief valve. Check choke linkage and see that choke valve is closed with choke button on instrument panel pulled out and fully open when button pushed in.

THROTTLE VALVE SETTING:—With stopscrew backed off so that valve tightly closed, top of lower idle discharge port should be .005-.009" below lower edge of valve and top of Vacuum Spark Port should be .000-.004" below valve.

NOTE—Throttle valve is notched at idle port opening.

TROUBLE SHOOTING:—**Engine stalls or Idle unsatisfactory**—Check idle adjusting screw and idle speed setting (above). If engine stalls, remove idle passage tube and idle tube and clean with compressed air. Remove idle adjusting screw and blow out idle ports and passage with air.

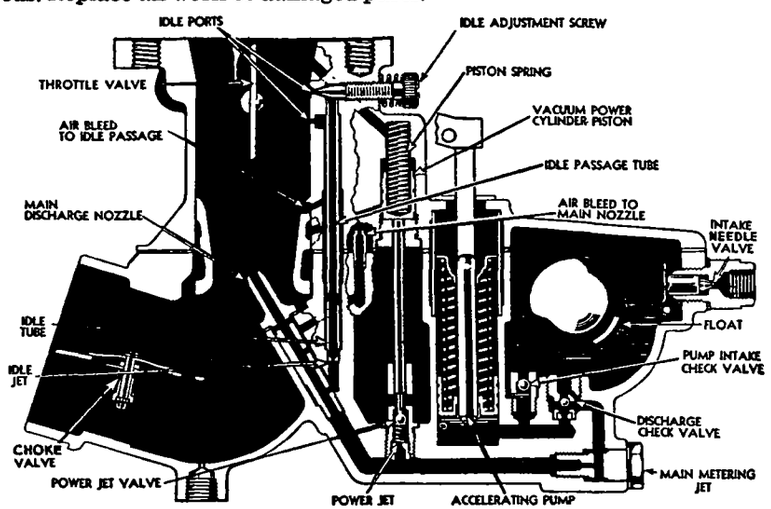
Acceleration Unsatisfactory—Check pump setting. Remove main metering jet, pump jet, and check valve assemblies and clean with compressed air. See that check valves are tight in carburetor casting. Examine pump spring.

Carburetor Loads up—Check float level and adjust as directed above.

Excessive Fuel Consumption or Poor Gasoline Mileage—See that vacuum piston operates freely and does not stick in cylinder. Examine vacuum piston spring (replace spring if weak or damaged). Make certain that correct flange gasket used at manifold, that vacuum port opens into gasket slot and that vacuum passage is clean. See that step-up valve is tight in carburetor casting and seats properly (disassemble and clean valve and power jet assembly). Check vacuum piston pushrod for free operation. Check jet calibration (see Jet Specification Table).

SERVICING:—**Disassembly**—Take out bowl cover screws and remove bowl cover and accelerating pump assembly. Compress pump spring, take out connector pin, disassemble and remove pump spring, retaining spring, and piston from pump rod and plate assembly. Take out vacuum piston plug, remove vacuum piston and spring. Remove idle adjusting screw and idle passage tube, pump sleeve, power jet pushrod, float lever pivot pin, float, and needle valve. Remove pump intake check valve, pump discharge check valve, and power jet from bowl. Remove main nozzle air bleed jet, idle jet, main nozzle, and main metering jet (on side of carburetor).

Servicing—Wash all parts in clean gasoline, blow out all passages in carburetor and all jets with compressed air. See that idle ports, air bleed passages, vacuum spark port, and throttle bore are free from carbon. See that vacuum piston cylinder is clean and that piston moves freely, clean vacuum passages thoroughly. (CAUTION:—Sticking of piston may cause power jet to be open at low speeds which will cause excessive fuel consumption and poor economy). Disassemble power jet valve and clean valve and power jet thoroughly. Clean and inspect pump check valves, idle jet, main nozzle, metering jet and air bleeds. Replace all worn or damaged parts.



Reassembly—Use all new gaskets (see Parts List below). Soak needle seat gasket in denatured alcohol for 15 minutes, install on needle seat and allow to dry in place before needle and seat assembly is installed. Assemble carburetor in reverse order to disassembly directions above and note following special instructions and cautions: If throttle valve removed, make certain that notch on edge of valve is placed on vacuum port side and set throttle valve as directed above. Install accelerating pump sleeve with holes in end of sleeve downward. When installing carburetor upper body, see that accelerating pump enters pump cylinder properly and that vacuum piston pushrod is in place. Check float level and adjust carburetor when re-installed on engine.

CAUTION—When installing carburetor, make certain that correct flange gasket is used and that slot in gasket uncovers vacuum spark port on carburetor flange. If this port covered, vacuum economizer will not operate correctly and gasoline consumption will be excessive.

SERVICE PARTS:—**Gasket Set**—No. 153. **Repair Package**—No. 1090.

1941 CARTER (B&B) UPDRAFT CARBURETOR JET SPECIFICATIONS

Car Model	Yr.	Carb. No.	Main Metering Screw: Standard Flow	Main Metering Screw: Standard Part No.	Main Metering Screw: 1 Size Lean Part N .	Main Metering Screw: 2 Sizes Lean Part No.	Main Nozzle Size	Main Nozzle Part No.	Stepup Jet Power Orifice Siz	Stepup Jet Power Orifice Part No.	Idle Orifice Tube Size	Idle Orifice Tube Part No.	Idle Passage Tube	Pump Size	Valve Part No.
CHEVROLET C-O-E Trk	'41	489-S	268-72cc.	159-46	5%	159-53	10%	159-54	#33	12-166	.038"	162-22	.0236"	123-16	123-12	.0635"	149-65S

CHRYSLER SIX MODEL C28

E6S2, E6S3, E6W1—CARS WITH STANDARD TRANSMISSION

EA1—CARS WITH FLUID DRIVE & STANDARD TRANSMISSION

E6T1, E6T2—FIRST CARS (FLUID DRIVE & VACAMATIC TRANSMISSION)

E6U1—LATER CARS (FLUID DRIVE & VACAMATIC TRANSMISSION)

E6U2—LATEST CARS (FLUID DRIVE & VACAMATIC TRANSMISSION)

DE SOTO MODEL S8

E6N3—CARS WITH STANDARD TRANSMISSION (Eng. No. 1001 to 3959)

E6S2, E6S3—CARS EQUIPPED WITH STANDARD TRANSMISSION (Eng. No. 3960 Up)

EB1—CARS WITH FLUID DRIVE & STANDARD TRANSMISSION

E6V1—CARS WITH FLUID DRIVE & SIMPLIMATIC TRANSMISSION (Eng. No. 1001 to 4199)

E6U1, E6U2—CARS WITH FLUID DRIVE & SIMPLIMATIC TRANSMISSION (Eng. No. 4200 Up)

NASH MODELS

513-S—NASH '600', AMBASSADOR MODEL 4140 (1941)

PLYMOUTH MODELS

D6A2—MODELS P11, P12—STANDARD EQUIPMENT

D6C2—MODELS P11, P12—WITH AUTOMATIC CHOKE

B6P1—MODELS P11, P12—ECONOMY MODELS

PRODUCTION CHANGE NOTE:—Chrysler, De Soto (Wth Std. Transmission)—Carburetors listed above have different specifications and jet calibrations. See tune up data below and Carter (B&B) Jet Specification Table (following).

Chrysler, De Soto (Fluid Drive & Vacamatic or Simplimatic Transmission)—These models have Kick-down Switch for Transmission control (same on all models) and special Dashpot or Slow-closing Throttle (two types used). Dashpot design changed in production and different designs used as follows:

Models E6T1, E6U1, E6V1, EA1, EB1—Dashpot on these models is adjustable with an adjustment screw on the carburetor directly above the dashpot plunger

Models E6T2, E6U2—Dashpot is not adjustable (no adjustment screw) and has solenoid control so that it operates when throttle is closed at car speeds below 8 MPH. (First & Second Gear), 15 MPH. (Third & Fourth Gear) only.

SPECIAL SERVICE NOTES:—Whenever the body gasket (between the main body casting and air horn and bowl cover casting) is removed for carburetor servicing, use new gasket when reassembling. This is important to prevent air leaks at this point which will affect carburetor economy (carburetors are 'balanced' type with bowl vented through air horn. NOTE—This body gasket is Part No. 121-69 (E6N3, E6S2, E6S3, E6W1, D6A2, D6C2, B6P1, 513-S), No. 121-88 (E6T1, E6U1, E6V1), No. 121-90 (E6T2, E6U2, EA1, EB1).

Vacuum Step-up Spring for High Altitudes (1940 & Previous Models)—For operation at altitudes greater than 5000 feet, vacuum step-up spring should be changed to Part No. 61-134 at same time leaner metering jets are installed. This spring used as standard equipment on 1941 models and no change is required

TYPE:—Same design as previous Carter (B&B) models except for addition of Kick-down Switch and Slow-closing Throttle Dashpot (models used on cars with Fluid Drive and Vacamatic or Simplimatic Transmission only). ***Refer to 1941 Carburetion Equipment Index (for article on Chrysler Slow-closing Throttle) and 1941 Mechanical Equipment Index (for article on Chrysler Vacamatic & Simplimatic Underdrive Transmission for data on Kick-down Switch).***

IDLING ADJUSTMENT:—Idle adjusting screw controls fuel discharge through lower idle port and should be turned in for leaner mixture, out for richer mixture. Approximate idle screw settings given in table below. Adjust only with engine warmed up so that choke valve is wide open and fast idle inoperative. Idle speed controlled by throttle lever stopscrew. See car model 'T&E' page for complete carburetor tune up instructions.

Car Model	Carburetor	Idle Setting	Idle Speed
Chrysler C28①	E6S2, S3, W1; EA1	½-1½ turns open	6 MPH.
Chrysler C28②	E6T1, T2, U1, U2	½-1½ turns open	4 MPH.③
De Soto S8①	E6N3, S2, S3; EB1	½-1½ turns open	6 MPH.
De Soto S8②	E6V1, U1, U2	½-1½ turns open	4 MPH.③
Nash 4140	513-S	½-1¼ turns open	6 MPH.
Plymouth P11, P12	D6A2, C2	½-1¼ turns open	6 MPH.
Plymouth Economy	B6P1	½-1½ turns open	6 MPH.

①—Cars with Standard Transmission. ③—Or 450 RPM. maximum.
②—Cars with Fluid Drive & Vacamatic or Simplimatic Transmission.

ACCELERATING PUMP:—Delayed action type (spring operated pump plunger). Same design as used on previous Carter (B&B) models.

Seasonal Adjustment—Three holes provided in throttle lever for connector link engagement. Inner hole provides minimum stroke, center hole medium stroke, outer hole maximum stroke. See car 'T&E' page for recommended settings.

Pump Stroke Adjustment—To check, remove air horn and float bowl cover assembly, back off throttle stopscrew so that throttle valve closes tightly, connect pump connector link in correct hole of throttle lever (see table below), install Universal Pump Stroke Gauge T109-117S on bowl so that indicator lip on gauge rests on top of pump plunger shaft. Note gauge reading, then open throttle wide and again note gauge reading. Difference between two readings is pump stroke (in sixty-fourths of an inch) and should agree with table below. To adjust, bend horizontal portion of pump connector link.

Pump Gauge Change Note—All T109-117S pump gauges after Sept. 15, 1940 have new indicator arm with gauging lips on both ends. This new indicator arm, Part No. T109-153, can be installed on previous gauges to bring them up to date.

Car Model	Carburetor	Pump Stroke	Pump Setting
Chrysler C28	E6S2, S3, W1	26/64"	Medium Stroke
Chrysler C28	EA1	26/64"	Medium Stroke
Chrysler C28	E6T1, T2, U1, U2	26/64"	Medium Stroke
De Soto S8	E6N3, S2, S3	26/64"	Medium Stroke
De Soto S8	E6U1, U2, V1	26/64"	Medium Stroke
De Soto S8	EB1	26/64"	Medium Stroke
Nash 4140	513-S	30/64"	Maximum Stroke
Plymouth P11, P12	D6A2, C2	24/64"	Medium Stroke
Plymouth Economy	B6P1	19/64"	Medium Stroke

VACUUM STEP-UP (ECONOMIZER):—No adjustment required but setting should be checked when carburetor reassembled after servicing to insure step-up valve closing. To check, push vacuum piston down in cylinder to end of stroke, check clearance between piston plate and head of step-up valve needle stem. Clearance should be 1/64-1/32". To adjust, bend piston plate slightly.

Vacuum Step-Up Spring—When servicing carburetor, make certain that correct Step-up Spring installed as follows: No. 61-135 (E6N3, E6S2, E6S3, E6W1, D6A2, D6C2, 513-S), No. 61-134 (E6T1, T2; E6U1, U2; E6V1, B6P1, EA1, EB1).

FLOAT LEVEL:—To check float level, remove air horn (integral with float bowl cover), use special gauge No. 1522-B, placing gauge on top edge of bowl with lugs extending down toward float on either side of soldered seam. Press lip of float lever against needle valve, float should contact both lugs on gauge. Adjust by bending float lever lip slightly at point where it contacts valve needle (do not bend float arm). If gauge not used, top of float (not soldered seam) should be 5/64" (all models except EA1, EB1), 1/16" (EA1, EB1) plus or minus 1/64".

Float Needle Valve & Seat—Triangular type. Furnished only in matched sets as follows: No. 25-82S—#44 Intake Hole (E6N3, E6S2, E6S3, E6U1, E6U2, E6V1, EB1, D6A2, D6C2, 513-S), No. 25-102S—#44 Intake Hole (E6T1, E6T2, E6W1, EA1), No. 25-77S—#48 Intake Hole (B6P1 only).

THROTTLE VALVE SETTING:—When installing valves, insert attaching screws loosely, back throttle stopscrew off, tap valves lightly to centralize in bore, then fasten screws securely.

Setting—With throttle stopscrew backed off so that valve tightly closed, distance from top edge of valve to top of upper idle port should agree with 'Idle Port' figure in table below, and distance from top of valve to top of vacuum spark port should agree with 'Vacuum Spark Port' figure (except as noted).

Car Model	Carburetor	Idle Port Height	Vacuum Spark Port
Chrysler C28	E6S2, S3, W1	.088-.092"	.035-.041"
Chrysler C28	EA1	.088-.092"	.035-.041"
Chrysler C28	E6T1, T2, U1, U2	.088-.092"	.035-.041"
De Soto S8	E6N3, S2, S3	.088-.092"	.035-.041"
De Soto S8	EB1	.088-.092"	.035-.041"
De Soto S8	E6U1, U2, V1	.088-.092"	.035-.041"
Nash 4140	513-S	.118-.122"	.022-.028"①
Plymouth P11, P12	D6A2, C2	.118-.122"	.003-.009"①
Plymouth Economy	B6P1	.130-.134"	.035-.041"

①—Bottom of port above top edge of valve (top of port on other models).

CHOKE:—Offset type with poppet relief valve. Choke control on Plymouth models (without Automatic Choke) is semi-automatic (spring-loaded). Sisson Automatic choke Std. on Chrysler & De Soto, optional on Plymouth.

Fast Idle—Consists of a throttle shaft dog (throttle lever stop) pivoted below throttle shaft and linked to choke valve lever so that throttle opened to fast idle position when choke valve closed for starting. No adjustments required. NOTE—This Fast Idle not used on Plymouth B6P1 Economy Carburetor.

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SERVICING:—Kick-down Switch & Slow-closing Throttle Note—On carburetors fitted with these units (E6T1, E6T2, E6U1, E6U2, E6V1, EA1, EB1), kick-down switch and slow-closing throttle are disassembled as part of regular carburetor disassembly as directed below. Disregard data pertaining to these units on all other models on which they are not used. CAUTION—If kick-down switch spring (located within piston) is replaced, make certain that any washers located within piston are not disturbed. If piston and spring are replaced, washers should be discarded (do not use washers with new piston and spring). ***Refer to 1941 Carburetion Equipment Index for article on Chrysler Slow-closing Throttle for complete data.***

Disassembly:—Take out throttle lever screw, remove throttle lever. Disconnect fast idle connector rod, take out attaching screws and remove air horn and float bowl cover assembly, remove float and lever assembly, float pin and retainer, remove body gasket. Remove idle orifice tube and plug assembly, step-up piston plate and rod assembly, step-up piston spring and gasket at bottom of cylinder, remove dashpot plunger and link and dashpot solenoid (on models so equipped). Remove pump connector link, remove pump plunger and rod assembly, pump spring, and pump link. Remove step-up jet and gasket assembly. Remove pump check plug and discharge check ball. Remove main metering jet and gasket assembly. Remove pump retainer ring and intake check ball. Take out attaching screws and remove body flange assembly and insulator. Remove pump jet rivet plug and pump jet. Remove main vent tube rivet plug, remove main vent tube (use tool T109-70). Remove float intake needle seat and gasket. Remove idle adjusting screw and spring, and idle port rivet plug. Remove throttle valve, throttle shaft and arm assembly, choke tube bracket assembly, choke valve, choke valve shaft and lever assembly. On models with kick-down switch, take out screws in endplate, withdraw plunger and springs and terminal block, remove switch contact piston and spring (CAUTION—Use care not to lose washers within piston and make certain that these washers replaced when switch reassembled unless new piston and spring installed when washers should be discarded).

Servicing:—Wash all parts except cork gaskets in clean gasoline. Blow out all jets and channels with compressed air (do not use wire drills to clean jets—dissolve gum deposits with denatured alcohol). Examine all parts for damage and wear, replace worn parts, use all new gaskets when reassembling carburetor.

Assembly:—Install all parts in reverse order from disassembly directions given above. Group all parts of intake system (float, intake valve, etc.), low speed system, high speed system, accelerating pump, kick-down switch, slow-closing throttle, choke system, to facilitate assembly and insure all parts being replaced in correct order. Adjust idle setting, float level, accelerating pump stroke and seasonal adjustment, slow-closing throttle adjustment (first type only), as directed above and note following special instructions for reassembly:

Balance Tube—When servicing carburetor make certain that balance tube in air horn is open and clean. Always use new gasket between body casting and air horn to insure air tight joint at bowl cover. Any air leak at bowl cover will upset 'balance' feature and affect fuel economy.

Vacuum Step-up Passage—Passage opens on carburetor mounting flange and special gasket (with slots which register with this vacuum passage hole) must be used when installing carburetor on manifold. Shutting off of this vacuum passage hole will cause excessive fuel consumption.

Clogged Main Vent Tube—Will cause excessive richness at speeds above 50 MPH. To replace tube, use tool T109-42 to remove rivet plug beneath float bowl, then remove old vent tube with Tool 109-70, use this tool to install new vent tube on all models except B6P1 (use tool T109-151 to install longer tube used on this B6P1 model only), make certain that tube seats tightly and install new rivet plug. CAUTION—Always use new Main Vent Tube and rivet plug when these parts are removed.

Throttle Valve—Valves should be installed with trademark 'C' facing down and toward idle port. Install valve screws loosely, close valve completely and tap lightly to centralize valve in bore, then tighten screws securely. Check throttle valve position as directed above.

Choke Valve—Centralize choke valve in same manner as throttle valve (above) before tightening attaching screws.

Kick-down Switch—Make certain that any washers found in switch piston are re-installed in piston unless new piston and spring being installed, in which case, washers should be discarded.

Slow-closing Throttle (First Type)—Adjusted as directed in special Chrysler Slow-closing Throttle article in Carburetion Equipment Section (refer to Carburetion Equipment Index for this data).

Slow-closing Throttle (Second Type)—Connect one solenoid terminal to kick-down switch terminal, connect other solenoid terminal to 'SF' terminal on transmission control relay. See special article on Chrysler Slow-closing Throttle in Carburetion Equipment Section and article on Chrysler Vacamatic & Simplimatic Underdrive Transmission in Mechanical Equipment Section for complete data on slow-closing throttle and kick-down switch.

TROUBLE SHOOTING:—Engine stalls while idling—Check idle setting (above). Check slow-closing throttle adjustment (first type only) as directed in article on Chrysler Slow-closing Throttle in Carburetion Equipment Section. Remove Idle Orifice Tube and Plug Assembly and clean tube and passages with compressed air. Remove idle adjusting screw and blow out idle ports with air.

Carburetor Loads Up—Check and adjust float level (see specifications above).

Acceleration Unsatisfactory—Remove pump jet and clean with compressed air, or replace pump jet. Examine pump for worn or damaged plunger leather, clogged or leaking intake or discharge check balls, sediment in pump cylinder. CAUTION—Use care not to damage plunger leather when installing plunger in cylinder.

Poor Gasoline Mileage (Economy complaints)—Check float level. See that main metering jet is correct type and not worn (special lean metering jets available for special service such as high altitudes or high test fuel). See that step-up jet tight on seat and not leaking, make certain that step-up valve rod and piston clean and not binding or sticking, check step-up piston spring (replace spring if weak or damaged). Check for clogged main vent tube (will cause excessive richness and poor gasoline mileage at speeds above 50 MPH.). See Main Vent Tube servicing data above.

1941 CARTER (B&B) DOWNDRAFT CARBURETOR JET SPECIFICATIONS

Car Model	Yr.	Carb. No.	Main Metering Jet Flow	Main Metering Jet Standard Part No.	Main Metering Jet 1 Size Lean Less	Main Metering Jet 1 Size Lean Part No.	Main Metering Jet 2 Sizes Lean Less	Main Metering Jet 2 Sizes Lean Part No.	Main Vent Air Bleed Size	Tube Assem. Part No.	Stepup Jet Power Orifice Size	Stepup Jet Power Orifice Part No.	Idle Orifice Tube Size	Idle Orifice Tube Part No.	Pump Jet Assembly. Jet Size	Pump Jet Assembly. Part No.
CHRYSLER C28	1941	E6S2, S3	312-316cc	159-89S	5%	159-87S	10%	159-63S	.0315"	145-13	.0413"	149-56S	.0276"	123-31S	.0374"	48-75
CHRYSLER C28 ⑪	1941	E6T1, T2	312-316cc	159-89S	5%	159-87S	10%	159-63S	.0315"	145-13	.0413"	149-56S	.0276"	123-31S	.0374"	48-75
CHRYSLER C28 ⑪	1941	E6U1, U2	312-316cc	159-89S	5%	159-87S	10%	159-63S	.0315"	145-13	.0413"	149-56S	.0276"	123-31S	.0374"	48-75
CHRYSLER C28	1941	E6W1	312-316cc	159-89S	5%	159-87S	10%	159-63S	.0315"	145-13	.0413"	149-56S	.0276"	123-31S	.0374"	48-75
CHRYSLER C28 ⑬	1941	EA1	312-316cc	159-89S	5%	159-87S	10%	159-63S	.0315"	145-13	.0413"	149-56S	.0276"	123-31S	.0374"	48-75
DE SOTO S8	1941	E6N3	282-286cc	159-63S	5%	159-59S	10%	159-61S⑩	.0315"	145-13	.0374"	149-43S	.0295"	123-39S	.0374"	48-75
DE SOTO S8	1941	E6S2, S3	312-316cc	159-89S	5%	159-87S	10%	159-63S	.0315"	145-13	.0413"	149-56S	.0276"	123-31S	.0374"	48-75
DE SOTO S8 ⑫	1941	E6U1, U2	312-316cc	159-89S	5%	159-87S	10%	159-63S	.0315"	145-13	.0413"	149-56S	.0276"	123-31S	.0374"	48-75
DE SOTO S8 ⑫	1941	E6V1	282-286cc	159-63S	5%	159-59S	10%	159-61S⑩	.0315"	145-13	.0374"	149-43S	.0295"	123-39S	.0374"	48-75
DE SOTO S8 ⑬	1941	EB1	312-316cc	159-89S	5%	159-87S	10%	159-63S	.0315"	145-13	.0413"	149-56S	.0276"	123-31S	.0374"	48-75
NASH '600' 4140	1941	513S	———	159-95S⑥	5%	159-58S⑦	10%	159-66S⑧	.0315"	145-17	.0374"	149-70S⑨	.0276"	123-31S	.0275"	48-103
PLYMOUTH P11, P12	1941	D6A2,C2	254--258cc	159-61S	5%	159-66S	10%	159-82S	.0315"	145-17	#63	149-43S	.0276"	123-31S	.0315"	48-73
PLYMOUTH ECON.	1941	B6P1	168-172cc	159-70S	—	———	—	———	.0315"	145-39	.0236"	149-60S	.0276"	123-41S	.0236"	48-81

⑥—Supersedes 159-58S (248-252cc.), now 1 Size Lean.
⑦—Supersedes 159-60S.
⑧—Supersedes 159-64S.
⑨—Supersedes 149-56S (.0413").
⑩—3 Sizes Lean—159-66S.
⑪—Cars with Vacamatic Underdrive Trans. & Fluid Drive.
⑫—Cars with Simplimatic Underdrive Trans. & Fluid Drive.
⑬—Cars with Std. Trans. & Fluid Drive.

AA1-Ford No. 91A-9510-A
FORD, ALL '85' PASSENGER CAR MODELS (1941)
FORD, ALL '85' AND '95' TRUCK MODELS (1941)
MERCURY, MODEL 19A (1941)

AA1-Ford No. 06H-9510
LINCOLN, ZEPHYR & CONTINENTAL MODEL 16H (1941)
LINCOLN, CUSTOM MODEL 168H (1941)

TYPE:—Dual or double barrel, plain tube, downdraft type. Carburetors are same design as used on corresponding 1940 car models.

IDLE ADJUSTMENT:—Idle adjusting screw for each carburetor barrel controls fuel discharge through lower (closed throttle idling) port. Screws should be turned in for leaner mixture, out for richer mixture. Setting should be approximately ⅝-⅞ turns open from inner seated position. Manufacturer recommends that vacuum gauge be used for this adjustment and each idle screw adjusted in turn to secure highest steady reading of gauge. Idle speed controlled by throttle lever stopscrew and should be set for 5-7 MPH speed. See car model 'T&E' page for complete adjustment directions on car.

METERING JETS:—Main metering jets are non-adjustable type located in float bowl and acessible by removing plug on side of float bowl opposite each jet. Jets should be changed only to compensate for special operating conditions such as high altitudes. See Chandler-Groves Jet Specification table.

ECONOMIZER:—Consists of a spring-loaded, vacuum diaphragm controlled, by-pass valve assembly screwed in lower face of main body casting so that valve extends into float bowl (diaphragm assembly fits in recess in throttle valve body casting and vacuum passage in casting connects diaphragm chamber with carburetor barrel below throttle valve). Vacuum economizer set at factory to open when vacuum decreases to 8½-9" of HG. (corresponding to engine speed of 3800 RPM). No adjustment provided.

ACCELERATING PUMP:—Pump cylinder and piston located in float bowl, operated by inverted 'L' shaped pump rod linked to throttle lever. Fuel is drawn into pump cylinder through inlet ball check valve at lower end when throttle is closed and is discharged through outlet check valve and pump discharge nozzle when throttle opened for acceleration (nozzle is located at upper edge of venturis and has two discharge holes so that fuel is discharged equally into each carburetor barrel). Pump piston connection to pump rod is through a driving spring on the piston stem which prevents loading up engine when throttle opened suddenly and also prolongs pump discharge (spring compressed at beginning of piston travel, expands at end of travel).

Capacity—As shown in table below in cc. per 10 strokes. Throttle lever stopscrew must be backed off to allow throttle to close completely and pump link must be connected in center hole.

Car Model	Carburetor	Pump Capacity
Ford '85', Mercury	91A-9510-A	9-13 cc.
Lincoln	06H-9510	14-18 cc.

Adjustment—Three holes provided in throttle lever for pump link connection (these holes numbered 1-2-3 from throttle valve shaft outward). Inner (#1) hole provides minimum stroke, Center (#2) hole medium stroke, Outer (#3) hole maximum stroke. Recommended setting is #1 hole (Summer), #2 hole (Winter), #3 hole (Extreme Cold Weather). See car model 'T&E' page.

NOTE—Pump link is locked in lower end of pump rod by a spring-loaded snap lock. To disengage lock, pull link shaft out of pump rod.

FLOAT LEVEL:—Fuel Level—Fuel level in bowl should be 11/16" ± 1/32" (Ford and Mercury), 19/32" ± 1/32" (Lincoln Models) below the top edge of the bowl (gasket seat) with 3 lbs. pressure (engine idling). NOTE—If glass tube or other sight level indicator used to check level, use extreme care to eliminate errors caused by capillary action of fuel in sight tube.

Float Level—With bowl cover and float assembly removed, remove gasket, invert cover so that float weight holds needle valve closed, check float with 9550-A 'Go' and 'No Go' gauge. On Ford and Mercury models, place gauge on bowl cover with gauging arm over float (check both ends of each float). On Ford and Mercury models, the 'Go' (1.353") end of gauge should clear the float. The 'No Go' (1.322") end of the gauge should rest on the float while the base of the gauge at the 'no go' end should clear the air horn. Lincoln models are checked in the same manner except that 1/16" feeler must be used between float and gauging arm on gauge.

Adjustment—Use 9550-C bending tool to bend float arm. Use extreme care to keep float level (check both ends of float). Make certain that float has sufficient travel to allow it to drop to bottom of float chamber (travel controlled by stop on float arm).

Float Needle Valve & Seat—Furnished in matched sets only as follows: Ford Part No. 78-9564 (All Models).

CHOKE:—Offset type with poppet type relief valve to prevent over-choking.

THROTTLE-KICKER (STARTING):—Consists of a spring loaded lever pivoted on side of carburetor casting so as to contact cam on choke lever at upper end and throttle lever at lower end (through throttle stopscrew which is mounted on this starting lever). Lever is rotated by choke lever cam when choke valve closed for starting and opens throttle to starting position. No adjustment

SERVICING:—Disassembly—Take out choke lever screw, remove choke lever, pawl, and spring. Take out throttle kicker screw, remove throttle kicker and spring. Take out five air horn screws, remove air horn assembly, use care not to bend float. Remove accelerator pump link (pry upper end of link out), remove pump plunger and rod assembly. Remove drain plugs and gaskets, remove main metering jets (use tool 9510-A, remove front nozzle bar screws and clamp, remove idle tubes and brass air bleeds from nozzle bar, then remove rear nozzle bar screws and clamp, remove nozzle bars, pump discharge nozzle and gasket, and nozzle bar gasket. Remove check valve retainer from bottom of pump cylinder (use small rod with hooked end), invert main body casting and catch pump discharge brass needle and check ball which will drop out. Remove throttle body attaching screws and lockwashers, lift throttle body off. Use wrench 9904-A to remove economizer valve assembly and gasket. Remove throttle valve loose lever collar, loose lever and spring, idle adjusting screws and springs. Take out float hinge pin and remove float assembly from air horn, remove fuel inlet needle valve and seat assembly and gasket (use wrench 9510-A).

Servicing—Clean all carburetor parts and make certain that all corrosion removed from float bowl. Examine all parts for wear as directed below and replace all worn or damaged parts (renew all following parts when carburetor overhauled: Accelerator pump rod felt and brass rod retainer, pump check valve retainer, accelerator pump piston, economizer (power) valve assembly), and all gaskets.

Float Inlet Valve & Seat—Keep needle valve and seat together as a set, rinse in cleaning solution and wipe off with clean cloth; if re-installed in carburetor, polish float lever end of needle valve with #320 'wet or dry' paper.

Choke Valve—Check valve tightness by holding air horn assembly against light and noting light around edge of valve. Check poppet relief valve and replace choke valve assembly if relief valve spring weak or broken. Check choke lever boss on air horn for wear using new choke lever, replace air horn if boss worn. Check choke lever for wear at ball end and in 'V' opening which engages choke shaft lever. Clean out choke lever pawl hole (use reamer 9537-A).

Float Assembly—See that float lever firmly soldered to float, examine float for leaks (immerse float in water heated just below boiling point, bubbles indicate that float leaks). Polish needle valve contact point on float arm with #320 'wet or dry' paper. Check float level and travel (use 9550-A gauge) as directed under Float Level (above) when float re-installed.

Throttle Valve Assembly—Check valves for tightness in same manner as choke valve (above). Replace complete assembly if valves worn, shaft worn or loose, throttle valve lever loose on shaft, or if pump link hole in throttle lever worn. If throttle valves replaced, stake attaching screws securely (use 9518-C anvil and 9518-D punch). Check throttle valve position using gauge 9518-A (which gauges distance from valve to idle ports with valve closed), replace throttle body and valve assembly if distances not within gauging limits.

Accelerating Pump—Remove brass retainer and pump rod felt from main body before cleaning casting in cleaning solution (solution will damage felt). If main body has shoulder around accelerating pump rod hole, remove this shoulder with a file (shoulder limits pump stroke) and if no vent provided between float bowl and pump head clearance chamber (larger section at top of pump cylinder), provide a vent by cutting a slot with a hacksaw or small file. Use driver 9513-C to install felt and brass retainer in pump rod hole. Seat check ball in bottom of pump cylinder by tapping lightly with a brass drift rod, then use ⅝" wood or fibre dowel to press retainer down in place. When installing brass pump discharge needle, tap needle lightly with brass drift to insure that it seats properly. When installing pump plunger and rod assembly, make certain that correct link is used (Ford and Mercury link marked 'C', Lincoln link marked '6'—do not use unmarked link). Check pump action when completely assembled, a good stream should be apparent at each pump jet when throttle opened several times (fill bowl with fuel to make this test).

Economizer Power Jet Assembly—When installing valve assembly, use new gasket and tighten securely to 15 lb. ft. torque.

Carburetor Body Castings—Clean castings thoroughly in cleaning solution, clean ports and channels with correct drill in hand chuck 9518-E as follows: Lower Idle Port (nearest throttle valve)—9518-H (.037") drill, Upper Idle Port—9518-E (.0395") drill, Idle Adjustment Screw Holes—9518-F (.046") drill, Idle Adjustment Screw Threads—9541-A Tap (use care not to remove any metal or enlarge holes), Idle Adjusting Needle Seat—9541-C refacer and 9541-D guide bushing, Accelerating Pump Rod Hole—9513-B reamer, also clean out felt retainer groove.

Marvel-Schebler Model TSX—Ford No. 9N-9510-A.
FORD TRUCK, ALL MODELS WITH 4 CYLINDER ENGINE (1941)

TYPE:—Plain tube updraft type with low speed (idle) and high speed (power) adjustments. Float bowl is concentric type with double 'saddle' type float and is vented through air horn. Fuel for idling is taken from main nozzle well up through passage in carburetor body and air horn castings to idle discharge ports at the throttle edge and is metered by Idle jet installed in lower end of passage in air horn and bowl cover casting. Idle adjusting screw controls air bleed in idle passage. Fuel for main nozzle is metered by power adjusting needle which controls fuel flow from bowl to main nozzle well and a Maximum Fuel Limiting Jet is located at the bottom of the main nozzle well for additional control. There is also an Economizer Jet located in a channel in the carburetor casting. Main nozzle is air bled through passage opening into top of float bowl chamber in bowl cover casting behind venturi. This passage has an Air Vent Cup pressed in the upper end at the bowl cover casting gasket opening.
CAUTION—If Air Vent Cup removed, new cup must be installed and reamed after assembly to specified size of .035" as directed in Servicing section below.

ADJUSTMENT:—Adjust carburetor only after engine warmed up and with choke valve wide open. Then adjust low speed (idling) and high speed (power) adjustments as follows:

Low Speed Idling Adjustment—Set throttle stopscrew for correct 5-7 MPH. idle speed. Turn idle adjusting screw in until engine begins to roll (mixture too rich), then turn screw out slowly until engine idles smoothly. Recheck idle speed. NOTE—This method of adjustment will give a setting which is slightly on the rich side which is preferable to a too lean setting.

High Speed Power Adjustment—Open throttle approximately ⅓. Turn power adjusting needle (on bowl cover beside fuel inlet connection) in or clockwise slowly until engine begins to lose power and speed drops off, then turn needle out or counter-clockwise until speed picks up and engine runs smoothly. Check performance and if engine tends to backfire or falter in picking up load, turn power adjusting needle out or counter-clockwise one notch at a time until acceleration is satisfactory. NOTE—This setting will give most economical performance and Economizer Jet will provide proper fuel mixture for full throttle operation. Power adjusting needle should be approximately 1 turn out from inner seated position.

FLOAT LEVEL:—Float is double type and both floats should be set exactly alike. To check float level, remove bowl cover and float assembly, invert cover, measure from gasket surface on cover to nearest edge of floats. Distance should be 9/32". To adjust float level, use bending tool M-8 and bend float lever at narrow section midway between valve and floats. Adjust both floats exactly alike.

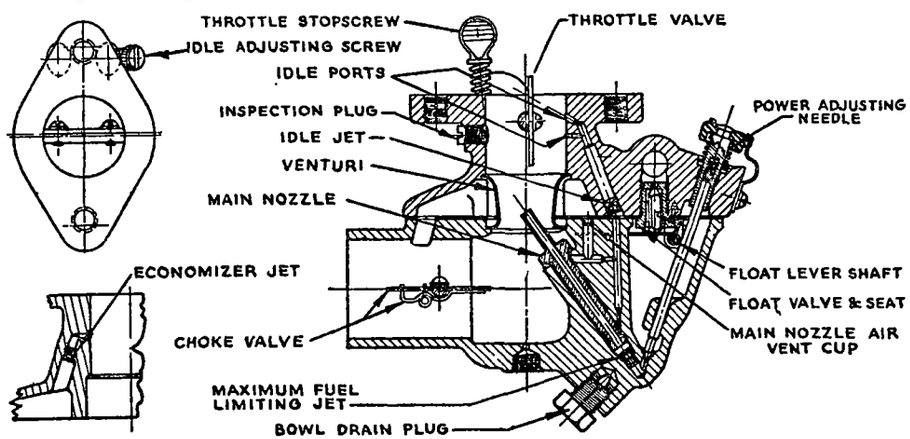
Needle Valve & Seat—Furnished as matched sets only. Ford No. 9N-9564.

CHOKE:—Choke valve is butterfly type with spring-loaded flapper type relief valve. Check choke linkage and adjust so that choke valve fully closed when choke control button pulled out, and wide open when control button pushed in.

SERVICING:—Disassembly—Back out and remove power adjusting needle, spring, and gasket (CAUTION—Power adjusting needle must be removed before any attempt made to remove bowl cover and air horn casting). Remove four bowl cover attaching screws, remove bowl cover and air horn assembly. Take out float lever shaft, remove float and lever assembly, float valve, float valve seat and gasket, bowl cover gasket, venturi, Economizer Jet (use long, slender screwdriver), Idle Jet, idle adjusting screw and spring, fuel intake elbow and strainer screen, throttle valve screws and lockwashers, and throttle valve. Examine throttle valve shaft for wear (use new shaft when reassembling if wear evident), remove throttle shaft and lever, and packing at lever end of shaft. Remove idle port inspection plug. Remove main nozzle and nozzle gasket (use tool M-78), remove Maximum Fuel Limiting Jet from bottom of nozzle well. If necessary to remove Air Vent Cup from top of main nozzle air bleed passage, insert sharp pointed tool in cup and pry cup out (CAUTION—New cup must be installed when carburetor reassembled and then reamed to specified size—see Reassembly data below). Remove float bowl drain plug, remove dust strainer at bottom of carburetor (if strainer cannot be cleaned without removal). Remove choke valve screws, choke valve, shaft and lever assembly, and shaft packing.

Servicing—Clean out all passages and channels in carburetor castings, blow out jets with air, examine all parts for wear. NOTE—When overhauling carburetor after normal service, following parts only should require replacement: Throttle shaft and lever assembly, Float valve and seat (furnished as matched set), float lever shaft, power adjusting needle, felt packing on throttle valve and choke shafts.

Reassembly—Use new gaskets, install all parts in reverse order to disassembly directions above. Note following special directions and cautions: When installing choke valve and throttle valve, hold valves in closed position (throttle valve stopscrew must be backed off to allow valve to close completely) while tightening attaching screws, then check valves to make certain that they operate freely



without binding. When installing idle adjusting screw and power adjusting needle use care not to tighten these screws excessively which will groove needle point and prevent satisfactory adjustment (turn screws in until lightly seated, then back idle adjusting screw off 2 turns, power adjusting needle 1 turn which is approximate setting and will allow engine to be warmed up so that accurate adjustment can be made). Adjust float level.

Air Vent Cap Servicing Note—If cap removed, press new cap in place in main body casting, then ream hole in cap to finished size of .035".

Part	Jet Specifications	Ford Part No.
Idle Jet		9N-9596
Maximum Fuel Limiting Jet		9N-9533
Main Nozzle		9N-9530
Power Adjusting Needle		9N-9565A
Venturi		9N-9586A
Float Valve & Seat (Matched Set)		9N-9564

1941 CHANDLER-GROVES DOWNDRAFT CARBURETOR JET SPECIFICATIONS

Car Model	Year	Carburetor Model	Venturi Size	Main Jet Size	Metering Jet Part No.	Main Discharge Nozzle Part Number Left Hand	Main Discharge Nozzle Part Number Right Hand	Nozzle Air Bleed Plug Part No.	Economizer Assembly Part No.	Idle Tube Size	Idle Tube Part No.	Pump Nozzle Size	Pump Nozzle Part No.
FORD '85' Models	1941	91A-9510-A	.94"	.050"②	78-9533-A	91A-9921,23	91A-9920,22	78-9924	78-9904	54cc.	78-9542	#69	91A-9577
LINCOLN 16H, 168H	1941	06H-9510	1.00"	.053"④	06H-9533	06H-9923	06H-9922	78-9924	96H-9904	64cc.	86H-9542	#69	91A-9577
MERCURY	1941	91A-9510-A	.94"	.050"②	78-9533-A	91A-9921,23	91A-9920,22	78-9924	78-9904	54cc.	78-9542	#69	91A-9577

NOTE—All Part Numbers in above table are Ford Part Numbers.

②—Under 5000 ft. .048" (5000-10000 ft.) Part No. 78-9533-B. .046" (10000-15000 ft.) Part No. 78-9533-C. .044" (Over 15000 ft.) Part No. 78-9533-D.
④—Under 5000 ft. .051" (5000-10000 ft.). .045" (10000-15000 ft.). .043" (Over 15000 ft.).

Number **MODEL AAV-2**

380041—CHRYSLER 8, MODEL C30 SARATOGA & NEW YORKER (1941)
CHRYSLER 8, MODEL C33 CROWN IMPERIAL (1941)

NOTE:—Code No. Identification Marking—Carburetors may be identified by Code Number 4-103 stamped on bowl cover above fuel level inspection plug.

Throttle Guard on Cars with Fluid Drive—Used on cars with Fluid Drive to prevent engine stalling. See Chrysler Throttle Guard article in Carburetion Equipment Section for complete adjustment instructions.

TYPE:—Aircraft type, duplex, downdraft carburetor. Similar to AAV-2 type used on preceding Chrysler Eight models.

IDLING ADJUSTMENT:—Idle adjusting screw for each barrel controls fuel discharge from lower idling port. Screws should be turned in for leaner mixture and out for richer mixture and must be set alike. Idle speed controlled by throttle lever stopscrew and should be set for 6 MPH idling speed with engine warmed up (choke valve wide open and fast idle inoperative). See tune up instructions on car model 'T&E' page for complete adjustment data.

METERING JETS:—Main metering jets are non-adjustable fixed type. Jets should be changed only for special operating conditions such as high altitude. See Jet Specification Table for standard jet calibrations for all models.
NOTE—Whenever main discharge jet located directly above main metering jet is removed, new lead gasket must be used in carburetor body to insure a good seal when jet is replaced. Use tool T-19099 to remove plug, tool T-24924 to remove and install main metering jet, tool T-24967 to remove and install main discharge jet.

ECONOMIZER:—Consists of a by-pass valve and jet in the carburetor main body controlled by a vacuum piston in a cylinder in the air horn casting. Economizer by-passes fuel around main metering jets to main nozzles when vacuum in manifold decreases sufficiently so that piston is forced down by spring. No adjustment required.
NOTE—Use special tool T-24733 to remove vacuum power piston No. P-22803.

Setting—Vacuum piston opens valve with manifold vacuum of 5-7" of HG. corresponding to car speed of 70-75 MPH.

ACCELERATING PUMP:—Capacity—With pump set for maximum stroke, capacity per 10 strokes is 21-25 cc. (Fast), 27-31 cc. (Slow). Use T-24972 Pump Capacity Burrette Gauge to check pump capacity.

Adjustment—Two holes provided in throttle lever for pump link engagement. Inner hole (short radius) provides minimum stroke, outer hole (long radius) maximum stroke. See car model 'T&E' page for recommended settings.

FAST IDLE:—Consists of a stepped rotary cam linked to the choke valve lever and serving as a stop for the throttle lever stopscrew. Cam is rotated to fast idle position when choke valve closed for cold starting so that throttle valve held open slightly.

Adjustment—To check setting, hold stopscrew against first step of fast idle cam and check choke valve opening with ⅛" drill rod inserted between edge of choke valve and air horn wall. If opening not correct, adjust rod length (turn ball joint end on rod). Open throttle wide and again check choke valve opening with 7/32" rod. If opening not correct, bend extended arm of fast idle cam slightly.

FLOAT LEVEL:—Fuel Level—Should be ⅝" below top surface of float bowl with 4 lbs. pressure (engine idling) or approximately even with the bottom of the inspection hole on side of float bowl (take out plug to check level).

Float Height—Use special service tool, T-24971 when setting floats. Remove air horn and float cover assembly, invert, mount tool on cover gasket. Tool guides will also check float travel (floats must be free and not rub on bowl). Adjust floats by bending float lever. Use extreme care to adjust both floats alike.

Float Valve & Seat—Part No. P-22499. Furnished only as matched sets.

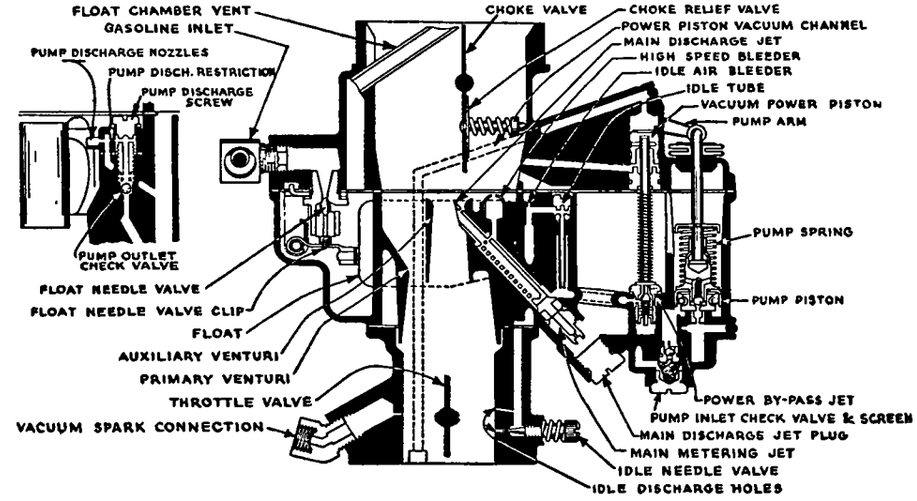
Float Bowl Vent—Bowl is vented to air horn by vent tube pressed in side of air horn above choke valve.

THROTTLE VALVE SETTING:—When installing throttle valves, they must be set so that distance from upper lip of valve to lower edge of upper idle port is .040" (plus or minus .004") and distance from upper lip of valve to lower edge of vacuum spark port (use #56 drill inserted in port) is .015" (plus or minus .004") with throttle valve tightly closed.

Throttle Valves—Part No. P-22752, 5° type.

CHOKE VALVE:—Offset type. Sisson Automatic Choke is standard equipment. See Sisson Automatic Choke article in Carburetion Equipment Section.

SERVICING:—Disassembly—Disconnect pump connector and fast idle connector rods, take out retaining screws and lift off bowl cover and air horn assembly. Take out float hinge pin, remove float and needle valve assembly, remove fuel inlet elbow. Remove idle tubes from main body casting, take out pump discharge nozzle attaching screw, remove nozzles, remove pump discharge ball check valve from screw hole (ball will drop out when carburetor inverted, use extreme care not to lose this ball and make certain that it is re-installed when carburetor reassembled). Remove main discharge jet plugs (use special screwdriver T-19099), take out metering jets (use special tool T-24924). If main discharge jets are removed, use special tool T-24967 and see that all traces of old



lead gasket removed from jets and seat in carburetor (use new gasket when jets re-installed). Take out four retaining screws and remove throttle body. Remove pump inlet valve plug, strainer screen and inlet valve. Remove economizer by-pass valve. Remove vacuum piston assembly (use special wrench T-24733).

Servicing—Examine economizer vacuum piston and remove any carbon or gum with crocus cloth (do not use emery or clean piston with gasoline or other cleaning fluid). Check by-pass valve and pump check valves for tightness by using special T-24970 tester (screw valve in proper opening of tester, immerse valve in gasoline and blow through tester—any leakage of valve will be indicated by bubbles). Clean all jets with gasoline or use denatured alcohol to dissolve gum deposits (CAUTION—do not attempt to clean jets with wire or drill rod). Blow out all channels and passages in carburetor with air, remove any carbon deposits in ports and throttle body. Replace worn and damaged parts.

Reassembly—Use all new gaskets (See Service Parts list below). Reassemble carburetor by reversing disassembly directions given above. Use new lead gasket when installing main discharge jets and make certain that all traces of old gasket removed from jets and seat in carburetor casting. Check and adjust float level, accelerating pump setting, throttle valve setting, fast idle, and idle setting when carburetor reassembled.

SERVICE PARTS:—Gasket Set—Part No. 382395.

Number **MODEL AAV-26**

380015—CADILLAC V8, SERIES 41-60S, 61, 62, 63, 67, 75 (1941)
380037—PACKARD SUPER EIGHT, MODELS 1903,3A,4,5,6,7,8 (1941)
380038—STUDEBAKER PRESIDENT, MODEL 7C (1941)

NOTE:—Code No. Identification Marking—Carburetors may be identified by Code Number stamped on bowl cover above fuel level inspection plug as follows: 205-8—Cadillac AAV-26; 10-44, 10-44A or 10-44B—Packard AAV-26 (see Service Notes below); 6-97 or 6-97A—Studebaker AAV-26 (see Service Notes).

Cadillac & Studebaker Models—Carter 'WDO' dual carburetors also used on these cars. See article on Carter 'WDO' Dual Carburetor for complete data.

Packard Throttle Guard—Used on cars with Econo-drive (Overdrive) to prevent engine stalling when free-wheeling. ***See article in Carburetion Equipment Section for complete adjustment instructions.***

SPECIAL SERVICE NOTES & PRODUCTION CHANGES:—Packard Idle Air Bleed Change—Idle air bleed in carburetor main body (see illustration) was #70 drill size on first 10-44 and 10-44A carburetors and has been changed to #60 drill size on later Code 10-44B carburetors. To correct complaints of poor idling performance on Packard cars, check carburetor and on first types with #70 idle air bleed, increase this hole size by drilling idle air bleed out with #60 drill.

Studebaker Change to correct flat spot on acceleration—Later Code 6-97A carburetors (used on cars after Serial No. 7139912), have idle passage inserts installed in idle passages and counterbore in main metering jet orifice. To correct complaints of flat spot at approximately 20 MPH on acceleration on cars with first type 6-97 carburetor (before above Serial No.), install following parts: Two No. 382269 Idle Passage Inserts, Two new type No. P-24773 Main Metering Jets. To make this installation, remove carburetor and remove throttle body which will expose drilled idle passages in main body casting. Install insert in each idle passage, driving insert down flush with bottom of counterbore in carburetor body with big end of insert toward opening in passage. Remove and discard both old metering jets, install new type metering jets.

TYPE:—Aircraft type, duplex, downdraft carburetor. Similar to type used on preceding Cadillac and Packard models.

IDLE ADJUSTMENT:—Adjust only when engine warmed up so that Automatic Choke and Fast Idle inoperative (choke valve wide open, stopscrew on lowest step of fast idle cam). Set throttle stopscrew for correct 7-8 MPH (Cadillac) 8 MPH (Studebaker), 6 MPH (Packard) idle speed. Turn idle screws (one screw for each barrel, both screws must be adjusted alike) in until engine begins to miss, then turn screw out until engine begins to roll, finally turn screw in slowly until engine fires smoothly. These screws control fuel mixture discharge from lower (closed throttle) idle port. Recheck idle speed and readjust throttle stopscrew if necessary. See car model 'T&E' page for complete adjustment instructions. Check Fast Idle setting (see below).

METERING JETS:—Main metering jets are non-adjustable type located under plug at lower end of each nozzle. Jets should be changed only for special operating conditions such as high altitude. See Stromberg Jet Specification Table for complete jet data. IMPORTANT—See Special Service Notes (above).

ECONOMIZER:—Consists of a by-pass valve and jet in the carburetor main body controlled by a vacuum piston in a cylinder in the air horn casting. Economizer by-passes fuel around main metering jets to main nozzles when vacuum in manifold decreases sufficiently so that piston forced down by spring.

Setting—Vacuum piston opens valve with manifold vacuum of 4-6" of HG. (Packard), 5-6" (Cadillac & Studebaker) equal to car speed of 65-70 MPH.

ACCELERATING PUMP:—Similar to design used on other 'AAV' carburetors with spring-loaded relief valve in piston head and duration spring on rod above piston (light spring above duration spring in dust washer retainer) except that strainer has been added below intake check valve (see Note below).

Capacity—Pump capacity per 10 strokes fast (F), slow (S) is shown in table below. Pump must be set for correct stroke (see Adjustment) as shown in table.

Car Model	Carburetor	Pump Capacity	Pump Setting
Cadillac	AAV-26	13-17 cc.(F), 18-22 cc.(S)	Minimum
Packard	AAV-26	14-18 cc.(F), 27-31 cc.(S)	Maximum
Studebaker	AAV-26	12-16 cc.(F), 16-20 cc.(S)	Minimum

Pump Seasonal Adjustment—Two holes provided in throttle lever for pump rod connection (all models). Inner hole (short radius) provides minimum stroke and pump discharge, outer hole (long radius) maximum stroke. See car model 'T&E' page for recommended settings and seasonal changes on each model.

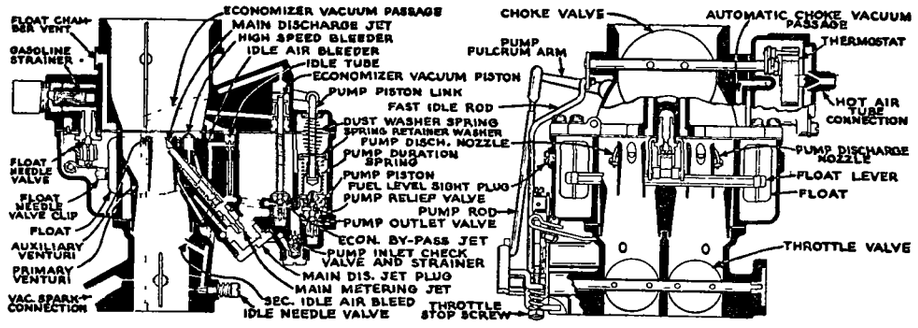
Pump Servicing Note—Strainer screen located in plug below pump intake check valve should be cleaned frequently to insure satisfactory pump operation.

FAST IDLE & CHOKE RELEASE:—Check and adjust as directed below. See Stromberg Automatic Choke (with integral Fast Idle) article in Carburetion Equipment Section for description and complete servicing instructions.

Cadillac—Open throttle and rotate fast idle cam so that stopscrew rests on high lobe of cam. Move choke valve toward closed position as far as possible, check choke valve opening by inserting drill rod between edge of valve and air horn wall. Choke valve opening should be .116" (#32 drill). To adjust, bend connecting rod between choke valve lever and fast idle cam loose lever at point near upper end. Use care not to cause bind in fast idle mechanism.

Packard & Studebaker—Check and adjust in same manner as Cadillac (above) except that choke valve opening should be equivalent to 7/64" drill.

Choke Release (All Models):—When throttle valve is opened wide, ear on throttle lever makes contact with fast idle cam loose lever and rotates the lever so as to open the choke valve to correct flooding. To check operation, open throttle wide, check choke valve opening by inserting 11/64" (.156-.187") drill rod between upper edge of choke valve and air horn wall. If choke valve opening not correct, adjust by bending ear on throttle lever slightly (use bending tool T-25056). Use care not to bind fast idle rod or distort fast idle cam spring.



FLOAT LEVEL:—Fuel Level—Should be 5/8" (all models) below top edge of bowl with engine idling or fuel pressure of 5 lbs. (Cadillac, Packard), 3 lbs. (Studebaker). To check fuel level, remove plug in sight hole on side of bowl. Fuel should be even with bottom of hole.

Float Height—Use special service tool T-24971 to check floats. Remove air horn and bowl cover assembly, invert cover and place tool on gasket. Top of floats should be 5/64" above tops of vertical guides (Cadillac, Packard), even with tops of guides (Studebaker) and sides of floats tangent to tool guides without any drag (to provide clearance between floats and bowl). Use extreme care to adjust both floats alike.

Float Valve & Seat—Part No. P-22499. Furnished only as matched sets. When installing, make certain that needle valve is clipped to float lever.

Float Bowl Vent—Bowl vented through opening on side of air horn directly below air cleaner collar (and through balance tube in air horn on Cadillac).

THROTTLE VALVE SETTING:—To check throttle valve setting, back throttle stopscrew off so that valves are tightly closed, insert drill rods in idle port and vacuum port as follows: Idle Port—#56 (Cadillac), #58 (Packard), #60 (Studebaker); Vacuum Spark Port—#58 (Cadillac, Packard), #56 (Studebaker). Measure distance from throttle valve to nearest side of drill. Distances should be correct as shown in table below (all figures plus or minus .004").

Car Model	Throttle Valve	Idle Port	Vacuum Spark Port
Cadillac	P-24172—5°	.040"	.012"
Packard	P-24740	.022"	.012"
Studebaker	P-24740	.020"	Flush

CHOKE:—Stromberg automatic integral type. See article in Carburetion Equipment Section for complete servicing directions.

Choke Setting—Inverted 'V' mark on thermostat cover scale should coincide with reference mark on top of choke housing. To adjust, loosen three cover screws, rotate thermostat cover assembly.

Studebaker—Thermostat cover marked for three settings as follows: 'H', 'M', 'R'. Standard setting is with 'R' mark coinciding with reference mark on housing flange (correct for regular fuel and operating conditions). If engine loads up or over-chokes with this 'R' setting, change to 'M' setting. 'H' setting should only be used for continuous use of highly volatile fuel.

CAUTION—When connecting heat tube to thermostat cover connection, do not use excessive pressure which may rotate cover and change choke setting.

SERVICING:—Carburetors disassembled and serviced in same manner as AAV-2 types (see preceding AAV-2 article for complete data) except for Automatic Choke and Fast Idle mechanism. ***See Stromberg Type AAV-26 Automatic Choke article in Carburetion Equipment Section for complete servicing data.***

SERVICE PARTS:—Gasket Set 382393 (Cadillac, Packard), 382394 (Studebaker).

Number **MODEL BXOV-26**

380039—PACKARD '110' SIX, MODEL 1900 (1941)
380036—STUDEBAKER COMMANDER, MODEL 11A (1941)

NOTE:—Code No. Identification Marking—Carburetors may be identified by Code Number stamped on float bowl cover as follows: 10-45 (Packard), 6-98 (Studebaker).

Studebaker Models—Carter 'WA1' Model 410-S carburetor also used on these cars. See Carter WA1 Carburetor article for complete data on this type.

Packard Throttle Guard—Used on all cars with Econo-drive (Overdrive) to prevent engine stalling when free-wheeling. See Packard Throttle Guard article in Carburetion Equipment Section for complete adjustment instructions.

THROTTLE GUARD NOTE:—Vacuum diaphragm type throttle guard used on all cars with Overdrive to prevent engine stalling at speeds below 20 MPH. See Packard Throttle Guard article in Carburetion Equipment Section for adjustment instructions.

TYPE:—Plain tube, downdraft type with throttle operated accelerating pump and vacuum controlled economizer. Similar to type used on previous Packard Six model (not used previously on Studebaker).

Note—This model fitted with integral Fast Idle & Automatic Choke (thermostatic coil mounted on air horn and linked directly to choke valve shaft). See article in Carburetion Equipment Section for complete Fast Idle and Automatic Choke Servicing data.

IDLING ADJUSTMENT:—Adjust only when engine warm so that Automatic Choke and Fast Idle inoperative (choke valve wide open, throttle stopscrew on lowest step of fast idle cam) and engine idling at hot or slow idle speed. Idle adjusting screw controls fuel mixture discharge from lower idle port and should be turned in for leaner mixture, out for richer mixture (standard setting approximately 1¼ turns open from inner seated position). Idle speed controlled by throttle lever stopscrew and should be set for idle speed of 6 MPH. (Packard), 7-8 MPH. (Studebaker). See car model 'T&E' page for complete tune up instructions. Check Fast Idle Setting.

METERING JETS:—Main metering jet is non-adjustable type located under plug at lower end of discharge jet. Jets should be changed only for special operating conditions such as high altitudes. See Stromberg Jet Specification table for complete jet data.

ECONOMIZER:—Consists of a by-pass valve and jet in the carburetor main body controlled by a vacuum piston in a cylinder in the air horn casting. Economizer by-passes fuel around main metering jets to main nozzles when vacuum in manifold decreases sufficiently so that piston is forced down by spring. No adjustment required.

NOTE—Use special tool T-24733 to remove vacuum power piston No. P-24043.

Setting—Vacuum piston opens valve with manifold vacuum of 4-6" of HG. corresponding to car speed of 65-70 MPH.

ACCELERATING PUMP:—Operated by throttle lever through vertical pump rod under float bowl cover. Fuel is drawn into pump chamber through strainer screen and inlet ball check valve and is discharged through outlet valve and pump discharge nozzle located in side of mixing chamber above main venturi when throttle opened for acceleration. Pump piston has duration spring on piston rod (spring compressed on sudden throttle openings, subsequent spring expansion prolongs pump discharge).

Capacity—Pump capacity in cc. per 10 strokes with pump set for medium stroke (link in center hole of throttle lever) is shown in table below. Use T-24972 Pump Capacity Burrette Gauge to check pump capacity.

Car Model	Carburetor	Pump Capacity	Pump Setting
Packard	BXOV-26	11-14 cc. (S)	Medium Stroke
Studebaker	BXOV-26	6-10 cc. (F), 16-20 cc. (S)	Medium Stroke

(F)—Fast stroke. (S)—Slow stroke.

Adjustment—Three holes provided in throttle lever for pump link connection. Link engaged in center hole provides normal setting, outer hole (long radius) provides maximum pump discharge, inner hole (short radius) minimum discharge. See car model tune up page for recommended seasonal changes.

Pump Servicing Note—Strainer screen located in pump inlet in bottom of float bowl should be cleaned at frequent intervals to insure satisfactory pump performance.

FAST IDLE & CHOKE RELEASE:—Fast idle mechanism consists of a fast idle lever and cam mounted below the throttle valve shaft so that the cam serves as a stop for the throttle stopscrew. Fast idle lever is linked to choke valve lever by connecting rod so that cam is rotated to the fast idle position when the choke valve closes for cold starting. Choke release mechanism consists of an ear on the throttle lever which engages a lug on the fast idle cam so that the cam is rotated and choke valve opened when the throttle valve is opened wide. Fast idle and choke release setting are both adjusted by bending connector rod as follows:

Adjustment—Hold throttle stopscrew on lowest step of fast idle cam and against edge of second step, move choke valve toward closed position as far as possible (do not force valve beyond point where fast idle cam and lever are stopped against throttle stopscrew). Check choke valve opening by inserting 11/32" drill rod between upper edge of valve and air horn wall. If choke opening not correct, adjust by bending connector rod at bend near choke valve lever.

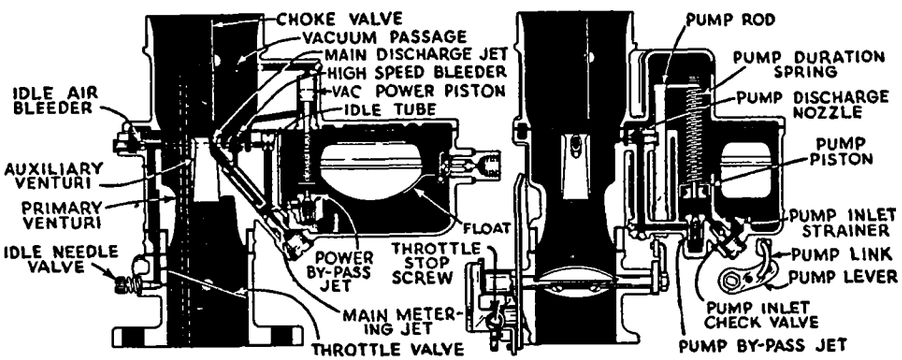
FLOAT LEVEL:—Fuel Level—Set at ⅝" below top edge (gasket seat) of bowl with 3 lbs. pressure (engine idling). Adjust by bending float arm at point where it is attached to float (use tool T-24733).

NOTE—Float fulcrum pin is retained by spring clip seated in float seat recess. When installing fulcrum pin, see that spring clip is seated and that it engages notches at ends of pin.

Float Needle Valve & Seat—Part No. P-21918—.093" intake hole (Packard), No. P-24063—.086" intake hole (Studebaker). Furnished as matched sets only.

Float Bowl Vent—Bowl is vented to outside atmosphere through slot in upper end of pump rod housing on bowl cover.

THROTTLE VALVE SETTING:—Valve is No. P-24059—20° type. To check valve setting, insert #56 drill in idle port, #56 drill (Packard), #60 drill (Studebaker) in vacuum spark control port above throttle valve, measure from edge of throttle valve to nearest side of drill. Idle port should be .010" (plus or minus .004") from valve and Vacuum Spark Control Port should be Flush with valve.



CHOKE:—Valve is offset plain type. Operated by automatic choke thermostatic spring coil which is linked directly to shaft. See article in Carburetion Equipment Section for Automatic Choke data.

SERVICING:—Disassembly—Disconnect choke connector link, take out six retaining screws, remove bowl cover and air horn assembly. Remove float pin lock wire (this will spring out when released), remove float hinge pin, remove float, needle valve, and needle valve seat. Remove idle tube from carburetor body casting, disconnect pump link and withdraw pump rod and piston assembly. Remove pump outlet check valve (in bottom of pump cylinder), remove inlet check valve plug and valve assembly. Remove main jet plug (use tool T-19099), main metering jet (use tool T-24924), and main discharge jet (use tool T-24967). Remove vacuum economizer by-pass valve assembly. To remove vacuum piston, use tool T-24733 inserting tool prongs in slots in piston retaining plug. To dismantle choke assembly, take out retaining screws and remove thermostat cover and coil assembly (do not remove thermostat coil from cover), remove small nut and lockwasher on end of choke valve shaft, turn lever to withdraw vacuum piston from cylinder and remove piston and link assembly.

Servicing—Examine vacuum economizer piston and automatic choke vacuum piston for carbon and gum deposits, clean with crocus cloth (do not use emery or wash pistons with gasoline). Check economizer by-pass valve and pump check valves for tightness by using special T-24970 tester (screw valve in proper opening of tester, immerse valve in gasoline and blow through tester—any valve leakage will be indicated by bubbles). Clean all jets with gasoline or use denatured alcohol to dissolve gum deposits (CAUTION—do not attempt to clean jets with wire or drill rods). Blow out all channels and passages in carburetor with air, remove all carbon deposits in ports and throttle body. Replace all worn or damaged parts.

Reassembly—Use all new gaskets (see Service Parts list below), reassemble carburetor by reversing disassembly directions given below. Check and adjust float level, accelerating pump setting, throttle valve setting, fast idle and choke setting, and idle setting when carburetor reassembled.

SERVICE PARTS:—Gasket Set—Part No. J-5652-G (all models).

Number **MODEL BXV-3**

A-18123—DODGE, MODEL D19 (1941)—WITHOUT FLUID DRIVE.

MODEL BXVD-3

380044—DODGE, MODEL 19 (1941)—WITH FLUID DRIVE.

380045—DODGE, EXPORT D19 (1941)—WITH FLUID DRIVE.

NOTE:—Model BXVD-3—This model has special dash pot or slow closing throttle device and is used on cars with Fluid Drive only. See Slow Closing Throttle data below for adjustment.

SPECIAL SERVICE NOTES & PRODUCTION CHANGES (BXVD-3 CARBURETOR):—On later cars with Fluid Drive equipped with BXVD-3 Carburetors Code 3-59B (Domestic), 3-60B (Export); these carburetors have differences in specifications from first Code 3-59 and 3-60 carburetors as follows: Main Metering Jet—.057" Part No. P-19442 (was .058"), Power By-pass Jet—#58 Part No. 382675 (was #54 Part No. P-21197), Vacuum Piston Assembly—Part No. P-24201 (was No. P-24043).

Economy Complaints on First Cars—On first Fluid Drive cars equipped with first BXVD-3 carburetors Code 3-59 (Domestic), 3-60 (Export); new Main Metering Jet, Power By-pass Jet, and Vacuum Piston Assembly (same as listed above for later 3-59B and 3-60B carburetors) may be installed for increased economy. Refer to Servicing data below for jet removal and installation directions. This change does not apply to BXV-3 carburetor used on cars without Fluid Drive.

TYPE:—Plain tube, downdraft type. Similar to type used on previous Dodge models. Model BXVD-3 (new type) similar to BXV-3 except that is it equipped with special dash pot or slow closing throttle device (see data below).

IDLING ADJUSTMENT:—Idle adjusting screw controls fuel discharge from lower idle port and should be turned in for leaner mixture, out for richer mixture. Adjust only with engine warmed up so that choke valve wide open and fast idle inoperative. Idle speed controlled by throttle lever stopscrew and should be set for 6 MPH. hot or slow idle speed (with choke valve wide open). See car model 'T&E' page for complete tune up instructions.

METERING JET:—Main metering jet is non-adjustable type and should be changed only for special operating conditions such as high altitude. See Stromberg Jet Specification table for complete jet data.

NOTE—Use tool T-19099 to remove main jet plug, tool T-24924 to remove and install main metering jet, tool T-24967 to remove and install main discharge jet.

ECONOMIZER:—Vacuum piston type. Consists of a vacuum piston in a cylinder in the air horn casting which controls the by-pass valve and jet assembly in the main body casting. No adjustment required. Economizer is set to open valve with vacuum of 4-6" of HG. corresponding to car speed of 65-70 MPH.

ACCELERATING PUMP:—Capacity—With pump set for medium stroke (center hole in throttle lever), capacity in cc. per 10 strokes when pump operated slowly is 11-14 cc. Use T-24972 Pump Capacity Burrette Gauge to check capacity.

Adjustment—Three holes provided in throttle lever for pump link connection. Link engaged in center hole provides normal setting, outer hole (long radius) provides maximum pump discharge, inner hole (short radius) minimum discharge. See car model tune up page for recommended seasonal changes.

Pump Servicing Note—Strainer screen located in pump inlet in bottom of float bowl should be cleaned at frequent intervals to insure satisfactory pump performance.

FAST IDLE:—Consists of a cam pivoted directly below the throttle lever shaft and linked to the choke valve. Cam serves as stop for throttle lever stopscrew and opens throttle to fast idle position when choke valve is closed for starting. No adjustment required but stopscrew should be at high point of cam with choke valve fully closed.

SLOW CLOSING THROTTLE (BXVD-3):—Consists of a dashpot and piston assembly in the float bowl with the piston linked by a rod to a control lever which engages the throttle valve lever. When the throttle is opened, dashpot cylinder is filled with fuel which flows freely in through dashpot check valve. When the accelerator pedal is released (to close throttle), this fuel is trapped in the cylinder and is allowed to escape slowly through this relief hole in the dashpot piston stem above the piston. This action retards the movement of the piston and linkage toward the closed throttle position and the linkage prevents the throttle valve closing too rapidly.

Setting—Full travel of dashpot piston should be 5/16-11/32" with all slack removed from linkage. To check, place rule on float bowl cover at dashpot piston stem, measure distance from bowl cover to edge of retainer on stem, open throttle and recheck distance. Difference in readings should be 5/16-11/32".

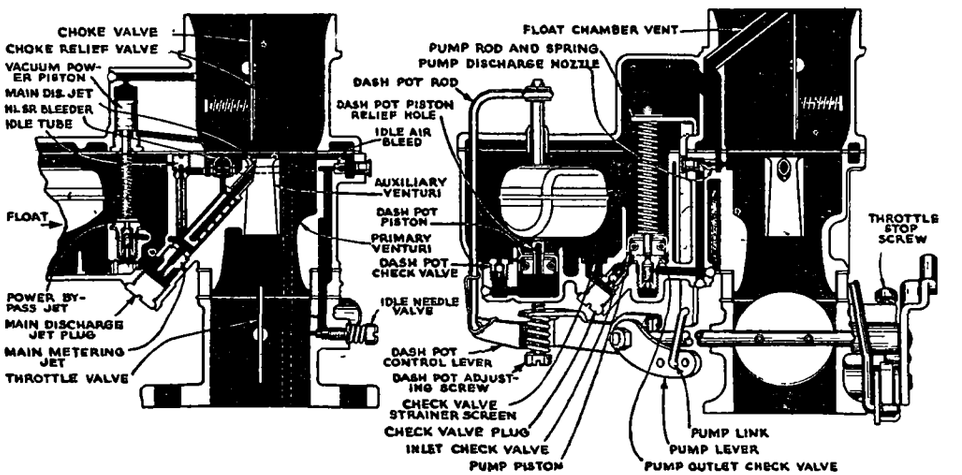
Adjustment—Turn adjusting screw on dashpot control lever under float bowl to lengthen stroke, out to shorten stroke.

FLOAT LEVEL:—Fuel Level—Should be 5/8" below top edge of float bowl with engine idling (3 lbs. pressure). Adjust by bending float lever arm at point where it is attached to float.

Needle Valve & Seat Assembly—Part No. P-24063. Furnished only as matched set. When installing float or needle valve make certain that spring clip is properly engaged in notches on float fulcrum pin.

CHOKE:—Valve is offset type with poppet type relief valve.

Automatic Choke—Sisson. See article in Carburetion Equipment Section for adjustment and servicing instructions.



THROTTLE VALVE SETTING:—Part No. P-24059 (20° type). To check throttle valve, insert #58 drill in idle port, two #60 drills in vacuum spark ports. With stopscrew backed off and throttle valve tightly closed, throttle valve edge should be flush with edge of drills (.006" maximum clearance between valve and idle port drill allowable). NOTE—An additional #60 vacuum spark port is drilled at random below throttle valve.

SERVICING:—Disassembly—Disconnect fast idle connector rod. On Model BXVD-3 only, disconnect dashpot piston connector rod. Take out retaining screws, remove bowl cover and air horn assembly. Free clip on float hinge pin (clip will spring out when released), take out hinge pin, remove float and needle. Disconnect accelerating pump link, withdraw pump rod and piston assembly, remove pump outlet check valve (in bottom of pump cylinder). Remove economizer valve assembly. Remove main discharge jet plug (use T-19099 screwdriver). If main metering jet and main discharge jet to be removed (can be cleaned with air without being removed) use special tool T-24924 (to remove metering jet), T-24967 (to remove discharge jet). To remove vacuum economizer piston, use tool T-24733 and engage tool prongs in slot in piston retainer.

Servicing—Clean all jets with gasoline or use denatured alcohol to dissolve gum deposits (do not attempt to clean jets with wire or drill rods). Blow out all jets and passages in carburetor with air.

Reassembly—Use all new gaskets (see Service Parts list below), assemble carburetor by reversing disassembly directions. Check and adjust float level, accelerating pump setting, throttle valve setting, dashpot or slow closing throttle setting (BXVD-3), and idle setting as directed above.

SERVICE PARTS:—Gasket Set—No. J-5968-G (BXV-3 and BXVD-3).

DY-1A—CROSLEY, MODEL CB-41 (1941)

TYPE:—Single barrel, plain tube, downdraft type with high speed (Main) and low speed (Idle) adjustments.

ADJUSTMENT:—Make adjustments in order as listed below. Preliminary adjustment will allow engine to be started and warmed up (other adjustments should not be made until engine thoroughly warm).

Preliminary Adjustment:—Close Main Adjustment Screw by turning to right (clockwise) until it is lightly seated, then back screw out exactly two complete turns. Close Idle Adjustment Screw by turning to right (clockwise) until it is lightly seated, then back screw out exactly one complete turn. Start engine and run until thoroughly warmed up.

Main (High Speed) Adjustment:—With engine warm and running, open throttle so that engine speed is 30-35 M.P.H. Turn Main Adjustment Screw in or clockwise slowly (¼ turn at a time) until engine slows down due to lack of fuel, then back screw out very slowly (⅛ turn at a time) until maximum speed is secured. Correct setting will be approximately 1½ turns open (first 1000 cars), 1¾-2 turns open (later cars) of screw from inner seated position.

Idle (Low Speed) Adjustment:—Set throttle lever stopscrew so that engine runs at faster than normal idling speed. Close throttle. Turn Idle Adjustment Screw in or clockwise to lean mixture until engine begins to miss, then back screw out slowly until engine fires smoothly. Clear manifold by opening throttle momentarily, then recheck idle setting. Correct setting will be approximately ¾-1¼ turns of the screw from the inner seated position. Set throttle lever stopscrew for idling speed of 7 M.P.H. when pulling car in high gear.

PERFORMANCE:—Should be satisfactory for operation at altitudes less than 5000 feet if adjustments correctly made as directed above. If performance not satisfactory, check adjustments and tune up engine (see car model T&E page for tune up data). See Trouble Shooting Section below.

FLOAT LEVEL:—Fuel Level—Should be 23/32" below top edge of float bowl or just below lower edge of inspection hole on side of float bowl (remove inspection hole plug to check level).

Float Level—To check, invert upper body assembly (air horn and float bowl cover with complete float mechanism), measure from face of body gasket to top of raised seam on each float. Distance should be 1 27/64". To adjust, bend each float lever arm **using extreme care to secure equal setting for both floats.** DISASSEMBLY CAUTION—Before taking off Upper Body Assembly (to check or adjust float level), remove Idle Adjustment Screw, Spring and Idle Tube to avoid damage to tube and main nozzle when upper body assembly lifted off.

Inlet Needle Valve & Seat—Part No. 06287 (matched set).

CHOKE:—Plain butterfly type. Adjust choke linkage so that choke valve is wide open when dash control button is pushed all the way in.

TROUBLE SHOOTING:—Engine Stalls—Check idle speed setting, tighten throttle stop retaining screw, check idling or low speed adjustment, see that idle adjustment screw not ringed, clean idle tube and idle fuel channels with air, check float level (see Fuel Level Note below).

Flatness on Acceleration—Check Idle (Low Speed) and Main (High Speed) Adjustments, check float level (if engine loads up, see Fuel Level Note below), clean idle tube and idle fuel channels with air.

Performance Unsatisfactory—Tune up engine (see car model T&E page for tune up data), check all carburetor adjustments.

Fuel Level Note—If fuel level in float bowl rises above setting, dismantle needle valve, clean needle valve and seat with a soft clean cloth, reseat needle valve by tapping with finger several times while turning needle around. Reset float level. If level not maintained, install new needle valve and seat.

SERVICING:—Before removing Upper Body Assembly (air horn and float bowl cover), remove Idle Adjustment Screw and spring, unscrew and remove Idle Tube through adjusting screw hole—this is important to avoid damage to tube and nozzle when upper assembly lifted off. Idle tube positioning pin in main body casting is not removable. Main nozzle outlet and gasket are staked in main body casting and cannot be removed (nozzle base can be removed through main adjustment screw plug hole after adjustment screw assembly removed). Blow out all jets and channels with compressed air—do not use wires or drills to clean passages. See that float bowl vent to air horn is open and clean.

Reassembly—Replace all worn or damaged parts with genuine Tillotson service parts. Use all new gaskets and replace parts in same order as removed. See that nozzles and plugs are tight. Set float level and adjust carburetor.

1941 STROMBERG DOWNDRAFT CARBURETOR JET SPECIFICATIONS

Car Model	Year	Carb. No.	Venturi Size	Main Metering Jet Size	Main Metering Jet Part No.	By-Pass Jet Size	By-Pass Jet Part No.	Main Discharge Jet Size	Main Discharge Jet Part No.	H.S. Bldr.	Idle Tube Size	Idle Tube Part No.	Idle Air Bld. Jet Size	Idle Air Bld. Jet Part No.	Pump Discharge Nozzle Size	Pump Discharge Nozzle Part No.
BUICK 40	1941	AAV-16	1 1/32"	.045"[29]	P-24773	#60	P-24674	#32-28	P-24670	#70	#70	P-19424	#42[23]	P-24683	#68	P-24594
BUICK 40, 50 Front	1941	AAV-16	15/16"	.041"[30]	P-24773	#60	P-24674	#32-28	P-24670	#70	#65	[35]382806	#42[23]	P-24683	#68	P-24594
BUICK 40, 50 Rear	1941	AA-1	15/16"	.048"[31]	P-24773	—	—	#32-28	P-24670	#70	#65	[35]382806	#42[23]	P-24683	—	—
BUICK 60, 70, 90 Front	1941	AAV-16	1 1/32"	.047"[32]	P-24773	#56	P-21657	#32-28	P-24670	#70	#65	[35]382806	#42[23]	P-24683	#68	P-24594
BUICK 60, 70, 90 Rear	1941	AA-1	1 1/32"	.053"[33]	P-24773	—	—	#32-28	P-24670	#70	#65	[35]382806	#42[23]	P-24683	—	—
CADILLAC All V8	1941	AAV-26	1⅛"	.050"[27]	P-19442	#53	P-24064	#32	P-23567	#70	#66	P-23527	#36[24]	P-23658	#68	P-24594
CHRYSLER C30, C33	1941	AAV-2	1⅛"	.053"	P-22660	2#56	382454	#36	P-22795	#70	#70	P-19424	#42	—	.65	#[22]P-23245,6
DODGE D19	1941	BXV-3	1 5/32"	.058"	P-19442	#54	P-21197	#28-36	P-24036	#68	#70	P-21778	#54	P-20470	#70[18]	P-24067
DODGE D19 Fluid Dr.	1941	BXVD-3	1 5/32"	.058"	P-19442	#54	P-21197	#28-36	P-24036	#68	#70	P-21778	#54	P-20470	#70[18]	—
PACKARD 1900	1941	BXOV-26	1 7/32"	.060"	P-19442	#53	P-24064	#28-34	382407	#68	#68	P-21962	#60	P-24749	#68[16]	—
PACKARD 1903 to 8	1941	AAV-26	1⅛"	.050"	P-24773	#54	P-21197	#32	P-23567	#70	#65	382572	#36[25]	P-23536	#68	P-24594
STUDEBAKER Com. 11A	1941	BXOV-26	1 3/16"	.057"	P-19442	#54	P-21197	#28-36	382492	#70	#70	P-21778	#54	P-20470	#70[26]	P-24067
STUDEBAKER Pres. 7C	1941	AAV-26	1 1/32"	.044"	[15]	#56	P-21657	#36	382408	#70	#65	382572	#38[25]	P-24683	#68	P-24594

[18]—Pump By-Pass Jet 2#56, Part No. P-24062.
[22]—Pump discharge nozzles in Main Body. Pump By-pass Jet #63, Part No. P-23742.
[23]—#65 (was #70) in Main Body also.
[24]—#52 in Main Body also. Supersedes No. P-24536.
[25]—#60 in Main Body also.
[26]—Discharge Reducer. Also uses Pump By-pass Jet #63. Part No. P-23742.
[27]—Was .049".
[15]—P-19442 (first cars). Should be replaced by new type P-24773 when idle passage tubes installed (to correct off-idle leanness).
[28]—Part No. P-23985 except: Chrysler AAV-2—No. P-22369, Dodge BXV-3 and BXVD-3—No. P-24315, Packard BXOV-26—No. P-24315.
[29]—Under 3500 feet—.045". 3500-9000 feet—.042". Over 9000 feet—.040".
[30]—Under 3500 feet—.041". 3500-9000 feet—.039". Over 9000 feet—.037".
[31]—Under 3500 feet—.048". 3500-9000 feet—.046". Over 9000 feet—.044".
[32]—Under 3500 feet—.047". 3500-9000 feet—.045". Over 9000 feet—.043".
[33]—Under 3500 feet—.053". 3500-9000 feet—.051". Over 9000 feet—.049".
[35]—Supersedes #70 Part No. P-19424.

MODEL 61A5—Outline 9321
BANTAM, SUPER FOUR SERIES 65 (1941)

TYPE:—Plain tube, updraft, 'balanced' type with float bowl vented through drilled hole in carburetor casting which opens into air horn. Fuel jets consist of a Low Speed or Idling System and a High Speed or Main Jet System in conjunction with a Compensating System which operate as follows:

Idling System—Fuel for closed throttle idling and low speed operation is taken from the main discharge jet well through a cross-drilled passage in the lower end of the main discharge jet and up through the idle fuel channel to the Idle Jet which meters this fuel. As the fuel leaves the idle jet it is mixed with air admitted through the Idle Air Channel and controlled by the Idle Adjusting Screw. The fuel mixture is then discharged through the Priming Plug port into the air stream at the throttle edge.

Main Jet System—At higher engine speeds, fuel is discharged directly from the main discharge jet into the throat of the venturi and the idling system drops out. This fuel is metered by the Main Jet located in the fuel channel below the main discharge jet and the discharge jet is air bled by admitting air from the idle air channel through the Well Vent and drilled cross-channels in the lower end of the main discharge jet. This well vent and air bleed channel form the Compensating System. The main jet and compensating system are not adjustable but the main discharge jet delivery can be made richer or leaner by changing the main discharge jet or the well jet (see Performance data below).

IDLE ADJUSTMENT:—Idle adjusting screw controls air for the idle fuel mixture. Adjust only when engine thoroughly warmed up and choke valve wide open. Set throttle stopscrew so that engine idles at 6 MPH., turn idle adjusting screw in or clockwise for richer mixture, out or counter-clockwise for leaner mixture until engine fires smoothly. Final position of adjusting screw should be 1-1½ turns out from inner seated position. Check idle speed and readjust throttle stopscrew.

CAUTION—If idle adjusting screw must be turned in less than ¾ turn from inner seated position for good idling performance, check carburetor for clogged idle channels and jet or for air leaks at gasket between main body and throttle body gaskets (see Servicing below).

PERFORMANCE:—Performance should be satisfactory if Idle Adjustment correctly made as directed above. If necessary to change main discharge jet fuel delivery calibration for special operating conditions, this fuel mixture can be made richer by either increasing the size of the Main Discharge Jet or decreasing the size of the Well Vent. The fuel mixture can be made leaner by either decreasing the size of the Main Discharge Jet or increasing the size of the Well Vent. See Jet Calibration Table below.

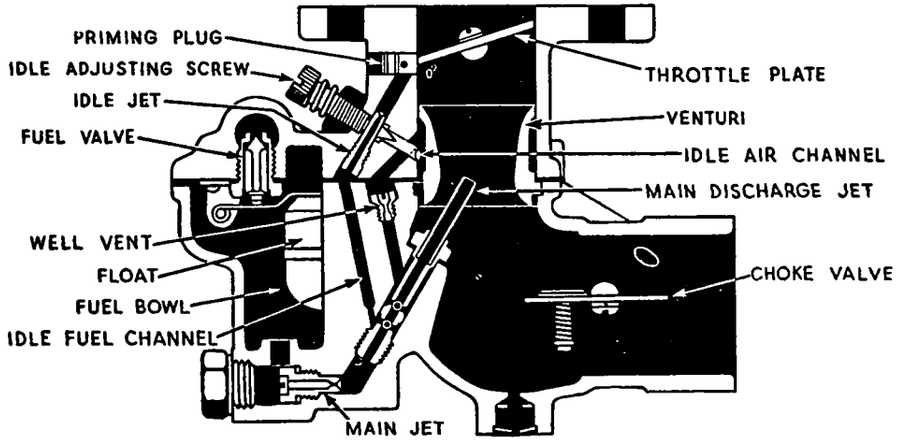
FLOAT LEVEL:—Fuel Level—Fuel level in bowl should be 13/32-15/32" below top edge (gasket seat) of float bowl.

Float Level—Bottom of float at free end should be 1 5/32" (plus or minus 3/64") from the gasket seat of the throttle body (bowl cover) with the needle valve closed. Check by inverting throttle body.

Adjustment—Manufacturer recommends that no attempt be made to correct float level by bending float arm. Install new parts to correct level.

CHOKE:—Butterfly type with poppet type relief valve. When checking choke linkage, see that choke valve is wide open when choke control button on instrument panel is pushed in, and that valve is fully closed when button is pulled out.

SERVICING NOTES:—Always use new Body Gasket #C142-16 between main body casting and throttle body casting whenever carburetor is dismantled for cleaning. Carburetor is 'balanced' type and air leaks at this point will upset carburetor performance.



ZENITH JET SPECIFICATIONS
Bantam—Model 61A5—Outline 9321

Part	Size	Part Number
Venturi	#16	C38-35
Main Jet	#18	C52-6-1
Idling Jet	#15	C55-6
Main Discharge Jet	#60-1	C66-26-1
Well Vent	#20	C77-18
Fuel Valve & Seat	#25	C81-17

NOTE—Fuel valve and Fuel Valve Seat (Float Valve) are furnished in matched sets. Always replace both parts as a unit.

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Std. Equipment On: Car Model	Fuel Pump Type	Fuel Pump Exch. No.	Fuel & Vacuum Pump Type	Fuel & Vacuum Pump Exch. No.
Buick 41-40,40A,50 ('41)			AJ	529
Buick 41-60,70,90 ('41)			AJ	530
Cadillac 41-60S,62,67,75 ('41)				521
Cadillac 41-61,63 ('41)				522
Chevrolet (All) ('41)	AF	429		
Chrysler C28 ('41)		505		
Chrysler C30,C33 ('41)		514		
Crosley CB41 ('41)	R			
DeSoto S8 ('41)		505		
Dodge D19 ('41)		505		
Ford (All) ('41)	R	541		
Graham 109,113 ('41)	R			
Hudson 10,18 ('41)	AF	509	AJ②	
Hudson 11,12 ('41)	AP	499	AJ②	
Hudson 14,15,17 ('41)	AP	499	AJ②	
Lincoln 16H, 168H ('41)	R	541		
Mercury 19A ('41)	R	541		
Nash 4140 ('41)	W	532	AD①	
Nash 4160 ('41)	W	533	AD①	
Nash 4180 ('41)	W	534	AD①	
Oldsmobile 66,76,96 ('41)			AJ	536
Oldsmobile 68,78,98 ('41)			AJ	535
Packard 1900 ('41)	AT	524G		
Packard 1951 ('41)	AH	525		
Packard 1901,1A ('41)	AH	525		
Packard 1903,4,5,6,7,8 ('41)			AJ	537
Plymouth P11,P12 ('41)		505		
Pontiac 41-24,25,26 ('41)	AH	496	AJ②	
Pontiac 41-27,28,29 ('41)	AH	539	AJ②	
Studebaker 3G ('41)	AE	527		
Studebaker 11A ('41)	AE	540		
Studebaker 7C ('41)	AE	528		
Willys 441, 441P ('41)	AF	538		

①—Cars with Overdrive. ②—Optional Equipment.

FUEL PUMP TESTING

NOTE:—Manufacturer recommends that Fuel Pump Analyzer No. 1521551 be used in making these tests. All tests should be made with the fuel pump in place on the engine and the engine running to drive the pump. Engine speed should be 30-35 MPH (for capacity test), lowest possible idling speed (pressure test).

TESTING:—Test equipment should be connected at pump outlet. Disconnect fuel line from pump to carburetor at pump, use special fitting and connect "T" connection, use rubber tubing to join gasoline line to end of "T", connect test equipment (bleeder line, pressure gauge and shut-off valve to open and close bleeder line) to side opening of "T" connection. Operate engine and make tests in following order.

CAPACITY TEST

Bleeder tube end must be at carburetor level or slightly higher. Shut-off valve should be open permitting fuel delivery through bleeder tube. Operate engine at 30-35 M.P.H. note quantity of fuel pumped in 45 seconds or 1 minute(see table below). Pressure gauge not used in making this test. If pump capacity in excess of 1 pint, check pump pressure (see test below), and if pressure not excessive pump need not be checked further. Delivery capacity of 1 pint is ample for all engine operation.

PRESSURE TEST

Idle engine at lowest possible speed to secure static pressure reading. Close shut-off valve. Note pressure gauge reading. Pressure should not exceed figure in table below. If pressure does not exceed this figure and capacity is satisfactory, fuel pump operation is OK. Excessive pressure may cause rich fuel mixture and in extreme cases flooding of carburetor (if carburetor floods and pressure is not excessive, check carburetor float level setting and see that float needle valve shuts off tightly).

Fuel Pump No.	Minimum Capacity	Maximum Pressure
429	1 Pint in 1 Minute	3¾ lbs.
496	1 Pint in 45 Seconds	4¾ lbs.
499	1 Pint in 45 Seconds	4½ lbs.
505	1 Pint in 1 Minute	4 lbs.
509	1 Pint in 1 Minute	3½ lbs.
514	1 Pint in 45 Seconds	4 lbs.
521, 522	1 Pint in 45 Seconds	4¾ lbs.
524	1 Pint in 1 Minute	4 lbs.
525	1 Pint in 45 Seconds	4¾lbs.
527, 528	1 Pint in 1 Minute	3½ lbs.
529	1 Pint in 45 Seconds	4¾ lbs.
530	1 Pint in 45 Seconds	5 lbs.
532, 533, 534	1 Pint in 1 Minute	3½ lbs.
535, 536	1 Pint in 45 Seconds	5 lbs.
537	1 Pint in 45 Seconds	4¾ lbs.
538	1 Pint in 1 Minute	2½ lbs.
539	1 Pint in 45 Seconds	4¾ lbs.
540	1 Pint in 1 Minute	3½ lbs.
541	1 Pint in 1 Minute	2¾ lbs.

FUEL PUMP TROUBLE SHOOTING

FUEL PUMP UNIT

TROUBLE SHOOTING:—If the pump action is not satisfactory, check in accordance with the following table:

No Fuel or Insufficient Fuel at Carburetor:

(1) Gasoline tank empty.
(2) Bent, kinked, leaky tubing or connections. Tighten all connections. Check condition of tubing. Replace if necessary.
(3) Dirty filter screen or loose sediment bowl. Take off glass sediment bowl, clean filter screen. Examine cork gasket and replace if necessary. Tighten bowl thumbnut securely.
(4) Loose valve plugs or caps. Examine gasket under head of plug, replace if necessary. Tighten plugs securely.
(5) Dirty or warped valves. Loose valve seat. Remove valve plugs and take out valves. Wash valves in gasoline. If warped or gummed, replace. Examine valve seat for smooth surface and see that seat is tight in pump body. Replace valves and assemble valve springs and plugs.
(6) Worn linkage, weak driving spring. Check for excessive play in linkage or worn rocker arm pin which will shorten pump stroke. Check driving spring (under diaphragm).
(7) Insufficient pump capacity. Check capacity (above).

Fuel Leakage through Vent in Pump Body:

(1) Worn or punctured diaphragm. Replace diaphragm.
(2) Loose diaphragm nut or defective gasket. See that nut on upper end of pull rod is tight and that gasket under nut is in good condition.

Fuel Leakage at edge of Diaphragm:

(1) Loose cover screws. Tighten cover screws securely (alternately around pump body).

Carburetor Flooding:

(1) Carburetor needle valve not seating. Check for worn valve or seat, sediment or other obstruction preventing seating of valve. Check float level.
(2) Excessive pump pressure. Check pressure (above).

VACUUM PUMP UNIT

TROUBLE SHOOTING:—If vacuum pump performance is not satisfactory as evidenced by faulty windshield wiper action, check as directed in following table:

Windshield Wiper operations slow at high speeds or when accelerating. Indicates that vacuum pump is not operating. Check windshield wiper lines and fittings. If no leaks are found, disassemble vacuum pump and check valves and diaphragm.

Oil Smoke in Engine Exhaust. Indicates punctured diaphragm. To check before disassembling pump, disconnect line between pump and manifold, operate pump, hold a piece of paper over pump outlet. Oil spray in exhaust from pump indicates a punctured diaphragm (if no oil spray noted at this point, oil smoke may indicate defective piston rings, etc.

FUEL PUMPS

TYPE:—Mechanically operated, diaphragm type, with oil seal on pull rod and riveted diaphragm and pull rod assembly. Types used on various car models differ slightly in design of linkage and sediment bowl (some types have separate glass sediment bowl) but service operations are essentially the same on all types.

OPERATION:—On all AC fuel pumps, suction stroke is positively actuated by the pump linkage (when rocker arm pushed in toward pump, pump link pulls down on diaphragm pullrod) and the delivery stroke is actuated by the driving spring under the diaphragm. Fuel delivery is controlled by the back pressure in the delivery line so that whenever the carburetor float valve is closed, diaphragm remains at top of stroke with driving spring compressed and the motion of the rocker arm is absorbed by the pump linkage. When pressure is relieved by the opening of the carburetor float valve, pumping is resumed.

PERFORMANCE:—See separate article on Fuel Pump Testing (preceding page) for Capacity & Pressure specifications for each pump model. Use Fuel Pump Analyzer to check performance.

TROUBLE SHOOTING:—See article on Fuel Pump Trouble Shooting (preceding page).

SERVICING:—Manufacturer recommends that, whenever pump requires overhauling, a Replacement Exchange Pump should be installed (see Equipment List on preceding page for Replacement Pump Nos.).

Disassembly:—On types with separate glass or metal sediment bowl, remove retaining nut or screw, remove bowl, gasket, and filter element or strainer screen. On types with built-in sediment bowl, remove cover screw, cover, gasket, and strainer screen. Mark cover and body castings to insure correct replacement, take out screws in flange holding the two castings together, remove cover casting using care not to tear diaphragm assembly. Take out screw in valve retainer, remove retainer and lift out valve assemblies. To remove pullrod and diaphragm assembly on types with oil seal assembled on pullrod (where seal and retainer assembly seated on boss in pump body), use thin bladed tool to lift lower edge of retainer up on edge of pump body boss, disengage pullrod from rocker arm link by pressing down and away from rocker arm on pullrod (wedge link up toward diaphragm with screwdriver inserted through rocker arm slot), lift pullrod and diaphragm assembly out. On types with oil seal installed in recess in pump body, remove rocker arm pin (where pin staked in body, remove stakings; where small counterbored end of pin swedged out to hold pin in place, drill out this counterbored end of pin), disengage link from pullrod, lift pullrod and diaphragm assembly straight out to avoid damage to oil seal.

Oil Seals:—Oil seals installed in recess in pump body are staked in place and should be removed only if seal being replaced. Oil seals assembled on pullrod stem consist of several oil seal washers assembled between upper and lower retainers with small oil seat spring between upper retainer and diaphragm lower retainer. Note position of oil seal parts on pull rod stem before removing seal and re-install in same relative positions (retainers locked on pullrod by being rotated 1/4 turn.

Diaphragm Assembly:—On types where pullrod end riveted over upper diaphragm protector, pull rod and diaphragm should be replaced as an assembly. New diaphragms can be installed on types where a nut is used. When installing diaphragms, see that upper and lower protectors properly installed (with cupped edges away from diaphragm), line up holes in diaphragm layers with locating ring or several cover screws and make certain that holes in correct relation to flat or link slot on pullrod, use special wrench to hold alignment washer from turning while tightening pullrod nut and use extreme care not to twist diaphragm layers out of alignment.

Valve Assembly:—On types with valve cages installed in recesses in pump casting and retained by retainer and screw, make certain that inlet and outlet valves installed in correct position, see that retainer fits snugly on each valve cage and that retainer screws are tightened securely (see that retainer does not shift while screws being tightened). On types with separate valve discs and springs installed under valve plugs, see that valve seat is clean and smooth, place fibre valve on seat, install spring on valve, install valve plug making certain that boss on plug enters spring and that valve is not cocked on seat, tighten plug securely.

Pump Reassembly:—Install pullrod and diaphragm assembly and oil seal assembly by reversing disassembly procedure. Engage pullrod and rocker arm link (if rocker arm pin removed, use special tapered assembly tool to line up rocker arm and link parts, push tool out with rocker arm pin as pin is installed). When installing cover assembly, push in on rocker arm so diaphragm is flat and holes line up with hole in pump body and cover, install all cover screws and turn screws down evenly until pump flanges are 1/8" apart, then release rocker arm or use special tool to press up on link and pullrod so that diaphragm flexed in upper position, tighten all cover screws evenly and securely. CAUTION—This flexing of the diaphragm when cover screws are being tightened is necessary to insure full stroke of pump in operation.

FUEL & VACUUM PUMPS

TYPE:—Combination fuel-and-vacuum pumps consist of a conventional diaphragm type fuel pump with an additional diaphragm type vacuum pump unit mounted on the pump body and operated by the same rocker arm (separate rocker arm links used so that each pump section can operate individually).

FUEL PUMP SECTION

OPERATION & SERVICING:—Same as for separate fuel pumps. See Fuel Pump servicing data above.

VACUUM PUMP SECTION

OPERATION:—Exhaust stroke positively actuated by pump link and rocker arm, suction stroke actuated by large driving spring above diaphragm. Whenever windshield wiper not in use (inlet or suction line shut off), manifold vacuum holds diaphragm at upper end of stroke with driving spring compressed and rocker arm motion is absorbed by linkage.

SERVICING:—Disassembly. With pump clamped in vise, take out two opposite flange screws and install special guide pins as pilots when cover removed (guides may be made up of 3/16" cold-rolled stock, 2" long, with 1/4" of 10-32 thread on one end). Mark cover and body flanges to insure correct reassembly, take out remaining flange screws, lift off cover assembly. Press down on rocker arm, unhook diaphragm assembly from inner pump link, lift diaphragm assembly out.

Vacuum Pump Body Assembly. Place fibre inlet valve on brass valve seat (body furnished with valve seat installed), and position inlet valve spring on valve. Install spider-shaped valve stop plate on valve spring making certain that top coil of spring is seated in recess in stop plate. Install outlet valve spring and see that spring is centered in recess in body. Press down on inlet valve stop plate, install fibre outlet valve on valve spring, see that legs on stop plate fit into recess in body. Without releasing stop plate, slide retainer gasket into position, place retainer on top of gasket (countersunk holes must face up), insert flat-headed retainer screws and tighten securely (tighten center screws first, end screw last). Turn pump body over and install screen making certain that screen is flat and fits snugly around screw holes in body, install gasket on screen, place bottom cover on gasket and install four cover screws. See that gasket fits properly and cover screws tightened evenly to prevent leaks at this point.

Diaphragm & Pullrod Assembly—On types where pullrod riveted over diaphragm protector, replace diaphragm and pullrod as an assembly. New diaphragms can be installed on types where a nut is used on this point. When installing diaphragm, see that upper and lower protectors properly installed (cupped edges away from diaphragm, line up hole in diaphragm layers and see that these holes in correct relation to flat or link slot on pullrod, use special wrench to hold alignment washer from turning while tightening pullrod nut and use extreme care not to twist diaphragm layers out of alignment. Place oil seal parts (retainers, washer, and spring) in position in pump body and see that assembly fits snugly in recess around the pullrod hole. Install diaphragm on top of retainer spring, threading pullrod through oil seal and engaging hooked end of longer pump link in pullrod slot.

Vacuum Pump Assembly. Clamp pump body (with fuel pump installed) in vise with vacuum diaphragm up. Press down on rocker arm until diaphragm is flat on flange, install small metal wedge between body and shoulder on arm to hold it in this position while completing assembly. Place heavy driving spring on diaphragm, place vacuum pump body assembly in position on spring making certain flange marks line up and that spring is centered on diaphragm and around boss in pump body. Press down on vacuum pump body, insert flange screws (lockwasher on each screw), turn screws down loosely. Remove rocker arm wedge, tighten screws evenly. Check vacuum pump operation after pump re-installed on engine.

DESCRIPTION:—The A.C. Electric Gasoline Gauge is of the balanced coil type and consists of two units, a dash unit or recording gauge and a tank unit or measuring device mounted on top of the gasoline tank. The dash unit mounted on the instrument panel consists of two coils mounted at an angle of 90 degrees. The gauge pointer is attached to an armature which is pivoted at the intersection of the coil axes. The dash unit is connected to the coil side of the ignition switch and to the tank unit through insulated wires. The dash unit is grounded through the mounting screws to the instrument board and car frame.

Tank Unit:—Gearless type with integral float arm and contactor arm (rheostat ground brush). Float arm is pivoted in lower end of tank unit case so that movement of the arm (with the rise and fall of the float in the tank) causes the upper end of the arm to sweep across the tank unit resistance coil. Except for this float arm construction and separately mounted fuel outlet pipe (some models), gasoline gauge is similar to type used on previous car models.

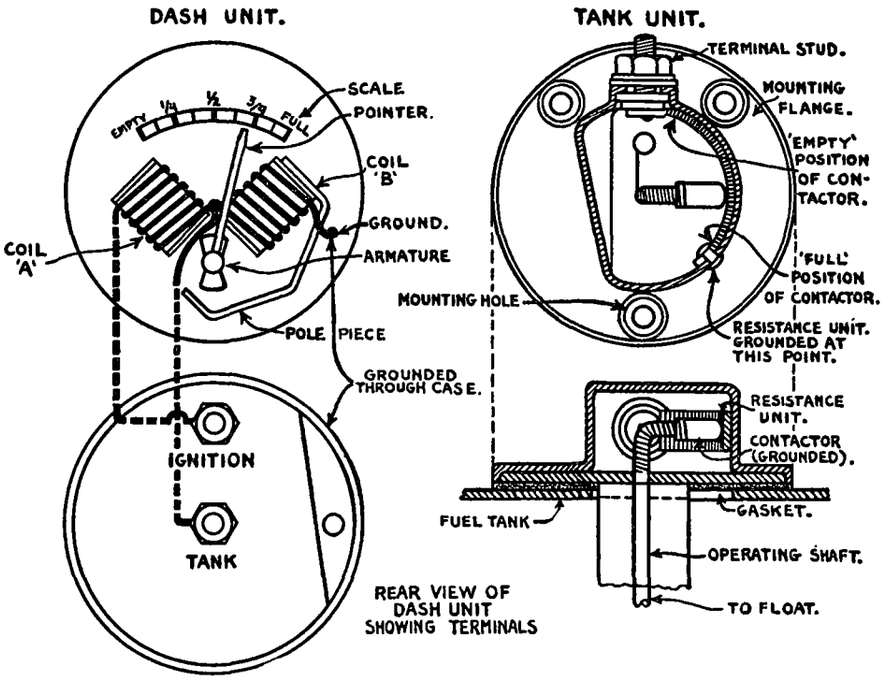
OPERATION:—The upper terminal of the dash unit marked 'Ignition' is connected to the coil side of the ignition switch (or to the 'auxiliary' terminal of lock switch coils) so that the gauge is operative whenever the ignition switch is turned on. Current flows through coil 'A' of the dash unit to the center terminal marked 'Tank'. The second coil 'B' is connected to this terminal. The other end of this coil winding is grounded to the gauge case. The 'Tank' terminal of the gauge is connected to the terminal on the tank unit and circuit is completed to ground through the tank unit resistance winding. This resistance winding in the tank unit is grounded through the movable contactor so that the resistance is cut in or out of the dash unit coil circuits as the float rises and falls with the gasoline level in the tank.

INSTALLATION:—Both the tank unit and dash unit are grounded and care must be taken whenever the units are installed or replaced that a ground is provided. On the tank unit it will be sufficient to remove paint and carefully clean the tank under the tank unit flange.

TROUBLE SHOOTING:—Defective units should be replaced and servicing operations will be confined to locating trouble in dash unit or tank unit. Check gauge operation from following table:

1. **Pointer does not move when ignition is turned 'on'.**
   The line from the ignition switch to the dash unit is open. Check connections and supply new lead from switch to 'IGN' terminal on gauge.
2. **Gauge indicates 'Full' at all times.**
   The line between dash unit and tank unit is open. Check connections and replace line with insulated wire.
   Tank unit burned out. Replace tank unit.
   Tank unit not grounded. Check by supplying new ground from tank unit to car frame.
3. **Gauge indicates 'Empty' at all times.**
   Wires reversed on dash unit. See that connections are made as indicated above on diagram.
   Dash unit is not grounded. See that dash unit is properly grounded. Check by supplying special test ground to car frame. If dash unit does not register correctly, it must be replaced.

SERVICING:—No service operations required other than to see that wires are properly connected and terminals are tight. Defective units (as determined by tests given below) should be replaced.



AC GASOLINE GAUGE TESTING

NOTE:—Manufacturer recommends that AC Gas Gauge Tester, Part No. 1516000, or HMO-204 be used to make tests. Tester similar to gas gauge Tank Unit equipped with test leads and an operating handle by which the resistance can be cut in and out of the gauge circuit in a similar manner to the operation of the tank unit on the car.

TESTING:—Make the following tests in the order given which will completely check all gas gauge units and wiring.

DASH UNIT

With ignition switch 'off', disconnect tank wire at terminal on back of dash unit, connect RED tester lead to this terminal, ground BLACK tester lead to frame. Turn ignition switch 'on', move Tester arm up and down. Gas gauge dash unit should register 'Full' and 'Empty'. If operation is O.K., disconnect tester and reconnect tank wire. If dash unit pointer does not register correctly, check feed wire by connecting 6 volt test lamp between dash unit Ignition Terminal (second terminal on back of dash unit) and ground. If test lamp does not light, circuit from ignition switch is defective and ignition switch and connecting wire should be checked or replaced. If lamp lights (gauge circuit O.K.) and dash unit does not operate, replace dash unit and reconnect wires.

GAUGE WIRING

Disconnect tank unit wire at nearest point to tank unit (bayonet type snap connector or junction block). Attach Red tester lead to wire running back to dash unit, ground BLACK tester lead to the car frame. Turn ignition 'on'. Move tester arm up and down and watch dash unit pointer which should move from 'Empty' to 'Full'. If dash unit reads 'Empty' at all times, or if reading is lower than when dash unit tested alone (dash unit test above), check wire for shorts or leaks (broken insulation, short junction block terminals, un-insulated connectors touching body or frame, etc.). If dash unit reads above 'Full' at all times, or if reading is higher than when dash unit tested alone, check wire for open-circuits (break in wire, loose connections, corroded terminals, etc.). If dash unit and wire tests O.K., check tank unit.

TANK UNIT

Remove tank unit, clean tank unit terminal and mounting flange thoroughly, connect tank unit to wire running to dash unit, ground tank unit by connecting jumper wire from tank unit mounting flange to car frame. Turn ignition 'on'. Move tank unit float arm up and down. Dash unit pointer should move from 'Empty' to 'Full'. If dash unit reading indicates tank unit defective, replace tank unit. Always check tank units before installing in tank and make certain that float arm is free (check for freedom of movement by noting that float arm falls back to empty position when released in various positions). See that gasoline tank and tank unit mounting flange are clean (tank unit grounded to frame through tank) and that a good ground contact exists between tank and frame.

Car Model	Dash Unit — Gasoline Gauge —	Tank Unit
Chrysler Six, C28 (1941)	NG-9704D	NG-9329T
Chrysler Eight, C30,C33 (1941)	NG-9704D	NG-9330T
DeSoto, Model S8 (1941)	NG-9685D	NG-9329T
Dodge, Model D19 (1941)	NG-9674D	NG-9329T
Nash '600', 4140 (1941)	NG-9645D	NG-9637T
Nash Amb. 6, 4160 (1941)	NG-9645D	NG-9637T
Nash Amb. 8, 4180 (1941)	NG-9645D	NG-9637T
Plymouth, P11, P12 (1941)	NG-9651D	NG-9329T
Studebaker Champ. 3G (1941)	NG-9594D	NG-9659T
Studebaker Comm. 11A (1941)	NG-9594D	NG-9659T
Studebaker Pres. 7C (1941)	NG-9594D	NG-9659T

DESCRIPTION:—Gauge consists of a bimetal or thermostatic arm type dash unit and a rheostat type tank unit connected together by two wires.

Dash Unit—Pointer actuated by the two bimetal arms on which heating coils are wound (these arms hinged at upper end with lugs to engage pointer at lower end). The two outer bimetal arms (without heating coils) compensate the dash unit for temperature changes (left hand arm controls dash unit contacts, right hand arm has insulated stop at each side to limit motion in each direction) and the contacts compensate for battery voltage variations (remain closed at 5 volts or less, open and close at voltages above 5 volts to maintain constant gauge input). The circuit through the dash unit is from the 'IGN.SW' terminal through the contacts and then through each heating coil to terminals '1' and '2'.

Tank Unit—Consists of a resistance coil wound on a flat form and connected between the two tank unit terminals. Contact arm is grounded and circuit from each terminal is through the resistance to ground at the contact arm. Contact arm is mounted on the float lever and moves across the resistance as the float rises and falls so that resistance is cut out of one dash unit heating coil circuit and in on the other heating coil circuit with this movement.

OPERATION:—When the ignition switch is turned on, current flow through heating coil on each bimetal arm in the dash unit depends on contact arm position in tank unit (contact arm controls amount of resistance in each heater coil circuit) and the unequal current flow through each coil causes an unequal deflection of the bimetal arms so that the pointer is moved on the scale. Any change in the position of the tank unit contact arm (caused by float movement) causes a like change in the bimetal arm deflection and pointer reading of the dash unit. When voltage at gauge exceeds 5 volts, or if bimetal arms become overheated, contacts open and close to maintain constant input so that readings are accurate regardless of voltage fluctuations (pointer position entirely dependent on division of current between heating coils on bimetal arms as controlled by tank unit. Contact opening and closing is sufficiently rapid so that pointer does not change). External temperature changes (affecting outer unwound bimetal arms) cause a slight rotation of the hinge so that position of inner bimetal arms and pointer remains unchanged. Gauge design results in a lag or damping action so that pointer fluctuations due to fuel tank surges are minimized. When ignition switch is turned off, bimetal arms flex away from pointer which is then returned to the empty position by the counterweight at the lower end.

TESTING:—Use spare tank unit, which is known to be in good order, to test gauge units. Disconnect wires on terminals '1' and '2' of dash unit, connect these terminals to same numbered terminals of test tank unit, ground test unit to car. Turn ignition switch on and operate test unit by hand, moving float from empty to full position, and noting dash unit pointer reading. NOTE—Allow one minute for dash unit to indicate true reading. If dash unit reads correctly when operated with test tank unit, trouble is in wiring or tank unit (see Trouble Shooting Table and test directions below). If dash unit does not read correctly, replace unit (see Calibration Adjustment below).

Checking Wiring—Connect 6 volt test lamp in series with wire to tank unit at connector accessible through hole in trunk floor. With ignition turned on, lamp should go on and off at regular intervals. If lamp does not light, wire is grounded or open-circuited (See Trouble Shooting Table). Test both No. 1 and No. 2 wires in this manner. NOTE—Open-circuits are usually found at wire connectors in rear compartment. Clean contact surfaces thoroughly to remove all grease, dirt, insulating varnish. Grounds may occur at left windshield post where wires enter post or at left rear quarter window (make certain that moulding screws do not pinch or pierce wiring insulation).

TROUBLE SHOOTING:—If wires open-circuited, grounded or reversed, gauge will read inaccurately as follows:

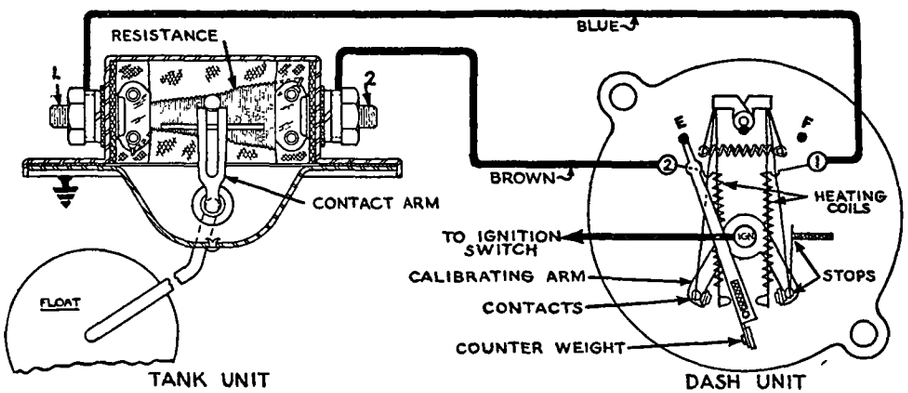
	Gauge Reading With:		
Wire (See Note)	Tank Empty	Tank ½ Full	Tank Full
#1 Wire Grounded	Empty	¼ Full	½ Full
#1 Wire Open	½ Full	¾ Full	Full
#2 Wire Grounded	½ Full	¾ Full	Full
#2 Wire Open	Empty	Empty	Empty
#1 & #2 Wires Reversed	Full	½ Full	Empty

NOTE—Dash unit and tank unit terminals are marked as indicated above (tank unit terminals may be painted over). See Car wiring diagram (on car model 'T&E' page) for wire colors.

Gauge Reading Inaccurate—See table above. May also be caused by excessive tightening which has loosened terminal studs requiring replacement of dash unit (see Service Note and Calibration Adjustment).

Pointer Sticks or Binds—See that pointer does not bind on panel at lower end (if necessary, shim gauge out from panel by installing gasket cut to size of dash unit mounting face. Check pointer bearing alignment and endplay (adjust by bending bearing supports).

Fluctuating Pointer—Examine contact points and clean by drawing piece of bond paper between them.



CALIBRATION ADJUSTMENT:—If pointer position not correct at Empty or Full, or if gauge reads inaccurately, dash unit should be calibrated as follows: Remove dash unit from car, connect to tank unit known to be in good condition and to a battery (see illustration for connections). Loosen both nuts on 'IGN.SW' terminal (inner nut is staked on later type units) to release calibrating arms. Set tank unit float in Empty position, move left hand calibrating arm (on which stationary contact is mounted) to right to raise pointer reading, or to left to lower pointer reading. Move tank unit float arm to Full position, move right hand calibrating arm to right to raise pointer reading, or to left to lower pointer reading. Recheck gauge at Empty position (setting may be changed by the Full adjustment). Tighten nuts on 'IGN.SW' terminal to lock calibrating arms in position using extreme care not to shift arms while tightening inner nut.
NOTE—When making this adjustment, or when testing dash unit on the bench, unit must be shielded from air currents which might cause unequal cooling of the bimetal arms and affect the gauge reading. Allow 1 minute for bimetal arm heating coils to heat up, after moving tank unit float, before checking dash unit pointer position.

1941 KING-SEELEY GASOLINE GAUGE

DESCRIPTION:—This is an electric type gauge using bi-metal arms on which heating coils are wound in both the tank or engine unit 'Sender' and the dash unit 'Receiver'. The two heating coils are connected in series and the gauge circuit is completed to ground through a set of contacts in the Sender unit (one of which is mounted on the bi-metal arm). The ground contact in the Sender is mounted on a movable arm (arm mounted through diaphragm forming lower cover of Sender unit and flexes diaphragm as it is moved). The lower end of the ground contact arm is actuated by the upper end of the float rod. When the float moves up to follow the gasoline level, the rod moves the arm so that contact pressure and length of time contacts remain closed is increased.

OPERATION:—When the Sender contacts are closed a current flows through the heating coils of both the Sender and Receiver units. This causes the bi-metal arm in the Receiver to bend, moving the pointer, and indicating a reading on the gauge dial. At the same time the heating coil in the Sender unit causes its bi-metal arm to bend, opening the contacts and interrupting the current flow. When this occurs the heating action stops and the cooling of the bi-metal arm causes it to flex in the opposite direction and again close the contacts. In operation, this cycle takes place very rapidly (approximately once each second for gauge when tank empty) so that steady reading secured on Receiver dial.

TROUBLE SHOOTING:—Manufacturer recommends use of extra or test Sender and Receiver to check operation of units which do not perform satisfactorily.

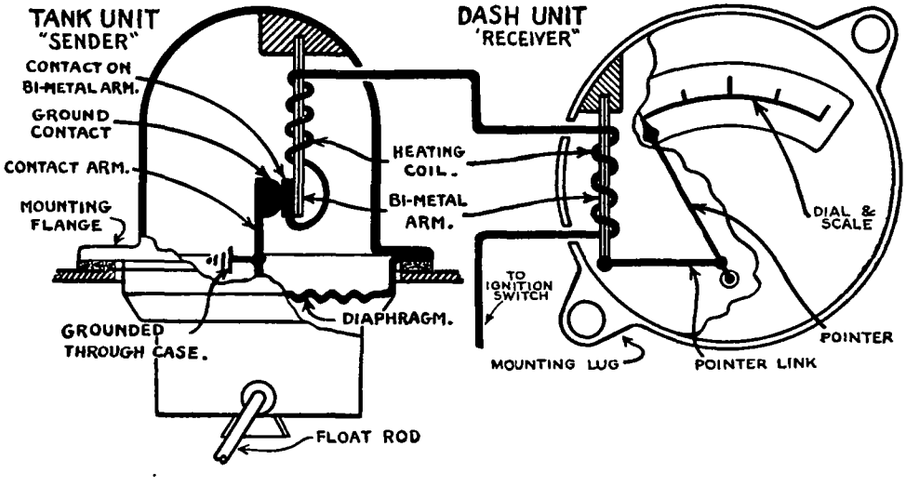
Testing Sender:—Disconnect lead of Sender unit on car, connect this lead to test Sender and ground this Sender to the car frame. Turn on ignition, move Sender float up to 'full' position and note reading on Receiver. Receiver should read full or 'F' after 10-15 seconds time. If Receiver reading is correct, check following points before replacing Sender unit.

1. **Ground.** Sender is grounded through case. See that all paint and grease are removed under flange and both surfaces make good contact.
2. **Radio By-pass Condenser Shorted.** If by-pass condenser is connected at Sender on cars with radio, test for short-circuit by disconnecting condenser and noting gauge operation. If gauge is satisfactory, replace condenser.

If reading secured with test Sender is same as that with Sender on car, check wire connecting Sender and Receiver. Replace if open-circuited or grounded.

Testing Receiver—Disconnect wires on Receiver on car and connect to same terminals on test Receiver. Turn on ignition switch and note reading on gauge. If test Receiver reading is correct, replace Receiver on car. If test Receiver reading is same as car Receiver, repeat tests on Sender and wiring.

SERVICING:—No service operations are required other than to see that wires are properly connected and terminals are tight. No repair operations are possible and defective Senders and Receivers should be replaced.



1941 STEWART GASOLINE GAUGE

DESCRIPTION:—This is an electric gauge of the 'balanced' coil type and consists of a dash unit or recording device and a tank unit or measuring device. The two units are connected by an insulated wire and each unit is grounded. The feed wire on the dash unit is connected to the accessory terminal of the ignition switch (or coil side of switch) so that the gauge is operative only with the ignition turned 'on'.

OPERATION:—The two coils in the dash unit are connected in parallel to the switch terminal (1) on the gauge case. Coil (A) is grounded to the gauge case so that the current flow through this coil is constant. The other end of coil (B) is connected to the tank terminal on the gauge case so that the coil is in series with the resistance unit in the tank unit. The resistance unit is grounded through the contactor on the upper end of the gasoline tank float rod so that the resistance is cut in or out of the coil (B) circuit as the float rises and falls.

MOUNTING:—Both the dash unit and tank unit are grounded through the case and a good ground must be provided when they are mounted on the car. Remove all paint and grease from under the mounting flange.

TANK UNIT NOTE:—Tank units are furnished in both Gear Type (for tanks greater than 12" in depth or where baffles prevent installation of lever type) and Lever Type (for tanks of 12" depth or less). Tank units furnished with floats not attached to arm and should be installed as follows:

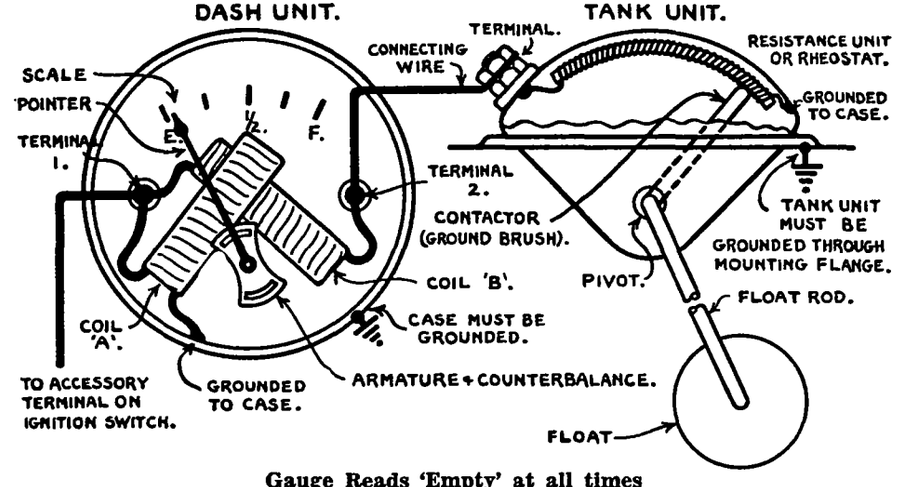
Gear Type—Travel limited to 52½° above and below horizontal position of arm. When installing, cut off float arm to correct length required for depth of tank and solder float on arm in horizontal position.

Lever Type—Furnished with float arm 12" long. Cut off float arm to correct length and solder float on arm at right angles to arm and with long diameter of float horizontal.

TROUBLE SHOOTING:—If gauge operation not satisfactory check as follows:

Gauge Reads 'Full' at all times

1. Lead between dash unit and tank unit is grounded. Check by disconnecting lead at each end and substituting a test jumper wire. If gauge operates correctly, replace lead.
2. Connections on dash unit reversed. Reverse wires and note performance.
3. Coil (A) in dash unit open-circuited. To check, disconnect tank unit lead on dash unit momentarily. Pointer should move to 'Empty' end of scale. This coil should draw .13 ampere at 6.0 volts (between switch terminal on dash unit and ground on case with tank unit lead disconnected).
4. Resistance unit in tank unit short-circuited. Check with voltmeter and battery between tank unit terminal and ground on case with dash unit lead disconnected. Resistance of unit should be 110 ohms.



Gauge Reads 'Empty' at all times

1. Dash unit not grounded. Examine ground contact or run extra ground lead from case to car frame.
2. Open-circuit between dash unit and tank unit. Check by connecting jumper wire between terminals on units and noting gauge performance.

Gauge Reading Inaccurate

Mechanical defect in dash unit or tank such as tight pivot bearings, armature counterbalance binding or incorrectly positioned, bent dial pointer, or bent float rod.

SERVICING:—Replace all defective dash units and tank units.

SINGLE BARREL CARBURETOR TYPE

Car Model	Carburetor
Graham Hollywood, 113 (1941)	WA-1 472-S
Hudson Six, 10, 18 (1941)	WA-1 454-S
Nash Ambass. Six, 4160 (1941)	WA-1 435-S
Oldsmobile Six, 66, 76, 96 (1941)	WA-1 481-S, 504-S
Pontiac Six, 41-24, 25, 26 (1941)	WA-1 494-S
Studebaker Champion, 3G (1941)	WA-1 496-S
Studebaker Commander, 11A (1941)	WA-1 410-S

DUAL CARBURETOR TYPE

Buick, 41-40 (1941) Single Carburetor	WCD 487-S
Buick, 41-40, 50 (1941) Compound Carburetion	WCD 509-S
Buick, 41-60, 70, 90 (1941) Compound Carburetion	WCD 490-S
Cadillac, 41-60S,61,62,63,67,75 (1941)	WDO 506-S
Graham Hollywood, Schgr. 109 (1941)	WDO 488-S
Hudson Six, 11, 12 (1941)	WDO 461-S, 501-S
Hudson Eight, 14, 15, 17 (1941)	WDO 455-S, 502-S
Nash Ambass. Eight, 4180 (1941)	WDO 511-S
Oldsmobile Eight, 68, 78, 98 (1941)	WDO 480-S, 503-S
Packard Clipper, Model 1951 (1941)	WDO 512-S
Packard Eight, '120' 1901, 1A (1941)	WDO 478-S
Pontiac Eight, 41-27, 28, 29 (1941)	WDO 469-SM
Studebaker President, Model 7C (1941)	WDO 409-S

NOTE:—Buick Compound Carburetion Cars—Front carburetor only is fitted with automatic choke (Climatic Control) and fast idle. Rear carburetor does not have choke valve or fast idle mechanism.

Buick, Cadillac, Studebaker Commander & President Models—These cars also use Stromberg Carburetors (AAV-16—Buick, AAV-26—Cadillac & Studebaker President, BXOV-26—Studebaker Commander). See separate articles on Stromberg Automatic Choke & Fast Idle for data on cars with Stromberg carburetors.

SPECIAL SERVICE NOTES:—Studebaker Champion—To correct complaints of insufficient heat at Climatic Control, which will cause choke valve to be slow in opening as engine warms up, make certain that heat tube is not bottoming in pocket in exhaust manifold. It is recommended that end of heat tube be cut off at an angle so that tube cannot bottom and close off passage in tube.

DESCRIPTION:—The Carter Climatic Control is an automatic choke designed to choke the carburetor for cold starting and to control the choking action during the warming up period. It employs a combination of engine temperature (hot air from hot air stove on manifold is delivered to control unit case by a flexible connecting tube) and manifold vacuum (vacuum passage in carburetor casting connects port below throttle valve and port in control case) to actuate a thermostatic spring linked to the choke valve shaft lever and a vacuum piston assembly built around the shaft lever (piston is mounted directly on end of lever). The control is adjusted to close the choke valve completely at 70°F. and the choke valve is opened progressively by the thermostatic spring as the engine warms up. The piston assembly, actuated by manifold vacuum, tends to open the choke when the engine begins to fire and prevents over-choking. A 'fast-idle' control is linked on the choke valve shaft (see below).

THERMOSTATIC COIL SETTING:—On all models except those noted in table below, center index mark or notch on thermostatic coil housing should be lined up with mark on piston plate housing. On other models, thermostatic coil housing should be rotated clockwise (Rich), counter-clockwise (Lean), number of notches shown in the table below.

Car Model	Carburetor	Thermostat Coil Setting
Hudson 6 & 8	501-S, 502-S	③1 Notch Lean
Nash Six 4160	435-S	①1 Notch Rich
Nash Eight 4180	511-S	②Centered
Oldsmobile Eight	480-S Only	2 Notches Rich
Packard Eight	478-S Only	1 Notch Rich
Pontiac Six	494-S	3 Notches Rich
Pontiac Eight	469-SM	2 Notches Rich
Studebaker Comm. 11A	410-S	1 Notch Rich
Studebaker Pres. 7C	409-S	1 Notch Rich
All Others		Centered

①—Supersedes 2 Notches Rich originally specified for this model.
②—Supersedes 1 Notch Rich originally specified for this model.
③—Supersedes Centered Setting originally specified for these models.

Adjustment—Loosen two mounting screws on rim of thermostatic coil housing, rotate coil and housing assembly, tighten mounting screws. NOTE—See Servicing data below for proper installation of thermostatic coil and housing assembly if taken off carburetor.

NOTE—If performance not satisfactory with standard settings as given above, thermostatic coil can be rotated 1 notch clockwise to lean setting (if engine runs rich or has a tendency to load up), 1 Notch counter-clockwise to enrich setting (if engine runs lean during warming up period). Adjustments should always be made with engine Cold (allow 4 hours for engine to cool off after being run), setting should be changed only 1 notch at a time, and performance should be checked while engine is warming up.

SERVICING (SINGLE BARREL CARBURETOR TYPE):—Disassembly—Take out attaching screws, remove retainers on rim of piston housing plate, turn thermostatic coil housing clockwise to disengage coil hook from prong, remove thermostatic coil and housing assembly. Remove strainer screen. Take out choke valve retaining screws, remove valve. Loosen clampscrew on fast idle link and lever assembly, bend lip under screw with screwdriver so that it clears portion of choke valve shaft which is not flat, revolve choke valve shaft so that piston clears cylinder, withdraw choke shaft, piston, piston lever and link as an assembly. Do not remove the rivet mounting piston plate housing on the air horn (these parts line-reamed at factory). If piston plate housing has been removed, line up the three holes so that the choke valve shaft and piston work freely.

Servicing—Wash all parts except thermostatic coil and housing assembly and cork gaskets in clean gasoline. Clean thermostatic coil assembly and blow out all passages with air. Replace all worn or damaged parts, use new gaskets when reassembling. CAUTION—Make certain that end of thermostatic coil does not drag on housing. Replace assembly if coil drags or is distorted.

Reassembly—Install choke shaft, piston lever, link, and piston in air horn and at the same time install choke lever, link, and screw assembly on shaft behind piston plate housing. Install choke valve using new screws and turning screws down loosely, close choke valve and tap valve lightly to centralize valve in air horn, then tighten valve screws securely. See that choke valve operates freely without binding in air horn. Tighten choke lever screw. Install strainer in piston plate housing (replace if dirty or clogged). Install thermostatic coil housing with reference mark or label at bottom, turn counter-clockwise until mark is at top and in line with mark on piston plate housing, tighten retaining screws. Check thermostatic coil setting (above), check and adjust Fast Idle, and Unloader (see Fast Idle section below).

SERVICING (DUAL CARBURETOR TYPE):—Disassembly—Take out attaching screws, remove retainers on rim of piston plate housing, turn thermostatic coil housing clockwise to disengage coil hook from prong, remove thermostatic coil assembly. Remove screw holding choke trip lever (fast idle end of choke valve shaft), remove washer, trip lever, fast idle cam and collar assembly from shaft. Take out choke valve attaching screws, remove valve. Turn shaft counter-clockwise until piston clears cylinder, remove piston (flat type) pull shaft and lever assembly out of air horn (round type piston removed as part of shaft assembly—use care not to lose piston pin).

Servicing—Same as Single Barrel type (above).

Reassembly—Install choke shaft, lever, and piston assembly in air horn. Install choke valve using new screws and tapping valve lightly before screws tightened to centralize it in air horn bore. Check to see that valve operates freely and does not bind (valve should fall open of own weight). Install fast idle cam and collar assembly, washer, and trip lever on shaft, tighten mounting screw. Install piston housing strainer. Install thermostatic coil and housing assembly with reference notch at bottom, turn assembly counter-clockwise until notch is at top in line with reference mark on piston plate housing, tighten retaining screws. Check Thermostatic Coil setting (above), adjust Fast Idle, Unloader, and Choke Valve Lock (see Fast Idle section below).

INSTALLATION CAUTION:—Make certain that hot air flexible tubing connections are tight. Air leak at housing will interfere with correct Climatic Control operation. See that choke valve operates freely without binding at any point.

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FAST IDLE & UNLOADER

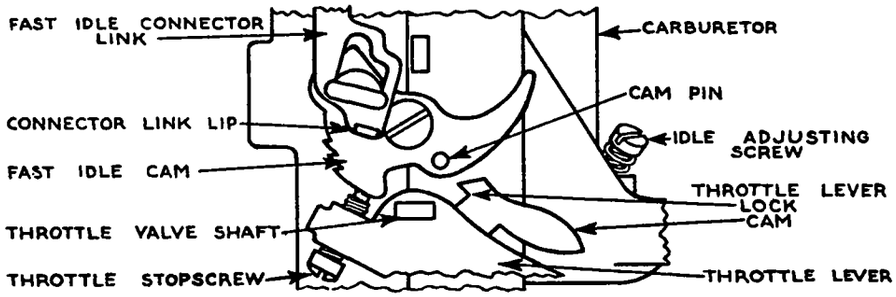
SINGLE BARREL CARBURETOR TYPE

FAST IDLE:—Consists of a fast idle cam pivoted directly above the throttle lever (serves as throttle lever stop) and linked to automatic choke mechanism.

Adjustment—To check, see that fast idle cam is in normal or slow idle speed position, tighten throttle lever stopscrew until it just seats against cam, rotate cam until stopscrew is against (not on) first step of cam. Hold cam in this position and check choke valve opening by using tool T109-85 (all models) to check clearance between edge of valve and air horn wall. Clearance should be 5/8". If clearance not correct, adjust by bending offset portion of fast idle link using tool T109-41.

UNLOADER:—Consists of a cam on the throttle lever which opens the choke valve (through fast idle linkage) when throttle is held wide open to correct flooding. To check, hold throttle wide open, check clearance between lower edge of choke valve and air horn wall. See table below for correct clearance and checking gauge on each model. To adjust, bend cam on throttle lever (use Tool T109-41).

Car Model	Carburetor	Gauge Number	Choke Valve Clearance
Graham 113	472-S	T109-83	1/2"
Hudson 10, 18	454-S	T109-81	7/16"
Nash 4160	435-S	T109-82	31/64"
Oldsmobile 6	504-S	T109-81	7/16"
Oldsmobile 6	481-S	T109-80	3/8"
Pontiac 6	494-S	T109-106	7/32"
Studebaker Champ.	496-S	T109-31	1/4"
Studebaker Comm.	410-S	T109-31	1/4"



TRIP LEVER:—Hudson Model 454-S—Should be adjusted after all other choke linkage adjustments have been made. This trip lever not used on other carburetor models.

Adjustment—Hold choke valve tightly closed with pin on fast idle came resting at bottom of slot in fast idle link. Bend trip lever stop on fast idle link so that clearance between fast idle cam and lip on trip lever is .010".

'WCD' DUAL CARBURETOR TYPE

FAST IDLE:—Consists of a fast idle cam and cam trip lever assembly mounted on the carburetor so that the cam engages the fast idle screw on the throttle shaft dog and collar assembly. Cam trip lever is linked to the choke valve shaft by a connector rod so that the cam is rotated to the fast idle position when the choke valve is closed for cold starting. As the choke valve opens, trip lever is revolved and spring returns fast idle cam to off position and throttle valves return to hot or slow idle speed position (controlled by throttle stopscrew).

Adjustment—With choke valve tightly closed, adjust fast idle screw so that clearance between throttle valve and carburetor bore on side opposite idle port is .012" (487-S), .015" (490-S), .012" (509-S). To make this adjustment, back off throttle stopscrew, back off fast idle adjusting screw until it just contacts high point of fast idle cam (choke valve closed and fast idle cam in fast idle position), then turn fast idle screw in 2½ turns (all models) which will provide correct throttle opening. Reset throttle stopscrew for correct hot or slow idle speed.

UNLOADER:—Consists of an ear on the throttle lever which engages fast idle cam so as to open the choke valve when the throttle valve is opened wide.

Adjustment—Two separate adjustments required as follows: **First**—Loosen screw on choke valve shaft lever, insert .010" feeler between lip on fast idle cam and boss on carburetor flange casting, hold choke valve tightly closed and tighten lever screw. **Second**—With throttle valves wide open, adjust unloader lip on throttle lever so that choke valve opening or clearance between upper edge of choke valve and air horn wall is 3/16" (use T109-28 gauge to check opening on all models).

'WDO' DUAL CARBURETOR TYPE

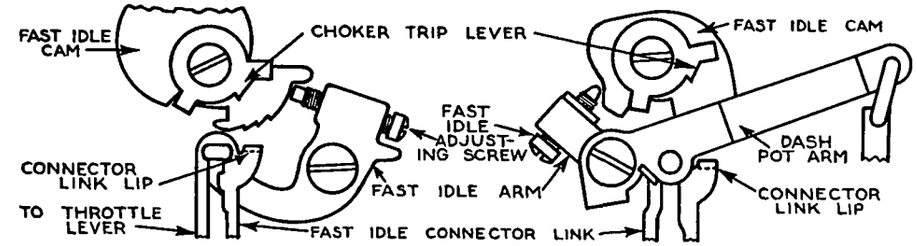
FAST IDLE:—Consists of a fast idle lever and screw mounted directly below the fast idle cam on the choke valve shaft so that the fast idle screw contacts the fast idle cam and positions the lever in accordance with the choke valve position. Fast idle lever is linked to throttle valve lever so that the throttle valve is held open in fast idle position when the choke valve is closed.

Adjustment—Hold choke valve tightly closed, adjust fast idle screw so that clearance between throttle valve and carburetor wall on side opposite idle port is correct as shown in table below (use special checking gauge inserted between edge of valve and wall to check opening).

Car Model	Carburetor	Throttle Opening	Checking Gauge
Cadillac	506-S	.023"	T109-149
Graham 109	488-S	.026"	T109-114
Hudson 6 & 8	461-S, 455-S	.018" (See Note)	T109-44
Hudson 6	501-S	.045"	
Hudson 8	502-S	.053"	
Nash 8	511-S	.015"	T109-44
Oldsmobile 8	503-S, 480-S	.015"	T109-44
Packard 8	478-S, 512-S	.030"	T109-29
Pontiac 8	469-SM	.010"	See Note
Studebaker 7C	409-S	.018"	T109-44

Note—Gauge No. T109-44 used for both .015" and .018" settings.

Hudson Note—On Carburetor Models 461-S, 455-S, fast idle can be adjusted as follows: With throttle stopscrew set for correct slow idle speed of 600 RPM., open throttle so that clearance between stopscrew and stop on carburetor casting is .030", hold in this position, close choke valve, turn fast idle adjusting screw in until it just contacts fast idle cam.



Oldsmobile Note—With correct fast idle setting, clearance between throttle valve stopscrew and stop on carburetor casting should be .030" (503-S), .025" (480-S) with choke valve closed and fast idle screw on high lobe of fast idle cam.

Pontiac Note—Fast idle can also be adjusted as follows: Back off throttle stopscrew so that throttle valves tightly closed, hold choke valve closed, back off fast idle screw so that it clears high lobe of fast idle cam, turn screw in until it barely drags on cam, then turn screw in additional 5/8 turn to provide correct .010" throttle opening. With this fast idle setting, clearance between throttle lever stopscrew and stop on carburetor casting will be .032" with stopscrew set for correct hot or slow idle speed of 7-8 MPH.

UNLOADER:—Consists of a lip on the throttle connector which engages the choke trip lever on the choke valve shaft so that the choke valve is opened when the throttle is wide open. To adjust, hold throttle valve wide open, bend lip on fast idle connector link so that clearance between upper edge of choke valve and air horn wall is correct as shown in table below (use specified gauge to check this opening).

Car Model	Carburetor	Unloader Gauge No.	Clearance
Cadillac	506-S	T109-39	13/64"
Graham 109	488-S	T109-31	1/4"
Hudson 6	461-S, 501-S	T109-31	1/4"
Hudson 8	455-S, 502-S	T109-31	1/4"
Oldsmobile 8	503-S	T109-31	1/4"
Oldsmobile 8	480-S	T109-28	3/16"
Packard 8	478-S, 512-S	T109-28	3/16"
Pontiac 8	469-SM	T109-28	3/16"
Studebaker 7C	409-S	T109-28	3/16"

Choke Valve Lock:—With unloader properly adjusted, choke valve will be locked in wide open position with throttle valves wide open. Choke valve will be released when throttle valves closed.

Car Model	Sisson Choke Model
Chrysler Six, Model C28 (1941)	AC-758B
Chrysler Eight, Models C30, C33 (1941)	AC-600
DeSoto, Model S8 (1941)	AC-758B
Dodge, Model D19 (1941)	AC-758B
Plymouth P11, P12 ('41)—Accessory Equipment	AC-758B

DESCRIPTION:—The Sisson Automatic Choke is a separate unit mounted on the exhaust manifold and connected to the carburetor choke valve lever by a connector rod. A solenoid within the choke case is connected to the starter side of the starting switch so that the solenoid is energized while the starter is operating. A thermostat is also mounted within the choke case and the solenoid and thermostat operate together to close the choke valve for cold starting and to control the choke valve during the warming up period. The AC-700 Series (AC-758B) and AC-600 Series, while of different design, operate in the same manner.

OPERATION:—When the starter is operated to crank the engine, the automatic choke solenoid is energized, attracting the armature, and rotating the choke lever, which is attached to the choke valve lever through a control rod so that the choke valve is closed if the engine is cold. When the engine is warm this armature movement does not take place and no choking action results. When the engine begins to fire and the starting switch is opened, the solenoid circuit is broken. The choke lever is then controlled entirely by the thermostatic spring within the choke case and this tends to rotate the lever and open the choke valve as the engine warms up. With the engine at normal operating temperatures, the choke valve will be entirely open.

ADJUSTMENT:—Model AC758B—Remove air cleaner, open throttle approximately ¼. Move choke lever until hole in automatic choke shaft (opposite end from lever) lines up with slot in bearings, insert special tool, Sisson No. C-723, through hole in shaft and push tool down so that lower end engages slot in choke base mounting flange. Loosen clampscrew on choke lever, press up on lever until choke valve is closed tight (sight down air horn), hold lever in this position and tighten clampscrew. Remove tool.

Model AC-600—Remove air cleaner, open throttle approximately ¼, take off automatic choke cover. Clamp special adjusting tool, Sisson No. AC-620, in place on choke so that end of tool enters and lines up hole in armature and hole in magnet core, move flat bar on tool so that armature is locked tightly against magnet core. Loosen clampscrew on choke lever, move lever until choke valve is closed tight (sight down air horn), hold lever in this position and tighten clampscrew. Remove tool and replace automatic choke cover.

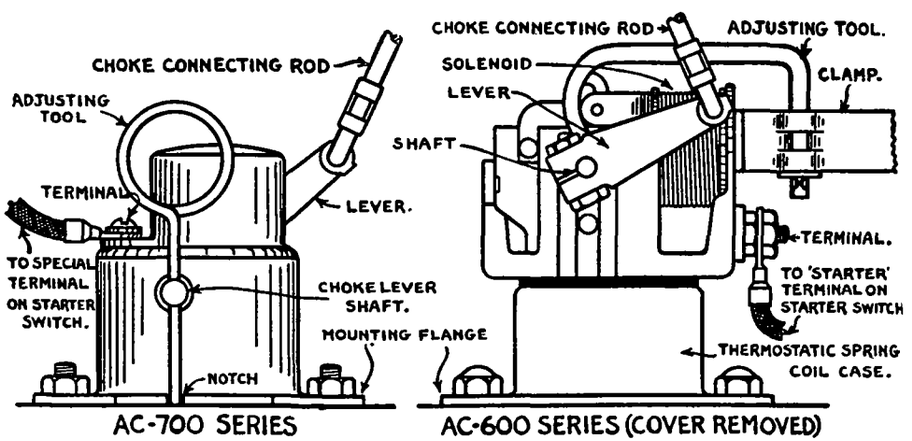
CAUTION—When replacing air cleaner, make certain that clamp not tightened excessively which may cause choke valve to bind. See that choke valve does not bind or stick and that entire choke mechanism and fast idle linkage operate freely. Always check choke adjustment with throttle partly open. See car model 'T&E' page for Throttle-Cracker adjustment.

SERVICING:—If Trouble Shooting directions below do not correct faulty operation, remove Automatic Choke Unit and test operation on test fixture such as Sisson Model AC-753. Replace units which are defective. Do not oil any part of choke mechanism. When installing choke, make certain that heat insulating gasket is in place between exhaust manifold and choke case. Do not use a terminal screw on AC-758B models which is longer than original screw (Caution—a longer terminal screw will interefere with correct operation).

TROUBLE SHOOTING:—If engine does not start or warm up properly, and for all hard starting complants due to faulty choke operation, check following points first before replacing Automatic Choke.

Hard Starting with Cold Engine:

1. Check fast idle mechanism to see that it is free and not binding at any point (fast idle connecting rods usually connected to choke valve lever and binding will interfere with choke action).
2. See that choke rod connecting Automatic Choke lever and choke valve lever does not bind in levers.
3. Examine carburetor choke lever, Automatic Choke lever, and fast idle mechanism and remove all paint, grease, or dirt which might cause binding.
4. Check carburetor choke valve, see that edges are smooth and that valve does not rub against air horn walls or bind in any position. See that air cleaner does not interfere with choke valve and that mounting screw is not tightened excessively which will distort air horn and bind choke valve (check choke valve operation with air cleaner in place).
5. Check electrical connections at Automatic Choke and starter switch. Examine wire for short-circuits and breaks.
6. Check Automatic Choke ground (unit grounded through case). See that mounting screws are tight and that manifold under mounting flange is clean.
7. Check throttle cracking linkage (see Tune up instructions on car model page). This is important to insure correct throttle opening for starting and to place automatic choke in operation (on some cars with fast idles, fast idle will prevent choke valve closing until throttle valve has been opened to free fast idle cam).
8. Check Automatic Choke adjustment (see instructions above). If Automatic Choke does not function correctly after checking these points, the unit should be replaced.



Hard Starting with Hot Engine:

1. Check for rich mixture or flooding caused by percolating discharge of carburetor when engine stopped. To check, remove air cleaner immediately after stopping engine, note whether gasoline dripping into manifold from carburetor nozzle (this overflow should show up within 3-5 minutes after engine is stopped). Correct by installing special size Float Valve Needle and Seat Assembly and checking float level. See carburetor article in Carburetor Section for float level specifications.
2. Check carburetor for High Float Level. See Carburetor article in Carburetor Section for Float Level specifications and adjusting directions.

Engine Stalls while Cold:

1. Check Manifold Heat Control Valve. See Manifold Heat Control data on car model 'T&E' page for directions.
2. Check carburetor Fast Idle setting. See Carburetor article in Carburetor Section for directions.

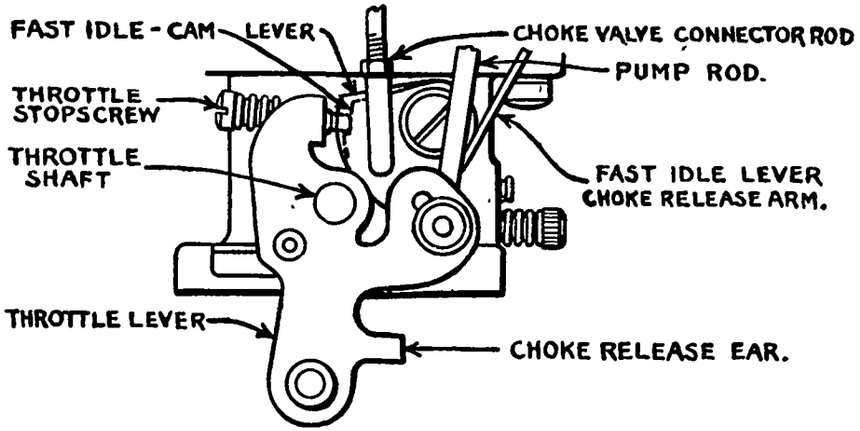
CHRYSLER EIGHT FAST IDLE

Car Model	Carburetor	Automatic Choke
Chrysler Eight, C30, C33 (1941)	Stromberg AAV-2	Sisson AC-600

NOTE:—This Carburetor and Fast Idle is used in conjunction with a separately mounted automatic choke, Sisson Model AC-600. See Sisson Automatic Choke article for data on this unit.

DESCRIPTION & OPERATION:—**Fast Idle**—Consists of a stepped fast idle cam and a fast idle lever pivoted directly above the throttle valve shaft and linked to the choke valve lever. Fast idle cam serves as the stop for the throttle stopscrew. When the choke valve is closed for cold starting, fast idle cam is rotated so that the stopscrew rests on the highest step of the cam and the throttle valve is opened to the fast idle position. As the engine warms up and the choke valve opens, fast idle cam is allowed to drop down and throttle valve to close progressively until, when the choke valve is wide open, the throttle is closed to the hot or slow idle position with the stopscrew resting on the lowest step of the cam.

Unloader or Choke Release—Consists of an ear on the throttle lever which strikes an extended arm on the fast idle lever when the throttle is opened wide so that the choke valve is opened somewhat to correct flooding caused by over-choking.



SETTING & ADJUSTMENT:—**Fast Idle**—To check setting, close throttle valve so that stopscrew is against first step of fast idle cam. Move choke valve toward closed position as far as possible (do not force valve beyond point where stopscrew strikes edge of next step on fast idle cam). Choke valve opening in this position should be ⅛" (check by inserting ⅛" drill rod between edge of valve and air horn wall). Adjust by loosening locknut and changing position of ball joint on lower end of connector rod.

Choke Release—To check setting, open throttle valve wide, note choke valve opening by inserting drill rod between edge of valve and air horn wall. Opening should be 7/32". Adjust by bending arm on fast idle cam lever slightly.

CHRYSLER SLOW-CLOSING THROTTLE VACAMATIC OVERDRIVE TYPE

Used on following Models with Fluid Drive:

Chrysler Eight, Saratoga & New Yorker Models C30K, C30N (1941)

Chrysler Eight, Crown Imperial Model C33 (1941)

DESCRIPTION & OPERATION:—Throttle Guard is designed to prevent engine stalling when the accelerator pedal is released quickly. It consists of a plunger operating on a swivel block which is part of the accelerator linkage. Plunger is actuated by a spring-loaded vacuum diaphragm unit (similar to those used for vacuum spark control) connected to the engine manifold and having a relief valve at the point where it is connected to the Throttle Guard body. In normal operation, the throttle guard plunger follows the swivel in the linkage as the accelerator pedal is depressed (due to the vacuum unit spring pressure). When the accelerator pedal is released quickly, the increase in manifold vacuum acting with the throttle return spring pull offsets the vacuum unit spring pressure and the accelerator pedal return is retarded, the speed of the pedal return being controlled by the metered relief valve in the vacuum line.

SETTING:—With engine running at idle speed of 5 MPH. (5-7 MPH) in high gear on level road, throttle control plunger should just touch swivel block on throttle rod. Setting can be adjusted by loosening capscrews holding vacuum unit on throttle cross-shaft and rotating unit to proper position. Tighten capscrews after completing adjustment.

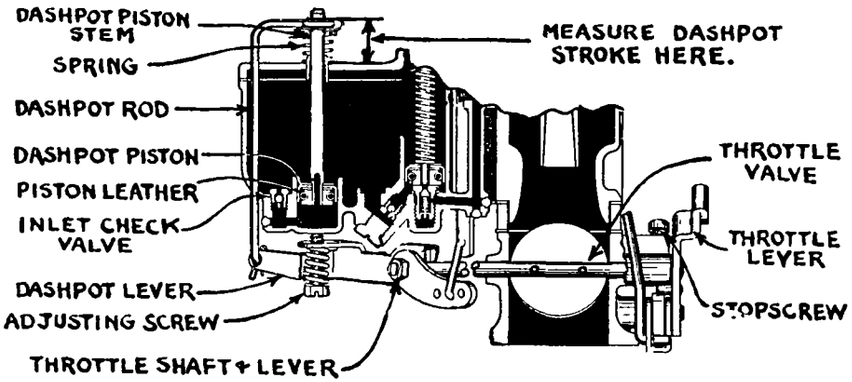
SERVICING:—**Assembly & Adjustment**—When installing throttle guard, see that carburetor adjusted for correct idle mixture and speed (smooth firing and idle speed of 5 MPH). With push pin removed, attach throttle guard and bracket so that bracket is horizontal and 1⅛" from end of tube. Hold choke valve open, close throttle so that stopscrew is against low step on fast idle cam (hot or slow idle speed position), insert stub pin setting tool, adjust nut on rear end of bell crank-to-carburetor rod so that slight drag secured on .010" feeler placed between swivel block and stub pin setting tool. Tighten locknut using extreme care not to disturb position of adjusting nut. Remove stub pin setting tool and install throttle guard push pin.

DODGE SLOW-CLOSING THROTTLE

Used on following Models with Fluid Drive:

Car Model	Carburetor
Dodge, Custom & Deluxe Model D19 (1941)	BXVD-3

NOTE:—This carburetor with Slow-closing throttle used on cars with Fluid Drive only.



DESCRIPTION & OPERATION:—The Slow-closing Throttle device consists of a dashpot and piston assembly in the float bowl with the piston linked by a rod to a control lever which engages the throttle valve lever. When the throttle is opened, dashpot cylinder is filled with fuel which flows freely in through dashpot check valve. When the accelerator pedal is released (to close throttle), this fuel is trapped in the cylinder and is allowed to escape slowly through the relief hole in the dashpot piston stem above the piston. This action retards the movement of the piston and linkage toward the closed throttle position and the linkage prevents the throttle valve closing too rapidly.

ADJUSTMENT:—Adjusting screw on dashpot control lever under float bowl should be adjusted for proper stroke (turn screw in to lengthen stroke, out to shorten stroke). Full travel of dashpot piston should be 5/16-11/32" with all slack removed from linkage. To check, place rule on float bowl cover at dashpot piston stem, measure distance from bowl cover to edge of retainer on stem, open throttle and recheck distance. Difference in readings should be 5/16-11/32".

SERVICING:—No special servicing operations required. See Carburetor article in Carburetor Section for complete carburetor servicing data including Slow-closing throttle mechanism.

CHRYSLER & DE SOTO SLOW CLOSING THROTTLE

Used on following Models with Fluid Drive:

Chrysler Six, C28 (1941)—With Vacamatic Underdrive Transmission.
Chrysler Six, C28 (1941)—With Std. Transmission (EA1 Carburetor).
DeSoto, Model S8 (1941)—With Simplimatic Underdrive Transmission.
DeSoto, Model S8 (1941)—With Std. Transmission (EB1 Carburetor).

PRODUCTION CHANGE NOTE:—Two different types of Slow-closing Throttle have been used on 1941 cars. First type (no solenoid) has adjustment screw and should be adjusted as directed below. Second type (with solenoid control) is not adjustable and does not require attention.

DESCRIPTION & OPERATION:—The Slow-closing Throttle device consists of a dashpot built in the carburetor float bowl with the dashpot piston linked to the throttle lever. When the throttle valve is opened, dashpot piston is lifted up in cylinder and cylinder fills with fuel which flows in through the fuel passage and past the check ball. When the accelerator pedal is released to close the throttle, the check ball moves up to close the large fuel passage and the fuel trapped in the cylinder prevents the dashpot piston moving down so that the throttle is prevented from closing. The fuel in the cylinder is allowed to escape through the restricted fuel passage and this allows the piston to descend slowly and the throttle valve to close slowly. The first type slow-closing throttle has an adjustment screw located in the carburetor casting directly above the upper end of the dashpot piston stem. This screw should be adjusted as directed below. Second type slow-closing throttle does not have this adjustment screw

Dashpot Solenoid (Second Type Slow-closing Throttle on Carburetor Models E6T2 & E6U2)—On this model, dashpot fuel control valve is a separate unit (valve built in dashpot plunger stem on first type) with a spring-loaded solenoid operated valve plunger directly above the fuel passage check ball. At car speeds below 8 MPH (First or Second Gear), 15 MPH. (Third or Fourth Gear), solenoid is energized and the valve plunger is drawn up so that the check ball is free to seat and shut off the large fuel passage so that fuel forced out of cylinder is required to flow through restricted fuel passage which retards closing of throttle valve and provides correct slow-closing throttle action. At car speeds above 8 MPH. (First or Second Gear), 15 MPH. (Third or Fourth Gear), solenoid is not energized and spring forces valve plunger down which prevents check ball seating. Fuel is then free to escape from cylinder through upper large fuel passage and throttle closes promptly without slow-closing throttle action.

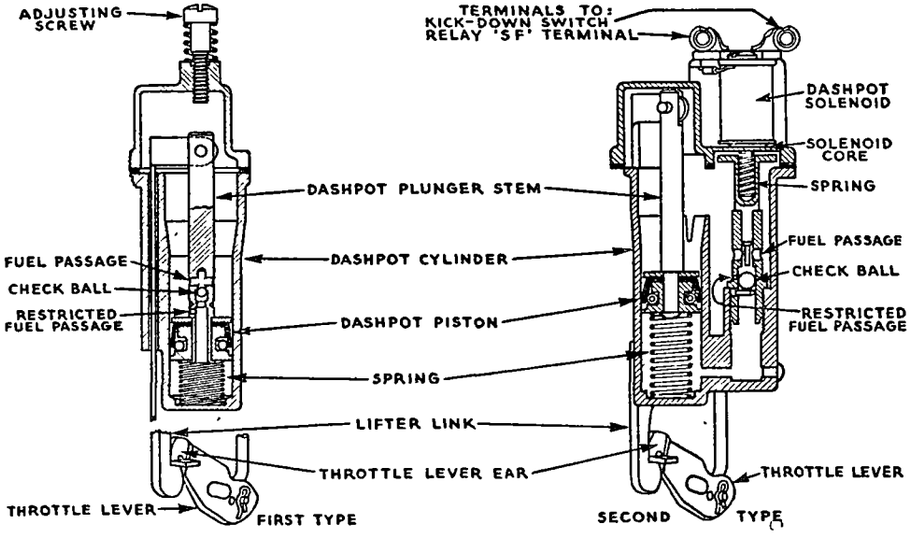
Solenoid Wiring—Solenoid has two terminals. Either terminal should be connected to the terminal on the 'Kick-down Switch' on the carburetor and the other terminal should be connected to the 'SF" terminal on the Transmission Control Relay (see car model wiring diagram on 'T&E' page for complete transmission wiring diagram). With these connections, solenoid is energized with the Governor Switch contacts closed, and inoperative with the Governor Switch contacts open (at speeds above 8 or 15 MPH. as detailed above).

ADJUSTMENT:—First Type Slow Closing Throttle (On Carburetor Models E6T1, E6U1, E6V1, EA1, EB1)—Adjustment screw should be turned out approximately 5 full turns. To adjust, turn screw in as far as possible, then back screw out exactly 5 full turns to provide correct stroke of 7/32" and check operation. If engine tends to stall when throttle is closed, retarding action is insufficient and screw should be turned out slightly. If automatic upshift is retarded, screw should be turned in slightly (too much retarding of throttle closing will delay synchronizing of gears and delay shifting).

Second Type Slow-closing Throttle (Carburetor Models E6T2, E6U2)—No adjustment required.

SERVICING:—No special servicing operations required. See Carburetor article in Carburetor Section for complete carburetor servicing data including Slow-closing Throttle mechanism.

NOTE—Leather seal on dashpot piston must be in good condition for proper operation. Worn, cracked, dry, or damaged piston seal will permit fuel escape past piston and interfere with slow-closing throttle action.



1941 PACKARD THROTTLE GUARD

Used on following Models with Econo-Drive:

Packard Clipper, Model 1951 (1941)
Packard Six, '110' Model 1900 (1941)
Packard Eight, '120' Models 1901, 1A (1941)
Packard Super Eight, '160' Models 1903, 4, 5 (1941)
Packard Custom Super Eight, '180' 1906, 7, 8 (1941)

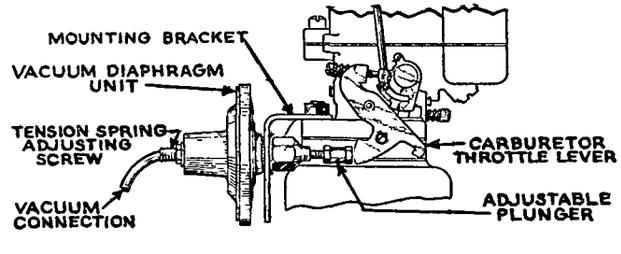
DESCRIPTION:—Throttle Guard is designed to prevent engine stalling in the range from 0 to 20 M.P.H. It consists of a vacuum diaphragm unit, similar to those used on distributors for vacuum spark control, mounted on the carburetor so that the diaphragm plunger actuates the throttle valve fast idle lever.

OPERATION:—Throttle Guard cuts in at 4 MPH. when manifold vacuum decreases sufficiently so that spring within unit forces plunger out against throttle lever opening throttle and accelerating engine to prevent stalling. Throttle Guard kicks out at 9 MPH. when manifold vacuum increases sufficiently to retract plunger and allow throttle to close to regular 6 MPH hot or slow idle speed position.

ADJUSTMENT & TESTING:—*Note*—Make certain that carburetor correctly adjusted and set for 6 MPH. hot or slow idling speed before adjusting Throttle Guard.

Adjustment—Check clearance between outer end of throttle guard plunger and lug on throttle lever. This should be .060" (Six), .020" (Eight, Super Eight). Loosen locknut and turn tension spring and adjusting screw on outer face of throttle guard until distance from top of locknut to end of screw is 3/16" (Six, Eight), 7/32" (Super 8), tighten locknut. Check setting by road-testing car.

Road Testing—See that Overdrive Control knob pushed in (Overdrive operative), allow car to coast in high gear (accelerator pedal released) and decrease car speed slowly by applying brakes. Throttle guard should cut in at 4 MPH. (slight movement of accelerator pedal will be noted) and bring car speed up to 9 MPH. (with brakes released) at which speed it should kick out. If cut in speed is above 4 MPH., decrease spring tension by turning adjusting screw out slightly; if cut in speed below 4 MPH., increase spring tension by turning screw in. If kick out speed is higher than 9 MPH., increase gap between diaphragm plunger and throttle lever (loosen locknut and turn plunger on rod); if kick out speed below 9 MPH., decrease gap.



Used On:

Car Model	Carburetor
Buick, 41-40,50,60,70,90 (1941)	AAV-16
Cadillac V8, 41-60S,61,62,63,67,75 (1941)	AAV-26
Packard Super 8, '160' 1903,4,5; '180' 1906,7,8 ('41)	AAV-26
Studebaker President, Model 7C (1941)	AAV-26

NOTE:—Buick Compound Carburetion Cars—Front carburetor only (AAV-16) is fitted with Automatic Choke and Fast Idle. Rear Carburetor (AA-1) does not have choke valve or fast idle mechanism.

Buick, Cadillac, Studebaker Models—These cars also use Carter WCD (Buick), WDO (Cadillac, Studebaker) carburetors. See Carter Climatic Control article for data on automatic choke and fast idle on cars with Carter Carburetors.

DESCRIPTION & OPERATION:—Thermostatic coil and vacuum piston type. Thermostatic coil and vacuum piston are mounted on carburetor and linked directly to choke valve lever (no external linkage). Vacuum passage (for piston operation) is drilled in carburetor casting and opens into manifold below throttle valve. Hot air tube (for thermostatic coil operation) is connected between choke housing and hot air stove on exhaust manifold. When engine is cold, thermostatic coil winds up and tends to close choke valve (valve cannot close until throttle opened momentarily to release fast idle screw from cam, but is snapped closed as soon as throttle opened). When engine begins to fire, manifold vacuum causes vacuum piston to be drawn into cylinder which opens choke valve slightly against the thermostatic coil tension to provide proper air mixture for continued running. As engine warms up, thermostatic coil tends to unwind, releasing choke valve and allowing it to open (valves are offset).

Fast Idle:—Consists of a stepped cam linked to the choke valve. When choke valve closed by thermostatic coil for cold starting, cam is revolved so that the throttle stopscrew rests on highest step of the cam and throttle is held open in fast idle position. As engine warms up and choke valve opens, cam is revolved and throttle allowed to close, until with the engine warm and choke valve wide open, throttle is closed to hot or slow idle position.

ADJUSTMENT:—Thermostatic Coil Setting—Inverted 'V' mark or '0' mark on thermostatic coil housing should line up with reference mark on choke housing (all models except Buick AAV-16 Single Carburetor on Series 41-40), 1 Notch Lean (Buick 40 with Single Carburetor) or clockwise from mark on housing. This standard setting may be varied not more than 2 graduations (AAV-26) for use of high test fuel or with exceptional operating conditions. If warming up performance is not satisfactory with this setting, check choke valve and linkage for binding or replace thermostatic coil assembly. When installing thermostatic coil, place coil housing in position with coil hook down, then rotate housing in 'Rich' direction until correct setting secured (this will insure coil hook engaging prong properly).

NOTE—For identification, thermostat coil cover has the figure '6' (All Buick models), '14' (Packard) stamped on the face of the cover near the direction arrow which is marked 'Rich.'

Studebaker Models—Choke housing on these models marked by three letters 'H', 'M', 'R'. To adjust, loosen mounting screws, rotate housing until 'R' mark lines up with reference projection on housing flange. This is standard setting. If engine tends to load up or over-choke, change setting to 'M' position. Use 'H' setting only when highly volatile fuels used.

CAUTION—When connecting heat tube, use extreme care not to use excessive pressure in tightening connection which may rotate thermosatic coil housing and change setting.

Fast Idle Setting—After setting both slow idle speed (throttle stopscrew adjustment), and fast idle speed (fast idle adjusting screw adjustment), see that choke valve is open, close throttle valve so that stopscrew is on high lobe of cam (all models except Buick for which see note below). Move the choke valve toward closed position as far as possible (do not force valve beyond point where stopscrew strikes against next step of fast idle cam). Measure remaining choke valve opening by inserting drill rod or special gauge (see table below) between edge of valve and air horn wall. If choke valve opening not correct, adjust by bending connector rod slightly at point below choke valve lever.

Buick Models—To check fast idle setting on these models, close choke valve against #53 drill (between valve and wall), open and close throttle and note clearance between locking lever on throttle valve lever and lug on loose lever mounted on fast idle cam shaft. Lever should just clear lug. Adjust by bending fast idle connector rod slightly.

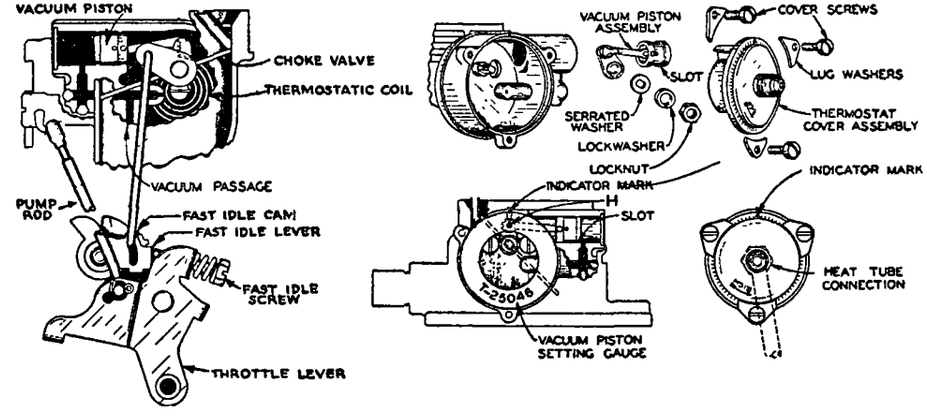
Car Model	Carburetor	Choke Valve Opening
Buick	AAV-16	See Special Data.
Cadillac	AAV-26	#32 Drill (.116")
Packard	AAV-26	7/64"
Studebaker	AAV-26	7/64"

Choke Release (Wide Open Throttle Adjustment)—Open throttle to wide open position so that choke valve is opened by ear on fast idle lever contacting lug on fast idle cam. Check choke valve opening with special gauge T-25057 (Buick), T-25056 (All Others), or by inserting drill rod between edge of choke valve and air horn wall. Opening should be .156-.187" (11/64" drill). Adjust by bending ear on throttle lever slightly.

SERVICING (EXCEPT STUDEBAKER AAV-26):—Disassembly—Disconnect heat tube, remove carburetor from manifold, remove thermostatic coil housing attaching screws and lug washers, remove coil assembly by rotating cover clockwise to disengage coil hook from lever prong and lifting cover off. Remove locknut on end of choke valve shaft (use wrench T-25047), remove nut, lockwasher, serrated washer from shaft. Take out vacuum piston assembly.

Servicing—Clean cylinder with cloth saturated with Acetone or alcohol, blow out all channels with air, clean screen on inside of cover by blowing through heat tube connection (use care not to distort screen. Do not attempt to remove thermostat coil (coil and cover serviced as an assembly).

Assembly & Adjustment—When installing vacuum piston, make certain that slot is down toward vacuum port (do not lubricate cylinder). Assemble the serrated washer, lockwasher, and locknut in order on the end of the choke shaft and tighten nut only loosely (do not tighten fully until vacuum piston adjusted). Install gauge ring, tool T-25046, with small hole in tool fitting over pin on choke lever and indicator line on rim of tool in line with reference mark on choke housing. Hold choke valve closed against drill or gauge (see table),



tighten locknut lightly with wrench T-25047, remove gauge ring T-25046 and tighten the locknut securely. Recheck the choke valve to make certain that setting not changed by tightening of locknut. See that choke valve operates freely. This adjustment is extremely important to properly position vacuum piston and thermostatic coil prong. When assembly fast idle connector rod, install bushing (washer—Buick) on lower end of rod only after rod has been assembled to lever. See that fast idle cam torsional spring is assembled with end of spring hook against ear of lever. See that cam operates freely and make certain that rod does not bind in slot in cam. This is very important.

Car Model	Carburetor	Drill — Valve Opening — Gauge
Buick 40 Single Carb.	AAV-16	15/64" — T-25086
Buick All Comp'd. Carb.	AAV-16	#5
Cadillac	AAV-26	#3 (.213")
Packard	AAV-26	#4 — T-25085

SERVICING (STUDEBAKER AAV-26):—Serviced in same manner as BXOV-26 models (vacuum piston lever slotted for choke valve shaft engagement and no adjustment required). *See Stromberg BXOV-26 Automatic Choke article for servicing data on this model.*

Used On:

Car Model	Carburetor
Packard Six, '110' Model 1900 (1941)	BXOV-26
Studebaker Commander, Model 11A (1941)	BXOV-26

NOTE:—Studebaker Model—Carter WA1 Carburetor also used on this model. See Carter Climatic Control article for data on Automatic Choke and Fast Idle on cars with Carter Carburetor.

DESCRIPTION & OPERATION:—Thermostatic coil and vacuum piston type. Thermostatic coil and vacuum piston are mounted on carburetor and linked directly to choke valve lever (no external linkage). Vacuum passage (for piston operation) is drilled in carburetor casting and opens into manifold below throttle valve. Hot air tube (for thermostatic coil operation) is connected between choke housing and hot air stove on exhaust manifold. When engine is cold, thermostatic coil winds up and tends to close choke valve (valve cannot close until throttle opened momentarily to release fast idle screw from cam, but is snapped closed as soon as throttle opened). When engine begins to fire, manifold vacuum causes vacuum piston to be drawn into cylinder which opens choke valve slightly against the thermostatic coil tension to provide proper air mixture for continued running. As engine warms up, thermostatic coil tends to unwind, releasing choke valve and allowing it to open (valves are offset).

Fast Idle:—Consists of a stepped cam linked to the choke valve. When choke valve closed for cold starting, cam is revolved so that throttle stopscrew rests on highest step of cam and throttle is held open in fast idle position. As engine warms up and choke valve opens, cam is revolved and throttle allowed to close, until with the engine warm and choke valve wide open, throttle is closed to hot or slow idle position.

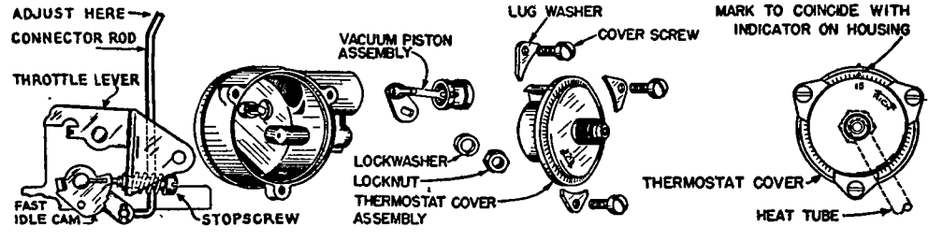
ADJUSTMENT:—Thermostatic Coil Setting—Inverted 'V' mark or '0' mark on thermostatic coil housing should line up with reference mark on choke housing. This standard setting may be varied not more than 2 graduations for use of high test fuel or with exceptional operating conditions. If warming up performance is not satisfactory with this setting, check choke valve and linkage for binding or replace thermostatic coil assembly. When installing thermostatic coil, place coil housing in position with coil hook down, then rotate housing in 'Rich' direction until correct setting secured (this will insure coil hook engaging prong properly).

Studebaker Models—Choke housing on these models marked by three letters 'H', 'M', 'R'. To adjust, loosen mounting screws, rotate housing until 'R' mark lines up with reference projection on housing flange. This is standard setting. If engine tends to load up or over-choke, change setting to 'M' position. Use 'H' setting only when highly volatile fuels used.

CAUTION—When connecting heat tube, use extreme care not to use excessive pressure in tightening connection which may rotate thermostatic coil housing and change setting.

Fast Idle Setting—With choke valve open, close throttle so that stop-screw is on low lobe of fast idle cam and against step on cam. Move choke valve toward closed position as far as possible (do not force valve beyond point where all clearance is taken up). Check remaining choke valve opening by inserting 11/32" drill rod between edge of choke valve and air horn wall. If opening not correct, adjust by bending connector rod slightly at bend near upper end. CAUTION—Make certain that fast idle mechanism does not bind.

SERVICING:—Disassembly—Disconnect heat tube from thermostat coil cover, remove carburetor from manifold. Remove thermostat coil cover attaching screws and lug washers, remove thermostat coil and cover assembly (rotate cover clockwise to disengage coil hook from lever prong). Remove cork insulator and baffle plate. Remove locknut on end of choke valve shaft (use wrench T-25047), remove lockwasher. Loosen housing attaching screws slightly (do not take screws out), take out vacuum piston assembly.



Servicing—Clean vacuum piston cylinder with clean cloth saturated with Acetone or alcohol. Clean vacuum piston (do not use abrasives). Blow out all channels with compressed air. Do not attempt to remove thermostatic coil from housing (service as an assembly).

Assembly—Do not lubricate piston or cylinder when installing vacuum piston assembly. Install piston and engage slot in lever on flatted end of choke valve shaft (can only be installed in correct position), tighten housing attaching screws securely. Install lockwasher and and locknut, use wrench T-25047 to tighten locknut securely. Install baffle plate and cork insulator (CAUTION—if cork insulator buckled or does not fit properly, it will cause vacuum piston lever to bind and new insulator should be used). Install thermostat coil and cover assembly and adjust as directed above.

1941 MECHANICAL CAR MODEL INDEX

IMPORTANT—Refer to "FIELD & PRODUCTION CHANGES, NEW TYPE UNITS, SPECIAL SERVICE NOTES" at front of 1941 Tune Up & Electrical pages.

Car	Model	Year	Page
AMERICAR			See Willys
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BUICK SPECIAL SHOP NOTES For All 1941 Models			M-339, 40
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BUICK	41-60, 41-70, 41-90	1941	M-342
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CHEVROLET SPECIAL SHOP NOTES For All 1941 Models			M-346, 7
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CHEVROLET	AJ, AK, AL, AN, Y Comm'l. & Trucks	1941	M-350
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CHRYSLER	C28 Royal & Windsor	1941	M-353
CHRYSLER	C30K, C30N Saratoga & NewYorker	1941	M-354, 5
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CROSLEY SPECIAL SHOP NOTES For 1941 Model			M-357
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DE SOTO SPECIAL SHOP NOTES For 1941 Model			M-351, 2
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DODGE	D19 Luxury Liner Deluxe & Custom	1941	M-359
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FORD	1ND, 1NY 4 Cyl. Truck	1941	M-362, 3
FORD	Trucks (All 'V8' Models)	1941	M-362, 3
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GRAHAM	113 Hollywood	1941	M-364
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HUDSON	10, 11, 12 Sixes; 10, 18 Business Cars	1941	M-367, 8
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LINCOLN SPECIAL SHOP NOTES For All 1941 Models			M-370
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MERCURY SPECIAL SHOP NOTES For 1941 Model			M-360
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PACKARD SPECIAL SHOP NOTES For All 1941 Models			M-380
PACKARD	1951 Clipper	1941	M-381
PACKARD	1900 '110' Six	1941	M-382
PACKARD	1901, 1A '120' Eight	1941	M-383
PACKARD	1903, 3A, 4, 5 '160' Super Eight	1941	M-384
PACKARD	1906, 7, 8 '180' Cust. Super Eight	1941	M-384
PLYMOUTH SPECIAL SHOP NOTES For All 1941 Models			M-351, 2
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PONTIAC	41-24, 41-25, 41-26 Sixes	1941	M-388
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STUDEBAKER SPECIAL SHOP NOTES For All 1941 Models			M-390, 1
STUDEBAKER	3G Champion	1941	M-392
STUDEBAKER	11A Commander	1941	M-393
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WILLYS	441 Pick-Up, 441P Panel Delivery	1941	M-395, 6

BANTAM NOTE—All Bantam Model 65 (1941) Specifications and Service Data same as for 1940 model. Refer to 1940 Supplement for Bantam Model 65 (1940).

TORQUE WRENCH SPECIFICATIONS:—*See Torque Wrench article in Mechanical Equipment Section for tightening specifications for Cylinder Head, Main & Connecting Rod Bolts, etc.*

HOOD LOCK:—Hood hinged at each side. Hood fastener handle (part of louvre moulding stamped with car model name, Special, etc.) located at each side. To raise hood, pull out fastener handle, push in on safety catch rod with red rubber covering (under fastener handle) and hold until hood raised. Hood can be held open with support arm on upper edge of engine dash.

HOOD REMOVAL:—Unlatch both hood fasteners (at each side), release safety catches and lift hood off. No tools required.

HOOD ADJUSTMENT:—Hood Fastener. Fasteners must pass over and inside of ribs in fastener plates under edge of hood at each side. Outer edges of fasteners must be parallel to hood flanges when locked. Adjust by removing cotter pin holding operating link in rear fastener. Change operating link rod length by turning rod in or out of trunnion on handle until outer edge of fasteners are parallel to fender flange with fastener closed.

Hood Pilot—Adjust pilots in fender (to rear of each fastener) for proper hood fit to fender and cowl.

Grille to Hood Nose—Hood clearance between hood nose and top center grille strip should be ⅛". Adjust bolted bracket at top rear of grille on radiator stamped cover.

Rear Brackets—U shaped hood hinge located at upper rear corner of each front fender at cowl. These hinges or brackets prevent hood from contacting door if door opened as hood is raised. With hood raised, rear corner of hood must contact shroud. To adjust, bend outer edge of bracket until hood corner contacts shroud.

FRONT FENDER REMOVAL:—Fender forms hood side panel, headlamp shell, and part of radiator shell. Fender can be removed as follows: Disconnect headlamp wires at rear of junction blocks. Remove stamped cover over radiator (fastened to upper flange of front fenders) and insert pin in hole to secure fender to radiator mounting strap. Remove radiator side grille (work from above after stamped cover removed). Remove fender bolts from top flange of skirt, radiator lower panel, and skirt at gravel deflector. Remove cowl trim board and nuts (inside car). Remove fender-to-rocker panel bolts at lower rear corner of fender. Remove fender-to-cowl bolt at hinge pillar and lift off fender.

COMPRESSION RATIO CHANGE (FIRST CARS WITH COMPOUND CARBURETION):—On engines with first type Cylinder Head (see Production Change Note below) and compression ratio of 7.0-1, compression ratio can be lowered to correct spark rap by installing thicker head gaskets as listed below. *See Cylinder Head Gasket Installation data below.*

Model	Replacement Gasket	Compr. Ratio
40,50	No. 1323288①	6.67-1
60,70,90	No. 1297992②	6.68-1

①—This is production gasket used on later Series 41-40 cars with Single Carburetor.

②—This is 1940 type gasket which is .050" thick.

CYLINDER HEAD & COMPRESSION RATIO PRODUCTION CHANGE (ALL MODELS):—For lower compression ratio on all Compound Carburetion engines, new cylinder heads with combustion chamber depth increased by .032" were used in production on all cars after following Engine Numbers: 4220016 (40 with Single Carburetor), 4208629 to 4210399 and all engines after 4215901 (40,50 with Compound Carburetion), 4197602 (60, 70, 90). See special head gasket data below. IMPORTANT NOTE—Since these new heads also used on 40 with Single Carburetor, new .050" gasket used (original gasket .070" thick) for approximately same compression ratio (6.5-1 first, 6.4-1 later). See complete Head Gasket data following.

Cylinder Head Marking:—All cylinder heads machined for new compression ratio (above) marked 'L' at front end of spark plug cover face.

Cylinder Head Gaskets:—Gaskets unchanged on all Compound Carburetion Engines (.015" thick crimped type), change in compression ratio being effected by machining out head. On Series 41-40 with Single Carburetor, new thinner gasket (.050" thick—first type .070" thick) used to secure approximately same compression ratio with new head (same machined out head as used on other engines). NOTE—This new Series 41-40 gasket, Part No. 1323288, may be used on 1940 Series 40 & 50 cars (1940 gasket, No. 1303962, may be used on 1941 Series 40 but 1941 type is preferred as ferrules between cylinder bores provide greater strength). *See Cylinder Head Gasket Installation data below.*

Compression Ratio & Head Gaskets

Car Model	Ratio	Gasket	Ratio	Gasket
40 Single Carb	6.5-1	1321396	6.4-1	1323288
40,50 Compd.	7.0-1	1320433	6.7-1	1320433
60,70,90 Compd	7.0-1	1320436	6.7-1	1320436

CYLINDER HEAD GASKET INSTALLATION:—Gaskets now coated with lacquer. Whenever cylinder head removed, head and block should be thoroughly cleaned to remove any trace of lacquer from old gasket. **Do not use any type of coating (gasket oil, or sealer) when installing this new lacquer-coated cylinder head gasket. Always use new gasket whenever cylinder head installed.** These gaskets are crimped type. See Cylinder Head Gasket Installation (Series 50 & 70) for special instructions on these models.

Series 41-40 Gasket Note—Two types of head gaskets used: (1) Engines with single carburetors use Steelbestos type (.070" or .050" thick—see Production Change Note above). (2) Engines with Compound Carburetion use crimped gasket .015" thick.

CYLINDER HEAD GASKET INSTALLATION (SERIES 50 & 70):—Engine dash protrudes over rear of engine and cylinder head must be pushed forward when it is removed in order to clear body. #16 push rod must be removed and installed with cylinder head in order to avoid damage to push rod. To install cylinder head and gasket with least possibility of damage to gasket, car manufacturer recommends following procedure be used: Loosen exhaust pipe and pull away from engine to allow clearance for gasket (carburetor and manifold assemblies may be left in position on exhaust pipe). Set cylinder head in position on top of engine before installing head gasket. Tilt head up on right side with edge of head resting on top of push rod cover. Tilt head up on left side just enough to insert cylinder head gasket from left side. Set head flat on block and gasket, align gasket with hole in head and block. To minimize possibility oil leak between edges of cylinder head gasket and push rod cover, head gasket should be pushed toward push rod cover as far as possible.

INSTALLING 14 MM. SPARK PLUGS ON FIRST CARS:—These new 14 MM. spark plugs used on all engines after following Engine Numbers: 4306734 to 4309599 inclusive and 4316800 Up (40 with Single Carburetor), 4306735 to 4309599 inclusive and 4312638 Up (40, 50 Compound Carburetion), 4287873 (60,70,90). On cars before above Engine Numbers which were equipped with 10 MM. spark plugs, the new 14 MM. spark plugs may be installed to correct complaints of spark plugs fouling and causing uneven engine operation. To install these 14 MM. plugs, follow instructions given below.

IMPORTANT NOTE—The 10 MM. spark plugs were changed in production from No. 104 to No. 106 and all No. 104 plugs should be replaced by one of following types: No. 104 with dash under 0, No. 106 with dash under 0, No. 106 without dash. Before changing to 14 MM. spark plugs, make certain that complaints not caused by use of these original No. 104 plugs.

Cylinder Head Fixture:—Wooden holding fixture should be made up so that head can be mounted on bench with spark plug holes vertical. To make this fixture, mount two 1¾" thick, 4⅜" high, blocks on base so that total length (to outside edge of blocks) is 30¼" (this dimension important so that fixture can be used on all heads). Cut 90° 'V' notch in each block so that one side of 'V' raised 25° from the horizontal. This will support head at angle with spark plug holes vertical.

Drilling Cylinder Head:—With cylinder head mounted on fixture on bench, thoroughly clean spark plug recess and mount drill guide bushing, No. J-1747-1, on spark plug seat using extreme care to see that bushing seats squarely on seat. Use ½" twist drill in portable electric drill to drill out spark plug hole. CAUTION—Bushing must be used to guide drill and bushing must be installed squarely on seat to insure holes being drilled properly in cylinder head.

Tapping Cylinder Head:—Use special tap guide bushing, No. J-1747-2, and regular 14 mm.-1.25 tap to thread each spark plug hole. Use extreme care to secure good threads.

Installing Spark Plugs & Cylinder Head:—When head is reworked as directed above, spark plug gasket seat will be tapered (not flat). Install spark plugs with one gasket. Check cylinder head gasket and install correct gasket for desired compression ratio as directed above (On first cars with compression ratio of 7.0-1, thicker gasket may be installed to lower compression ratio if complaints of spark rap being corrected). *See Compression Ratio Change data above.*

ENGINE MOUNTINGS:—Identification. Part numbers moulded in rubber section of mounting. When two part numbers used, part number determined by color name (black or red) following number. If rubber black use part number preceding the word black, if rubber red or mounting paint marked red, use part number preceding word red.

Front Mounting—On Series 40, 50, 60, 70 same mounting used (also same on both right and left sides). Series 40, 50 mounting installed with bolt flange to rear, Series 60, 70 to front. Series 90 use similar type but bolt holes are different and right and left mountings are not the same.

Center Mounting—Single mounting used on bottom front end of transmission. Mounting same for all series except that softer rubber used on Series 40, 50. Mounting secured to front face of transmission by two special head bolts, to top of frame crossmember by two bolts (bolt holes in support slotted for fore and aft positioning), and to forward side of cross member by one bolt and shims (to take up space for fore and aft positioning). Mounting not adjustable for up and down position.

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Transmission Support Mounting:—Saddle type mounting under universal joint (torque ball) housing mounted on cross-member bolted to each leg of 'X' member. Brace rod connected between cross-member and under side of 'X' member. Shims provided at each end of cross-member. Softer rubber used in Series 40, 50 mounting. Install mounting with thin portion of rubber section to front. This mounting is a positioning member only (does not support weight of engine).

Engine Mounting Adjustment:—Loosen all mountings on frame, loosen transmission support rod at mounting, loosen transmission support cross-member at frame ends (with mounting tight at torque ball), and center torque tube and ball joint in frame X-member. For proper engine mounting adjustment proceed as follows: Tighten right and left front engine mountings to engine and frame. Tighten center engine mounting to transmission and frame cross-member (use shims to take up space between forward web of frame cross-member and lower mounting flange at lower bolt). Tighten transmission support mounting to transmission and transmission support (cross-member). Shim transmission support at frame ends without disturbing its normal position. Tighten rod at transmission support without placing any 'push' or 'pull' tension on rod.

CYLINDER BORE SIZES:—Original production (new engine) bore size indicated on all engines by number and color of paint marks on lower crankcase flange, under gasket, in line with each cylinder (not uniform for all cylinders of one block). See table below for sizes and markings.

.010" Oversize Production Engines:—Factory engines equipped with .010" (low limit) pistons marked by dash (—) following engine number.

Color Markings:—Cylinder bore paint marks on lower crankcase flange on right side extend from underneath oil pan gasket. Piston paint marks on underside of one or both piston bosses visible from below with oil pan removed (pistons need not be removed).

PISTONS (ORIGINAL PRODUCTION):—Pistons graded for size in .0003" steps and marked by one or two color marks below pin bosses within skirt. Pistons fitted in .010" Oversize Production Engines are low limit .010" oversize pistons. All replacement pistons fitted with piston pins. See table below for original piston size for all original cylinder bore sizes.

Series 40, 50—Original Production

Piston Diameter 3 3/32"

Piston & Engine Mark	Piston Diameter	Cylinder Diameter
XX—Yellow	3.0886-3.0889"	3.0907-3.0910"
X —Yellow	3.0889-3.0892"	3.0910-3.0913"
• —Yellow	3.0892-3.0895"	3.0913-3.0916"
•• —Yellow	3.0895-3.0898"	3.0916-3.0919"
• —Green	3.0898-3.0901"	3.0919-3.0922"
•• —Green	3.0901-3.0904"	3.0922-3.0925"
• —White	3.0904-3.0907"	3.0925-3.0928"
•• —White	3.0907-3.0910"	3.0928-3.0931"
• —Red	3.0910-3.0913"	3.0931-3.0934"
•• —Red	3.0913-3.0916"	3.0934-3.0937"
• —Blue	3.0916-3.0919"	3.0937-3.0940"
•• —Blue	3.0919-3.0922"	3.0940-3.0943"

Series 60, 70, 90—Original Production

Piston Diameter 3 7/16"

Piston & Engine Mark	Piston Diameter	Cylinder Diameter
XX—Yellow	3.4334-3.4337"	3.4357-3.4360"
X —Yellow	3.4337-3.4340"	3.4360-3.4363"
• —Yellow	3.4340-3.4343"	3.4363-3.4366"
•• —Yellow	3.4343-3.4346"	3.4366-3.4369"
• —Green	3.4346-3.4349"	3.4369-3.4372"
•• —Green	3.4349-3.4352"	3.4372-3.4375"
• —White	3.4352-3.4355"	3.4375-3.4378"
•• —White	3.4355-3.4358"	3.4378-3.4381"
• —Red	3.4358-3.4361"	3.4381-3.4384"
•• —Red	3.4361-3.4364"	3.4384-3.4387"
• —Blue	3.4364-3.4367"	3.4387-3.4390"
•• —Blue	3.4367-3.4370"	3.4390-3.4393"

PISTONS (REPLACEMENT SERVICE):—Pistons furnished in following sizes for service (not graded and marked as for earlier car models).

Series 40, 50—Replacement Pistons

Nominal Size	Piston Diameter	Part Number
Standard①	3.0910-3.0922"	1393028
.005" Oversize	3.0966-3.0972"	1393029
.010" Oversize	3.1016-3.1022"	1393030
.015" Oversize	3.1066-3.1072"	1393031
.020" Oversize	3.1116-3.1122"	1393032
.030" Oversize	3.1216-3.1222"	1393033

Series 60, 70, 90—Replacement Pistons

Nominal Size	Piston Diameter	Part Number
Standard①	3.4358-3.4370"	1393034
.005" Oversize	3.4414-3.4420"	1393035
.010" Oversize	3.4464-3.4470"	1393036
.015" Oversize	3.4514-3.4520"	1393037
.020" Oversize	3.4564-3.4570"	1393038
.030" Oversize	3.4664-3.4670"	1393039

①—Standard size pistons supplied for service are all high limit pistons (or same as .001" oversize pistons). Therefore no .001" oversize furnished.

Piston Diameter—Measure at top of skirt at right angles to wrist pin bosses (greatest diameter) with pistons at 70° F. minimum.

Piston Fitting—Clearance .0018-.0024" (40, 50), .0020-.0026" (60, 70, 90). See 1941 Buick 'M' pages for fitting piston with feeler gauges.

REPLACEMENT PISTON RINGS:—Car manufacturer supplies oversize rings in sizes listed below and recommends that they be fitted to pistons as follows:

Ring Oversize	Piston Oversize
.010"	.005" to .010"
.020"	.011" to .020"
.030"	.021" to .030"

Replacement Ring Sets—Cylinder bores up to .005" maximum taper can usually be serviced by installing Perfect Circle X-90 piston ring set. To correct oil consumption in slightly worn engines, use new regular compression rings and two oil control rings of #3 type (which has narrower cylinder wall contact than #4 ring and gives more control during break-in) in both #3 and #4 piston ring grooves.

Excessive Oil Consumption Note—When installing rings to correct this condition use a fine hone very lightly on all bores (just enough to dull glaze surface and not changing bore size). This will allow quicker break-in of new rings. See Replacement Ring Sets (above) for optional ring sets and oil consumption correction in slightly worn engines.

Piston Ring Tool—Use service tool KMO-297-E (40, 50), KMO-297-D (60, 70, 90) for removing and installing rings.

REPLACEMENT MAIN BEARINGS:—Bearings are furnished (singly) or finished (sets only) as follows:

Unfinished—Have .012-.014" diameter extra babbitt stock and must be line-reamed to size.

Finished—Furnished in sets of 5 only which are finish-reamed as a set and require no reaming when installed (must not be used singly).

REAR MAIN BEARING OIL SEAL:—Cork gaskets used between vertical joint of bearing cap and crankcase, special packing gasket assembled in crankcase and bearing cap to rear of oil collecting groove on crankshaft. Bearing grooved ahead of oil collecting groove on crankshaft with drain hole into crankcase.

Installation—Use new cork gaskets and packing gasket. Packing gasket must be cut 3/64" above face of bearing for tight fit when assembled. Operate engine slowly when first starting after installing new oil seals.

#16 PUSH ROD INSTALLATION & REMOVAL (SERIES 50 & 70):—See Cylinder Head Gasket Installation (above) for removal and installation procedure.

ROCKER ARMS:—Same as 1940. Rocker arms are mounted on tubular shaft and held against side of shaft brackets by spring installed on shaft between adjacent rocker arms. Shaft retained in brackets by pilot setscrew installed in top of #2 bracket. When installing rocker arms, make certain that lug on side of arm at adjusting screw end is toward bracket (all rocker arms Series 40, 50, intake rocker arms Series 60, 70, 90). Exhaust rocker arms for Series 60, 70, 90 are straight (not offset) and do not have reference lug.

Rocker Arm Clearance—.002-.004".

Rocker Arm Lubrication Connection:—Metering restriction for oil feed to hollow rocker arm shaft located in cylinder head and oil pipe fitted directly into top of #1 bracket. #1 and #2 brackets are same part and shaft pilot screw is self-tapping type.

OIL PUMP:—Slot in pump shaft engages tongue on end of distributor shaft. Distributor shaft only pinned to drive gear.

Drive Clearances—Drive shaft bearing .001-.0025". Drive gear backlash .003-.005".

Pump Gear Clearances—Idler gear bearing .001-.0025". Backlash .003-.006". End Clearance .0005-.004".

Relief Valve Clearance—.003-.006".

CLUTCH PEDAL RETURN SPRING:—All models equipped with over-center type pedal return spring mounted between clutch pedal and frame. Tighten bracket mounting eyebolt nut up to limit of threads so as to stretch spring as much as possible. When removing clutch or brake pedal bracket, back off nut on eyebolt first to relieve spring tension.

TRANSMISSION STEADY REST:—See Engine Mountings (Transmission Support Mounting) above for complete data.

HOOD REMOVAL & ADJUSTMENT DATA, FRONT FENDER REMOVAL:—*See Buick Shop Notes.*

SERIAL NUMBER:—First number 1-3880108 (Flint), 2-3892008 (California), 3-3897008 (Linden). Stamped on tag attached to front of dash on right side.

ENGINE NUMBER:—First number (40) 4 — , (50) 5—4074859 (same number for both series). On boss on right side of crankcase behind oil filter.

.010" Oversize Engines—Engines factory-equipped with .010" OS. pistons marked (—) after Engine No.

ENGINE SPECIFICATIONS:—**Own 40, 50.** 8 cylinder, 'I' head type. **Bore**—3 3/32". **Stroke**—4⅛".

Displacement—248 cu. ins. **Rated HP**—30.63.

Developed Horsepower—115 at 3500 RPM (40 Single Carb.), 125 at 3800 RPM (40 Comp. Carb., 50).

Compression Ratio—6.5-1 (First 40—Single Carb.), 6.4-1 (Later 40—Single Carb.), 7.0-1 (First 40,50—Compound Carb.), 6.7-1 (Later 40,50—Compound Carb.).

See Buick Shop Notes for Compression Ratio change, New Cylinder Heads, and special Head Gasket Data.

Compression Pressure—142 lbs. (6.5-1 hd.), 148 lbs. (7.0-1 hd.) at 1000 RPM (uniform within 6 lbs.).

Vacuum Reading—Steady 18-20" idling at 7-8 MPH.

See Buick Shop Notes for Engine Mounting Adj. data.

PISTONS:—Fireball, turbulator top, aluminum alloy, transverse slot, full skirt, cam ground type with anodized finish. No 'T-slot' used. *See Buick Shop Notes for size identification (color marks) and Replacement Piston data.* **Length**—4 5/16".

Weight—13.78 ozs. (stripped), 19.84 (rings and pin).

Removal—Pistons and rods removed from above.

Clearance—.0021" (.0018-.0024") at top of skirt.

Fitting New Pistons—If micrometer used, check at point 90° from pin hole just below transverse slot. Clearance above correct with piston at 70°F. If feeler gauge used, insert ½" x 12" feeler between piston and cylinder wall at right angle to pin bosses (piston inverted, pin parallel to crankshaft). Piston should pass on .0015" feeler, hold on .00225".

Installing Pistons:—Hollowed side to camshaft.

PISTON RINGS:—Two compression (#1 notched, #2 taper faced), two slotted oil rings (#3 heavy duty, #4 regular) per piston, all above pin (heat-dam groove above top ring groove.

NOTE—Install top compression ring with relief up, #2 compression with mark TOP up.

Ring	Width	End Gap	Side Clearance
Compr. ①	3/32"	.010-.020"	.0015-.0035"
Oil Control	3/16"	.010-.020"	.0015-.003"

①—Wall thickness Top .155", #2 .140".

Replacement Rings:—*See Buick Shop Notes for data.*

PISTON PIN:—**Diameter**—.8127". **Length**—2 11/16". Pin clamped in rod. Pins not furnished separately. All replacement pistons have fitted pins installed.

Pin Fit in Piston—.0003-.0004" @ 70° (easy finger push). NOTE—Pin clamp bolt tension 25-30 ft. lbs.

CONNECTING ROD:—**Length**—7⅝". **Weight**—28.46 ozs.

Crankpin Journal Diameter—2".

Lower Bearing—Spun babbitt-lined type.

Clearance—.0008-.0018". **Sideplay**—.005-.010".

Bearing Adjustment:—Shims. Do not file rods or caps.

Installing Rods:—Marks on rod and cap toward rear of engine, oil hole to camshaft. Align rod and cap.

NOTE—Use special ground bolts & palnuts on caps.

CRANKSHAFT:—5 bearing, 8 integral counterweights.

Journal Diameters—#1, 2 5/16"; #2, 2⅜"; #3, 2 7/16"; #4, 2½"; #5, 2 9/16".

Bearings—Steel-backed, durex-lined, slip-in type. *See Buick Shop Notes for Replacement Bearing data and Rear Main Oil Seal Installation.*

Clearance—.0007-.0022".

Bearing Adjustment:—Shims. Do not file caps.

End Thrust:—Center (#3) bearing. **Endplay** .004-.008".

CAMSHAFT:—5 bearing. Non-adjustable chain drive.

Journal Diameters—#1, 2 5/32"; #2, 2⅛"; #3, 2 3/32; #4, 2 1/16"; #5, 1¾".

Bearing Type—Steel-backed, babbitt bushings.

Clearance—.0005-.0035".

End Thrust:—Thrust plate between front bearing and camshaft sprocket. **Endplay**—.004-.008".

Timing Chain:—Link-Belt. Width 1". Pitch .500". Lgth. 24½" or 49 links. Initial slack ¼-⅜". 1" worn.

Camshaft Setting:—Mesh copper-plated washers on chain (10 links apart) with sprocket marks upward.

VALVES:—

	Head Diam.	Stem Diam.	Overall Length
Intake	1 17/32"	.3720"	5 7/64"
Exhaust	1 11/32"	.3715"	5 7/64"

	Seat Angle	Lift	Stem Clearance
Intake	45°	.348"	.0015-.0035"
Exhaust	45°	.348"	.0021-.0039"

Series 50 Note—#16 push rod must be removed and installed with cylinder head. *See Buick Shop Notes*

Tappet Clearance:—.015" all valves—engine hot.

Valve Guides:—Press fit in head, installed with stepped end up. Finish ream for correct clearance.

Valve Springs:—Double springs on all valves. Spring free length 1⅞" (inner), 2 5/16" (outer).

	Inner Spring Pressure	Inner Spring Length	Outer Spring Pressure	Outer Spring Length
Closed	15½-20½ lbs.	1 21/32"	26½-31½ lbs.	1 15/16"
Open	45-51 lbs.	1 5/16"	67-73 lbs.	1 19/32"

Valve Lifters:—Barrel type, cast iron. Lifter guide holes reamed in block. **Clearance**—.0005-.0025".

Rocker Arms:—*See Buick Shop Notes for installation*

Valve Timing:—See Camshaft Setting above.

Timing Points (Valve .004" Open)

Intake Valves—Open 13° BTDC. Close 68° ALDC.

Exhaust Valves—Open 55° BLDC. Close 22° ATDC.

Opening and Closing Points

Intake Valves—Open 26° BTDC. Close 81½° ALDC.

Exhaust Valves—Open 68° BLDC. Close 35° ATDC.

Valve Timing Check—With .015" tappet clearance, #2 or 7 exhaust valve should be .145" open (actual valve opening—use dial indicator) with #1 & 8 pistons at TDC and flywheel mark 'U.D.C/1&8' at indicator (inspection hole, right front face of housing).

LUBRICATION:—Pressure type (gear type oil pump in crankcase). *See Buick Shop Notes for Oil Pump data.*

Normal Oil Pressure:—45 lbs. at 35 MPH.

Oil Pressure Regulator:—On pump. Opens at 45 lbs.

Crankcase Capacity:—8 qts. (dry), 6 qts. (refill).

COOLING SYSTEM:—**Cap.** 13 qts. (14¼ with heater).

Pressure Valve—In filler cap. Opens at 7 lbs.

Water Pump:—Ball-bearing, packless type.

For complete data, refer to 1941 Mech. Equip. Index.

Thermostat:—Harrison. In cylinder head outlet.

Setting—Opens at 148-155°F. Fully open 173°F.

Temperature Gauge:—AC #1511070 Thermo gauge.

For complete data, refer to 1941 Mech. Equip. Index.

CLUTCH:—**Own Make with Borg & Beck 'Borglite' or Long 10CF-TS driven member.** Single plate, 'crown spring' type. *For data, refer to Mech. Equip. Index.*

Facings—Molded-woven (B & B), woven (Long) types. 2 required. Inside Diameter 6½" (B & B), 6¾" (Long). Outside Diameter 10". Thickness ⅛".

NOTE—Install driven member oil baffle to rear.

Pedal Adjustment:—Free movement ¾-1" (adjusting screw and locknut on link at clutch fork). Toeboard clearance set by rubber bumper under toeboard.

See Buick Shop Notes for Pedal Return Spring data.

Removal:—Remove Rear Axle & Transmission (see below), take off clutch underpan, disconnect linkage at yoke, remove clutch release bearing support by taking out spring washer in housing, pull out yoke (with release bearing) from fulcrum, mark clutch and flywheel, remove cover mounting screws.

TRANSMISSION:—**Own Make.** All helical gear, constant-mesh, synchro-mesh (second and high), sliding gear (low and reverse) with remote shift.

For complete data, refer to 1941 Mech. Equip. Index.

Transmission Control:—Buick 'Handi-shift' type.

For complete data, refer to 1941 Mech. Equip. Index.

Removal:—Remove Rear Axle (see below), remove rear transmission support (wire shims to ends of support for correct replacement) and steady rest rod, place engine jacks (J-1580) on frame cross member with pilot end in hole in housing at each side of engine mounting, tighten jacks to take load off mounting, remove selector and shift levers, transmission mounting bolts (install guide pins J-851), remove 2 nuts freeing rear engine mounting (bolt heads seat in notches), adjust jacks to take strain off mounting bolts, remove transmission.

See Buick Shop Notes for Transmission Steady Rest

UNIVERSAL JOINT:—**Saginaw or Spicer 202-5.** 1 used.

For complete data, refer to 1941 Mech. Equip. Index.

REAR AXLE:—**Own Make.** Semi-floating, hypoid gear type with torque tube drive.

For complete data, refer to 1941 Mech. Equip. Index.

Ratio—**4.4-1** (white) Std. 40 Single Carb.; **4.1-1** (no paint) Std. 40 Comb. Carb., 50; **3.9-1** (red) Optl. 40 Single Carb. & 50. Paint marks on outer ends of axle shaft flanges, figures under axle housing.

Backlash—.006-.010". Screw adjustment.

Removal:—Hoist rear end of car. Disconnect parking brake at equalizer, hydraulic brake line at fitting anchored to left channel iron-strut, lower end of shock absorber links, rear radius rod at axle end, lower end of chassis springs (tie springs to bumper for clearance). Disconnect torque tube at universal joint ball, remove axle assembly from beneath car. IMPORTANT—2 piece torque tube assembly used (flanged at rear end and bolted to carrier). **Torque tube should never be dismantled at rear end except for gasket replacement.** Furnished as an assembly.

Axle Shaft Removal:—*See Mechanical Equipment Section.* NOTE—Right shaft ¾" longer than left.

Wheel Bearing Adjustment—None.

Rear Suspension:—Coil springs, conventional axle.

For complete data, refer to 1941 Mech. Equip. Index.

SHOCK ABSORBERS:—**Delco. Front**—Model 1948-A. Double acting, hydraulic type. **Rear**—Model 2105-C,D. Double acting, hydraulic, parallel cylinder.

For complete data, refer to 1941 Mech. Equip. Index.

STEERING:—**Steering Gear.** Saginaw Ball Bearing Worm-and-Nut. *For data, refer to Mech. Equip. Index.*

Front Suspension:—Independent, linked parallelogram type with coil springs.

For complete data, refer to 1941 Mech. Equip. Index.

Kingpin Inclination—3½° at 1⅛° Camber.

Camber—Regular Springs—Neg. ⅛° to Pos. 1⅛°. High Springs—Pos. ⅛° to 1⅜°. Not adjustable.

Caster—Positive ⅜° ± ⅜°. Adjustable.

Toe In—0-1/16". Adjust both tie rods equally.

Steering Geometry Inner wh'l 22° ± ¾°. Outer 20°.

BRAKES:—**Service**—Bendix hydraulic, duo-servo, single anchor type without eccentric adjustment. Hand lever applies rear wheel service brakes.

For complete data, refer to 1941 Mech. Equip. Index.

Drums—Centrifuse cast-iron type. Diameter 12".

Lining—Woven—Ferodo BZ-10-2C (primary). Moulded Manhattan Raybestos 2320 K (secondary). Width 1¾". Thickness 9/16". Length 9 15/16" (primary), 12¾" (secondary).

Clearance—.015" at each end of secondary shoe with primary shoe forced out against drum.

Hand Brake:—See Service Brakes above.

HOOD REMOVAL & ADJUSTMENT DATA, FRONT FENDER REMOVAL:—*See Buick Shop Notes.*

SERIAL NUMBER:—First number 1-3880108 (Flint), 2-3892008 (California), 3-3897008 (Linden). Stamped on tag attached to front of dash on right side.

ENGINE NUMBER:—First number (60) 6-, (70) 7-, (90) 9-4074859. On boss on right side of crankcase **.010" Oversize Engines**—Engines factory-equipped with .010" OS pistons marked (—) after Engine No.

ENGINE SPECIFICATIONS:—**Own 60, 70, 90.** 8 cylinder, 'I' head type. **Bore**—3 7/16". **Stroke**—4 5/16". **Displacement**—320.2 cu.ins. **Rated HP**—37.81. **Developed Horsepower**—165 at 3800 RPM. **Compression Ratio**—7.0-1 (First cars), 6.7-1 (Later cars). *See Buick Shop Notes for Compression Ratio change, new Cylinder Heads, and special service Cylinder Head Gasket data.* **Compression Pressure**—151 lbs. at 1000 RPM (all cylinders uniform within 6 lbs.). **Vacuum Reading**—Steady 18-20" idling at 7-8 MPH. *See Buick Shop Notes for Engine Mounting Adj. data.*

PISTONS:—Fireball, turbulator top, aluminum alloy, transverse slot, full skirt, cam ground type with anodized finish. No 'T-slot' used. *See Buick Shop Notes for size identification (color marks) and Replacement Piston data.* **Length** 4 9/16". **Weight**—17.94 ozs. (stripped), approx. 1.56 lbs. (with rings and pin). **Removal**—Pistons and rods removed from above. **Clearance**—.0023" (.0020-.0026") at top of skirt.

Fitting New Pistons:—If micrometer used, check at point 90° from pin hole just below transverse slot. Clearance above correct with piston at 70°F. If feeler gauge used, insert ½" x 12" feeler between piston and cylinder wall at right angles to pin bosses (piston inverted, pin parallel to crankshaft). Piston should pass on .0015" feeler, hold on .00225".

Installing Pistons:—Hollowed side to camshaft.

PISTON RINGS:—Two compression (#1 notched, #2 taper faced), two slotted oil rings (#3 heavy duty, #4 regular) per piston, all above pin (heat-dam groove above top ring). NOTE—Install top comp. ring with relief up, #2 with mark TOP up.

Ring	Width	End Gap	Side Clearance
Compr. ①	3/32"	.010-.020"	.0015-.0035"
Oil Control	3/16"	.010-.020"	.0015-.003"

①—Wall thickness Top .172", #2 .150".

Replacement Rings:—*See Buick Shop Notes for data.*

PISTON PIN:—**Diameter**—.8747". **Length**—3 1/16". Pin clamped in rod. Pins not furnished separately. All replacement pistons have fitted pins installed. **Pin Fit in Piston**—.0003-.0004" @ 70° (easy finger push). NOTE—Pin clamp bolt tension 25-30 ft. lbs.

CONNECTING ROD:—**Length**—8¼". **Weight**—35.58 ozs. **Crankpin Journal Diameter**—2¼". **Lower Bearing**—Spun babbitt-lined type. **Clearance**—.0008-.0018". **Sideplay**—.005-.010".

Bearing Adjustment:—Shims. Do not file rods or caps.

Installing Rods:—Marks on rod and cap toward rear of engine, oil hole to camshaft. Align rod and cap. NOTE—Use special ground bolts & palnuts on caps.

CRANKSHAFT:—5 bearing, 8 integral counterweights. **Journal Diameters**—#1, 2 9/16".; #2, 2⅝"; #3 2 11/16"; #4, 2¾"; #5, 2 13/16". **Bearings**—Steel-backed, durex-lined, slip-in type. *See Buick Shop Notes for Replacement Bearing data and Rear Main Bearing Oil Seal Installation.* **Clearance**—.0007-.0022".

Bearing Adjustment:—Shims. Do not file caps.

End Thrust:—Center (#3) bearing. **Endplay** .004-.008".

CAMSHAFT:—5 bearing. Non-adjustable chain drive. **Journal Diameters**—#1, 2 5/32"; #2, 2⅛"; #3, 2 3/32"; #4, 2 1/16"; #5, 1¾". **Bearing Type**—Steel-backed, babbitt bushings. **Clearance**—.0005-.0035".

End Thrust:—Thrust plate between front bearing and camshaft sprocket. **Endplay**—.004-.008".

Timing Chain:—Link-Belt. Width 1". Pitch .500". Length 25" or 50 links. Initial slack ¼-⅜". 1" worn.

Camshaft Setting:—Mesh copper-plated washers on chain (10 links apart) with sprocket marks upward.

VALVES:—

	Head Diam.	Stem Diam.	Overall Length
Intake	1 25/32"	.3720"	5¼"
Exhaust	1 7/16"	.3715"	5¼"

	Seat Angle	Lift	Stem Clearance
Intake	45°	.347"	.0015-.0035"
Exhaust	45°	.342"	.0021-.0039"

Series 70 Note—#16 push rod must be removed and installed with cylinder head. *See Buick Shop Notes*

Tappet Clearance:—.015" all valves—engine hot.

Valve Guides:—Press fit in head, installed with stepped end up. Finish ream for correct clearance.

Valve Springs:—Double springs used on all valves. Spring free length 1⅞" (inner), 2 5/16" (outer).

	Inner Spring Pressure	Inner Spring Length	Outer Spring Pressure	Outer Spring Length
Closed	15½-20½ lbs.	1 21/32"	26½-31½ lbs.	1 15/16"
Open	45-51 lbs.	1 5/16"	67-73 lbs.	1 19/32"

Valve Lifters:—Barrel type, cast-iron. Lifter guide holes reamed in block. **Clearance**—.0005-.0025".

Rocker Arms:—*See Buick Shop Notes for installation data.*

Valve Timing:—See Camshaft Setting above.

Timing Points (Valve .004" Open)

Intake Valves—Open 14° BTDC. Close 71° ALDC.
Exhaust Valves—Open 56° BLDC. Close 25° ATDC.

Opening & Closing Points

Intake Valves—Open 27° BTDC. Close 84½° ALDC.
Exhaust Valves—Open 69° BLDC. Close 38½° ATDC.

Valve Timing Check—With .015" tappet clearance, #2 and 7 exhaust valve should be .155" open (actual valve opening—use dial indicator) with #1 & 8 pistons on TDC and flywheel mark 'U.D.C/1&8' at indicator (inspection hole, right front face of housing).

LUBRICATION:—Pressure type (gear type oil pump in crankcase). *See Buick Shop Notes for oil pump data.* **Normal Oil Pressure**—45 lbs. at 35 MPH. **Oil Pressure Regulator**—On pump. Opens at 45 lbs. **Crankcase Capacity:**—10 qts. (dry), 8 qts. (refill).

COOLING SYSTEM:—**Cap.** 16¾ qts. (18 with heater). **Pressure Valve**—In filler cap. Opens at 7 lbs.

Water Pump:—Ball-bearing, packless type.
For complete data, refer to 1941 Mech. Equip. Index.

Thermostat:—Harrison. In cylinder head outlet. **Setting**—Opens at 148-155°F. Fully open 173°F.

Temperature Gauge:—AC #1511070 Thermo gauge.
For complete data, refer to 1941 Mech. Equip. Index.

CLUTCH:—**Own Make with Borg & Beck 'Borglite' or Long 10½CF-TI driven member.** Single plate, dry disc type. *For data, refer to Mech. Equip. Index.* **Facings**—Molded-woven (B & B), woven (Long) types, 2 used. I.D. 6½". O.D. 10½". Thick. ⅛". NOTE—Install driven member oil baffle to rear.

Pedal Adjustment:—Free movement ¾-1" (adjusting screw and locknut on link at clutch fork). Toeboard clearance set by rubber bumper under toeboard. *See Buick Shop Notes for Pedal Return Spring data.*

Removal:—Remove Rear Axle & Transmission (see below), take off clutch underpan, disconnect linkage at yoke, remove clutch release bearing support by taking out spring washer in housing, pull out yoke (with release bearing) from fulcrum, mark clutch and flywheel (reassemble to marks), remove mounting screws in cover. NOTE—Metal spacers may be used between release levers and cover to relieve spring tension.

TRANSMISSION:—**Own Make.** All helical gear, constant-mesh, synchro-mesh (second and high), sliding gear (low and reverse) with remote shift.
For complete data, refer to 1941 Mech. Equip. Index.

Transmission Control:—Buick 'Handi-shift' type.
For complete data, refer to 1941 Mech. Equip. Index.

Removal:—Remove Rear Axle (see below), remove rear transmission support (wire shims to ends of support for correct replacement) and steady rest rod, place engine jacks (J-1580) on frame cross member with pilot end in hole in housing at each side of engine mounting, tighten jacks to take load off mounting, disconnect shift linkage, remove transmission mounting bolts (install guide pins J-851) and 2 nuts freeing rear engine mounting (bolt heads seat in notches), adjust jacks to take strain off mounting bolts, remove transmission.
See Buick Shop Notes for Transmission Steady Rest data.

UNIVERSAL JOINT:—**Saginaw.** One used.
For complete data, refer to 1941 Mech. Equip. Index.

REAR AXLE:—**Own Make.** Semi-floating, hypoid gear type with torque tube drive.
For complete data, refer to 1941 Mech. Equip. Index.

Ratio—3.9-1 (red) Std. 60, 70. **4.2-1** (no paint) Std. 90. **3.6-1** (blue) Optl. 60, 70. Paint marks on outer end of shaft, figures on underside of housing.

Backlash—.006-.010". Screw adjustment.

Removal:—Hoist rear end of car. Disconnect parking brake at equalizer, hydraulic brake line at fitting anchored to left channel iron-strut, lower end of shock absorber links, rear radius rod at axle end, lower end of chassis springs (tie springs to bumper for clearance). Disconnect torque tube at universal joint ball, remove axle assembly from beneath car. **Series 60, 70 Note**—2 piece torque tube assembly used (flanged at rear end and bolted to carrier). **Torque tube should never be dismantled at rear except to replace gasket** Furnished as an assembly.

Axle Shaft Removal:—*See Mechanical Equipment Section.* NOTE—Right shaft ¾" (60, 70), 15/16" (90) longer than left. **Wheel Bearing Adjustment**—None.

Rear Suspension:—Coil springs, conventional axle.
For complete data, refer to 1941 Mech. Equip. Index.

SHOCK ABSORBERS:—**Delco. Front**—Model 1948-A (all). **Rear**—2105-C,D (60,70), 1757-A,B (90). Double acting hydraulic (2105 parallel cylinder type).
For complete data, refer to 1941 Mech. Equip. Index.

STEERING:—**Steering Gear**—Saginaw Ball Bearing Worm-and-Nut type.
For complete data, refer to 1941 Mech. Equip. Index.

Front Suspension:—Independent, linked parallelogram type with coil springs.
For complete data, refer to 1941 Mech. Equip. Index.

Kingpin Inclination—3½° at 1⅛° Camber (60, 70). 4¾° at ⅞° Camber (90).

Camber—Regular Springs—Neg. ⅛° to Pos 1⅛° (60, 70), Neg. ⅜° to Pos. ⅞° (90). **High Springs**—Pos. ⅛° to 1⅜° (60, 70). Not adjustable.

Caster—Positive ⅜° ± ⅜°. Adjustable.

Toe In—0-1/16". Adjust both tie rods equally.

Steering Geometry Inner wh'l 22°±¾°. Outer 20°.

BRAKES:—**Service**—Bendix hydraulic, duo-servo, single anchor type without eccentric adjustment. Hand lever applies rear wheel service brakes.
For complete data, refer to 1941 Mech. Equip. Index.

Drums—12" centrifuse (60, 70). 14" cast-iron (90).

Lining—Woven—Ferodo BZ-10-2C (primary), Moulded Manhatten Raybestos 2320K (secondary). Width 2¼" (60, 70), 2" (90). Thickness 3/16" (60, 70), ¼" (90). Length—Primary 10" (60, 70), 12 1/16" (90); Secondary 12 15/16" (60, 70), 14¾" (90).

Clearance—.015" at both ends of secondary shoe with primary shoe forced out against drum.

Hand Brake:—See Service Brakes above.

TORQUE WRENCH SPECIFICATIONS:—*See Torque Wrench article in Mechanical Equipment Section for tightening specifications for Cylinder Head, Main & Connecting Rod Bolts, etc.*

HOOD LOCK:—Radiator ornament controls manual and automatic safety catch. To raise hood, tilt ornament back, lift up on forward edge of hood. CAUTION—Do not hold radiator ornament down when closing hood (this will cause damage to manual catch).

HOOD REMOVAL:—Hood and side panels are integral. To remove hood, raise hood and prop front end up. Remove counter-balancing springs by removing clevis pin on cowl at top of springs (41-60S only), use tool J-1638 to remove springs at bottom (all other models). Remove two shoulder capscrews from hood links-to-cowl bracket, lift hood off. CAUTION—Do not loosen or remove cowl brackets which control hood alignment.

Hood Alignment—If hood alignment necessary when hood re-installed, see Front Sheet Metal Assembly Alignment below for directions.

Hood Spring Note—Right and left hood springs not interchangeable. Install springs with top hook offset toward rear of car.

FRONT GRILLE REMOVAL:—Raise hood, disconnect parking light wires. Remove six Phillip's head screws from radiator grille-to-fender at front, six countersunk screws from radiator grille-to-shroud top flange. Lift radiator grilles out and remove parking lights from back of grilles. To remove vertical fins, remove attaching clips holding fins in place and disassemble fins.

Grille Alignment—If grille alignment required when grilles re-installed, see Sheet Metal Assembly Alignment below for directions.

FRONT SHEET METAL ASSEMBLY ALIGNMENT:—Assembly consists of Hood, Fenders, Radiator Core, Grilles and casings, baffles, and cradle assembly. Individual parts may be removed and installed separately without affecting alignment but if most parts removed, or if alignment required, entire assembly should be aligned as follows:

Alignment—With fenders off, assemble radiator core, grille casings, baffles, and cradle assembly loosely on front cross-member. Install hood loosely on cowl hinge brackets and see that brackets are loose on cowl. With hood down, push cowl hinge brackets up until links strike on brackets (41-60S) or on hinge bracket flange (all other models), install lower front cowl hinge bracket-to-cowl bolts and tighten securely. Force back end of each bracket down (loop wire over notch in ear at back end of bracket and pull down on wire with pry bar hooked under frame) so that hood wrapped tightly to cowl, tighten lower rear bolt on each cowl hinge bracket securely, raise hood and tighten upper bolt in each bracket securely. Assemble front fenders loosely to radiator casing and baffle assemblies, remove kick pad in front compartment, install rear fender bolt nuts loosely from inside car. Align fenders to hood, door panel, and radiator casing assembly and tighten all mounting screws and nuts securely. Tighten radiator assembly on front cross-member (shim cradle, if necessary, to maintain front fender alignment).

Front Fender Tail Alignment (41-60S)—Loosen screw in front face of door under weather strip and two screws in bottom face of door and align fender tail to front fender. Tighten screws.

Sheet Metal Clearances—3/32" at hood-to-fender catwalk and hood-to-radiator casing, ⅛" at hood-to-cowl (at top) and hood-to-door (at top), 5/32" hood-to-door (at bottom).

RADIATOR CORE REMOVAL:—Drain radiator and disconnect upper and lower hoses, disconnect thermostat-to-shutter rod at thermostat in radiator top tank. Remove carburetor air cleaner and fan. Remove capscrews mounting radiator on cradle assembly at each side of radiator, lift radiator core assembly out.

CYLINDER HEAD:—Same cylinder head used on all engines. Cylinder head gaskets interchangeable on right and left sides of engine.

Installation—Two cap screws used at water outlet connection on each head have oversize head and are ½" longer than other head screws. **Use two long cylinder head cap screws at water outlet connection only** to avoid damage to engine water jacket. Car manufacturer recommends use of Perfect Seal Gasket Paste when cylinder head gaskets installed.

LOWERING COMPRESSION RATIO—Special shims available for installation between cylinder head and block to reduce compression ratio for use of low octane fuel or special operating conditions.

ORIGINAL PRODUCTION ENGINE BORE & PISTON SIZES:—Cylinder bores and pistons graded in 30 sizes and marked by letter (10 letters used, singly, or with '+' or '—' sign for total of 30 sizes) as indicated in table below (+ and — sizes not shown). Marks are located as follows:

Cylinder Bore Marking—Letter stenciled on top of cylinder block at outer edge of cylinder bore and in line with center of bore (if not + or —), to left of bore center (—), to right of bore center (+). Plus or Minus sizes are indicated by these different letter positions and actual + or — signs are not used.

Piston Marking—Letter is marked on piston head.

Letter①	Piston Size	Cylinder Size
A	3.4979-3.4981"	3.5000-3.5002"
B	3.4981-3.4983"	3.5002-3.5004"
C	3.4983-3.4985"	3.5004-3.5006"
D	3.4985-3.4987"	3.5006-3.5008"
E	3.4987-3.4989"	3.5008-3.5010"
H	3.4989-3.4991"	3.5010-3.5012"
J	3.4991-3.4993"	3.5012-3.5014"
K	3.4993-3.4995"	3.5014-3.5016"
L	3.4995-3.4997"	3.5016-3.5018"
M	3.4997-3.4999"	3.5018-3.5020"

①—Cylinder bore letter in line with center of bore (letter to left of center indicates —, to right of center indicates +).

CAUTION—Cylinder bores should always be measured with micrometer to make certain that bore has not been enlarged in field without being marked 'oversize'.

REPLACEMENT PISTONS:—Finished pistons furnished for service in sizes listed below.

Nominal Size	Piston Diameter
Standard	3.4979-3.4999"
.003" Oversize	3.5014-3.5029"
.005" Oversize	3.5034-3.5049"
.010" Oversize	3.5084-3.5099"
.015" Oversize	3.5135-3.5149"
.030" Oversize	3.5284-3.5299"

CAUTION—Cylinder bores should always be measured with micrometer (1¼" below top of block and at right angles to crankshaft) to make certain that bore has not been enlarged by refinishing in the field without being marked 'oversize.'

FITTING NEW PISTONS:—Pistons should be fitted with skirt clearance (measured adjacent to 'T' slot and just below horizontal slot) of .0020-.0022" at 70° F. minus .0001" for each 5.5° above 70°, or plus .0001" for each 5.5° below 70°, if measured at other temperatures. Clearance can be determined by using micrometers, or pistons can be fitted by using feeler gauges as follows:

Micrometer Gauge Method:—Measure cylinder bore with micrometer gauge at point 1¼" below top edge and at right angles to crankshaft. Set inside micrometer at cylinder bore size, **then measure this gauge length with same outside micrometer used to measure piston.** This method will eliminate any error introduced by using different gauges to measure cylinder and piston. Use outside micrometer to measure piston diameter at upper corner of 'T' slot (adjacent to 'T' slot and just below horizontal slot—piston must be measured at this point because skirt tapered with .001-.002" larger diameter at lower end). Select piston of correct size so that clearance when installed will be .0020-.0022" at 70°F. If block and piston not at 70° when measured, subtract .0001" for each 5.5° above 70°, add .0001" for each 5.5° below 70°.

Feeler Gauge Method:—Use ½" feeler stock .002", .0025", or .003" thick (see Feeler Gauge Note and table below) on side of piston directly over 'T' slot (center feeler on slot) with lower rounded end of feeler extending ½" down on piston skirt past horizontal slot (feeler must not extend further down on piston skirt because skirt is tapered with greater diameter at bottom). Install piston and feeler in cylinder with piston right side up and feeler toward side, measure pull required to withdraw feeler. Pull will vary in accordance with thickness of feeler gauge used and with piston temperature. See table for correct pull for each feeler gauge thickness to give correct piston clearance of .0020-.0022" at 70° F. and subtract .0001" clearance or 2/5 lb. pull for each 5.5° increase in piston temperature over 70°, add .0001" clearance or 2/5 lb. pull for each 5.5° decrease in piston temperature below 70°.

Feeler Pull	Piston Clearance (70°F.)		
(In lbs.)	.002" Feeler	.0025" Feeler	.003" Feeler
1	.00225"	.00275"	.00326"
2	.002"	.00252"	.00304"
3	.00175"	.00228"	.0028"
4	.0015"	.00205"	.00258"
5	.00125"	.00182"	.00235"
6	.001"	.00157"	.00213"
7	.00075"	.00133"	.0019"
8	.0005"	.0011"	.00167"

Feeler Gauge Note—Feeler gauges used for piston clearance measurement should be clean and smooth with lower end rounded. Rusted or wrinkled feelers should be discarded and rough edges should be honed to prevent scratching cylinder wall.

PISTON PIN FITTING:—Piston pin holes in piston have bearingized finish and, if oversize pins are installed, holes should be honed to proper size as follows: Use Piston Pin Hone, Part No. KMO-336, mount hone in vise and revolve piston on hone slowly by hand—**do not use electric drill to drive hone.** Use very fine abrasive (Grit No. 240A), washing abrasive out frequently with gasoline or kerosene. CAUTION—Always wash piston thoroughly before inserting pin to gauge for size. Pins should

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be a free hand press fit in each piston boss with no perceptible play at 70°F. (.0001-.0003" clearance).

CONNECTING RODS:—Bearing Removal & Installation—Bearing halves not interchangeable (upper half has oil hole for piston pin bushing lubrication). When installing bearings, make certain that tangs on bearings engage grooves in cap and rod and see that oil hole in upper half lines up with oil lead in rod to piston pin bushing.

MAIN BEARING SERVICING:—Bearing Removal—Bearing upper halves can be 'rotated' out without removing crankshaft. Install flattened cotter pin in oil hole in crankshaft so that pin engages bearing, turn crankshaft in reverse direction to push bearing out.

Bearing Installation—Clean all oil lines and crankcase before installing new bearings (see Lubrication System Servicing below). Install new upper bearing halves in same manner as old bearings removed ('rotate' bearings in place with cotter pin installed in oil hole, make certain that locating lug is in correct position).

Rear Main Bearing Oil Seals—With crankshaft out of engine, remove rear main bearing shells (to avoid damage), clean all old packing out of groove in crankcase and bearing cap, use tool J-1177 to install new packing as follows: Install length of new packing in groove in crankcase, drive packing up into place with tool J-1177 by pounding on tool handle with hammer, hold tool in position and cut off each end of packing flush with bearing edge. Install packing in bearing cap in same manner. When installing rear main bearing cap in engine, install new cork plugs in grooves on each side of bearing cap to prevent oil leaks at this point. Plugs should be well greased to facilitate installation.

CAMSHAFT:—Removal—To remove camshaft, first remove generator, carbruetor, fuel and vacuum pump, manifolds, and valve lifter assemblies. Remove radiator grille (see Front Grille Removal above), and radiator (see Radiator Core Removal above). Take out screws and remove timing chain cover, remove chain, remove retaining screws in camshaft thrust plate, withdraw camshaft.

Camshaft Bushing Servicing—Remove old bushings by pressing them out of bearing supports using tool J-829 (transmission and flywheel housing must be removed to take out rear bushing). To install new bushings, coat bushings with white lead, install front bushing first, then rear bushing, finally center bushing. Use tool J-829 to press bushings in place and pilot tool in two other bushings while pressing third bushing in place. CAUTION—Make certain that oil holes in each bushing lined up with oil leads in support.

VALVE SERVICING:—Valve Removal & Installation—Valve lifter assemblies must be removed before valves can be taken out. Use valve lifter J-257-X to compress springs for removal and installation of valve spring retainers and locks. Check valves for correct length (before installing lifters) with tool J-1055 measuring distance from end of valve stem to heel of cam (cam lobe turned 180° away from valve). If valve stem too long, grind off end of stem so that gauge will slide into place with valve seated. If tool not available, check clearance between end of valve stem and valve lifter plunger with plunger pressed down in lifter cylinder (lifter must be drained of oil for this check). Clearance should be .030-.070".

Valve Lifter Servicing—When installing lifter assemblies on engine, valve lifter bodies should be filled with oil and tool J-827 used to install lifter brackets in engine. Apply engine oil to tops of lifter assemblies after they have been installed. Connect oil feed pipes at supply end only and crank engine until all air is expelled from pipes, then connect pipes to lifter bracket connection. Check clearance between lifter and valve stem with plunger spring fully compressed and plunger seated in cylinder (all oil forced out). This clearance should be .030-.070". *See Wilcox-Rich 'Zero-Lash' Hydraulic Valve Lifter article in Mechanical Equipment Section for complete lifter servicing data.*

LUBRICATION SYSTEM SERVICING:—Before installing new main and connecting rod bearings, or when installing lifters in engine in which sludge noted in valve compartment, clean entire engine lubricating system thoroughly as follows: Remove oil pump and baffle, remove plug at front end of crankcase oil header, blow out oil lines by applying kerosene and air (use kerosene gun) at upper end of valve silencer feed line and at oil header opening. Wash down valve chambers and crankcase with compressed air and kerosene. Check and clean small hole at lower end of each connecting rod, clean any clogged oil lines with wire brush. Clean oil pump, baffle, float screen, regulator valve, and oil pan with compressed air and kerosene.

Oil Pump Specifications—Pump body and drive shaft clearance—.0010-.0025" (new), .005" (worn limit). Pump body and pump gear clearance—.002-.004" (new), .006" (worn limit). Pump gear endplay —.001-.004" (new), .006" (worn limit). Pump drive gear backlash—.008-.012" maximum.

Oil Pressure Regulator Specifications—Clearance between valve plunger and housing—.0020-.0035". (new), .005" (worn limit). Regulator spring pressure—5¾-6¼ lbs. at 1 13/32". Spring free length 2 25/64".

RADIATOR SHUTTER THERMOSTAT:—Shutter Control Rod Adjustment—With cooling system cold (below thermostat opening temperature of 150°), disconnect thermostat lever from shutter control rod, loosen locknut and turn clevis on thermostat end of rod to lengthen rod until clevis eye is 1/16" past hole in thermostat lever (rod 1/16" too long), tighten locknut and connect rod (align clevis and lever by forcing rod to right). This setting provides initial pressure on shutters which tends to keep them closed when cold.

Thermostat Checking—To check thermostat for correct operation on car, disconnect shutter control rod and note force required to open thermostat when cold (below opening temperature of 150°). Pull of 45-50 lbs. on spring scale hooked to thermostat stem should be required to open thermostat. If pull is less than 45 lbs., remove thermostat and check as follows: Place thermostat on brick in pan of water (thermostat must not come in contact with surface of pan), insert thermometer in water to check temperature, heat water and note thermostat operation. At 175°F, thermostat stem should raise 9/16" to open position and at 190°, stem should support weight of 20 lbs. without closing (Std. Thermostat). High-Reading thermostat should open 9/16" at 190°F. and support 20 lb. weight at 205°F. Before replacing thermostat check shutters for sticking or binding.

Radiator Shutter Checking—To check shutters for free operation, disconnect and remove control rod, hook spring scale in place of rod. Pull required to open shutters should not exceed 4 lbs. If pull exceeds 4 lbs., lubricate shutters and remove any cause of binding or sticking.

CLUTCH BALANCING:—Make certain that balance marks lined up when clutch installed on flywheel, then check balance by running engine at speed of 24-30 MPH. with rear wheels jacked up and note if any excessive vibration apparent. If vibration noted, re-balance clutch as follows: Install one or two ⅛" thick washers with 5/16" hole on clutch cover mounting capscrew (start at point where clutch drilled for balancing), repeat test and note if vibration increased or decreased. Add or remove washers at each mounting capscrew until satisfactory balance secured.

Locking Pin Removal:—Replacement clutches furnished by car manufacturer equipped with a locking pin (or block) under each release lever. These 3 pins must be removed when clutch installed on car (pins released when cover tightened) to avoid damage when car operated (pins will drop into clutch housing).

TRANSMISSION EXTENSION HOUSING:—Production Change—Two types of extension housing used in production (changed after first 3500 cars) as noted below. First type housing must be changed to second type on these first cars, if rear axle with optional gear ratio installed, to permit installation of different speedometer pinion for new axle ratio. Second type housing only furnished for service.

Extension Housing (First Type)—Permits mounting of speedometer pinion for standard rear axle ratio only. Must be changed to second type if rear axle ratio changed.

Extension Housing (Second Type)—May be identified by letter 'R' stamped on transmission case under speedometer cable opening. This housing permits mounting of speedometer pinion for standard and all optional rear axle ratios.

HOOD REMOVAL & INSTALLATION DATA, GRILLE REMOVAL, FRONT SHEET METAL ASSEMBLY ALIGNMENT:—*See Cadillac Shop Notes.*

SERIAL & ENGINE NUMBER:—1st number 5340001 (61), 8340001 (62), 7340001 (63), 6340001 (60S), 9340001 (67), 3340001 (75). On crankcase behind left cylinder block and on left frame side rail at steering gear.

ENGINE SPECIFICATIONS:—**Own.** 8 cylinder, 90° Vee, L head type. Upper crankcase and cylinder blocks cast Enbloc. **Bore**—3½". **Stroke**—4½".
Displacement—346 cu. ins. **Rated HP**—39.20.
Developed Horsepower—150 at 3400 RPM.
Compression Ratio—7.25-1 Std. cast-iron head.
See Cadillac Shop Notes for Cylinder Head Installation and Shims for Lowering Compression Ratio.
Compression Pressure—182 lbs. at 1000 RPM.
Vacuum Reading—Steady 20-21" idling at 7-8 MPH.

PISTONS:—Lynite or Bohn Lo-Ex aluminum alloy, 'T' slot, cam ground, anodized finish. **Length**—4⅛".
Weight—18.30 ozs. (stripped), 25.10 ozs. (complete).
Removal—Pistons and rods removed from above.
Clearance—.0020-.0022" at 70° F. for top of skirt
Original Bore & Piston Sizes, Replacement Pistons:—*See Cadillac Shop Notes for sizes and markings.*
Fitting New Pistons:—*See Cadillac Shop Notes for micrometer and feeler gauge data.*
Installing Pistons:—T-slot to left, for all pistons.

PISTON RINGS:—4 rings, all above pin (heat-dam groove above top ring). #1 Compression (PC Type 200—upper inner edge notched), #2 Comp. (70—lower outer edge notched), #3 Oil (X-90) & #4 Oil (85) slotted types. Drain holes in oil ring grooves.

Ring	Width	End Gap	Side Clearance
Compr. (Top)	3/32"	.007-.012"	.0023-.0041"
Compr. (#2)	⅛ "	.007-.012"	.0013-.0026"
Oil Control	5/32"	.007-.015"	.0013-.0026"

Replacem't Rings:—.003" .005" .010" .015" .030" oversize.

PISTON PIN:—**Diameter**—⅞". **Length**—3 1/16". Floating type. *See Cadillac Shop Notes for oversize pin data.*
Pin Fit in Piston—.0001-.0003" (new), .0006" (worn) or free hand-press fit at 70° F. in each boss.
Pin Fit in Rod Bushing—.0002-.0008" clearance (new), .0018" (worn limit).

CONNECTING ROD:—**Weight** 37.472 ozs. **Length** 8¾".
Crankpin Journal Diameter—2.4590-2.4595".
Lower Bearing—Steel-backed, babbitt-lined type.
Clearance—.0015-.0025" (new), .0045" Max. (worn).
Sideplay—.008-.014".
Bearing Adjustment:—None (no shims). Replace bearings. Do not file rods or caps. *See Cadillac Shop Notes for connecting rod bearing removal & installation.*
Installing Rods:—Numbers on rods and bearing caps on same side and toward bottom of engine.

CRANKSHAFT:—3 bearing with 6 counterweights.
See Cadillac Shop Notes for main bearing servicing and rear main bearing oil seal renewal.
Journal Diameters—2½" all bearings.
Bearings—Removable steel-backed, babbitt-lined.
Clearance—.0015-.0025" (new), .005" Max. (worn).
Bearing Adjustment:—None (no shims). Replace bearings. Do not file bearing caps.
End Thrust:—Taken by center (#2) bearing.
Endplay—.001-.005" (new), .010" Max. (worn).

CAMSHAFT:—3 bearing, non-adjustable chain drive.
See Cadillac Shop Notes for camshaft bushing data.
Journal Diameters—#1 and #2, 2.4071-2.4078"; #3, 2.0009-2.0016".
Bearing Type—Steel-backed, babbitt bushings.
Clearance—.0015-.0033" (new), .0045" Max. (worn).
End Thrust:—Taken by thrust plate behind camshaft sprocket. No endplay should be permitted.
Timing Chain:—Link-Belt Type 3766TWC-19. Width 1 11/32". Pitch ⅜". Length 23¼" or 62 links.
NOTE—Install chain 'endless' as an assembly with sprockets. Use Pilot Tool J-836 on end of camshaft.
Camshaft Setting:—Sprockets marked. Mesh chain with sprockets turned so that '0' marks are adjacent and in line with a straightedge across shaft centers.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1.876-1.886"	.3415-.3425"	5 33/64"
Exhaust	1.626-1.636"	.3405-.3415"	5 33/64"

	Seat Angle	Lift	Stem Clearance
Intake	45°	.335"	.0012-.0032"
Exhaust	45°	.345"	.0022-.0042"

NOTE—Stem clearance worn limit .005" (all valves).
See Cadillac Shop Notes for valve servicing.
Tappet Clearance:—None (automatic take-up used).
Valve Guides:—Press in block (long step end down).
Valve Lifters:—Wilcox-Rich 'Zero-lash' type hydraulic lifters (Mushroom type) in removable brackets.
For complete data, refer to 1941 Mech. Equip. Index.
Clearance—.0010-.0024" (new), .0035" (worn).
Valve Springs:—Free length 2.210".

	Spring Pressure	Spring Length
Valve Closed	63½ lbs.	1.926"
Valve Open	145 lbs.	1.581"

Valve Timing:—See Camshaft Setting above.
Intake Valves—Open at TDC. Close 42° ALDC.
Exhaust Valves—Open 52° BLDC. Close 10° ATDC.
Valve Timing Check—#1 cylinder (front-left bank) intake valve should open with piston at TDC and mark 'C.1/6' on crankshaft pulley aligned with chain case cover pointer (on right side).

LUBRICATION:—Pressure type (gear type oil pump in crankcase). *See Cadillac Shop Notes for oil pump data and oil pressure regulator specifications.*
Normal Oil Pressure:—15 lbs. idling, 25 lbs. at 30 MPH.
Oil Pressure Regulator:—Opens at 30 lbs. On oil pump. Not adjustable.
Crankcase Capacity:—7 quarts.

COOLING SYSTEM:—**Capacity**—25 quarts.
Pressure Valve—In filler cap.
Water Pump:—Self-adjusting packing type.
For complete data, refer to 1941 Mech. Equip. Index.
Thermostat:—Mounted in radiator top tank, linked to radiator shutters by rod on forward side.
Setting—(Std. Type) Starts to open 153-158° F., fully open 175° F. (High Reading Type—use with Heaters) Starts to open 168-173° F. Fully open 190°.
See Cadillac Shop Notes for Thermostat Tests and Radiator Shutter servicing and Radiator Core removal.
Temperature Gauge:—AC Electric. #1510773 (dash unit), #1510774 (engine unit).
For complete data, refer to 1941 Mech. Equip. Index.

CLUTCH:—**Long Model 11CF-10½TI (61, 62, 63, 60S), 11CF-TI (67, 75, 62 & 75 Comm'l).** Semi-centrifugal, single plate, dry disc type.
For complete data, refer to 1941 Mech. Equip. Index.
Facings—Woven (spirally grooved) type, 2 required. Inside Diameter 7" (all). Outside Diameter 10½" (61, 62, 63, 60S), 11" (others). Thickness .135".
Pedal Adjustment:—Pedal free travel ⅞-1⅛" (adjusting nut on connector link at clutch fork).
Removal:—Remove transmission (see below), drop clutch housing pan, remove release yoke and sleeve, punch mark clutch cover, pressure plate and flywheel, remove 6 cover screws. NOTE—Install driven member with oil guard to rear.
See Cadillac Shop Notes for clutch locking pin removal (on replacement clutches) and balancing data.

TRANSMISSION:—**Own Make.** All helical gear, constant-mesh, synchro-mesh (second and high), sliding gear (low and reverse) with remote shift.
For complete data, refer to 1941 Mech. Equip. Index.
Production Change—*See Cadillac Shop Notes for Transmission Extension Housing change.*
Transmission Control:—Remote steering col. shift.
For complete data, refer to 1941 Mech. Equip. Index.
Removal:—Support engine with jack under rear end of oil pan (use wooden block to avoid damage to pan), remove propeller shaft (disconnect front and rear universals), free transmission extension at engine rear support, remove crossmember with engine rear support, disconnect speedometer cable, remove shifter rods from levers at transmission, support transmission at rear, take out mounting screws, pull straight back (plug clutch connection shaft bearing drain hole as soon as accessible to prevent lubricant loss), lower front end of transmission and remove.
See Mechanical Equipment Section for shifter linkage adjustment when transmission installed.

UNIVERSAL JOINTS:—**Mechanics 3C.** Needle bearing. NOTE—One piece propeller shaft used. Slip joint at rear of transmission ahead of front universal.
For complete data, refer to 1941 Mech. Equip. Index.

REAR AXLE:—**Own Make.** Hypoid gear, semi-floating type with Hotchkiss drive. NOTE—Manufacturer recommends Carrier Assembly be serviced by factory.
For complete data, refer to 1941 Mech. Equip. Index.
Ratio—**3.77-1** (Std. 61, 62, 63, 60S; Optl. 67, 75). **3.36-1** Economy (Optl. 61, 62, 63, 60S). **4.27-1** (Std. 67, 75, 62 & 75 Comm'l.). **4.58-1** (75 Special Bus). NOTE—Ratio identified by number stamped on bottom of differential case beneath pinion shaft as follows: 3.77-1 (no mark), 3.36-1 ("6"), 4.27-1 ("4").
Backlash—.004-.010". Screw adjustment.
Removal:—Disconnect rear universal (do not disengage spline joint at transmission), remove axle shafts (see below) and carrier mounting bolt nuts.
Axle Shaft Removal:—Remove wheel, dust cap and axle shaft nut. Pull hub and drum, disconnect brake line, remove brake backing plate. Pull shaft and bearing assembly (Tool J-838). NOTE—Install new oil seal and bleed brake line which was disconnected.
Wheel Bearing Adjustment—None.

SHOCK ABSORBERS:—**Delco.** FRONT 1946-G, H (all). REAR 1754-N, P (61, 62, 63, 60S), 2008-C, D (67), 2007-N, P (75), 1751-V, W (62 & 75 Comm'l.). Double acting, opposed-piston, hydraulic types.
For complete data, refer to 1941 Mech. Equip. Index.

STEERING:—**Steering Gear**—Saginaw Ball Bearing Worm-and-Nut (Recirculating Ball) type.
For complete data, refer to 1941 Mech. Equip. Index.
Front Suspension:—Independent, linked parallelogram type with coil springs.
For complete data, refer to 1941 Mech. Equip. Index.
NOTE—Specifications below correct with car at curb weight (car unloaded with full gas tank).
Kingpin Inclination—5°51' crosswise (for 0° camber).
Caster—Neg. 1¾° to Neg. 2¾°. Equal within ½°.
Camber—Neg. ⅜° to Pos. ⅜°. Equal within ½°.
Toe In—1/32-3/32" (at rest). Loosen clamp bolts, turn adjusters at outer end of each rod equally.
Steering Geometry (Toe-out on turns)—Outer wheel turned 20°. Inner wheel as follows:

	61, 62, 63, 60S	67, 75, 62 & 75 Comm'l.
Left turn	25°25'	24°7'
Right turn	24°42'	23°6'

BRAKES:—**Service**—Bendix hydraulic, duo-servo, single anchor type without eccentric adjustment. Hand lever applies rear wheel service brakes.
For complete data, refer to 1941 Mech. Equip. Index.
Drums—Centrifuse. Diameter 11.995-12.005".
Lining—Molded. Length 11 17/32" (primary), 12 31/32" (secondary). Width 2¼" (front), 2" (rear 61, 62, 63, 60S), 2½" (rear Others), Thickness 3/16".
Clearance—.015" at both ends of secondary shoe with primary shoe forced out against drum.
Hand Brake:—See Service Brakes above.

TORQUE WRENCH SPECIFICATIONS:—*See Torque Wrench article in Mechanical Equipment Section for tightening specifications for Cylinder Head, Main & Connectng Rod Bolts, etc.*

HOOD LOCK & HOOD ADJUSTMENT:—Alligator type hood with control knob under left side of instrument panel. To open hood, pull out on control knob (hood will raise slightly), reach under front of hood opening, press up on safety catch, lift hood.

Hood Lock Adjustment:—Hood latching lever located beneath grille plate. To adjust, raise hood, loosen lock screw on control cable adjusting sleeve (in hole in grille plate), push dash control knob all the way in, see that latch plate in locked position, move sleeve to contact latch lever, tighten lock screw.

Hood Alignment (at Cowl):—Cowl panel and hinge bracket holes slotted for hood adjustment. To adjust, raise hood, release hood springs, loosen front and rear hinge bracket-to-cowl attaching bolts at each side, close hood. Position hood for proper alignment (while closed). Hold rear end of hood firmly on cowl and tighten rear hinge bracket bolt at each side (inside of cowl). Raise hood, tighten front hinge bracket-to-cowl bracket bolt at each side, connect hinge springs.

(At Radiator Grille)—Clearance between hood nose and top of radiator grille should be 1/16". To adjust, turn hood locking bolt in or out of retainer for correct clearance, tighten lock nut.

FRONT END REMOVAL:—Front Fenders, Radiator, and Grille may be removed as a unit for work on front of engine or for Independent Suspension Unit removal as follows: Raise hood, loosen lockscrew at hood lock control cable adjusting sleeve and disconnect cable. Drain radiator and disconnect upper and lower hose connections. Remove bolts attaching radiator brace rod to top of radiator support. Disconnect headlamp wires from junction block on each side, remove wiring harness from clip at radiator. Remove bolts attaching fenders to body, two fender skirt brace bolts at frame, nuts from 2 bolts attaching radiator support to front cross-member. From under fenders, remove sheet metal screws from lower grille panel reinforcing strips across openings in panel under bumper brackets. Remove front end sheet metal assembly from car.

Radiator Grille Removal:—Raise hood, disconnect hood latch control cable at latch and at clip to rear of latch, remove one grille-to-fender screw at each side on top, working through opening between grille and radiator core remove one bolt and three nuts at each side and center baffle-to-lower baffle bolt, remove grille molding bolt nuts along bottom and at each side (below fenders and lower grille panel). Pull grille assembly off car.

Lower Baffle & Lower Grille Panel Removal:—Remove Radiator Grille (see above). Working from beneath fenders (all bolts and screws under fenders), remove two lower panel-to-fender return flange bolts, two sheet metal screws attaching reinforcing strips across bottom of bumper bracket openings in panel, three lower baffle-to-side baffle sheet metal screws. Remove baffle. Lower baffle and grille panel riveted together and must be removed and installed as an assembly. Use 3/16" x ½" stove bolts when reassembling lower baffle and lower grille panel.

RADIATOR CORE REMOVAL:—To remove radiator core (without disturbing grille), drain radiator, remove lower hose connection, disconnect upper hose. Pull out control knob on dash and raise hood, disconnect front end of radiator brace rods, loosen both sides of brace rod at dash and turn rod up to allow clearance for radiator core. Remove headlamp wiring harness from clip at each top corner of radiator core. Remove 2 core-to-shell bolts at each side, tilt top of core to rear and lift out.

ENGINE REMOVAL:—Drain radiator and cylinder block of all cooling liquid and remove the hood. Remove Fenders, Radiator, and Grille as an assembly (see Front End Removal above). Disconnect generator leads and free wiring loom from support clip, remove battery and starting cables. Disconnect distributor low and high tension leads, take out ignition coil mounting screws, lay coil on cowl. Disconnect gas line at fuel pump, throttle and choke controls at carburetor, and accelerator rod at bellcrank. Disconnect exhaust pipe from manifold. Remove front floor mat and floor plate over transmission, disconnect vacuum and air lines at shift cylinder. Remove front floor mat and body floor cover over transmission. Remove outer half of reactionary metal boot (work under car) by taking out two bolts fastening halves together. On all cars except Cabriolet proceed as follows: Loosen reactionary lever assembly-to-transmission operating shaft clamp bolt, drive assembly from shaft carefully, disconnect selector rod from selector lever by taking out cotter pin in transmission end of rod, remove 3 vacuum cylinder bracket-to-transmission capscrews and move assembly clear of transmission. On Cabriolet only proceed as follows: Disconnect vacuum cylinder piston rod and valve link from reactionary lever system (to prevent upsetting vacuum valve adjustment, replace clevis pin thru piston rod yoke and valve link). Then for all cars continue as follows: Disconnect clutch pedal link and pullback spring. Remove bolts in universal joint ball retainer, slide retainer and ball back on shaft, take out 4 screws holding universal trunnion bearings on front yoke, remove trunnion bearings. Remove 4 bolts from transmission rear support, remove front and side engine mounting bolts, remove bolts in starter cross-shaft. Remove third cylinder head bolt from rear on left side, install engine lifting eye bolt in this bolt hole, attach hoist and lift engine until clear of mountings, pull engine forward and lift to clear front cross-member, then roll chassis back until engine is free. When engine re-installed, adjust mountings, align hood (see above).

ENGINE MOUNTINGS:—Adjustment—Tighten front engine mounting bolts (replace mountings if oil-soaked), tighten rear mounting bolts at transmission (studs must be tight in case), clearance between cross-member and 'U' section plate should be .005-.015" **(limits fore and aft engine movement)**, if clearance excessive, remove mounting and bend plate to obtain correct clearance. Tighten side engine mounting bracket bolts. Take out engine side mounting bolts, check clearance between mounting and bracket at each side, clearance must be 1/16" (if clearance excessive, use ⅜" plain washer to shim for proper clearance, if clearance less than 1/16", loosen bracket bolts and push mounting up or if necessary remove brackets and file holes with round file to give 1/16" clearance). Tension on side mountings must be equal at each side.

HARMONIC BALANCER:—Serviced as complete assembly only (component parts not serviced separately). 1941 balancer cannot be used on earlier cars.

Removal—Remove Front End Assembly as a unit first (see directions above). Use Chevrolet Harmonic Balancer Puller and Driver (consists of puller body, puller screw and pinned driver head), attach puller body to balancer by means of 2 capscrews in two tapped holes in balancer, pull balancer by turning up puller screw.

Installation—Place driver in starting crank jaws of balancer, install puller body (as above), line up keyway in balancer and key in crankshaft, turn puller screw down to contact driver, then use puller screw as driver and drive balancer in place.

MAIN BEARINGS:—Installation—Front intermediate bearing shell marked 'I' in oil groove and must be used in #2 bearing cap. Rear intermediate bearing shell flanged to take crankshaft end thrust. Front intermediate (#2) and Rear intermediate (#3) bearing caps must be installed with mark 'FRONT' (#2 cap) to front, 'REAR' (#3 cap) to the rear.

Line-Boring—Bearings must be line-bored with .008" shims (four .002" shims) under each end of bearing caps. After line-boring, Rear intermediate (#3) bearing must be faced to provide endplay.

Endplay Adjustment—Taken by rear intermediate (#3) bearing. When installing new bearings, this bearing should be machined on front flange just enough to clean up the face of the bearing flange. Then machine rear flange of bearing to obtain endplay of .004-.007" (measure with feeler gauge inserted between rear side of #3 bearing and crankshaft with shaft in extreme rear position.

CRANKSHAFT OIL SEALS:—Rear. Same as 1940. Rear main bearing cap (mounted on four bolts with two locating dowels) with wick type oil seal installed in groove in cap and crankcase used. Seal bears on outer rim of crankshaft flange (oil slinger and check valve in oil return hole in bearing cap have been discontinued). To install new seal in bearing cap, insert packing in groove and roll firmly in place with rounded tool (roll from both ends toward center). Use round block of wood (same diameter as crankshaft flange) to hold packing in place, cut both ends off evenly and flush with bearing cap face. Install upper half of seal in crankcase in same manner with engine out of car.

Front (Timing Gear Cover) Oil Seal—Spring-loaded leather type installed in pocket in timing gear cover. To install new seal, place seal on special Oil Seal Replacer J-995 with free end of leather toward end of tool, seat seal in cover with few light hammer blows on tool. NOTE—Timing gear cover must be centered on crankshaft when installed on engine to prevent balancer damaging oil seal. To install cover, coat seal with grease, install centering guide J-966 on crankshaft, install cover and tighten cover screws.

CAMSHAFT BEARINGS:—Installation. Oil groove extends 70° around bearing from oil hole. To insure proper alignment with oil hole in block, mark front of bore opposite oil hole. Align oil hole in bearing with mark (with groove toward bottom of engine away from oil hole in block), press bearings in, stake in place, and line-ream (see below).

Reaming—Special reamer with four cutters on one bar recommended by car manufacturer (for proper alignment). Insert reamer through #1, #2, and #3 bearings. Start reamer cutters in all four bearings at the same time (wash metal cuttings away with liberal supply of kerosene while reaming), turn reamer slowly until cutters pass through bearings. Remove reamer by rotating in same direction as when reaming bearings and withdraw from engine. Bearing cuttings must be blown out with compressed air. Install camshaft and check bearing clearances with narrow feeler gauge. Clearance should be .002-.004". Install expansion plug to rear of rear bearing.

TIMING GEARS:—Alignment—Timing gear alignment controlled by number of gaskets assembled between Crankcase Front End Plate and Cylinder Block.

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With timing gears and camshaft out of engine, assemble End Plate on cylinder block using two gaskets and hold in place with three screws. Place a new Camshaft Thrust Plate in hole in End Plate. Lay a straightedge across thrust plate and shoulder on crankshaft (for timing gear). Align these two surfaces (add one gasket if straightedge strikes shoulder on crankshaft, remove one gasket if space between straightedge and shoulder). Install screws and bolts in End Plate and set screws with punch. **Gear Installation**—Crankshaft gear made of steel and should be removed and installed with puller and driver. Gear drive fit on end of crankshaft and held in place with a key. Composition camshaft gear must be removed using a removing sleeve (to support gear on hub) in an arbor press. New thrust plate must be used whenever gear removed (plate damaged by gear removal sleeve). Install new thrust plate on camshaft and press gear on shaft with arbor press (support back of front camshaft journal and use hub of gear only as pressing medium). Gear is press fit on shaft (press gear on shaft for Free Fit to .003" maximum clearance for Thrust Plate). Install camshaft in engine with gear punch marks opposite each other. Check timing gear runout with dial indicator (.003" max. crankshaft, .004" max. camshaft). Timing gear backlash .002-.005".

TAPPET CLEARANCE ADJUSTMENT:—Normalizing Engine—Tappet clearance changes while engine is warming up and should be adjusted only after engine has been 'normalized' as follows: Run engine at 600 RPM and check oil temperature with thermometer at overflow pipe on valve rocker shaft connector until no change noted in oil temperature for period of five minutes (oil temperature will become stabilized at some point between 150-225° F.). This normalizing period will be from 5 to 30 minutes depending on engine temp. when started.

VALVE GUIDE INSTALLATION:—Use special valve guide drivers J-1089 (Intake), J-1090 (Exhaust) to install guides. Drivers have stop-collars which correctly position guides so that distance from cylinder head to top of guide is 1 1/16" (Intake), 61/64" (Exhaust). After guides installed, rough ream to inside diameter of .341", then finish ream to .343" diameter.

ROCKER ARMS:—New design rocker arms used. Rocker arms are diamond-bored and 'granodized' (no bushings used) and fit directly on rocker arm shafts. Four different rocker arms used (offset at an angle), **Left Hand Exhaust (marked 1 or 9), Right Hand Exhaust (0 or 2), Left Hand Intake (3 or 5), Right Hand Intake (4 or 6).** Number carried on side of each arm (1, 2, 5, 6 Flint production; 0,3,4,9, Tonawanda production—rocker arms of same type interchangeable regardless of manufacturing plant). Install rocker arms in following order (numbered front to rear), on front shaft: **#1,** L.H. Exhaust (1 or 9); **#2,** R.H. Intake (4 or 6); **#3,** L.H. Intake (3 or 5); **#4,** R.H. Exhaust (0 or 2); **#5,** L.H. Exhaust (1 or 9); **#6,** R.H. Intake (4 or 6); on rear shaft: **#7,** L.H. Intake (3 or 5); **#8,** R.H. Exhaust (0 or 2); **#9,** L.H. Exhaust (1 or 9); **#10,** R.H. Intake (4 or 6); **#11,** L.H. Intake (3 or 5); **#12,** R.H. Exhaust (0 or 2). Rocker arms installed on tubular shafts and held against side of shaft brackets by spring installed on shaft between adjacent rocker arms and locked in position by hairpin spring installed in groove in plugged end of each shaft. Rocker shafts must be removed and installed as an assembly. Shafts should be assembled as follows: Open end of each shaft must be toward the center, stamped steel baffle in open end of rear shaft must be in vertical position, connect shafts by slipping brass oil connector over open end of each shaft.

OIL DISTRIBUTOR:—Distributor located within recess in left side of engine block (under cover plate). Distributor valve mounted on plate which is clamped on block by cover so that entire valve assembly is within engine. Oil Distributor operates in same manner as units used on previous models. CAUTION—Inner and outer gaskets used with valve assembly plate must not be interchanged. **Removal**—To dismantle oil distributor, take out three screws in cover plate, remove cover plate, outer gasket, valve assembly plate, inner gasket. **Assembly**—Install cork gasket with **two center holes** between valve assembly plate and block, and use cork gasket with **center cut out** between valve assembly plate and cover, tighten cover screws.

OIL LEAD TO VALVE ROCKER ARMS:—Installation— New assembly must be used (nipple and pipe assembly Part No. 839186) whenever assembly removed from engine. To install proceed as follows: insert pipe in block, coat threads of nipple with white lead and screw in block (on right side), install nipple and sleeve nut on lower end of pipe (left side of block) and secure in place, then bend pipe in upward loop and connect to oil distributor, bend pipe on right side of engine to clear push rod cover and bend upper end so that it passes through hole in cylinder head, connect pipe to valve rocker shaft coupling. Fill cooling system, run engine and check all connections for oil and water leaks.

CHECKING OILING SYSTEM:—Oil Pan. Oil nozzle height, oil trough height and aiming of oil nozzles should be checked whenever oil pan removed. To check proceed as follows: Remove oil pan gasket. Use Oil Nozzle Depth Gauge J-969-3 to check oil nozzle height for connecting rod dipper clearance. Hook end of gauge over pan rail, position gauge in trough with side marked 'FRONT' toward front of oil pan. Open end of nozzle in trough should clear gauge. Repeat check for all 6 troughs. Use Oil Trough Depth and Connecting Rod Dipper Height Gauge J-696-2 (regular 216.5 cu. in. engine), J-1646 (for Heavy Duty 235.5 cu. in. engine) to check oil trough height. Gauge stem (center bar extending down) should just touch edge of all troughs (with bar resting on oil pan rail). Check oil nozzle aim with Oil Pan Target Gauge J-696-1 (for regular and Heavy Duty Engines). Install gauge and position it with dowels engaging screw holes in oil pan. Install Water Nozzle J-793-3 in main oil line. Tilt oil pan 45° so that nozzles are not covered by water in troughs. Use enough water to just straighten water streams from nozzles. Nozzle streams must hit holes in gauge. Use Oil Nozzle Wrench J-793-2 to adjust nozzles so that each water stream passes through center of its target hole. Recheck oil nozzle height (height may be disturbed when nozzles adjusted).

Connecting Rod Dipper Height—Use Oil Trough Depth & Connector Rod Dipper Height Gauge J-969-2 (regular engine), J-1646 (Heavy Duty 235 cu. in. Engine). Place gauge over connecting rod with two side pins on gauge resting on lower face of crankcase (pan gasket must be removed). End of dipper should just touch face of cross bar on gauge with rod in lowest position. If dipper does not touch gauge, it should be replaced; if dipper interferes with gauge, correct by bending dipper.

REAR SPRING SEATS (ALL PASSENGER CARS):— Bracket welded on front of housing at each spring. Spring seat attached to bracket by means of rubber bushed bolt (spacer sleeve through which bolt passes, used to prevent collapse of bracket when tightening bolts with great deal of pressure). Rubber washers used between bracket and each end of spring seat. Spring seat attached to springs through conventional U-bolts. IMPORTANT—When reassembling spring seat to bracket (when installing rear axle), **eye bolt nut must not be tightened until** all other connections made and car weight resting on all 4 wheels.

REAR SPRING REAR SHACKLE (PASS. CARS):—Two types of rear spring rear shackles used as follows: **Threaded Design**—Same as 1940 type.

Tight Shackle Pin Correction—If shackle pins tight or seized, remove pin and bushing assembly from rear spring hanger, enlarge eye in hanger approximately .005-.010" with a drift, install new pin and bushing assembly.

Rubber-bushed Design—New type used on some 1941 cars. Shackle assembly consists of outer shackle plate with two pins serrated through plate and swaged in place, two split-type synthetic rubber bushings (each bushing consists of two halves with a shoulder on the outer end of each half), an inner shackle plate, and two castellated lock nuts. Rubber bushings extend out ¼" beyond space between two shackle plates when tightened in place. When inner plate bottoms on pin shoulders (by tightening lock nuts) excess rubber (¼" extension) forced into eye and around pins forming a tightly locked joint.

Servicing—Rubber-bushed shackle may be removed by merely raising car to relieve load, removing two lock nuts and inner shackle plate (releasing pressure on bushings) and taking out outer shackle plate with pins, and removing bushings from spring and hanger eyes. Shackle can be installed as follows: Raise car to properly position spring hanger and spring eye for shackle installation, clean bushing holes, bushings (inside and outside), shackle plates and pins, install bushings in spring and hanger eyes with shoulder on each half on outside, install shackle plate with pins (insert pins through bushings with pins extending in toward center of car), install inner shackle plate, tighten lock nuts half way on pins, set car on wheels at curb weight (no load or passengers in car), bounce rear end of car to seat bushings, then without disturbing normal rest position of car, tighten lock nuts on inner shackle until plate bottoms on shoulders of pins. These shackles require no lubrication.

REAR SPRING SEATS (½ TON TRUCKS):—Fitting. Whenever rear spring seats are adjusted, clearance between spring seat and rear axle housing must be checked as follows: Block up rear of car under frame side rails, drop rear of spring by disconnecting spring shackle, take out spring U-bolts, remove spring seats (lower spring cap secured by means of 2 screws). File face of each spring seat half evenly (place in bench vise) until spring seat gives slight drag when placed on housing and rotated. CAUTION—File both halves evenly.

CAB-OVER-ENGINE MODELS

REMOTE CONTROL TYPE GEARSHIFT LEVER:—Removal—Disconnect gearshift lever from top of engine cover, loosen wire on cloth boot, raise boot above transmission cover tower. Remove nut from stub gearshift lever and raise reverse latch Bowden cable support onto top of lever. Use gearshift lever removing tool K-353 to remove lever assembly from transmission cover. When installing lever, see that end of reverse latch shift rod seats in upper part of 'U' shaped bracket at end of reverse latch Bowden cable and that retaining nuts are tight so that rod anchored in bracket.

ENGINE HOOD & RADIATOR GRILLE:—Alligator type hood with dash-controlled hood lock and safety catch. *See Chevrolet Shop Notes for Hood Lock Operation and Adjustment, and Radiator Grille Removal.*

Front End Assembly Removal—Fenders and Radiator Grille may be removed as a unit for access to Front Suspension. *See Chevrolet Shop Notes for data.*

FLEET MODEL NOTE:—Special Economy Engine available for all models. May be identified by special Tune Up Specification Plate on Push Rod Cover listing special settings and Fleet Car Identification Plate on instrument panel to right of the glove compartment. Special carburetor used has stop-pin to limit throttle opening to ½ throttle.

SERIAL NUMBER:—First number 1001 with model prefix as follows: AG (Master Deluxe), AH (Special Deluxe). Stamped on plate on right front floor.

ENGINE NUMBER:—First number AA-1001 (Flint), AC-1001 (Buffalo-Tonawanda). On boss on right side of engine to rear of distributor.

ENGINE SPECIFICATIONS:—6 cylinder, valve-in-head type.

Bore—3½". **Stroke** 3¾".

Displacement—216.5 cu. ins. **Rated HP**—29.4.

Developed Horsepower—90 HP at 3300 RPM (Passenger Cars and Trucks except Cab-Over-Engine), 90 HP at 3100 RPM (Cab-Over-Engine Trucks).

Compression Ratio—6.50-1 Std. cast-iron head.

Compression Pressure—110 lbs. min. at cranking speed (all cylinders equal within 5-10 lbs.).

NOTE—Engine must be at normal operating temperature (idle at 600 RPM for 20 minutes).

Vacuum Reading—Steady 20-22" idling at 450 RPM.

Engine Removal & Engine Mounting Adjustment:—*See Chevrolet Shop Notes for Instructions.*

Cylinder Head Installation:—Use new gasket and install with mark 'This Side Up' upward. Use cylinder head guide pins to align head.

PISTONS:—**Passenger Cars**—Cast-iron, flat head, cam ground, tin plated with slipper type skirt.

Trucks—Same as Pass. Cars except 1½ ozs. heavier and may be identified by a small forged boss on the lower center of each piston pin boss.

Weight—27.15 ozs. (Pass. Car), 28.56 ozs. (Trucks) with bushings installed. **Length**—3¾".

Removal—Pistons and rods removed from above.

Clearance—Top .0147-.0183". Skirt .0017-.0023".

Replacement Pistons:—Finished pistons with bushings and pins fitted furnished Standard and .003", .010", .020", .030", .040" oversize. NOTE—Hone cylinder for .003" oversize, rebore and hone for other sizes (rebore .002" less than piston oversize, finish by honing for piston clearance below). Bore taper and out-of-round must not exceed .001".

Fitting Pistons:—Use feeler gauge between piston and cylinder wall at right angles to pin bosses. Piston should pass through bore with light pressure on .002" feeler and lock on .003" feeler.

PISTON RINGS:—Two compression, one oil control ring per piston, all above pin. Oil ring groove drilled for oil drainage. NOTE—Taper faced compression ring used. Install with side mark 'TOP' upward.

Ring	Width	End Gap①	Side Clearance
Compr.	.1235-.1240"	.005-.015"	.0015-.003"
Oil Cont.	.1860-.1865"	.005-.015"	.002-.0035"

①—Worn end gap limit 1/32" maximum.

Replacement Rings:—Furnished standard size and .005", .010", .020", .030", .040" oversize.

PISTON PIN:—**Diameter**—.8645-.8650". **Length**—3.135-3.165". Pin locked in rod, piston bronze bushed.

Pin Fit in Piston—Thumb push fit (room temp.).

Replacement Pins:—Std. & .003", .005", .010" oversize. NOTE—New pistons fitted with bushings and pins.

CONNECTING ROD:—**Length** 6 13/16". **Weight** 28.3 ozs.

Crankpin Journal Diameters—2.311-2.312".

Lower Bearing—Spun babbitt-lined type.

Clearance—.001-.0025". **Sideplay**—.004-.012" (side clearance between rod and pin bosses .025" min.).

Bearing Adjustment:—Solid shims. Remove shims equally at both sides to secure 'snap fit' (rod tight to hand but should snap from one side to other with light tap of 8 oz. hammer), **then replace one .002" shim for clearance** (if unequal number, place extra shim on camshaft side). Rod should snap from side to side with one hand pressure with proper bearing fit.

Palnut Note—Palnuts used to lock rod bolts. Use new palnut, install with open side toward end of bolt, turn finger tight against rod nut, then tighten ½ turn additional.

Installing Rods:—Numbers on rods and caps must be together and installed in same numbered cylinder with numbers and pin clamp bolt toward camshaft side. Install oil dippers on rods with mouth toward camshaft side of engine. Check dipper heights. *See Chevrolet Shop Notes for Oil Dipper Height data.*

CRANKSHAFT:—4 bearing, 7 integral counterweights. NOTE—Wick-type rear bearing oil seal (no slinger). *See Chevrolet Shop Notes for Crankshaft Front and Rear Oil Seals and Harmonic Balancer servicing data.*

Journal Diameters—#1, 2.6835-2.6845"; #2, 2.7145-2.7155"; #3, 2.7455-2.7465"; #4, 2.7765-2.7775". NOTE—Journal taper or out-of-round limits .001". Run-out limits for #2 and #3 bearings .002".

Bearing Type—Steel-backed, babbitt-lined.

Clearance—.002-.004". *See Chevrolet Shop Notes for Main Bearing Line-boring and Bearing Installation.*

Bearing Adjustment:—Solid shims. Remove shims until slight drag secured when shaft turned by hand, **then replace one .002" shim for clearance** (if unequal number of shims used, place extra shim on same side for all bearings).

End Thrust:—Taken by #3 bearing (adjusted by facing new bearings). **Endplay** .004-.007". *See Chevrolet Shop Notes for Endplay Adjustment.*

CAMSHAFT:—Four bearing. Helical gear drive.

Journal Diameters—#1, 2.0282-2.0292; #2, 1.9657-1.9667"; #3, 1.9032-1.9042"; #4, 1.8407-1.8417". NOTE—Journal out-of-round limits .001". Run-out limits .002" (straighten if excessive).

Bearing Type—Steel-backed, babbitt-lined bushings. *See Chevrolet Shop Notes for Camshaft Bearing installation and line-reaming instructions.*

Clearance—.002-.004".

End Thrust:—Taken by thrust plate behind camshaft gear (gear position controlls endplay). *See Timing Gear installation in Chevrolet Shop Notes for data.*

Endplay—Free fit to .003" maximum.

Timing Gears:—Crankshaft gear Steel. Camshaft gear Bakelite & Fabric. Maximum gear run-out .003" crankshaft, .004" camshaft. *See Chevrolet Shop Notes for Timing Gear installation instructions.*

Backlash—.002-.005".

Camshaft Setting:—Gears punchmarked. Mesh marked tooth of crankshaft gear with marked space between teeth of camshaft gear.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1 41/64"	.3407-.3417"	6 7/32"
Exhaust	1 15/32"	.3397-.3407"	4 55/64"

	Seat Angle	Lift	Stem Clearance
Intake	30°	.2947"	.001-.003"
Exhaust	30°	.3118"	.002-.004"

NOTE—1941 valves not interchangeable with earlier type.

Tappet Clearance:—.006-.008" Int., .013-.015" Exh. Hot (Engine 'normalized'). Use lower figure for ordinery service, higher figure for severe Truck operation.

See Chevrolet Shop Notes for Tappet Adjustment.

Economy Engines—Intake .010", Exhaust .016", Hot.

Valve Guides:—Pressed in head (new types—longer exhaust guide used—guides not interchangeable with earlier types). *See Chevrolet Shop Notes for Valve Guide Installation and Reaming instructions.*

Valve Springs:—Free length 2⅛". When checked with U15 Tester, spring pressure should be 125-133 lbs. at 1½".

	Spring Pressure	Length
Valve Closed	49-56 lbs.	1 13/16"
Valve Open	121-133 lbs.	1½"

NOTE—New umbrella type valve spring cap covers used on Intake Valves only (diverts oil from valve end of rocker arm out over spring, reducing oil on valve stem thereby diminishing oil consumption and exhaust smoke when idling). Install springs with close-coil end toward cylinder head. Use round valve caps on Intake Valves (also covers as noted above), hexagonal caps on Exhaust Valves.

Valve Lifters:—Same as 1940 (pushrod seat brazed on top). **Clearance**—.001" (free fit in guide holes).

Rocker Arm Assembly:—New Armasteel type (no bushing used). 4 different types of arms. *See Chevrolet Shop Notes for Rocker Arm data.*

Valve Timing:—See Camshaft Setting above.

Intake Valves—Open 3° BTDC. Close 35° ALDC.

Exhaust Valves—Open 46° BLDC. Close 5° ATDC.

Valve Timing Check—With .006" tappet clearance #1 intake valve should open with #1 piston 3° or .0032" BTDC with point on flywheel approx. 1.158 teeth before 'U/C' mark aligned with indicator in inspection hole in right front face of housing.

LUBRICATION:—Pressure and positive splash system. *See Chevrolet Shop Notes for Oil Distributor, and Rocker Arm Lead & Overflow Pipe servicing.*

Oil Pump Installation—Assemble ground side of idler gear toward cover. Oil pump assembly mounted in crankcase by tapered setscrew. See that screw seated firmly in tapered hole in pump housing before tightening locknut.

Normal Oil Pressure:—14 lbs. at 21 MPH (Pass. Cars), 14 lbs. at 2000 RPM (Trucks).

Oil Pressure Regulator:—Located on oil pump cover. Opens at 75 lbs. Non-adjustable type. Pressure normally controlled by Oil Distributor Valve on left side of engine which opens at 15 lbs.

Oil Distributor:—*See Chevrolet Shop Notes for data.*

Checking Oiling System:—Should be checked whenever pan removed. *See Chevrolet Shop Notes for data.*

Crankcase Capacity:—5½ qts. dry, 5 qts. refill (All).

COOLING SYSTEM:—**Capacity**—14 qts. (except Cab-Over-Engine), 16½ qts. (Cab-Over Engine). *See Chevrolet Shop Notes for Radiator Core Removal.*

Water Pump:—New two outlet packless type with sealed ball-bearing shaft. NOTE—Pumps not interchangeable with earlier models (same on all 1941 models except for fan).

For complete data, refer to 1941 Mech. Equip. Index.

Thermostat:—Harrison. In cylinder head outlet.

Setting—Starts to open 142°F (Regular), 150°F (Alcohol Anti-freeze), 162°F (Permanent Anti-freeze & Economy Engines). Temperature marked on valve top.

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CLUTCH:—Own Make. Diaphragm spring, single plate, dry disc type. NOTE—New clutch driven member (with revised spring cushions), clutch linkage (for proper release of new driven member) and flywheel oil groove (just inside clutch plate driving surface to prevent any excess grease thrown out by clutch pilot bearing from reaching facings) used.

For complete data, refer to 1941 Mech. Equip. Index.

Facings—Woven asbestos, 2 used. Inside Diam. 6⅛". Outside Diam. 9⅛". Thickness .132-.138".

Adjustment:—Pedal free travel ¾-1". To adjust, loosen checknut and turn adjusting nut on connecting link at clutch throwout fork. NOTE—Use finger pressure (not foot) when checking free travel.

Removal:—Remove transmission and flywheel underpan (see Transmission Removal below). Remove throwout bearing from fork, remove fork by prying fork off ball, remove fork mounting (use ¾" wrench). Install Clutch Pilot Tool K-411 (to support clutch), loosen all six cover bolts evenly, remove assembly from below. CAUTION—Do not allow pressure plate to hang on retracting springs (support by hand). When installing clutch align 'X' mark on cover with 'X' mark on flywheel.

TRANSMISSION:—Own Make. All helical gear type. Constant-mesh, synchro-mesh (second and high), sliding gear (low and reverse).

For complete data, refer to 1941 Mech. Equip. Index.

Trannsmission Control:—Remote control, steering column shift, vacuum power type.

For complete data, refer to 1941 Mech. Equip. Index.

Removal (except Cabriolet):—Remove front floor mat and floor cover over transmission. Remove outer half of reactionary lever metal boot (work under car) by taking out two bolts fastening halves together. Loosen 3 vacuum cylinder bracket-to-transmission capscrews and reactionary lever assembly-to-transmission operating shaft clamp bolt. Drive assembly from end of shaft with care. Disconnect selector rod from selector lever after removing cotter pin from transmission end of selector rod. Remove 3 vacuum cylinder bracket-to-transmission capscrews and move assembly (bracket, vacuum cylinder and reactionary levers) away from transmission. Disconnect pull rod and brake cables from brake cross shaft and remove cross-shaft. Disconnect speedometer cable. Remove 4 universal joint ball collar-to-retainer capscrews and slide ball back on propeller shaft housing. Remove 4 capscrews which secure front trunnion bearings to the front yoke. Remove 2 front yoke trunnion bearings and split the joint. Push front end of propeller shaft down for clearance. Remove 4 rear transmission mounting-to-frame cross member bolts. Remove two upper transmission-to-clutch housing capscrews and insert guide pins. Remove clutch underpan and two lower transmission-to-clutch housing capscrews. Slide transmission back and lift out through opening in floor.

Removal (Cabriolet):—Transmission removal on this model differs from regular passenger car removal (above) due to use of special 'VK' frame. Removal procedure for Cabriolet as follows: Remove front floor mat and floor cover over transmission. Remove outer half of reactionary lever metal boot by taking out two bolts fastening halves together. Disconnect selector rod from selector lever after removing cotter pin from transmission end of selector rod. Disconnect gearshift control rod by removing cotter pin, washer and anti-rattle spring from transmission end of rod. Disconnect vacuum cylinder piston rod and valve link from reactionary levers. **To prevent upsetting vacuum valve adjustment, replace clevis pin through piston rod yoke and valve link.** Remove vacuum cylinder from mounting bracket. Disconnect pull rod and brake cables from brake cross-shaft and remove cross-shaft. Disconnect speedometer cable. Remove 4 universal joint ball collar-to-retainer capscrews and slide ball back on propeller shaft housing. Remove 4 capscrews which secure front trunnion bearings to front yoke. Remove 2 front yoke trunnion bearings and split the joint. Push front end of propeller shaft down for clearance. Remove 4 rear transmission mounting-to-frame cross member bolts. Remove two upper transmission-to-clutch housing capscrews and insert guide pins. Remove clutch underpan and two lower transmission-to-clutch housing capscrews. Slide transmission back until clutch shaft just free of driven member, raise rear end sufficient to remove transmission rear mounting (free mounting from transmission and move it forward enabling removal of mounting through opening in frame). Pull transmission back and turn it toward the left as required for sufficient clearance to lift it out through opening in floor.

UNIVERSAL JOINT:—Own Make—Needle bearing 'cross' type. One used.

For complete data, refer to 1941 Mech. Equip. Index.

Service Note—Floating bushings (replacing roller bearings) available for servicing universal joint.

For complete data, refer to 1941 Mechanical Equipment Index, for 'Chevrolet Universal Joint' article.

REAR AXLE:—Own Make. Semi-floating, Hypoid gear type with Torque Tube drive.

For complete data, refer to 1941 Mech. Equip. Index.

Ratio—4.11-1 Standard. 3.73-1 Optional.

NOTE—Axles may be identified by prefix on serial number (located on top of the differential carrier casting on the right side of the center rib) as follows: 4.11-1—'AG' or 'AJ'. 3.73-1—'AH' or 'AP' (optional gear ratio).

Backlash—.005-.007". Screw adjustment.

Removal:—Raise rear of car, remove rear wheels and brake drums, install clamps on wheel brake cylinders, disconnect hand brake cables from brake pull rods and remove cables from cable clamps on frame, disconnect brake line at axle housing and shock absorber 'I' bolts at spring seats. Remove spring 'U' bolts, disconnect spring shackles and drop springs. Pull axle assembly back to free front end of drive shaft. Withdraw axle assembly from beneath car.

Rear Spring Rear Shackle Note—2 types used in production. First type same as 1940. Second type rubber bushed and requires no lubrication. ***See Chevrolet Shop Notes for Rear Spring Rear Shackle servicing.***

Axle Shaft Removal:—Wheel bolted directly on flange on outer end of axle shaft. Shaft retained by 'C' washer on inner end of differential case. To remove axle shaft, remove wheel, take out two 'zipon' brake drum retaining nuts (on second wheel stud at either side of drain hole in drum), remove drum, install clamp on wheel brake cylinder. Remove axle housing cover, differential pinion shaft lock screw, pinion shaft and axle shaft spacer. Push axle shaft in, remove 'C' washer on inner end of shaft, pull shaft out.

Installation—Assemble new oil deflector, gasket (coat both sides with heavy shellac or paint), line up extra hole (center hole of closely grouped three holes) with notch in hub flange on axle shaft (oil pocket in oil deflector should also be aligned with this notch), install six special bolts, forcing heads down to deflector, and peen shoulder on bolts into countersink around bolt holes in flange using Special Peening Tool and Anvil so that these parts are riveted together. Check endplay adjustment (below). NOTE—Axle shafts unequal length. Use longer shaft on right hand side.

Endplay Adjustment—When installing shaft, select correct spacer block (see below) so that with spacer installed on pinion shaft between inner ends of axle shafts, shaft endplay will be from a Free fit to .014" maximum clearance.

Axle Spacer (Passenger Car)—Three spacer blocks furnished which give four sizes as follows: Narrow—1.0105". Medium—1.0195" and 1.0295". Wide—1.0345".

(Trucks)—Two spacer blocks furnished which give three sizes as follows: Narrow—1.1485". Wide—1.1575" and 1.1675". **These dimensions are taken across ground surfaces.**

NOTE—Spacers should be installed with ground surface toward axle shaft end. Medium (Passenger Car), Wide (Truck) Spacers are ground on all four sides (giving two different sizes as listed above).

SHOCK ABSORBERS:—Delco Model 2200-A,B (front), 2100-A,B (rear). Double acting, hydraulic, parallel cylinder type. Same as 1940 types except for valve changes due to increased car weight.

Shock Absorber Valve Change to correct 'Crunching' Noise in Front Shock Absorber—New valve (part #1069124) released during production. Valve marking same as first type. ***For complete data, refer to 1941 Mechanical Equipment Index for 'Delco Parallel Cylinder Type' Shock Absorber article.***

STEERING:—Steering Gear—Saginaw Worm-and-Roller type.

For complete data, refer to 1941 Mech. Equip. Index.

Front Suspension:—Independent, linked parallelogram type with coil springs. Same as 1940 except for longer springs, larger wheel spindles and new front wheel inner bearings.

'Crunching' Noise Correction—See Shock Absorber Valve Change Note above.

For complete data, refer to 1941 Mech. Equip. Index.

NOTE—Make checks with car weight on wheels and special gauge installed at front to level frame.

Kingpin Inclination—4¾° ± ½°.

Caster—0° ± ½°. Adjustable.

Camber—Negative ¼° ± ½°. Adjustable.

Toe In—0-1/16". To adjust, loosen clamp bolts at each end of **left tie rod** and turn rod. When tightening clamp bolts, tie rod ends must be in alignment with ball studs (to prevent binding).

Steering Geometry (toe-out on turns)—Outer wheel turned 20°. Inner wheel turned 24° ± 2°.

BRAKES:—Service—Own Make. Hydraulic type. Hand lever applies rear wheel service brakes.

For complete data, refer to 1941 Mech. Equip. Index.

Wheel Cylinders—Diameter: 1¼" (front), 1 3/16" (rear). Sizes stamped under adjusting cup lock spring on wheel cylinder housing.

Drums—Cast iron rim, steel web. Diameter 11".

Lining—Moulded type. Width 1¾". Thickness 3/16". Length per wheel 22⅝".

Clearance—Adjusting Cover (on wheel cylinder) backed off 4 Notches from slight drag position.

Braking Power—47½% rear wheels, 52½% front.

Hand Brake:—See Service brakes above.

MODEL DESIGNATION:—Models, Nominal Rating, and Wheelbases for all trucks are as follows:

Model	Nominal Rating	Wheelbase
AK	½ Ton	115"
AJ (Dubl-Duti)	½ Ton	115"
AL	¾ Ton	125¼"
AN	¾ Ton Long W. B.	134½"
YR	1 & 1½ Ton	134½"
YS	1½ Ton	160"
YU (Cab-Over-Eng.)	1½ Ton	109⅛"
YV (" " ")	1½ Ton	132⅝"
YW (" " ")	1½ Ton	158⅛"
YT	School Bus	160" & 195⅛"

SERIAL NUMBER:—First number 1001 (all models) with model prefix as listed above. On plate on rear side of dash (Cab-Over-Engine), on right side of cowl under engine hood (all others).

ENGINE NUMBER:—Stamped on right side of crankcase to rear of distributor. First No. 1001 (each plant) with prefix letters as follows:

Model	Flint	Buffalo (Tonawanda)
½ Ton	AD	AE
¾ & ¾ Ton Special	AAF	AAN
1½ Ton	AF	AN
1½ Ton (235 cu. in. Engine)	AG	—
1½ Ton C-O-E	AJ	—
1½ Ton C-O-E (235 cu.in. Eng.)	AL	—
Dubl-Duti Panel	AM	—

FLEET MODEL NOTE:—Same as passenger car. *See 1941 Chevrolet Passenger Car 'M' page (preceding).*

ENGINE SPECIFICATIONS (REGULAR ENGINE) AND SERVICE DATA:—*See 1941 Chevrolet AG and AH 'M' pages (preceding) for complete data.* All data (Pistons, Rings, Pins, Connecting Rods, Main Bearings, Camshaft, Valves, Lubrication and Cooling System) same as for passenger cars except as noted.

SPECIAL 235 CUBIC INCH OPTIONAL TRUCK ENGINE:—Available as a regular production option on all 1½ Ton Heavy Duty & C-O-E Trucks.

Servicing:—All service operations and clearances same as for Regular Engine except for connecting rod oiling system adjustment. *See 1941 Chevrolet AG and AH 'M' pages (preceding) for complete data.*

Non-interchangeable Parts:—Parts are interchangeable between the Regular Engine and the Special 235 Cubic Inch Engine except as follows: Cylinder Block and Crankcase, Cylinder Block Assembly (Short Motor), Push Rods (approximately ¾" longer on large engine and identified by shoulder just below cup at top end), Valve Tappets, Camshaft, Piston and Pin Assembly, Piston Rings (Compression and Oil Control), Crankshaft, Connecting Rod, Harmonic Balancer, Oil Pan, Oil Pan Pipe Assembly, Oil Distributor to Valve Rocker Shaft Pipe Assembly, Oil Pump Screen Cover Support Assembly.

ENGINE SPECIFICATIONS (235 CUBIC INCH OPTIONAL TRUCK ENGINE):—6 cylinder, valve-in-head **Bore**—3 9/16". **Stroke**—3 15/16". **Displacement**—235.5 cu. ins. **Rated HP**—30.4. **Developed Horsepower**—93 HP at 3100 RPM. **Compression Ratio**—6.62-1 std. cast-iron head. *See Special 235 Cubic Inch Optional Truck Engine Note above for Servicing and Non-interchangeable Parts.*

CLUTCH (AL, AN, YR, YS, YU, YV, YW, YT):—**Own Make.** Diaphragm spring, single plate, dry disc type. NOTE—Driven member vibration dampener now equipped with 6 (coil) springs instead of 8. *For complete data, refer to 1941 Mech. Equip. Index.*

½ Ton & Dubl-Duti Note—Passenger car clutch used. *See 1941 Chevrolet Passenger Car 'M' page (preceding).*

Facings—Woven asbestos, 2 used. Inside Diam. 7". Outside Diam. 10¾". Thickness .137-.143".

Adjustment & Removal:—Same as passenger car. *See 1941 Chevrolet Passenger Car 'M' page (preceding).*

3 SPEED TRANSMISSION (AK, AJ, AL):—**Own Make.** All helical gear type. Constant-mesh, synchro-mesh (second and high), sliding gear (low and reverse). *For complete data, refer to 1941 Mech. Equip. Index.*

Removal:—See 4 Spd. Transmission Removal (below).

4 SPEED TRANSMISSION (OPTL. AK, AJ, AL; STD. ON ALL OTHERS):—**Own Make.** Sliding spur gear type. *For complete data, refer to 1941 Mech. Equip. Index.*

Important Gear Change Note—Two different low and reverse gear ratios used during 1941. Ratios may be identified by transmission serial numbers and identification markings. *For complete data, see 1941 Mechanical Equipment Index for Chevrolet 4 Speed Truck Type Transmission article.*

Transmission Control (Cab-Over-Engine):—Remote control type. *See Chevrolet Shop Notes for data.*

Removal (AK, AJ):—Remove floor boards. Disconnect speedometer cable. Remove hand brake lever from transmission. Remove 4 universal joint ball collar-to-retainer capscrews and slide ball back on propeller shaft housing. Remove 4 capscrews which secure trunnion bearings to front yoke. Remove 2 front yoke trunnion bearings and split the joint. Push front end of propeller shaft down for clearance (NOTE—On 4 spd. transmission, frame cross member must be removed to drop shaft). Remove 2 upper transmission-to-clutch housing capscrews and insert guide pins, remove clutch underpan and take out 2 lower mounting capscrews and slide transmission out and remove. NOTE—On 4 spd. type transmission 2 brake master cylinder bracket capscrews must be removed.

Removal (AL):—Remove floor boards. Disconnect speedometer cable. Remove hand brake lever from transmission. Split center universal joint by removing two trunnion bearing 'U' clamps (tape or wire trunnions together to prevent losing bearings). Remove 4 universal ball retainer-to-transmission bolts and slide retainer back on tube. Remove center bearing support bracket-to-frame cross member bolt nuts. Pull front propeller shaft assembly to rear free of front universal. Remove transmission as for AK and AJ using guide pins.

Removal (YU):—Removal same as for AL (above) except that one propeller shaft only used. Split front universal and remove transmission (as above).

Removal (All Others):—Remove floor boards. Disconnect speedometer cable. Remove hand brake lever from transmission. Split front universal joint by removing two trunnion bearing 'U' clamps (tape or wire trunnions together to prevent losing bearings). Remove center bearing support bracket-to-frame cross member bolts. Pull front propeller shaft assembly to front to free from rear shaft. Then remove transmission as for AK, AJ above.

UNIVERSAL JOINTS:—**Own Make.** Needle bearing type (AJ, AK), bushing type (AL—front universal only). **Spicer**—Needle bearing types (all others). *For complete data, refer to 1941 Mech. Equip. Index.*

Propeller Shaft Support Bearing:—*See Chevrolet Shop Notes for servicing instructions.*

REAR AXLE (AK, AJ, AL, AN):—**Own Make.** Semi-floating, Hypoid gear type with Torque Tube drive (AK, AJ), Hotchkiss drive (AL, AN). *For complete data, refer to 1941 Mech. Equip. Index.*

Ratio—4.11-1 (AK), 4.55-1 (all others).

Backlash—.005-.008" (all). Screw adjustment.

Removal, Axle Shaft Removal, Endplay Adjustment:—Same as for Passenger Car (except on AL and AN propeller shaft can be disconnected at rear universal for Rear Axle Removal). *See 1941 Chevrolet Passenger Car 'M' page (preceding) for data.*

REAR AXLE (YR, S, T, U, V, W):—**Own Make.** Full-floating, Hypoid gear type with Hotchkiss drive. *For complete data, refer to 1941 Mech. Equip. Index.*

Ratio—6.17-1 Std., 5.43-1 Optl. NOTE—Axles identified by prefix letters on part number stamped on top right side of differential housing as follows: 6.17-1—'AR' or 'AS'. 5.43-1—'AT' or 'AW'.

Backlash—.005-.008". Screw adjustment.

Removal:—Remove differential cover and axle shafts (see below). Disconnect rear universal by removing two U-bolts from rear yoke (wire trunnions to retain bearings). Slide shaft forward and lower to floor. Remove differential carrier mounting bolts.

Axle Shaft Removal:—Bend lock plate lugs away from capscrew heads, take out 8 capscrews in axle shaft flange, install two 7/16" x 14 capscrews in tapped holes in flange (between regular screw holes), turn screws up evenly to loosen shaft, withdraw shaft and aluminum gasket. NOTE—Use new aluminum gasket and lock plate when shaft installed.

Wheel Bearing Adjustment:—Remove axle shaft (see above), locknut and adjusting nut lock (within wheel hub), use J-870 wrench and tighten adjusting nut tight, then back off 45°, see that wheel hub turns freely by hand, install lock and locknut, bending lock tangs in notches on both nuts.

REAR AXLE (TWO SPEED):—Optl. on all Trucks. *For complete data, refer to 1941 Mech. Equip. Index.*

Ratio—5.64-1 & 8.22-1 Std. 6.17-1 & 8.22-1 Optl.

Backlash—.006-.012". Screw adjustment.

Removal, Axle Shaft Removal & Wheel Bearing Adjustment:—Same as regular truck axle (above).

SHOCK ABSORBERS:—**Delco Hydraulic Type.** Single acting front and rear (AJ, K, L, N). Double acting type Optl. *For data, refer to Mech. Equip. Index.*

STEERING:—**Steering Gear**—Saginaw Ball-Bearing Worm-and-Nut. *For data, refer to Mech. Equip. Index.*

Front Suspension:—Conventional 'I' beam section front axle with Reverse-Elliott ends and semi-elliptic springs. NOTE—Kingpin bushings 'floating' type on AJ, K, L, N.

Kingpin Inclination—7°10' (all except Cab-Over-Engine), 8° (Cab-Over-Engine), ± 1° crosswise.

Caster—1¾° (AJ, AK, AL, AN), 2¾° (YR, YS, YT), 3° (YU, YV, YW), ±½°. Adjust by inserting wedge shims between spring and axle (up to 2°), use tools for greater correction.

Camber—1° ±½°. Bend cold for minor corrections.

Toe In—5/64"-⅛". Adjust by turning tie rod.

Steering Geometry—Outer wheel 20°, Inner 23° ±2°.

BRAKES:—**Service—Own Make.** Hydraulic type. Hand lever applies rear service brakes. *For complete data, refer to 1941 Mech. Equip. Index.*

Wheel Cylinders—Diameter 1¼" (front wheels—all), 1 3/16" (rear—AJ, AK, AL), 1⅜" (rear—¾ Ton Special, AN), 1½" (rear—all others). Size stamped on housing under adjusting cup lock spring.

Drums—Cast alloy iron (except YU, YV, YW), pressed steel (YU, YV, YW). Diameters 11" (all AJ, AK, AL, front AN), 14" (rear AN, front YR, S, T, U, V, W), 16" (rear YR, S, T, U, V, W).

Lining—Moulded type	Width	Thickness	Length
AJ, AK, AL; AN (front)	1¾"	3/16"	22⅝"
AN (rear)	2"	17/64"	38½"
YR, YS, YT (front)	2"	¼"	28⅞"
YR, YS, YT (rear)	3"	¼"	35 13/16"
YU, YV, YW (front)	2"	17/64"	28⅞"
YU, YV, YW (rear)	3"	17/64"	35 13/16"

Clearance—Adjusting cover backed off 4 Notches (AJ, AK, AL), 5 Notches (all others—front wheels), adjusting pinion shaft backed off ¾ turn (YR, YS, YT, U, V, W—rear), from slight drag position.

Hand Brake:—See Service Brakes above.

TORQUE WRENCH SPECIFICATIONS:—*See Torque Wrench article in Mechanical Equipment Section for tightening specifications for Cylinder Head, Main & Connecting Rod Bolts, etc.*

HOOD LOCK:—Chrysler C28, C30, C33; Dodge D19. Conventional center hinge hood. Each side locked by button under each end of instrument panel. To raise hood side, pull button out on side to be raised which unlatches hood, lift up on edge of hood. NOTE—Dodge hood side panels are removable.

Control Cable Adjustment—Cable for each hood side must be adjusted separately as follows: Pull out on control button on instrument panel on side to be adjusted, press down on hood to lock it in place. Open opposite side for access to control cable on locked side. Loosen screw on clamp at forward end of cable on front fender panel (for Chrysler), on hood side panel (for Dodge), and adjust clamp for less than ⅛" free play in cable (excessive free play allows wire stop to contact cable sheathing before latch is released), tighten screw. Repeat operation for opposite hood side.

De Soto S8, Plymouth P11, P12:—Alligator type hood with control button under left side of instrument panel. A safety catch is located under nose of hood. To raise hood, pull out on control button (hood will raise slightly), push up on saftey catch under front end of hood, lift hood up. NOTE—Plymouth hood side panels can be removed.

Control Cable Adjustment—Raise hood, loosen set screw in clamp on front end of cable, adjust clamp position for ⅛" minimum free play between clamp and latch arm in locked position, tighten set screw. Check safety catch for proper locking action.

HOOD ALIGNMENT:—Chrysler C28, C30, C33; Dodge D19. Hood fit to side panels adjustable by loosening screws at front and rear pivot plates, adjust hood for proper clearance at side panels, tighten pivot plate screws. No adjustment required at spring latches. Check Hood Lock for proper locking action (see Control Cable Adjustment above).

De Soto S8, Plymouth P11, P12:—Hood alignment may be adjusted as follows: (1) Hood lock latch stud at front end. To adjust, loosen locknut on top of stud, turn stud in or out for proper hood fit, tighten lock nut. (2) Hood hinge position. Open hood just beyond normal open position, unhook hood hinge spring and remove spring. Loosen lower hood hinge bracket screw (on inner side on cowl extension) and upper screw (on outer side at upper rear corner of hinge). Do not disturb front upper cap screw (this must be tight to hold hinge in position). Align hood hinge by closing hood. Open hood carefully without disturbing hood hinge position and tighten screws. (3) Hood fore-and-aft position. Open hood, loosen three hood-to-hinge screws (on under side of hood ledge at rear), shift hood position backward or forward until correct fit obtained, tighten screws. Check Hood Lock for proper locking action (see Control Cable Adjustment instructions above).

FRONT END ASSEMBLY (UNIT) REMOVAL:—Radiator shell, radiator core, and both front fenders (including hood side panels on Dodge and Plymouth) can be removed as an assembly as follows: Raise hood and drain radiator. Remove hood on Chrysler and Dodge only. Disconnect battery cables at battery. Remove battery on Plymouth only. Disconnect horn wires at relay and remove horn and mounting plate assembly on Plymouth only. Disconnect headlight wires at junction block on left fender. Disconnect hood latch release cables (at each side on Chrysler and Dodge, at lock plate on radiator shell on De Soto and Plymouth). Remove hood lock and plate assembly on Plymouth only (mark plate and radiator shell and reassemble to these marks when installing assembly). Remove front bumper assembly on all models except De Soto. Remove engine inlet and outlet water hoses. Remove fender-to-body stud nuts and studs, and nuts from fender braces and running boards. With a man at each side lifting on fender skirt, radiator shell, radiator core, hood lower side panels and both front fenders can be removed as an assembly. When installing assembly, attaching bolts should be installed loosely, hood aligned (see Hood Alignment above), and then tighten to secure assembly on car.

RADIATOR CORE REMOVAL:—6 cylinder Cars—Remove hood and radiator ornament (on Chrysler and Dodge only). Drain cooling system. Remove inlet and outlet hoses. On Chrysler, remove water outlet elbow and thermostat, fan belt, water pump cap screws, and lift water pump out. On Dodge, remove fan blade cap screws in flange on pump shaft and take off fan blades. Free headlight wires from clips so that wires clear radiator. Remove nuts and cap screws from radiator support on each side. On De Soto and Plymouth, remove brackets at upper left and right corners of radiator support. Lift radiator core up and out of chassis (on Chrysler and De Soto, tilt upper end of core back).

8 cylinder Cars—Remove hood and radiator ornament, drain cooling system. Remove front end assembly (see Front End Assembly (Unit) Removal above). Remove radiator support-to-core cap screws and nuts. Lift radiator core out.

OIL PAN REMOVAL:—Drain oil and replace drain plug. Remove clutch housing underpan to avoid damaging oil pan gaskets on underpan dust shield (NOTE—On Eight cylinder cars, raise rear of engine slightly so that pan clears frame cross-member). Remove oil level indicator, drop oil pan on tie rod. Pan can then be removed by reaching in under crankcase and raising oil strainer to clear baffle while sliding pan out to rear.

Installation (6 cylinder Engines)—When installing new gaskets, end gaskets should extend ¼" to ⅛" above level of oil pan (these ends must not be cut off). Side gasket installed with ends resting on top of protruding end gaskets. Gaskets will be compressed into place when pan screws tightened.

ENGINE ASSEMBLY REMOVAL:—Engine, clutch, and transmission assembly can be removed from car as an assembly as follows: Remove the hood. Remove Front End Assembly (see removal instructions above). Remove propeller shaft (on cars with two shafts see Propeller Shaft Center Bearing Removal following). On cars with Power Shift remove the vacuum control unit. Disconnect the following: Fuel pump flexible line at pump, exhaust pipe at manifold, throttle controls, choke control (on Plymouth only), heat indicator tube and bulb at head, oil gauge line at flexible tube, generator wires, speedometer cable, hand brake, gear shift and selector rods at transmission, clutch pedal linkage and torque tube, windshield wiper vacuum hose (on cars with vacuum type wiper). Remove crankcase ventilator breather pipe and front and rear engine support bolts. Connect hoist to engine (remove air cleaner if necessary) and lift assembly out of chassis. When re-installing assembly reverse procedure listed above, check Hood Alignment and Hood Lock operation (see instructions above).

ENGINE NUMBER LETTERING ('SPECIAL STANDARD BORE & BEARING SIZES):—Letters used with engine number **(not in circular pads)** denote following 'special standard' sizes: **'A'**—.020" larger standard cylinder bore. **'B'**—.010" smaller standard main and connecting rod bearings. **'AB'**—Cylinder bore, main and connecting bearings 'special standard'.

ORIGINAL PISTON & CYLINDER BORE SIZES:—Original production (new engine) piston and bore sizes indicated by letter located as follows:

Piston Size—Letter stamped on piston head (number following letter on Dodge pistons is weight).

Bore Size—Letter stamped on pad at top of block on distributor side.

.020" Oversize Pistons and Bores—Graded in same steps as for standard sizes except .020" larger and marked P, Q, R, S, and T.

CHRYSLER C28, DE SOTO S8

Piston & Engine Mark	Piston Diameter	Cylinder Diameter
A	3.37425-3.37475"	3.37475-3.37525"
B	3.37475-3.37525"	3.37525-3.37575"
C	3.37525-3.37575"	3.37575-3.37625"
D	3.37575-3.37625"	3.37625-3.37675"
E	3.37625-3.37675"	3.37675-3.37725"

CHRYSLER C30, C33

A	3.24925-3.24975"	3.24975-3.25025"
B	3.24975-3.25025"	3.25025-3.25075"
C	3.25025-3.25075"	3.25075-3.25125"
D	3.25075-3.25125"	3.25125-3.25175"
E	3.25125-3.25175"	3.25175-3.25225"

DODGE D19

A	3.2495"	3.24975-3.25025"
B	3.2500"	3.25025-3.25075"
C	3.2505"	3.25075-3.25125"
D	3.2510"	3.25125-3.25175"
E	3.2515"	3.25175-3.25225"

PLYMOUTH P11, P12①

A	3.12415-3.12465"	3.12475-3.12525"
B	3.12465-3.12515"	3.12525-3.12575"
C	3.12515-3.12565"	3.12575-3.12625"
D	3.12565-3.12615"	3.12625-3.12675"
E	3.12615-3.12665"	3.12675-3.12725"

①—Data for aluminum alloy, U-slot pistons only. Steel-banded type pistons also used on these cars.

Additional Piston Sizes—AA pistons .0005" smaller than A pistons, EE pistons .005" larger than E

Dodge Steel Strut Piston Weight—All 6 pistons in one block must be alike (same number on head).

REPLACEMENT PISTONS:—Finished Pistons—Furnished in standard size and .003", .005", .010", .015", .020", .023", .025", .030", .040", .050", .060" oversize. **Semi-finished Pistons**—Furnished in two sizes: (1) for cylinder bores from standard to .023" oversize, (2) for bores .025-.050" oversize. Pistons are finished except for skirt (head and ring grooves finished). **Piston skirt must be cam ground** and not finished circular. IMPORTANT—Second group pistons (.025-.050") must not be used for oversizes below .025" due to piston head and ring grooves being finished to different size than first group.

CONNECTING ROD BEARINGS:—Removal & Installation. Bearing shells can be removed after taking off bearing caps. When installing bearing shells, oil hole in rod and bearing must be aligned and ear on bearing halves fitted in notch in rod and cap.

Fitting Bearings—To check bearing clearance, place an oiled piece of feeler stock, .0015" thick (Sixes), .002" thick (Eight), ½" wide and 1" long between bearing and crankshaft. Tighten bearing cap bolt nuts. Bearings clearance is correct when slight drag felt when turning crankshaft by hand. If no drag felt, and crankshaft journal out-of-round and taper not over .001", install proper undersize bearing listed below.

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Undersize Bearings—Finished bearing shells furnished .001", .002", .010", .012" undersize. Install .001" or .002" undersize bearings on standard crankshafts which show slight wear, .010" for 'Special Standard' .010" crankshafts (see Engine Lettering 'Special Standard' Bore & Bearing Sizes Note above), .012" bearings for 'Special Standard' .010" crankshafts which show slight wear. Bearing size correct when proper clearance obtained (see Fitting above).

MAIN BEARINGS:—Removal & Installation (with engine in car). Bearing shells can be removed and installed without removing crankshaft as follows: Remove oil pan (see Oil Pan Removal following), clutch housing underpan, oil pump strainer, and crankshaft pulley shield. On six cylinder engines, remove oil pan front end oil seal plate by taking out 2 lower screws on chain case cover. On eight cylinder engines, remove two lower screws on timing chain cover to front main bearing cap, and front and rear main bearing caps using Special Puller Tool C-305 (caps are sealed in position and puller must be used to remove them). Remove one bearing cap at a time and with Special Tool C-584 inserted in oil hole in crankshaft, upper bearing shell can be rotated out by turning crankshaft in clockwise direction. Upper bearing shells can be installed by reversing removal procedure. Sharp edge on plain edge of bearing should be removed by chamfering it slightly. CAUTION—Upper and lower bearing shells on Chrysler Six and De Soto on all except rear are alike and interchangeable, rear bearing halves interchangeable and must be used only at #4 bearing. Upper and lower bearing shells on Chrysler 8, Dodge, and Plymouth are not interchangeable. Bearing half with oil hole must be used for upper half of bearing.

Fitting Bearings—To check bearing clearance, place an oiled piece of feeler stock, .002" thick, ½" wide, and 1" long between bearing and crankshaft. Tighten bearing cap nuts or cap screws. Bearing clearance is correct when slight drag felt when turning crankshaft by hand. If no drag felt, and crankshaft journal out-of-round and taper not over .001", install proper undersize bearing listed below.

Undersize Bearings—Finished bearing shells furnished .002", .010", .012" undersize. Install .002" undersize bearings on standard crankshafts which show slight wear, .010" for 'Special Standard' .010" crankshafts (see Engine Lettering 'Special Standard' Bore & Bearing Sizes Note above), .012" bearings for 'Special Standard' .010" crankshafts which show slight wear. Bearing size correct when proper clearance obtained (see Fitting Bearings above).

Replacement Main Bearing Caps—Furnished for service where original caps damaged of broken (the original caps should not be filed or shimmed—See Fitting Bearings above). Replacement main bearing caps 1/16" shorter and have 1/64" larger stud holes than original caps to permit fitting on engine. These caps must be fitted on engine since they are line-reamed on master fixture and not on engine which results in size variation. Fit replacement caps on engine by filing or shimming to obtain proper bearing clearance only when first installed on engine. When servicing bearings on engines with replacement caps already installed, fit bearings as directed above without filing or adding shims.

CRANKSHAFT OIL SEALS:—Servicing—Car manufacturer recommends that new oil seals be installed if chain cover or rear bearing cap removed.

Front Oil Seal—Oil seal located in timing chain cover. Consists of spring-backed composition seal in a stamped steel housing pressed in chain case cover with composition gasket installed between seal and cover. To install seal proceed as follows: Insert new composition gasket in chain case cover, drive new seal in place with drift or similar tool slightly larger than seal (seal is press fit in cover), seal must have a tight, even fit in seat in cover. Center seal on crankshaft when installing chain case cover as follows: Install chain case cover on engine with cover screws tightened just enough to hold cover in place, install Special Centering Tool C-522 on end of crankshaft and hold it in place by tightening crankshaft starting jaw finger tight, tighten chain case cover screws and as cover gasket is being compressed, tighten crankshaft starting jaw nut so as to maintain slight tension between centering tool and seal. Remove tool after chain case cover screws secured. Tighten starter jaw to 108 ft. lbs. min.

Rear Oil Seal (6 cylinder Engines)—Located at rear main bearing. Consists of oil seal packing assembled on rear face of bearing cap and crankcase (upper half held by retainer assembled on rear face of crankcase, lower half by retainer assembled on rear face of bearing cap). Gaskets used on top face of bearing cap at each side, around oil slinger grooves and along shoulder across cap. Install new packing in retainer on crankcase and cap, place new gaskets on cap and install on engine without disturbing position of gaskets.

Rear Oil Seal (8 cylinder Engines)—Located at rear main bearing. Consists of seal assembled on rear face of bearing cap and crankcase (upper half held by retainer assembled on rear face of crankcase, lower half by retainer asembled on rear face of bearing cap), and by rubber seals assembled in vertical grooves on each side of bearing cap. When installing rubber seals, upset grooves on each side of cap with prick punch to anchor seals in grooves and prevents seals sliding out when cap installed.

CAMSHAFT REMOVAL:—Remove Front End Assembly as a unit (see removal directions in first column). Remove cylinder head, fuel pump, oil pump, valve tappet cover plates, crankshaft pulley, front motor support (with front of engine jacked up), timing chain cover, camshaft sprocket and timing chain. If valves and valve springs are not to be removed, prop valves up by inserting wooden wedges at opposite sides under valve head. Raise tappets and hold in this position (use spring type clothes pins or similar tool to hold tappets up). Withdraw camshaft (rotate shaft to clear any obstructions).

Chrysler 8 Note—In addition to instructions listed above, two oil feeder lines in valve chamber must be removed and #4 piston must be on top dead center in order to remove camshaft.

EXHAUST VALVE SEAT INSERTS:—Inserts can be serviced by re-grinding only (cannot be re-cut due to hardness of material used). .010" oversize valve seat inserts should be installed where seats have been loosened in service. Inserts not used on inlet valves and seats can be serviced with re-cutting tools. Special Tool Set C-327, C-386 available for servicing exhaust valve seat inserts.

Re-Grinding—Clean valve guide, chamfer upper end of valve guide, fit valve guide pilot securely in place, dress grinding stones of Special Reconditioning Tool C-372 for concentricity on diamond dressing tool, operate grinding tool dry (CAUTION—Do not use valve grinding compound on inserts. Seat runout .0005" max. (check with dial indicator).

Replacing Inserts—Remove valves. Using Special Tool C-387, remove valve seat insert. Clean up insert seat in block by removing all burrs and rough edges (NOTE—If .010" oversize inserts to be installed, cylinder block must be cut to fit oversize valve seat insert). Install new valve seat insert (chill insert by using ice which contracts insert enough to permit easy installation in block), lock insert in block by using crimping or peening tool (in Tool Set C-387), re-grind insert (see above).

OIL PUMP REMOVAL:—Turn engine over until distributor rotor in firing position for #1 cylinder (allow engine to remain in this position while pump off engine) and remove capscrew in pump body.

Installation:—When installing oil pump where crankshaft has been moved while pump off engine, turn crankshaft until #1 cylinder is at firing position (both valves closed, piston on compression), set distributor rotor at #1 terminal and install pump. Then reset ignition timing (see 'T&E' page).

WATER DISTRIBUTION TUBE:—Removable one-piece tube installed in engine between cylinders and valve ports (on six cylinder engines), on right side of engine just above valve spring chamber (on eight cylinder engines) and distributes water from pump to exhaust valve ports through holes in tubes.

Servicing—A new tube should be installed whenever engine overhauled or when rusted or corroded in order to provide correct water circulation in engine block. To replace tube proceed as follows: Remove front end assembly (see Front End Assembly (Unit) Removal above). On six cylinder engines remove water pump which will expose front end of tube. On eight cylinder engines, remove welch plug to right of water pump to expose front end of tube. Remove tube by using rod with hook formed on end and engage it in slot on upper edge of tube just inside block, pull tube out. NOTE—On 8 cylinder engines, see that front end of tube flared in same manner as tube which was removed from engine.

PROPELLER SHAFT CENTER BEARING:—Used on all passenger car models with two propeller shafts. Consists of ball-bearing mounted on rear end of front propeller shaft with an oil seal assembled to front and to rear of bearing, and this assembly (bearing and oil seals) enclosed in a housing which is flange mounted on rear side of frame cross-member. An insulator is assembled on front end of housing. To remove assembly, remove nuts and lockwashers from differential and transmission companion flanges to free propeller shafts at front and rear, take out 4 center bearing housing-to-frame cross-member mounting bolts, remove propeller shaft and center bearing as an assembly.

HAND BRAKE ADJUSTMENT:—The hand brake adjustments can be made from beneath car as follows: Fully release hand lever (cable length adjusted by means of clevis at lower end). Adjust anchor screw for .015-.020" band to drum clearance by bending back tab of anchor screw lock and turning screw (on lower right side of brake), then lock screw by bending tab against flat of screw. Loosen guide bolt locknut and adjust guide bolt adjusting nut for .015-.020" band to drum clearance (these two nuts located in front of release springs at left side), then tighten locknut. Turn large adjusting bolt nut (on lower end of bolt below springs) for .015-.020" band to drum clearance for upper half of band. Groove in upper end of this nut must contact ridge on band operating lever spacer above nut. NOTE—Clearance between side of anchor bracket at center of band and anchor must not exceed .005" (if clearance excessive band may be distorted when brake applied). To correct, compress saddle in vise or place on block and tap lightly with a hammer.

HOOD LOCK, FRONT END ASSEMBLY & OIL PAN REMOVAL:—*See Chrysler Shop Notes.*

SERIAL NUMBER:—On right front door hinge post. First number: Detroit—7,657,501 (Royal), 7,901,601 (Windsor). Canada—9,717,741 (Royal).

ENGINE NUMBER:—First number C28-1001. Stamped on left side of block between #1 and #2 cylinders. *See Chrysler Shop Notes for engine number lettering data ('Special Standard' bore and bearing sizes).*

ENGINE SPECIFICATIONS:—6 cylinder, 'L' head type. **Bore**—3⅜". **Stroke**—4½". **Displacement**—241.5 cu. ins. **Rated HP**—27.34. **Developed Horsepower**—112 (Std. 6.8-1 or 6.5-1 hd.), 115 (Optl. 7.2-1 hd.—Std. 7 pass.), at 3600 RPM. **Compression Ratio and Pressure**—As follows:

Ratio	Pressure at 1000 RPM	At 125 RPM
6.8 or 6.5-1 iron	140-150 lbs.	115-125 lbs.
7.2-1 aluminum hd.	150-160 lbs.	120-130 lbs.

Vacuum Reading—Steady 18-20" idling (below 1000'). *See Chrysler Shop Notes for engine removal directions.*

PISTONS:—Aluminum alloy, U-slot, cam ground, tin coated. **Length**—3⅞". **Weight**—17.5 ozs. (stripped). **Removal**—Pistons and rods removed from above. **Clearance**—Top .023". Skirt .0000-.0010". **Original Bore & Piston Sizes, Replacement Pistons:**—*See Chrysler Shop Notes for sizes and markings.* **Fitting New Pistons:**—Check piston size with micrometer across large diameter at bottom of skirt. Insert .002" x ½" feeler between cylinder wall and piston (inverted, pin removed) on side opposite slot. Feeler pull 5-7 lbs. (with piston and block at 70° F). **Installing Pistons:**—Slot away from camshaft.

PISTON RINGS:—4 rings, all above pin #1 Compression (upper inner edge stepped), #2 Comp. (lower outer edge stepped), #3 & 4 (slotted oil rings).

Ring	Width	End Gap	Side Clearance
Comp. (Top)	⅛"	.007-.015"	.002-.004"
Comp. (#2)	⅛"	.007-.015"	.0015-.0035"
Oil Control	5/32"	.007-.015"	.001-.0025"

Replacement Rings:—Std. & .003", .005", .010", .015", .020", .023", .025", .030", .040", .050", .060" oversize.

PISTON PIN:—**Diameter**—55/64". **Length**—2⅞". Floating type. Pin hole in rod bronze bushed. **Pin Fit in Piston**—Thumb push fit (piston at 130°). **Pin Fit in Rod Bushing**—Thumb push fit at 70°F. **Replacement Pins:**—Std. & .003", .005", .008" oversize.

CONNECTING ROD:—**Weight**—33.9 ozs. (with bearings and bolts). **Length**—7⅞". **Lower Bearing Diameter**—2⅛". *See Engine Lettering Note in Chrysler Shop Notes for 'Special Standard' size.* **Lower Bearing**—Removable, precision type, thin babbit on steel. **Clearance**—.0005-.0015". **Sideplay**—.0055-.0115". **Bearing Adjustment:**—None (no shims). Replace bearings. *See Chrysler Shop Notes for instructions.* **Replacement Bearings:**—*See Chrysler Shop Notes.* **Installing Rods:**—Oil metering hole toward camshaft.

CRANKSHAFT:—4 bearings, 9 integral counterweights. *See Chrysler Shop Notes for Replacement Main Bearing Caps and Crankshaft Front and Rear Oil Seals.* **Bearing Diameters**—2½". *See Engine Lettering Note in Chrysler Shop Notes for 'Special Standard' size.* **Bearing Type**—Removable, precision type, thin babbitt on steel. **Clearance**—.001-.002". **Bearing Adjustment:**—*See Chrysler Shop Notes for bearing removal, replacement sizes and adjustment data.* **End Thrust:**—Taken by flange faces on rear (#4) main bearing. **Endplay**—.003-.007".

CAMSHAFT:—4 bearing. Non-adjustable chain drive. *See Chrysler Shop Notes for Camshaft Removal.* **Bearing Diameters**—#1, 2"; #2, 1 31/32"; #3, 1 15/16"; #4, 1¼". **Bearing Type**—Removable steel-backed, babbitt-lined bushings (except #4 machined in block). **Clearance**—.001-.003" (#1), .0015-.0035" (all others). **End Thrust:**—Taken by thrust plate behind camshaft sprocket hub. **Endplay**—.002-.006".

Timing Chain:—Morse Type 1883N, No. 2661. Width 1". Pitch .500" (½"). Length 24" or 48 links.

Camshaft Setting:—Sprockets marked. Mesh chain with sprockets turned so that '0' marks are adjacent and in line with a straightedge across shaft centers.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1 21/32"	.340-.341"	4 25/32"
Exhaust	1 17/32"	.340-.341"	4 25/32"

	Seat Angle	Lift	Stem Clearance
All Valves	45°	⅜"	.0015-.0035"

See Chrysler Shop Notes for Exhaust Valve Seat Inserts.

Tappet Clearance:—.008" Intake, .010" Exh. (hot and idling), .002" additional exh. clearance desirable for sustained high speeds. NOTE—Tappet screws self-locking (no locknuts). Remove right front wheel and lower wheel housing panel for access to valves.

Valve Guides:—Remove from above. Press new guides in (stepped end down) with upper end ⅞" below top of block, finish ream (Tool CM-83) to .3425-.3435".

Valve Springs:—Install with closely coiled end to top.

Free length 2".	Spring Pressure	Length
Valve Closed	40- 45 lbs.	1¾"
Valve Open	107-115 lbs.	1⅜"

Valve Lifters:—Mushroom type (remove from below). Stem diam. ⅝". Ream holes from above (pilot in valve guide). Oversizes .001", .008", .030" & .060". **Lifter Clearance in Block**—.000-.001".

Valve Timing:—See Camshaft Setting above. **Intake Valves**—Open 12° BTDC. Close 44° ALDC. **Exhaust Valves**—Open 50° BLDC. Close 6° ATDC. **Valve Timing Check**—With .014" (cold) tappet clearance #6 intake valve should open with #6 piston to 12° or .063" BTDC with 12th graduation before DC mark on impulse neutralizer aligned with pointer on chain case cover. Reset tappet clear. at .008" hot.

LUBRICATION:—Pressure (pump on right of engine). *See Chrysler Shop Notes for Oil Pump Removal.* **Normal Oil Pressure:**—30-45 lbs. at 30 MPH and above. **Oil Pressure Relief Valve:**—Under plug below starter. Opens at 40-45 lbs. Spring painted red, green, or unmarked. If spring replaced, use same color spring. **Crankcase Capacity:**—5 quarts (refill).

COOLING SYSTEM:—**Capacity** 18 qts. *See Chrysler Shop Notes Radiator Core Removal & Water Distrib. Tube data.* **Water Pump:**—Packless type with grease fitting. *For complete data, refer to 1941 Mech. Equip. Index.* **Thermostat:**—Bishop & Babcock or Fulton. On cyl. hd. **Setting**—Starts to open 157-162°F. Fully open 183°F.

CLUTCH:—Borg & Beck Model 10A7 (Std.), 9A7 (with Fluid Drive), 11A6 (Taxi) with 'Borglite' driven member. Assembly No. 940 (10A7), 953 (9A7), 941 (11A6) stamped on cover. Single plate, dry disc type *For complete data, refer to 1941 Mech. Equip. Index.* **Facings**—Molded-Woven, 2 used. Inside Diam. 7" (10A7), 6" (9A7), 6½" (11A6). Outside Diameter 10" (10A7), 9¼" (9A7), 11" (11A6). Thickness .125" (⅛"). **Adjustment:**—Pedal should just clear toeboard (adjust stopscrew on lower end of pedal) & have 1" free travel (adjusting nut on connector link at fork). **Removal:**—Remove release fork pull-back spring, Transmission (see Transmission) and housing underpan. Pull out clutch release bearing and sleeve. Mark cover and flywheel (or driving plate on Fluid Drive). Take out cover screws, remove assembly.

FLUID DRIVE (OPTL.):—Fluid coupling at rear of engine. *For complete data, refer to Mech. Equip. Index.*

TRANSMISSION (STD.):—Own Make. All helical gear, constant-mesh, synchro-mesh (second & high), sliding gear (low & reverse) with remote shift. *For complete data, refer to 1941 Mech. Equip. Index.* **Transmission Control:**—Steering column shift. Manual type Std., Power Shift (vacuum type) Optl. *For complete data, refer to 1941 Mech. Equip. Index.* **Removal:**—Jack up front end of car, disconnect front universal (loosen companion flange nut if disassembling transmission—see Chrysler Shop Notes for Propeller Shaft Center Bearing Removal on 7 pass.). Disconnect speedometer cable, hand brake cable, gear-shift rods, vacuum and air hose (if Power Shift used). Remove trans.-to clutch housing capscrews and nuts. Pull unit to rear, down and out of car. NOTE—Use pilot studs when installing assembly.

VACAMATIC (UNDERDRIVE TYPE) TRANSMISSION (OPTL.):—*For data, refer to Mech. Equip. Index.* **Transmission Control:**—Mech. steering column shift. *For complete data, refer to 1941 Mech. Equip. Index.* **Removal:**—Same as Std. Transmission (above) plus the following: Remove floor board, wires from vacuum unit solenoid, interrupter and governor switches, hose from vacuum unit air cleaner to vacuum unit. Take out vacuum unit (disconnect pullout cable and return spring and remove pivot pin).

UNIVERSAL JOINTS:—Detroit-Universal Series 7200. *For complete data, refer to 1941 Mech. Equip. Index.* **Propeller Shaft Center Bearing:**—Used on 7 passenger sedans. *See Chrysler Shop Notes for servicing.*

REAR AXLE:—Own Make. Semi-floating, Hypoid gear type with Hotchkiss drive. *For complete data, refer to 1941 Mech. Equip. Index.* **Ratio**—3.9-1 Std. 4.3-1 Std. 7 pass. 3.54-1 Vacamatic trans. (5 pass.), 3.91-1 (7 passenger). **Backlash**—.006-.010". Screw adjustment. **Removal:**—Disconnect rear universal, remove axle shafts (see below) and carrier assembly cap screws. **Axle Shaft Removal**—Remove wheel, hub, and drum assembly (use screw type hub puller—Tool C-319), block brake pedal, disconnect brake line at wheel cylinder, take off backing plate with oil seal, pull shaft and bearing (Tool C-158). NOTE—Use Tool C-358 to pull oil seal, drift C201 or 202 to install. **Wheel Bearing Adjustment:**—*See Chrysler C30 page.*

SHOCK ABSORBERS:—Domestic—Monroe Direct Acting, Delco (cars with 18" wheels). **Export**—Delco Direct acting or Adjustable Direct acting. *For complete data, refer to 1941 Mech. Equip. Index.*

STEERING:—Steering Gear—Chrysler (Gemmer design Models 305, 335 '3 tooth'—7 pass.) worm-and-roller types with 'push-pull' adjustment. *For complete data, refer to 1941 Mech. Equip. Index.* **Front Suspension:**—Independent, linked parallelogram type with coil springs. *For complete data, refer to 1941 Mech. Equip. Index.* **Kingpin Inclination**—4¾° to 6°. **Camber**—Positive ¼°. Limits 0° to Pos. ¾°. **Caster**—Negative 1° to Positive 1°. Not adjustable. **Toe In**—1/16" (0-⅛"). Turn both rods equally. **Steering Geometry**—Inner wheel 22°0'. Outer 20°.

BRAKES:—Service. Lockheed hydraulic, double anchor type. Hand lever applies independent shaft brake. *For complete data, refer to 1941 Mech. Equip. Index.* **Wheel Cylinders**—Stepped bore type (front only). **Drums**—Centrifuse. Diameter 11". **Lining**—Molded asbestos. 2" wide. 13/64" thick. Length (front shoe) 11 15/32", (rear shoe) 7 31/32". **Clearance**—.012" Toe (top), .006" Heel, for each shoe. **Braking Power**—60% front wheels, 40% rear. **Hand Brake:**—On drum at rear of transmission. **Adjustment**—*See Chrysler Shop Notes for instructions.* **Drum**—Cast-iron. Diameter 6", 7" (Vacam. Trans.). **Lining**—Width 2". Thick. 5/32". Length 17 1/16" (Std. trans.), 20⅛" (cars with Vacamatic Trans.).

HOOD LOCK:—Conventional center hinge hood. Each side locked by button under each end of instrument panel. Pull button out to unlatch hood side.
Control Cable Adjustment—Control button free play should be ⅛" max To adjust cable, pull control button, close side to be adjusted (open opposite side), adjust clamp at forward end of control cable for less than ⅛" free play (excessive free play allows wire stop to contact cable sheathing before latch is released).

FRONT END ASSEMBLY & OIL PAN REMOVAL:—*See Chrysler Shop Notes for directions.*

SERIAL NUMBER:—Stamped on plate on right front door hinge pillar post First number for each model·

C30 New Yorker	C33 Crown Imperial
6,624,101	7,807,501

ENGINE NUMBER:—First number C30-1001 (C30), C33-1001 (C33). Stamped on left side of cylinder block between Nos. 2 and 3 cylinders
See Chrysler Shop Notes for Engine Number Lettering data ('Special Standard' bore and bearing sizes).

ENGINE SPECIFICATIONS:—8 cylinder, 'L' head type.
Bore—3¼". **Stroke**—4⅞".
Displacement—323 5 cubic inches.
Rated Horsepower—33 80 (A M A rating)
Developed Horsepower—137 HP at 3400 RPM (C30 with 6 8-1 std cast-iron head). 140 HP at 3400 RPM (C33 std , C30 optl , 6 8-1 aluminum head).
Compression Ratio—6 8-1 cast-iron head Std C30. 6.8-1 aluminum head Std. C33, Optl. C30
Compression Pressure—150-160 lbs. at 1000 RPM or 120-130 lbs at cranking speed of 125 RPM Reading should not vary more than 10 lbs between cylinders.
Vacuum Reading—Steady 18-20" idling at 6 MPH min for altitudes up to 1000 feet
See Chrysler Shop Notes for Engine Removal directions.

PISTONS:—Aluminum alloy, U-slot, cam ground, tin coated type.
Length—3⅞".
Weight—16 3 ozs. (stripped—piston only).
Removal—Pistons and rods removed from above.
Clearance—Head clearance at top land (difference in diameter) 022". Skirt .0000-.0010". See Fitting New Pistons (following).
Original Bore & Piston Sizes, Replacement Pistons:—*See Chrysler Shop Notes for sizes and markings.*
Fitting New Pistons:—Check piston size with micrometer calipers across large diameter (90° from pin bosses) at bottom of skirt. Insert .002" x ½" feeler stock (long enough to extend into bore for full length of piston) between cylinder wall and piston with piston inverted and pin removed Pull to withdraw feeler should be 5 to 7 lbs. with piston & block at 70°F.
NOTE—Cylinder maximum allowable taper .0015", out-of-round .002". Use hone to 'clean-up' cylinders, bore and hone for badly scored bores Reconditioned bores should be within limits of .0005" taper and .0005" out-of-round
Installing Pistons:—Slot away from camshaft.

PISTON RINGS:—Four rings per piston, all above pin. #1 Compression (upper inner edge stepped), #2 Compression (lower out edge stepped). #3 and #4 oil rings (slotted type).
NOTE—Compression rings are coated type.

Ring	Width	End Gap	Side Clearance
Comp. (top)	⅛"	007-.015"	.002-.0040"
Comp. (#2)	⅛"	.007-.015"	.0015-.0025"
Oil Control	5/32".	.007-.015"	.001-.0035"

Replacement Rings:—Std. & .003", .005", .010", 015", .020", .023", .025", .030", .040", .050", .060" oversize.

PISTON PIN:—**Diameter**—55/64". **Length**—2¾". Pin floats in piston and rod. Held by retaining ring at each end Pin hole in rod bronze bushed
Pin Fit in Piston—Thumb push fit with piston heated to 130° F.
Pin Fit in Rod Bushing—Thumb push fit at normal room temperature.
Replacement Pins:—Furnished standard size and .003", .005", .008" oversize.

CONNECTING ROD:—**Weight**—37 3 ounces (with bearings and bolts). **Length**—9".
Lower Bearing Diameter—2 3/16". *See Engine Lettering Note in Chrysler Shop Notes for 'Special Std.' size.*
Lower Bearing—Removable precision type, thin babbitt on steel
Clearance—001- 002". **Sideplay**—006- 011".
See Chrysler Shop Notes for Fitting Connecting Rod Bearings.
Bearing Adjustment:—None (no shims). Replace bearings Do not file rods or caps Install new bearings with boss engaging groove in rod and cap.
Replacement Bearings:—*See Chrysler Shop Notes.*
Installing Rods:—Lower bearings are offset Install rods with widest portion of bearing toward the rear on #1, #3, #5, and #7; toward the front on #2, #4, #6, and #8 All rods should be installed with oil metering hole in lower end toward camshaft.

CRANKSHAFT:—5 bearing type with 8 integral counterweights. Impulse neutralizer mounted on front
See Chrysler Shop Notes for Replacement Main Bearing Caps and Crankshaft Front and Rear Oil Seals.
Bearing Diameters—2 45/64". *See Engine Lettering Note in Chrysler Shop Notes for 'Special Standard' size.*
Bearing Type—Removable, precision type, thin babbitt on steel.
Clearance—001- 002".
Bearing Adjustment:—*See Chrysler Shop Notes for bearing removal, front and rear main bearing cap removal, replacement bearing sizes and fitting data.*
End Thrust:—Taken by flange faces on rear (#5) main bearing.
Endplay—.003- 007".

CAMSHAFT:—6 bearing Non-adjustable chain drive.
See Chrysler Shop Notes for Camshaft Removal.
Bearing Diameters—#1, 2 1/16"; #2, 2 1/32"; #3, 2"; #4, 1 31/32"; #5, 1 15/16"; #6, 1⅜".
Bearing Type—Removable, steel-backed, babbitt-lined bushings (except #6 machined in crankcase).
Clearance—001-.003" (#1), .0015-.0035" (all others).
NOTE—Replacement bearings are finished (reaming, scraping or burnishing not required).
End Thrust:—Taken by thrust plate assembled behind camshaft sprocket.
Endplay—.002-.006".
Timing Chain:—Whitney No. 668983 center link guide type. Width 1¼". Pitch ½". Length 47 links or 23½".
Camshaft Setting:—Sprockets marked. Mesh chain with sprockets turned so that '0' marks are adjacent and in line with a straightedge across shaft centers.

VALVES:—	Head Diameter	Stem Diameter	Length
Intake	1 17/32"	340-.341"	5⅞"
Exhaust	1 11/32"	.340-.341"	5⅞"

	Seat Angle	Lift	Stem Clearance
All Valves	45°	⅜"	.0015-.0035"

See Chrysler Shop Notes for Exhaust Valve Seat Inserts.

Tappet Clearance:—.008" Intake, .010" Exhaust (with engine running and at normal operating temperature). For cars to be driven at continuous high speeds an additional 002" exh clearance desirable.
NOTE—Tappet screws are self-locking type (no locknuts used). Remove right front wheel and lower wheel housing panel for access to valves
Valve Guides:—Remove from above. Press new guides in place with upper end 1" (Intake and Exhaust) below top face of cylinder block with taper end up (Intake), down (Exhaust) and ream (use Tool CM-83) to .3425-.3435" inside diameter. Counterbore exhaust guide at top to diameter of .365-.375" and ⅜" deep after guide installed in block.
Valve Springs:—Install with closely coiled ends at top. Free length 2 25/64".

	Spring Pressure	Spring Length
Valve Closed	52-58 lbs	2 1/32"
Valve Open	129-137 lbs	1 21/32"

NOTE—Use special valve spring tester tool MTR-67 for checking pressure before installing springs.
Valve Lifters:—Mushroom type (remove from below with oil pan, camshaft and valves out of engine). Stem diameter ⅝". Ream guide holes from above with valves out of engine (install reamer pilot of Tool C-265 in valve guide to insure alignment of lifter). Lifters furnished for service in standard and .001", .008", .030", 060" oversize.
Lifter Clearance in Block—000- 001".
Valve Timing:—See Camshaft Setting above
Intake Valves—Open 6° BTDC Close 50° ALDC
Exhaust Valves—Open 44° BLDC. Close 12° ATDC.
NOTE—Above figures correct with tappet clearance of 011" Intake, .014" Exhaust (cold).
Valve Timing Check—With .011" (cold) tappet clearance #8 intake valve should open with #8 piston 6° or 0170" BTDC with 6th graduation before DC mark on impulse neutralizer aligned with pointer on chain case cover. Reset tappet clearance at .008" (engine idling and at normal operating temperature). NOTE—Car manufacturer recommends use of Timing Indicator Tool C-435 (measures piston travel) inserted in timing hole in cylinder head over #8 piston.

LUBRICATION:—Pressure system with gear type oil pump mounted on right side of crankcase.
See Chrysler Shop Notes for Oil Pump removal and installation.
Normal Oil Pressure:—30-45 lbs at 30 MPH and above with proper viscocity oil and engine at normal operating temperature.
Oil Pressure Relief Valve:—Under cap on lower left side of crankcase. Adjustable To adjust, remove cap, withdraw lock wire, turn slotted plug clockwise to increase pressure, counter-clockwise to decrease pressure Relief valve opens at 40-45 lbs.
Crankcase Capacity:—6 quarts (refill).

COOLING SYSTEM:—**Capacity**—24 quarts.
See Chrysler Shop Notes for Radiator Core Removal and Water Distribution Tube Servicing.
Pressure Valve—In filler cap. Opens at 1½-2½ lbs.
Water Pump:—Packless type with sealed ball-bearing shaft. Grease fitting for seal lubrication
For complete data, refer to 1941 Mech. Equip. Index.
Removal—Drain cooling system, remove fan belt, loosen fan shroud-to-radiator core screws on left side, remove by-pass hose and elbow, disconnect pump inlet hose, remove pump-to-back plate screws, remove generator strap, lift out pump and fan assembly.

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Thermostat:—Bishop & Babcock or Fulton. In cylinder head outlet elbow. Install with bellows down. **Setting**—Starts to open 157-162°F. Fully open 183°F.

Temperature Gauge:—Auto-Lite (Motometer) Vapor tension type. Auto-Lite Part No. H-9703.
For complete data, refer to 1941 Mech. Equip. Index.

Drain Valves:—Two drain valves used. To drain system, remove radiator pressure cap, open radiator drain cock and engine drain cock on left side.

CLUTCH:—Borg & Beck Model 10A6 with 'Borglite' driven member. Assembly No. 939 stamped on cover. Single plate, dry disc type with spiral grooved facings, pressure plate oil baffle and pedal overcenter return spring. Clutch assembly mounted on clutch driving plate at rear of fluid drive unit. NOTE—No spring dampener used on clutch driven member.
For complete data, refer to 1941 Mech. Equip. Index.

Adjustment:—Pedal should just clear underside of toeboard. To adjust, loosen locknut and turn stopscrew at lower end of pedal arm above shaft. Pedal free travel should be 1". To adjust, turn clutch release fork adjusting nut on connector link at clutch release fork.

Removal:—Remove transmission (see Transmission Removal instructions following). Remove clutch release bearing. Jack up rear of engine (to allow clutch housing pan to clear frame cross-member), remove clutch housing pan and dust shield. Mark clutch cover and clutch driving plate (assemble to these marks when reinstalling clutch assembly to maintain balance). Remove clutch cover-to-driving plate screws (release spring tension evenly by turning each screw out a few turns at a time). Clutch assembly and driven member can then be lowered out through pan opening.

FLUID DRIVE:—Consists of fluid coupling assembled to rear of engine in place of conventional flywheel.
For complete data, refer to 1941 Mech. Equip. Index.

Removal:—Remove clutch (see Clutch Removal directions above). Using special box wrench (Tool C-589) loosen fluid drive-to-crankshaft stud nuts, pull fluid drive unit back free from crankshaft flange, remove nuts. Withdraw fluid drive and clutch driving plate from clutch housing.

TRANSMISSION (STD. C30):—Own Make. All helical gear type, constant-mesh, synchro-mesh (second and high), sliding gear (low and reverse) with remote shift.
For complete data, refer to 1941 Mech. Equip. Index.

Transmission Control:—Steering column shift. Manually operated shift Standard, Power Shift (vacuum operated) Optional equipment.
For complete data, refer to 1941 Mech. Equip. Index.

Removal:—Jack up front end of car (use floor jacks under lower control arms). Disconnect front universal joint (loosen companion flange nut if transmission to be disassembled). Disconnect speedometer cable, hand brake cable at brake band, gearshift and gearshift selector control rods at transmission. If Power Shift used, disconnect vacuum and air hose and remove gearshift selector rod. Take out transmission-to-clutch housing cap screws and nuts. Pull transmission to rear, lower assembly out of car. NOTE—Use pilot studs when installing transmission to avoid springing clutch disc.

VACAMATIC (OVERDRIVE TYPE) TRANSMISSION (STD. C33, OPTL. C30):—New type 4 Speed & Reverse Transmission consisting of a two-speed manually controlled unit in conjunction with an Automatic Overdrive unit (Warner Model AS1-R7B) which provides two additional speeds.
For complete data, refer to 1941 Mech. Equip. Index.

Transmission Control:—Remote control, steering column mounted mechanical shift.
For complete data, refer to 1941 Mech. Equip. Index.

Removal:—Drain lubricant from transmission and overdrive cases. Remove propeller shaft by disconnecting front and rear universal joints (on cars with propeller shaft center bearing, free center bearing mounting from frame cross member). Loosen companion flange nut if disassembling transmission. Remove hand brake clevis pin from lower end of cable. Disconnect solenoid coil wires and remove coil. Disconnect speedometer cable and gear shifter rods from transmission, overdrive control cable clevis at overdrive case. Remove transmission-to-clutch housing cap screws and nuts, two upper studs (install two nuts on end of stud and turn stud out) and replace with pilot studs. Withdraw transmission and overdrive as an assembly.

UNIVERSAL JOINTS:—Detroit-Universal Series 7300. Cross type with roller bearings. Two used on C30. Three used with Center Bearing on C33.
For complete data, refer to 1941 Mech. Equip. Index.

Propeller Shaft Center Bearing (C33):—*See Chrysler Shop Notes for removal and installation data.*

REAR AXLE (C30):—Own Make. Semi-floating, Hypoid gear type with Hotchkiss drive.
For complete data, refer to 1941 Mech. Equip. Index.

Ratio—4.56-1 (standard), 3.91-1 (with Vacamatic Transmission).

Backlash—.006-.010". Screw adjustment.

Removal:—Drain differential by removing two lower carrier-to-axle housing cap screws (C30), drain plug at rear of bottom of axle housing (C33). Remove both axle shafts (see Axle Shaft Removal following). Remove rear universal joint flange bolts and lower propeller shaft. Take out carrier-to-axle housing capscrews (bolts and nuts used on C33) and lift out differential gear carrier assembly.

Axle Shaft Removal—Remove wheel, axle shaft cotter pin and nut. Remove hub and drum assembly (use screw type hub puller—Tool C-319 for C30, Tool C-476 for C33—do not loosen hub by striking end of axle shaft or roller bearings at each side of axle will be damaged). Block brake pedal at toe board. Disconnect brake line at wheel cylinder. Remove brake backing plate-to-axle housing bolt nuts and take off oil seal and backing plate. If both axle shafts removed, keep wheel bearing shims separated so they may be reassembled to proper side of axle when replacing to maintain bearing adjustment (if new parts used, axle shaft end play should be checked when parts replaced). Pull axle shaft and bearing using Tool C-158. NOTE—Use Tool C-358 to remove axle drive shaft bearing, Tool C-293 to remove axle drive shaft oil seal, special drift (Tool C-201 or C-202) to install oil seal.

Wheel Bearing Adjustment:—Adjusting shims located between flanged ends of axle housing and brake backing plate. Remove wheel and hub assembly (see Axle Shaft Removal above). Check endplay with dial indicator (make sure that brake bolts are tight and tap end of axle shaft so that bearing cups are seated). To adjust, remove oil seal and backing plate, add or remove shims (furnished .010", .0125", .015" and .030" thick) equally at both ends of axle housing (to maintain central position of axle shaft thrust block) until proper endplay obtained.
Endplay—.003-.008".

REAR AXLE (C33):—Own Make. Semi-floating, Hypoid gear type with Hotchkiss drive. Barrel type differential with adjustable drive gear thrust pad used.
For complete data, refer to 1941 Mech. Equip. Index.
Ratio—4.55-1.
All other data same as for C26 Rear Axle above.

SHOCK ABSORBERS:—Delco or Monroe. Direct acting, hydraulic types. FRONT Delco 1134-E (C33 Domestic & Export, C30 Export), 1000-C (C30 & C33 Export). REAR Delco 1130-W (C33 Domestic & Export), 1001-T (C30 & C33 Export). Delco Models 1130 and 1134 are Adjustable Direct Acting type.
For complete data, refer to 1941 Mech. Equip. Index.

STEERING:—Steering Gear—Chrysler (Gemmer design Model 335 '3 tooth' type) worm-and-roller with 'push-pull' adjustment.
For complete data, refer to 1941 Mech. Equip. Index.

Front Suspension:—Independent, linked parallelogram type with coil springs.
For complete data, refer to 1941 Mech. Equip. Index.
NOTE—Specifications listed below apply with car weight on wheels and no passenger or trunk load.
Kingpin Inclination—4¾° to 6°.

Camber—Positive ¼° (preferred). Limits 0° to Positive ¾°.

Caster—Negative 1° to Positive 1°. Not adjustable.

Toe In—1/16" (preferred). Limits 0" to ⅛". Adjust by loosening clamp bolts on ends of both tie rods and turning rods equally, tighten clamp bolts. Make this adjustment with steering gear in mid-position. NOTE—Clamp bolt on left end of long tie rod should be turned below tie rod to give clearance for extreme turns.

Steering Geometry (toe-out on turns)—Inner wheel turned 21°30' with outer wheel turned 20°.

BRAKES:—Service—(Front Wheels)—Lockheed hydraulic, Two-Cylinder type (front shoe anchored at bottom and actuated by top cylinder, rear shoe anchored at top and actuated by bottom cylinder).

(Rear Wheels)—Lockheed hydraulic, double anchor type. Hand lever applies independent propeller shaft brake.
For complete data, refer to 1941 Mech. Equip. Index.

Wheel Cylinders—Straight cut bore type. Piston assembly (with spring) used. Bore diameter 1⅛".

Drums—Centrifuse. Diameter 12".

Lining—Molded asbestos. Width 2". Thickness 13/64". Length—Rear wheel rear shoe 9⅝". Front wheel front and rear shoes and Rear wheel rear shoe 12 9/16".

Clearance—Toe (wheel cylinder end) .007" for all shoes. Heel (anchor bolt end) .006" for all shoes except rear wheel rear shoes which is .007".

Braking Power—61% front wheels, 39% rear wheels.

Hand Brake:—On drum at rear of transmission.
Adjustment—*See Chrysler Shop Notes for instructions.*
Drum—Cast-iron. Diameter 7".
Lining—Width 2½". Thickness 5/32". Length 20⅛".

Power Brake Unit (C33):—Bendix Internal Valve Type.
For complete data, refer to 1941 Mech. Equip. Index.

ENGINE REMOVAL NOTE:—Engine removal from chassis required for all service work. *See Crosley Special Shop Notes for removal directions.*

SERIAL NUMBER:—First number 390-30000. Stamped on front face of cowl below battery shelf (in engine compartment).

ENGINE NUMBER:—First number C-21000. Stamped on top center of engine block at rear of carburetor.

ENGINE SPECIFICATIONS (1941):—Waukesha. Two cylinder, 'L' head, horizontal opposed, air-cooled type with shrouded cylinders and air circulating fan built in flywheel.

Bore—3". Stroke—2½". Rated Horsepower—7.2.

Displacement—35.3 cubic inches.

Developed Horsepower—12 at 4000 RPM.

Compression Ratio—5.6-1.

Compression Pressure—80 lbs. at cranking speed.

Vacuum Reading—No means of connecting gauge.

PISTONS:—Electric furnace cast iron. Matched for equal weight within ⅛ oz.

Weight—17.5 ozs. (with pin). **Length—2.807".**

Removal—Pistons & rods removed from above with engine out of chassis. *See Crosley Special Shop Notes for engine removal instructions.*

Clearance—.004-.0055". See Fitting Pistons.

Fitting New Pistons:—Use feeler gauges installed between piston and cylinder wall at right angles to pin hole. Piston should pass through bore on .004" feeler and lock on .0055" feeler.

Replacement Pistons:—Finished pistons furnished Standard and .010", .020" Oversize.

PISTON RINGS:—Two compression, one oil control ring per piston, all above pin.

Ring	Width	End Gap	Side Clearance
Compr. #1	⅛"	.010-.015"	.002-.0035"
Compr. #2	⅛"	.010-.015"	.0015-.003"
Oil Control	5/32"	.010-.018"	.001-.0025"

NOTE—Install oil ring with scraper edge down.

Replacement Rings:—Furnished Standard and .010", .020" Oversize.

PISTON PIN:—Diameter ¾". Pin floats in piston and rod, held by locking ring at each end.

Pin Fit in Piston—.0002" clearance or thumb push fit at normal temperature.

Pin Fit in Rod Bushing—.0004" clearance. Ream new bushings for this clearance.

Replacement Pins:—Std. and .005", .010" oversize.

CONNECTING ROD:—Weight 18 ozs. **Length 4¾".**

Lower Bearing—Removable steel-backed, babbitt lined type.

Crankpin Journal Diameter—1⅞".

Clearance—.0025". Sideplay—.008".

Adjustment:—None (no shims). Replace bearings. Do not file bearing caps.

Replacement Bearings:—Furnished Std. and .003" undersize. Install bearings with locating lugs fitted in notches in rod and cap. NOTE—Bearings can be renewed through pan opening without removing engine from chassis.

CRANKSHAFT:—Two bearing, counterweighted type. *See Crosley Special Shop Notes for Engine Removal directions for main bearing and crankshaft oil seal servicing.*

Journal Diameters—Front 1 13/16", Rear 2¼".

Bearing Type—Steel-backed, babbitt-lined bushings (not split). Front bearing mounted in timing gear housing cover.

Clearance—.001-.003" (frt.), **.0015-.003"** (rear).

Adjustment:—None. Replace bearings. *See Crosley Special Shop Notes for Crankshaft Removal directions.*

End Thrust:—Taken by rear bearing. Adjustable by replacing fiber thrust washer. **Endplay—.003-.005".**

CAMSHAFT:—Proferal (alloy iron). Two bearing, gear driven.

Bearing Type—Removable bushing in rear cover (front), machined in crankcase (rear).

Clearance—.001-.003".

Endplay—.006-.009". Controlled by timing gear. *See Crosley Special Shop Notes for Camshaft Removal and front bushing servicing data.*

Timing Gears:—Allowable runout .001". To renew gears, remove camshaft (see Crosley Shop Notes for data), use puller to remove old gears.

Camshaft Setting:—Mesh gears so that 'C' mark on camshaft gear and punchmark on crankshaft gear line up (install gears with these marks forward).

VALVES:—	Head Diameter	Stem Diameter
Intake	1⅜"	5/16"
Exhaust	1 5/32"	5/16"

	Seat Angle	Lift	Stem Clearance
Intake	45°	.300"	.002-.003"
Exhaust	45°	.300"	.003-.004"

Tappet Clearance:—.006-.0065" Intake, .008-.0085" Exhaust, Cold. Not adjustable. NOTE—After grinding valves, check tappet clearance with feeler gauge. Grind off end of valve stem if clearance less than minimum above.

Valve Springs:—Free length 1 27/32".

	Pressure	Length
Valve Closed	20 lbs.	1½"
Valve Open	41 lbs.	1 15/64"

Valve Guides:—Guides can be removed and renewed with engine out of car and dismantled (See Shop Notes for engine removal directions). Ream new guides with 5/16" reamer for correct stem clearance (above).

Valve Lifters:—Mushroom type. Remove from below with camshaft out of engine (see Shop Notes for Camshaft removal directions).

Lifter Clearance—.0005-.0015".

Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 20° BTDC. Close 60° ALDC.
Exhaust Valves—Open 60° BLDC. Close 20° ATDC.

To Check Valve Timing—Intake valve should open when point on flywheel 5.5 teeth before TDC mark (half round notch on rim of flywheel) lines up with small ribcast on top center of crankcase. Exhaust closing point is 5.5 teeth past TDC point.

LUBRICATION:—Pressure to crankshaft, connecting rod and camshaft bearings.

Oil Pump:—Rotary vane type mounted on timing gear cover and driven directly from camshaft.

Removal—Take out 4 screws mounting pump on timing gear cover, remove pump. Serviced by replacement. Use new gasket when installing pump.

Normal Oil Pressure:—35-45 lbs. with warm oil.

Oil Pressure Regulator:—On timing gear case cover. Adjustable by varying valve spring tension (increase tension to increase oil pressure).

Crankcase Capacity:—3 quarts.

COOLING:—Air-cooled by suction fan built in flywheel which draws air past cylinder barrel and head fins through ducts formed by shroud bolted over cylinders.

Cooling Fan Capacity—700 cu. ft. of air per minute at 3600 R.P.M.

CLUTCH:—Rockford. Single plate dry disc type.
For complete data, refer to 1941 Mech. Equip. Index.

Facings—Not furnished separately (each facing consists of 4 segments).

Adjustment:—Clutch pedal free travel should be 1.5". To adjust, loosen locknut and turn clevis on connector cable at lower end of throw-out yoke.

Removal:—Remove transmission (see Transmission Removal below) and rear axle as an assembly (do not disconnect drive shaft at rear of transmission case as for transmission removal only). Disconnect clevis at bottom of clutch yoke, remove throw-out bearing from top of yoke, take out six capscrews mounting clutch lever brackets on flywheel, remove clutch assembly.

TRANSMISSION:—Warner Model AS1-T92. Sliding spur gear type (all speeds).
For complete data, refer to 1941 Mech. Equip. Index.

NOTE—Transmission has Adaptor (Crosley No. 200957) bolted on rear which adapts transmission to new 1941 type Torque Tube and Propeller Shaft Assembly (with Universal Joint in ball housing on rear face of Adaptor). This Adaptor is also the Rear Engine Mounting.

Removal (1941):—Disconnect shock absorber links and brake cables and conduits at backing plates. Hoist rear of car to remove weight from springs, disconnect springs at rear axle. Disconnect speedometer cable and clutch cable clamp on bottom of transmission case, take off control housing and remove shift lever assembly. Take out capscrews in universal joint ball housing on transmission adaptor, pull rear axle and torque tube assembly to rear to disengage propeller shaft at universal joint **being careful not to lose washer and spring on shaft at rear of speedometer gear.** Support rear of engine, take out bolts in rear engine mounting. Take out four capscrews mounting transmission on flywheel housing, pull transmission straight back and remove.

UNIVERSAL JOINT:—Spicer No. 102. One used. In ball housing at rear of transmission adapator.
For complete data, refer to 1941 Mech. Equip. Index.

REAR AXLE:—Spicer (Salisbury) Model 11. Semi-floating spiral bevel gear type with Torque Tube drive.
For complete data, refer to 1941 Mech. Equip. Index.

Ratio—5.14-1 or **5.57-1.**

Backlash—.004-.008". Shim adjustment.

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Removal (1941):—Disconnect shock absorber links and brake cables and conduits at backing plates. Hoist rear of car to remove weight from springs, disconnect springs at rear axle. Take out capscrews in universal joint ball housing on transmission adaptor, pull rear axle and torque tube assembly to rear to disengage propeller shaft at universal joint **being careful not to lose washer and spring on shaft at rear of speedometer gear.** Remove axle assembly from beneath car.

Axle Shaft Removal—Remove hub cap, wheel, axle nut, pull hub (use puller No. 202318). Disconnect brake cable and conduit on backing plate, take out four capscrews and remove backing plate being careful not to lose bearing adjusting shims (between backing plate and axle housing flange). Pull axle and bearing out.

Wheel Bearing Adjustment:—Check endplay with dial indicator. Adjust by removing backing plate (see Axle Shaft Removal above) and adding or removing shims between backing plate and axle housing.

Endplay—.002-.007" between shaft and thrust block (total for both shafts).

TORQUE TUBE & PROPELLER SHAFT ASSEMBLY:—Spicer No. 98-1182X. Shaft is supported by bearing at center of torque tube and has splined end to engage rear axle pinion shaft (rear end), universal joint (front end). Front end of torque tube has been modified to include a ball housing for the universal joint and adaptor is used between the torque tube and the transmission case (rear engine mounting is located on adaptor).

SHOCK ABSORBERS:—Delco Model 1201G, H (front), 1201J, K (rear). Single acting, hydraulic type.
For complete data, refer to 1941 Mech. Equip. Index.

STEERING:—Steering Gear—Ross Model S-12. Cam-and-Lever type.
For complete data, refer to 1941 Mech. Equip. Index.

Front Suspension:—Conventional 'I' beam section front axle with reverse Elliott ends and semi-elliptic springs.

Kingpin Inclination—6°30' crosswise.

Camber—2°. No adjustment provided.

Caster—6½-11°. No adjustment provided.

Toe In—3/64-1/16". Adjust in usual manner by loosening tie rod clamp bolts and turning rod.

BRAKES:—Service—Hawley. Four wheel, mechanical type with 'floating' lining. Hand lever applies all four service brakes.
For complete data, refer to 1941 Mech. Equip. Index.

Drum Diameter—6".

Lining—Width 1". Thickness 5/32". Length 18⅜" per wheel. NOTE—Lining furnished in correct length to fit loosely around shoe assembly with 1/16-⅛" gap at ends (not riveted on shoes).

Clearance—Just clear of drag.

Hand Brake:—See Service Brakes above.

CROSLEY SPECIAL SHOP NOTES

ENGINE REMOVAL FOR SERVICING (1941):—Engine should be removed from chassis for all major service work as follows: Disconnect battery ground cable, distributor cables, choke and throttle connections, oil gauge tube line at engine. Close shut-off valve at gasoline tank on Coupe models. On all models, disconnect gas line at carburetor. Remove exhaust pipe (connecting manifold and muffler), accelerator bracket, generator, starting motor (accessible by removing plate in driver's compartment). Disconnect clutch cable bracket on transmission case, clutch cable clevis at clutch yoke, speedometer cable at transmission. Block up front end of car and remove front axle assembly and wheels (see below). Drain oil, remove oil pan and oil suction tube. Block up engine and transmission, remove hold-down bolts in front motor support and free rear support. Take out capscrews mounting transmission on flywheel housing, pull engine forward. Disconnect torque tube at adaptor on rear of transmission case, remove transmission. Lower engine to floor, raise front end of car, remove engine from below.

Engine Installation—Install engine in same manner. Check ignition timing if distributor disturbed.

PISTON & CONNECTING ROD REMOVAL:—With engine removed from chassis (above), take out 7 Phillips screws in each shroud, remove shrouds from cylinders. Remove cylinder heads and oil pan. Take out connecting rod bearing cap screws, push piston & rod assembly out through cylinder barrel.

CAMSHAFT REMOVAL:—With engine removed from chassis (above), remove intake and exhaust manifolds, cylinder shrouds (retained by Phillips screws), cylinder heads and oil pan. Remove connecting rod and piston assemblies, gear housing cover (with oil pump), and valve cover. Block up valves by placing 5/16"x¾" capscrew between crankcase and spring washer on each valve, pull camshaft and timing gear assembly out through front of crankcase.

CRANKSHAFT REMOVAL:—For Main Bearing & Crankshaft Oil Seal Servicing. With engine removed from chassis (above), dismantle engine and remove camshaft (see Camshaft Removal above). Take out 4 capscrews mounting flywheel on crankshaft flange, pull flywheel. Pull crankshaft out through front end of crankcase by hand.

Main Bearing Renewal—Drive old bearings out (rear bearing in crankcase, front bearing in gear housing cover), drive new bearing bushings in place. Bearings are precision type and need not be reamed.

Oil Seal Renewal—Drive old oil seals out of crankcase (rear), gear housing cover (front) with drift pin. Use mandril or hardwood block to drive new seals in place. CAUTION—When installing crankshaft use care not to damage leather oil seals.

CAMSHAFT BUSHING RENEWAL:—Take out 8 capscrews in gear housing cover and Phillips screws in oil pan which enter gear cover, remove gear cover. Drive or press camshaft bushing out of timing gear cover and install new bushing in same manner.

NOTE—Rear camshaft bushing is integral with crankcase and cannot be serviced.

FRONT WHEEL & AXLE ASSEMBLY REMOVAL: For Engine Removal from chassis. Raise front end of car until front wheels clear floor, disconnect brake cables at levers on backing plates and cable conduit from backing plate clamps. Disconnect drag link at pitman arm, disconnect shock absorber links at axle. Remove front spring 'U' bolts at axle. Hoist front end of car and roll wheel and axle assembly out from under car.

HOOD LOCK, FRONT END ASSEMBLY & OIL PAN REMOVAL:—*See Chrysler Shop Notes.*

SERIAL NUMBER:—On right front door hinge post. First number: Detroit—5,720,401 (Custom), 6,096,001 (Deluxe). Canada—9,373,196 (Custom).

ENGINE NUMBER:—First number S8-1001. Stamped on left side of block between #1 and #2 cylinders. *See Chrysler Shop Notes for engine number lettering data ('Special Standard' bore and bearing sizes).*

ENGINE SPECIFICATIONS:—6 cylinder, 'L' head type. **Bore**—3⅜". **Stroke**—4¼".
Displacement—228.1 cu. ins. **Rated HP**—27.34.
Developed Horsepower—105 HP (Std. 6.8-1 head), 108 HP (Optl. 7.2-1 hd.—Std. 7 pass.) at 3600 RPM.
Compression Ratio and Pressure—As follows:

Ratio	Pressure at 1000 RPM	At 125 RPM
6.8-1 cast-iron head	145-155 lbs.	115-125 lbs.
7.2-1 aluminum head	150-160 lbs.	120-130 lbs.

Vacuum Reading—Steady 18-20" idling (below 1000'). *See Chrysler Shop Notes for engine removal directions.*

PISTONS:—Aluminum alloy, U-slot, cam ground, tin coated. **Length**—3⅞". **Weight**—17.5 ozs. (stripped). **Removal**—Pistons and rods removed from above. **Clearance**—Top .023". Skirt .0000-.0010".
Original Bore & Piston Sizes, Replacement Pistons:—*See Chrysler Shop Notes for sizes and markings.*
Fitting New Pistons:—Check piston size with micrometer across large diameter at bottom of skirt. Insert .002" x ½" feeler between cylinder wall and piston (inverted, pin removed) on side opposite slot. Feeler pull 5-7 lbs. (with piston and block at 70° F.).
Installing Pistons:—Slot away from camshaft.

PISTON RINGS:—4 rings, all above pin #1 Compression (upper inner edge stepped), #2 Comp. (lower outer edge stepped), #3 & 4 (slotted oil rings).

Ring	Width	End Gap	Side Clearance
Comp. (Top)	⅛"	.007-.015"	.002-.004"
Comp. (#2)	⅛"	.007-.015"	.0015-.0035"
Oil Control	5/32"	.007-.015"	.001-.0025"

Replacement Rings:—Std. & .003", .005", .010", .015", .020", .023", .025", .030", .040", .050", .060" oversize.

PISTON PIN:—**Diameter**—55/64". **Length**—2⅞". Floating type. Pin hole in rod bronze bushed.
Pin Fit in Piston—Thumb push fit (piston at 130°).
Pin Fit in Rod Bushing—Thumb push fit at 70°F.
Replacement Pins:—Std. & .003", .005", .008" oversize.

CONNECTING ROD:—**Weight**—35.2 ozs. (with bearings and bolts). **Length**—8".
Lower Bearing Diameter—2⅛". *See Engine Lettering Note in Chrysler Shop Notes for 'Special Standard' size.*
Lower Bearing—Removable, precision type, thin babbit on steel.
Clearance—.0005-.0025". **Sideplay**—.0055-.0115".
Bearing Adjustment:—None (no shims). Replace bearings. *See Chrysler Shop Notes for instructions.*
Replacement Bearings:—*See Chrysler Shop Notes.*
Installing Rods:—Oil metering hole toward camshaft.

CRANKSHAFT:—4 bearing type with 7 counterweights. *See Chrysler Shop Notes for Replacement Main Bearing Caps and Crankshaft Front and Rear Oil Seals.*
Bearing Diameters—2½". *See Engine Lettering Note in Chrysler Shop Notes for 'Special Standard' size.*
Bearing Type—Removable, precision type, thin babbitt on steel. **Clearance**—.001-.002".
Bearing Adjustment:—*See Chrysler Shop Notes for bearing removal, replacement sizes and adjustment data.*
End Thrust:—Taken by flange faces on rear (#4) main bearing. **Endplay**—.003-.007".

CAMSHAFT:—4 bearing. Non-adjustable chain drive. *See Chrysler Shop Notes for Camshaft Removal.*
Bearing Diameters—#1, 2"; #2, 1 31/32"; #3, 1 15/16"; #4, 1¼".
Bearing Type—Removable steel-backed, babbitt-lined bushings (except #4 machined in block).
Clearance—.001-.003" (#1), .0015-.0035" (all others).
End Thrust:—Taken by thrust plate behind camshaft sprocket hub. **Endplay**—.002-.006".
Timing Chain:—Morse Type 1883N, No. 2661. Width 1". Pitch .500" (½"). Length 24" or 48 links.
Camshaft Setting:—Sprockets marked. Mesh chain with sprockets turned so that '0' marks are adjacent and in line with a straightedge across shaft centers.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1 21/32"	.340-.341"	4 25/32"
Exhaust	1 17/32"	.340-.341"	4 25/32"

	Seat Angle	Lift	Stem Clearance
All Valves	45°	⅜"	.0015-.0035"

See Chrysler Shop Notes for Exhaust Valve Seat Inserts.
Tappet Clearance:—.008" Intake, .010" Exh. (hot and idling), .002" additional exh. clearance desirable for sustained high speeds. NOTE—Tappet screws self-locking (no locknuts). Remove right front wheel and lower wheel housing panel for access to valves.
Valve Guides:—Remove from above. Press new guides in (stepped end down) with upper end ⅞" below top of block, finish ream (Tool CM-83) to .3425-.3435".
Valve Springs:—Install with closely coiled end to top.

Free length 2".	Spring Pressure	Length
Valve Closed	40- 45 lbs.	1¾"
Valve Open	107-115 lbs.	1⅜"

Valve Lifters:—Mushroom type (remove from below). Stem diam. ⅝". Ream holes from above (pilot in valve guide). Oversizes .001", .008", .030" & .060".
Lifter Clearance in Block—.000-.001".
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 12° BTDC. Close 44° ALDC.
Exhaust Valves—Open 50° BLDC. Close 6° ATDC.
Valve Timing Check—With .014" (cold) tappet clearance #6 intake valve should open with #6 piston 12° or .059" BTDC with 12th graduation before DC mark on impulse neutralizer aligned with pointer on chain case cover. Reset tappet clear. at .008" hot.

LUBRICATION:—Pressure (pump on right of engine). *See Chrysler Shop Notes for Oil Pump Removal.*
Normal Oil Pressure:—30-45 lbs. at 30 MPH and above.
Oil Pressure Relief Valve:—Under plug below starter. Opens at 40-45 lbs. Spring painted red, green, or unmarked. If spring replaced, use same color spring.
Crankcase Capacity:—5 quarts (refill).

COOLING SYSTEM:—**Capacity** 18 qts. *See Chrysler Shop Notes Radiator Core Removal & Water Distrib. Tube data.*
Water Pump:—Packless type with grease fitting. *For complete data, refer to 1941 Mech. Equip. Index.*
Thermostat:—Bishop & Babcock or Fulton. On cyl. hd. **Setting**—Starts to open 157-162°F. Fully open 183°F.

CLUTCH:—**Borg & Beck Model 10A7 (Std.), 9A7 (with Fluid Drive), 11A6 (Taxi) with 'Borglite' driven member.** Assembly No. 957 (10A7), 952 (9A7), 931 (11A6) stamped on cover. Single plate, dry disc type *For complete data, refer to 1941 Mech. Equip. Index.*
Facings—Molded-Woven, 2 used. Inside Diam. 7" (10A7), 6" (9A7), 6½" (11A6). Outside Diameter 10" (10A7), 9¼" (9A7), 11" (11A6). Thickness .125" (⅛").
Adjustment:—Pedal should just clear toeboard (adjust stopscrew on lower end of pedal) & have 1" free travel (adjusting nut on connector link at fork).
Removal:—Remove release fork pull-back spring, Transmission (see Transmission) and housing underpan. Pull out clutch release bearing and sleeve. Mark cover and flywheel (or driving plate on Fluid Drive). Take out cover screws, remove assembly.

FLUID DRIVE (OPTL.):—Fluid coupling at rear of engine. *For complete data, refer to Mech. Equip. Index.*

TRANSMISSION (STD.):—**Own Make.** All helical gear, constant-mesh, synchro-mesh (second & high), sliding gear (low & reverse) with remote shift. *For complete data, refer to 1941 Mech. Equip. Index.*
Transmission Control:—Steering column shift. Manual type Std., Power Shift (vacuum type) Optl. *For complete data, refer to 1941 Mech. Equip. Index.*
Removal:—Jack up front end of car, disconnect front universal (loosen companion flange nut if disassembling transmission—see Chrysler Shop Notes for Propeller Shaft Center Bearing Removal on 7 pass.). Disconnect speedometer cable, hand brake cable, gear-shift rods, vacuum and air hose (if Power Shift used). Remove trans.-to clutch housing capscrews and nuts. Pull unit to rear, down and out of car. NOTE—Use pilot studs when installing assembly.

SIMPLIMATIC (UNDERDRIVE TYPE) TRANSMISSION (OPTL.):—*For data, refer to Mech. Equip. Index.*
Transmission Control:—Mech. steering column shift. *For complete data, refer to 1941 Mech. Equip. Index.*
Removal:—Same as Std. Transmission (above) plus the following: Remove floor board, wires from vacuum unit solenoid, interrupter and governor switches, hose from vacuum unit air cleaner to vacuum unit. Take out vacuum unit (disconnect pullout cable and return spring and remove pivot pin).

UNIVERSAL JOINTS:—**Mechanics Type 2CR (new type), Detroit-Universal Series 7200 (7 pass. only).** *For complete data, refer to 1941 Mech. Equip. Index.*
Propeller Shaft Center Bearing:—Used on 7 passenger sedans. *See Chrysler Shop Notes for servicing.*

REAR AXLE:—**Own Make.** Semi-floating, Hypoid gear type with Hotchkiss drive. *For complete data, refer to 1941 Mech. Equip. Index.*
Ratio—4.1-1 Std. 4.3-1 Std. 7 pass. 3.54-1 Simplimatic trans. (5 pass.), 3.91-1 (7 pass.).
Backlash—.006-.010". Screw adjustment.
Removal:—Disconnect rear universal, remove axle shafts (see below) and carrier assembly cap screws.
Axle Shaft Removal—Remove wheel, hub, and drum assembly (use screw type hub puller—Tool C-319), block brake pedal, disconnect brake line at wheel cylinder, take off backing plate with oil seal, pull shaft and bearing (Tool C-158). NOTE—Use Tool C-358 to pull oil seal, drift C201 or 202 to install.
Wheel Bearing Adjustment:—*See Dodge D19 page.*

SHOCK ABSORBERS:—**Delco**—Direct Acting (Domestic). Adjustable Direct Acting type (Export). *For complete data, refer to 1941 Mech. Equip. Index.*

STEERING:—**Steering Gear**—Chrysler (Gemmer design Models 305, 335 '3 tooth'—7 pass.) worm-and-roller types with 'push-pull' adjustment. *For complete data, refer to 1941 Mech. Equip. Index.*
Front Suspension:—Independent, linked parallelogram type with coil springs. *For complete data, refer to 1941 Mech. Equip. Index.*
Kingpin Inclination—4¾° to 6°.
Camber—Positive ¼°. Limits 0° to Pos. ¾°.
Caster—Negative 1° to Positive 1°. Not adjustable.
Toe In—1/16" (0-⅛"). Turn both rods equally.
Steering Geometry—Inner wheel 22°0'. Outer 20°.

BRAKES:—**Service.** Lockheed hydraulic, double anchor type. Hand lever applies independent shaft brake. *For complete data, refer to 1941 Mech. Equip. Index.*
Wheel Cylinders—Stepped bore type (front only).
Drums—Cast-iron. Diameter 11".
Lining—Molded asbestos. 2" wide. 13/64" thick. Length (front shoe) 11 15/32", (rear shoe) 7 31/32".
Clearance—.012" Toe (top), .006" Heel, for each shoe.
Braking Power—60% front wheels, 40% rear.
Hand Brake:—On drum at rear of transmission.
Adjustment—*See Chrysler Shop Notes for instructions.*
Drum—Cast-iron. Diameter 6", 7" (Simplimatic).
Lining—Width 2". Thick. 5/32". Length 17 1/16" (Std.), 20⅛" (Cars with Simplimatic Trans.).

HOOD LOCK, FRONT END ASSEMBLY & OIL PAN REMOVAL:—*See Chrysler Shop Notes.*

SERIAL NUMBER:—On right front door hinge post. First number: 30,342,401 (Detroit), 9,422,901 (Canada).

ENGINE NUMBER:—First number D19-1001. Stamped on left side of block between #1 and #2 cylinders. *See Chrysler Shop Notes for engine number lettering data ('Special Standard' bore and bearing sizes).*

ENGINE SPECIFICATIONS:—6 cylinder, 'L' head type. **Bore**—3¼". **Stroke**—4⅜". **Displacement**—217.8 cu. ins. **Rated HP**—25.35. **Developed Horsepower**—91 HP at 3800 RPM. **Compression Ratio**—6.5-1 cast-iron head std. **Compression Pressure**—140-150 lbs. at 1000 RPM or aproximately 113 lbs. at cranking speed. **Vacuum Reading**—Steady 18-20" idling (below 1000'). *See Chrysler Shop Notes for Engine Removal directions.*

PISTONS:—Aluminum alloy, cam ground, split skirt, steel strut, tin coated type. **Length**—3 11/16". **Weight**—15.2 ounces (stripped). **Removal**—Pistons and rods removed from above. **Clearance**—Top (diff. in diam.) .028". Skirt .00025-.00075".

Original Bore & Piston Sizes, Replacement Pistons:—*See Chrysler Shop Notes for sizes and markings.*

Fitting New Pistons:—Check piston size with micrometer at bottom of skirt adjacent to slot. Insert .0015 x ½" feeler between cylinder wall and piston (inverted with pin removed) opposite slot. Pull to withdraw feeler 10-17 lbs. (piston & block at 70°F.).

Installing Pistons:—Slot away from camshaft.

PISTON RINGS:—4 rings, all above pin—#1 Compression (upper inner edge stepped), #2 Comp. (lower outer edge stepped), #3 and #4 (slotted oil rings).

Ring	Width	End Gap	Side Clearance
Compr. (Top)	3/32"	.007-.015"	.0025-.004"
Compr. (#2)	⅛"	.007-.015"	.0015-.0035"
Oil Control	5/32"	.007-.015"	.001-.0025"

Replacement Rings:—Std. & .003", .005", .010", .015", .020", .023", .025", .030", .040", .050", .060" oversize.

PISTON PIN:—**Diameter**—55/64". **Length**—2¾". Floating type. Pin hole in rod bronze bushed. **Pin Fit in Piston**—Thumb push fit (piston at 160°F.). **Pin Fit in Rod Bushing**—Thumb push fit at 70° F. **Replacement Pins:**—Std. & .003", .005", .008" oversize.

CONNECTING ROD:—**Weight**—30.4 ozs. (with bearings and bolts). **Length**—7 15/16". **Lower Bearing Diameter**—2 1/16". *See Engine Lettering Note in Chrysler Shop Notes for 'Special Std.' size.* **Lower Bearing**—Removable, precision type, thin babbitt on steel. **Clearance**—.0005-.002". **Sideplay**—.0055-.0115". **Bearing Adjustment:**—None (no shims). Replace bearings. *See Chrysler Shop Notes for instructions.* **Replacement Bearings:**—*See Chrysler Shop Notes.* **Installing Rods:**—Wide portion of bearing to rear (#1, 3, 5) to front (#2, 4, 6). Oil hole to camshaft.

CRANKSHAFT:—4 bearings, 7 integral counterweights. *See Chrysler Shop Notes for Replacement Main Bearing Caps and Crankshaft Front and Rear Oil Seals.* **Bearing Diameters**—2½". *See Engine Lettering Note in Chrysler Shop Notes for 'Special Standard' size.* **Bearing Type**—Removable, precision type, thin babbitt on steel. **Clearance**—.001-.0025". **Bearing Adjustment:**—*See Chrysler Shop Notes for bearing removal, replacement sizes and adjustment data.* **End Thrust:**—Taken by flange faces on rear (#4) main bearing. **Endplay**—.003-.007".

CAMSHAFT:—4 bearing. Non-adjustable chain drive. *See Chrysler Shop Notes for Camshaft Removal.* **Bearing Diameters**—#1, 2"; #2, 1 31/32"; #3, 1 15/16"; #4, 1¼". **Bearing Type**—Removable steel-backed, babbitt-lined bushings (except #4 machined in block). **Clearance**—.001-.003" (#1), .0015-.0035" (all others). **End Thrust:**—Taken by thrust plate behind camshaft sprocket hub. **Endplay**—.002-.006". **Timing Chain:**—Morse Type 1883N, No. 2661. Width 1". Pitch .500" (½"). Length 24" or 48 links. **Camshaft Setting:**—Sprockets marked. Mesh chain with sprockets turned so that '0' marks are adjacent and in line with a straightedge across shaft centers.

VALVES:

	Head Diameter	Stem Diameter	Length
All Valves	1 15/32"	.340-.341"	4 25/32"

	Seat Angle	Lift	Stem Clearance
Intake	45°	⅜"	.001-.003"
Exhaust	45°	⅜"	.003-.005"

See Chrysler Shop Notes for Exhaust Valve Seat Inserts. **Tappet Clearance:**—.008" Intake, .010" Exh. (hot and idling), .002" additional exh. clearance desirable for sustained high speeds. NOTE—Tappet screws self-locking (no locknuts). Remove right front wheel and lower wheel housing panel for access to valves. **Valve Guides:**—Remove from above. Press new guides in (stepped end down) with upper end ⅞" below top of block, finish ream (Tool CM-83) to .342-.343" Intake, .344-.345" Exhaust.

Valve Springs:—Install with closely coiled end to top.

	Spring Pressure	Length
Free length 2".		
Valve Closed	40- 45 lbs	1¾"
Valve Open	107-115 lbs	1⅜"

Valve Lifters:—Mushroom type (remove from below). Stem diam. ⅝". Ream holes from above (pilot in valve guide). Oversizes .001", .008", .030" & .060". **Lifter Clearance in Block**—.000-.001". **Valve Timing:**—See Camshaft Setting above. **Intake Valves**—Open 9° BTDC. Close 47° ALDC. **Exhaust Valves**—Open 47° BLDC. Close 9° ATDC. **Valve Timing Check**—With .014" (cold) tappet clearance #6 intake valve should open with #6 piston 9° or .0343" BTDC with 9th graduation before DC mark on impulse neutralizer aligned with pointer on chain case cover. Reset tappet clear. at .008" hot.

LUBRICATION:—Pressure (pump on right of engine). *See Chrysler Shop Notes for Oil Pump Removal.* **Normal Oil Pressure:**—30-45 lbs. at 30 MPH and above. **Oil Pressure Relief Valve:**—Under plug below starter. Opens at 40-45 lbs. If spring replaced, same colored spring should be used (Std. not colored). **Crankcase Capacity:**—5 quarts (refill).

COOLING SYSTEM:—**Capacity** 15 qts. *See Chrysler Shop Notes Radiator Core Removal & Water Distrib. Tube data.* **Water Pump:**—Packless type with grease fitting. *For complete data, refer to 1941 Mech. Equip. Index.* **Thermostat:**—Bishop & Babcock or Fulton. On cyl. hd. **Setting**—Starts to open 157-162°F. Fully open 183°F.

CLUTCH:—**Borg & Beck Model 10A7 (Std.), 9A7 (with Fluid Drive), 11A6 (Taxi) with 'Borglite' driven member.** Assembly No. 928 (10A7), 952 (9A7), 931 (11A6) stamped on cover. Single plate, dry disc type with spiral grooved facings and pressure plate oil baffle (10A7, 11A6). *For complete data, refer to 1941 Mech. Equip. Index.* **Facings**—Molded-Woven, 2 used. Inside Diam. 7" (10A7), 6" (9A7), 6½" (11A6). Outside Diameter 10" (10A7), 9¼" (9A7), 11" (11A6). Thickness .125" (⅛"). **Adjustment:**—Pedal should just clear toeboard (adjust stopscrew on lower end of pedal) & have 1" free travel (adjusting nut on connector link at fork). **Removal:**—Remove release fork pull-back spring, Transmission (see Transmission) and housing underpan. Pull out clutch release bearing and sleeve. Mark cover and flywheel (or driving plate on Fluid Drive). Take out cover screws, remove assembly.

FLUID DRIVE (OPTL.):—Fluid coupling at rear of engine. *For complete data, refer to Mech. Equip. Index.*

TRANSMISSION:—**Own Make.** All helical gear, constant-mesh, synchro-mesh (second & high), sliding gear (low & reverse) with remote shift. *For complete data, refer to 1941 Mech. Equip. Index.* **Transmission Control:**—Steering column shift. Manually operated Std., Power Shift (vacuum operated) Optl. *For complete data, refer to 1941 Mech. Equip. Index.* **Removal:**—Jack up front end of car, disconnect front universal (loosen companion flange nut if disassembling transmission—see Chrysler Shop Notes for Propeller Shaft Center Bearing Removal on 7 pass.). Disconnect speedometer cable, hand brake cable, gear-shift rods, vacuum and air hose (if Power Shift used). Remove trans.-to clutch housing capscrews and nuts. Pull unit to rear, down and out of car. NOTE—Use pilot studs when installing assembly.

UNIVERSAL JOINTS:—**Detroit-Universal Series 4200 (3 & 5 pass.), Series 7200 (7 pass.).** Roller bearings, ball and trunnion type (4200), cross type (7200). *For complete data, refer to 1941 Mech. Equip. Index.* **Propeller Shaft Center Bearing:**—Used on 7 passenger sedans. *See Chrysler Shop Notes for servicing.*

REAR AXLE:—**Own Make.** Semi-floating, Hypoid gear type with Hotchkiss drive. *For complete data, refer to 1941 Mech. Equip. Index.* **Ratio**—4.3-1 Sedans (5 & 7 pass.), 4.1-1 Coupes. **Backlash**—.006-.010". Screw adjustment. **Removal:**—Disconnect rear universal, remove axle shafts (see below) and carrier assembly cap screws. **Axle Shaft Removal**—Remove wheel, hub, and drum assembly (use screw type hub puller—Tool C-319), block brake pedal, disconnect brake line at wheel cylinder, take off backing plate with oil seal, pull shaft and bearing (Tool C-158). NOTE—Use Tool C-358 to pull oil seal, drift C201 or 202 to install. **Wheel Bearing Adjustment:**—Shims between backing plate and axle housing. With wheel and hub removed, check endplay with dial indicator. To adjust, remove backing plate (see above), add or remove shims (furnished .010", .0125", .015", .030" thick) equally at both wheels. **Endplay**—.003-.008".

SHOCK ABSORBERS:—**Delco.** Direct Acting (Domestic), Adjustable Direct Acting type (Export). *For complete data, refer to 1941 Mech. Equip. Index.*

STEERING:—**Steering Gear**—Chrysler (Gemmer design Models 305, 335 '3 tooth'—7 pass.) worm-and-roller types with 'push-pull' adjustment. *For complete data, refer to 1941 Mech. Equip. Index.* **Front Suspension:**—Independent, linked parallelogram type with coil springs. *For complete data, refer to 1941 Mech. Equip. Index.* **Kingpin Inclination**—4¾° to 6°. **Camber**—Positive ¼°. Limits 0° to Pos. ¾°. **Caster**—Negative 1° to Positive 1°. Not adjustable. **Toe In**—1/16" (0-⅛"). Turn both rods equally. **Steering Geometry**—Inner wheel 22°0'. Outer 20°.

BRAKES:—**Service.** Lockheed hydraulic, double anchor type. Hand lever applies independent shaft brake. *For complete data, refer to 1941 Mech. Equip. Index.* **Wheel Cylinders**—Stepped bore type (front only). **Drums**—Cast-iron. Diameter 11". **Lining**—Molded asbestos. 2" wide. 13/64" thick. Length (front shoe) 11 15/32", (rear shoe) 7 31/32". **Clearance**—.012" Toe (top), .006" Heel, for each shoe. **Braking Power**—60% front wheels, 40% rear.

Hand Brake:—On drum at rear of transmission. **Adjustment**—*See Chrysler Shop Notes for instructions.* **Drum**—Cast-iron. Diameter 6". **Lining**—Width 2". Thick. 5/32". Length 17 1/16".

MERCURY NOTE:—All '95' Engine data below applies to Mercury as well as Ford models with '95' Engine.

OIL PAN REMOVAL:—To remove oil pan, drain cooling system, disconnect upper and lower radiator hoses, disconnect exhaust pipe and remove cross-pipe, disconnect radius rods at rear end, push rear end of rods down and block in this position. Remove front engine support bolts, attach hoist and raise front end of engine. Remove oil pan screws, remove pan. NOTE—Pan removal will be facilitated by removing starter motor and engine side pans, disconnecting steering tie rod, and turning crankshaft so that #4 piston is at top dead center.

CYLINDER SLEEVES:—Replaceable dry type hardened cylinder sleeves used in production for all Ford 4 Cyl., '85' and Mercury Engines. Engines with sleeves can be identified by letter 'HS' stamped on top of block beside inner front corner of left cylinder hd.

Servicing:—To recondition engines with cylinder sleeves, sleeves should be replaced. Car manufacturer recommends use of KRW #6055A Sleeve Puller and Replacer (sleeves should not be pressed in with arbor press). **Sleeves furnished in standard size and should be fitted with new standard size pistons only.**

Model	Cylinder Sleeves	Part No.
4 Cyl. Eng.	.040"	99A-6055
'85' Engine	.040"	91A-6055
'95' Engine	.040"	99A-6055
'95' Engine	.060"	09A-6055

Fitting Pistons on Sleeve Equipped Engines:—Special gauge thicknesses used (not same as for engines without sleeves). See Piston Fitting Instructions on car model 'M' pages for data.

REPLACEMENT PISTONS:—Finished aluminum pistons furnished for service in following oversizes:

Passenger Car & Truck Pistons (3 Ring)

'85' Eng. — Part No.	'95' Eng.	Size
01A-6110-A	09A-6110-A	Standard
01A-6110-B	09A-6110-B	.0025" Oversize
01A-6110-C	09A-6110-C	.005" Oversize
01A-6110-D	09A-6110-D	.015" Oversize
01A-6110-E	09A-6110-E	.030" Oversize
01A-6110-F	09A-6110-F	.045" Oversize
01A-6110-G	09A-6110-G	.060" Oversize

Part No.	4 Cyl. Engine Piston	Size
99A-6110-A		Standard

Piston Fitting Note—Steel and aluminum pistons not fitted with same clearance (different feelers must be used) and pistons also fitted differently when sleeves not used. See Piston fitting instructions on car model 'M' pages for data.

REPLACEMENT PISTON PINS:—Pins furnished for service in Standard Size and in Under- and Oversizes which are color-marked for identification as follows:

Part No.	4 Cyl. Engine Color	Size
99A-6135-A		Standard
99A-6135-D	Blue	.001" Oversize
	'85' Engine	
48-6135-A①		Standard
48-6135-B①	Red	.002" Oversize
48-6135-C①	White	.002" Undersize
48-6135-D②	Blue	.001" Oversize
	'95' Engine	
99A-6135-A		Standard
99A-6135-B	Red	.002" Oversize
99A-6135-C	White	.002" Undersize

①—For steel pistons and '95' Truck with 99T Aluminum pistons. ②—For 91A, 99T Aluminum pistons.

REPLACEMENT PISTON RINGS:—Rings furnished only as sets in cartons for V8 '85' and '95' engines as listed below. For 4 Cyl. Engine, rings furnished separately (8 Compression, 4 Oil Rings required).

Part No.	4 Cyl. Engine Type	Size
99A-6150-A	Compression	Standard
99A-6150-B	Oil	Standard

'85' Engine
Aluminum Pistons

Part No. (See Note)		Size
81A-6149-A or 81AS-6149-A		Standard
81A-6149-B		.005" Oversize
81A-6149-C	81AS-6149-F	.015" Oversize
81A-6149-D	81AS-6149-B	.030" Oversize
81A-6149-E	81AS-6149-C	.045" Oversize
81A-6149-F	81AS-6149-D	.060" Oversize

Steel Pistons

81A-6149-G	81AS-6149-E	Standard

'95' Engine

99A-6149-A	99AS-6149-A	Standard
99A-6149-B		.005" Oversize
99A-6149-C	99AS-6149-E	.015" Oversize
99A-6149-D	99AS-6149-B	.030" Oversize
99A-6149-E	99AS-6149-C	.045" Oversize
99A-6149-F	99AS-6149-D	.060" Oversize

Part No. Note—Second part number listed above ('AS' prefix) is special 'steel section' type ring.

CONNECTING ROD BEARING SERVICING:—Bearings float between connecting rods and crankpin. Special Replacement bearings furnished oversize on outer diameter (for oversize rods) and undersize on inner diameter (undersize crankpins) as follows:

'85' & '95' Engines

Part Numbers		Con. Rod	Crankpin
85 Eng.	95 Eng.	Oversize	Undersize
81-A-6211-A	99-A-6211-A	Std.	Std.
81-A-6211-B	99-A-6211-J	Std.	.003"
81-A-6211-C	99-A-6211-K	Std.	.010"
81-A-6211-D	99-A-6211-B	.004"	.003"
81-A-6211-E	99-A-6211-C	.008"	.010"
81-A-6211-F	99-A-6211-D	.008"	.003"
81-A-6211-G	99-A-6211-E	.004"	.010"
————	99-A-6211-F	Std.	.015"
81-A-6211-J	99-A-6211-G	.004"	Std.
81-A-6211-K	99-A-6211-H	.008"	Std.
81-A-6211-L	99-A-6211-L	Std.	.0015"
81-A-6211-M	99-A-6211-M	Std.	.020"

Part No.	4 Cyl. Engine	Size
9N-6211 (8 used—4 double halves)		Standard

CRANKSHAFT BEARINGS:—Replacement bearings furnished in Standard Size and Undersizes as shown below. In addition, Rear Main Bearings (flanged on both ends—take crankshaft end thrust) furnished in special lengths as follows:

'85' & '95' Engines

Part Numbers		
Frt. & Center	Rear	Size
81-A-6333-A	81-A-6331-A	Standard
81-A-6333-B	81-A-6331-B	.005" Undersize
81-A-6333-C	81-A-6331-C	.010" Undersize
————	81-A-6331-D①	Standard
————	81-A-6331-E①	.005" Undersize
————	81-A-6331-F①	.010" Undersize
81-A-6333-D	81-A-6331-G	.015" Undersize
81-A-6333-E②	81-A-6331-H②	Standard
81-A-6333-F	81-A-6331-J	.020" Undersize
81-A-6333-G③	81-A-6331-K②	.010" Undersize

①—Length .015" Oversize. ③—O.D. .015" Oversize.
②—O.D. .015" Oversize. .010" Undersize in length.

Front & Rear	4 Cyl. Engine Center	Size
9N-6333	9N-6331	Standard

PISTON PIN FITTING:—Steel Pistons. Pins can be removed and installed without heating pistons. Pins, pistons, and rod bushings held to close limits so no fitting required. Check clearance as follows:
Pin Fit in Piston—With piston and pin at same temperature and clean, pin should drop through pin hole in piston (clearance .0007" maximum).
Pin Fit in Rod Bushing—With pin installed, hold pin so that rod hangs vertically, then rotate pin. Lower end of rod should move upward through arc of ½" max. before dropping back to vertical.

Aluminum Pistons:—Pistons must be heated by immersion in boiling water for one minute, or on special piston heater to a temperature not to exceed 200°F. for pin removal and installation. Pins, pistons, and rod bushings held to close limits so that no fitting required. Check clearances as follows:
Pin Fit in Piston—Pin should be hard hand push fit in piston with piston at room temperature.
Pin Fit in Rod Bushing—Same as for steel pistons

TIMING GEARS (FORD 85, 95 & MERCURY):—New type bolted-on Aluminum Alloy Camshaft Gear used on all V8 Engines. Gear can be replaced without removing camshaft from engine as follows:

Camshaft Gear (Aluminum Alloy Type):—Gear is bolted on camshaft hub flange by four offset capscrews. To remove gear, remove screw in front end of crankshaft, pull fan and pulley assembly (use puller 6312-A), remove timing gear cover. Bend back lockplate tangs, take out four camshaft gear mounting screws, remove gear. When replacing gear, make certain that marks on camshaft and crankshaft gears are lined up and see that lockplate tangs are bent up against flats on mounting screws. Use 6312-B Pulley Replacer to install pulley and fan. NOTE—Camshaft gear mounting screw holes offset so gear can only be installed in correct position.

VALVE SERVICING (ALL FORD AND MERCURY ENGINES):—Complete valve assembly (valve, spring, guide) should be removed as follows:

Valve Assembly Removal:—Use special bar type lifter V-78 (All Fords and Mercury) inserting the end of lifter through valve spring coils to engage flanged lower end of guides, pull guide down slightly, withdraw 'C' type guide retainer, lift valve assembly out through top of block.

Valve Assembly Dismantling:—Use special bench fixture Part No. V-130 (All Engines). Fixture consists of special press by which valve spring can be compressed to free spring retainer (fixture has stop which prevents excessive valve spring compression).

Valve Grinding and Tappet Clearance Note for all V8 Models):—To perform these operations with minimum amount of hand cranking, note which valves are fully open (first column in table below), grind or check valves listed on same line of table—then turn shaft 'til next 'valve open' point reached.

Valves Open	Valves to Grind
1. 4X & 1N	3X, 8N, 6N, 7X, 3N, 2X
2. 3X & 8N	1X, 7N, 5X, 2N, 4X, 1N
3. 1X & 7N	8X, 5N, 6X, 4N
OR	
1. 8X & 5N	1X, 7N, 6N, 7X, 3N, 2X
2. 6N & 7X	5X, 2N, 4X, 1N, 8X, 5N
3. 5X & 2N	6X, 4N, 3X, 8N

NOTE—'X' Exhaust Valve. 'N' Intake Valve.

Tappet Clearance Checking (All Models):—Use special two-step feeler to check clearance with valve lifter on heel of cam (see above). First .0125" step should be 'go', second .0135" 'no go'.

Valve Seat Insert Grinding Note:—Valve seat inserts are exceedingly hard (high-tungsten, chrome-alloy steel). Manufacturer recommends eccentric-grinding equipment be used to reface these inserts.

TRUCK NOTE:—All Engine data below applies also to Ford Truck Models with '85' engine. See Ford Truck 'M' page (following) for other data.

ENGINE HOOD NOTE:—Hood is Alligator type with release knob under instrument panel to left of steering column. To raise hood, pull out on release knob (hood will raise slightly), press in on safety catch under front edge of hood.

OIL PAN REMOVAL:—*See Ford Shop Notes for data.*

SERIAL & ENGINE NUMBER:—Stamped on top of clutch housing and on left frame member in front of dash bracket.

ENGINE SPECIFICATIONS (11A,C):—**Own 85,** 8 cyl., 90° Vee, L head. Both banks & crankcase cast Enbloc. **Bore**—3.062". **Stroke**—3.75".
Rated Horsepower—30. **Displacement** 221 cu. ins.
Developed Horsepower—85 at 3800 R.P.M.
Compression Ratio—6.20-1 (Pass. Cars, Comm. ¾&1 Ton), 5.9-1 (Other Trucks). Cast iron head.
Compression Pressure—140 lbs. (6.20-1 hd.), 130 lbs. (5.9-1 hd.) at 2400 RPM. max. 100 lbs. at 100 RPM.
Vacuum Reading—Steady 18-20" at 5-7 MPH.

ENGINE SPECIFICATIONS (1NC, 19C):—See Ford Truck 'M' page (following) for engine data on Model 1NC with 4 Cylinder Engine, see Mercury 'M' page for 19C with V8 '95' engine.

CYLINDER SLEEVES:—Hardened, dry type cylinder sleeves used on engines marked 'HS' on cylinder block beside inner front corner of left cylinder head.
Servicing:—*See Ford Shop Notes for complete data.*

PISTONS:—Steel alloy, light weight, cam ground type or Aluminum alloy, T slot type. Recondition engine to take finished replacement pistons (replace sleeves, install Std. pistons. See Sleeve Note).
Weight—333-337 grams (without rings or pin).
Removal—Pistons and rods removed from above.
Clearance—See Fitting New Pistons.
Replacement Pistons:—*See Ford Shop Notes for data.*
Fitting New Pistons:—Use .50" wide feeler stock of correct thickness inserted between piston and cylinder wall at right angles to pin to check clearance. Pull to withdraw feeler should be 6-10 lbs.

Feeler Thickness	Steel — Pistons — Aluminum
Engines with Sleeves	.003" — .0025"
Engines without Sleeves	.0025" — .002"

PISTON RINGS:—Two compression, one slotted oil ring, all above pin (drain holes in oil ring groove).
NOTE—Expander used with #2 Compr. and oil ring.

Ring	Width	End Gap	Side Clearance
Compr. #1	.0915-.0920"	.012-.017"	.0025-.003"
Compr. #2	.0915-.0920"	.012-.017"	.002-.0025"
Oil Contr	.1535-.1540"	.012-.017"	.0015-.002"

Replacement Rings:—*See Ford Shop Notes for data.*

PISTON PIN:—**Diameter**—.7501-.7504". **Length**—2.850" (steel pistons), 2.780" (aluminum pistons). Floating type. Pin hole in rod bronze-bushed.
Pin Fit in Piston:—.0005" clearance (steel pistons), + .0001" to — .0001" (aluminum pistons).
Pin Fit in Rod Bushing—.0001" clearance. *See Ford Shop Notes for Pin Fitting directions and Oversizes.*

CONNECTING ROD:—**Length** 7.002". **Weight** 476 grams.
Crankpin Journal Diameter—1.999" (connecting rod diameter on crankpin—2.220").
Bearing Type—Steel-backed, special-alloy lined. Bearing floats in both rods (side-by-side mounting) with bearing surface on inner and outer faces.
Bearing Dimensions—Length 1.747". Thick. .1095".
Clearance—.0005-.002" (total diametrical).
Sideplay—.010-.022" (total).
Bearing Adjustment:—None (no shims). Do not file.
Replacement Bearings:—*See Ford Shop Notes for special bearings for oversize rods and undersize crankpins.*
Installing Rods:—Marks on rods and caps must be together and installed in same numbered cylinder with marks pointing down toward oil pan.

CRANKSHAFT:—3 bearing. Integral counterweights.
Journal Diameters—2.499" (all bearings).
Bearing Type—Steel-backed, special-alloy lined.
Clearance—.001-.003" (or slight drag with .002" feeler assembled in bearing for clearance check).
Bearing Adjustment:—None (no shims). Do not file.
End Thrust:—Taken by rear main bearing. Adjust by replacing bearing. **Endplay**—.002-.006".
Replacement Bearings:—*See Ford Shop Notes for Undersizes and special long main bearings.*

CAMSHAFT:—Three bearing. Helical gear drive.
Bearing Diameters—1.797" (all bearings).
Bearings—Steel-backed, babbitt-lined bushings.
Clearance—.002".
End Thrust:—Taken by gear hub and cover plate. Adjusted by replacing coverplate. **Endplay**—.005-.015".
Timing Gears:—Cast alloy iron (crankshaft), Bakelized Fabric—pressed on shaft, or Aluminum Alloy—bolted on shaft (camshaft). **Backlash**—.004" max. *See Ford Shop Notes for Timing Gear Replacement.*
Camshaft Setting:—Mesh '0' marked tooth of crankshaft gear with '/' marked space on camshaft gear (this mark must be in line with mark on hub).

VALVES:

	Head Diameter	Stem Diameter	Length
All Valves	1.537"	.3115"	4.750-4.751"

	Seat Angle	Lift	Stem Clearance
All Valves	45°	.292"	.0015-.0035"

See Ford Shop Notes for Valve Servicing data.
NOTE—Seat insert used for all valves.
Tappet Clearance:—.0125-.0135". No adjustment.
Valve Guides:—Split type retained by 'C' washer and valve spring. *See Ford Shop Notes for servicing data.*
Valve Lifters:—Barrel type in reamed holes in block. **Diameter**—.9995". **Clearance**—.0005-.001".

Valve Springs:	Pressure	Length
Valve Closed	37-40 lbs.	2.13"
Valve Open	76-80 lbs.	1.84"

Valve Timing:—See Camshaft Setting above.
Intake Valves—Open at TDC. Close 44° ALDC.
Exhaust Valves—Open 48° BLDC. Close 6° ATDC.
To Check Valve Timing—No flywheel marks provided. Intake valve opens with piston at TDC.

LUBRICATION:—Pressure. Gear type oil pump mounted in crankcase at rear of engine.
Normal Oil Pressure:—30 lbs. at 2000 R.P.M.
Oil Pressure Regulator:—Under plug above front camshaft bearing. Opens at 30 lbs. Not adjustable.
Oil Pressure Gauge:—King-Seeley Electric. Ford No. Dash Unit—11A-9273 (Pass. Cars), 11C-9273A (Comm'l.), 11C-9273B (Sedan Dlvry.). Engine Unit —No. 48-9278 (all models).
For complete data, refer to 1941 Mech. Equip. Index.
Crankcase Capacity:—5 quarts.

COOLING SYSTEM:—**Capacity**—26¼ qts. (Pass. Cars), 22 qts. (Commercial), 14 qts. (4 Cyl. Commercial).
Water Pump:—Packless type, 2 used (1 for each bank). *See Mechanical Equipment Section for data.*
Thermostat:—In each cylinder head outlet (2 used). **Setting**—Start to open at 145°F. Fully open 180°.
Temperature Gauge:—King-Seeley Electric. Ford No. Dash Unit—11A-10883 (Pass. Cars), 11C-10883A (Comm'l), 11C-10883B (Sedan Delivery). Engine Unit—99A-10884 (all models).
For complete data, refer to 1941 Mech. Equip. Index.

CLUTCH:—**Long Model 9CF-CS.** Semi-centrifugal, single plate, dry disc type. *Refer to Mech. Equip. Index.*
Facings—Molded type, 2 required. Inside Diam. 5.76". Outside Diam. 9". Thickness .137".
Adjustment:—Pedal free movement should be 1.0-1.25". To adjust, remove clevis pin at end of connector rod, adjust clevis on rod.
Removal:—Slide rear axle and transmission to rear as a unit to expose clutch (see Transmission Removal below), take out mounting screws in cover.

TRANSMISSION:—**Own Make.** Constant-mesh, synchro-mesh (Second & High), sliding gear (low & reverse), all helical gear type. NOTE—Four speed spur gear type optional on Commercial Models.
For complete data, refer to 1941 Mech. Equip. Index.
Transmission Control (11A):—Remote control type.
For complete data, refer to 1941 Mech. Equip. Index.
Removal:—Disconnect gear shifter rods at levers on transmission (Pass. Cars), disconnect rear shock absorbers, hand brake cables, hydraulic brake line at torque tube connection (bleed lines when reconnected), and speedometer cable. Disconnect rear spring at center frame connection, take out universal joint ball housing screws, slide rear axle assembly back to disengage drive shaft at splined joint. Support rear of engine, take out rear engine mounting bolts, clutch housing screws & transmission.

UNIVERSAL JOINT:—**Spicer 202-6 (Std.), 202-8 (Comm'l. with 4 Spd. Trans.).** Steel bushing type. 1 used.
For complete data, refer to 1941 Mech. Equip. Index.

REAR AXLE:—**Own Make.** ¾ floating, Spiral Bevel gear type with Torque Tube drive.
For complete data, refer to 1941 Mech. Equip. Index.
Ratio—3.78-1 Std.; 3.54-1, 4.11-1 Optl. (V8), 4.55-1 (4 Cyl.). **Backlash**—.012" max.
Optional Axle:—Columbia Two-speed type.
For complete data, refer to 1941 Mech. Equip. Index.
Removal:—Disconnect rear shock absorbers, hand brake cables, hydraulic brake line at torque tube connection (bleed lines when re-connected), speedometer cable. Disconnect rear spring at center frame connection, take out universal joint ball housing screws, pull axle assembly to rear.
Axle Shaft Removal—*Refer to Mechanical Equipment Index for Ford Rear Axle article for data.*

SHOCK ABSORBERS:—**Houde (Houdaille).** Double acting, adjustable, hydraulic type.

Houde Model	Right—Ford No.	Left
Pass.Car (Frt.) BBCN	11A-18045A	11A-18046A
" (Rear) BBCZ	11A-18080A	11A-18081A
Comm'l. (Frt). BBCME	01A-18045B	01A-18046B
" (Rear) BBCZ	01A-18080A	01A-18081A

For complete data, refer to 1941 Mech. Equip. Index.

STEERING:—**Steering Gear**—Ford make, same as Gemmer Model 305 Worm & Roller type. See Gemmer.
For complete data, refer to 1941 Mech. Equip. Index.
Front Suspension:—Conventional 'I' beam section front axle with Reverse Elliott ends and transverse front spring. Axle positioned by radius rods.
Kingpin Inclination—8° crosswise.
Caster—9° Max., 4½° Min. Equal within ½°.
Camber—1° Max., ¼° Min. Must be equal within ¼° and the right wheel must not exceed the left. Axle may be bent cold to adjust caster & camber if proper tools (to prevent axle flange damage) used.
Toe In—1/16". Set at 1-10 ratio to Camber. Adjust by loosening tie rod clamp bolts and turning tie rod.
Steering Geometry—Inner wheel 23⅓°. Outer 20°.

BRAKES:—**Service.** Lockheed hydraulic, double anchor type. Hand lever applies rear wheel service brakes.
For complete data, refer to 1941 Mech. Equip. Index.
Drums—Cast iron. Diameter 12".
Wheel Cylinders—Stepped or two- stage bore type:
Front Wheel—Front cylinder 1.25". Rear 1.00".
Rear Wheel—Front cylinder 1.125". Rear 1.00".
Lining—Woven (forward shoes), Molded (rear shoes). Width 1.75". Thickness .20". Length per shoe 13.18" (forward shoes), 10.1" (rear shoes).
Clearance—Least possible amount without drag.
Hand Brake:—See Service Brakes above.

MODEL DESIGNATION:—Truck and Commercial models for 1941 with Engine Type and Wheelbase in which each model furnished are as follows:

Commercial Models

Model	Engine	Wheelbase
1NC	4 Cyl.	112"
11C	85 V8	112"
19C	95 V8	118"

See Passenger Car 'M' page (preceding) for all data on the above models except 4 Cylinder Engine.

¾ Tonner

Model	Engine	Wheelbase
1ND	4 Cyl.	122"
11D	85 V8	122"
19D	95 V8	122"

1 Tonner

1NY	4 Cyl.	122"
11Y	85 V8	122"
19Y	95 V8	122"

Cab-over-Engine Models

111W	85 V8	101"
11W	85 V8	134"
118W	85 V8	158"
19W	95 V8	134"
198W	95 V8	158"

Other Models

11T, U	85 V8	134"
118T	85 V8	158"
114T (School Bus)	85 V8	194"
19T, U	95 V8	134"
198T	95 V8	158"
194T (School Bus)	95 V8	158"

SERIAL & ENGINE NUMBER:—Stamped on top of clutch housing at rear of engine.

ENGINE SPECIFICATIONS & SERVICE DATA (V8 85 & 95 ENGINES):—*See Ford '85' Passenger Car 'M' page and Mercury 'M' page (for '95' Engine) for complete data.* All data (Cylinder Sleeves, Pistons, Pins, Rings, Connecting Rods, Main Bearings, Camshaft & Valves) same as for Passenger Cars except as noted in each section. All other data (including Lubrication & Cooling) given below.

ENGINE SPECIFICATIONS (4 CYL. ENGINE):—4 Cylinder, 'L' head, Enbloc type.

Bore—3.187". **Stroke**—3.75".

Displacement—119.5 cubic inches.

Rated Horsepower—16.2.

Developed Horsepower—30 at 2800 RPM.

Compression Ratio—6.0-1. Cast iron Head.

Compression Pressure—130 lbs. at 1000 RPM. or 100 lbs. at cranking speed of 100 RPM.

Vacuum Reading—18-20" steady idling at 5-7 MPH.

CYLINDER SLEEVES:—Hardened, dry type, cylinder sleeves used on all engines.

Servicing—*See Ford Shop Notes for complete data.*

PISTONS (4 CYL.):—Steel alloy, light weight, cam ground type. When reconditioning engine, replace cylinder sleeves and install new Std. pistons.

Weight—358-362 grams (without rings or pin).

Removal—Pistons and rods removed from above.

Clearance—See Fitting New Pistons.

Fitting New Pistons:—Use .003" feeler, .50" wide, inserted between piston and cylinder wall at right angles to pin. Pull required to withdraw feeler must be within 6-10 lbs.

PISTON RINGS (4 CYL.):—Two compression, one slotted oil control ring, all above pin. Oil ring groove drilled for oil drainage.

Ring	Width	End Gap	Side Clearance
Compr. #1	.0915-.0920"	.012-.017"	.0025-.003"
Compr. #2	.0915-.0920"	.012-.017"	.002-.0025"
Oil Contr.	.1535-.1540"	.012-.017"	.0015-.002"

Replacement Rings:—*See Ford Shop Notes for data.*

PISTON PIN (4 CYL.):—**Diameter**—.7501-.7504". **Length**—2.975". Floating type with locking ring in piston at each end. Pin hole in rod bronze-bushed.

Pin Fit in Piston—.0005" clearance.

Pin Fit in Rod Bushing—.0001" clearance. *See Ford Shop Notes for Piston Pin Fitting directions.*

CONNECTING ROD (4 CYL.):—**Length**—6.125".

Crankpin Journal Diameter—2.10".

Bearing Type—Removable steel-backed, special alloy lined type, clamped in rod and bearing cap. **Clearance**—.0005-.002". **Sideplay**—.002-.006".

Adjustment:—None (no shims). Replace bearings. Do not file rods or bearing caps.

CRANKSHAFT (4 CYL.):—Three bearing type with integral counterweights.

Journal Diameters—2.25".

Bearing Type—Removable, steel-backed, special alloy lined. Front & Rear bearings interchangeable. **Clearance**—.001-.003" (or slight drag with .002" feeler assembled in bearing for clearance check).

Bearing Adjustment:—None (no shims). Replace bearings. Do not file bearing caps.

End Thrust:—Taken by center bearing. Adjust by replacing bearing. **Endplay**—.002-.006".

CAMSHAFT (4 CYL.):—Three bearing with Helical Gear drive (gear furnished as unit with shaft).

Timing Gears:—Cast alloy iron (crankshaft), Bakelized fabric—pressed on shaft (camshaft).

Gear Backlash—.004" maximum.

Camshaft Setting:—Mesh '0' marked tooth of crankshaft gear with '/' marked space between teeth on camshaft gear (camshaft gear mark must be in line with mark on gear hub).

VALVES (4 CYL.):

	Head Diam.	Stem Diam.	Length
Intake	1.537"	.3115"	4.750-4.751"
Exhaust	1.281"	.3115"	4.750-4.751"

	Seat Angle	Lift	Stem Clearance
All Valves	45°	.307"	.0015-.0035"

See Ford Shop Notes for valve servicing data.

NOTE—Seat inserts used for all valves.

Tappet Clearance:—.0125-.0135" all valves. No. adj.

Valve Guides:—Split type retained by 'C' washer and valve springs. *See Ford Shop Notes for servicing data.*

Valve Lifters:—Barrel type in reamed holes in block. **Diameter**—.9995". **Clearance**—.0005-.001".

Valve Springs:—	Pressure	Length
Valve Closed	51-57 lbs.	2.13"

Valve Timing:—See Camshaft Setting above.

LUBRICATION:—Pressure system. Gear type oil pump in crankcase. Pump mounted on right side of front main bearing cap with pump housing integral with bearing cap (4 Cyl.), mounted separately at rear of crankcase (V8 Engines).

Normal Oil Pressure:—25 lbs. (4 Cyl. Eng.), 30 lbs. at 2000 RPM. (V8 Eng.) with warm oil.

Oil Pressure Regulator:—Opens at 25 lbs. (4 Cyl. Eng.), 30 lbs. (V8 Eng.). Not adjustable. Located under plug between cylinder banks at front of engine (V8 Engines).

Oil Pressure Gauge:—King-Seeley Electric. Ford No. 11C-9273A (Dash Unit), 48-9278 (Eng. Unit).
For complete data, refer to 1941 Mech. Equip. Index.

Crankcase Capacity:—4 qts. (4 Cyl.), 5 qts. (V8).

COOLING SYSTEM:—**Capacity**—14 qts. (All 4 Cyl.), 22 qts. (¾ & 1 Ton), 24 qts (Cab-over-Engine Trucks), 23 qts. (All other Trucks).

Water Pump (4 Cyl. Eng.):—Packless type, 1 used. Mounted on front end of cylinder block and driven by fan belt (fan mounted on front end of water pump shaft).
For complete data, refer to 1941 Mech. Equip. Index.

Removal—Remove drive belt, take out mounting bolts and remove fan. Take out pump mounting screws and remove pump assembly.

Water Pump (V8 Engines):—Packless type, 2 used (1 for each bank). Mounted on front of engine block.
For complete data, refer to 1941 Mech. Equip. Index.

Removal—Slack off drive belt, support engine at forward end, remove front engine mounting bolts (engine mounting integral with pump housing), take out mounting screws in pump body.

Thermostat:—In top radiator hose (4 Cyl. Eng.—1 used), in each cylinder head outlet elbow (V8 Engines—2 used).

Setting—Starts to open at 145° F. Fully open 180°F.

Temperature Gauge:—King-Seeley Electric. Ford No. 11C-10883A (Dash Unit), 99A-10884 (Eng. Unit).
For complete data, refer to 1941 Mech. Equip. Index.

CLUTCH:—**Long Model 9CF-CS (4 Cyl. Models), 11CF-CI (All Others).** Single plate, dry disc, Semi-centrifugal type.
For complete data, refer to 1941 Mech. Equip. Index.

Facings—Molded type, 2 required. Inside Diam. 5.76" (9CF), 6.5" (11CF). Outside Diam. 9" (9CF), 11" (11CF). Thickness .137" (all).

Adjustment:—Pedal free movement should be 1.5-1.75". To adjust, remove clevis pin at end of connector rod, adjust clevis on rod.

Removal:—Remove transmission (see Transmission Removal below). Take out mounting screws in clutch cover flange.

TRANSMISSION (3 SPD.):—**Own Make.** Std. on all ¾ Ton and on 1 Ton with V8 Engine (4 Spd. type Std. on 1 Ton with 4 Cyl. Engine). Constant-mesh, synchro-mesh, helical gears (Second & High), sliding spur gears (Low & Reverse).
For complete data, refer to 1941 Mech. Equip. Index.
NOTE—4 Spd. Transmission Optl. on these models.

Removal:—Remove 4 front companion flange bolt nuts at front universal. Take out 2 bolt nuts at coupling shaft center support (all except 101" WB.

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Cab-Over-Engine). Lower propeller shaft assembly to floor. Support engine at rear end, take out rear engine mounting bolts and clutch housing mounting screws. Pull transmission straight back and remove.

TRANSMISSION (4 SPD.):—Own Make. Std. on all models except ¾ Ton and 1 Ton (with V8 Engine). Sliding spur gear type.
For complete data, refer to 1941 Mech. Equip. Index.
NOTE—This Transmission Opti. on other models.

Removal:—Same as for 3 Spd. Transmission above.

UNIVERSAL JOINT:—Spicer. Needle bearing types. Two used (101" WB. models), 3 used with slip-joint in center behind coupling shaft bearing (122", 134", 158", 194" WB. models).
For complete data, refer to 1941 Mech. Equip. Index.

Spicer Model Nos.

Wheelbase	Front	Center	Rear
101"	1351-22, 23	None	1358-104, 115
122"	1318-103	1311-102	1318-103
134 & 158"	1358-4, 31	1351-110, 111	1358-104, 115
194"	1358-5, 32	1351-110, 111	1358-105, 116

Coupling Shaft (Center) Bearing:—A new type cushion mounted Coupling Shaft Ball Bearing bolted to underside of intermediate frame cross member is now used. Bearing is mounted on end of coupling shaft in a sleeve with a felt retainer sleeve on each end and a bearing baffle over the front end. Bearing is retained by center universal companion flange. Bearing and sleeve assembly mounted in center support which is bolted to underside of frame cross member.

REAR AXLE (STD.):—Own Make. Full floating, Spiral Bevel gear type with straddle-mounted pinion and Hotchkiss Drive.
For complete data, refer to 1941 Mech. Equip. Index.

Ratio	Standard	Optional
¾ & 1 Ton (4 Cyl.)	6.67-1	
¾ & 1 Ton (85 V8)	4.857-1	4.11-1
All Others	6.67-1	5.14-1, 5.83-1

Backlash—.004-.016".

Removal:—Split rear universal joint by taking out two 'U' bolts and nuts. Lower propeller shaft. Disconnect hand brake cables at equalizer (¾ & 1 Tonner) and flexible hydraulic brake line at rear axle (bleed lines when re-connected). Disconnect rear springs (semi-elliptic type) and withdraw axle assembly from beneath truck.

Axle Shaft Removal—Take out two screws (except ¾ & 1 Tonner) and remove hub cap, remove nuts on 8 hub studs which hold axle shaft flange in place, turn the two special screws (in tapped holes in flange) up evenly to break flange loose from wheel hub, **back these screws out,** strike axle shaft flange at center to loosen centering cones on studs, remove cones, pull axle shaft out (wheel not disturbed).

Wheel Bearing Adjustment—Remove axle shaft (above), use special bearing adjusting wrench and remove bearing locknut (outer nut), nut retainer, and grease retainer (except ¾ & 1 Tonner). Adjust inner bearing adjusting nut by turning up until tight and then backing off ⅛ turn, install grease retainer, bearing nut retainer, outer bearing locknut, turn locknut up tight.

NOTE—When installing axle shaft, make certain that gasket in place under shaft flange, cones in place on studs and that two loosening screws backed off sufficiently so that stud nuts can be tightened securely. Turn the two loosening screws in just enough to prevent loosening in service.

REAR AXLE (OPTL.):—Own Make. Two-speed type.
For complete data, refer to 1941 Mech. Equip. Index.
Ratio—5.83-1 (Direct), 8.11-1 (2nd speed).
Backlash—.006-.020".

Removal:—Same as for standard axle (above) except that control linkage must also be disconnected.

SHOCK ABSORBERS:—Houde (Houdaille). Model BB-CME (front), BBG (rear). Double acting, adjustable, hydraulic type.
For complete data, refer to 1941 Mech. Equip. Index.

STEERING:—Steering Gear—Gemmer Model 335 Worm-and-Roller type with 'Push-Pull' adjustment.
For complete data, refer to 1941 Mech. Equip. Index.

Front Suspension:—Conventional 'I' beam section front axle with Reverse Elliott ends and new semi-elliptic springs.

Kingpin Inclination—7° crosswise.

Caster—3½° Max., 1° Min. Must be equal within ½°.

NOTE—Caster angle controlled by wedge shims inserted between axle pads and springs. To increase caster, insert taper wedge shims equally at both sides (make certain that spring tie bolt passes through hole in wedge so that wedge held securely in place with spring leaves).

Camber—1° Max., ¼° Min. Must be equal within ¼° and right wheel must not exceed left wheel. NOTE—Axle may be bent cold to correct Camber provided that proper tools (wedges and blocks to prevent crushing axle flange) used.

Toe In—1/16". Set at 1-10 ratio to Camber. Toe-in increases with load on trucks and should be set with truck empty. Adjust by loosening clamp bolts and turning tie rod.

Steering Geometry (Toe out on Turns)—Outer wheel turned 20°. Inner wheel 23° (¾ & 1 Tonner), 23¾° (101" WB.), 22⅔° (134" WB.), 22¼° (158" WB.). Allowable variation ½°.

BRAKES:—Service. Lockheed, hydraulic, double anchor type. Hand lever applies rear wheel service brakes (¾ & 1 Ton), independent shaft brake (all others).
For complete data, refer to 1941 Mech. Equip. Index.

Drums—Cast-iron. Diameter: ¾ Ton (12" front & rear). 1 Ton (12" front, 14" rear). Other Trucks (14" front, 15" rear).

Wheel Cylinders—Stepped type used on ¾ Ton (front & rear wheels), 1 Ton (front). Sizes as follows:

	Front Wheel Front Rear	Rear Wheel Front Rear
¾ Ton	1.25"-1.00"	1.25"-1.00"
1 Ton	1.25"-1.00"	1.375"-1.375"
All Others	1.375"-1.375"	1.50"-1.50"

Lining—Forward shoes (Woven—all wheels ¾ Ton, front wheel 1 Ton. Molded—All Others). Rear shoes (Molded—All Models).

	Width	Thickness	Length per Shoe Forward	Rear
¾ Ton (all)	1.75"	.20"	13.18"	10.1"
1 Ton (front)	1.75"	.20"	13.18"	10.1"
1 Ton (rear)	2.00"	.268"	15.53"	10.75"
Others (front)	2.00"	.268"	15.53"	10.75"
Others (rear)	3.50"	.33"	16.64"	11.52"

Clearance—Least possible amount without drag.

Hand Brake (¾ & 1 Ton):—See Service Brakes above.

Hand Brake (Others):—On drum at rear of transmission.

Adjustment—Fully release hand brake lever. Flat on cam should rest on ear of band (if not, remove pin in lower end of hand lever). Turn anchor screw (on left side) in to give .010" clearance between drum and band, replace locking wire. Loosen lock nut and turn bracket adjusting screw (on right side) to give .010" clearance for lower half of band, tighten lock nut. Tighten adjusting rod nut (on right side), to give .010" clearance for upper half of band (slotted side of nut up). Adjust brake rod clevis so that pin enters clevis and hand brake lever with flat of cam on ear of band and lever in fully released position.

Drum Diameter—7.81".

Lining—Woven. Width 2.5". Thickness 0.250".

ENGINE HOOD NOTE:—Hood is Alligator type with latch at forward end. To raise hood, press toward left on hood latch handle in lower left front hood louvre, raise hood slightly, reach under lower edge of hood and release safety catch, raise hood.

SERIAL NUMBER:—First No. 700001 (109 '40), 700146 (109 '41), 900001 (113 '41). Stamped on plate on floor inside right rear door.

ENGINE NUMBER:—First No. 710001 (109 '40), 710222 (109 '41), 910001 (113 '41). On plate on right side of engine block and on Serial No. Plate (above).

ENGINE SPECIFICATIONS:—Six cylinder, 'L' head. 109 engine equipped with Graham Supercharger.
Bore—3¼". **Stroke**—4⅜".
Displacement—217.8 cu. ins.
Rated Horsepower—25.35 AMA.
Developed Horsepower—93 at 3800 RPM (113), 120 at 4000 RPM (Supercharged 109).
Compression Ratio—6.65-.1 Std. 7.0-1 & 7.25-1 Optl.
Compression Pressure—125 lbs. (113), 130 lbs. (109) at cranking speed for Std. 6.65-1 Head.
Vacuum Reading—17" idling at 7-8 MPH.

PISTONS:—Bohn autothermic, aluminum alloy, cam ground, plated type with special cylinder wall lubrication system. *See 1938 Graham Shop Notes.*
Weight—14⅛ ozs. (stripped). **Length**—3⅝".
Removal—Pistons and rods removed from above.
Clearance—Top .024". Skirt .0025".
Replacement Pistons:—Finished pistons (with pins fitted) furnished in oversizes of 3.247" to 3.252" (in .001" steps), 3.252" to 3.274" (in .002" steps) and 3.277". NOTE—Piston size stamped on head.
Fitting New Pistons:—Use .0025" feeler ½" wide inserted between piston and cylinder wall at right angles to pin. Pull required to withdraw feeler must be 10-15 lbs. at all points in cylinder.
Installing Pistons:—Install pistons with four vertical grooves on skirt toward camshaft (right side).

PISTON RINGS:—Two compression, two oil control rings per piston, all above pin.

Ring	Width	End Gap	Side Clearance
Compr.	3/32"	.007-.015"	.0015" Min.
Oil Cont.	5/32"	.007-.015"	.0015" Min.

Replacement Rings & Installation Directions:—*See Graham 1938 Shop Notes for data.*

PISTON PIN:—**Diameter** 13/16". **Length** 2 13/16". Pin locked in rod by clampscrew.
Pin Fit in Piston—.0005" clearance (hand push fit).
Replacement Pins:—Furnished Std. and .002", .005", .010" oversize (new pistons have fitted pins).

CONNECTING ROD:—**Length** 7". Bearing caps dowelled on rods and held by capscrews in blind tapped holes.
Crankpin Journal Diameters—2 1/16".
Lower Bearing—Removable steel-backed, cadmium-silver-lined type (not grooved, no oil spray hole).
Clearance—.0008-.0021". **Sideplay**—.004-.006".
Bearing Adjustment:—None (no shims). Replace bearings. New bearings should be tight with .002" feeler 1" long installed under cap (cap can be sanded on face plate to secure this fit). Install new bearings with tang engaging groove in rod and cap.
Installing Rods:—Lower Bearings offset. Install rod with widest half of bearing toward rear (#1, 3, 5), toward front (#2, 4, 6). Head of piston pin clampscrew should be toward camshaft on all rods.

CRANKSHAFT:—4 bearing, integral counterweights with Lanchester type Vibration dampener.
Journal Diameters—2⅜" all bearings.
Bearing Type (Front)—Cadmium-silver lined bushing inserted in hole in crankcase from forward end with bushing flange doweled to crankcase.
Bearing Type (Others)—Conventional removable steel-backed, cadmium-silver lined type.
Clearance (All Bearings)—.002".
Bearing Adjustment & Replacement:—*See Graham 1938 Shop Notes for Crankshaft bearing data.*
End Thrust:—Taken by front bearing. Adjusted by adding or removing shims furnished .002", .008" thick. **Endplay**—.004-.006".

CAMSHAFT:—4 Bearing. Non-adjustable Chain Drive. **Journal Diameters**—#1, 1⅞"; #2, 1 13/16"; #3, 1¾"; #4, 1¼". **Bearing Type**—Bronze bushings.
End Thrust:—Taken by spring-loaded plunger in forward end of camshaft.
Timing Chain:—Link-Belt No. 336. Width 1". Pitch .500". Length 23" or 46 links.
Camshaft Setting:—Sprockets are marked. With #1 and #6 pistons on top dead center and marks on both sprockets on upper left side, mesh chain so there are exactly 9 links or 10 pins (inclusive of pins meshed opposite marks) between marks.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1 33/64"	.341"	4 61/64"
Exhaust	1 21/64"	.341"	4 61/64"

	Seat Angle	Lift	Stem Clearance
Intake	30°	5/16"	.002-.003"
Exhaust	45°	5/16"	.002-.003"

Tappet Clearance:—.010" all valves, engine hot.
Valve Guides:—Pressed in block. Ream after installation for correct clearance.
Valve Springs:—Spring free length 2".

	Spring Pressure	Length
Valve Closed	44 lbs.	1 21/32"
Valve Open	98 lbs.	1 11/32"

Valve Lifters:—Cylindrical type. Diameter 1". Operate in guide holes 1 21/32" long finished in block.
Lifter Clearance in Guide—.0005-.0015".
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 4½° BTDC. Close 47½° ALDC.
Exhaust Valves—Open 47½°BLDC. Close 4½°ATDC.
To Check Valve Timing—Set tappet clearance #6 exhaust valve at .012". This valve should close with piston 4½° or .0088" past top dead center when flywheel mark 'EC-1' lines up with indicator under cover on right front face of flywheel housing. Reset tappet clearance at .010" hot.

SUPERCHARGER (109):—Own make, centrifugal type. Carburetor mounted directly on top of supercharger case (Supercharger blower between carburetor and manifold).
For complete data, refer to 1941 Mech. Equip. Index.
Supercharger Removal & Drive Data:—*See Graham 1938 Shop Notes for complete instructions.*

LUBRICATION:—Pressure system. Gear type oil pump located in crankcase.
Normal Oil Pressure:—45 lbs. at 30 M.P.H.
Oil Pressure Regulator:—Located on right side of crankcase at rear of engine number plate. Opens at 50 lbs. Adjusted by adding or removing washers between spring and plunger.
Oil Pressure Gauge:—Stewart (Stewart-Warner) electric.
For complete data, refer to 1941 Mech. Equip. Index.
Crankcase Capacity—5 quarts (refill).

COOLING SYSTEM:—**Capacity**—16 quarts.
Water Pump:—Packless type. Sealed ballbearing shaft.
For complete data, refer to 1941 Mech. Equip. Index.
Removal—Remove fan belt and pump mounting bolts, remove fan and pump as an assembly.
Thermostat:—Detroit Lubricator. In cyl. head outlet.
Setting—Starts to open 150°F. Fully open at 180°.

CLUTCH:—**Long Model 9½CF-CS.** Semi-centrifugal, single plate, dry disc type.
For complete data, refer to 1941 Mech. Equip. Index.
Facings—Chevron or Spiral wound Moulded type, 2 required. I.D. 6". O.D. 9½". Thickness .125".
Adjustment—Free movement of clutch pedal must be about 1¼". To adjust, loosen lock nut above pivot block at pedal, turn adjusting nut below pivot block on connector rod until proper clearance obtained.
Removal:—Remove Transmission (See Transmission below), take off clutch housing underpan, take out clutch mounting screws in cover flange (turning all screws out evenly, remove clutch from below.

TRANSMISSION:—**Warner.** Constant-mesh, synchromesh, (Second & High), sliding gear (Low & Reverse), all helical gear type.
For complete data, refer to 1941 Mech. Equip. Index.
Transmission Control:—Own remote control type mounted on steering column.
For complete data, refer to 1941 Mech. Equip. Index.
Removal:—Disconnect hand brake and clutch linkage, disconnect propeller shaft at front universal, support engine at rear, remove rear engine mounting cross-member, disconnect transmission shift linkage. Take out transmission mounting bolts, pull transmission straight back and remove.

UNIVERSAL JOINTS:—**Spicer 1271-101 (Frt.), 1278-101 (Rear).** Needle bearing type.
For complete data, refer to 1941 Mech. Equip. Index.

REAR AXLE:—**Spicer Model 41-3.** Semi-floating, hypoid gear type with Hotchkiss drive.
For complete data, refer to 1941 Mech. Equip. Index.
Ratio—4.09-1 Std., 4.55-1 Optl.
Backlash—.004-.008". Shim adjustment.
Removal:—Disconnect shock absorbers, brake line and hand brake linkage. Hoist rear end of car, disconnect propeller shaft at rear universal. Remove rear spring U-bolts, disconnect spring shackles, withdraw axle assembly from under car.
Wheel Bearing Adjustment:—Shims provided between flanged end of axle housing and backing plate. To adjust, remove wheel, hub, and drum assembly, remove shims to decrease endplay. **Endplay**—.002-.007".

SHOCK ABSORBERS:—**Delco.** Direct acting, hydraulic type.
For complete data, refer to 1941 Mech. Equip. Index.

STEERING:—**Steering Gear**—Gemmer Model 305 Worm-and-Roller type with 'push-pull' adjustments.
For complete data, refer to 1941 Mech. Equip. Index.
Front Suspension:—Spicer, conventional 'I' beam section front axle with Reverse-Elliott ends and semi-elliptic springs.
Kingpin Inclination—7½° crosswise.
Caster—3½°. Adjust by inserting wedge shims between spring and spring pad on axle.
Camber—1°. No adjustment.
Toe In—⅛". Adjust in usual manner by loosening clamp bolts and turning tie rod to change length.

BRAKES:—**Service**—Lockheed hydraulic type. Hand lever applies rear wheel service brakes.
For complete data, refer to 1941 Mech. Equip. Index.
Drums—10". Cast iron type.
Lining—Moulded type. Width 2". Thickness ¼". Length
Clearance—.006" heel, .010" toe for each shoe.
Hand Brake:—See Service Brakes above.
NoRol:—Optional equipment on all cars.
For complete data, refer to 1941 Mech. Equip. Index.

TORQUE WRENCH SPECIFICATIONS:—*See Torque Wrench article in Mechanical Equipment Section for tightening specifications for Cylinder Head, Main & Connecting Rod Bolts, etc.*

ENGINE HOOD (BONNET) LOCK:—Alligator type hood (hinged at front) with integral side panels and instrument panel lock. To raise hood, push forward on lock handle located under edge of instrument panel to left of steering column, lift rear of hood.

Hood (Bonnet) Removal—Unlock and raise hood. Disconnect bonnet light wires from terminals on fender junction block. Remove bonnet-to-bonnet support bolts and bonnet-to-bonnet hinge bolts. Lift bonnet straight up and remove from car. Align Hood and Front Fenders as directed below when installing Bonnet.

Radiator Louvre Panel Removal—Remove panel-to-fender bolts from under fender. Remove front bumper bolt and and loosen rear bolt permitting bumper assembly to be lowered. Remove center front screw from under panel and lift panel off.

HOOD (BONNET) AND FRONT FENDER ALIGNMENT:—U-shaped bonnet hinge consisting of cross-bar in back of grille with an upright arm at each end which attach to each side of hood. Hinge cross-bar equipped with loose fitting bracket at each end which is attached to frame bracket by screws. Frame and hood hinge brackets have serrated faces. Thick and thin hinge positioning washers assembled on each end of hinge cross-bar and are retained by a large cotter pin. Each front fender positioned by brace rod anchored to frame at lower end and to fender bracket on upper end by means of positioning nuts.

Hood (Bonnet) Adjustments—Bonnet alignment can be adjusted at three points as follows: For full fore-and-aft bonnet movement, loosen bonnet-to-bonnet hinge bolts (three on each side along lower edge of hood). For slight sidewise or lengthwise movement, loosen bonnet hinge frame bracket-to-frame bolts. To position bonnet hinge assembly for sidewise movement, take out large cotter pin in each end of hinge cross-bar and add or remove washers for correct fit.

Fender Adjustment—Fender fit can be adjusted by means of positioning nut on each side of fender bracket at upper end of brace rod. Separate brace rod for each fender located under bonnet behind radiator louvre panel.

Radiator Louvre Panel Adjustment—Louvre panel fit can be adjusted by loosening louvre-to-fender bolts on outer ends of panel. Bolts on back side of panel and are accessible from behind panel with bonnet raised. Louvre panel should be pushed forward as far as possible for correct fit.

FRONT FENDER REMOVAL:—Unlock and raise hood. Disconnect headlamp wires at junction block, unclip wires from fender and dash and push headlamp cables through hole in fender (remove battery if left fender to be removed). Remove fender bolts at following points: running board, brace rod top nut, louvre panel, fender cross member (with spacers), brace to cross member screw, core baffle to fender screws (right fender only), radiator lower tank shield screws, hood support screws, apron support to inspection cover screw, and horn bracket to frame screws. Lift fender off.

Right Front Fender Inspection Hole Plate Removal (for access to valve compartment)—Removable plate used in right front fender for access to valve chamber, fuel pump, and oil pump. To remove plate, unlock and raise hood, remove horn mounting bolts and push horns forward (in engine compartment). Raise front end of car, remove right front wheel and 12 cap screws along the top, bottom and front edge of plate (under fender).

ENGINE ASSEMBLY REMOVAL:—All engines can be removed as follows: Remove bonnet (see Hood Removal), front seat cushion, accelerator pedal, front floor mat, transmission hole cover, clutch housing to engine bolts, engine ground strap, radiator core (see Radiator Core Removal), radiator stay rods and horns. Disconnect generator, starter, temperature gauge, and oil check valve wires and remove wiring harness from clips on left side of engine. Disconnect flexible fuel pump feed line and remove fuel line to carburetor. Disconnect throttle linkage leading from accelerator cross shaft and remove cross shaft (pull shaft toward spring and slip shaft out of opposite bracket). Disconnect windshield wiper hose at manifold. Remove spark plug wires and bracket, distributor cap, carburetor and air cleaner. Disconnect exhaust pipe at manifold. Remove front engine support bolts and nuts. Hoist engine out of car (use Tool J-917 attached to engine) move engine forward carefully to disconnect from transmission mainshaft. With engine out of car, remove distributor, generator, fuel pump and clutch.

Installation—Reverse procedure listed above and properly position leather seal on clutch throwout bearing as follows: Wrap a piece of soft wire around leather seal with ends of wire extending up through clutch housing opening, lower engine into place using care not to damage clutch driving plate assembly when engaging transmission mainshaft, pull wire wrapped around seal out (with seal wired in this manner, edge will not curl over when engine installed).

ENGINE FRONT SUPPORT REMOVAL:—Drain cooling system. Remove generator, fan belt, radiator outlet hose and raise front end of car. Remove radiator lower tank shield, vibration dampener (see Vibration Dampener Removal) and timing gears (see Timing Gear Removal). Block up front end of engine and remove front engine mounting bolts and nuts. Take out engine support bolt and locks and remove plate.

Installation—Reverse procedure listed above, note the following points: Clean front face of cylinder block thoroughly and use new gaskets. When replacing engine mounting bolts, tighten nuts until upper and lower plates are against spacer.

ORIGINAL BORE SIZE:—Original production (new engine) bore size indicated by code mark stamped on lower edge of valve chamber opposite cylinders. See table below for size and code marks.

Code Mark	Cylinder Diameter	Code Mark	Cylinder Diameter
A	3.000"	AO	3.010"
B	3.0005"	BO	3.0105"
C	3.001"	CO	3.011"
D	3.0015"	DO	3.0115"
E	3.002"	EO	3.012"

Note—Recondition cylinders to size for which replacement pistons and rings available (see below).

Original Piston Size—Sizes and markings for original pistons same as for Replacement Pistons. See Replacement Piston Table and Piston Markings following.

REPLACEMENT PISTONS:—Standard and oversize pistons marked by letter stamped on head and furnished for **cylinder diameter sizes** listed below. See Replacement Rings (following) for ring sizes.

Piston Mark	Piston Size	Cylinder Size
B	2.9985"	3.000" & 3.0005"
D	2.9995"	3.001" & 3.0015"
F	3.0005"	3.002" & 3.0025"
J	3.0025"	3.004"
L	3.0035"	3.005"
BO	3.0085"	3.010" & 3.0105"
DO	3.0095"	3.011" & 3.0115"
FO	3.0105"	3.012" & 3.0125"
LO	3.0135"	3.015"
BB	3.0185"	3.020"
DD	3.0195"	3.021"
FF	3.0205"	3.022"

Piston Markings—Code marks stamped on head of piston indicate the following: **Letter** indicates piston size and cylinder size for which piston to be fitted (see table below). **Number** indicates piston weight in ounces (if 2 numbers used, one over the other, top number indicates weight in ounces, lower number ¼ ounces). All pistons in one engine should be of same weight (carry same weight marks on head). NOTE—Original factory installed pistons carry two additional numbers, one number indicates cylinder in which piston installed, second number indicates cylinder block number.

REPLACEMENT RINGS:—Use standard or oversize rings for replacement pistons listed above. Ring size and pistons for which each ring size applies listed in table below.

Ring Size	Piston Mark	Ring Size	Piston Mark
3.000"	B, D, F	3.010"	BO, DO, FO
3.003"	J	3.015"	LO
3.005"	L	3.020"	BB, DD, FF

Note—If rings filed, keep clearance at pin uniform with end gap (.005" minimum).

Expanding Piston Ring Service Kit—Hudson Part No. 161781 Kit available for six cylinder engines with 5/32" thick lower oil ring. Kit contains one complete ring set with expanders for six cylinder For eight cylinder, use one 6 cyl. kit Part No. 161780 (for 3/16" oil ring) and obtain additional rings and expanders from second 6 cyl. kit.

PISTON PIN SERVICING:—When replacing pins car manufacturer recommends that oversize piston pins be fitted to the piston boss and new piston pin bushings be installed in rod. Piston pin bosses are diamond-bored and should not be reamed.

Replacement Piston Pins—Furnished in standard size and .002", .005", .010" oversize.

Fitting Pins—Pins should be a hand press fit in piston with piston heated to 200°F. (heat in boiling water or electric furnace—do not use torch or direct heat). Replace pin bushing in rod and ream or burnish to .0003" greater diameter than pin (giving desired .0003" clearance on pin). To check pin fit in rod bushing, hold piston with rod in horizontal position, rod should just turn on pin of own weight. CAUTION—Do not ream piston pin bosses in piston.

CRANKSHAFT SIZE CODE:—Cars equipped with .010" undersize main bearing pins and connecting rod pins identified by marks stamped on left front corner of cylinder block on bottom face beside oil reservoir gasket (visible without removing oil reservoir) as follows:

MU—.010" undersize main bearing pins.
PU—.010" undersize connecting rod pins.
PMU—.010" undersize main and connecting rod pins.
NOTE—These pins require .010" undersize bearings.

CONNECTING ROD AND MAIN BEARING PALNUTS:—Palnut (locknut or companion nut) used in place

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of cotter pin to lock main bearing cap stud nuts and connecting rod bolt nuts. Consists of a small single thread nut stamped from light gauge steel and tempered.

Installation—After tightening main bearing cap nuts to 75 ft. lbs. tension or connecting rod bolt nuts to 40 ft. lbs. tension, intall new palnut with smooth face toward nut, spin palnut on until it touches nut finger tight, then lock in place with a wrench an additional ¼-⅓ turn. NOTE—Car manufacturer recommends that new palnuts be used whenever main bearing caps or connecting rod bearing caps installed.

VIBRATION DAMPENER REMOVAL:—Dampener can be removed from beneath car without removing radiator louvre panel or radiator (radiator must be removed on Eight only) as follows: Remove radiator louvre panel center moulding, front bumper bracket bolts permitting bumper to drop down, and fan belt. On Eight only, remove radiator (see Radiator Core removal following). Unscrew crankshaft starting jaw from end of crankshaft. Install jaw of special vibration dampener removal tool over dampener and place screw of tool through starting crank hole. Withdraw dampener by turning screw of dampener tool and remove dampener from beneath car on Six, from above on Eight.

CRANKSHAFT REMOVAL:—Crankshaft can be removed with engine in chassis as follows: Remove bonnet (see Hood (Bonnet) Removal above), radiator (see Radiator Core Removal following), vibration dampener (see Vibration Dampener Removal above), timing gears (see Timing Gear Removal following), transmission and clutch (see Hudson Six & Eight 'M' pages following). Remove flywheel, and engine oil pan and tray. Remove connecting rod bearing caps and push rods up clear of crankshaft. Remove front and rear main bearing caps with Puller Tool J-377. Remove center main bearing cap with care which will allow crankshaft to be lowered out of engine.

Installation—Reverse removal procedure listed above. Install new oil seals at front and rear main bearing cap (see Front and Rear Main Bearing Cap Installation following) and new palnuts on main and connecting rod bolts (see Connecting Rod and Main Bearing Palnut Installation above).

MAIN BEARINGS:—Removal and Installation (with engine in car). Bearing halves are retained in crankcase and caps by a machine screw in each half, requiring removal of crankshaft for access to screw in upper half. Remove crankshaft (see Crankshaft Removal above), take out machine screw in each bearing half in crankcase and caps, remove bearings. Reverse removal instructions to install bearings.

Fitting Bearings—No shims used on main bearings in the 1941 engines. To check bearing clearance, place a piece of .001" feeler stock, ½" wide and 1" long between bearing and crankshaft. Tighten bearing cap stud nuts. Bearing clearance is correct when there is a slight drag felt when turning crankshaft. If no drag felt, clearance is excessive and new factory-lined bearings furnished standard size and .010" undersize should be installed. Unfinished bearings also available, but these bearings must be line-reamed on engine. Bearing caps should not be filed to reduce bearing clearance. NOTE—Where new finished bearings installed and insufficient clearance noted, shims may be used to obtain proper clearance without scraping or reaming bearings. Normally shims will not be required.

Line-Reaming Bearings—Semi-finished bearings available for service which must be line-reamed on engine as follows: Place bearings in place in crankcase and caps with machine screws, see that ends of bearing shells are flush with crankcase and cap (if necessary dress ends of shell down), install bearing caps in place (NOTE—No shim pack used), and line-ream bearings to give .001" clearance. Thrust flange on center bearing must then be faced to give .006" endplay.

Front and Rear Main Bearing Cap Removal and Installation—These caps fit in machined openings in crankcase. Front cap has vertical and horizontal grooves, rear cap vertical grooves only, with packing installed in these grooves to seal caps in place. When removing these caps a special removing Tool J-377 must be used to pull caps out of engine. After caps removed, grooves in caps and crankcase must be cleaned of all old packing. If old packing not removed from crankcase, oil passages may be clogged. When installing main bearing caps, insert new packing in horizontal grooves in upper end of front cap first, using Crankshaft Bearing Packing Inserter Tool J-392, then install packing in vertical grooves on each side of front and rear caps (horizontal grooves not used on rear cap). Lower half of oil retainer on rear cap should be a tight fit against upper half to prevent oil leaks at this point.

CAMSHAFT CHANGE ON 3" x 4⅛" SMALL SIX CYLINDER ENGINE:—New design camshaft used on Model 10 engine after car no. 6848. Cams machined to new contour, intake and exhaust cams alike, which requires new valve timing and tappet clearance (see 1941 Hudson Six 'M' page following).

Identification—New camshaft used after car no. 6848 and may be identified by letter 'X' stamped on front face of shaft behind camshaft gear. Engines with this camshaft carry a decalcomania on valve cover stating "Tappet Clearance Hot, Inlet .010", Exhaust .012"."

Interchangeability—This new type camshaft can be installed on early 1941 engines and all 1940 engines with a bore of 3" and stroke of 4⅛" but must not be used in the 3" x 5" six cylinder engine. When this camshaft installed on engines originally equipped with old style camshaft, a decalcomania with the new tappet clearance figures of .010" Inlet and .012" Exhaust Hot, should be installed on valve cover plate.

CAMSHAFT SERVICING:—Camshaft Removal. Remove bonnet (see Hood (Bonnet) Removal above), radiator (see Radiator Core Removal following), radiator louvre panel, vibration dampener (see Vibration Dampener Removal above), fan blades, fan belt, timing gear cover and gasket, vibration dampener spacer, camshaft gear (3 bolts and lockwire), valve chamber cover, valves, tappets, oil pump, fuel pump, and distributor. Camshaft with thrust button and spring can then be withdrawn from engine by pressing down on radiator lower tank shield. NOTE—When installing camshaft, use new timing gear cover gasket and new leather oil seal (coat oil seal seat in cover with red or white lead and see that seal pressed tightly in place and not curled over when cover installed). Two special cover bolts used in lower left corner and must be installed in these holes only.

Camshaft Bearings—New thin type steel-backed, babbitt-lined bushings used (cannot be used for service on earlier cars). Factory reamed bearings available for replacement which require no reaming or scraping. Standard bearings with extra wall thickness permitting line-reaming on engine also available. These bearings should be line-reamed to give .001" bearing clearance.

Camshaft Bearing Removal & Installation—Bearings can be removed as follows: Remove camshaft (see Camshaft Removal above), remove oil pan and tray, press old bearings out. New bearings can be installed as follows: Press new bearings in place with locating notch on front edge at top (back of bearing has 1/16" chamfer so that bearings can be readily installed in crankcase, bearing material on front of bearing has light chamfer at front). Coat bearings lightly with engine oil and install camshaft as directed above.

TIMING GEAR REMOVAL:—Drain cooling system. Remove fan belt, radiator outlet hose, vibration dampener (see Vibration Dampener Removal), timing gear cover bolts, cover, cover gasket and vibration dampener spacer. Turn engine over until timing marks (2 teeth mark on camshaft gear, 1 tooth mark on crankshaft gear) coincide. Remove camshaft gear (retained by 3 capscrews and lock wire). Remove crankshaft gear using Puller Tool J-471.

Installation:—Reverse procedure listed above. Replace crankshaft gear with Tool J-483. Mesh timing gear marks as noted above.

Replacement Camshaft Gear:—A special .008" oversize camshaft gear (marked with daub of yellow paint on front face of gear) available for service. Gear backlash .002-.003" (Six), .004-.005" (Eight)

VALVE LIFTER REMOVAL:—Tappets (lifters) may be removed without removing cylinder head as follows: Remove Right Front Fender Inspection Hole Plate (see instructions under Front Fender Removal on preceding page). Remove valve chamber cover, break loose tappet adjusting screws, remove spring seat retainer using Tool J-915, remove tappet adjusting screw, spring seats, spring dampeners, tappet guide clamp screws and clamps. Take out tappet and guide assemblies.

CHECKING OILING SYSTEM:—See that oil lines securely in place and not bent or damaged. Drop oil reservoir and clean thoroughly every six months. When installing oil reservoir, check flapper valve on rear main bearing oil return tube (soldered in rear of reservoir). Valve must work freely and should be slightly open with reservoir level. Holes in gaskets between crankcase and oil dipper tray and between tray and reservoir must align with oil return tube (tube registers with hole in bearing).

OIL SUCTION PIPE SEAL:—Synthetic rubber suction pipe oil seal fitted in counter-bore in cylinder block flange at point where suction pipe passes through oil pan flange. Seal fitted around pipe and oil pan gasket widened at this point. Seal compressed by pan when pan screws tightened. NOTE—Use new seal whenever pan installed.

RADIATOR CORE REMOVAL:—Drain radiator and remove upper and lower hoses. Disconnect radiator stay rod bolt at top of radiator. Remove two radiator mounting bolts, lift core out of car.

CLUTCH OIL:—Servicing—Hudsonite (oil) in clutch must be renewed every 5000 miles. Turn engine over until hexagonal drain plug on front face of flywheel is visible in timing inspection hole on left side of motor rear support above starting motor. Remove hex head drain plug with a socket wrench, turn engine over ⅓ revolution until star on flywheel is at inspection hole, allow engine to stand in this position one minute to drain old oil, turn engine over until filler plug is again at inspection hole, insert ⅓ pint Hudsonite (use J-485 gun) replace plug. **Capacity & Oil—⅓ pt. Hudsonite Clutch Compound.**

MODEL 10 ENGINE OPTION:—This car series may be had with larger 3" x 5" six cylinder engine. See Serial Number Model 10 Note below for Serial Number Plate designation when car equipped with this engine.

ENGINE HOOD (BONNET) LOCK, HOOD REMOVAL AND ADJUSTMENT:—*See Hudson Shop Notes.*

SERIAL NUMBER:—First number 10101 (Model 10—See Note below), 11101 (Model 11 Super Six), 12101 (Model 12 Commodore Six), 18101 (Model 18 Big Boy Series). The first two figures of the car number indicates the model thus: 10101 (Model 10, Serial No. 101). Number stamped on plate attached to right front hinge pillar, visible with door open.

Model 10 Note—Number plate on this series carries additional designations as follows: 'T' for Traveler, 'D' for Deluxe, 'C' for Commercial cars.

Model 10 with 3" x 5" Engine—Cars with this engine designated by letter 'L' stamped on number plate following model letter (see Note above) as follows: 'TL' Traveler, 'DL' Deluxe, 'CL' Commercial.

ENGINE NUMBER:—Same as Serial Number (see above). Stamped on top of cylinder block on right side between #1 and #2 exhaust ports. See Model 10 Notes above.

ENGINE SPECIFICATIONS:—Models 10T, 10D, 10C. 6 cylinder, 'L' head type.

Bore—3". **Stroke**—4⅛".

Displacement—175 cubic inches.

Rated Horsepower—21.6.

Developed Horsepower—92 at 4000 RPM.

Compression Ratio—7.25-1 cast-iron head.

Compression Pressure—125 lbs. at 125 RPM (cranking speed). 90 lbs. minimum (10 lbs. max. variation).

Vacuum Reading—Steady 18-21" idling at 600 RPM.

ENGINE SPECIFICATIONS:—Models 10TL, 10DL, 10CL, 11, 12, 18. 6 cylinder, 'L' head type.

Bore—3". **Stroke**—5".

Displacement—212 cubic inches.

Rated Horsepower—21.6.

Developed Horsepower—102 at 4000 RPM (all models except Model 18), 98 at 4000 RPM (Model 18 only). NOTE—Model 18 equipped with single carburetor, other models equipped with duplex carburetor.

Compression Ratio—6.50-1 cast-iron head.

Compression Pressure—120 lbs. at 125 RPM (cranking speed). 90 lbs. minimum (10 lbs. max. variation).

Vacuum Reading—Steady 18-21" idling at 600 RPM.

See Hudson Shop Notes for Engine Removal instructions and Engine Front Support Removal and Installation.

PISTONS:—Own Lo-Ex aluminum alloy, 'T' slot, cam ground type. Use finished replacement pistons.

Weight—10.5 ozs. (stripped). **Length**—3 3/16".

Removal—Pistons and rods removed from above.

Clearance—Top .016". Skirt .0005-.001". See Fitting New Pistons below.

Original Bore & Piston Sizes, Replacement Pistons:—*See Hudson Shop Notes for sizes and markings.*

Fitting New Pistons:—Use .0015" feeler ½" wide inserted between piston and cylinder wall on side opposite slot at right angles to pin. Pull to withdraw feeler must be within 3-4 lbs. Use Tool J-888-A Piston Feeler Scale to measure pull.

Installing Pistons:—T-slot away from camshaft.

PISTON RINGS:—Two compression, two oil rings (one above pin, one below pin) per piston. Rings are square end type. Rings pinned to prevent rotation. Rings cut and notched to fit pin (clearance on pin equal to ring end gap).

Ring	Width	End Gap	Side Clearance
Compression	3/32"	.009-.011"	.001"
Oil	5/32"	.009-.011"	.001"

Replacement Rings:—*See Hudson Shop Notes for data.*

PISTON PIN:—Diameter—¾". **Length**—2 7/16". Floating type. Retained by locking rings.

See Hudson Shop Notes for Pin Servicing data.

Pin Fit in Piston—.0003" clearance (hand push fit) with piston heated to 200°F.

Pin Fit in Rod Bushing—.0003" clearance.

Replacement Pins:—Standard and .002", .005", .010" oversize.

CONNECTING ROD:—Weight—30¾ ozs. (3" x 4⅛" engines), 30 ozs. (3" x 5" engines).

Length—8⅝" (3" x 4⅛" engines), 8 3/16" (3" x 5" engines).

Crankpin Journal Diameter—1 15/16".

See Crankshaft Size Code Note in Hudson Shop Notes for Original Connecting Rod Bearing sizes.

Lower Bearing—Lead alloy, spun type. Exchange rods furnished standard and .010" undersize.

Clearance—.001". **Sideplay**—.006-.010".

Bearing Adjustment:—None (no shims). Do not file rods or caps. *See Hudson Shop Notes for Palnut (rod bolt nut locknut) installation data.*

Installing Rods:—Lower end of rods offset. Install rods with widest half of bearing toward the rear (#1, 2, 4), toward front (#3, 5, 6). Oil scoop on lower end of rod toward camshaft.

CRANKSHAFT:—3 bearing, integral counterweights.

See Hudson Shop Notes for Crankshaft and Vibration Dampener Removal, Main Bearing Removal and Installation, Replacement Bearings & Line-Reaming data.

Journal Diameters—#1, 2 11/32"; #2, 2⅜"; #3, 2 13/32".

See Crankshaft Size Code Note in Hudson Shop Notes for Original Main Bearing Sizes.

Bearings—Bronze-backed, high lead babbitt lined type. NOTE—Shim pack not used. Palnuts used in place of cotter pins to lock bearing cap nuts.

Clearance—.001".

Bearing Adjustment:—None (no shims). Do not file caps. *See Hudson Shop Notes for Bearing Adjustment and Palnut (locknut) Tightening procedure.*

End Thrust:—Taken by center bearing. Replace bearing if endplay excessive. NOTE—If new unfinished bearings installed, thrust face for center bearing must be faced for proper endplay.

Endplay—.006-.012".

CAMSHAFT:—Three bearing, gear driven type with new type bearings and timing gears.

See Hudson Shop Notes for Camshaft Removal and Camshaft Bearing installation instructions.

Production Change—Models 10T, 10D, 10C—Two types of camshafts used on this engine only (3" x 4⅛").

See Hudson Shop Notes for changes and identification.

Journal Diameters—#1, 2.000"; #2, 1.968"; #3, 1.5625".

Bearings—New type steel-backed, 'Bermax' (babbitt) lined bushings (formerly solid type babbitt).

Clearance—.002-.0025".

End Thrust:—Thrust washer between camshaft flange and crankcase. Spring loaded button in camshaft hub bears against thrust plate on gear cover. NOTE—Service thrust washer available which can be split and installed without removing camshaft.

Timing Gears:—Crankshaft gear cast-iron, camshaft gear laminated fibre. Tooth shape changed to 20° pressure angle (was 14½°) to provide quieter operation and longer gear life. Gears can be identified by figure 20 stamped on front face (crankshaft gear carries additional FRONT mark to insure correct installation). Gears may be installed in sets only (not singly) on earlier car models (new type gears similar to previous type except for tooth pressure angle).

Backlash—.002-.004".

See Hudson Shop Notes for Timing Gear removal and installation instructions.

Camshaft Setting:—Mesh marked crankshaft gear tooth between two marked teeth on camshaft gear.

VALVES:—

	Head Diameter	Stem Diameter	Length
All valves	1⅜"	11/32"	5 11/32"

	Seat Angle	Lift	Stem Clearance
Intake	45°	11/32"	.0025"
Exhaust	45°	11/32"	.004"

Tappet Clearance:—Two settings used. One setting for all 3" x 5" engines and early 3" x 4⅛" engines (with first type camshaft) and a second setting for later 3" x 4⅛" engines (with second type camshaft). This second setting on later 3" x 4⅛" engines carried on instruction label attached to valve cover plate.

Setting (All 3" x 5" engines and first 3" x 4⅛" engines up to Car No. 6848)—.006" Intake, .008" Exhaust with engine running and at normal operating temperature.

Setting (Later 3" x 4⅛" engines after Car No. 6848)—.010" Intake, .012" Exhaust (as indicated by label attached to valve cover plate) with engine running at normal operating temperature.

See Hudson Shop Notes for Fender Plate Removal for access to valve compartment.

Valve Guides:—Removable type. Length 2 9/16". Use Tool J-1188 to drive guide out. Install guides with Tool J-883-A with top of guide 1 1/16" below top of cylinder block. With guides installed, ream guides (Tool J-129-2) to .002" larger than valve stem to provide proper clearance.

Valve Springs:—Cadmium plated springs used with dampener installed on bottom with open side toward cylinder. Use Tool J-587-A to install spring and dampener assembly.

Spring Free Length—2 17/64".

	Spring Pressure	Spring Length
Valve Closed	40 lbs.	2"
Valve Open	80 lbs.	1 21/32"

NOTE—When springs removed, test for pressure (Tool U-15). Replace if pressure below 34 lbs. at 2".

Valve Lifters:—Roller shoe type, fitted in removable guides. *See Hudson Shop Notes for lifter removal.*

Valve Timing:—See Camshaft Setting above.

Model 10 up to Car #6848—All other Sixes

Intake Valves—Open 10°40' BTDC. Close 60° ALDC.

Exhaust Valves—Open 50° BLDC. Close 18°44' ATDC.

These figures correct with .010" tappet clearance.

Model 10 (3"x4⅛" engine) after Car #6848

Intake Valves—Open 28°30' BTDC. Close 68°30' ALDC.

Exhaust Valves—Open 52°40' BLDC. Close 32°40' ATDC. These figures correct with .010" tappet clear.

Valve Timing Check—With .010" tappet clearance #1 intake valve opens 10°40' BTDC (see Note below for later Model 10 cars) or approx. 4 teeth on flywheel before 'UDC.1-6/' mark lines up with indicator in inspection hole above starter (piston .0441" for first Model 10, .0562" for large six cylinder 3"x5" engines, before top dead center). Reset tappet clearance at .006" with engine running and at normal operating temperature.

Model 10 (after Car # 6848)—On these 3"x4⅛" engines which use the second type camshaft, intake valve opens with piston 28°30' before top dead center with tappet clearance set to .010".

LUBRICATION:—Duo-flo (pressure and positive splash) lubricating system.

Oil Pump:—Oscillating plunger type, gear driven by camshaft. Mounted on right side of crankcase.

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Normal Oil Pressure—4-12 lbs. with hot oil. No gauge used (see Oil Pressure Indicator below).

Oil Check Valve:—Located on right side of crankcase at rear. Opens at 4-12 lbs. with hot oil. Operates dash signal to indicate oil flow.

Oil Pressure Indicator:—Hudson Teleflash Oil Pressure Indicator. Consists of signal light on instrument panel operated by switch mounted on oil check valve.

For complete data, refer to 1941 Elec. Equip. Index.

Checking Oiling System:—***See Hudson Shop Notes.***

Crankcase Capacity:—4½ quarts (refill), 5½ (dry). **Servicing Note**—When changing oil without removing oil pan, refill with 4½ quarts. If oil pan removed, place 1½ quarts in upper tray before oil pan installed, then 4 quarts through filler with pan in place.

COOLING SYSTEM:—**Capacity**—13 quarts.

See Hudson Shop Notes for radiator core removal.

Water Pump:—Centrifugal, belt-driven, packless type with single outlet (no by-pass). Grease fitting provided for front & rear bearing lubrication.

For complete data, refer to 1941 Mech. Equip. Index.

Thermostat:—Fulton. Choke type located in cylinder head water outlet.

Setting—Starts to open150-155°F. Fully open 185°. NOTE—Special high temperature thermostats available for use with ethylene glycol type anti-freeze. Starts to open 160-165°F. Fully open 190°F.

Temperature Gauge:—King-Seeley Electric. K-S Nos. 8310 (Dash Unit—stamped 'T'), 7000 (Eng. Unit).

For complete data, refer to 1941 Mech. Equip. Index.

NOTE—Temperature gauge inoperative with ignition 'off'. Pointer returns to 'H' (hot) position.

CLUTCH:—**Own Make.** Single plate, cork insert type operating in oil.

For complete data, refer to 1941 Mech. Equip. Index.

Driven Member—Cork insert type. Inside Diameter 5¼" (10, 10L, 11—without overdrive), 6⅜" (12, 18; and all cars with overdrive). Outside Diameter 9" (10, 10L, 11—without overdrive), 10" (12, 18; and all cars with overdrive). Facing 90 cork inserts (9" size), 108 cork inserts (10" size), cork thickness .203".

Pedal Adjustment:—Two settings used dependent on connector link position on cross shaft lever. Normal setting (with connector link in center hole on cross shaft lever) 1½" clearance between underside of toeboard and center of clutch pedal clamp bolt. Second setting (with connector link in lower hole—for lighter clutch pedal pressure) clearance increased to 2". To adjust, loosen lock nut on connector link above clevis, take out clevis pin and turn clevis in or out for correct clearance. Check Automatic Clutch Control adjustment if this equipment used.

Clutch Oil Servicing:—***See Hudson Shop Notes for data.***

Removal:—Remove transmission (see Transmission Removal following). Drain clutch oil by turning engine over until plug on flywheel is accessible through timing inspection hole in rear engine support plate above starter, remove plug, turn engine over ⅓ revolution until star on flywheel visible through timing hole (drain hole then at bottom), allow lubricant to be drained. Loosen mounting bolts in clutch cover rim to release spring tension, remove bolts and lift clutch assembly off car.

NOTE—See Installation Note following Transmission Removal for Clutch Throwout Bearing Oil Seal data.

Automatic Clutch Control:—Vacumotive type. Optl.

NOTE—Governor switch changed during production.

For complete data, refer to 1941 Mech. Equip. Index.

TRANSMISSION:—**Own Make.** New all helical gear, constant-mesh type with synchro-mesh (Second and High), sliding gears (Low & Reverse) and steering column gear shift. NOTE—External shift rail locks not used.

For complete data, refer to 1941 Mech. Equip. Index.

Overdrive:—Warner Model AS1-R9B with electrical 'kick-down' control (new type—no centrifugal clutch pawls used). Optional equipment.

NOTE—Governor switch changed during production.

For complete data, refer to 1941 Mech. Equip. Index.

Transmission Control:—Hudson 'Handy-Shift' type.

For complete data, refer to 1941 Mech. Equip. Index.

Removal:—Transmission can be removed from inside car as follows: Take off accelerator pedal by removing cotter pins in anchor bracket and bell crank link clevis pins. Move steering column rubber hole cover up out of way. Remove floor mat by taking out screws at kick pads on dash and mat trim clips. Remove front seat cushion and transmission floor opening cover (CAUTION—Accelerator pedal operating rod should be secured so as not to drop on starter switch). Disconnect front universal by taking out four nuts and lock plates on U-bolts. Release clutch pedal return spring. Remove two cross shaft bracket bolts, clutch control link clevis pin and clutch pedal assisting spring. Remove Handy Shift control tube-to-transmission shift rod cotter pin, washer and grommet; transmission outer lever nut, washer and lever. Remove two flywheel guard-to-clutch housing screws and two rear engine mounting bolts (CAUTION—Do not remove rear engine mounting-to-clutch housing bolt). Jack rear of engine up ½" off frame. Remove clutch housing to transmission bolts. Disconnect speedometer cable from transmission. Pull transmission back and lift out.

Overdrive Transmission Removal—Same as standard transmission removal (above) except that overdrive control and wiring connections must be disconnected. Special Tool J-1502-H (hoist and dolly) should be used to lift transmission and lower onto dolly. Transmission and overdrive assembly can then be rolled out from beneath car.

Installation Note—Wrap one strand of soft wire around throw-out bearing oil seal to prevent leather curling over when transmission installed (twist wire with ends extending up through clutch housing so that it will come off the seal after transmission installed).

UNIVERSAL JOINTS:—**Spicer.** Needle bearing type.

Car Model	Spicer Model No. Front	Rear
10 (no Overdrive)	1261-101	1268-101
11, 12 (no Overdrive)	1271-101	1278-101
13, 18 (no Overdrive)	1281-101	1278-101
All Models (with Overdrive)	1281-101	1278-101

For complete data, refer to 1941 Mech. Equip. Index.

REAR AXLE:—**Own Make.** Semi-floating, spiral bevel gear type with Hotchkiss drive.

For complete data, refer to 1941 Mech. Equip. Index.

Ratio—without Overdrive: 4 5/9-1 Std. 10T, 10P, 10C, 18C; Optl. 11, 12, 18P. 4 1/9-1 Std. 11, 12, 18P; Optl. 10T, 10P, 10C. 4 7/8-1 Optl. 10T, 10P, 10C. **With Overdrive:** 4 7/8-1 Std. 10T, 10P, 10C, 18C. 4 5/9-1 Std. 11, 12, 18P; Optl. 10T, 10P, 10C, 18C. 4 1/9-1 Optl. 10T, 10P, 10C, 11, 12, 18P.

Backlash—.0005-.0035". Screw adjustment.

Removal:—Disconnect rear universal by taking out four nuts and lock plates on U-bolts, drop rear end of propeller shaft. Remove axle shafts (see instructions below). Remove bolts nuts on carrier flange, pull carrier assembly out of axle housing.

Axle Shaft Removal:—Hoist rear of car. Remove rear wheels. Remove axle shaft nut and washer (use Tool J-351). Remove hub and drum assembly using screw type wheel puller (Tool J-736—CAUTION—Car manufacturer recommends that screw type puller be used, if knock out type puller is used serious damage to differential parts may result). Remove 4 nuts on bearing cap bolts, push bolts out of backing plate, remove bearing cap and shims (without disturbing hand brake link). Take out rear wheel bearing and axle shaft using puller Tool J-352. Do not drag axle shaft on oil seal assembly in housing.

Wheel Bearing Adjustment:—Controlled by shims under bearing cap. To adjust, remove bearing cap (see directions above under Axle Shaft Removal), add or remove shims equally at both wheels (necessary to keep thrust spacer centered on differential pinion shaft—if adjustment made at one wheel only spacer will bind on shaft.

Endplay—.002-.004".

SHOCK ABSORBERS:—Direct acting, hydraulic types.

Car Model Sedans, Club Coupe:	Make	Front	Rear
10, 11, 18 (std. springs)	Monroe	160101	160107
10, 11, 18 (hvy. springs)	Monroe	161636	160108
12	Delco	1007-C	1008-S
Coupe (3 & 4 passenger): All	Monroe	161657	161658

For complete data, refer to 1941 Mech. Equip. Index.

STEERING:—**Steering Gear**—Gemmer Model 305 Worm-and-Roller type with 'push-pull' adjustment and Center Point Steering linkage.

For complete data, refer to 1941 Mech. Equip. Index.

Front Suspension:—Independent, linked parallelogram type with coil springs and Autopoise Control.

For complete data, refer to 1941 Mech. Equip. Index.

Kingpin Inclination—4°36' crosswise.

Caster—0° (Neg. ¼° to Pos. ¼°). Adjustable.

Camber—Positive ¼° to Positive ¾°. Adjustable.

Toe In—0-1/16". Center steering arm on frame must be at center of car. To adjust, loosen clamps at ends of each tie rod and adjust tubes equally (to increase toe-in turn rods in direction of wheel travel, to decrease, turn in opposite direction).

Steering Geometry (Toe-out on Turns)—With outer wheel turned 30°, inner wheel turn should be 25°.

BRAKES:—**Service.** Bendix hydraulic, duo-servo, single anchor type without eccentric adjustment. Mechanical follow-up (pedal linked to rear wheel brakes through hand brake cables) provided. Hand lever applies rear wheel service brakes.

For complete data, refer to 1941 Mech. Equip. Index.

Drums—New centrifuse type. Diameter 10".

Lining—Multibestos molded (primary), Ferodo woven (secondary). Width 1¾". Thickness 7/32". Length per wheel 22⅛".

Clearance—.015" at each end of secondary shoe with primary shoe forced out against drum.

Hand Brake:—See Service Brakes above.

ENGINE HOOD (BONNET) LOCK, HOOD REMOVAL AND ADJUSTMENT:—*See Hudson Shop Notes.*

SERIAL NUMBER:—1st number 14101 (14), 15101 (15), 17101 (17). On right front door hinge pillar post. First 2 figures of car number indicates model.

ENGINE NUMBER:—Same as Serial No. On top of cylinder block between #1 and #2 exhaust flanges.

ENGINE SPECIFICATIONS:—8 cylinder, 'L' head type.
Bore—3". **Stroke**—4½".
Displacement—254 cubic inches. **Rated HP.**—28.8.
Compression Ratio—6.50-1 cast-iron head.
Compression Pressure—120 lbs. at 125 RPM.
Vacuum Reading—Steady 18-21" idling at 600 RPM.
See Hudson Shop Notes for Engine Removal data.

PISTONS:—Own Lo-Ex aluminum alloy, 'T' slot, cam ground type. Use finished replacement pistons.
Weight—10.5 ozs. (stripped). **Length**—3 3/16".
Removal—Piston and rod assemblies may be removed from above or below.
Clearance—Top .016". Skirt .0005-.001".
Original Bore & Piston Sizes, Replacement Pistons:—*See Hudson Shop Notes for sizes and markings.*
Fitting New Pistons:—Use .0015" feeler ½" wide (Piston Feeler Scale Tool J-888-A) inserted between piston and cylinder wall on side opposite slot 90° from pin. Pull to withdraw feeler 3-4 lbs.
Installing Pistons:—'T' slot away from camshaft.

PISTON RINGS:—2 compression, 2 oil rings (1 above pin, 1 below pin). Rings positioned by pin in groove.

Ring	Width	End Gap	Side Clearance
Compression	3/32"	.009-.011"	.001"
Oil Cont. (#1)	3/16"	.009-.011"	.001"
Oil Cont. (#2)	5/32"	.009-.011"	.001"

Replacement Rings:—*See Hudson Shop Notes for data.*

PISTON PIN:—**Diameter**—¾". **Length**—2 7/16". Floating type. Retained by locking rings.
See Hudson Shop Notes for Pin Servicing data.
Pin Fit in Piston—.0003" clearance (hand push fit) with piston heated to 200°F.
Pin Fit in Rod Bushing—.0003" clearance.
Replacement Pins:—Std., .002", .005", .010" oversize.

CONNECTING ROD:—**Weight** 30 ozs. **Length** 8 3/16".
Crankpin Journal Diameter—1 15/16". *See Crankshaft Size Code Note in Hudson Shop Notes for original bearing size.*
Lower Bearing—Lead alloy, spun type. Exchange rods furnished standard and .010" undersize.
Clearance—.001". **Sideplay**—.006-.010".
Bearing Adjustment:—None (no shims). Replace rods.
See Hudson Shop Notes for Palnut (locknut) data.
Installing Rods:—Offset. Install rods with widest half of bearing toward rear (#1, 3, 5, 7), toward front (#2, 4, 6, 8). Oil scoop on all rods toward camshaft.

CRANKSHAFT:—5 bearing, integral counterweights.
See Hudson Shop Notes for Crankshaft and Vibration Dampener Removal, Main Bearing Removal and Installation, Replacement Bearings & Line-Reaming data.
Journal Diameters—#1, 2 9/32"; #2, 2 5/16"; #3, 2 11/32"; #4, 2⅜"; #5, 2 13/32". *See Crankshaft Size Code in Hudson Shop Notes for original bearing sizes.*
Bearings—Bronze-backed, high lead babbitt lined type. NOTE—Shim pack not used. Palnuts used in place of cotter pins to lock bearing cap nuts.
Clearance—.001".
Bearing Adjustment:—None (no shims). Do not file caps. *See Hudson Shop Notes for Bearing Adjustment and Palnut (locknut) tightening procedure.*
End Thrust:—Taken by center bearing. Replace bearing if endplay excessive. **Endplay**—.006-.012".

CAMSHAFT:—Five bearing, gear driven type with new type bearings and timing gears. *See Hudson Shop Notes for Camshaft Removal and Bearing Installation.*
Journal Diameters—#1, 2.029"; #2, 1.998"; #3, 1.966"; #4, 1.935"; #5, 1.498".
Bearings—New type steel-backed, 'Bermax' (babbitt) lined bushings (formerly solid type babbitt).
Clearance—.002-.0025".
End Thrust:—Thrust washer between camshaft flange and crankcase. Spring loaded button in camshaft hub bears against thrust plate on gear cover. NOTE—Service thrust washer available which can be split and installed without removing camshaft.
Timing Gears:—New type. All data same as for 1941 Hudson Six. *See 1941 Hudson Six, Models 10, 11, 12, 18 'M' article (preceding pages) for data.*
Camshaft Setting:—Mesh marked crankshaft gear tooth between two marked teeth on camshaft gear.

VALVES:

	Head Diameter	Stem Diameter	Length
Intake	1½"	11/32"	5 3/32"
Exhaust	1⅜"	11/32"	5 3/32"

	Seat Angle	Lift	Stem Clearance
Intake	45°	11/32"	.0025"
Exhaust	45°	11/32"	.004"

Tappet Clearance:—.006" Int., .008" Exh., hot & idling.
See Hudson Shop Notes for Fender Plate Removal.
Valve Guides:—Removable type. Length 2 9/16". Use Tool J-1188 to drive out guides. Install guides with Tool J-883-A with top of guide 15/16" below top of block. After installing, ream guides (Tool J-129-2) .002" larger than valve stem for stem clearance.
Valve Springs:—Cadmium plated springs used with dampener installed on bottom with open side toward cylinder. Use Tool J-587-A to install spring and dampener assembly. **Spring Free Length**—2 17/64".

	Spring Pressure	Spring Length
Valve Closed	40 lbs.	2"
Valve Open	80 lbs.	1 21/32"

NOTE—Replace if pressure below 34 lbs. at 2".
Valve Lifters:—Roller shoe type, fitted in removable guides. *See Hudson Shop Notes for lifter removal.*
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 10°40' BTDC. Close 60° ALDC.
Exhaust Valves—Open 50° BLDC. Close 18°44'ATDC.
Above figures correct with .010" tappet clearance.
Valve Timing Check—With .010" tappet clearance #1 intake valve should open with piston 10°40' or .0494" BTDC when a point on the flywheel approximately 3.97 teeth before 'UDC.1-8/' mark lines up with indicator in inspection hole above starter. Reset tappet clearance at .006" hot and idling.

LUBRICATION:—Duo-flo (pressure & positive splash).
Oil Pump:—Oscillating plunger type, gear driven by camshaft. Mounted on right side of crankcase.
Normal Oil Pressure—4-12 lbs. with hot oil. No gauge used (see Oil Pressure Indicator below).
Oil Check Valve:—Located on right side of crankcase at rear. Opens at 4-12 lbs. with hot oil. Operates dash signal to indicate oil flow.
Oil Pressure Indicator:—Hudson Teleflash Oil Pressure Indicator. *For data, refer to Elec. Equip. Index.*
Checking Oiling System:—*See Hudson Shop Notes.*
Crankcase Capacity:—7 qts. (refill), 9 qts. (dry).
Servicing Note—Whenever pan removed, install 2 qts. add'tl. oil in upper tray before installing oil pan.

COOLING SYSTEM:—**Capacity**—18 quarts.
See Hudson Shop Notes for radiator core removal.
Water Pump:—Centrifugal, belt-driven, packless type with double outlet (15,17—with by-pass), single outlet (14—no by-pass used).
For complete data, refer to 1941 Mech. Equip. Index.
Thermostat:—Fulton. By-pass type (15, 17), choke type (14), in cylinder head water outlet.
Setting—Starts to open 150-155°F. Fully open 185°F.
NOTE—Special high temperature thermostats available for use with ethylene glycol type anti-freeze. Starts to open 165-170°F (15, 17), 160-165°F (14). Fully open 195°F. (15,17), 190°F. (14).
Temperature Gauge:—King-Seeley Electric. K-S Nos. 8310 (Dash Unit—stamped "T"), 7000 (Eng. Unit).
For complete data, refer to 1941 Mech. Equip. Index.
NOTE—Gauge reads HOT with ignition 'off'.

CLUTCH:—**Own Make.** Single plate, cork insert type operating in oil.
For complete data, refer to 1941 Mech. Equip. Index.
Driven Member—Cork insert type. Inside Diam. 6⅜". Outside Diam. 10". Facing 108 corks .203" thick.
Pedal Adjustment & Clutch Removal:—*See 1941 Hudson Six (preceding 'M' page) for complete data.*
Clutch Oil Servicing:—*See Hudson Shop Notes for data.*
Automatic Clutch Control:—Vacumotive type Optl.
NOTE—Governor switch changed during production.
For complete data, refer to 1941 Mech. Equip. Index.

TRANSMISSION:—**Own Make.** New all helical gear, constant-mesh type with synchro-mesh (Second & High), sliding gears (Low & Reverse) and steering column gear shift. NOTE—External shift rail locks not used. *For data, refer to Mech. Equip. Index.*
Overdrive:—Warner Model AS1-R9B with electrical 'kick-down' control (new type—no centrifugal clutch pawls used). Optional equipment.
NOTE—Governor switch changed during production.
For complete data, refer to 1941 Mech. Equip. Index.
Transmission Control:—Hudson 'Handy-Shift' type.
For complete data, refer to 1941 Mech. Equip. Index.
Removal:—*See 1941 Hudson Six (preceding 'M' page).*

UNIVERSAL JOINTS:—**Spicer**—Front—1271-101 (except 17 without Overdrive). 1281-101 (17 Standard). Rear—1278-101 (all models). Needle bearing types.
For complete data, refer to 1941 Mech. Equip. Index.

REAR AXLE:—**Own Make.** Semi-floating, spiral bevel gear type with Hotchkiss drive.
For complete data, refer to 1941 Mech. Equip. Index.
Ratio—4 1/9-1 (Standard, Optl. on Overdrive), 4 5/9-1 (Std. with Ovdr., Optl. on reg. transmission).
Backlash—.0005-.0035". Screw adjustment.
Removal, Axle Shaft Removal and Wheel Bearing Adjustment:—*See 1941 Hudson Six (preceding page)*

SHOCK ABSORBERS:—**Delco**—Sedans & Club Coupes: 1007-C (front), 1008-S (rear). **Monroe**—3 & 4 passenger coupes: 161657 (front), 161658 (rear). Direct acting, hydraulic types.
For complete data, refer to 1941 Mech. Equip. Index.

STEERING:—**Steering Gear**—Gemmer Model 335. Worm-and-Roller type with 'push-pull' adjustment and Center Point Steering linkage.
For complete data, refer to 1941 Mech. Equip. Index.
Front Suspension:—Independent, linked parallelogram type with coil springs and Autopoise Control.
For complete data, refer to 1941 Mech. Equip. Index.
Kingpin Inclination—4°36' crosswise.
Caster—0° (Neg. ¼° to Pos. ¼°). Adjustable.
Camber—Positive ¼° to Positive ¾°. Adjustable
Toe In—0-1/16". Loosen clamps at ends of each tie rod (adjust rods equally with steering arm centered).
Steering Geometry—Inner wheel 25°, Outer 30°.

BRAKES:—**Service.** Bendix hydraulic, duo-servo, single anchor type without eccentric adjustment. Mechanical follow-up (pedal linked to hand brake cables) provided. Hand lever applies rear service brakes.
For complete data, refer to 1941 Mech. Equip. Index.
Drums—Centrifuse. Diameter 11".
Lining—Multibestos molded (primary), Ferodo woven (secondary). Width 1¾". Thickness 7/32". Length per wheel 23 15/16".
Clearance—.015" at both ends of secondary (rear) shoe with primary shoe forced out against drum.
Hand Brake:—See Service Brakes above.

TORQUE WRENCH SPECIFICATIONS:—*See Torque Wrench article in Mechanical Equipment Section for tightening specifications for Cylinder Head, Main & Connecting Rod Bolts, etc.*

OIL PAN REMOVAL:—To remove oil pan, disconnect radius rods at rear end, push rods down and block in this position (install block between ball connection at rear end and frame cross-member). Attach hoist to front bumper bars and raise front end of car (not front axle). Remove starter motor. Take out oil pan screws and remove pan. NOTE—Pan removal will be facilitated by disconnecting exhaust pipe, steering drag link, and tie rod.

RECONDITIONED ENGINES & CYLINDER BLOCKS:

Engines—Reconditioned engines (with Heads and Oil Pan) furnished in one size only as follows:

Model	Part No.
Zephyr 16H	06H-6012-A
Continental 16H	06H-6012-B
Custom 168H	06H-6012-B

Cylinder Blocks—Cylinder blocks with fitted pistons furnished as follows:

Part No.	Size
06H-6014-A	Std.
06H-6014-B	.015" Oversize
06H-6014-C	.030" Oversize

REPLACEMENT PISTONS:—Finished pistons are furnished in Standard Size & Oversizes as listed below with each size graded in steps as follows:

Standard Pistons

Part No.	Size
06H-6110-B2	2.8732-2.8735"
06H-6110-B4	2.8743-2.8746"
06H-6110-B6	2.8755-2.8758"
06H-6110-B8	2.8767-2.8770"

.015" Oversize

06H-6110-C2	2.8882-2.8885"
06H-6110-C4	2.8893-2.8896"

.030" Oversize

06H-6110-D2	2.9032-2.9035"
06H-6110-D4	2.9043-2.9046"

PISTON PIN FITTING:—**Steel Pistons.** Pins can be removed and installed without heating pistons. Pins, pistons, and rod bushings held to close limits so that no fitting required. Clearances can be checked as follows:

Pin Fit in Piston—With piston and pin at same temperature and clean, pin should drop through pin hole in piston (total clearance not to exceed .0007").

Pin Fit in Rod Bushing—With pin installed, hold pin so that rod hangs vertically, then rotate pin. Lower end of rod should move upward through arc not greater than ½" before dropping back to vertical position.

PISTON RINGS:—Piston Rings (and Expanders for #2 Compression Ring & Oil Ring) are furnished in Sets in Cartons and single as listed below (Rings should be ordered in sets).

Sets in Cartons
(Steel Segment Type)

Part No.	Size
06HS-6149-A	Standard
06HS-6149-B	.015" Oversize
06HS-6149-C	.030" Oversize

Single Rings
Upper Compression (No Expander)

Part No.	Type	Size
06H-6150-B		Standard
06H-6150-C		.015" Oversize
06H-6150-D		.030" Oversize

Lower Compression (With Expander)

06HS-6152-A	Steel Segment	Standard
06HS-6152-B	Steel Segment	.015" Oversize
06H-6152-C1	Muskegon	.015" Oversize
06H-6152-C2	Sealed Power	.015" Oversize
06HS-6152-C	Steel Segment	.030" Oversize
06H-6152-D1	Muskegon	.030" Oversize
06H-6152-D2	Sealed Power	.030" Oversize

Oil Control (With Expander)

06HS-6153-A	Steel Segment	Standard
06HS-6153-B	Steel Segment	.015" Oversize
06H-6153-C1	Muskegon	.015" Oversize
06H-6153-C2	Sealed Power	.015" Oversize
06HS-6153-C	Steel Segment	.030" Oversize
06H-6153-D1	Muskegon	.030" Oversize
06H-6153-D2	Steel Power	.030" Oversize

Piston Ring Identification—Muskegon and Sealed Power Rings and Expanders may be identified by following markings and differences:

Lower Compression Ring

Muskegon—Ring has word 'Top' stamped 42° above slot. Expander has 6 crimps.

Sealed Power—Ring has word 'Top' stamped 25° below slot. Expander has 7 crimps.

Oil Control Ring

Muskegon—Ring has 9 slots. Expander has 6 crimps and 5 slots.

Sealed Power—Ring has 8 slots. Expander has 7 crimps and 6 slots.

TIMING GEARS:—**Camshaft Gear**—New type aluminum alloy camshaft gear is bolted on camshaft hub flange by four offset capscrews and can be replaced without removing camshaft from engine. To remove gear, remove screw in front end of crankshaft, pull fan and dampener assembly (use Puller 6130-A), remove timing gear cover. Bend back lockplate tangs and take out four camshaft gear mounting screws, remove gear. When replacing gear, make certain that marks on camshaft gear and crankshaft gear are lined up and see that lockplate tangs are bent up against flats on mounting screws. Use 6360-B Dampener Replacer tool to install dampener assembly.

NOTE—Camshaft gear mounting screw holes are offset so that gear can only be installed in correct position.

Crankshaft Gear—To replace crankshaft gear, pull fan and dampener assembly (see Camshaft Gear Removal above), use 6306-C puller to remove crankshaft gear, 6306-D Gear Replacer to install gear.

VALVE SERVICING:—Complete valve assembly (valve, spring, guide) should be removed from the engine and dismantled on the bench as follows:

Valve Assembly Removal—Use special bar type lifter, VZ-185, inserting end of lifter through spring coils to engage flanged lower end of guide, pull guide down slightly to release retaining 'C' washer, pull 'C' washer out, lift valve assembly out through top of block.

Valve Assembly Dismantling—Use special bench fixture to compress valve spring so that spring retainer can be removed, then remove spring, separate guide halves and remove valve. Re-assemble valves in same manner.

Valve Installation Note—Intake valve guides have relief groove cut on one edge of each guide half. Install guides with this relief groove up.

Valve Seat Insert Grinding:—Manufacturer recommends use of eccentric grinding equipment to reface seat inserts (inserts are high-tungsten, chrome-alloy steel and are exceedingly hard).

Hydraulic Valve Lifter Servicing:—When lifters removed they should be installed dry (will fill with oil and become quiet more rapidly than if installed with oil film between plunger and cylinder which will trap air in unit). Whenever lifters removed from engine, service as follows:

Lifter Installation—Remove plunger from lifter body, wash out all oil, dry with air, re-install plunger in lifter body and install in engine.

CAUTION—Plunger is selective fit in lifter body and must not be interchanged. Make certain that each plunger re-installed in same lifter from which removed.

Lifter Clearance—Clearance between plunger and valve stem must be .030-.070" with no oil in unit and plunger and spring fully compressed. To check this clearance, see that lifter is on heel of cam, use screwdriver to fully depress plunger in lifter body, check clearance with feeler gauge.

See article in Mechanical Equipment Section for complete Wilcox-Rich 'Zero-lash' hydraulic lifter servicing data.

ENGINE HOOD NOTE:—Hood is Alligator type with release knob under instrument panel at extreme left side. To raise hood, pull out on release knob (hood will raise slightly), press in on safety catch under front edge of hood.

OIL PAN REMOVAL:—*See Lincoln Shop Notes for data.*

SERIAL & ENGINE NUMBER:—Stamped on top of clutch housing and on left side of front frame cross-member.

ENGINE SPECIFICATIONS:—Own Model 06H. 12 cylinder 75° Vee, L head type. Both blocks and crankcase cast enbloc. **Bore**—2.875". **Stroke**—3.75".
Rated Horsepower—39.6. **Displ'mt.**—292 cu. ins.
Developed Horsepower—120 at 3500 RPM.
Compression Ratio—7.2-1 Std. aluminum head.
Compression Pressure—154 lbs. at 1000 RPM. or 110 lbs. at cranking speed of 100 R.P.M.
Vacuum Reading—18-20" steady idling at 5 M.P.H.

PISTONS:—Steel alloy, light weight, cam-ground, with slipper type skirt. Recondition cylinders for finished replacement pistons.
Weight—360 grams (without rings or pin).
Removal—Pistons and rods removed from above.
Clearance—See Fitting New Pistons.

Replacement Pistons:—*See Lincoln Shop Notes for replacement piston and reconditioned block data.*

Fitting New Pistons:—Use .002" feeler, .50" wide, inserted between piston and cylinder wall at right angle to pin. Pull to withdraw feeler—3-6 lbs.

PISTON RINGS:—Two compression, one oil ring, all above pin. Oil ring groove drilled with drain holes. NOTE—Expander used with #2 Compr. and oil ring. Install this #2 Compr. ring with mark 'TOP' up.

Ring	Width	End Gap	Side Clearance
Compr. #1	.093-.0935"	.008-.013"	.0025-.003"
Compr. #2	.093-.0935"	.008-.013"	.002-.0025"
Oil Contr.	.1845-.185"	.008-.013"	.0015-.002"

Replacement Rings:—*See Lincoln Shop Notes for complete Ring and Expander size data.*

PISTON PIN:—**Diameter** .7501-.7504". **Length** 2.607". Floating type (locking ring in piston at each end). Pin hole in connecting rod bronze-bushed.
Pin Fit in Piston—.0005" clearance.
Pin Fit in Rod—.0001" clearance.
See Lincoln Shop Notes for pin fitting data.

CONNECTING ROD:—Length 7.40". **Weight** 638 grams.
Crankpin Journal Diameter—2.126".
Bearing Type—Steel-backed, copper-lead lined bearing halves clamped in each rod.
Clearance—.001". **Sideplay**—.002-.006".

Bearing Adjustment:—None (no shims). Replace bearings. Do not file rods or caps. NOTE—Engage tang on bearing in groove in rod and cap. See that long and short bearing cap bolts installed on correct side (rod split at angle, bolts unequal length).

Replacement Bearings:—Furnished Std. and .0015", .003", .020", .040" Undersize.

Installing Rods:—Marks on rods and caps must be together and installed in same numbered cylinder with marks pointing down toward oil pan.

CRANKSHAFT:—Four bearing with integral counterweights. NOTE—Crankshafts furnished Std. and .020", .040" undersize.
Journal Diameters—2.401" (all bearings).
Bearing Type—Steel-backed, copper-lead lined.
Clearance—.001" (or slight drag with .002" feeler assembled in bearing for clearance check).

Bearing Adjustment:—None (no shims). Replace bearings. Do not file bearing caps. NOTE—See that tang on bearing engages groove in block and cap.

Replacement Bearings:—Furnished Std. and .0015", .003", .020", .040" Undersize.

End Thrust:—Taken by rear main bearing. To adjust, replace bearing. **Endplay**—.002-.006".

CAMSHAFT:—Four bearing with Helical Gear drive. NOTE—Camshaft gear Aluminum-alloy type and is bolted on camshaft.
Journal Diameters—1.797" (all bearings).
Bearing Type—Steel-backed, babbitt-lined bushings pressed in block. **Clearance**—.002".

End Thrust:—Taken by gear hub and coverplate. Adjusted by replacing coverplate. **Endplay**—.005-.015".

Timing Gears:—Cast alloy iron (Crankshaft), New Aluminum Alloy—bolted on shaft (Camshaft).
Backlash—.004" Maximum.
See Lincoln Shop Notes for Timing Gear data.

Camshaft Setting:—Mesh marked tooth of crankshaft gear with space marked by line on camshaft gear (this line must be in line with mark on hub). NOTE—Cap screw holes in camshaft gear and shaft are unevenly spaced insuring correct gear position.

VALVES:—

	Head Diameter	Stem Diameter	Length
All Valves	1.537"	.3115"	4.750-4.751"

	Seat Angle	Lift	Stem Clearance
All Valves	45°	.292"	.0015-.0035"

NOTE—Valve Seat Inserts used for exhaust valves.
See Lincoln Shop Notes for Valve Servicing data.

Tappet Clearance:—None (hydraulic type lifters).

Valve Guides:—Cast iron, split type. Retained by 'C' washer and valve spring. *See Lincoln Shop Notes.*

Valve Lifters:—Barrel type, hydraulic tappet take-up (Wilcox-Rich Zero-lash type). Diameter .9995".
For complete data, refer to 1941 Mech. Equip. Index.

Valve Springs:	Pressure	Length
Valve Closed	51-57 lbs.	2.13"
Valve Open	111-121 lbs.	1.84"

Valve Timing:—See Camshaft Setting above.
Int. Valves—Open 10.42° BTDC. Close 35.58° ALDC.
Exh. Valves—Open 50.92° BLDC. Close 8.08° ATDC.
To Check Timing—No flywheel marks provided. If dead center position for any cylinder established on flywheel, intake valve for this cylinder should open approx. 3.24 teeth before this point with piston .0389" before top dead center.

LUBRICATION:—Pressure type with gear type oil pump in crankcase at rear of engine.
Normal Oil Pressure—40-45 lbs. at 2000 R.P.M.

Oil Pressure Regulator:—Above crankshaft bearing between cylinder banks at front end of engine. Opens at 50 lbs. Not adjustable.

Oil Pressure Gauge:—King-Seeley Electric. Ford No. 16H-9273 (Dash Unit—Zephyr 16H & Custom 168H), 06H-9273-B (Dash Unit—Continental). No. 48-9278 (Engine Unit—All Models).
For complete data, refer to 1941 Mech. Equip. Index.

Crankcase Capacity:—5 qts.

COOLING SYSTEM:—Capacity—27 quarts.

Water Pump:—Packless type, 2 used (1 for each bank).
For complete data, refer to 1941 Mech. Equip. Index.
Removal—Slack off drive belt, disconnect hose couplings, take out mounting screws on pump.

Thermostat:—In outlet hose for each bank (2 used).
Setting—Starts to open at 145°F. Fully open 180°F.

Temperature Gauge:—King-Seeley Electric. Ford No. 16H-10883 (Dash Unit—Zephyr 16H & Custom 168H), 06H-10883-B (Dash Unit—Continental). No. 99A-10884 (Engine Unit—All Models).
For complete data, refer to 1941 Mech. Equip. Index.

CLUTCH:—Long Model 10CF-TI. Semi-centrifugal single plate, dry disc type.
For complete data, refer to 1941 Mech. Equip. Index.
Facings—Woven type, 2 required. Inside Diam. 6". Outside Diam. 10". Thickness .140".

Adjustment:—Pedal free movement must be 1.5-2.0". To adjust, loosen locknuts, turn clevis on connector link.
Removal:—Slide transmission and rear axle to rear as a unit to expose clutch (see Transmission Removal below), take out mounting screws in clutch cover.

TRANSMISSION:—Own Make. Constant-mesh, synchro-mesh (Second & High), sliding gear (Low & Reverse), all helical gear type.
For complete data, refer to 1941 Mech. Equip. Index.

Overdrive (Optl.):—Warner Model AS1-R10. Type R10 overdrive with electrical solenoid control (no centrifugal clutch pawls) and 'kick-down' feature.
For complete data, refer to 1941 Mech. Equip. Index.

Transmission Control:—Mech. steering column shift.
For complete data, refer to 1941 Mech. Equip. Index.

Removal:—Disconnect hand brake cable, hydraulic brake line at torque tube connection (bleed lines when re-connected), speedometer cable, shock absorber links. Disconnect rear spring at center frame connection. Take off universal joint ball housing bolts, slide axle assembly to rear. Disconnect shifter rods from lever at transmission. Support engine at rear, take out rear engine mounting bolts, remove clutch housing mounting screws, pull transmission straight back.

UNIVERSAL JOINT:—Spicer Model 2102-1. Needle bearing type. Single joint at rear of transmission.
For complete data, refer to 1941 Mech. Equip. Index.

REAR AXLE:—Own Model. ¾ floating, Hypoid Gear type with Torque Tube drive.
For complete data, refer to 1941 Mech. Equip. Index.
Ratio—4.44-1. **Backlash**—.002-.004".
For complete data, refer to 1941 Mech. Equip. Index.

Removal:—Disconnect hand brake cable, hydraulic brake line at torque tube connection (bleed lines when re-connected), speedometer cable, shock absorber links. Disconnect rear spring at center frame connection, take out universal joint ball housing bolts, pull axle assembly to free shaft at joint.
Axle Shaft Removal—*Refer to Mechanical Equipment Index for article on Lincoln Rear Axle for data.*

SHOCK ABSORBERS:—Houde (Houdaille). Type BBCHN (Front), BBCLZ (Rear). Lincoln No. 16H-18045 (Right Front), 16H-18046 (Left Front), 16H-18080 (Right Rear), 16H-18081 (Left Rear). Double acting, hydraulic, adjustable type.
For complete data, refer to 1941 Mech. Equip. Index.

STEERING:—Steering Gear—Gemmer Model No. 330. Worm-and-roller type.
For complete data, refer to 1941 Mech. Equip. Index.

Front Suspension:—Conventional I-beam section axle with Reverse-Elliott ends and transverse spring. Axle positioned by radius rods and strut rod (anti-sway bar).
Kingpin Inclination—4° crosswise.
Caster—3° Min., 5° Max. Must be equal for both wheels within ½°. No adjustment.
Camber—¼° Min., ¾° Max. Must be equal for both wheels within ¼°, right wheel must not exceed left.
Toe In—1/16". Set at 1-10 ratio to Camber. To adjust, loosen clamp bolts, turn tie rod.
Steering Geometry (Toe out on turns)—Inner wheel turned 23°, outer 20°. Allowable variation ½°.

BRAKES:—Service—Bendix-Hydraulic, duo-servo, single anchor type without eccentric adjustment. Hand lever applies all four service brakes.
For complete data, refer to 1941 Mech. Equip. Index.
Wheel Cylinders—Diameter 1.125" (front), 1.00" (rear). Not interchangeable from one wheel to another. **Drums**—Diameter 12".
Lining—Molded (primary or forward shoe), Woven (secondary shoe). Width 1.75". Thickness .21", Length per shoe 11.95".
Clearance—.010" at each end of each shoe.

Hand Brake:—See Service Brakes above.

FORD TRUCK NOTE:—All Mercury Engine data below applies also to Ford Truck Models with '95' Engine

ENGINE HOOD NOTE:—Hood is Alligator type with release knob under instrument panel to left of steering column. To raise hood, pull out on release knob (hood will raise slightly), press in on safety catch under front edge of hood.

OIL PAN REMOVAL:—*See Ford Shop Notes for data.*

SERIAL & ENGINE NUMBER:—Stamped on top of clutch housing and on left frame member in front of dash bracket.

ENGINE SPECIFICATIONS:—**Own 95.** 8 Cylinder, 90° Vee, L head. Both banks & crankcase cast enbloc.
Bore—3.187". **Stroke**—3.75".
Rated Horsepower—32.5. **Displacement**—239 cu. ins.
Developed Horsepower—95 at 3600 RPM.
Compression Ratio—6.3-1 (Mercury & Ford Comm'l. with 95 Eng.), 5.9-1 (Ford Trucks). Cast iron type.
Compression Pressure—145 lbs. (6.30-1 hd.), 134 lbs. (5.9-1 hd.) at 2400 RPM max. 100 lbs. at 100 RPM.
Vacuum Reading—Steady 18-20" at 5MPH.

CYLINDER SLEEVES:—Hardened, dry type cylinder sleeves used on engines marked 'HS' on cylinder block above upper front corner of left cylinder head.
Servicing—*See Ford Shop Notes for complete data.*

PISTONS:—Steel alloy, light weight, cam ground type or Aluminum alloy, T slot type. Recondition engine to take finished replacement pistons (replace Sleeves and install Std. pistons on engines with sleeves).
Weight—Without rings or pin, 358-362 grams (Mercury), 364-368 grams (Ford Truck).
Removal—Pistons and rods removed from above.
Clearance—See Fitting New Pistons.
Replacement Pistons:—*See Ford Shop Notes for data.*
Fitting New Pistons:—Use .50" wide feeler stock of correct thickness inserted between piston and cylinder wall at right angles to pin to check clearance. Pull to withdraw feeler 6-10 lbs. (all types).

Feeler Thickness for:	Steel—Pistons	Aluminum
Engines with Sleeves	.003"	.0025"
Engines without Sleeves	.0025"	.002"

PISTON RINGS:—Two compression, one slotted oil ring, all above pin (drain holes in oil ring groove).
NOTE—Expander used with #2 Compr. and oil ring.

Ring	Width	End Gap	Side Clearance
Compr. #1	.0915-.0920"	.012-.017"	.0025-.003"
Compr. #2	.0915-.0920"	.012-.017"	.002-.0025"
Oil Contr.	.1535-.1540"	.012-.017"	.0015-.002"

Replacement Rings:—Furnished (sets in carton only) Std. and .005", .015", .030", .045", .060" oversize.

PISTON PIN:—**Diameter** .7501-.7504". **Length** 2.975". Floating type (locking ring in piston at each end). Pin hole in connecting rod bronze-bushed.
Pin Fit in Piston—.0005" clearance.
Pin Fit in Rod Bushing—.0001" clearance. *See Ford Shop Notes for Pin Fitting Directions and Oversizes.*

CONNECTING ROD:—**Length** 7.002". **Weight** 488 grams.
Crankpin Journal Diameter—2.139" (connecting rod diameter on crankpin—2.360").
Bearing Type—Steel-backed, special-alloy lined. Bearing floats in both rods (side-by-side mounting) with bearing surface on both inner and outer face.
Bearing Dimensions—Length 1.747". Thickness .1095". These bearings do not have end flanges.
Clearance—.0005-.002" (total diametrical).
Sideplay—.010-.022" (total).
Bearing Adjustment:—None (no shims). Do not file.
Replacement Bearings:—*See Ford Shop Notes for special bearings for oversize rods and undersize crankpins.*
Installing Rods:—Marks on rods and caps must be together and installed in same numbered cylinder with marks pointing down toward oil pan.

CRANKSHAFT:—3 bearing. Integral counterweights.
Journal Diameters—2.499" (all bearings).
Bearing Type—Steel-backed, special-alloy lined.
Clearance—.001-.003" (or slight drag with .002" feeler assembled in bearing for clearance check).
Bearing Adjustment:—None (no shims). Do not file.
End Thrust:—Taken by rear main bearing. Adjust by replacing bearing. **Endplay**—.002-.006".
Replacement Bearings:—*See Ford Shop Notes for Undersizes and special long main bearings.*

CAMSHAFT:—3 bearing. Helical gear drive (2 types of camshaft gears used—Bakelized Fabric pressed on shaft or new Aluminum Alloy type bolted on shaft).
Bearing Diameters—1.797" (all bearings).
Bearings—Steel-backed, babbitt-lined bushings.
Clearance—.002".
End Thrust:—Taken by gear hub and cover plate. Adjusted by replacing coverplate. **Endplay**—.005-.015".
Timing Gears:—Cast alloy iron (crankshaft), Bakelized Fabric—pressed on shaft, or Aluminum Alloy—bolted on shaft (camshaft). **Backlash**—.004" max. *See Ford Shop Notes for Timing Gear Replacement.*
Camshaft Setting:—Mesh '0' marked tooth of crankshaft gear with '/' marked space on camshaft gear (this mark must be in line with mark on hub).

VALVES:—

	Head Diameter	Stem Diameter	Length
All Valves	1.537"	.3115"	4.750-4.751"

	Seat Angle	Lift	Stem Clearance
All Valves	45°	.292"	.0015-.0035"

See Ford Shop Notes for Valve Servicing data.
NOTE—Seat inserts used for all valves.
Tappet Clearance:—.0125-.0135". No adjustment.
Valve Guides:—Split type retained by 'C' washer and valve springs. *See Ford Shop Notes for servicing data.*
Valve Lifters:—Barrel type in reamed holes in block. **Diameter**—.9995". **Clearance**—.0005-.001".

Valve Springs:	Pressure	Length
Valve Closed	37-40 lbs.	2.13"
Valve Open	76-80 lbs.	1.84"

Valve Timing:—See Camshaft Setting above.
Intake Valves—Open at TDC. Close 44° ALDC.
Exhaust Valves—Open 48° BLDC. Close 6° ATDC.
To Check Valve Timing—No flywheel marks provided. Intake valve opens with piston at TDC.

LUBRICATION:—Pressure. Gear type oil pump mounted in crankcase at rear of engine.
Normal Oil Pressure:—30 lbs. at 2000 R.P.M.
Oil Pressure Regulator:—Under plug above front camshaft bearing. Opens at 30 lbs. Not adjustable.
Oil Pressure Gauge:—King-Seeley Electric. Ford No. 19A-9273 (Dash Unit), No. 48-9278 (Engine Unit). *For complete data, refer to 1941 Mech. Equip. Index.*
Crankcase Capacity:—5 quarts.

COOLING SYSTEM:—**Capacity** 25½ quarts.
Water Pump:—Packless type, 2 used (1 for each bank). *For complete data, refer to 1941 Mech. Equip. Index.*
Removal—Slack off drive belt, support engine at forward end, remove front engine mounting bolts, take out mounting screws in pump body.
Thermostat:—In each cylinder head outlet (2 used).
Setting—Starts to open at 145°F. Fully open 180°.
Temperature Gauge:—King-Seeley Electric. Ford No. 19A-10883 (Dash Unit), No. 99A-10884 (Eng. Unit). *For complete data, refer to 1941 Mech. Equip. Index.*
NOTE—Gauge reads 'Hot' when turned off.

CLUTCH:—**Long Model 10CF-TI.** Single plate, dry disc, semi-centrifugal. NOTE—Clutch is new larger type. *For complete data, refer to 1941 Mech. Equip. Index.*
Facings—Woven type, 2 required. Inside Diam. 6¾". Outside Diam. 10". Thickness .125".
Adjustment:—Pedal free movement must be 1.0-1.25". To adjust, remove pin at throw-out shaft lever end of connecting link, turn clevis on link rod.
Removal:—Slide rear axle and transmission to rear as a unit to expose clutch (see Transmission Removal below), take out mounting screws in cover.

TRANSMISSION:—**Own Make.** Constant-mesh, synchro-mesh (second & high), sliding gear (low & reverse), all helical gear type.
For complete data, refer to 1941 Mech. Equip. Index.
Transmission Control:—Mech. steering col. shift.
For complete data, refer to 1941 Mech. Equip. Index.
Removal:—Disconnect gear shifter rods at levers on transmission case. Disconnect rear shock absorbers, hand brake cables, hydraulic brake line at torque tube connection (bleed lines when re-connected), speedometer cable. Disconnect rear spring at center frame connection. Take out universal joint ball housing screws, slide rear axle assembly back to disengage drive shaft at splined joint. Support engine at rear, take out rear engine mounting bolts, and clutch housing screws. Remove transmission.

UNIVERSAL JOINT:—**Spicer Model 202-6.** Steel bushing type. Single joint at rear of transmission case. *For complete data, refer to 1941 Mech. Equip. Index.*

REAR AXLE:—**Own Make.** ¾ floating, Spiral Bevel Gear type with Torque Tube drive.
For complete data, refer to 1941 Mech. Equip. Index.
Ratio—3.54-1 Std., 3.78-1 & 4.11-1 Optl.
Backlash—.010" maximum.
Optional Axle:—Columbia Two-speed type.
For complete data, refer to 1941 Mech. Equip. Index.
Removal:—Disconnect rear shock absorbers, hand brake cables, hydraulic brake line (at torque tube connection—bleed lines when re-connected), speedometer cable, shock absorber links. Disconnect rear spring at center frame connection. Take out universal joint ball housing screws, pull axle assembly to rear to disengage drive shaft at splined joint.
Axle Shaft Removal—*Refer to 1941 Mech. Equip. Index for article on Ford and Mercury Rear Axle.*

SHOCK ABSORBERS:—**Houde (Houdaille).** Type BBCN (Front), BBCZ (Rear). **Ford Nos.—Front** 11A-18045A (Right), 11A-18046A (Left). **Rear** 11A-18080A (Right), 11A-18081A (Left). Hydraulic, double-acting, adjustable type.
For complete data, refer to 1941 Mech. Equip. Index.

STEERING:—**Steering Gear**—Gemmer Model 305 Worm-and-Roller type with 'push-pull' adjustment.
For complete data, refer to 1941 Mech. Equip. Index.
Front Suspension:—Conventional 'I' beam section front axle with Reverse Elliott ends and transverse spring. Axle positioned by radius rods.
Kingpin Inclination—8° crosswise.
Caster—9° Max., 4½° Min. Must be equal within ½°. Axle may be bent cold to correct caster if proper tools (wedges and blocks to prevent crushing axle flange) are used.
Camber—1° Max., ¼° Min. Must be equal within ¼°, right wheel must not exceed left. Adjust in same manner as for caster (see caster data above).
Toe In—1/16". Set at 1-10 ratio to Camber. Adjust by loosening clamp bolts and turning tie rod.
Steering Geometry (Toe Out on Turns)—Outer wheel turned 20°, Inner wheel 23⅓°. No adjustment.

BRAKES:—**Service.** Lockheed hydraulic, double anchor type. Hand lever applies rear service brakes.
For complete data, refer to 1941 Mech. Equip. Index.
Drum—Cast iron. Diameter 12".
Wheel Cylinders—Stepped type as follows:
Front Wheel....1.25"-1.00". Rear Wheel....1.125"-1.00".
Lining—Woven (all shoes). Width 1.75". Thickness .20". Length per shoe 13.18" (forward shoes), 10.1" (rear shoes).
Clearance—Least possible amount without drag.
Hand Brake:—See Service Brakes above.

TORQUE WRENCH SPECIFICATIONS:—*See Torque Wrench article in Mechanical Equipment Section for tightening specifications for Cylinder Head, Main & Connecting Rod Bolts, etc.*

HOOD LOCK:—Alligator type hood hinged at cowl. Hood lock button located on left side under instrument panel. Removable hood side panels used.

ENGINE CODE (ORIGINAL BORE & BEARING SIZES):—Engines factory-equipped with oversize bores or undersize main or connecting rod bearings carry a three letter code for identification. **Standard engines carry no code mark.**

Code Mark Location—Three letter code stamped adjacent to engine number on cylinder block.

Letter Position—Three letter code used. Position of letter indicates the following:
1st Letter—Original Bore Size.
2nd Letter—Main Bearing Journal Size.
3rd Letter—Crankpin Journal Size.

Size Identification—Letters indicate following:
'A'—Standard size (bore or bearing sizes).
'B'—.010" Undersize (main or con rod bearings).
'C'—.010" Oversize (bore size with .010" OS Pistons).

PISTON RINGS:—Installation—A plain top compression ring is used on all models and must be installed with bevel on upper inner edge toward top of the piston. A taper faced compression ring is used in second ring groove with a plain expander installed behind it. This ring should be installed with taper extending out toward the bottom. In #3 ring groove (below piston pin on Model 4140), #3 and #4 ring grooves (above piston pin on Models 4160 and 4180), slotted type oil rings with a ventilated type expander installed behind ring is used. Ring fit correct with *.010-.015" End Gap* and *.002-.004" Side* Clearance. Stagger end gaps of rings and expanders on piston.

Replacement Piston Rings—Statite piston rings furnished by car manufacturer for service. These rings can be installed in cylinder bores up to .009" taper or .003" out-of-round for correction of excessive oil consumption using same pistons.

CONNECTING ROD:—Bearing Removal & Installation. Removable bearing shells used. To remove bearings, take off bearing caps, remove bearings from rod and cap. Fit bearings as directed below. When installing bearings, oil hole in upper half should register with oil spit hole in rod. Tongue on each bearing should engage groove in rod and cap.

Replacement Bearings—Finished bearings furnished standard and .002", .010" undersize.

Fitting Bearings—Same procedure as listed for Main Bearings following with the same feeler stock.

Palnut (Rod Bolt Locknut) Installation—Palnuts used to lock connecting rod bolt nuts in place of cotter pin. Tighten bolt nuts to 27-30 ft. lbs. tension on 4140, 50-55 ft. lbs. tension on 4160 and 4180, with a tension wrench. Lock bolt nuts in place by installing new palnuts. Install with smooth face toward nut, draw nut up tight but do not overtighten.

VIBRATION DAMPENER:—Model 4140 & 4160. Non-adjustable, rubber-cushioned vibration dampener mounted on forward end of crankshaft. Outer flywheel secured to dampener hub by rubber-cushioned bolts. On Model 4140, a cork seal and rubber seal ring installed between front end of crankshaft and hub retainer. Hub assembly installed as follows: Lock hub on shaft with woodruff key, install large lockwasher with notches on inner edge, cork seal, rubber seal ring and hub retainer in recess in hub, install hex head lock screw with helical lockwasher under it in screw hole in end of crankshaft and tighten screw securely. On Model 4160, dampener hub retained by a special nut with shakeproof lockwasher (no seals installed behind hub retainer as on 4140). On all models, rubber block retaining bolt nuts on front face of dampener hub must be drawn up tight. No adjustment provided. Two oil wicks under brass plugs on outer edge of dampener should be oiled every 2000 miles. Remove plugs, saturate oil wicks with light engine oil.
IMPORTANT NOTE—When installing front flywheel on hub, timing marks must be in line with hub key-way and on the same side. Whenever new front flywheel installed, balance holes must be duplicated as to size and depth for proper balance.

Model 4180—An adjustable, rubber-cushioned vibration dampener mounted on forward end of crankshaft. Consists of hub retained on end of crankshaft by a special nut. Pulley secured to front face of hub by four screws. Two rubber cushions assembled on each screw, rear half installed with shoulder toward hub, front half with shoulder toward circular ring. This ring fits in recess on front face of pulley and screw holes are provided for assembling ring under screws. All four screws should be drawn down evenly and inner ends (on rear side of hub) should be peened to lock screws in place. Screw tension can be adjusted to eliminate knock caused by vibration dampener. Fan belt tension should be checked first since excessive belt tension will cause dampener to knock. Oil dampener in same manner as for 4140 & 4160 above.
CAUTION—See Important Note above.

MAIN BEARINGS:—Removal & Installation—Upper bearing halve may be 'rotated' out by inserting pin in oil hole in crankshaft and turning shaft in the direction of locating tongue on bearing. Bearings can be installed by reversing removal procedure

Replacement Bearings—Finished bearings which require no reaming or scraping are furnished standard size and .002", .010" undersize.

Fitting Bearings—To check bearing clearance, insert short piece of .002" feeler stock, ½" wide, lengthwise to crank pin between bearing and crankshaft, tighten cap. Bearing fit correct when a definite drag is felt when rotating crankshaft (CAUTION—Do not rotate crankshaft more than 1" in either direction). If no drag felt, replace bearings with proper undersize (as listed above) until bearing fit correct. Do not shim bearings or file caps.

Replacement Main Bearing Caps—On 6 cyl. engines replace caps as follows: Align bore in cap with bore in crankcase by filing sides of cap (caps fit in recess in block). To assure correct alignment, cap retaining screws should be tightened, then backed off slightly and crankshaft rotated allowing cap to be properly positioned, tighten retaining screws to 66-70 ft. lbs. tension with tension wrench. On eight cylinder engines, replace caps as follows: Install caps on engine, tighten retaining screws, back off screws slightly, line up dowel holes in cap and crankcase (original caps doweled in place when bearings line-bored) to align bore in cap with bore in crankcase, tighten screws to 70-73 ft. lbs.

Rear Main Bearing Oil Seal (4140)—Hemp packing fitted in groove in crankcase and cap behind oil slinger on crankshaft. Cap sealed with rubber plugs in groove on each side where cap fitted in recess in block. Use Tool J-1610 to install packing in groove in cap and block. Place packing in groove (with bearing shell removed), place small diameter of tool over packing, hit end of tool with lead hammer to seat packing, cut ends of packing flush with bearing cap seat, remove tool. Repeat operation for groove in block. Install plugs on sides of cap.
4160—A reverse thread oil slinger on crankshaft rotates in line with cored groove in block and cap. No seal installed in this groove. Groove in cap provided with two 13/32" diameter oil return holes. Cap sealed with straight grain pine wood seal plugs installed in groove on each side of cap where cap fitted in recess in block. With bearing cap off, check clearance between oil slinger threads and bore in block and cap. Clearance must be .006-.008" uniformly around shaft to provide eccentric oil thread. If clearance too small, file crankshaft thread (CAUTION—Do not alter bore in block and cap for clearance adjustment). Clean seal plug grooves in cap to provide flat and smooth surfaces. After bearing cap installed, place gasket compound on inner end of plug, tap plug carefully in place in groove on each side of cap, cut off ends of plugs flush.
4180—Reverse threads cut on crankshaft behind oil slinger. Slinger turns in line with cored groove in block and cap. No seal installed in this groove. Groove in cap provided with oil return holes. Clearance between threads (behind oil slinger) and bore in block (behind oil slinger groove) should be .006-.008". Check with cap off engine. If clearance too small file threads on crankshaft. Cap sealed to oil pan with cork gasket. Rear edge of cap sealed to flywheel housing pan by an additional cork gasket.

CRANKSHAFT END THRUST PLATE (4140):—Crankshaft end thrust taken by flanged edges of front bearing. A steel thrust plate is assembled between rear face of timing chain sprocket and flanged face of front bearing. Plate keyed to shaft by woodruff key which also secures sprocket on shaft. When plate installed, chamfered edge on inner diameter should face toward the rear for tight fit against bearing journal. See Crankshaft Front Oil Seal below.

CRANKSHAFT FRONT OIL SEAL:—Models 4140 & 4160. A felt seal is fitted in the timing chain cover which bears against vibration dampener hub. Seal seat in cover has inner edge turned up to form a shedder on inside of cover. An oil slinger is assembled behind vibration dampener hub which extends over outer edge of oil shedder. Use Tool J-1430 installed on end of crankshaft when tightening timing chain cover screws to align seal properly. NOTE—On Model 4140 a cork seal and rubber seal ring is assembled behind vibration dampener to seal front end of crankshaft. See Vibration Dampener above for data.

Model 4180—Oil threads formed on rear of vibration dampener hub with an oil slinger assembled behind hub. A steel-bushing is assembled in opening in timing chain cover. Use Tool J-1430 installed on end of crankshaft when tightening timing chain cover screws to align steel bushing properly.

CAMSHAFT REMOVAL:—Model 4140. Special valve tappet retaining clips (supplied in sets of 16—Tool No. J-1612) available for camshaft removal without necessity of removing valves or cylinder head. Clips can be installed between spring seat and block.

Models 4160 & 4180—Tappets on these engines can be retained by rubber bands or hacksaw blade

SELF-LOCKING TAPPET SCREWS (4140):—No locknut used on tappet adjusting screw. Threaded bushing welded to top of tappet with threads out of index with threads in tappet which locks tappet screw in position. Screw tension should be 50 inch lbs.

HOOD LOCK & ENGINE CODE (BORE & BEARING SIZES) NOTE:—*See Nash Shop Notes for data.*

SERIAL NUMBER:—First No. K-5001. Stamped on plate on right side of cowl under engine hood.
Service Serial Number—N4-5001 Up. On plate on right front door hinge pillar.

ENGINE NUMBER:—First No. K-5001 (same as Serial No.). Stamped on left side of engine block at front

ENGINE SPECIFICATIONS:—6 cylinder, 'L' head type. Cylinders cast Enbloc with intake manifold cast in block (Iso-thermal fuel intake system).
Bore—3⅛". **Stroke**—3¾".
Displacement—172.6 cu. ins. **Rated HP**—23.44.
Developed Horsepower—75 at 3600 RPM.
Compression Ratio—6.7-1 Std. (cast-iron head).
Compression Pressure—120 lbs. at 350 RPM.
Vacuum Reading—18-20" idling at 6 MPH.

PISTONS:—Aluminum alloy, Autothermic, cam-ground, tin-plated type. **Length**—3⅜".
Original Bore Sizes:—*See Engine Code Note in Nash Shop Notes for data.*
Removal—Pistons and rods removed from above.
Clearance—See Fitting New Pistons.
Replacement Pistons:—Furnished std. and .001", .002", .003", .005", 010", .012", .015", .020", .040" oversize.
Fitting New Pistons:—Use .002" oiled feeler ½" wide between piston and wall at right angles to pin hole on side opposite slot. Pull to withdraw feeler must be within 12-18 lbs. with piston at room temperature.
Installing Pistons:—Pin offset toward camshaft and slot to left side (trademark on piston toward front).

PISTON RINGS:—Two compression, one oil ring per piston, all above pin. Oil ring groove drilled for oil drain.

Ring	Width	End Gap	Side Clearance
Compr.	.093"	.010-.015"	.002-.004"
Oil Contr.	.1865"	.010-.015"	.002-.004"

Replacement Rings & Installation Data:—*See Nash Shop Notes for complete data.*

PISTON PIN:—**Diameter**—.8120". **Length**—2.609". Floating type, retained by locking ring at each end. Pin hole in piston offset toward camshaft.
Pin Fit in Piston—Light push fit (piston at 200° F.).
Pin Fit in Rod Bushing—Select fit for .0001" clearance or light push fit at normal temperature.
Replacement Pins:—Standard, .001, .003" oversize.

CONNECTING ROD:—**Length**—6¾". **Weight**—24 ozs.
Upper Bearing (Piston Pin Bushing)—Bronze.
Crankpin Journal Diameter—2". *See Engine Code Note in Nash Shop Notes for original bearing sizes.*
Lower Bearing—Removable steel-backed babbitt.
Clearance—.0015-.0025". **Sideplay**—.004-.008".
Bearing Adjustment:—None (no shims). Replace bearings. *See Nash Shop Notes for instructions and 'Palnut' data.*
Replacement Bearings:—Std., .002", .010" undersize.
Installing Rods:—Mark rods and bearing caps before removal and install in same position. Oil hole in lower end of rod must be toward right of engine.

CRANKSHAFT:—Four bearing, counterweighted type. *See Nash Shop Notes for Vibration Dampener data.*
Journal Diameters—2 31/64" all bearings. *See Engine Code Note in Nash Shop Notes for Original bearing sizes.*
Bearings—Removable steel-backed babbitt type.
Clearance—.002".
Bearing Adjustment:—None (no shims). Replace bearings. *See Nash Shop Notes for bearing installation and fitting, replacement main bearing caps, and rear main bearing oil seal data.*
Replacement Bearings:—Std., .002". .010" undersize.
End Thrust:—Taken by #1 front bearing. *See Nash Shop Notes for thrust plate and oil seal data.*
Endplay—.004-.006".

CAMSHAFT:—4 bearing. Non-adjustable chain drive. *See Nash Shop Notes for Camshaft removal data.*
Bearing Type—Steel-backed, babbitt bushings.
Clearance—.002".
End Thrust:—Taken by front bearing and camshaft sprocket. **Endplay**—.004-.006".
Timing Chain:—Whitney No. 49205 roller chain. Width 9/16". Pitch ⅜". Length 22½" or 60 links.
Camshaft Setting:—Mesh chain with marks on camshaft and crankshaft sprockets adjacent and in line with straightedge across shaft centers. With camshaft turned so mark is 45° past (to right) of top vertical position, there should be 9½ links between marks.

VALVES:—	Head Diameter	Stem Diameter	Length
Intake	1 11/32"	.3412"	4¾"
Exhaust	1 9/32"	.3412"	4¾"

	Seat Angle	Lift	Stem Clearance
All Valves	45°	5/16"	.002-.003"

Tappet Clearance:—.015" all valves, engine hot and idling (.018" max. may be used for sustained high speed driving). *See Nash Shop Notes for Self-locking type tappet adjusting screw data.*
Valve Guides:—Press fit in block (press in place 1" below top of block, ream for valve stem clearance).

Valve Springs:—	Pressure	Length
All Valves	83 lbs.	1 7/16"

Valve Lifters:—Mushroom type in guide holes reamed in block. Removed from below. *See Nash Shop Notes for Camshaft Removal (necessary to remove lifters).*
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 19° BTDC. Close 63° ALDC.
Exhaust Valves—Open 59° BLDC. Close 23° ATDC.
To Check Valve Timing—With .015" tappet clearance, #1 intake valve opens 19° BTDC with 'DC' mark on vibration dampener at front of engine 1 3/16" ahead of pointer on chain case cover. #1 exhaust valve closes 23° ATDC. with 'DC' mark 1 15/16" past the pointer.

LUBRICATION:—Pressure system. Gear type oil pump on right side of crankcase (driven by inclined shaft).
Normal Oil Pressure:—25-30 lbs. at 25 MPH (warm oil).
Oil Pressure Regulator:—Under plug on left side of crankcase behind pump. Opens at 25 lbs. Non-adj.
Crankcase Capacity:—5 quarts.

COOLING SYSTEM:—**Capacity** 14 qts. (15 with heater).
Water Pump:—Centrifugal, adjustable packing type. *For complete data, refer to 1941 Mech. Equip. Index.*
Removal—Drain radiator, disconnect hose and drive coupling, take out mounting screws in pump flange.
Thermostat:—Fulton or Dole. In cyl. head outlet.
Setting—Starts to open at 160° F.
Temperature Gauge:—Auto-Lite (Motometer) Vapor Tension type. Auto-Lite No. H-9706.
For complete data, refer to 1941 Mech. Equip. Index.

CLUTCH:—**Borg & Beck Model 8A7.** Assembly No. 959. Single plate, dry disc type.
For complete data, refer to 1941 Mech. Equip. Index.
Facings—Molded metallic type, 2 required. Inside Diam. 5⅜". Outside Diam. 8". Thickness ⅛".
Pedal Adjustment:—Free travel ½-1". Adjust by loosening one nut, tightening opposite nut on connector rod at clutch fork (tighten nuts to apply slight tension to rubber cushions, lock each nut with 'Palnut'.
Removal:—Remove transmission (see below), disconnect clutch pedal linkage, remove clutch housing and pan, punchmark flywheel, clutch cover and pressure plate (reassemble to same marks), take out clutch fork and mounting screws in cover flange. Remove clutch assembly.

TRANSMISSION:—**Warner Model AS3-T84G (Std.), AS4-T84G (with Overdrive).** All helical gear, constant-mesh, synchro-mesh (second & high), sliding gear (low and reverse).
For complete data, refer to 1941 Mech. Equip. Index.
Overdrive (Cruising Gear):—Warner Type R7C with electrical 'kick-down' control Optl.
For complete data, refer to 1941 Mech. Equip. Index.
Transmission Control:—Mech. steering column shift.
For complete data, refer to 1941 Mech. Equip. Index.
Removal:—Disconnect torque tube at trunnion bracket and remove Rear Axle (see below), disconnect shift rods and Overdrive control wires and cable, disconnect speedometer cable. Support engine at rear, remove rear engine mountings, take out transmission mounting bolts, pull transmission straight back and remove from below.

UNIVERSAL JOINTS:—**Mechanics No. 1½R.** Needle bearing type, 1 used (in rear bearing bracket at rear of transmission). NOTE—Universal joint is free fit on rear end of transmission mainshaft and press fit on forward end of propeller shaft.
For complete data, refer to 1941 Mech. Equip. Index.

REAR AXLE:—**Own Make.** Semi-floating, hypoid gear type with Torque Tube Drive.
For complete data, refer to 1941 Mech. Equip. Index.
Ratio—4.1-1 Std. 4.4-1 with Overdrive.
Backlash—.005-.007".
Removal:—Jack up rear end of car and support securely with body jacks placed on either side of frame at point 6" forward of front end of rear fender (CAUTION—car weight must not rest on body frame flange which projects below frame rail). Disconnect stabilizer bar and rear spring and shock absorber mounting brackets from axle, disconnect trunnion bracket at transmission rear bearing bracket by removing nuts on forward ends of trunnion bracket mounting studs, pull axle to rear to disengage propeller shaft and universal joint assembly from transmission mainshaft, remove axle and torque tube assembly from under car. *Refer to Mech. Equip. Index 'Nash Rear Axle article' for Trunnion Bracket installation & adjustment, & shaft bearing data.*
Axle Shaft Removal & Wheel Bearing Adjustment:—Same as for other Nash models (see next page).
Rear Suspension:—Coil spring type with shock absorbers mounted within springs.
For complete data, refer to 1941 Mech. Equip. Index.

SHOCK ABSORBERS:— **Delco Model 1026-N (front), 1023-BB (rear).** Direct acting, hydraulic type.
For complete data, refer to 1941 Mech. Equip. Index.

STEERING:—**Steering Gear**—Gemmer Model 250. Worm-and-roller. *Refer to Mech. Equip. Index for data.*
Front Suspension:—New enclosed type with knuckle support and coil spring on kingpin mounted on frame cross-member.
For complete data, refer to 1941 Mech. Equip. Index.
Kingpin Inclination—5½° crosswise.
Caster—0° plus or minus ½°. Adjustable.
Camber—0° to ½° Pos. Adjustable.
Toe In—0-1/16" measured 10" up from floor. Adjusted by turning tube at outer end of each tie rod equally. CAUTION—Clamp bolts must be down toward ground to prevent interference with body during wheel movement.
Steering Geometry (Toe Out on Turns)—Inner wheel turned 21° plus ½°, Outer wheel 20°.

BRAKES:—**Service**—Lockheed hydraulic, double anchor type. Hand lever applies rear service brakes.
For complete data, refer to 1941 Mech. Equip. Index.
Drums—Cast iron. Diameter 9".
Lining—Moulded. Width 1¾". Thickness 3/16". Length 20½" per wheel.
Clearance—.008" toe, .004" heel for each shoe.
Hand Brake:—See Service Brakes above.

HOOD LOCK & ENGINE CODE (BORE & BEARING SIZES) NOTE:—*See Nash Shop Notes for data.*

SERIAL NUMBER:—First No. R-353001. On plate on right frame siderail under engine hood.
Service Serial Number—First No. N6-45001. Stamped on left front door pillar post.

ENGINE NUMBER:—First No. R-353001 (same as Serial No.). On right hand side of cylinder block at front

ENGINE SPECIFICATIONS:—6 cylinder, valve-in-head, Twin Ignition type with Iso-thermal fuel intake system (intake manifold cast in cylinder head—water jacketed for temperature control).
Bore—3⅜". **Stroke**—4⅜".
Displacement—234.8 cu. ins. **Rated HP**—27.34.
Developed Horsepower—105 at 3400 RPM.
Compression Ratio—6.3-1 Std. cast-iron head.
Compression Pressure—125 lbs at 350 RPM.
Vacuum Reading—Steady 18-20" idling at 7-8 MPH.

PISTONS:—Aluminum alloy, Autothermic, cam-ground, tin-plated type. **Length**—3⅞".
Removal—Pistons and rods removed from above.
Clearance—See Fitting New Pistons.
Original Bore Sizes:—*See Engine Code Note in Nash Shop Notes for data.*
Replacement Pistons:—Furnished std. and .001", .002", .003", .005", 010", .012", .015", .020", .040" oversize.
Fitting New Pistons:—Use .002" oiled feeler ½" wide between piston and wall on side opposite slot at right angles to pin hole. Pull to withdraw feeler must be 12-18 lbs. with piston at room temperature.
Installing Pistons:—Pin offset toward camshaft and slot toward left (trademark on piston toward front). NOTE—Piston pin offset 1/16".

PISTON RINGS:—Two compression, two oil control rings per piston, all above pin. Oil ring grooves drilled for oil drainage.

Ring	Width	End Gap	Side Clearance
Compr.	.124"	.010-.015"	.002-.004"
Oil Contr.	.155"	.010-.015"	.002-.004"

Replacement Rings:—*See Nash Shop Notes for data.*

PISTON PIN:—**Diameter**—.8745". **Length**—2.804". Floating type, retained by locking ring at each end. Pin hole in piston offset toward camshaft.
Pin Fit in Piston—Light push fit (piston at 200° F.).
Pin Fit in Rod Bushing—Select pin for .0001" clearance or light push fit at normal temperature.
Replacement Pins:—Standard, .001" .003" oversize.

CONNECTING ROD:—**Length**—8¾". **Weight**—36¼ ozs.
Upper Bearing (Piston Pin Bushing)—Bronze.
Crankpin Journal Diameter—2.002". *See Engine Code Note in Nash Shop Notes for original bearing sizes.*
Lower Bearing—Removable, steel-backed babbitt.
Clearance—.0015-.0025". **Sideplay**—.008-.012".
Bearing Adjustment:—None (no shims). Replace bearings. Do not file rods or bearing caps. *See Nash Shop Notes for instructions and 'Palnut' data.*
Replacement Bearings:—Std. & .002", .010" undersize.
Installing Rods:—Mark rods and bearing caps before removal and install in same position. Oil hole in lower end of rod must be toward right of engine.

CRANKSHAFT:—7 bearing, counterweighted type.
See Nash Shop Notes for Vibration Dampener data.
Journal Diameters—2 31/64" all bearings. *See Engine Code Note in Nash Shop Notes for original bearing sizes.*
Bearings—Removable steel-backed, babbitt type.
Clearance—.002-.003".
Bearing Adjustment:—None (no shims). Replace bearings. *See Nash Shop Notes for bearing installation and fitting, replacement main bearing caps, and rear main bearing oil seal data.*
Replacement Bearings:—Std. & .002", .010" undersize.
End Thrust:—Taken by center bearing. Replace bearing to take up excessive endplay. **Endplay** .004-.006".

CAMSHAFT:—Non-adjustable roller-chain drive.
See Nash Shop Notes for Camshaft Removal directions.
Bearing Type—Steel-backed, babbitt bushings.
Clearance—.002".
End Thrust:—Taken by front bearing.
Endplay—.004-.006".
Timing Chain:—Whitney No. 49205 roller chain. Width 9/16". Pitch ⅜". Length 22½" or 60 links.
Camshaft Setting:—Mesh chain with marks on camshaft and crankshaft sprockets adjacent and in line with straightedge across shaft centers. With camshaft turned so that sprocket mark is 45° past (to right) of top vertical position, there should be 9½ links between sprocket marks.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1¾"	.3725"	5 17/32"
Exhaust	1 19/32"	.3725"	5 17/32"

	Seat Angle	Lift	Stem Clearance
All Valves	45°	11/32"	.002-.004"

Tappet Clearance:—.015" all valves, engine hot and idling (.018" max. may be used for sustained high speed driving. CAUTION—Oil plug in drilled passage in cylinder head (between oil filter pipe and lead to rocker arm shaft) must be removed to cut off oil to rocker arm shafts when valves adjusted with engine running. IMPORTANT—Plug must be replaced after adjustment completed (oil is bypassed in head with plug out and valve mechanism will not be oiled).
Valve Guides:—Press fit in head (positioned by shoulder on guide). Ream new guides for clearance.
Valve Springs:—Double springs used on all valves. Free length 1 21/32" (inner), 2" (outer spring).

	Inner Spring Pressure	Inner Spring Length	Outer Spring Pressure	Outer Spring Length
Valve Closed	21 lbs.	1 3/8"	38 lbs.	1 11/16"
Valve Open	51 lbs.	1 1/32"	95 lbs.	1 11/32"

Valve Lifters:—Mushroom type. Lifter guide holes in block. Remove from below with camshaft out.
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 11.6° ATDC. Close 34.6° ALDC.
Exhaust Valves—Open 49.3° BLDC. Close 5° ATDC.
To Check Valve Timing—With .015" tappet clearance, #1 intake valve opens 11.6° ATDC. with 'DC' mark on vibration dampener at front of engine 23/32" after the indicator on the chain case cover. Exhaust valve closes with piston 5° or .0104" ATDC.

LUBRICATION:—Pressure system with gear type oil pump in crankcase (pump driven by separate gear from camshaft with oil delivery up along drive shaft to oil gallery in engine block).
Normal Oil Pressure:—25-30 lbs. at 25 MPH (warm oil).
Oil Pressure Regulator:—On oil pump cover. Opens at 30 lbs. Not adjustable.
Crankcase Capacity:—6 quarts.

COOLING SYSTEM:—**Capacity** 17 qts. (18 with heater).
Water Pump:—Centrifugal, adjustable packing type.
For complete data, refer to 1941 Mech. Equip. Index.
Removal—Drain radiator, disconnect hose and drive coupling, take out mounting screws in pump flange.
Thermostat:—Fulton or Dole. In cyl. head outlet.
Setting—Starts to open at 160°F.
Temperature Gauge:—Auto-Lite (Motometer) Vapor Tension type. Auto-Lite No. H-9644.
For complete data, refer to 1941 Mech. Equip. Index.

CLUTCH:—**Borg & Beck Model 10A7. Assembly No. 950.** Single plate, dry disc type.
For complete data, refer to 1941 Mech. Equip. Index.
Facings—Moulded-woven type, 2 used. Inside Diam. 7". Outside Diam. 10". Thickness ⅛".
Pedal Adjustment & Over-center Spring Setting:—Pedal free travel ½-1". Adjusted in same manner as on the Nash 8 (see next page for instructions). CAUTION—Over-center spring setting must be checked whenever clutch pedal is adjusted.
Removal:—Remove Transmission (see below). Disconnect clutch pedal linkage, support engine at rear and free rear engine mountings, remove clutch housing and pan. Punchmark flywheel, clutch cover and pressure plate (reassemble to same marks), remove clutch mounting screws and clutch.

TRANSMISSION:—**Own Make.** New design, all helical gear, constant-mesh, synchro-mesh (second & high), sliding gear (low & reverse).
For complete data, refer to 1941 Mech. Equip. Index.
Overdrive (Cruising Gear):—Warner Model AS1-R7C, Type R7C with electrical 'kick-down' control.
For complete data, refer to 1941 Mech. Equip. Index.
Transmission Control:—Mech. steering column shift.
For complete data, refer to 1941 Mech. Equip. Index.
Removal:—Disconnect shift rods, speedometer cable, overdrive control cable & wires (if used), and driveshaft. Remove two right transmission mounting studs and install pilot studs (to support transmission during removal), remove other mounting stud nuts, pull transmission straight back and remove

UNIVERSAL JOINTS:—**Mechanics Type 2CR.** New type roller bearing joint. Two used.
For complete data, refer to 1941 Mech. Equip. Index.

REAR AXLE:—**Own Make.** Semi-floating, hypoid gear type with Hotchkiss drive.
For complete data, refer to 1941 Mech. Equip. Index.
Ratio—4.1-1 Std., 4.4-1 with Overdrive.
Backlash—.005-.007". Shim adjustment.
Removal:—Hoist rear end of car, disconnect shock absorbers, remove axle shafts (see below), free axle from springs by disconnecting U bolts and rear shackles, withdraw axle assembly from beneath car.
Axle Shaft Removal:—Remove wheel and drum, disconnect brake line and cable, remove backing plate mounting bolt nuts, oil seal retainer, backing plate, and bearing adjusting shims. Withdraw shaft and bearing, using care not to drag shaft on oil seal.
Wheel Bearing Adjustment—Shims located between backing plate and flanged end of housing. To adjust, remove wheel and backing plate (above), add or remove shims for endplay. **Endplay** .003-.006".

SHOCK ABSORBERS:—**Delco Model 1016-E (front), 1023-BB (rear).** Direct acting, hydraulic type.
For complete data, refer to 1941 Mech. Equip. Index.

STEERING:—**Steering Gear**—Gemmer Model 305. Worm-and-Roller type with 'push-pull' adjustment.
For complete data, refer to 1941 Mech. Equip. Index.
Front Suspension:—Independent, linked parallelogram type with coil springs.
For complete data, refer to 1941 Mech. Equip. Index.
Kingpin Inclination—4½° crosswise.
Caster—0° to ½° Neg. Adjustable.
Camber—Pos. ¼° to ½°. Adjustable.
Toe In—1/32-3/32" measured 10" up from floor. Adjustable by loosening clamp bolts and turning adjusting tube at outer end of each tie rod equally.
Steering Geometry (Toe out on turns)—Inner wheel turned 21° plus ¾°, outer wheel exactly 20°.

BRAKES:—**Service**—Bendix hydraulic, duo-servo, single anchor type, without Eccentric Adjustment. Hand lever applies rear wheel service brakes.
For complete data, refer to 1941 Mech. Equip. Index.
Drums—Cast iron. Diameter 10".
Lining—Moulded type. Width 2." Thickness 3/16". Length 22" per wheel.
Clearance—.015" at each end of secondary shoes with primary shoes forced out against drum.
Braking Power—53% front, 47% rear wheels.
Hand Brakes:—See Service Brake above.

HOOD LOCK & ENGINE CODE (BORE & BEARING SIZES) NOTES:—*See Nash Shop Notes for data.*

SERIAL NUMBER:—First No. B-110001. On plate on right frame siderail under engine hood.
Service Serial Number—First No. N8-17001. Stamped on left front door pillar post.

ENGINE NUMBER:—First No. B-110001 (same as Serial No.). On right side of cylinder block at front end.

ENGINE SPECIFICATIONS:—8 cylinder, valve-in-head, Twin Ignition type with Iso-thermal fuel intake system (intake manifold cast in cylinder head—water jacketed for temperature control).
Bore—3⅛". **Stroke**—4¼".
Displacement—260.8 cu. ins. **Rated HP**—31.25.
Developed Horsepower—115 at 3400 RPM.
Compression Ratio—6.3-1 Std. cast iron head.
Compression Pressure—110 lbs. at 350 RPM.
Vacuum Reading—Steady 18-20" idling at 7-8 MPH.

PISTONS:—Nelson Bohnalite, aluminum alloy, Invar strut, tin-plated, split skirt type.
Weight—16 ozs. (stripped). **Length**—3 11/16".
Removal—Pistons and rods removed from below.
Clearance—See Fitting New Pistons.
Original Bore Sizes:—*See Engine Code Note in Nash Shop Notes for data.*
Replacement Pistons:—Furnished std. and .001", .002", .003", .005", 010", .012", .015", .020", .040" oversize.
Fitting New Pistons:—Use .0025" dry (not oiled) feeler between piston and wall on side opposite slot at right angles to pin hole. Pull to withdraw feeler 8-15 lbs. with piston at room temperature.
Installing Pistons:—Pin offet toward camshaft. Slot toward left (trademark in piston toward front).

PISTON RINGS:—Two compression, two oil control rings per piston, all above pin. Oil ring grooves drilled for oil drainage.

Ring	Width	End Gap	Side Clearance
Compr. (both)	.124"	.010-.015"	.002-.004"
Oil Cont. (Upper)	.124"	.010-.015"	.002-.004"
Oil Cont. (Lower)	.1865"	.010-.015"	.002-.004"

Replacement Rings:—*See Nash Shop Notes for data.*

PISTON PIN:—**Diameter**—.8747". **Length**—2.574". Floating type, retained by locking ring at each end. Pin hole in piston offset toward camshaft.
Pin Fit in Piston—Light push fit (piston at 200°F).
Pin Fit in Rod Bushing—Select pin for .0001" clearance or light push fit at normal temperature.
Replacement Pins:—Std., .001", .003", .005" oversize.

CONNECTING ROD:—**Length**—8¾". **Weight**—34 ozs.
Upper Bearing (Piston Pin Bushing)—Bronze.
Crankpin Journal Diameter—2.002". *See Engine Code Note in Nash Shop Notes for original bearing sizes.*
Lower Bearing—Removable steel-backed, babbitt.
Clearance—.0015-.0025". **Sideplay**—.008-.012".
Bearing Adjustment:—None (no shims). Replace bearings. Do not file rods or bearing caps. *See Nash Shop Notes for instructions and 'Palnut' data.*
Replacement Bearings:—Std. & .002", .010" undersize.
Installing Rods:—Mark rods and bearing caps before removal and install in same positions. Oil hole in lower end of rod must be toward right of engine.

CRANKSHAFT:—Nine bearing. No counterweights.
See Nash Shop Notes for Vibration Dampener data.
Journal Diameters—2 31/64" all bearings. *See Engine Code in Nash Shop Notes for original bearing sizes.*
Bearings—Removable steel-backed, babbitt type.
Clearance—.002-.003".
Bearing Adjustment:—None (no shims). Replace bearings. *See Nash Shop Notes for bearing installation and fitting, replacement main bearing caps, and rear main bearing oil seal data.*
Replacement Bearings:—Std. & .002", .010" undersize.
End Thrust:—Center (#5) bearing. Replace bearing to take up excessive endplay. **Endplay**—.004-.006."

CAMSHAFT:—Non-adjustable roller chain drive.
See Nash Shop Notes for Camshaft Removal directions.
Bearings—Steel-backed, babbitt bushings.
Clearance—.002".
End Thrust:—Taken by front bearing. **Endplay** .004-.006".
Timing Chain:—Diamond double roller type. Width 9/16". Pitch ⅜". Length 23¼" or 62 links.
Camshaft Setting:—Mesh chain with marks on sprockets adjacent and in line with straightedge across shaft centers. With camshaft turned so that sprocket mark is 45° past (to right) of top vertical position, there should be 10 links between sprocket marks.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1 21/32"	.3725"	5½"
Exhaust	1 15/32"	.3725"	5½"

	Seat Angle	Lift	Stem Clearance
All Valves	45°	11/32"	.002-.004"

Tappet Clearance:—.015" all valves, engine hot and idling. NOTE—.018" maximum may be used for sustained high speed driving.
Valve Guides:—Press fit in head (positioned by shoulder on guide). Ream new guides for correct clearance.
Valve Springs:—Double springs used on all valves. Free length 1 21/32" (inner), 2" (outer spring).

	Inner Spring Pressure	Inner Spring Length	Outer Spring Pressure	Outer Spring Length
Valve Closed	21 lbs.	1 3/8"	38 lbs.	1 11/16"
Valve Open	51 lbs.	1 1/32"	95 lbs.	1 11/32"

Valve Lifters:—Mushroom type. Lifter guide holes reamed in block. Remove from below (camshaft out).
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 16° ATDC. Close 38° ALDC.
Exhaust Valves—Open 45° BLDC. Close 10° ATDC.
To Check Valve Timing—With .015" tappet clearance, #1 intake valve opens 16° ATDC with 'DC' mark on vibration dampener at front of engine 1 5/16" after the indicator on the chain case cover. Exhaust valve closes with piston 10° or .0400" ATDC.

LUBRICATION:—Pressure system. Gear type oil pump in crankcase. NOTE—When pump installed, slot in shaft should be across engine with #1 piston in firing position.
Normal Oil Pressure:—25-30 lbs. at 25 MPH (warm oil).
Oil Pressure Regulator:—On oil pump cover. Opens at 30 lbs. Not adjustable.
Crankcase Capacity:—7 quarts.

COOLING SYSTEM:—**Capacity** 16 qts. (17 with heater).
Water Pump:—Centrifugal, adjustable packing type.
For complete data, refer to 1941 Mech. Equip. Index.
Removal—Drain radiator, disconnect hose and drive coupling, take out mounting screws in pump flange.
Thermostat:—Fulton or Dole. In cyl. head outlet.
Setting—Starts to open at 160°F.
Temperature Gauge:—Auto-Lite (Motometer) Vapor Tension type. Auto-Lite No. H-9644.
For complete data, refer to 1941 Mech. Equip. Index.

CLUTCH:—**Borg & Beck Model 10A7. Assembly No. 950.** Single plate, dry disc type.
For complete data, refer to 1941 Mech. Equip. Index.
Facings—Moulded-woven type, 2 used. Inside Diam. 7". Outside Diam. 10". Thickness ⅛".
Pedal Adjustment:—Pedal free travel ½-1". To adjust, loosen one nut and tighten opposite nut on connector link at throw-out shaft lever. Both nuts must be tightened securely and locked with 'Palnuts'.
Over-center Spring Adjustment—Check when clutch pedal adjusted. Loosen nut in lever on end of clutch throw-out shaft, position lever so that spring hole in lever not more than ⅛" above line from lever screw hole to other spring hole in engine bracket.
Removal:—Remove Transmission (see below). Disconnect clutch pedal linkage, support engine at rear and free rear engine mountings, remove clutch housing and pan. Punchmark flywheel, clutch cover and pressure plate (reassemble to same marks), remove clutch mounting screws and clutch.

TRANSMISSION:—**Own Make.** New design, all helical gear, constant-mesh, synchro-mesh (second & high), sliding gear (low & reverse).
For complete data, refer to 1941 Mech. Equip. Index.
Overdrive (Cruising Gear):—Warner Model AS1-R7C, Type R7C with electrical 'kick-down' control.
For complete data, refer to 1941 Mech. Equip. Index.
Transmission Control:—Mech. steering column shift.
For complete data, refer to 1941 Mech. Equip. Index.
Removal:—Disconnect shift rods, speedometer cable, overdrive control cable & wires (if used), and driveshaft. Remove two right transmission mounting studs and install pilot studs (to support transmission during removal), remove other mounting stud nuts, pull transmission straight back and remove

UNIVERSAL JOINTS:—**Mechanics Type 3CR.** New type roller bearing joint. Two used.
For complete data, refer to 1941 Mech. Equip. Index.

REAR AXLE:—**Own Make.** Semi-floating, hypoid gear type with Hotchkiss drive.
For complete data, refer to 1941 Mech. Equip. Index.
Ratio—4.1-1 Std., 4.4-1 with Overdrive.
Backlash—.005-.007". Shim adjustment.
Removal:—Hoist rear end of car, disconnect shock absorbers, remove axle shafts (see below), free axle from springs by disconnecting U bolts and rear shackles, withdraw axle assembly from beneath car.
Axle Shaft Removal:—Remove wheel and drum, disconnect brake line and cable, remove backing plate mounting bolt nuts, oil seal retainer, backing plate, and bearing adjusting shims. Withdraw shaft and bearing, using care not to drag shaft on oil seal.
Wheel Bearing Adjustment—Shims located between backing plate and flanged end of housing. To adjust, remove wheel and backing plate (above), add or remove shims for endplay. **Endplay** .003-.006"

SHOCK ABSORBERS:—**Delco Model 1016-E (front), 1023-BB (rear).** Direct acting, hydraulic type.
For complete data, refer to 1941 Mech. Equip. Index.

STEERING:—**Steering Gear**—Gemmer Model 335. Worm-and-Roller type with 'push-pull' adjustment.
For complete data, refer to 1941 Mech. Equip. Index.
Front Suspension:—Independent, linked parallelogram type with coil springs.
For complete data, refer to 1941 Mech. Equip. Index.
Kingpin Inclination—4½° crosswise.
Caster—0° to ½° Neg. Adjustable.
Camber—Pos. ¼° to ½°. Adjustable.
Toe In—1/32"-3/32" measured 10" up from floor. Adjustable by loosening clamp bolts and turning adjusting tube at outer end of each tie rod equally.
Steering Geometry (Toe out on turns)—Inner wheel turned 21° plus ¾°, outer wheel exactly 20°.

BRAKES:—**Service**—Bendix hydraulic, duo-servo, single anchor type, without Eccentric Adjustment. Hand lever applies rear wheel service brakes.
For complete data, refer to 1941 Mech. Equip. Index.
Drums—Cast iron. Diameter 10".
Lining—Moulded type. Width 2." Thickness 3/16". Length 22" per wheel.
Clearance—.015" at each end of secondary shoes with primary shoes forced out against drum.
Braking Power—53% front, 47% rear wheels.
Hand Brakes:—See Service Brake above.

TORQUE WRENCH SPECIFICATIONS:—*See Torque Wrench article in Mechanical Equipment Section for tightening specifications for Cylinder Head, Main & Connecting Rod Bolts, etc.*

HOOD LOCK:—Hood lock controlled by 'Push-Pull' control knob to left of steering column on lower flange of instrument panel. To raise hood, pull control knob out to release hood latch (hood will raise 1½"), press up on tab of 'Safety Hook' under center of hood at front.

HOOD REMOVAL:—Hood panel can be removed as follows: Remove hood hinge-to-cowl bolts (mark hinge location on cowl to facilitate installation). Remove hood hinge brace-to-tie bar bolts, lift off hood.

Hood Alignment—Hood to dash clearance should be 3/16". This clearance must be even across rear edge of hood. Hood can be adjusted as follows: Hood can be adjusted for up and down and forward movement by means of enlarged holes in cowl at hood hinges. Hood fit along top of grille and fenders adjustable by moving rubber bumpers on hood at each side of aligning bolt at front end up or down. Aligning bolt can also be adjusted. Adjustable support in middle of tie bar between hood hinges should be adjusted to contact hood panel with tension, but not enough tension to move panel away from cowl. Prevents hood distortion (does not affect hood fit).

FRONT END SHEET METAL ASSEMBLY REMOVAL:—Front fender, radiator grille, and radiator core can be removed as an assembly without removing hood as follows: Drain cooling system. Disconnect radiator upper and lower hoses, headlight wires and wiring harness at junction block, horn, and hood latch operating cable from latch plate at radiator grille. Remove cowl kick pads from inside car and remove 4 fender-to-cowl bolts (3 at rear edge of fender, 1 at cowl just to rear of hood hinge). Disconnect radiator brace rods at cowl. Jack up front end of car. Remove 2 fender-to-rocker panel bolts (at lower rear corner of fender) and 3 fender-to-frame bolts behind fender skirt (below front edge of engine dash). Remove bumper primary bar from secondary bar and nut and washer from radiator support-to-frame front cross-member bolt (on underside of cross-member). Free snap-in fasteners from splash guard at front cross-member. Move front end assembly forward (center bolt hole in support plate slotted) and remove from car.

Alignment—When assembly installed, adjust fender to door clearance as described below. Check hood fit (see Hood Alignment above).

Front Fender Alignment—When fender installed on car, it must be properly aligned and clearance at door must be adjusted as follows: Fender bolt holes at cowl and body are enlarged to permit fitting fender. Install fender bolts just tight enough to allow shifting fender for alignment. Fit fender to door in such a manner as to just allow door to open. Gap between rear edge of fender and door should be ⅛" plus 1/32" minus 0" and be equal for both sides of car. After fender fitted, tighten bolts.

CYLINDER HEAD SERVICING:—Steel-asbestos cylinder head gasket used. **This gasket cannot be reused.** When installing new gasket, coat both sides with thin coat of P.O.B. Perfect Gasket Seal with room temperature of approximately 70° F. (edges at cylinder bore holes must be wiped clean of all sealer). Install gasket with 3/16" flange next to cylinder block (flange on upper side 3/32" wide). To prevent leakage, plain washers are used under cylinder head bolt heads. Use Torque Wrench (Tool J-1264) and tighten bolts to 60-70 lbs. ft. tension. ***See Cylinder Head Tightening Diagram in 1941 Mechanical Equipment Section for tightening order.***

8 Cylinder Engine Note—Install new neoprene grommet in pump by-pass hole on front of head.

OIL PAN REMOVAL:—Oil pan can be removed as follows: Disconnect idler arm support from frame and drop steering relay rod assembly. Remove flywheel lower pan on 8 cylinder engines only. Remove pan bolts. For access to bolts at front end of pan, unhook fasteners of splash guard between radiator lower baffle and frame cross-member and work through openings in front cross-member. Turn crankshaft to place counterweights up out of the way, remove one or the other of the engine filler plates if necessary, take off pan.

Installation—Use new gaskets and permit them to dry before installing pan so that gaskets will not be disturbed when pan installed on engine.

PISTON PINS:—**Servicing**—Standard size pins only furnished for service. Pin bosses in pistons electrolited and must not be reamed. Replacement pistons (standard and oversize) furnished with pins fitted.

Removal:—To remove pin, take out lockscrew, place assembly in boiling water for one minute. With Tool HM-535 push pin out through plain boss end.

Fitting:—Pin fit in piston .0001" loose to .0002" tight (plain boss), .0002-.0005" tight (lock screw boss). Pin fit in rod bushing .0003-.0006". If rod bushing worn, press new bushing in place (align oil hole in bushing and rod), burnish with Tool HM-587E and line ream with Reamer HM-586 to .8558-.8562".

Installing:—To install pin, heat piston and pin (as for Removal above), dip pin in hot light engine oil, start pin through plain boss end of piston and through rod (make sure lock screw hole in pin and boss will be aligned), then with Tool HM-535 lightly push pin in place until hole in pin and boss aligned (use punch in hole to correct slight mis-alignment). IMPORTANT—Pin must not be forced (if heavy push required, indicates piston has cooled, disassemble and reheat piston and pin). After pin in place, coat lock screw with graphite and tighten to 9-11 lbs. ft. tension with a torque wrench.

MAIN BEARING UPPER HALVES:—**Removal**—May be removed without removing crankshaft by removing bearing cap and inserting pin (Tool HM-J-173) in oil hole in shaft. With tang on pin engaging plain end of bearing shell, rotate shaft in usual direction and turn shell out.

Installation—Remove sharp edge from plain end of bearing, insert this end at indented side of support and rotate in place using pin in oil hole in shaft.

CRANKSHAFT END THRUST:—Taken through front (#1) main bearing. Two bronze thrust plates doweled to bearing cap, one to front face of cap and one to rear face. A steel thrust collar is assembled between front bronze plate & crankshaft sprocket.

Hydra-Matic Cars—Steel thrust collar (Part No. 414229) has a more highly polished finish than that used on synchro-mesh transmission equipped cars. Can be identified by finish and part no. which is etched on collar. This collar only furnished for service (can be used to service synchro-mesh transmission equipped cars also). Front bronze thrust washer has eight grooves in face of plate and must be assembled with these grooves next to steel thrust collar. A plain bronze thrust washer is used at rear.

REAR MAIN BEARING OIL SEAL:—Consists of oil slinger on crankshaft to rear of bearing with asbestos covered wiper seal in groove in bearing support and bearing cap. Cork strips used to seal vertical joints between bearing support and cap.

Installation—With crankshaft out of engine and bearing cap and shells off, crowd seal in rear groove of bearing support by hand. Use seal compressor Tool J-955 over seal and tap tool 3 or 4 times to seat seal. With tool resting on seal, cut ends flush at each end. Repeat operation for bearing cap. Seal must entirely fill groove and be trimmed flush to prevent oil leaks. Install cork seals in vertical grooves when installing cap.

CAMSHAFT END THRUST:—Forward thrust now taken by semi-circular flange around camshaft opening in front engine support plate. Backward thrust taken by flange ahead of front camshaft bearing journal and front face of cylinder block (same as 1940). IMPORTANT NOTE—Camshaft on 1941 Engines recessed at front end for spring-loaded thrust button (formerly used to take forward thrust). Spring-loaded button should not be assembled to camshaft on 1941 engines (see above). 1941 timing chain cover equipped with camshaft thrust plate so that this cover may be used in service for earlier cars. Thrust plate does not function on 1941 engines.

OIL PUMP:—Gear type pump. Six and Eight pump identical except for gear faces which are ¼" wider on Eight. When assembling pump gear on shaft, press shaft on gear flush with outer end of gear (Six), with gear extending ¼" beyond end of shaft (Eight—Use Tool J-954 which properly positions gear on shaft). Pump drive gear must be assembled with Feeler Gauge J-954-1 between inner face of gear hub and pump body to give proper end clearance for pump shaft. Use new pump body gasket.

Installation—Set engine in firing position for #1 cylinder with rotor opposite #1 segment in distributor cap. Note position of distributor shaft tongue for proper oil pump drive gear mesh, then raise distributor and mesh pump drive gear with camshaft gear. Replace distributor in position and reset ignition timing.

RADIATOR CORE REMOVAL:—Radiator core can be removed as follows: Raise hood. Disconnect hood latch operating cable at latch, pull cable back free of core support flange. Remove 4 radiator core-to-lower support bolts at each side. Core on Six cylinder engines can then be removed by rotating fan as required while lifting core out of car. On Eight cylinder engines, remove 2 upper core support (U-shaped channel behind core)-to-fender and lower support bolts at each side. Core can then be removed by rotating upper support toward engine as required, turning fan as necessary, and lifting out.

CLUTCH HOUSING REINFORCING PLATE:—Used on all 8 cylinder cars with conventional transmission. Consists of 3/16" steel plate bolted between clutch housing and underpan (replaces conventional gasket). Plate is secured to housing by 2 screws. 12 screws used to bolt underpan (through plate) to housing. Coat both sides of plate with Permatex.

1940 & PREVIOUS MODELS

CLUTCH RELEASE BEARING:—**Production Change**—Beginning with Engine No. G-190392 (6 Cyl.), L-365742 (8 Cyl.), new type release bearing which has pressure gun fitting used so that bearing can be lubricated in service. Fitting extends down at angle toward left side and is accessible by removing lower clutch cover pan. Lubricate once each year (or at 5000 mile intervals for extreme service) using petrolatum only (heavy grease will not penetrate carbon release bearing).

IMPORTANT REPLACEMENT NOTE—This new type bearing with grease fitting can be installed on early 1940 cars and 1939 models to correct complaints of dry or noisy release bearings.

HOOD LOCK, FRONT END SHEET METAL ASSEMBLY & OIL PAN REMOVAL:—*See Oldsmobile Shop Notes.*

MODEL NOTATION	Model	Series
Special Six	F-41	66
Dynamic Cruiser Six	G-41	76
Custom Cruiser Six	H-41	96

SERIAL NUMBER:—On plate on upper left corner of engine dash. 1st nos.:

	66	76	96
Lansing	66-1001	76-1001	96-1001
California	66C1001	76C1001	96C1001
Linden, N. J.	66L1001	76L1001	96L1001

ENGINE NUMBER:—First number G225001 (LHD cars). On top left side of engine back of water pump.
Hydra-matic Drive Cars—Carry no. prefix 'GA'.

ENGINE SPECIFICATIONS:—6 cylinder, 'L' head.
Bore—3½". **Stroke**—4⅛".
Displacement—238.1 cu. ins. **Rated HP**—29.4.
Developed Horsepower—100 at 3400 RPM (Std. hd.).
Compression Ratio—6.1-1 Std., 5.74-1 Export.
Compression Pressure—115 lbs. ± 10 lbs. at cranking speed of 100 RPM (Std. head).
Vacuum Reading—Steady 17" min. at idling speed.
See Oldsmobile Shop Notes for Cylinder Head Servicing.

PISTONS:—Aluminum alloy, T-slot, cam ground type with electro-hardened oxide bearing surface.
Weight—17.37 ozs. (stripped). **Length**—4 1/32".
Removal—Pistons and rods removed from above.
Clearance—Top .023-.028". Skirt .0005-.0010".
NOTE—Piston skirt taper inward from bottom to top should be .0015-.002". Differs from Eight.
Replacement Pistons:—Finished pistons (pins fitted) .003", .005", .010", .015", .030" oversize. Same wt. as std.
Fitting New Pistons:—Check piston for size with micrometers (pin removed) 90° from pin bosses ⅜" below lower ring groove and ⅜" from bottom of skirt. Insert .002" x ½" feeler between piston (pin removed) and cylinder wall on valve side with piston inverted and T-slot on opposite side from feeler. Pull to withdraw feeler must be 4 to 11 lbs. (piston and block at 70°—low limit below 70°, high above).
Installing pistons:—Mark 'V-S' on head toward valves (slot away from valves). Pin hole offset 3/32".

PISTON RINGS:—2 compression (coated type—install with mark TOP up), 2 oil control, all above pin.

Ring	Width	End Gap	Side Clearance
Compr.	.0925-.0935"	.008-.018"	.001-.003"
Oil Contr.	.1860-.1865"	.007-.015"	.001-.0025"

Replacement Rings:—.010", .020", .030" oversize.

PISTON PIN:—**Diameter**—.8554-.8557". **Length**—3 5/32". Pin locked in one piston boss by lockscrew (opposite end slotted). Pin bosses are plated and must not be reamed. Standard size pins only serviced.
Pin Fit in Piston—.0001" loose to .0002" tight (plain boss end), .0002-.0005" tight (lock boss end).
Pin Fit in Rod Bushing—.0003-.0006" clearance.
See Oldsmobile Shop Notes for Pin Fitting directions.

CONNECTING ROD:—**Length**—7 13/16". **Weight**—28.0 ounces (complete except for bearing inserts).
NOTE—Six and Eight rods not interchangeable.
Crankpin Journal Diameter—2.123-2.124".
Lower Bearing—Removable steel-backed, babbitt. **Clearance**—.0005-.0025". **Sideplay**—.0055-.0105".
Bearing Adjustment:—None. Replace bearings.
Installing Rods:—Oil spit hole at lower end toward valves and grooves on rod and cap bolt boss (part number side) matched. Special ground cap bolts with self-locking nuts used and should be tightened with torque wrench to 50-55 lbs. ft. tension.

CRANKSHAFT:—4 bearings, integral counterweights.
Journal Diameters—#1, 2.478-2.479"; #2, 2.5405-2.5415"; #3, 2.6655-2.6665"; #4, 2.6855-2.6865".
Bearings—Removable, steel-backed, babbitt. Upper and lower halves interchangeable except #1 (front) which has additional short oil groove to front.
Clearance—.0005-.002" (rear), .001-.003" (all others).
Bearing Adjustment:—None (no shims). Replace bearings. Do not file caps. **Endplay**—.004-.008".
NOTE—9/16" cap bolts on rear bearing, ½" others.
See Oldsmobile Shop Notes for Main Bearing Removal, Crankshaft End Thrust and Oil Seal data.

CAMSHAFT:—4 bearing. Non-adjustable chain drive.
Journal Diameters—#1, 1.9970-1.9975"; #2, 1.9345-1.9350"; #3, 1.8720-1.8725"; #4, 1.8095-1.8100".
Bearings—Bronze bushings. **Clearance** .0015-.0035".
End Thrust:—Forward end thrust now taken by front engine support plate. *See Oldsmobile Shop Notes.*
Timing Chain:—Whitney No. 411239. Width 1". Pitch .500" (½"). Length 47 links or 23½".
Camshaft Setting:—Mesh chain with sprocket marks adjacent and in line with a straightedge across the shaft centers (or use Tool HM-408-0).

VALVES:—	Head Diameter	Stem Diameter	Length
Intake	1 9/16"	.3415-.3425"	5 51/64"
Exhaust	1 27/64"	.3410-.3418"	5 51/64"

	Seat Angle	Lift	Stem Clearance
Intake	30°	.303"	.00175-.00375"
Exhaust	45°	.298"	.00245-.00425"

Tappet Clearance:—.008" Int., .011" Exh. Hot & idling.
NOTE—Self-locking tappet screws used. Remove right fender filler plate for access to valves.
Valve Guides:—Intake and exhaust guides same. Press guides in so top end ⅞" below top of block. (Tool J-1042 positions guide correctly in block). Ream to .34425-.34525" inside diam. (not tapered).

Valve Springs:—	Spring Pressure	Spring Length
Valve Closed	50½ lbs.	2¼"
Valve Open	95½ lbs.	1 15/16"

Valve Lifters:—Mushroom type (same on 6 & 8). Holes reamed in block have bearing-ized finish (if worn, fit oversize lifter without reaming hole) Body Diam. .6235-.6240". Furn .001", .002", .005", .010", OS. **Clearance**—.0005-.0008". NOTE— 1⅛" diameter face lifter only should be used on 1941 models.
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 5° BTDC. Close 45° ALDC.
Exhaust Valves—Open 45° BLDC. Close 5° ATDC.
Valve Timing Check—With .0124" tappet clearance, #1 intake valve should open with piston 5° (.0163") BTDC with flywheel TDC mark (steel ball insert) approx. 2 teeth before indicator (hole on left front face of housing). Reset tappet clearance at .008" hot.

LUBRICATION:—Pressure (gear type pump on right of engine). *See Oldsmobile Shop Notes for Oil Pump data.*
Normal Oil Pressure:—28-33 lbs.
Oil Pressure Regulator:—On pump, opens at 30 lbs. Non-adjustable type.
Crankcase Capacity:—5 quarts.

COOLING SYSTEM:—**Capacity**—17¾ quarts.
See Oldsmobile Shop Notes for Radiator Core Removal.
Water Pump:—Packless, sealed ball-bearing type.
For complete data, refer to 1941 Mech. Equip. Index.
Thermostat:—Harrison. In cylinder head outlet.
Setting—Starts to open 152°F. Fully open 173°F.
Temperature Gauge:—AC Electric #1511043 (dash), #1510772 (engine unit). *Refer to Mech. Equip. Index.*

CLUTCH (STD. TRANS.):—**Borg & Beck Model 9A7 with 'Borglite' driven member.** Marked #924 on cover. Single plate, dry disc type with steel and asbestos composition pressure plate oil baffle and clutch release bearing lubrication fitting.
For complete data, refer to 1941 Mech. Equip. Index.
Facings—Spiral wound (spirally grooved) molded woven, 2 used. Inside Diam. 6", O.D. 9¼". ⅛" thick.
Pedal Adjustment:—Free travel 1-1½". Turn link at fork in or out of clevis on auxiliary shaft.
Removal:—Remove transmission (see data below), clutch underpan and take out 6 mounting screws in clutch cover (when installing, use 2 long shank mounting screws in 2nd hole on each side of locating dowel), lower clutch assembly out.

TRANSMISSION (STD.):—**Own Make.** All helical gear, constant-mesh, synchro-mesh (second & high), sliding gear (low & reverse) with remote shift.
For complete data, refer to 1941 Mech. Equip. Index.
Transmission Control:—Oldsmobile 'Handi-shift' type.
For complete data, refer to 1941 Mech. Equip. Index.
Removal:—Disconnect shift and selector rods from levers at transmission, speedometer cable, rear universal and slide slip yoke and propeller shaft to rear. Remove four transmission mounting capscrews, pull transmission straight back and remove.

HYDRA-MATIC DRIVE (OPTL.):—**Own Make**—Consists of fluid coupling & automatic transmission.
For complete data, refer to 1941 Mech. Equip. Index.

UNIVERSAL JOINTS:—**Mechanics 2C or 2CR (new type).** Roller bearing types. Two used.
For complete data, refer to 1941 Mech. Equip. Index.
NOTE—Slip joint formed at rear of transmission ahead of front U-joint (driveshaft 1 piece type).

REAR AXLE:—**Own Make.** Semi-floating, hypoid gear type with torque taken through 2 support arms.
For complete data, refer to 1941 Mech. Equip. Index.
Ratio—**4.1-1** Std. 66. **4.3-1** Std. 76 & 96, Mountain ratio 66. **3.42-1** Hydra-Matic 66. **3.63-1** Hydra-Matic 76 & 96. **4.55-1** Mountain 76 & 96. **3.9-1** Plains ratio.
NOTE—Ring and pinion gear ratio (41-10, etc.) stamped on top side of differential carrier.
Backlash—.004-.008". Screw adjustment.
Removal:—Disconnect drive shaft at rear universal (do not disengage spline joint at transmission), remove axle shafts and carrier flange capscrews.
Axle Shaft Removal:—Hoist rear end, remove wheel, brake drum, backing plate mounting nuts, static collector and loosen bearing retainer (do not move backing plate or brake line may be damaged). Pull shaft and bearing with puller J-942 (do not allow shaft to drag on oil seal), replace 1 backing plate nut.
Wheel Bearing Adjustment—None.
Rear Suspension:—Quadri-coil type (support arms).
For complete data, refer to 1941 Mech. Equip. Index.

SHOCK ABSORBERS:—**Delco.** FRONT—Model 1947-C (right), D (left). RIGHT REAR—2105-E (76, 96), G (66). LEFT REAR—2105-F (76, 96), H (66). Double acting (parallel cylinder type rear), hydraulic.
For complete data, refer to 1941 Mech. Equip. Index.

STEERING:—**Steering Gear**—Saginaw Worm-and-Roller type. *For data, refer to Mech. Equip. Index.*
Front Suspension:—Independent, linked parallelogram type with coil springs.
For complete data, refer to 1941 Mech. Equip. Index.
Kingpin Inclination—4°51'10".
Caster—0-¾° Negative. Adjustable.
Camber—Negative ¼° to Positive ¾°. Adjustable.
Toe In—1/16-⅛". Adjust each tie rod equally.
Steering Geometry—Inner wh'l 23° ± ½°. Outer 20°.

BRAKES:—**Service.** Bendix hydraulic, duo-servo, single anchor type without eccentric adjustment. Hand lever applies rear wheel service brakes.
For complete data, refer to 1941 Mech. Equip. Index.
Wheel Cylinder Bore—Front wheel 1 3/32". Rear 1".
Drums—Cast-iron. Diameter 11".
Lining—Molded. Width 1¾" (66), 2" (76, 96). Thickness 3/16". Length per shoe 9 11/32" (primary), 11 31/32" (secondary shoe).
Clearance—.015" at both ends of secondary shoe with primary shoe forced out against drum.
Hand Brake:—See Service Brakes above.

HOOD LOCK, FRONT END SHEET METAL ASSEMBLY & OIL PAN REMOVAL:—*See Oldsmobile Shop Notes.*

MODEL NOTATION:—

	Model	Series
Special Eight	E-41	68
Dynamic Cruiser 8	J-41	78
Custom Cruiser 8	L-41	98

SERIAL NUMBER:—On plate on upper left corner of engine dash. 1st nos.:

	68	78	98
Lansing	68-1001	78-1001	98-1001
California	68C1001	78C1001	98C1001
Linden, N. J.	68L1001	78L1001	98L1001

ENGINE NUMBER:—First number L379001 (LHD cars). On top left side of engine back of water pump. **Hydra-matic Drive Cars**—Carry no. prefix 'LA'.

ENGINE SPECIFICATIONS:—8 cylinder, 'L' head. **Bore**—3¼". **Stroke**—3⅞". **Displacement**—257.1 cu. ins. **Rated HP**—33.8. **Developed Horsepower**—110 at 3600 RPM (Std. hd.). **Compression Ratio**—6.3-1 Std., 5.7-1 Export. **Compression Pressure**—105 lbs. ± 10 lbs. at cranking speed of 100 RPM (Std. head). **Vacuum Reading**—Steady 17" min. at idling speed. *See Oldsmobile Shop Notes for Cylinder Head Servicing.*

PISTONS:—Aluminum alloy. T-slot, cam ground type with electro-hardened oxide bearing surface. **Weight**—16 ozs. (stripped). **Length**—3 15/16". **Removal**—Pistons and rods removed from above. **Clearance**—Top .023-.028". Skirt .0013-.0018". NOTE—Piston skirt taper inward from bottom to top should be .00025-.00075". Differs from Six. **Replacement Pistons:**—Finished pistons (pins fitted) .003", .005", .010", .015", .030" oversize. Same wt. as std. **Fitting New Pistons:**—Check piston for size with micrometers (pin removed) 90° from pin bosses ⅜" below lower ring groove and ⅜" from bottom of skirt. Insert .002" x ½" feeler between piston (pin removed) and cylinder wall on valve side with piston inverted and T-slot on opposite side from feeler. Pull to withdraw feeler must be 4 to 11 lbs. (piston and block at 70°—low limit below 70°, high above). **Installing pistons:**—Mark 'V-S' on head toward valves (slot away from valves). Pin hole offset 3/32".

PISTON RINGS:—2 compression (coated type—install with mark TOP up), 2 oil control, all above pin.

Ring	Width	End Gap	Side Clearance
Compr.	.0925-.0935"	.009-.014"	.001-.003"
Oil Cont.	.1860-.1865"	.009-.014"	.001-.0025"

Replacement Rings:—.010", .020", .030" oversize.

PISTON PIN:—**Diameter**—.8554-.8557". **Length** 2 31/32". Pin locked in one piston boss by lockscrew (opposite end slotted). Pin bosses are plated and must not be reamed. Standard size pins only serviced. **Pin Fit in Piston**—.0001" loose to .0002" tight (plain boss end), .0002-.0005" tight (lock boss end). **Pin Fit in Rod Bushing**—.0003-.0006" clearance. *See Oldsmobile Shop Notes for Pin Fitting directions.*

CONNECTING ROD:—**Length**—7 13/16". **Weight**—28.0 ounces (complete except for bearing inserts). NOTE—Six and Eight rods not interchangeable. **Crankpin Journal Diameter**—2.123-2.124". **Lower Bearing**—Removable steel-backed, babbitt. **Clearance**—.0005-.0025". **Sideplay**—.0055-.0105". **Bearing Adjustment:**—None. Replace bearings. **Installing Rods:**—Oil spit hole at lower end toward valves and grooves on rod and cap bolt boss (part number side) matched. Special ground cap bolts with self-locking nuts used and should be tightened with torque wrench to 50-55 lbs. ft. tension.

CRANKSHAFT:—5 bearing, 8 integral counterweights. **Journal Diameters**—#1, 2.478-2.479"; #2, 2.5405-2.5415"; #3, 2.603-2.604"; #4, 2.6655-2.6665"; #5, 2.6855-2.6865". **Bearings**—Removable, steel-backed, babbitt. Upper and lower halves interchangeable except #1 (front) which has additional short oil groove to front. **Clearance**—.0005-.002" (rear), .001-.003" (all others). **Bearing Adjustment:**—None (no shims). Replace bearings. Do not file caps. **Endplay**—.004-.008". NOTE—9/16" cap bolts on rear bearing, ½" others. *See Oldsmobile Shop Notes for Main Bearing Removal, Crankshaft End Thrust and Oil Seal data.*

CAMSHAFT:—5 bearing. Non-adjustable chain drive. **Journal Diameters**—#1, 2.0600-2.0595"; #2, 1.9975-1.9970"; #3, 1.9350-1.9345"; #4, 1.8725-1.8720"; #5, 1.8100-1.8095". **Bearings**—Bronze bushings. **Clearance** .0015-.0035". **End Thrust:**—Forward end thrust now taken by front engine support plate. *See Oldsmobile Shop Notes.* **Timing Chain:**—Link-Belt. Width 11/16" (after approx. 1st 10,000 cars), 1" (1st 10,000 cars). Pitch .500". Length 47 links or 23½". **Camshaft Setting:**—Mesh chain with sprocket marks adjacent and in line with a straightedge across the shaft centers (or use Tool HM-408-0).

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1 9/16"	.3415-.3425"	5 51/64"
Exhaust	1 27/64"	.3410-.3418"	5 51/64"

	Seat Angle	Lift	Stem Clearance
Intake	30°	.286"	.00175-.00375"
Exhaust	45°	.314"	.00245-.00425"

Tappet Clearance:—.008" Int., .011" Exh. Hot & idling. NOTE—Self-locking tappet screws used. Remove right fender filler plate for access to valves. **Valve Guides:**—Intake and exhaust guides same. Press guides in so top end ⅞" below top of block. (Tool J-1042 positions guide correctly in block). Ream to .34425-.34525" inside diam. (not tapered).

Valve Springs:—Same spring used on both valves and on 6&8 engines. Damper on top of each spring. Free length 2 19/32".

	Spring Pressure	Spring Length
Valve Closed	50½ lbs.	2¼"
Valve Open	95½ lbs.	1 15/16"

Valve Lifters:—Mushroom type (same on 6 & 8). Holes reamed in block have bearing-ized finish (if worn, fit oversize lifter without reaming hole) Body Diam. .6235-.6240". Furn .001", .002", .005", .010", OS. **Clearance**—.0005-.0008". NOTE— 1⅛" diameter face lifter only should be used on 1941 models. **Valve Timing:**—See Camshaft Setting above. **Intake Valves**—Open at TDC. Close 35° ALDC. **Exhaust Valves**—Open 45° BLDC. Close 10° ATDC. **Valve Timing Check**—With .0124" tappet clearance #1 intake valve should open with piston at top dead center (flywheel mark 'TDC/'—NOT STEEL BALL INSERT) aligned with pointer in left front face on flywheel hous'g. Reset tappet clear. .008" hot & idl'g.

LUBRICATION:—Pressure (gear type pump on right of engine). *See Oldsmobile Shop Notes for Oil Pump data.* **Normal Oil Pressure:**—28-33 lbs. **Oil Pressure Regulator:**—On pump, opens at 30 lbs. Non-adjustable type. **Crankcase Capacity:**—6 quarts.

COOLING SYSTEM:—**Capacity**—21½ quarts. *See Oldsmobile Shop Notes for Radiator Core Removal.* **Water Pump:**—Packless, sealed ball-bearing type. *For complete data, refer to 1941 Mech. Equip. Index.* **Thermostat:**—Harrison. In cylinder head outlet. **Setting**—Starts to open 152°F. Fully open 173°F. **Temperature Gauge:**—AC Electric #1511043 (dash), #1510772 (engine unit). *Refer to Mech. Equip. Index.*

CLUTCH (STD. TRANS.):—**Borg & Beck Model 10A7 with 'Borglite' driven member.** Marked #927 on cover. Single plate, dry disc type with sheet metal pressure plate oil baffle and release bearing lubrication fitting. *For data, refer to Mech. Equip. Index.* **Facings**—Spiral wound (spirally grooved) molded woven, 2 used. Inside Diam. 7". O.D. 10". ⅛" thick. **Pedal Adjustment:**—Free travel 1-1½". Turn link at fork in or out of clevis on auxiliary shaft. **Removal:**—Remove transmission (see data below), clutch underpan and reinforcing plate. Take out 6 mounting screws in clutch cover (when installing, use 2 long shank mounting screws in 2nd hole on each side of locating dowel), remove clutch. *See Oldsmobile Shop Notes for Clutch Housing Reinforcing Plate data.*

TRANSMISSION (STD.):—**Own Make.** All helical gear, constant-mesh, synchro-mesh (second & high), sliding gear (low & reverse) with remote shift. *For complete data, refer to 1941 Mech. Equip. Index.* **Transmission Control:**—Oldsmobile 'Handi-shift' type. *For complete data, refer to 1941 Mech. Equip. Index.* **Removal:**—Disconnect shift and selector rods from levers at transmission, speedometer cable, rear universal and slide slip yoke and propeller shaft to rear. Remove four transmission mounting capscrews, pull transmission straight back and remove.

HYDRA-MATIC DRIVE (OPTL.):—**Own Make**—Consists of fluid coupling & automatic transmission. *For complete data, refer to 1941 Mech. Equip. Index.*

UNIVERSAL JOINTS:—**Mechanics 2C or 2CR (new type).** Roller bearing types. Two used. *For complete data, refer to 1941 Mech. Equip. Index.* NOTE—Slip joint formed at rear of transmission ahead of front U-joint (driveshaft 1 piece type).

REAR AXLE:—**Own Make.** Semi-floating, hypoid gear type with torque taken through 2 support arms. *For complete data, refer to 1941 Mech. Equip. Index.* **Ratio**—**4.1-1** Std. 68. **4.3-1** Std. 78 & 98, Mountain ratio 68. **3.42-1** Hydra-Matic (all). **4.55-1** Mountain ratio 78 & 98. **3.9-1** Plains ratio (all). NOTE—Ring and pinion gear ratio (41-10, etc.) stamped on top side of differential carrier. **Backlash**—.004-.008". Screw adjustment. **Removal:**—Disconnect drive shaft at rear universal (do not disengage spline joint at transmission), remove axle shafts (see below), remove capscrews on carrier flange, pull carrier assembly out. **Axle Shaft Removal:**—*See 1941 Oldsmobile 6 page.* **Wheel Bearing Adjustment**—None. **Rear Suspension:**—Quadri-coil type (support arms). *For complete data, refer to 1941 Mech. Equip. Index.*

SHOCK ABSORBERS:—**Delco.** FRONT—Model 1947-C (right), D (left). RIGHT REAR—2105-E (78, 98), G (68). LEFT REAR—2105-F (78, 98), H (68). Double acting (parallel cylinder type rear), hydraulic. *For complete data, refer to 1941 Mech. Equip. Index.*

STEERING:—**Steering Gear**—Saginaw Worm-and-Roller type. *For data, refer to Mech. Equip. Index.* **Front Suspension:**—Independent, linked parallelogram type with coil springs. *For complete data, refer to 1941 Mech. Equip. Index.* **Kingpin Inclination**—4°51'10". **Caster**—0-¾° Negative. Adjustable. **Camber**—Negative ¼° to Positive ¾°. Adjustable. **Toe In**—1/16-⅛". Adjust each tie rod equally. **Steering Geometry**—Inner wh'l 23° ± ½°. Outer 20°.

BRAKES:—**Service.** Bendix hydraulic, duo-servo, single anchor type without eccentric adjustment. Hand lever applies rear wheel service brakes. *For complete data, refer to 1941 Mech. Equip. Index.* **Wheel Cylinder Bore**—Front wheel 1 3/32". Rear 1". **Drums**—Cast-iron. Diameter 11". **Lining**—Molded. Width 1¾" (68), 2" (78, 98). Thickness 3/16". Length per shoe 9 11/32" (primary), 11 31/32" (secondary shoe). **Clearance**—.015" at both ends of secondary shoe with primary shoe forced out against drum. **Hand Brake:**—See Service Brakes above.

TORQUE WRENCH SPECIFICATIONS:—*See Torque Wrench article in Mechanical Equipment Section for tightening specifications for Cylinder Head, Main & Connecting Rod Bolts, etc.*

FRONT END REMOVAL:—For work on front of engine, remove radiator and fender assembly as a unit as follows: drain cooling system, remove fender-to-body bolts, fender-to-running board bolts, fender to brace bolts, disconnect radiator hoses, free radiator tie rods, free radiator anchor bolt on frame remove running board molding from fender and lift entire assembly off. Above data applies to all 1900 models except 1951.

ORIGINAL BORE & PISTON SIZES:—Piston size indicated by mark stamped on head of each piston. Cylinder bore size indicated by mark stamped on top left face of cylinder block at Cylinder #4 (Six), #8 ('120' and Clipper Eights), #1 (Super Eight). Piston and cylinder marks should correspond (AA piston in AA bore, etc.) as shown in following tables:

'110' SIX, '160' AND '180' SUPER EIGHT

Mark	Piston Size	Cylinder Size
AA	3.49825-3.49850"	3.49950-3.49975"
A	3.49850-3.49875"	3.49975-3.50000"
BB	3.49875-3.49900"	3.50000-3.50025"
B	3.49900-3.49925"	3.50025-3.50050"
CC	3.49925-3.49950"	3.50050-3.50075"
C	3.49950-3.49975"	3.50075-3.50100"
DD	3.49975-3.50000"	3.50100-3.50125"
D	3.50000-3.50025"	3.50125-3.50150"

CLIPPER & '120' EIGHT

Mark	Piston Size	Cylinder Size
AA	3.24825-3.24850"	3.24950-3.24975"
A	3.24850-3.24875"	3.24975-3.25000"
BB	3.24875-3.24900"	3.25000-3.25025"
B	3.24900-3.24925"	3.25025-3.25050"
CC	3.24925-3.24950"	3.25050-3.25075"
C	3.24950-3.24975"	3.25075-3.25100"
DD	3.24975-3.25000"	3.25100-3.25125"
D	3.25000-3.25025"	3.25125-3.25150"

CYLINDER HEADS (ALL MODELS):—Cast iron heads used on all models. Each head marked by part number on front end (and letters 'HC' for optional high compression heads).

Car	Standard	High Compression
Six	354122	354675
Eight	348200	351243
Clipper	351243	
Super 8	341586	351254

Head Installation—Coat both sides of gasket with good grade of gasket paste (not necessary on Packard service gaskets which are supplied coated). Coat studs with grease and tighten stud nuts cold. Recheck stud nut tightening tension after engine warmed-up. *See Cylinder Head Tightening Order Diagrams and Torque Wrench Tightening Tension Tables in Mechanical Equipment Section. Refer to Mechanical Equipment Index.*

REPLACEMENT PISTONS:—Finished Autothermic, Cam-ground, Tin-plated type pistons (as furnished for installation on 1941 and previous car models) are stamped on head with decimal figure (.005, .010, etc.) indicating nominal oversize and one or two letters (AA, A, BB, B, CC, C, DD, D) which indicates the actual variation of the piston (in .00025" steps) from indicated nominal oversize. See oversizes listed below and size variations for each letter (in table).

This system of marking makes it possible to order a finished piston (using number and letter) for any particular finished bore size within these limits.

Piston Oversizes (Figures Stamped on Piston Head)—Standard size and .005", .010", .020", .030", .040" oversize. See Piston Variation in table below for size variation indicated by letter.

Piston Variation
(Letters Stamped on Piston Head)
For All Models and Piston Oversizes

AA—.00025" Under marked size.
A—Same as marked size.
BB—.00025" Over marked size.
B—.0005" Over marked size.
CC—.00075" Over marked size.
C—.001" Over marked size.
DD—.00125" Over marked size.
D—.0015" Over marked size.

PISTON PIN BUSHING (ALL MODELS):—Formed by two split type bushings pressed in rod eye from opposite sides so as to form oil groove in center. Rifle-drilled oil passage in rod must open into this groove. New split type piston pin bushing must be expanded to tight fit in rod with a burnishing tool and then reamed to size for correct fit (see 'M' page for fitting data).

CONNECTING ROD 'PALNUTS (6, 8, & CLIPPER):—Special patented self-locking locknuts are used on connecting rod bolt nuts in place of cotter pins. To install, turn regular connecting rod bolt up to desired point (see Tightening Specifications in Mechanical Equipment Section). Turn 'Palnut' on bolt (smooth side toward regular nut) until it contacts nut, then tighten Palnut ¼-⅓ additional turn to lock it in place.

OIL PUMP INSTALLATION (ALL MODELS):—Install pump with driving slot as near parallel as possible to center-line of camshaft with distributor rotor in line with #1 segment in cap. Punch mark on pump gear should be at the bottom (Six), at the top (8, Clipper, & Super 8). Recheck ignition timing.

1940 & PREVIOUS MODELS

CLUTCH LINKAGE SERVICING (MODELS 1700,1; 1800,1):—Clutch pedal linkage on these models allows pedal to move downward as wear develops and clearance at ends of rods increases. Pedal position must be checked to see that pedal travel sufficient to allow complete clutch disengagement. Note that this condition is just the reverse of pedal tending to come up due to lining wear on clutch plate.

Clutch Linkage Replacement—New 1941 design clutch pedal linkage can be installed on these cars. Car manufacturer recommends that 1941 design linkage be installed where linkage requires repair or replacement. Available under following part number: Clutch Relay Equipment Part No. 377473 (1700, 1800), 277494 (1701, 1801). NOTE—1941 design linkage installation same as for 1939 and 1940 models.

A flat washer Pc. No. 24595 (included with above equipment) must be installed between face of pedal extension and shoulder on stud to prevent stud being drawn into chamfered hole. This hole in pedal extension was chamfered on 1939 and 1940 models on both sides.

HOOD LOCK NOTE:—Hood is one-piece, side-hinge type with instrument panel lock control knobs and may be raised from either side after lock released on that side. To raise hood, press down and back on control knob on side on which hood to be raised. Raise hood about 1", press in on safety rod (lower edge of hood approx. 2' forward of rear of engine) to release safety catch, lift hood up and engage support prop in opening on underside of hood (prop pivoted on dash).

SERIAL NUMBER:—Stamped on plate on left side of dash under engine hood. First number 1401-2001.

ENGINE NUMBER:—On upper left side of engine block between #3 & #4 cylinders. First No. D-400051.

ENGINE SPECIFICATIONS:—Eight cylinder, 'L' head type. **Bore**—3¼". **Stroke**—4¼".
Displacement—282 cubic ins. **Rated HP.**—33.8.
Developed Horsepower—125 at 3600 RPM.
Compression Ratio—6.85-1 Std. cast iron head.
Compression Pressure—118 lbs. at 125 RPM. cranking speed.
Vacuum Reading—18-20" steady idling at 6 MPH.

PISTONS:—Aluminum alloy, autothermic, strut type, tin plated, cam ground type. **Length**—3⅞".
Weight—17¼ ozs. (stripped), 23⅛ (with rings&pin).
Removal—Pistons and rods removed from above.
Clearance—.0005"-.001". See Fitting New Pistons.
Original Bore & Piston Sizes, Replacement Pistons:—*See Packard Shop Notes for sizes and markings.*
Fitting New Pistons:—Insert .0015" feeler ½" wide between piston and cylinder wall on side opposite slot. Pull to withdraw feeler should be 12-18 lbs.
Installing Pistons:—Slot toward valves.

PISTON RINGS:—2 Ferrox coated compression rings (Perfect Circle—#1 K-200 upper inner edge beveled, #2 K-70 lower outer edge grooved), 1 oil control (X-90 'C' wall) ring, all above pin.
IMPORTANT NOTE—K type piston ring wall thickness greater than S.A.E. wall rings and need extra deep grooves. **Do not use S.A.E. wall rings in K ring grooves as ring breakage or over oiling may result.**

Ring	Width	End Gap	Side Clearance
Comp. (#1)	.0925-.0935"	.007-.017"	.0025-.003"
Comp. (#2)	.1240-.1235"	.007-.017"	.0025-.003"
Oil Control	.1865-.186"	.007-.015"	.0015-.002"

Replacement Rings:—.005, .010", .020", .030", .040" O.S.

PISTON PIN:—**Diameter**—.875". **Length**—2 51/64". Pin floats in piston and rod, held by locking rings.
Pin Fit in Piston—Finger push fit (piston at 160°).
Pin Fit in Rod Bushing—Finger push fit at 70°F.
Replacement Pins:—Std. and .003", .006" oversize.

CONNECTING ROD:—**Length** 7 11/16". **Weight** 31.6 ozs.
Upper Bearing (Piston Pin Bushing)—Split type.
See Packard Shop Notes for servicing data.
Crankpin Bearing Diameter—2 3/32".
Lower Bearing—Shimless, precision, steel backed, babbitt lined type. Bearings furnished standard and .001", .002", .003", .015" undersize.
Clearance—.0005-.0015". **Endplay**—.004-.010".
Bearing Adjustment:—None (no shims). Replace bearings. Do not file rods or caps.
See Packard Shop Notes for 'Palnut' installation data.
Installing Rods:—Oil squirt hole toward camshaft.

CRANKSHAFT:—5 bearing, 8 integral counterweights and rubber friction disc vibration damper.
Bearing Diameter—2¾".
Bearings—Interchangeable, shimless, precision, steel-backed, babbitt lined type. Furnished standard size and .001", .002" undersize.
Clearance—.0005-.0015".
Bearing Adjustment:—None (no shims). Replace bearings (upper halves can be 'rotated' in and out).
End Thrust:—By #3 bearing. **Endplay**—.003-.008".

CAMSHAFT:—5 bearing. Non-adjustable chain drive.
Bearings—Shimless, precision, steel backed, babbitt lined type. **Clearance**—.001-.003".
End Thrust:—Taken by thrust plate in back of camshaft sprocket. **Endplay**—.0025-.006".
Timing Chain:—Morse Type C-3682R (No. 1525) or Ramsey. Width 1¼". Pitch .375". Length 21¾" or 58 links.
Camshaft Setting:—Install chain and sprockets together with '0' marks on sprockets adjacent and in line with straightedge across shaft centers.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1 31/64"	.33975"	5.619"
Exhaust	1⅜"	.33975"	5.619"

	Seat Angle	Lift	Stem Clearance
Intake	30°	.318"	.002-.003"
Exhaust	45°	.3175"	.004-.005"

Tappet Clearance:—.007" Intake, .010" Exh. (warm & idling). NOTE—Self-locking tappet screw used.
Valve Guides:—Pressed in block from above with upper end 31/32" below valve seat. Exhaust guides counter-bored on upper inner diameter to ⅜" diameter and ⅜" deep.
Valve Springs:—Intake and exhaust springs interchangeable.

	Spring Pressure	Spring Length
Valve Closed	47-52 lbs.	1⅝"
Valve Open	114-124 lbs.	1 5/16"

NOTE—Serrated washer installed on top of springs.
Valve Lifters:—Mushroom type. Remove from below with camshaft out. Lifters furnished .001", .002", .005" oversize. Use Tool S.T. 5144 (piloted in valve guide) and ream for .005" oversize lifters.
Diameter—.6235-.6240". **Clearance**—.0003-.0012".
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 1° BTDC. Close 39° ALDC.
Exhaust Valves—Open 45° BLDC. Close 5° ATDC.
Above figures correct with .0125" Intake, .015" Exhaust tappet clearance.
Valve Timing Check—With .0125" tappet clearance #1 intake valve should open with #1 piston 1° or .0004" BTDC with 1st graduation before top dead center mark '#1 UP.DC' on vibration damper lined up with pointer (permissible variation 4° either way). Reset tappet clearance .007" (hot & idling).

LUBRICATION:—Pressure (pump on right of engine).
See Packard Shop Notes for Oil Pump installation.
Normal Oil Pressure:—40 lbs. at 45 MPH.
Oil Pressure Relief Valve:—Mounted on pump cover. Not adjustable. Spring pressure 14 lbs. ± 2 oz.@1⅞".
Crankcase Capacity:—6 quarts.

COOLING SYSTEM:—**Capacity**—17 quarts.
Pressure Valve—In filler cap. Opens at 4½ lbs. (Std.), 12 lbs. (with Air Conditioning equipment).
Water Pump:—Packless, sealed ball-bearing type.
For complete data, refer to 1941 Mech. Equip. Index.
Removal—Remove fan belt, disconnect pump hose, take out pump mounting screws, lift out pump.
Thermostat:—Harrison. In cylinder head outlet.
Setting—Starts to open 147½°.

CLUTCH:—**Long Model 10CF-CI.** Semi-centrifugal, single plate, dry disc type. *Refer to Mech. Equip. Index.*
Facings—Woven (U.S. Asbestos No. 1133-G), 2 used. Inside Diam. 6". Outside Diam. 10". Thick. .125".
Adjustment:—Adjust nut on pedal rod (at clutch fork) for 1½-1¾" free travel (2" on cars with Electromatic Clutch).
Removal:—Remove transmission (see Transmission Removal following) and flywheel housing lower cover. Disconnect and remove pedal rod, clutch throw-out bearing. Remove clutch cover screws (release tension evenly) and lower assembly out.
Electromatic Clutch Control:—Electric type. Optl.
For complete data, refer to 1941 Mech. Equip. Index.

TRANSMISSION:—**Own Make.** Constant-mesh, helical, ball-bearing mounted low speed gear (sliding spur reverse gear). Synchro-mesh (second & high).
For complete data, refer to 1941 Mech. Equip. Index.
Econo-Drive Transmission:—Warner-Packard type (Warner Model AS2-R9) overdrive unit with electrical control. Optional equipment on all cars.
For complete data, refer to 1941 Mech. Equip. Index.
Transmission Control:—Own Remote Control type.
For complete data, refer to 1941 Mech. Equip. Index.
Removal:—Disconnect shifter rods, speedometer cable, hand brake cable at equalizer, engine ground strap, overdrive cable and solenoid wires (if used), front universal (block drive shaft up against floor pan) and rubber bearing at rear of overdrive. Support rear of engine with jack and unbolt cross member (at frame ends and transmission case), disconnect clutch retractor spring. Take out transmission-to-flywheel housing screws, remove assembly.

UNIVERSAL JOINTS:—**Mechanics Model 3CR (new type).** Needle bearing type.
For complete data, refer to 1941 Mech. Equip. Index.
CAUTION—Rear universal flange nut controls pinion bearing pre-load (must be adjusted whenever nut is loosened). *Refer to Mechanical Equipment Index for 'Packard Rear Axle' for instructions.*

REAR AXLE:—**Own Make.** Semi-floating, hypoid gear type with Hotchkiss drive. Cover welded in place.
For complete data, refer to 1941 Mech. Equip. Index.
Ratio—4.09-1 Std., 4.36-1 (with Econo-Drive).
Backlash—.003-.005". Screw adjustment.
Removal:—Remove wheel, hub, and brake backing plate assembly. Withdraw axle shafts. Disconnect rear universal joint and drop drive shaft. Remove carrier-to-housing bolt nuts, withdraw carrier.
Wheel Bearing Adjustment—Endplay controlled by shims between flanged end of housing and brake backing plate. Unbolt backing plate and clips holding brake tube to housing. Add or remove shims (endplay up to .050" can be adjusted to desired .006" at one wheel). **Endplay**—.004-.007".

SHOCK ABSORBERS:—**Front**—Delco Model 1946-J,K. Double acting, hydraulic type (part of Ind. Suspension). **Rear**—Monroe. Direct acting, hydraulic type.
For complete data, refer to 1941 Mech. Equip. Index.

STEERING:—**Steering Gear**—Packard (Gemmer design Model 330) Worm-and-roller type with new type steering linkage (idler arm on right frame siderail). Refer to Gemmer Model 330 article.
For complete data, refer to 1941 Mech. Equip. Index.
Front Suspension:—New type Packard 'Safe-T-Flex' Independent Suspension (parallelogram type upper and lower support arms—no torque arms).
For complete data, refer to 1941 Mech. Equip. Index.
Kingpin Inclination—5°35' crosswise.
Camber—¼° plus or minus ½°. Adjustable.
Caster—Neg. 1° plus or minus ½°. Adjustable.
Toe In—0" (plus 1/16", minus 0") at hub height. Adjust by turning adjuster at outer end of each tie rod equally.

BRAKES:—**Service.** Bendix hydraulic, duo-servo, single anchor type without eccentric adjustment. Hand lever applies rear wheel service brakes.
For complete data, refer to 1941 Mech. Equip. Index.
Drums—Centrifuse. Diameter 12".
Lining—Molded (Marshall 2201H-8). Width 1¾". Thick. 3/16". Length 11½" (primary shoe), 13" (secondary).
Clearance—.015" at both end of secondary shoe with primary shoe forced out against drum.
Hand Brake:—See Service Brake (above).

SERIAL NUMBER:—On left side of cowl (use Eng. No.).
ENGINE NUMBER:—First number D1551. On upper left side of block between #2 and #3 cylinders.
ENGINE SPECIFICATIONS:—6 cylinder, 'L' head type.
Bore—3½". **Stroke**—4¼".
Displacement—245 cu. ins. **Rated HP**—29.4.
Developed Horsepower—100 at 3600 RPM (Std. hd.).
Compression Ratio and Pressure—As follows:
6.39-1 Std. cast-iron head—110 lbs. at 125 RPM.
6.71-1 Optl. HC cast-iron hd.—118 lbs. at 125 RPM.
See Packard Shop Notes for Cylinder Head data.
Vacuum Reading—18-20" steady idling at 6 MPH.
PISTONS:—Aluminum alloy, autothermic, strut type, tin plated, cam ground type. **Length**—3⅞".
Weight—20¼ ozs. (stripped), 26¾ (with rings & pin).
Removal—Pistons and rods removed from above.
Clearance—.0005-.001". See Fitting New Pistons.
Original Bore & Piston Sizes, Replacement Pistons:—*See Packard Shop Notes for sizes and markings.*
Fitting New Pistons:—Insert .0015" feeler ½" wide between piston and cylinder wall on side opposite slot. Pull to withdraw feeler should be 12-18 lbs.
Installing Pistons:—Slot toward valves.
PISTON RINGS:—2 Ferrox coated compression rings (Perfect Circle—#1 K-200 upper inner edge beveled, #2 K-70 lower outer edge grooved), 1 oil control (X-90 'C' wall) ring, all above pin.
IMPORTANT NOTE—K type piston ring wall thickness greater than S.A.E. wall rings and need extra deep grooves. **Do not use S.A.E. wall rings in K ring grooves as ring breakage or over oiling may result.**

Ring	Width	End Gap	Side Clearance
Comp. (#1)	.0930-.0935"	.007-.017"	.0025-.003"
Comp. (#2)	.1240-.1235"	.007-.017"	.0025-.003"
Oil Control	.1865-.186"	.007-.015"	.0015-.002"

Replacement Rings:—.005", .010", .020", .030", .040" O.S.
PISTON PIN:—**Diameter**—.875". **Length**—3 1/64". Pin floats in piston and rod, held by locking rings.
Pin Fit in Piston—Finger push fit (piston at 160°).
Pin Fit in Rod Bushing—Finger push fit at 70° F.
Replacement Pins:—Std. and .003", .006" oversize.
CONNECTING ROD:—**Length** 7 11/16". **Weight** 31.6 ozs.
Upper Bearing (Piston Pin Bushing)—Split type.
See Packard Shop Notes for servicing data.
Crankpin Bearing Diameter—2 3/32".
Lower Bearing—Shimless, precision, steel backed, babbitt lined type. Bearings furnished standard and .001", .002", .003", .015" undersize.
Clearance—.0005-.0015". **Endplay**—.004-.010".
Bearing Adjustment:—None (no shims). Replace bearings. Do not file rods or caps.
See Packard Shop Notes for 'Palnut' installation data.
Installing Rods:—Oil squirt hole toward camshaft.
CRANKSHAFT:—4 bearings, 6 integral counterweights
Bearing Diameter—2¾".
Bearings—Interchangeable, shimless, precision, steel-backed, babbitt lined type. Furnished standard size and .001", .002" undersize.
Clearance—.0005-.0015".
Bearing Adjustment:—None (no shims). Replace bearings (upper halves can be 'rotated' in and out).
End Thrust:—Taken by front (#1) bearing.
Endplay—.003-.008".
CAMSHAFT:—4 bearing. Non-adjustable chain drive.
See Packard Shop Notes for Radiator & Fender assembly (unit) removal for work on front end of engine.
Bearings—Shimless, precision, steel backed, babbitt lined type. **Clearance**—.001-.003".
End Thrust:—Taken by thrust plate in back of camshaft sprocket. **Endplay**—.0025-.006".
Timing Chain:—Morse Type C-3682R (No. 1525) or Ramsey. Width 1¼". Pitch .375". Length 21¾" or 58 links.
Camshaft Setting:—Install chain and sprockets together with '0' marks on sprockets adjacent and in line with straightedge across shaft centers.

VALVES:—	Head Diameter	Stem Diameter	Length
Intake	1 19/32"	.33975"	5.619"
Exhaust	1⅜"	.33975"	5.619"

	Seat Angle	Lift	Stem Clearance
Intake	30°	.318"	.002-.003"
Exhaust	45°	.3175"	.004-.005"

Tappet Clearance:—.007" Intake, .010" Exh. (warm & idling). NOTE—Self-locking tappet screw used. Remove right front fender plate for access to valves.
Valve Guides:—Pressed in block from above with upper end 31/32" below valve seat. Exhaust guides counter-bored on upper inner diameter to ⅜" diameter and ⅜" deep.
Valve Springs:—Intake and exhaust springs interchangeable.

	Spring Pressure	Spring Length
Valve Closed	47-52 lbs.	1⅝"
Valve Open	114-124 lbs.	1 5/16"

NOTE—Serrated washer installed on top of springs.
Valve Lifters:—Mushroom type. Remove from below with camshaft out. Lifters furnished .001", .002", .005" oversize. Use Tool S.T. 5144 (piloted in valve guide) and ream for .005" oversize lifters.
Diameter—.6235-.6240". **Clearance**—.0003-.0012".
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 1° BTDC. Close 39° ALDC.
Exhaust Valves—Open 45° BLDC. Close 5° ATDC.
Above figures correct with .0125" Intake, .015" Exhaust tappet clearance.
Valve Timing Check—With .0125" tappet clearance #1 intake valve should open with #1 piston 1° or .0004" BTDC with 1st graduation before top dead center mark '#1 UP.DC' on vibration damper lined up with pointer (permissable variation 4° either way). Reset tappet clear. .007" (hot & idling).
LUBRICATION:—Pressure (pump on right of engine).
See Packard Shop Notes for Oil Pump installation.
Normal Oil Pressure:—40 lbs. at 45 MPH.
Oil Pressure Relief Valve:—Mounted on pump cover. Not adjustable. Spring pressure 14 lbs. ± 2 oz. @ 1⅞".
Crankcase Capacity:—5 quarts.
COOLING SYSTEM:—**Capacity**—15 quarts.
Pressure Valve—In filler cap. Opens at 4½ lbs. (Std.), 12 lbs. (with Air Conditioning equipment).
Water Pump:—Packless, sealed ball-bearing type.
For complete data, refer to 1941 Mech. Equip. Index.
Removal—Remove fan belt, disconnect pump hose, take out pump mounting screws, lift out pump.
Thermostat:—Bishop & Babcock. In head outlet.
Setting—Starts to open at 147½° F.
CLUTCH:—**Long Model 9½CF-CS, 11CFS-CI (Taxi).** Semi-centrifugal, single plate, dry disc types.
Taxi Note—Clutch is a riveted assembly.
For complete data, refer to 1941 Mech. Equip. Index.
Facings—Woven (U.S. Asbestos No. 1133-G), 2 used. I.D. 6", 6½" (Taxi). O.D. 9½", 11" (Taxi). Thick. ⅛".
Adjustment:—Adjust nut on pedal rod (at clutch fork) for 1½-1¾" free travel (2" when equipped with Electromatic Clutch).
Removal:—Remove transmission (see Transmission Removal following) and flywheel housing lower cover. Disconnect and remove pedal rod, clutch throw-out bearing. Remove clutch cover screws (release tension evenly) and lower assembly out.
Electromatic Clutch Control:—Electric type. Optl.
For complete data, refer to 1941 Mech. Equip. Index.
TRANSMISSION:—**Own Make.** Constant-mesh, helical, ball-bearing mounted low speed gear (sliding spur reverse gear). Synchro-mesh (second & high).
For complete data, refer to 1941 Mech. Equip. Index.
Econo-Drive Transmission:—Warner-Packard type (Warner Model AS2-R9) overdrive unit with electrical control. Optl. *Refer to Mech. Equip. Index.*
Transmission Control:—Own Remote Control type.
For complete data, refer to 1941 Mech. Equip. Index.
Removal:—Disconnect shifter rods, speedometer cable, hand brake cable at equalizer, engine ground strap, overdrive cable and solenoid wires (if used), front universal (block drive shaft up against floor pan) and rubber bearing at rear of overdrive. Support rear of engine with jack and unbolt cross member (at frame ends and flywheel housing lower cover). Disconnect clutch retractor spring and fore and aft restraint rod. Take out transmission-to-flywheel housing screws, remove assembly.
UNIVERSAL JOINTS:—**Detroit-Universal Series 4251 (4200 front, 5150 rear).** Front joint is ball & trunnion type with roller bearings (takes slip or end travel—no slip joint used). Rear joint is roller bearing type with cross.
For complete data, refer to 1941 Mech. Equip. Index.
CAUTION—Rear universal flange controls pinion bearing pre-load. *For complete data, refer to 1941 Mech. Equip. Index for Packard Rear Axle article.*
REAR AXLE:—**Own Make.** Semi-floating, Hypoid gear type with Hotchkiss drive. Cover welded in place.
For complete data, refer to 1941 Mech. Equip. Index.
Ratio—4.3-1 Std. 4.55-1 with Econo-Drive trans'm.
Backlash—.003-.005". Screw adjustment.
Removal:—Remove wheel, hub, and brake backing plate assembly. Withdraw axle shafts. Disconnect rear universal joint and drop drive shaft. Remove carrier-to-housing bolt nuts, withdraw carrier.
Wheel Bearing Adjustment—Endplay controlled by shims between flanged end of housing and brake backing plate. Unbolt backing plate and clips holding brake tube to housing. Add or remove shims (endplay up to .050" can be adjusted to desired .006" at one wheel). **Endplay**—.004-.007".

SHOCK ABSORBERS:—	Front	Rear
Domestic	Delco 1966-C,D	Monroe 364630
Export	Delco 1966-C,D	Delco 1130-W

Front shocks are double acting type. Rear shocks are direct acting (adjustable type Delco).
For complete data, refer to 1941 Mech. Equip. Index.
NOTE—No Fifth Shock Absorber used.
STEERING:—**Steering Gear**—Packard (Gemmer design Model 330) Worm-and-roller type with center steering. Refer to Gemmer Model 330 article.
For complete data, refer to 1941 Mech. Equip. Index.
Front Suspension:—Independent 'Safe-T-fleX' type (parallelogram type—coil springs & torque arms).
For complete data, refer to 1941 Mech. Equip. Index.
NOTE—Frame height must be set first before checking Caster and Camber.
Frame Height—With car on level floor, distance from floor to top of frame side rail at front wheel center-line 17⅝" (load car until figure correct).
Kingpin Inclination—2½° crosswise.
Camber—Pos. ½° (plus ¾°, minus 0°). Adjustable.
Caster—Pos. ½° ± ½°. Shim adjustment.
Toe In—0" (+ 1/16", — 0") at hub height. Turn both tie rods equally (rod lengths equal within ½").
Steering Geometry—Inner wheel 23½°. Outer 20°.
BRAKES:—**Service.** Bendix hydraulic, duo-servo, single anchor type without eccentric adjustment. Hand lever applies rear wheel service brakes.
For complete data, refer to 1941 Mech. Equip. Index.
Drums—Centrifuse. Diameter 11".
Lining—Molded (Marshall 2201). Width 1¾". Thick. 3/16". Length 10⅝" (primary shoe), 12" (secondary).
Clearance—.015" at both ends of secondary shoe with primary shoe forced out against drum.
Hand Brake:—See Service Brakes above.

SERIAL NUMBER:—On left side of cowl (use Eng. No.).
ENGINE NUMBER:—First number D300051. On upper left side of block between #2 and #3 cylinders.
ENGINE SPECIFICATIONS:—8 cylinder, 'L' head type. **Bore**—3¼". **Stroke**—4¼". **Displacement**—282 cu. ins. **Rated HP**—33.8. **Developed Horsepower**—120 at 3600 RPM (Std. hd.). **Compression Ratio and Pressure**—As follows: 6.41-1 Std. cast-iron head—110 lbs. at 125 RPM. 6.85-1 Optl. HC cast-iron hd.—118 lbs. at 125 RPM. *See Packard Shop Notes for Cylinder Head data.* **Vacuum Reading**—18-20" steady idling at 6 MPH.
PISTONS:—Aluminum alloy, autothermic, strut type, tin plated, cam ground type. **Length**—3⅞". **Weight**—17¼ oz. (stripped), 23⅛ (with rings & pin). **Removal**—Pistons and rods removed from above. **Clearance**—.0005-.001". See Fitting New Pistons.
Original Bore & Piston Sizes, Replacement Pistons:—*See Packard Shop Notes for sizes and markings.*
Fitting New Pistons:—Insert .0015" feeler ½" wide between piston and cylinder wall on side opposite slot. Pull to withdraw feeler should be 12-18 lbs.
Installing Pistons:—Slot toward valves.
PISTON RINGS:—2 Ferrox coated compression rings (Perfect Circle—#1 K-200 upper inner edge beveled, #2 K-70 lower outer edge grooved), 1 oil control (X-90 'C' wall) ring, all above pin.
IMPORTANT NOTE—K type piston ring wall thickness greater than S.A.E. wall rings and need extra deep grooves. **Do not use S.A.E. wall rings in K ring grooves as ring breakage or over oiling may result.**

Ring	Width	End Gap	Side Clearance
Comp. (#1)	.0925-.0935"	.007-.017"	.0025-.003"
Comp. (#2)	.1240-.1235"	.007-.017"	.0025-.003"
Oil Control	.1865-.186"	.007-.015"	.0015-.002"

Replacement Rings:—.005", .010", .020", .030", .040" O.S.
PISTON PIN:—**Diameter**—.875". **Length**—2 51/64". Pin floats in piston and rod, held by locking rings. **Pin Fit in Piston**—Finger push fit (piston at 160°). **Pin Fit in Rod Bushing**—Finger push fit at 70° F.
Replacement Pins:—Std. and .003", .006" oversize.
CONNECTING ROD:—**Length** 7 11/16". **Weight** 31.6 ozs. **Upper Bearing (Piston Pin Bushing)**—Split type. *See Packard Shop Notes for servicing data.* **Crankpin Bearing Diameter**—2 3/32". **Lower Bearing**—Shimless, precision, steel backed, babbitt lined type. Bearings furnished standard and .001", .002", .003", .015" undersize. **Clearance**—.0005-.0015". **Endplay**—.004-.010".
Bearing Adjustment:—None (no shims). Replace bearings. Do not file rods or caps. *See Packard Shop Notes for 'Palnut' installation data.*
Installing Rods:—Oil squirt hole toward camshaft.
CRANKSHAFT:—5 bearings, 8 integral counterweights **Bearing Diameter**—2¾". **Bearings**—Interchangeable, shimless, precision, steel-backed, babbitt lined type. Furnished standard size and .001", .002" undersize. **Clearance**—.0005-.0015".
Bearing Adjustment:—None (no shims). Replace bearings (upper halves can be 'rotated' in and out).
End Thrust:—By #3 bearing. **Endplay**—.003-.008".
CAMSHAFT:—5 bearing. Non-adjustable chain drive. *See Packard Shop Notes for Radiator & Fender assembly (unit) removal for work on front end of engine.* **Bearings**—Shimless, precision, steel backed, babbitt lined type. **Clearance**—.001-.003".
End Thrust:—Taken by thrust plate in back of camshaft sprocket. **Endplay**—.0025-.006".
Timing Chain:—Morse Type C-3682R (No. 1525) or Ramsey. Width 1¼". Pitch .375". Length 21¾" or 58 links.
Camshaft Setting:—Install chain and sprockets together with '0' marks on sprockets adjacent and in line with straightedge across shaft centers.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1 31/64"	.33975"	5.619"
Exhaust	1⅜"	.33975"	5.619"

	Seat Angle	Lift	Stem Clearance
Intake	30°	.318"	.002-.003"
Exhaust	45°	.3175"	.004-.005"

Tappet Clearance:—.007" Intake, .010" Exh. (warm & idling). NOTE—Self-locking tappet screw used. Remove right front fender plate for access to valves.
Valve Guides:—Pressed in block from above with upper end 31/32" below valve seat. Exhaust guides counter-bored on upper inner diameter to ⅜" diameter and ⅜" deep.
Valve Springs:—Intake and exhaust springs interchangeable.

	Spring Pressure	Spring Length
Valve Closed	47-52 lbs.	1⅝"
Valve Open	114-124 lbs.	1 5/16"

NOTE—Serrated washer installed on top of springs.
Valve Lifters:—Mushroom type. Remove from below with camshaft out. Lifters furnished .001", .002", .005" oversize. Use Tool S.T. 5144 (piloted in valve guide) and ream for .005" oversize lifters. **Diameter**—.6235-.6240". **Clearance**—.0003-.0012".
Valve Timing:—See Camshaft Setting above. **Intake Valves**—Open 1° BTDC. Close 39° ALDC. **Exhaust Valves**—Open 45° BLDC. Close 5° ATDC. Above figures correct with .0125" Intake, .015" Exhaust tappet clearance. **Valve Timing Check**—With .0125" tappet clearance #1 intake valve should open with #1 piston 1° or .0004" BTDC with 1st graduation before top dead center mark '#1 UP.DC' on vibration damper lined up with pointer (permissable variation 4° either way). Reset tappet clear. .007" (hot & idling).
LUBRICATION:—Pressure (pump on right of engine). *See Packard Shop Notes for Oil Pump installation.*
Normal Oil Pressure:—40 lbs. at 45 MPH.
Oil Pressure Relief Valve:—Mounted on pump cover. Not adjustable. Spring pressure 14 lbs. ± 2 oz. @ 1⅞".
Crankcase Capacity:—6 quarts.
COOLING SYSTEM:—**Capacity**—17 quarts. **Pressure Valve**—In filler cap. Opens at 4½ lbs. (Std.), 12 lbs. (with Air Conditioning equipment).
Water Pump:—Packless, sealed ball-bearing type. *For complete data, refer to 1941 Mech. Equip. Index.* **Removal**—Remove fan belt, disconnect pump hose, take out pump mounting screws, lift out pump.
Thermostat:—Harrison. In cylinder head outlet. **Setting**—Starts to open 147½°.
CLUTCH:—**Long Model 10CF-CI.** Semi-centrifugal, single plate, dry disc type. *Refer to Mech. Equip. Index.* **Facings**—Woven (1901—U. S. Asbestos 1133-G, 1901-A—Hycoe DV3112A), 2 required. Inside Diameter 6". Outside Diameter 10". Thickness .125".
Adjustment:—Adjust nut on pedal rod (at clutch fork) for 1½-1¾" free travel (2" when equipped with Electromatic Clutch).
Removal:—Remove transmission (see Transmission Removal following) and flywheel housing lower cover. Disconnect and remove pedal rod, clutch throw-out bearing. Remove clutch cover screws (release tension evenly) and lower assembly out.
Electromatic Clutch Control:—Electric type. Optl. *For complete data, refer to 1941 Mech. Equip. Index.*
TRANSMISSION:—**Own Make.** Constant-mesh, helical, ball-bearing mounted low speed gear (sliding spur reverse gear). Synchro-mesh (second & high). *For complete data, refer to 1941 Mech. Equip. Index.*
Econo-Drive Transmission:—Warner-Packard type (Warner Model AS2-R9) overdrive unit with electrical control. Optl. *Refer to Mech. Equip. Index.*
Transmission Control:—Own Remote Control type. *For complete data, refer to 1941 Mech. Equip. Index.*
Removal:—Disconnect shifter rods, speedometer cable, hand brake cable at equalizer, engine ground strap, overdrive cable and solenoid wires (if used), front universal (block drive shaft up against floor pan) and rubber bearing at rear of overdrive. Support rear of engine with jack and unbolt cross member (at frame ends and flywheel housing lower cover). Disconnect clutch retractor spring and fore and aft restraint rod. Take out transmission-to-flywheel housing screws, remove assembly.
UNIVERSAL JOINTS:—**Mechanics Model 3CR (new type), 3C (front shaft 1901A).** Needle bearing type. *For complete data, refer to 1941 Mech. Equip. Index.* CAUTION—Rear universal flange controls pinion bearing pre-load. *For complete data, refer to 1941 Mech. Equip. Index for Packard Rear Axle article.*
REAR AXLE:—**Own Make.** Semi-floating, Hypoid gear type with Hotchkiss drive. Cover welded in place. *For complete data, refer to 1941 Mech. Equip. Index.* **Ratio**—Std: 4.09-1 (1901); 4.7-1, 4.9-1 or 5.22-1 (1901A). For Econo-Drive: 4.36-1 (1901), 4.9-1 (1901A). **Backlash**—.003-.005". Screw adjustment.
Removal:—Remove wheel, hub, and brake backing plate assembly. Withdraw axle shafts. Disconnect rear universal joint and drop drive shaft. Remove carrier-to-housing bolt nuts, withdraw carrier. **Wheel Bearing Adjustment**—Endplay controlled by shims between flanged end of housing and brake backing plate. Unbolt backing plate and clips holding brake tube to housing. Add or remove shims (endplay up to .050" can be adjusted to desired .006" at one wheel). **Endplay**—.004-.007".
SHOCK ABSORBERS:—

	Delco: Front	Rear
1901, 1901A	1966-C,D	1021-V
1901 Export	1966-C,D	1030-W

Double acting type (1966-C,D), Direct acting (1021-V), Adjustable direct acting (1030-W). *For complete data, refer to 1941 Mech. Equip. Index.*
Fifth Shock Absorber (Stabilizer):—Houdaille Model NFT. Double acting, hydraulic, adjustable type. *For complete data, refer to 1941 Mech. Equip. Index.*
STEERING:—**Steering Gear**—Packard (Gemmer design Model 330) Worm-and-roller type with center steering. Refer to Gemmer Model 330 article. *For complete data, refer to 1941 Mech. Equip. Index.*
Front Suspension:—Independent 'Safe-T-fleX' type (parallelogram type—coil springs & torque arms). *For complete data, refer to 1941 Mech. Equip. Index.* NOTE—Frame height must be set first before checking Caster and Camber.
Frame Height—With car on level floor, distance from floor to top of frame side rail at front wheel center-line 18⅛" (1901), 18¾" (1901A). Load car until this figure obtained. **Kingpin Inclination**—2½° crosswise. **Camber**—Pos. ½° (plus ¾°, minus 0°). Adjustable. **Caster**—Pos. ½° ± ½°. Shim adjustment. **Toe In**—0" (+ 1/16", — 0") at hub height. Turn both tie rods equally (rod lengths equal within ½"). **Steering Geometry**—Inner wheel 23½°. Outer 20°.
BRAKES:—**Service.** Bendix hydraulic, duo-servo, single anchor type without eccentric adjustment. Hand lever applies rear wheel service brakes. *For complete data, refer to 1941 Mech. Equip. Index.* **1901A Note**—*See 1941 Packard Super 8 'M' page.* **Drums**—Centrifuse. Diameter 12". **Lining**—Molded (Marshall 2201). Width 1¾". Thick. 3/16". Length 11½" (primary shoe), 13" (secondary). **Clearance**—.015" at both ends of secondary shoe with primary shoe forced out against drum.
Hand Brake:—See Service Brake (above).

SERIAL NUMBER:—On left side of cowl (use Eng. No.).
ENGINE NUMBER:—First number D-500,051 (1903,4,5), CD-500,051 (1906,7,8). Stamped on upper left side of cylinder block between #3 and #4 cylinders.
ENGINE SPECIFICATIONS:—8 cylinder, 'L' head type. **Bore**—3½". **Stroke**—4⅝". **Displacement**—356 cu. ins. **Rated HP**—39.2. **Developed Horsepower**—160 at 3600 RPM (Std. hd.). **Compression Ratio**—6.45-1 Std., 6.85-1 Optl. CI hds. **Compression Pressure**—118 lbs. at cranking speed for standard 6.45-1 head. *See Packard Shop Notes for Cylinder Head data.* **Vacuum Reading**—18½" steady idling at 6 MPH.
PISTONS:—Aluminum alloy, autothermic, strut type, tin plated, cam ground type. **Length**—3⅞". **Weight**—20¼ ozs. (stripped), 26¾" (with rings&pin). **Removal**—Pistons and rods removed from above. **Clearance**—.0005-.001". See Fitting New Pistons. **Original Bore & Piston Sizes, Replacement Pistons:**—*See Packard Shop Notes for sizes and markings.* **Fitting New Pistons:**—Insert .0015" feeler ½" wide between piston and cylinder wall on side opposite slot. Pull to withdraw feeler should be 12-18 lbs. **Installing Pistons:**—Slot toward valves.
PISTON RINGS:—2 Ferrox coated compression rings (Perfect Circle—#1 K-200 upper inner edge grooved, #2 K-70 lower outer edge grooved), 1 oil control (X-90 'C' wall) ring, all above pin. IMPORTANT NOTE—K type piston ring wall thickness greater than S.A.E. wall rings and need extra deep grooves. **Do not use S.A.E. wall rings in K ring grooves as ring breakage or over oiling may result.**

Ring	Width	End Gap	Side Clearance
Comp. (#1)	.0930-.0935"	.007-.017"	.0025-.003"
Comp. (#2)	.1240-.1235"	.007-.017"	.0025-.003"
Oil Control	.1865-.186"	.007-.015"	.0015-.002"

Replacement Rings:—.005", .010", .020", .030", .040" O.S.
PISTON PIN:—**Diameter**—.875". **Length**—3 1/64". Pin floats in piston and rod, held by locking rings. **Pin Fit in Piston**—Finger push fit (piston at 160°). **Pin Fit in Rod Bushing**—Finger push fit at 70° F. **Replacement Pins:**—Std. and .003", .006" oversize.
CONNECTING ROD:—**Length** 9¼". **Weight** 42.0 ozs. **Upper Bearing (Piston Pin Bushing)**—Split type. *See Packard Shop Notes for servicing data.* **Crankpin Bearing Diameter**—2¼". **Lower Bearing**—Shimless, precision, steel backed, babbitt lined type. Bearings furnished standard and .001", .002", .003", .015" undersize. **Clearance**—.0005-.0015". **Endplay**—.004-.010". **Bearing Adjustment:**—None (no shims). Replace bearings. Do not file rods or caps. **Installing Rods:**—Oil squirt hole toward camshaft.
CRANKSHAFT:—9 bearings, 8 bolted counterweights **Bearing Diameter**—2¾". **Bearings**—Interchangeable, shimless, precision, steel-backed, babbitt lined type. Furnished standard size and .001", .002" undersize. **Clearance**—.0005-.0015". **Bearing Adjustment:**—None (no shims). Replace bearings (upper halves can be 'rotated' in and out). **End Thrust:**—By #5 bearing. **Endplay**—.003-.008".
CAMSHAFT:—8 bearing. Non-adjustable chain drive. *See Packard Shop Notes for Radiator & Fender Assembly (unit) removal for work on front end of engine.* **Bearings**—Shimless, precision, steel-backed, babbitt lined type. **Clearance**—.001-.003". **End Thrust:**—Taken by thrust plate in back of camshaft sprocket. **Endplay**—.0025-.006". **Timing Chain:**—Morse Type C-3682R (No. 765). Width 1¼". Pitch .375". Length 62 links or 23¼". **Camshaft Setting:**—Install chain and sprockets together with '0' marks on sprockets adjacent and in line with a straightedge across the shaft centers.
VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1.670"	.33975"	6.212"
Exhaust	1 7/16"	.33975"	6.212"

	Seat Angle	Lift	Stem Clearance
Intake	30°	.340"	.002-.003"
Exhaust	45°	.340"	.004-.005"

Tappet Clearance:—None (automatic take-up used). **Valve Guides:**—Pressed in block from above with upper end 31/32" below valve seat. Exhaust guides counter-bored on upper inner diameter to ⅜" diameter and ⅜" deep. **Valve Springs:**—Washer used on top of each spring.

	Spring Pressure	Spring Length
Valve Closed	55-61 lbs.	1¾"
Valve Open	130-140 lbs.	1 13/32"

Valve Lifters:—Wilcox-Rich 'Zero-lash' type hydraulic lifters (mushroom type). Remove from below with camshaft out. Lifters furnished .001", .002", .005" oversize. Use Tool S.T. 5101 (piloted in valve guide) and ream for .005" oversize lifters. **Diameter** .7177-.7182". **Clearance** .0002" selective. *For complete data, refer to 1941 Mech. Equip. Index.* **Valve Timing:**—See Camshaft Setting above. **Intake Valves**—Open 4° BTDC. Close 51° ALDC. **Exhaust Valves**—Open 49° BLDC. Close 10° ATDC. **Valve Timing Check**—#1 exhaust valve close 10° after top dead center (#1 piston .0438" ATDC) with hydraulic lifter dry (all oil drained out) and built up with feeler stock for zero tappet clearance.
LUBRICATION:—Pressure (pump on right of engine). *See Packard Shop Notes for Oil Pump Installation.* **Normal Oil Pressure:**—50 lbs. at 45 MPH. **Oil Pressure Relief Valve:**—On pump cover. Not adjustable. Spring pressure 17½-18½ lbs. at 1⅞". **Crankcase Capacity:**—7 quarts.
COOLING SYSTEM:—**Capacity**—20 quarts. **Pressure Valve**—In filler cap. Opens at 7 lbs. (Std.), 12 lbs. (with Air Conditioning equipment). **Water Pump:**—Packless, sealed ball-bearing type. *For complete data, refer to 1941 Mech. Equip. Index.* **Removal**—Remove fan belt, disconnect pump hose, take out pump mounting screws, lift out pump. **Thermostat:**—Harrison. In radiator top tank (operates radiator shutters). Starts to open 135°F. NOTE—If cylinder head water outlet thermostat used, this thermostat starts to open at 162½°F.
CLUTCH:—**Long Model 11CFS-CI.** Semi-centrifugal single plate, dry disc type (riveted assembly). *For complete data, refer to 1941 Mech. Equip. Index.* **Facings**—Woven (U.S. Asbestos No. 1133-G), 2 used. Inside Diam. 6½". Outside Diam. 11". Thick. .125". **Adjustment:**—Adjust nut on pedal rod (at clutch fork) for 1¾-2¼" free travel. **Removal:**—Remove transmission (see Transmission Removal following) and flywheel housing lower cover. Disconnect and remove pedal rod, clutch throw-out bearing. Remove clutch cover screws (release tension evenly) and lower assembly out. **Electromatic Cluteh Control:**—Electric type. Optl. *For complete data, refer to 1941 Mech. Equip. Index.*
TRANSMISSION:—**Own Make.** Constant-mesh, helical, ball-bearing mounted low speed gear (sliding spur reverse gear). Synchro-mesh (second & high). *For complete data, refer to 1941 Mech. Equip. Index.* **Econo-Drive Transmission:**—Warner-Packard type (Warner Model AS1-R9A) overdrive unit with electrical control. Optional equipment on all cars. *For complete data, refer to 1941 Mech. Equip. Index.* **Transmission Control:**—Own Remote Control type. *For complete data, refer to 1941 Mech. Equip. Index.* **Removal:**—*See 1941 Packard 8 '120' M page.*
UNIVERSAL JOINTS:—**Mechanics Model 3CR (new type), 3C (front shaft 1903A,6,7,8).** Needle bearing. *For complete data, refer to 1941 Mech. Equip. Index.* CAUTION—Rear universal flange controls pinion bearing pre-load. *For complete data, refer to 1941 Mech. Equip. Index for Packard Rear Axle article.*
REAR AXLE:—**Own Make.** Semi-floating, Hypoid gear type with Hotchkiss drive and special Ring Gear Support Roller. Cover welded in place. *For complete data, refer to 1941 Mech. Equip. Index.*

Model	Ratios: Std.	Econo-Dr.	Optl.
1903, 1906	3.92-1	4.36-1	4.09-1
1904, 1907	4.09-1	4.36-1	4.36-1
1905, 1908	4.36-1	4.54-1	4.54-1
1903A	4.54-1	4.7-1	4.7-1
1903AB	5.12-1		

Backlash—.003-.005". Screw adjustment. **Removal & Wheel Bearing Adjustment:**—*See 1941 Packard 8 Model 1901,1A 'M' page (preceding) for data.*
SHOCK ABSORBERS:—**Front**—Delco Model 1966-C,D. Double acting, hydraulic type. **Rear** 1903 Coupes & 1906: Monroe 364725 (Valve Assembly 11423 superseded by 11428); 1903 Sedans: Monroe 362710; All Others: Delco 1021-V; All Models Export: Delco 1030-W. All rear shocks are hydraulic, direct acting type (Delco 1030-W is an adjustable direct type). *For complete data, refer to 1941 Mech. Equip. Index.* **Fifth Shock Absorber (Stabilizer):**—Houdaille Model NFT. Double acting, hydraulic, adjustable type. *For complete data, refer to 1941 Mech. Equip. Index.*
STEERING:—**Steering Gear**—Packard (Gemmer design Model 330) Worm-and-roller type with center steering. Refer to Gemmer Model 330 article. *For complete data, refer to 1941 Mech. Equip. Index.* **Front Suspension:**—Independent 'Safe-T-fleX' type (parallelogram type—coil springs & torque arms). *For complete data, refer to 1941 Mech. Equip. Index.* NOTE—Frame height must be set first before checking Caster and Camber. **Frame Height**—With car on level floor, distance from floor to top of frame side rail at front wheel center-line 18¾" (1903,4,5,6,7,8), 19¼" (1903A, 3AB). Load car until figure correct. **Kingpin Inclination**—2½° crosswise. **Camber**—Pos. ½° (plus ¾°, minus 0°). Adjustable. **Caster**—Negative ¾° plus or minus ½° (all except 1903A, 3AB). 2½° plus or minus ½° (1903A, 3AB only). **Toe In**—0" (+ 1/16", — 0") at hub height. Turn both tie rods equally (rod lengths equal within ½"). **Steering Geometry**—Inner wheel 23½°. Outer 20°.
BRAKES:—Service. Bendix hydraulic, duo-servo, single anchor type with eccentric adjustment (except 1903 & 6). Hand lever applies rear service brakes. *For complete data, refer to 1941 Mech. Equip. Index.* **Drum**—Centrifuse. Diameter 12". **Lining**—Moulded type. Marshall 2201.

Model	Width	Thickness	Length per Shoe Primary	Secondary
1903,6	2"	3/16"	11½"	13"
1904,5,7,8	2¼"	3/16"	13"	13"
1901A①	2¼"	3/16"	13"	13"
1901A②	2½"	3/16"	13"	—
1901A②	2¼"	3/16"	—	13"
1903A①	2½"	3/16"	13"	13"
1903AB③ Front	2½"	3/16"	13"	13"
1903AB③ Rear	2¾"	3/16"	15"	15"

①—Hearse & Ambulance. ③—Airport Limousine.
②—Heavy Duty Ambulance 4194HD, 4194HDF.
Clearance—All except 1903,6—.010" at heel and toe of each shoe. **1903,6**—.015" at both ends of secondary shoe with primary shoe forced out against drum.
Hand Brake:—See Service Brakes (above).

HOOD LOCK, FRONT END ASSEMBLY & OIL PAN REMOVAL:—*See Chrysler Shop Notes.*

SERIAL NUMBER:—On right front door hinge post.

	Detroit	Los Angeles	Evansville	Canada
P11	15,000,101	3,121,501	22,001,001	9,821,241
P12	11,123,001	3,269,301	20,105,001	9,616,761

ENGINE NUMBER:—P11-1001 (P11), P12-1001 & up (P12). On left side of block between #1 & #2 cyls. *See Chrysler Shop Notes for Engine Number Lettering data ('Special Standard' bore and bearing sizes).*

ECONOMY MODEL NOTE:—These cars have special Carburetor and Rear Axle ratio. Identified by 'E' in Eng. No. as follows: P11-E-1001 or P12-E-1001.

ENGINE SPECIFICATIONS:—6 cylinder, 'L' head type. **Bore**—3⅛". **Stroke**—4⅜".
Displacement—201.3 cu. ins. **Rated HP**—23.44.
Developed Horsepower—87 HP at 3800 RPM.
Compression Ratio—6.7-1 cast-iron head std.
Compression Pressure—145-155 lbs. at 1000 RPM or 110-120 lbs. at cranking speed (125 RPM).
Vacuum Reading—Steady 18-20" idling (below 1000'). *See Chrysler Shop Notes for Engine Removal directions.*

PISTONS:—Two types used optionally: (1)—Aluminum alloy, U-slot, cam ground, tin coated. **Length**—3 11/16". **Weight**—14.4 ozs. (stripped). **(2)**—Steel banded, aluminum alloy and steel. **Length**—3 5/16". **Weight**—14.5 ozs. (stripped).
Removal—Pistons and rods removed from above.
Clearance—Top land .028" (U-slot), .031" (steel banded). Skirt .0001-.0011" (U-slot), .001-.002" (steel).
Original Bore & Piston Sizes, Replacement Pistons:—*See Chrysler Shop Notes for sizes and markings.*
Fitting New Pistons:—Check piston size with micrometer at bottom of skirt at right angles to pin bosses. With piston and wall dry, piston should pass through bore of own weight (pin removed) with slight drag at normal room temperature (70° F.).
Installing Pistons:—Slot away from valves (U-slot). Strut toward front of engine (steel-banded type).

PISTON RINGS:—4 rings, all above pin—#1 Compression (upper inner edge stepped), #2 Comp. (lower outer edge stepped), #3 and #4 (slotted oil rings).

Ring	Width	End Gap	Side Clearance
Compr. (Top)	3/32"	.007-.015"	.0025-.004"
Compr. (#2)	⅛"	.007-.015"	.0015-.0035"
Oil Control	5/32"	.007-.015"	.001-.0025"

Replacement Rings:—Std. & .003", .005", .010", .015", .020", .023", .025", .030", .040", .050", .060" oversize.

PISTON PIN:—**Diameter**—55/64". **Length**—2⅝". Floating type. Pin hole in rod bronze bushed.
Pin Fit in Piston—Thumb push fit (piston at 100°).
Pin Fit in Rod Bushing—Thumb push fit at 70° F.
Replacement Pins:—Std. & .003", .005", .008" oversize.

CONNECTING ROD:—**Weight** 31.52 ozs. (with bearings and bolts). **Length**—7 15/16".
Lower Bearing Diameter—1 15/16". *See Engine Lettering Note in Chrysler Shop Notes for 'Special Std.' size.*
Lower Bearing—Removable, precision type, thin babbitt. **Clearance** .0005-.0015". **Sideplay** .0055-.0115".
Bearing Adjustment:—None (no shims). Replace bearings. *See Chrysler Shop Notes for instructions.*
Replacement Bearings:—*See Chrysler Shop Notes.*
Installing Rods:—Wide portion of bearing to rear (#1, 3, 5) to front (#2, 4, 6). Oil hole to camshaft.

CRANKSHAFT:—4 bearings, 7 integral counterweights. *See Chrysler Shop Notes for Replacement Main Bearing Caps and Crankshaft Front and Rear Oil Seals.*
Bearing Diameters—2¼". *See Engine Lettering Note in Chrysler Shop Notes for 'Special Standard' size.*
Bearing Type—Removable, precision type, thin babbitt on steel. **Clearance**—.001-.002".
Bearing Adjustment:—*See Chrysler Shop Notes for bearing removal, replacement sizes and adjustment data.*
End Thrust:—Taken by flange faces on rear (#4) main bearing. **Endplay**—.003-.007".

CAMSHAFT:—4 bearing. Non-adjustable chain drive. NOTE—2 types used (see Valve Timing).
See Chrysler Shop Notes for Camshaft Removal.
Bearing Diameters—#1, 2"; #2, 1 31/32"; #3, 1 15/16"; #4, 1¼".
Bearing Type—Removable steel-backed, babbitt-lined bushings (except #4 machined in block).
Clearance—.001-.003" (#1), .0015-.0035" (all others).
End Thrust:—Taken by thrust plate behind camshaft sprocket hub. **Endplay**—.002-.006".
Timing Chain:—Morse Type 1883N, No. 2661. Width 1". Pitch .500" (½"). Length 24" or 48 links.
Camshaft Setting:—Sprockets marked. Mesh chain with sprockets turned so that '0' marks are adjacent and in line with a straightedge across shaft centers.

VALVES:—

	Head Diameter	Stem Diameter	Length
All Valves	1 15/32"	.340-.341"	4 25/32"

	Seat Angle	Lift	Stem Clearance
Intake	45°	⅜"	.001-.003"
Exhaust	45°	⅜"	.003-.005"

See Chrysler Shop Notes for Exhaust Valve Seat Inserts.
Tappet Clearance:—.008" Intake, .010" Exh. (hot and idling), .002" additional exh. clearance desirable for sustained high speeds. NOTE—Tappet screws self-locking (no locknuts). Remove right front wheel and lower wheel housing panel for access to valves.
Valve Guides:—Remove from above. Press new guides in (stepped end down) with upper end ⅞" below top of block, ream to .342-.343" Int., .344-.345" Exh.
Valve Springs:—Install with closely coiled end to top.

	Spring Pressure	Length
Free length 2".		
Valve Closed	40- 45 lbs.	1¾"
Valve Open	107-115 lbs.	1⅜"

Valve Lifters:—Mushroom type (remove from below). Stem diam. ⅝". Ream holes from above (pilot in valve guide). Oversizes .001", .008", .030" & .060".
Lifter Clearance in Block—.000-.001".
Valve Timing:—See Camshaft Setting above.
Engine Numbers 1001 to 150391
Intake Valves—Open 12° BTDC. Close 44° ALDC.
Exhaust Valves—Open 50° BLDC. Close 6° ATDC.
Engine Number 150392 and Up
Intake Valves—Open 9° BTDC. Close 47° ALDC.
Exhaust Valves—Open 47° BLDC. Close 9° ATDC.
Valve Timing Check—With .014" (cold) tappet clearance #6 intake valve should open with #6 piston **12° or .060" (up to Engine No. 150391), 9° or .0343" BTDC (Engine No 150392 and Up)** with 12th graduation (first cars), 9th graduation (later cars) before DC mark on crankshaft pulley aligned with pointer on cover. Reset tappet clear .008" hot.

LUBRICATION:—Pressure (pump on right of engine). *See Chrysler Shop Notes for Oil Pump Removal.*
Normal Oil Pressure:—30-45 lbs. at 30 MPH and above.
Oil Pressure Relief Valve:—Under plug below starter. Opens at 40-45 lbs. Spring painted red, green or unmarked. If spring replaced, use same color spring.
Crankcase Capacity:—5 quarts (refill).

COOLING SYSTEM:—**Capacity** 14 qts. *See Chrysler Shop Notes Radiator Core Removal & Water Distrib. Tube data.*
Water Pump:—Packless type with grease fitting. *For complete data, refer to 1941 Mech. Equip. Index.*
Thermostat:—Bishop & Babcock or Fulton (Fulton only on P11). Starts to open 157-162° F. Fully open 183°.

CLUTCH:—Borg & Beck Model 9A7, 11A6 (Taxi) with 'Borglite' driven member. #955 (9A7), #931 (11A6) stamped on cover. Single plate, dry disc types. *For complete data, refer to 1941 Mech. Equip. Index.*
Facings—Molded-Woven, 2 used. I.D. 6" (9A7), 6½" (11A6). O.D. 9¼" (9A7), 11" (11A6). Thickness ⅛".
Adjustment:—Pedal should just clear toeboard (adjust stopscrew an lower end of pedal & have 1" free travel (adjusting nut on connector link at fork).
Removal:—Remove release fork pull-back spring, transmission (see Transmission) and housing underpan. Disconnect release fork from pivot, pull out release bearing and sleeve. Mark cover and flywheel. Take out cover screws evenly, remove assembly.

TRANSMISSION:—Own Make. All helical gear, constant-mesh, synchro-mesh (second and high), sliding gear (low and reverse) with remote shift. *For complete data, refer to 1941 Mech. Equip. Index.*
Transmission Control:—Steering column shift. Manual type Std. Power Shift (vacuum type) Opt'l. *For complete data, refer to 1941 Mech. Equip. Index.*
Removal:—Jack up front end of car, disconnect front universal (loosen companion flange nut if disassembling transmission—see Chrysler Shop Notes for Propeller Shaft Center Bearing Removal on 7 pass.). Disconnect speedometer cable, hand brake cable, gear-shift rods, vacuum and air hose (if Power Shift used). Remove trans.-to clutch housing capscrews and nuts. Pull unit to rear, down and out of car.

UNIVERSAL JOINTS:—Detroit-Universal Series 4200 (3 & 5 pass.), Series 7200 (7 pass.). Roller bearings, ball and trunnion type (4200), cross type (7200). *For complete data, refer to 1941 Mech. Equip. Index.*
Propeller Shaft Center Bearing:—Used on 7 passenger sedans. *See Chrysler Shop Notes for servicing.*

REAR AXLE:—Own Make. Semi-floating, Hypoid gears with Hotchkiss drive. *Refer to Mech. Equip. Index.*
Ratio—**3.73-1** (P11, 12 Econ.), **3.9-1** (P11 Coupe), **4.1-1** (P11 Sedan, P12 Coupe exc. Conv.), **4.3-1** (P12 5 & 7 pass. Sedans, Conv. Coupe), **4.56-1** (P11, 12 6.00x18" tires). **Backlash** .006-.010". Screw adjustmet.
Removal:—Disconnect rear universal, remove axle shafts (see below) and carrier assembly cap screws.
Axle Shaft Removal—Remove wheel, hub, and drum assembly (use screw type hub puller—Tool C-319), block brake pedal, disconnect brake line at wheel cylinder, take off backing plate with oil seal, pull shaft and bearing (using Tool C-158).
Wheel Bearing Adjustment:—Shims between backing plate and axle housing. With wheel and hub removed, check endplay with dial indicator. To adjust, remove backing plate (see above), add or remove shims (furnished .010", .0125", .015", .030" thick) equally at both wheels. **Endplay**—.003-.008".

SHOCK ABSORBERS:—Delco—Direct Acting (Dom. & Exp.), Adjustable Direct Acting (Dom. 20" wheels, Export). *For data, refer to Mech. Equip. Index.*

STEERING:—Steering Gear—Chrysler (Gemmer design Models 305, 335—7 passenger) worm-and-roller with 'push-pull' adjustment. See Gemmer. *For complete data, refer to 1941 Mech. Equip. Index.*
Front Suspension:—Independent, linked parallelogram type & coil springs. *Refer to Mech. Equip. Index.*
Kingpin Inclination—4¾° to 6°.
Camber—Positive ¼°. Limits 0° to Pos. ¾°.
Caster—Negative 1° to Positive 1°. Not adjustable.
Toe In—1/16" (0-⅛"). Turn both rods equally.
Steering Geometry—Inner wheel 22°0'. Outer 20°.

BRAKES:—Service. Lockheed hydraulic, double anchor type. Hand lever applies independent shaft brake. *For complete data, refer to 1941 Mech. Equip. Index.*
Drums—10" centrifuse, 11" (7 passenger).
Lining—Molded asbestos. 2" wide, 13/64" thick. Length per shoe: Front—10 5/16", 11 15/32" (Seven passenger); Rear—7 11/16", 7 31/32" (7 passenger).
Clearance—.012" Toe (top), .006" Heel, for each shoe.
Hand Brake:—On drum at rear of transmission.
Adjustment—*See Chrysler Shop Notes for instructions.*
Drum—Cast-iron. Diameter 6".
Lining—Width 2". Thick. 5/32". Length 17 1/16".

TORQUE WRENCH SPECIFICATIONS:—*See Torque Wrench article in Mechanical Equipment Section for tightening specifications for Cylinder Head, Main & Connecting Rod Bolts, etc.*

HOOD LOCK:—Hood is Alligator type with instrument panel lock control button. To raise hood, pull out on control knob under instrument panel (hood will raise slightly), press up on safety catch tab (under front edge of hood) to release safety catch, raise hood. NOTE—When working on front of car, hood lock can be released without operating lock control button by inserting 8" screwdriver between first and second radiatior grille bars on right side so that point of screwdriver is engaged between hood catch lever and front of bracket to pry lever so as to release catch.

Hood Lock Adjustment—If lock control button requires considerable effort to release catch, or if hood must be slammed to engage lock, lubricate all parts of lock mechanism. If this does not correct trouble, adjust lock pilot stud by loosening locknut on upper end of stud and turning stud in or out (lower end of stud slotted for screwdriver). Check operation and make certain that stud locknut tightened securely.

HOOD REMOVAL & INSTALLATION:—Before removing hood, mark location of hinge on cowl (scribe around hinge with pointed tool) so that hinge can be re-installed in exact same position. Use pry bar to remove hood hinge springs, remove two bolts from hood hinge assembly at right and left side of cowl, remove hood. Hood panels can be dismantled by removing center silver streak and then taking out 14 sheet metal screws holding panels together. Re-install hood in same manner.

Hood Fitting—If hood does not fit tightly at cowl, loosen hood hinge to cowl bolts slightly and drive hinge down, tighten hinge bolts. When installing new hinges, install hinge on cowl, note alignment and whether hinge binds with mounting bolts tight. Shim with washers installed between bracket and cowl, if necessary, so that hinge operates freely, then bolt hinge to hood.

POWER PLANT (ENGINE & TRANSMISSION) REMOVAL:—Drain radiator and cylinder block, remove hood. Remove Front Fenders and Radiator as a unit (see above). Disconnect and remove selector control rod from transmission, disconnect shifter lever from transmission shifter shaft. Disconnect fuel line at pump, oil pressure gauge line, windshield wiper tube, throttle control rods, temperature gauge engine unit, engine ground strap and all wiring, speedometer cable at transmission, clutch control bracket at flywheel housing, clutch throw-out fork, exhaust pipe at manifold. Disconnect rear universal joint, remove propeller shaft (withdraw shaft from transmission). Disconnect front engine support by taking out two bolts. Attach chain hoist to engine, remove bolts from rear engine mountings, lift engine free of rear support crossmember, pull engine and transmission assembly forward and remove from frame. Re-install in same manner using new exhaust pipe gaskets. Adjust clutch pedal free travel, Safety Shift adjustments, and throttle linkage after engine installed.

FRONT FENDER AND RADIATOR ASSEMBLY REMOVAL:—To facilitate work on front of engine, remove fenders and radiator as an assembly as follows: Drain radiator, disconnect hoses, remove front bumper assembly, hex head fender-to-body bolts, Fender-to-frame brace bolts, headlamp wires from top side of fender apron and headlamp terminal at body side of terminal, right headlamp wires from back of terminal on right fender side apron, wire harness from radiator, and 2 nuts from beneath radiator support. Lift front end assembly off

FRONT ENGINE INSULATOR REMOVAL:—Remove splash shields in back of radiator, disconnect exhaust pipe, remove two bolts from front engine to mounting support, jack engine up enough at front end for access to insulator. Clean dirt off mounting from below, remove two screws holding mounting on frame, remove mounting. Re-install in same manner and tighten all mounting bolts securely.

RADIATOR CORE REMOVAL:—Drain cooling system, disconnect radiator hoses, take out 3 capscrews at each side of radiator core and tip fan shroud back against front of engine. Lift radiator core up and out of shell, rotating the fan to clear the radiator water outlet connection. Re-install radiator in same manner.

Water Distributing Tube Servicing—Consists of a metal tube installed in the engine block with closed end toward rear of engine which distributes cooling water through block. If engine overheats, check tube for corrosion or rust and replace tube. Install tube with closed end toward rear.

OIL PAN REMOVAL (Eight Only):—For access to attaching screws at front end of pan, remove radiator splash aprons as follows: Remove screws attaching aprons to front cross-member and radiator support, remove aprons from inside engine compartment by lifting aprons out with a circular motion (rotate right apron to right, and left apron to left, as they are being lifted out).

ORIGINAL BORE & PISTON SIZES:—Original bore sizes, and size of piston installed in each cylinder bore, may be determined by letter stamped on piston head and on top face of cylinder block as listed below. Piston sizes graduated in five .0005" steps as follows:

Piston & Engine Mark:	Six—Piston Size	Eight
'A'	3.5605"	3.247"
'B'	3.561"	3.2475"
'C'	3.5615"	3.248"
'D'	3.562"	3.2485"
'E'	3.5625"	3.249"

REPLACEMENT PISTONS:—**Standard**—Pistons furnished in following sizes for replacement of Standard Production Pistons listed above. Sizes and part numbers for each model are as follows:

Part No. — Six — Size		Part No. — Eight — Size	
505036	3.5605"	503048	3.247"
505037	3.5615"	503049	3.248"
505038	3.5635"	503050	3.249"

First size covers 'A' and Low Limit 'B' production pistons. Second size covers High Limit 'B', all 'C', and Low Limit 'D' pistons. Third size covers High Limit 'D' and all 'E' pistons.

Oversize Replacement Pistons:—Finished pistons furnished in following oversizes: .005", .010", .020", .030". NOTE—All factory replacement pistons held to uniform weight within 1/16 oz. and all oversize pistons up to .030" oversize are same weight as standard pistons.

PISTON PIN FITTING:—Pins case-hardened & ground (out-of-round .0002" max.). To install pins, coat inside of piston bosses with graphite grease, insert slotted end of pin in lockscrew boss and press in place. Pressure to install pin in piston should be 200-300 lbs. Car manufacturer recommends use of following tools (in conjunction with arbor press): hydraulic cylinder & gauge (J-1325-SA-1), piston rest block (J-1325-1), piston pin remover (J-1325-2), piston skirt plug (J-1325-3).
NOTE—On 1941 engines, pins installed with slot to one side (toward bottom on previous models) and new self-locking pin lockscrew is used.

PISTON PIN BUSHING:—**New Type Service Bushings**—New type aluminum bronze bushings which are more resistant to corrosion furnished for service as follows: Part No. 505320 (6 Cyl. beginning 1935), 505321 (8 Cyl. beginning 1933). These bushings may be distinguished from previous bronze type by lighter color and less coppery appearance (bushings darken and may require polishing or buffing to bring out difference in color).
Installation—Press bushings in place, making sure that 3/32" groove between bushings aligned with oil hole in rod. Then burnish bushings securely in place with burnishing bar. Then accurately hone bushing for .0003-.0005" clearance on pin. Car manufacturer recommends use of following tools for servicing pin bushings: J-540-1—Bushing Remover. J-540-2—Bushing Replacer (tool fitted with shoulder which prevents bushings from being pressed too far in or from collapsing while being installed), J-516 Burnisher Bar, and J-526 Burnisher Block. NOTE—These tools are used in conjunction with an arbor press using the J-526 Burnisher Block as a support for the rod on the press.

CONNECTING ROD LOWER BEARING:—Removable type. No adjustment. Shims should not be used or bearing caps filed. When replacing bearings check crankpins. If scored or out-of-round and taper exceeds .001" crankshaft should be replaced.
Fitting—Use .0015" brass shim ½" wide and ⅞" long. Remove cap and lay shim across bearing. Tighten cap (with shim in place). Check bearing fit as follows:—Rod should be locked when testing end movement by hand but should slide on crankpin when tapped lightly with hammer (if rod can be moved by hand, install .001" undersize bearing). Rod should move freely on pin with shim removed.
Installation—Bearing shells fitted with tangs (Six—one to each edge of bearing, Eight—two on each edge). Install cap with tangs on opposite sides of rod (Six), on opposite ends of crankpin (Eight).

MAIN BEARINGS:—**Removal.** Bearings can be removed with caps removed and crankshaft in place by inserting suitable tool (see NOTE following) in oil hole in shaft and rotating shaft in usual direction.
NOTE—Bearing Removal Tool can be made from ⅛"x1½" cotter key. Bend each end of key up 5/16" to make ⅝" long base. With this as a base, bend key to form 59° angle. With this tool inserted in place end will just protrude far enough to engage bearing.
Installation—Insert plain edge of bearing in indented side of bearing support, slowly rotate crankshaft until bearing seated.

FITTING MAIN BEARINGS:—If the crankshaft is badly scored manufacturer recommends that it be replaced. To check bearing fit, use .002" brass shim ½" wide and 1" long. With cap removed place shim across bearing. Tighten cap (with shim in place). Test bearing fit by rocking flywheel by hand. **Do**

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not rock flywheel more than 1" in either direction or bearing may be damaged by shim. If crankshaft locks with shim in place and rotates freely with shim removed bearing size correct. If shaft moves with shim in place use .001" undersize bearing. IMPORTANT—Do not file main bearing caps. These caps are not furnished separately.

REAR MAIN BEARING OIL SEAL (Six only):—Consists of oil slinger on crankshaft to rear of rear main bearing operating in groove formed in block and cap (drain hole in cap returns oil to crankcase) with asbestos seal fitted in separate groove at rear.
Installation—With crankshaft out of engine and bearing shells removed, press packing in rear groove in block, seat packing using Tool J-1045 (large diameter to front of engine) by tapping tool with lead or rawhide hammer. With tool in place, cut each end of seal flush with bearing cap seat. Repeat operation for cap. Install crankshaft & bearings.

HARMONIC BALANCER:—Replace for service.
Removal & Installation—Can be removed from under car without removing front assembly. Use a 13/16" socket wrench to remove the retaining screw, remove balancer. NOTE—If balancer corroded on crankshaft, remove Front Assembly and use Puller J-496.

CAMSHAFT:—Removal—Remove Front Fender and Radiator Assembly (see above), remove fan belt, fan, and harmonic balancer (use Puller J-496). Support front end of engine with jack and remove front engine support (see Front Engine Insulator Removal above), remove timing chain cover, chain, and sprockets. Remove cylinder head and valve covers, take out valves and lifters (lifters are barrel type and can be removed from above with valves out). Remove oil pump, fuel pump, and distributor. Take out screws and remove camshaft thrust plate, withdraw camshaft at front of engine. Re-install camshaft in same manner making certain that timing chain cover is properly centered (see Timing Chain Cover and Oil Seal data below). After camshaft installed, check Valve Timing, Ignition Timing, and Tappet Clearance.

Bearing Servicing—Use special tool J-550 to remove and install camshaft bearings (rear bearing on Eight must be pulled out toward front as expansion plug at rear prevents driving on bearing from rear). Use driver to install all bearings making certain that oil hole in bearings is lined up with hole in block (holes are at bottom of bearings). Then line ream all bearings to finished sizes as follows:

Bearing Finished Size:	Six	Eight
#1 (Front)	1.9950-1.9955"	1.9950-1.9955"
#2	1.9937-1.9642"	1.9637-1.9642"
#3	1.9325-1.9330"	1.9325-1.9330"
#4	1.9012-1.9017"	1.9012-1.9017"
#5		1.8700-1.8705"

TIMING CHAIN COVER & OIL SEAL:—Consists of a cork seal and spring assembled on the crankshaft in front of the chain sprocket so that the cork bears against the inner face of the timing chain cover.

Installing New Cork Seal—Coat seal with graphite lubricant, rubbing lubricant well into the face of the cork, before installing seal in engine. This lubrication necessary to prevent noise developing at this point.

Installing Timing Chain Cover—Use J-546 tool to center timing chain cover before cover screws are tightened.

OIL PUMP SERVICING:—Pump Removal & Installation—Turn crankshaft so that #1 piston on top dead center of compression stroke with distributor rotor at #1 firing position. Remove steering idler arm and right hand engine side pan. Take out pump mounting bolts and remove pump. When installing pump, see that prick punch mark on pump is down, install pump without disturbing distributor shaft position, recheck Ignition Timing.
Pump Specifications—Pump shaft bearing clearance .0005-.002". Shaft and body end clearance .002-.006". Idler gear bearing clearance .0005-.002". Driving gear backlash .003-.004". Driving gear and idler gear backlash .006-.008". Driving gear and idler gear clearance .002-.006".
Pressure Relief Valve—New type. Consists of a spring-loaded disc valve located in the pump body beneath the idler gear. When pressure exceeds 40 lbs., disc is forced off its seat and oil is by-passed back to inlet side. Valve is not adjustable.

CRANKCASE OIL CLEANER:—New Pontiac type 'controlled flow' design consisting of settling chamber built in the oil inlet and filter screen housing in the crankcase. With this design, oil drawn in through the fine-mesh filter screen flows up through inlet pipe and down in settling chamber (concentric with the inlet pipe) until direction is sharply reversed by flat baffle in chamber. This reversal of flow causes dirt particles to be thrown out of the oil and settle in the bottom of the chamber (baffle prevents dirt accumulation in chamber being disturbed or picked up by oil).
Servicing—No servicing required but Oil Cleaner should be removed and settling chamber cleaned out when oil pan removed for other work, or if car has been upset or turned over so that sediment in chamber disturbed.
Oil Cleaner Removal & Installation—To remove cleaner with oil pan off engine, disconnect oil suction pipe from crankcase as a unit. Take out attaching screws and remove cleaner from bracket and suction pipe. Remove snap ring on bottom of cleaner and remove oil screen. Take out ten screws which mount cleaner head in housing shell, remove settling chamber from housing shell. Wash all parts in gasoline and scrape sediment from settling chamber. When reassembling cleaner, see that all gaskets in good condition or use new gaskets, turn head and housing shell upside down, insert two screws and place gasket inside shell, then set settling chamber in place and start screw threads, turn assembly right side up and install remainder of screws, tighten all screws securely. Install strainer, snap ring, and suction pipe.

OIL FILLER CAP & CRANKCASE VENTILATOR CLEANER:—All oil filler caps (Std. & Heavy Duty type) serve as inlet for crankcase ventilating system and must be correctly installed on engine. Install cap **with seam on side engaging groove in top of oil filler pipe** and opening in cap toward fan. Service filler cap and crankcase outlet cleaner (heavy duty) as follows:
Standard Filler Cap—Inspect at 1000 mile intervals and clean when necessary. Wash copper gauze filter element in gasoline and re-oil by dipping in engine oil before re-installing.
Heavy Duty Filler Cap—Used on cars with heavy duty (oil bath) type carburetor air cleaner. Similar to standard cap except for generator cleaning capacity. Service in same manner as standard cap and always clean outlet pipe air cleaner at same time.
Crankcase Ventilator Outlet Pipe Air Cleaner—Consists of a copper gauze filtering element in an elbow on the crankcase outlet pipe. Clean in same manner as filler cap (above). NOTE—No outlet pipe cleaner used on cars with Standard Filler Cap and oil-wetted type carburetor air cleaner.

1940 & PREVIOUS MODELS

CRANKCASE VENTILATOR OUTLET PIPE CLEANER (1940 MODELS):—The small filter element installed in lower end of crankcase ventilator outlet pipe should be removed and discarded (this cleaner will restrict outlet and interfere with crankcase ventilation if not serviced regularly). NOTE—For cars operated in extremely dusty territory, manufacturer recommends that 1941 type Heavy Duty outlet pipe and filter (see 1941 data above) be installed on 1940 cars.

CRANKCASE OIL CLEANER (1941 TYPE) INSTALLATION ON PREVIOUS MODELS:—The 1941 type built-in permanent oil cleaner can be installed on 1939-40 Six Cylinder, and 1940 Eight Cylinder cars to replace regular inlet screen. See 1941 Crankcase Oil Cleaner data (above) for installation directions.

CAMSHAFT SPROCKET REPLACEMENT (1937-39):—Eight Cylinder Models Only—On all eight cylinder engines for 1937, 1938, and 1939 before Engine No. 8-188892; a camshaft sprocket with a short hub and a spacer washer was used. New type camshaft sprocket, Part No. 503454, is furnished for service and when this new sprocket installed on above cars, **spacer washer should be discarded.**

REAR AXLE OIL SEAL LEAKS:—Rear axle oil leaks may develop due to oil passing by axle shaft oil seal outer edge and working through between rear wheel bearing retainer and flange of axle housing and down onto brake lining. To correct this condition, coat axle housing shaft oil seal seat with sealing material (Permatex or Permagasket) before installing seal and also coat both sides of rear brake oil deflector gasket.

ACCELERATOR PEDAL STICKING:—Will cause engine to idle or run faster than normal. To correct this complaint, enlarge bolt holes in accelerator pedal cross-shaft mounting brackets with portable drill so brackets will align with shaft when reinstalled. Oil shaft at regular lubrication periods. Check to see that pedal rod has clearance at hole in toeboard and that rubber bellows on rod is not jammed in toeboard hole. On Torpedo 8, make certain that correct accelerator pedal #504294 (9⅜" long) installed. If Deluxe pedal (10 3/16" long) installed on this model, pedal will jump off studs.

CLUTCH PEDAL RATTLE CORRECTION:—Due to end-play in countershaft and lever as pedal depressed caused by shrinkage of felt at each end of shaft. To correct, leave felts on but install extra felt No. 502099 on frame end of shaft and soak all felts in engine oil. IMPORTANT—Felts should be oiled at each lubrication period to prevent squeaks.

CLUTCH PILOT BUSHING:—New clutch pilot bushing #412562 (oilless type) available for 1935 to 1940 cars. This can be used in place of regular production roller bearing where hole in crankshaft worn. Bushing can be driven into worn hole to give snug fit and provides a smooth running surface for shaft.
Installation—Soak bushing in light engine oil, place bushing on end of driver (Tool J-1329-P), insert tool through hole in flywheel housing and drive bushing in place making certain that it bottoms in hole. Manipulate driver out of bushing. NOTE—Clutch pilot bushing remover (Tool J-1448-1) available for bushing removal.

HOOD FITTING, HOOD LOCK ADJUSTMENT, AND FRONT FENDER & RADIATOR REMOVAL:—*See Pontiac Shop Notes for instructions.*

SERIAL NUMBER:—On plate on left side of dash under hood. 1st nos.:

	Pontiac	California	Linden
Deluxe 41-25	P6JA-1001	C6JA-1001	L6JA-1001
Str mlnr. 41-26	P6JB-1001	C6JB-1001	L6JB-1001
Custom 41-24	P6JC-1001	C6JC-1001	L6JC-1001

ENGINE NUMBER:—First number 6-761501. Stamped on boss left front corner of engine block.

ENGINE SPECIFICATIONS:—6 cylinder, 'L' head type. **Bore**—3 9/16". **Stroke**—4". **Displacement**—239.2 cu. ins. **Rated HP**—30.4. **Developed Horsepower**—90 at 3200 RPM (Std. hd.). **Compression Ratio**—6.5-1 Std., 7.5-1 HC Optl. **Compression Pressure**—155 lbs. (Std.), 179 (HC hd) @ 1000 RPM (approx. 118-120 lbs., cranking spd. Std. hd). **Vacuum Reading**—Steady 18-20" idling at 7-8 MPH. *See Pontiac Shop Notes for Power Plant Assembly and Front Engine Insulator Removal.*

PISTONS:—Electro-plated, chrome nickel alloy iron. Cannot be ground. **Length** 3 19/32". **Weight** 27 ozs. Piston & pin and rod weight variation 1/16 oz. max. **Removal**—Pistons and rods removed from above. **Clearance**—Top land .0175-.0315". Skirt .002".

Original Bore & Piston Sizes, Replacement Pistons:—*See Pontiac Shop Notes for sizes and markings.*

Fitting New Pistons:—Insert .0015" x ½" feeler between piston and cylinder wall. Pull to withdraw feeler must be 10-20 lbs. Taper and out-of-round limits—Piston .0005", Cylinder .0005" max. new.

PISTON RINGS:—Two taper faced compression rings above pin, one slotted oil ring below pin. NOTE—Install compression rings with mark TOP up.

Ring	Width	End Gap	Side Clearance
Compression	.0930-.0935"	.009-.014"	.0015-.003"
Oil Control	.1860-.1865"	.007-.017"	.001-.0025"

Replacement Rings:—Oversizes .005", .010", .020", .030".

PISTON PIN:—**Diameter**—15/16". **Length**—3 1/16". Pin locked in one piston boss (new self-locking lock-screw used). Free end slotted (slot on side rather than bottom as on preceding models). **Pin Fit in Piston**—*See Pontiac Shop Notes for data.* **Pin Fit in Rod Bushing**—.0003-.0005" clearance.

Replacement Pins:—.001" (red & brown), .003" (red), .005" (blue) oversize. Paint marked on end of pin.

CONNECTING ROD:—**Weight** 2.31 lbs. **Length** 7 9/16". **Piston Pin Bushing (Upper Bearing)**—Split aluminum bronze bushings. *See Pontiac Shop Notes for data.* **Lower Bearing Diameter**—2⅛". **Lower Bearing**—New thin type, interchangeable, steel-backed, white bearing metal alloy. Furnished standard size and .001" undersize. **Clearance**—.0005-.0015" (new). **Endplay**—.005-.010".

Bearing Adjustment:—None (no shims). *See Pontiac Shop Notes for Fitting and Installing Bearings.*

Installing Rods:—Not offset (install either way). NOTE—Self-locking rod bolt nuts used.

CRANKSHAFT:—4 bearing, integral counterweights. *See Pontiac Shop Notes for Harmonic Balancer Removal and Rear Main Bearing Oil Seal Renewal.* **Bearing Diameters**—#1, 2½"; #2, 2 17/32"; #3, 2 19/32"; #4, 2⅝". **Bearings**—New thin type, steel-backed, white bearing metal alloy. Upper & lower halves alike. Furnished Std. & .001" undersize. **Clearance** .001-.003".

Bearing Adjustment:—None (no shims). *See Pontiac Shop Notes for Removal and Fitting of Bearings.*

End Thrust:—At #3 bearing. **Endplay**—.003-.008".

CAMSHAFT:—4 bearing. Non-adjustable chain drive. *See Pontiac Shop Notes for Camshaft Removal, Bearing Finished Sizes and Timing Cover Oil Seal data.* **Bearing Diameters**—#1, 2"; #2, 1 31/32"; #3, 1 15/16"; #4, 1 29/32". **Bearings**—Steel-backed, babbitt-lined bushings. **Clearance**—.0015-.0025" (new).

End Thrust:—Steel thrust plate behind camshaft sprocket. Replace if worn. **Endplay**—.002-.005".

Timing Chain:—Morse Type C-1882K (No. 1532). Width 1". Pitch ⅜". Length 21" or 56 links.

Camshaft Setting:—Sprockets marked. Mesh chain with sprockets turned so that '0' marks are adjacent and in line with a straightedge across shaft centers.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1 19/32"	.310-.311"	5.718"
Exhaust	1 15/32"	.310-.311"	5.718"

	Seat Angle	Lift	Stem Clearance
Intake	30°	19/64"	Free fit to .0006"①
Exhaust	45°	19/64"	Free fit to .0006"①

① Guides tapered (.0006" max. clearance at bottom).

Tappet Clearance:—.011-.013" all valves (engine warm). Use .011" feeler as 'go' gauge, .013" as 'no go'. NOTE—Car manufacturer recommends .013" exhaust clearance for sustained high speed driving.

Valve Guides:—Removable, tapered guides (.001" taper to the inch with greatest clearance at top). IMPORTANT—Measure clearance at bottom end. Valve should just fall through guide of own weight when started in guide. NOTE—Guides should be cleaned with Tool KMO-122 valve guide cleaner (blade type). Service guides straight cut, install guides (ream to fit valve stems with reamer P.R. 131).

Valve Springs:—Intake and exhaust springs identical. Install with two closed coils at top and dampener on top of each spring. Use new dampeners whenever removed from spring. **Free Length**—2 9/16".

	Spring Pressure	Spring Length
Valve Closed	56-63 lbs.	1 29/32"
Valve Open	97-105 lbs.	1 19/32"

Valve Lifters:—Barrel type, cast-iron. Guide holes reamed in block. Lifters furnished .005" oversize (use pilot reamer J-706-P when reaming holes to maintain alignment). **Clearance**—Free fit. Lifter should just move freely with finger touch.

Valve Timing:—See Camshaft Setting above. **Intake Valves**—Open 5° BTDC. Close 39° ALDC. **Exhaust Valves**—Open 45° BLDC. Close 5° ATDC. **Valve Timing Check**—With .015" tappet clearance #6 intake valve should open with #6 piston 5° or .0096" before top dead center with first straight line of flywheel mark '/IGN.ONE/' slightly past indicator in left front face of flywheel housing. Reset tappet clearance .011-.013" (warm).

LUBRICATION:—Pressure (pump on right of engine). *See Pontiac Shop Notes for Oil Pump servicing and new type Pontiac (built-in) Oil Cleaner servicing.* **Normal Oil Pressure:**—35-40 lbs. with warm oil. **Oil Pressure Regulator:**—On pump. Opens at 40 lbs. Non-adjustable type. **Crankcase Capacity:**—6 qts.

COOLING SYSTEM:—**Capacity**—18 qts. *See Pontiac Shop Notes Radiator Core Removal & Water Distr. Tube data.* **Pressure Valve**—In filler cap. Opens at 3¾ lbs.

Water Pump:—Packless, sealed ball-bearing type. *For complete data, refer to 1941 Mech. Equip. Index.*

Thermostat:—Harrison. In cylinder head outlet. **Setting**—Starts to open 151° F. Fully open 173° F.

Temperature Gauge:—AC Electric. No. 1511053 (Dash Unit), No. 1510772 (Engine Unit). *For complete data, refer to 1941 Mech. Equip. Index.*

CLUTCH:—**Inland.** 'Diaphragm' type, single plate, dry disc type with Long 9CF-TS, No. CM-5250; 10CF-CS, No. CM-5122 (Taxi) driven member. *For complete data, refer to 1941 Mech. Equip. Index.* **Facings** Moulded, 2 used. Inside Diam. 6" (all). Outside Diam. 9⅛", 10" (Taxi). Thickness .125".

Pedal Adjustment:—Free travel ⅞-1⅛" (adjusting nut on link at clutch fork). Pedal height to lower face of pedal should be 4¾" (41-25), 5 3/16" (others). Adjust stopscrew at lower end of pedal arm.

Removal:—Remove transmission (see below), take off bottom housing cover and control shaft inner bracket. Disconnect pedal pull-back spring. Remove fork ball support, fork, and throwout bearing. Paint mark cover and flywheel (locating pin in flywheel discontinued) and reassemble to these marks to maintain balance. Remove cover bolts evenly until tension relieved. Move clutch away from flywheel at bottom to remove disc, lower assembly out of car.

TRANSMISSION:—**Own Make.** All helical gear, constant-mesh, synchro-mesh (second & high), sliding gear (low & reverse) with remote shift. *For complete data, refer to 1941 Mech. Equip. Index.*

Transmission Control:—Pontiac 'Safety-Shift' type. NOTE—Single shifter rod (replacing 2 rods and idler) used on late 41-24, 41-26 and for replacement. *For complete data, refer to 1941 Mech. Equip. Index.*

Removal:—Disconnect speedometer cable, gearshift selector and control rods from transmission. Disconnect rear universal (wire trunnions) and pull out propeller shaft. Remove upper transmission mounting screws, install guide pins (J-851), remove lower screws, pull transmission to rear and lower out of car.

UNIVERSAL JOINTS:—**Mechanics 2C or 2CR (new type).** Roller bearing types. *For complete data, refer to 1941 Mech. Equip. Index.* NOTE—1 piece driveshaft used. Slip joint formed at rear of transmission ahead of front universal.

REAR AXLE:—**Own Make.** Semi-floating, Hypoid gear type with Hotchkiss drive. *For complete data, refer to 1941 Mech. Equip. Index.* **Ratio**—4.3-1 (white) 41-24, 41-26. 4.1-1 (green) 41-25. 3.9-1 (red) Economy. 4.55-1 Heavy Duty (yellow). Color marked on end of right axle shaft. **Backlash**—.003-.012" (new), slightly over .012" (worn).

Removal:—Disconnect rear universal and wire trunnions (do not disengage spline joint at transmission), remove axle shafts and carrier flange capscrews.

Axle Shaft Removal:—Remove wheel, brake drum, 4 backing plate bolt nuts, static collector, and loosen bearing retainer (do not move backing plate or brake line may be damaged). Pull shaft with puller J-942 (do not drag axle shaft on oil seal). **Wheel Bearing Adjustment**—None.

SHOCK ABSORBERS:—**Delco.** FRONT—Model 1947-C (right), D (left). REAR—1024-V (Domestic). Double acting, hydraulic (1024-V direct acting). *For complete data, refer to 1941 Mech. Equip. Index.*

STEERING:—**Steering Gear** Saginaw worm-and-roller. *For complete data, refer to 1941 Mech. Equip. Index.*

Front Suspension:—Independent, linked parallelogram (coil spring) type. *Refer to Mech. Equip. Index.* **Kingpin Inclination**—4⅜° to 4⅞°. **Caster**—Negative ¾°. Limits Neg. ½° to Neg. 1°. **Camber**—0° preferred. Limits Neg. ¼° to Pos. ¼°. **Toe In**—0-1/16". Adjust tie rod tubes equally. **Steering Geometry**—Inner wheel 23° ± ½°. Outer 20°.

BRAKES:—**Service.** Bendix hydraulic, duo-servo, single anchor type without eccentric adjustment. Hand lever applies rear wheel service brakes. *For complete data, refer to 1941 Mech. Equip. Index.* **Wheel Cylinder Bore**—Front wheel 1". Rear 15/16". **Drums**—Steel (nickel alloy iron liner). Diameter 11". **Lining**—Moulded. Width 1¾". Thickness 3/16". Length 9 11/32" (Primary shoe—D-R Multibestos), 11 31/32" (Secondary shoe—L-8 Multibestos). **Clearance**—.015" at both ends of secondary shoe with primary shoe forced out against drum.

Hand Brake:—See Service Brakes above.

HOOD FITTING, HOOD LOCK ADJUSTMENT, AND FRONT FENDER & RADIATOR REMOVAL:—*See Pontiac Shop Notes for instructions.*

SERIAL NUMBER:—On plate on left side of dash under hood. 1st nos.:

	Pontiac	California	Linden
Deluxe 41-27	P8JA-1001	C8JA-1001	L8JA-1001
Str'mlnr. 41-28	P8JB-1001	C8JB-1001	L8JB-1001
Custom 41-29	P8JC-1001	C8JC-1001	L8JC-1001

ENGINE NUMBER:—First number 8-246501. Stamped on boss on left front corner of engine block.

ENGINE SPECIFICATIONS:—8 cylinder, 'L' head type. **Bore**—3¼". **Stroke**—3¾". **Displacement**—248.9 cu. ins. **Rated HP**—33.8. **Developed Horsepower**—103 at 3500 RPM (Std. hd.). **Compression Ratio**—6.5-1 Std., 7.5-1 HC Optl. **Compression Pressure**—155 lb. (Std.), 175 (HC hd.) @ 1000 RPM (approx. 118-120 lbs., cranking spd. Std. hd.). **Vacuum Reading**—Steady 18-20" idling at 7-8 MPH. *See Pontiac Shop Notes for Power Plant Assembly, Front Engine Insulator and Oil Pan Removal.*

PISTONS:—Electro-plated, chrome nickel alloy iron. Cannot be ground. **Length** 3 19/32". **Weight** 24⅝ ozs. Piston & pin and rod weight variation 1/16 oz. max. **Removal**—Pistons and rods removed from above. **Clearance**—Top land .0175-.0295". Skirt .002". **Original Bore & Piston Sizes, Replacement Pistons:**—*See Pontiac Shop Notes for sizes and markings.* **Fitting New Pistons:**—Insert .0015" x ½" feeler between piston and cylinder wall. Pull to withdraw feeler must be 10-20 lbs. Taper and out-of-round limits—Piston .0005", Cylinder .0005" max. new.

PISTON RINGS:—Two taper faced compression rings above pin, one slotted oil ring below pin.

NOTE—Install compression rings with mark TOP up.

Ring	Width	End Gap	Side Clearance
Compression	.0930-.0935"	.009-.014"	.0015-.003"
Oil Control	.1860-.1865"	.007-.017"	.001-.0025"

Replacement Rings:—Oversizes .005", .010", .020", .030".

PISTON PIN:—Diameter—15/16". **Length**—2⅞". Pin locked in one piston boss (new self-locking lock-screw used). Free end slotted (slot on side rather than bottom as on preceding models). **Pin Fit in Piston**—*See Pontiac Shop Notes for data.* **Pin Fit in Rod Bushing**—.0003-.0005" clearance. **Replacement Pins:**—.001" (red & brown), .003" (red), .005" (blue) oversize. Paint marked on end of pin.

CONNECTING ROD:—Weight 1.98 lbs. **Length** 7 9/16". **Piston Pin Bushing (Upper Bearing)**—Split aluminum bronze bushings. *See Pontiac Shop Notes for data.* **Lower Bearing Diameter**—2". **Lower Bearing**—New thin type, interchangeable, steel-backed, white bearing metal alloy. Furnished standard size and .001" undersize. **Clearance**—.0005-.0015" (new). **Endplay**—.005-.010". **Bearing Adjustment:**—None (no shims). *See Pontiac Shop Notes for Fitting and Installing Bearings.* **Installing Rods:**—Not offset (install either way). NOTE—Self-locking rod bolt nuts used.

CRANKSHAFT:—5 bearing, integral counterweights. *See Pontiac Shop Notes for Harmonic Balancer Removal.* **Bearing Diameters**—#1, 2⅜"; #2, 2 13/32"; #3, 2 7/16"; #4, 2 15/32"; #5, 2½". **Bearings**—New thin type, steel-backed, white bearing metal alloy. Upper & lower halves alike. Furnished Std. & .001" undersize. **Clearance** .001-.003". **Bearing Adjustment:**—None (no shims). *See Pontiac Shop Notes for Removal and Fitting of Bearings.* **End Thrust:**—At #4 bearing. **Endplay**—.003-.008".

CAMSHAFT:—5 bearing. Non-adjustable chain drive. *See Pontiac Shop Notes for Camshaft Removal, Bearing Finished Sizes and Timing Cover Oil Seal data.* **Bearing Diameters**—#1, 2"; #2, 1 31/32"; #3, 1 15/16"; #4, 1 29/32"; #5, 1⅞". **Bearings**—Steel-backed, babbitt-lined bushings. **Clearance**—.0015-.0025" (new). **End Thrust:**—Steel thrust plate behind camshaft sprocket. Replace if worn. **Endplay**—.002-.005". **Timing Chain:**—Morse Type 766-T (No. 2660). Width ¾". Pitch ⅜". Length 21" or 56 links. **Camshaft Setting:**—Sprockets marked. Mesh chain with sprockets turned so that '0' marks are adjacent and in line with a straightedge across shaft centers.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1 15/32"	.310-.311"	5.53"
Exhaust	1 11/32"	.310-.311"	5.53"

	Seat Angle	Lift	Stem Clearance
Intake	30°	19/64"	Free fit to .0006"①
Exhaust	45°	19/64"	Free fit to .0006"①

① Guides tapered (.0006" max. clearance at bottom).

Tappet Clearance:—.011-.013" all valves (engine warm). Use .011" feeler as 'go' gauge, .013" as 'no go'. NOTE—Car manufacturer recommends .013" exhaust clearance for sustained high speed driving. **Valve Guides:**—Removable, tapered guides (.001" taper to the inch with greatest clearance at top). IMPORTANT—Measure clearance at bottom end. Valve should just fall through guide of own weight when started in guide. NOTE—Guides should be cleaned with Tool KMO-122 valve guide cleaner (blade type). Service guides straight cut, install guides (ream to fit valve stems with reamer P.R. 131). **Valve Springs:**—Intake and exhaust springs identical. Install with two closed coils at top and dampener on top of each spring. Use new dampeners whenever removed from spring. **Free Length**—2 9/16".

	Spring Pressure	Spring Length
Valve Closed	56-63 lbs.	1 29/32"
Valve Open	97-105 lbs.	1 19/32"

Valve Lifters:—Barrel type, cast-iron. Guide holes reamed in block. Lifters furnished .005" oversize (use pilot reamer J-706-P when reaming holes to maintain alignment). **Clearance**—Free fit. Lifter should just move freely with finger touch. **Valve Timing:**—See Camshaft Setting above. **Intake Valves**—Open 5° BTDC. Close 39° ALDC. **Exhaust Valves**—Open 45° BLDC. Close 5° ATDC. **Valve Timing Check**—With .015" tappet clearance #8 intake valve should open with #8 piston 5° or .0089" before top dead center with first straight line of flywheel mark '/IGN.ONE/' slightly past indicator in left front face of flywheel housing. Reset tappet clearance .011-.013" (warm).

LUBRICATION:—Pressure (pump on right of engine). *See Pontiac Shop Notes for Oil Pump servicing and new type Pontiac (built-in) Oil Cleaner servicing.* **Normal Oil Pressure:**—35-40 lbs. with warm oil. **Oil Pressure Regulator:**—On pump. Opens at 40 lbs. Non-adjustable type. **Crankcase Capacity:**—6 qts.

COOLING SYSTEM:—Capacity 19½ qts. *See Pontiac Shop Notes Radiator Core Removal & Water Distr. Tube data.* **Pressure Valve**—In filler cap. Opens at 3¾ lbs. **Water Pump:**—Packless, sealed ball-bearing type. *For complete data, refer to 1941 Mech. Equip. Index.* **Thermostat:**—Harrison. In cylinder head outlet. **Setting**—Starts to open 151° F. Fully open 173° F. **Temperature Gauge:**—AC Electric. No. 1511053 (Dash Unit), No. 1510772 (Engine Unit). *For complete data, refer to 1941 Mech. Equip. Index.*

CLUTCH:—Inland. 'Diaphragm' type, single plate, dry disc type with Long 9½CF-TS, No. CM-5253 driven member. *For data, refer to Mech. Equip. Index.* **Facings** Moulded, 2 used. Inside Diameter 6". Outside Diameter 9½". Thickness .125" (⅛"). **Pedal Adjustment:**—Free travel ⅞-1⅛" (adjusting nut on link at clutch fork). Pedal height to lower face of pedal should be 4¾" (41-27), 5 3/16" (others). Adjust stopscrew at lower end of pedal arm. **Removal:**—Remove transmission (see below), take off bottom housing cover and control shaft inner bracket. Disconnect pedal pull-back spring. Remove fork ball support, fork, and throwout bearing. Paint mark cover and flywheel (locating pin in flywheel discontinued) and reassemble to these marks to maintain balance. Remove cover bolts evenly until tension relieved. Move clutch away from flywheel at bottom to remove disc, lower assembly out of car.

TRANSMISSION:—Own Make. All helical gear, constant-mesh, synchro-mesh (second & high), sliding gear (low & reverse) with remote shift. *For complete data, refer to 1941 Mech. Equip. Index.* **Transmission Control:**—Pontiac 'Safety-Shift' type. NOTE—Single shifter rod (replacing 2 rods and idler) used on late 41-28, 41-29 and for replacement. *For complete data, refer to 1941 Mech. Equip. Index.* **Removal:**—Disconnect speedometer cable, gearshift selector and control rods from transmission. Disconnect rear universal (wire trunnions) and pull out propeller shaft. Remove upper transmission mounting screws, install guide pins (J-851), remove lower screws, pull transmission to rear and lower out of car.

UNIVERSAL JOINTS:—Mechanics 2C or 2CR (new type). Roller bearing types. *For complete data, refer to 1941 Mech. Equip. Index.* NOTE—1 piece driveshaft used. Slip joint formed at rear of transmission ahead of front universal.

REAR AXLE:—Own Make. Semi-floating, Hypoid gear type with Hotchkiss drive. *For complete data, refer to 1941 Mech. Equip. Index.* **Ratio**—4.3-1 (white) 41-28, 41-29. 4.1-1 (green) 41-27. 3.9-1 (red) Economy. 4.55-1 Heavy Duty (yellow). Color marked on end of right axle shaft. **Backlash**—.003-.012" (new), slightly over .012" (worn). **Removal:**—Disconnect rear universal and wire trunnions (do not disengage spline joint at transmission), remove axle shafts (see below), remove carrier flange capscrews, pull carrier assembly out. **Axle Shaft Removal:**—Remove wheel, brake drum, 4 backing plate bolt nuts, static collector, and loosen bearing retainer (do not move backing plate or brake line may be damaged). Pull shaft with puller J-942 (do not drag axle shaft on oil seal). **Wheel Bearing Adjustment**—None.

SHOCK ABSORBERS:—Delco. FRONT—Model 1947-C (right), D (left). REAR—1024-V (Domestic). Double acting, hydraulic (1024-V direct acting). *For complete data, refer to 1941 Mech. Equip. Index.*

STEERING:—Steering Gear Saginaw worm-and-roller. *For complete data, refer to 1941 Mech. Equip. Index.* **Front Suspension:**—Independent, linked parallelogram type with coil springs. *For complete data, refer to 1941 Mech. Equip. Index.* **Kingpin Inclination**—4⅜° to 4⅞°. **Caster**—Negative ¾°. Limits Neg. ½° to Neg. 1°. **Camber**—0° preferred. Limits Neg. ¼° to Pos. ¼°. **Toe In**—0-1/16". Adjust tie rod tubes equally. **Steering Geometry**—Inner wheel 23° ± ½°. Outer 20°.

BRAKES:—Service. Bendix hydraulic, duo-servo, single anchor type without eccentric adjustment. Hand lever applies rear wheel service brakes. *For complete data, refer to 1941 Mech. Equip. Index.* **Wheel Cylinder Bore**—Front wheel 1". Rear 15/16". **Drums**—Steel (nickel alloy iron liner). Diameter 11". **Lining**—Moulded. Width 1¾". Thickness 3/16". Length 9 11/32" (Primary shoe—D-R Multibestos), 11 31/32" (Secondary shoe—L-8 Multibestos). **Clearance**—.015" at both ends of secondary shoe with primary shoe forced out against drum. **Hand Brake:**—See Service Brakes above.

TORQUE WRENCH SPECIFICATIONS:—*See Torque Wrench article in Mechanical Equipment Section for tightening specifications for Cylinder Head, Main & Connecting Rod Bolts, etc.*

HOOD LOCK (ALL MODELS):—Hood is Alligator type with hood lock release knob in driver's compartment below edge of instrument panel to left of steering column. To raise hood, pull out on release knob (hood will raise slightly), pull forward on safety catch under front edge of hood (ahead of lock stud), raise hood.

Hood Lock Adjustment—Lock stud should be positioned so that hood locks securely with firm pressure on top of hood (if stud adjusted too high, hood will not lock securely; if stud adjusted too low, hood will rattle). To adjust lock, loosen locknut on upper end of lock stud, engage screwdriver in slot at lower end of stud, turn stud counter-clockwise to lower stud, clockwise to raise stud, tighten locknut after completing adjustment. Lubricate latch on underside of grille top baffle and control wire in cable conduit for smooth operation.

HOOD SIDE PANEL REMOVAL:—Separate removable hood side panels used. To remove, take out attaching bolts on each panel.

ORIGINAL BORE & PISTON SIZES:—Bore Size—Marked by figure stamped on top face of cylinder block next to each cylinder bore as follows:

Champion		Commander		President	
Mark	Size	Mark	Size	Mark	Size
0	3.000"	25	3.3125"	05	3.0605"
05	3.0005"	3	3.313"	1	3.061"
1	3.001"	35	3.3135"	15	3.0615"
15	3.0015"	4	3.314"	2	3.0620"
2	3.002"	45	3.3145"	25	3.0625"
25	3.0025"	5	3.315"	3	3.063"

Original Pistons—Stamped with size of cylinder bore in which pistons are installed.

Replacement Pistons—Stamped figure on top indicates actual size of piston.

CYLINDER HEAD INSTALLATION:—Coat both bottom of head gasket and lower face of cylinder head with Perfect Seal Gasket Cement (use sparingly), coat head capscrews with white lead. Tighten head screws to tension of 600-650 in. lbs. (Champion), 1000 in. lbs. (Commander & President) and recheck before starting engine.

CONNECTING ROD 'PALNUT' INSTALLATION:—Used on all models. Consists of a special patented locknut installed on top of regular nut instead of cotter-pin. To install Palnut, tighten regular nut to tension of 300-325 in. lbs. (Champion), 650 in. lbs. (Commander & President), install Palnut with open face out (away from regular nut), tighten Palnut until it just contacts regular nut, then tighten Palnut ⅓ turn additional to lock it in place.

PISTON PIN REMOVAL & INSTALLATION:—Champion—Tapered pin and nut secures pin in rod. To remove pin, place rod and piston on assembling fixture No. J1293, take nut off and install on opposite end of pin and turn nut down pulling pin out. To install, place pin on fixture, slip piston and rod on pin, tighten pin nut (rock rod to insure lock pin seats properly). One nut only used on tapered lock pin.

SELF-LOCKING TAPPETS:—Champion—Tappet screws slotted on upper end and require no locknuts. When tappet screws replaced, car manufacturer recommends that screws must check as follows: Pull required to move tappet screw must be 25 in. lbs. minimum (4 lbs. pull on 6" wrench).

VIBRATION DAMPENER:—President—Consists of a spring-loaded flywheel mounted on four tapered rubber cushions between a friction facing on the fan pulley and a damper plate on the front end of the crankshaft. The flywheel oscillation is controlled by the friction of the friction facing and the compression of the rubber cushions. Flywheel radial movement is controlled by a fibre ring on the fan pulley hub. Spring tension is adjusted by shims under spring in flywheel, compression of rubber cushions adjusted by shims on bolt sleeve between cushion and damper plate.

Removal & Installation:—Dampener can be removed as an assembly (without disturbing adjustment) by removing two of the four retaining screws in the damper plate (do not disturb other two screws). Use Puller HM-925 to remove dampener assembly by installing two puller screws in holes from which dampener retaining screws removed.

NOTE—When installing crankshaft nut, make certain that copper-asbestos gasket in place under nut (necessary to prevent oil leaks at this point).

Servicing:—If dampener disassembled for replacement of rubber cones or springs, these parts must be adjusted when re-installed as follows:

Rubber Cones—Assemble friction facing, damper flywheel, bolt sleeves, and rubber cones on top of fan pulley. Install one heavy washer on top of each cone. Press cones and spacer sleeves firmly down in position, measure amount spacer projects above face of heavy washer on cone by using feeler gauge (build up feeler gauge thickness until top surface of feeler even with top edge of spacer sleeve). Measure total thickness of feeler gauge and heavy washer with micrometer, select two heavy washers and shims (as required) equal to the micrometer reading **plus .015"** (to insure correct cone compression of .015"), install this shim and washer pack on top of the rubber cone when installing the damper plate and retaining screws, tighten screws securely (sleeves limit cone compression to correct figure).

Damper Springs—Shims are installed in flywheel under each tension spring so that spring pressure is 50 lbs. each or 200 lbs. total. If new springs installed, use same shim pack as removed from under old spring.

VIBRATION DAMPENER:—Commander—Consists of a flywheel mounted on two rubber discs (discs have insulating buttons at pilot rivet holes) mounted on the crankshaft pulley hub at the forward end of the crankshaft and retained by a large nut on the end of the crankshaft. Compression of rubber discs is limited by length of crankshaft pulley hub (when retaining nut drawn up securely) and no adjustment required. If dampener does not operate correctly, replace rubber discs.

CAMSHAFT REMOVAL:—Champion—To remove camshaft, use Puller HM-925 to remove crankshaft fan pulley, take out screws and remove timing gear cover. Remove oil pump and drive shaft, take off valve tappet cover plates, remove cylinder head. Install special valve lifter supports (see Note below) on each valve lifter (lifters are mushroom type and must be blocked up so as to clear cam lobes). Remove two capscrews retaining camshaft thrust plate (insert socket wrench between camshaft gear spokes), pull camshaft gear and camshaft out as an assembly. When installing camshaft, do not tighten timing gear cover screws until after crankshaft pulley has been installed so as to secure correct alignment of pulley hub and oil seal washer in gear cover.

NOTE—Valve lifter supports should be made of hardened strip steel in inverted 'U' shape .750" high and 21/32" wide (inside). A ⅜" slot, 9/16" deep, with rounded end and 1/16" radius corners, should be cut in top of support and front corners should be beveled ⅛" for distance ⅜" back from front edge. This will allow supports to be tipped down to engage lifters and will raise lifters sufficiently to clear cams when supports pushed in place.

Commander—To remove camshaft, use Puller HM-925 to remove vibration dampener assembly, take out screws and remove timing gear cover. Remove cylinder head and valve tappet cover plates, remove oil pump assembly. Remove valves, springs, and valve lifters (lifters are barrel type and can be removed from above after adjusting screw removed). Insert wrench through timing gear spokes and remove two camshaft thrust plate retaining screws. Pull camshaft gear and camshaft out as an assembly. When installing camshaft, do not tighten timing gear cover screws until after vibration dampener has been installed to secure correct alignment of crankshaft pulley hub and oil seal washer in timing gear cover.

President—Camshaft removal same as Commander model (above) except that valve tappet and guide assemblies should be taken out by removing screws in each assembly. When re-installing these assemblies, make certain that gaskets are in place and that oil holes in gaskets line up with holes in block.

TIMING GEARS:—Camshaft Gears (All Models)—Holes provided in gears (on Champion and Commander), gear hub recess threaded (President) for gear puller to remove gears. Use tool HM-925 (Champ.&Comm.), HM-865 (President). See Replacement Camshaft Gear Sizes (below) for size selection when replacing gears. Use gear pusher tool HM-861X (all models) to install gears. CAUTION—Do not drive gears on with a hammer which will loosen gear at hub.

Replacement Camshaft Gear Sizes:—Furnished in three sizes: 'S'—Standard, 'H'—High Limit, 'L'—Low Limit. When replacing gear on engine with considerable service, install next largest camshaft gear size. For reconditioned engine with new camshaft and main bearings use same size gear. Crankshaft gear furnished in standard size only.

Crankshaft Gear (All Models):—Tapped holes provided in all gears for puller. Use Puller HM-925 to remove gear, Pusher HM-861X to install gear.

VALVE SPRING INSTALLATION:—Valve Lifter Tension Springs (All Models)—Consists of a 'U' shaped flat spring installed so as to engage lower end of valve stem and upper end of lifter (spring tension keeps lifter on cam lobe). Make certain that these tension springs in place when valves and springs installed.

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Spring Dampers (Commander & President)—Consist of open-sided cages installed on upper (closed coil) end of each valve spring. Make certain that dampers in place when springs installed. Dampers not used on Champion Valve Springs.

OIL PAN INSTALLATION:—Champion—Separate oil filler block and pan gasket used at front end of engine. When installing oil pan, install filler block and gasket first, align filler block screw holes with drift and install and tighten filler block screws securely. See that filler block gasket is in good condition and properly aligned (rubber band may be used to retain gasket until pan installed), install side and rear gaskets, use pilot screws to guide pan into place.

Commander—Oil pan removal and installation will be facilitated by turning crankshaft so that #2 piston is on top dead center.

OIL PUMP INSTALLATION:—Commander. To insure correct rotor position of distributor when pump installed, install pump as follows: Remove distributor, crank engine over (with piston #1 on compression) until vibration damper mark 'UDC/1-6' lines up with pointer on gear case, sight down distributor shaft hole and mesh oil pump drive gear so that drive tongue on shaft is 30° from the horizontal (upper end pointing toward rear of engine) with offset toward the top. Distributor shaft slot should engage drive tongue with rotor turned to #1 segment in distributor cap.

Champion:—Install oil pump as follows: Turn engine over until #1 piston at TDC. entering power stroke (flywheel mark U.D.C.1-6 in line with pointer on left rear engine plate). Engage pump shaft with camshaft gear with key-way pointing down (keyway will rotate to rear when gears meshed), assemble pump to engine. Check distributor drive tongue position by sighting down distributor shaft hole (distributor out). With #1 cylinder in firing position, tongue should be parallel with camshaft and offset (narrow half of shaft) toward camshaft. Distributor shaft slot should engage drive tongue with rotor turned to #1 segment in distributor cap.

President:—Install oil pump as follows: Turn engine over until piston #1 is on TDC entering power stroke with vibration damper mark 'UDC/1-8' lined up with pointer on gear case, turn pump shaft so that distributor drive tongue is approximately 45° from the vertical (upper end pointing toward rear of engine) with offset toward the top (right side of car when installed). Install pump which will rotate gear so that tongue should be approximately parallel with camshaft and offset away from shaft. Install distributor drive shaft, meshing slot at lower end with oil pump shaft tongue. Slot at upper end of shaft should be at right angles to camshaft and offset toward rear of engine. Distributor shaft tongue should engage with this slot with rotor turned to #1 segment in distributor cap.

CLUTCH RELEASE SHAFT LUBRICATION:—On all Studebaker models (see Champion Note below), bushing at each end of clutch release cross-shaft should be oiled with lubricating oil at regular chassis lubricating periods. CAUTION—If bushings not oiled. clutch may stick or slip due to seizing of shaft.

Clutch Release Shaft—Lubricate shaft at each side of clutch housing with SAE #30 engine oil every 1000 miles.

Clutch Cross Shaft—Remove cover on outside of frame siderail at left end of clutch cross-shaft and lubricate shaft at this point with SAE #30 engine oil every 5000 miles. CAUTION—When installing cover, make certain that felt, felt retainer, and spring are correctly installed within cover.

OVERDRIVE TRANSMISSION REAR SUPPORT INSTALLATION:—President Models—The rear support (must be removed to remove transmission) should be installed with original shims in same location in order to maintain alignment. These shims located between support and frame at each end. If shims lost or readjustment necessary, install support as follows: Hold support in place under transmission case, install sufficient shims at each end to take up all except 1/16" clearance between support and frame, install frame bolts, tighten bolts securely with shims in place. This clearance will provide correct compression of the support rubber cushions.

HILL HOLDER ADJUSTMENT:—On cars with Hill-Holder (optional equipment), check action whenever clutch adjusted to make certain that brakes release just before clutch engages.

Adjustment—Loosen locknut on end of Hill-holder control rod, shorten rod for earlier brake release, lengthen rod for later release, tighten locknut.

1940 & PREVIOUS MODELS

OIL LEAKS AT FAN DRIVE PULLEY (CHAMPION):—To correct oil leakage at this point on 1939 and 1940 cars, install special copper asbestos gasket No. 199108 on front face of fan drive pulley, install new heavier plain washer No. 189959 on gasket, and use new star type lockwasher on retaining screw when screw is replaced. NOTE—These parts are installed at factory on later 1940 cars. Star type lockwasher replaces helical type lockwasher used on earlier cars. New plain washer is 7/32" thick.

FRONT FENDER APRONS & BAFFLES:—To Correct Complaints of Ignition cutting out due to water splashing from road—Baffles should be installed on Champion cars and aprons should be checked on other models as follows:

Champion Models (1939-40):—Install baffles at front face of frame body brackets under each front fender to seal opening at rear edge of fender aprons. On late 1940 cars, holes are drilled in body bracket for baffle installation. On 1939 and early 1940 cars, drill hole 1" from top face of bracket and 1 7/16" from frame using 7/32" drill. Use special self-tapping screws to attach baffles.

Commander & President (1939-40):—Check shield at rear end of front fender aprons and bend apron so that anti-squeak strip riveted on lower edge of shield contacts forward face of front frame body bracket tightly. This will prevent water being deflected from bracket onto engine.

IMPORTANT SERVICE CAUTION—On cars before Serial No. 4157417 (Comm. 10A), 7134832 (Pres. 6C), check apron on both sides of car for interference with brake tubes located below lower edge of apron and bend apron in so that clearance is at least ¼".

CLUTCH RELEASE SHAFT LUBRICATION:—Champion 1939-40 Models—To prevent clutch slipping or sticking due to seizing of release shaft, shaft should be oiled at regular intervals as directed for 1941 model (above) and new type bushings can be installed as directed below. To correct squeaks or other noise at frame end of clutch release cross-shaft, felt oiler and cover should be installed on frame at outer end of shaft as directed below.

Champion Release Shaft Bushings (1939-40)—New type porous, oil-impregnated bushings available for service (Part No. 199918—bushing, 196080—bushing and retainer assembly) to correct sticking of shaft. The new bushings should be oiled regularly in same manner as other types as directed above.

Clutch Release Cross-shaft Oiler:—Consists of felt oiler, spring and cover similar to type used on all 1941 models. To install this assembly on 1939-40 cars, clean outer face of left frame siderail around end of clutch release cross-shaft and shaft, install felt on end of shaft, place cover over felt with attaching bolt holes along line of frame, mark bolt holes for drilling, remove cover and felt, drill holes for attaching bolts with 7/32" drill. Saturate felt (Part No. 199621) with #30 engine oil and install felt on end of shaft, install felt retainer washer, retainer spring (Part No. 631893), and cover (Part No. 199619) in order and tighten cover bolts securely. Cover should be removed and felt lubricated with SAE #30 engine oil every 5000 miles.

ENGINE PAN INSTALLATION:—Champion 1939-40—To prevent mud and water splashing up on engine from road, special service pans, Front Engine Pan Part No. 199059, and Engine Side Pan Part No. 197183, may be installed as follows:

Engine Front Pan—Place pan in position between two front cross-members with notched edge clearing fuel line, mark mounting hole locations. Drill five mounting holes with 13/64" drill, bolt pan in position.

Engine Side Pan—Place pan in position on left side of engine so that it clears steering gear and clutch housing (pan attaches to upper edge of frame siderail and re-inforcing brace to lower edge), mark mounting hole locations. Drill three 13/64" mounting holes in top edge of frame for pan bolts, one 13/64" hole in lower edge of frame for re-inforcing brace, bolt pan and brace in position.

HOOD LOCK:—*See Studebaker Shop Notes for data.*

SERIAL NUMBER:—On left front door hinge post. First No.: 90101 (South Bend), 811201 (Los Angeles).

ENGINE NUMBER:—First number 101201. Stamped on pad on upper left front corner of engine block.

ENGINE SPECIFICATIONS:—6 cylinder, 'L' head type. **Bore**—3". **Stroke**—4".
Displacement—169.6 cu. ins. **Rated HP**—21.6.
Developed Horsepower—80 HP at 4000 RPM.
Compression Ratio—6.5-1 Std. cast-iron head.
Compression Pressure—105 lbs. at 150 RPM.
See Studebaker Shop Notes for Cyl. Head Installation.
Vacuum Reading—Steady 17-18" idling at 8 MPH.

PISTONS:—Aluminum alloy, T-slot, cam ground, tin plated. **Length** 2 29/32". **Weight** 8.96 ozs. (stripped). **Removal**—Pistons and rods removed from above. **Clearance**—Top .014-.019" Skirt .0015" selective.
Original Bore & Piston Sizes, Replacement Pistons:—*See Studebaker Shop Notes for sizes and markings.*
Fitting New Pistons:—Insert .002" x 1" feeler between piston and wall on camshaft side (pin parallel to crankshaft, T-slot away from camshaft). Pull to withdraw feeler 16-22 lbs. NOTE—Cylinders out-of-round or taper over .002" should be reconditioned.
Installing Pistons:—T-slot away from camshaft.

PISTON RINGS:—3 coated rings, all above pin. #1 Comp. '200' (step up). #2 Comp. '70' (step down). #3 Oil '85' (slotted). Heat dam above #1 groove.

Ring	Width	End Gap	Side Clearance
Comp. (Top)	3/32"	.007-.017"	.0015-.002"
Comp. (#2)	1/8"	.007-.017"	.0015-.002"
Oil Control	5/32"	.007-.017"	.0015-.002"

Replacement Rings:—Std. & .010", .020", .030" oversize.

PISTON PIN:—**Diameter** .7491-.7495". **Length**—2⅝". Pin locked in rod by tapered pin and locknut.
See Studebaker Shop Notes for Pin Servicing data.
Pin Fit in Piston—.0001-.0003" clearance or light finger-push fit at room temperature (70°).
Replacement Pins:—Std. & .0025", .005" oversize. Use Hone No. PH-1 to obtain proper piston fit.
NOTE—Replacement pistons fitted with pins.

CONNECTING ROD:—**Length** 6⅜". **Weight** 20.96 ozs.
Crankpin Journal Diameter—1.81175-1.81275".
Lower Bearing—Spun babbitt (cap bearings chamfered on upper edge). New rods furnished on exchange basis standard and .010", .020" undersize.
Clearance—.0005-.002". **Sideplay**—.005-.009".
NOTE—Use reamer HM-591-F to secure correct bearing clearance. Crankpin out-of-round, tapered or scored .0015" max. (use Tool No. 1C for reconditioning crankpins).
Bearing Adjustment:—None. Replace rods.
See Studebaker Shop Notes for 'Palnut' installation.
Installing Rods:—Narrow portion of bearing to front (#1, 3, 5), to rear (#2, 4, 6). Side marked with cyl. number and oil spray hole toward camshaft.

CRANKSHAFT:—4 bearing, integral counterweights.
Journal Diameter—2.437-2.4375".
Bearings—Removable steel-backed, babbitt-lined.
Clearance—.0005-.0025".
Adjustment:—None (no shims). Replace bearings (std. size, .010", .020", .030" undersize).
NOTE—Front oil pan seal block may be removed for access to front main bearing cap by removing 4 lower timing gear cover screws (on front face).
End Thrust:—Thrust plate assembled between front bearing and crankshaft gear. Controlled by shims (furnished .003", .005", .007" thick) between plate and journal face. **Endplay**—.003-.006".
NOTE—Install new seals (specially treated wood) whenever rear main bearing cap replaced

CAMSHAFT:—Four bearing with helical gear drive.
See Studebaker Shop Notes for Camshaft Removal.
Journal Diameters—#1, 1.7475-1.7480"; #2, 1.71625-1.71700"; #3, 1.68575-1.68650"; #4, 1.62325-1.62400".
Bearings—Split steel-backed, babbitted bushings.
NOTE—Align bushing with oil hole in block.
Clearance—.00075-.00225" (#1), .001-.00275" (others).
End Thrust:—Taken by thrust plate assembled on front face of engine behind camshaft gear. Spacer assembled back of gear hub. **Endplay**—.004-.008"
Timing Gears:—Crankshaft (cast-iron), Camshaft (Celeron with steel hub). **Backlash** .001-.003".
See Studebaker Shop Notes for Gear Removal and Replacement Gear size selection.
Camshaft Setting:—Mesh marked camshaft gear tooth between two marked teeth on camshaft gear.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1 11/32"	.310-.311"	4 11/32"
Exhaust	1 9/32"	.310-.311"	4 11/32"

	Seat Angle	Lift	Stem Clearance
All Valves	45°	5/16"	.001-.0035"

Tappet Clearance:—.016" (cold) all valves. Self-locking tappet screw tension should be 25 in. lbs. Remove hood side panel for access to valves.
Valve Guides:—Pressed in block from above 1 3/16" below top of block. Finish ream to .312-.3135".
Valve Springs:—Install with closed coil up. Replace if springs over 10% weak (test with Tool U-15).

Free length 2 3/32".	Spring Pressure	Length
Valve Closed	49-53 lbs.	1 21/32"
Valve Open	90-94 lbs.	1 11/32"

Valve Lifters:—Mushroom type (remove from below). **Diameter**—.62375-.62425". **Clearance** .0005-.00175". Lifters furnished .0005", .001" oversize.
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 15° BTDC. Close 49° ALDC.
Exhaust Valves—Open 54° BLDC. Close 10° ATDC.
Valve Timing Check—With .020" tappet clearance #1 intake valve should open with #1 piston 15° or .0893" BTDC with flywheel mark 'IN.OP.1-6/' aligned with pointer on left rear engine plate. Reset tappet clearance at .016" (cold).

LUBRICATION:—Pressure (pump on right of engine).
See Studebaker Shop Notes for Oil Pan and Oil Pump installation instructions.
Normal Oil Pressure:—40 lbs. at 25-30 MPH.
Oil Pressure Relief Valve:—On lower right front corner of engine block. Opens at 30-40 lbs. Not adj.
Crankcase Capacity:—5 quarts.

COOLING SYSTEM:—**Capacity**—10 quarts.
Water Pump:—Packless, sealed ball-bearing type.
For complete data, refer to 1941 Mech. Equip. Index.
Removal—Drain water, remove fan belt, fan blades and pulley, pump hose, 3 pump mounting screws.
Thermostat:—Bishop & Babcock. In cyl. head outlet.
Setting—Starts to open 151° F. to 155° F.
Drain Valves:—At radiator lower tank and plug on left side of cylinder block at rear. If heater used, disconnect hose at cylinder head and hold hose below level of heater.

CLUTCH:—**Borg & Beck Model 8A7 with 'Borglite' driven member.** Clutch assembly No. 925 stamped on cover. Single plate, dry disc type.
For complete data, refer to 1941 Mech. Equip. Index.
Facings—Molded-metallic (spiral-grooved), 2 used. Inside Diam. 5⅜". Outside Diam. 8". Thickness ⅛".
Adjustment:—Free travel 1" (min.). Turn adjusting sleeve on pedal connector link.
Hill-Holder (NoRol) Note—Check whenever clutch pedal adjusted. Set so that Hill-Holder releases just as clutch engages (change rod length).
Removal:—Remove transmission (see below), take off clutch housing, take out 6 mounting screws in clutch cover flange, lift off cover assembly.
See Studebaker Shop Notes for Clutch Release Shaft Lubrication instructions.

TRANSMISSION:—**Warner.** Model AS1-T84G (Std.), AS2-T84G Type R7C (optl. overdrive with electrical 'kick-down' control). All helical gear type, synchromesh (second & high), sliding gear (low & reverse).
For complete data, refer to 1941 Mech. Equip. Index.
Transmission Control:—Mechanical steering col. shift.
For complete data, refer to 1941 Mech. Equip. Index.
Removal:—Disconnect the rear universal and withdraw propeller shaft from transmission. Disconnect shift levers and speedometer cable at transmission. Place jack under engine rear plate and free rear engine support. Remove transmission-to-clutch housing capscrews, pull transmission out.
Overdrive Note—On cars with overdrive, disconnect overdrive control cable and solenoid wires.

UNIVERSAL JOINTS:—**Spicer Model 1268-102.** Needle bearing type. Two used.
For complete data, refer to 1941 Mech. Equip. Index.
NOTE—1 piece driveshaft used. Slip joint formed at rear of transmission ahead of front universal.

REAR AXLE:—**Spicer Model 23.** Semi-floating, Hypoid gear type with Hotchkiss drive.
For complete data, refer to 1941 Mech. Equip. Index.
Ratio—4.56-1 standard. 4.10-1 optional.
Backlash—.005-.007". Shim adjustment.
Removal:—Hoist rear of car, disconnect propeller shaft at rear universal, hydraulic brake lines, brake cables, and shock absorbers. Remove spring U-bolts, disconnect rear spring shackles and withdraw axle.
NOTE—Use Puller HM-931 to remove axle shaft, Handle J-270-1 and disc J-270-13 to install inner shaft oil seal.
Wheel Bearing Adjustment:—Shims between backing plate and axle housing. With wheel and hub removed (use Hub Puller J-446) check endplay with dial indicator. To adjust, remove backing plate, add or remove shims (.003", .005", .010", .030" thick).
Endplay—.001-.005".

SHOCK ABSORBERS:—**Houdaille. Model BBFS2 (front), BBDS (rear).** Double acting, hydraulic.
For complete data, refer to 1941 Mech. Equip. Index.

STEERING:—**Steering Gear**—Ross Model T-12. Cam-and-Twin lever type.
For complete data, refer to 1941 Mech. Equip. Index.
Front Suspension:—Planar type independent suspension with transverse spring. Specifications below apply with car weight on wheels but without load.
For complete data, refer to 1941 Mech. Equip. Index.
Kingpin Inclination—5½°.
Caster—1° to 2°.
Camber—¼° to ¾°. Shim adjustment.
Toe In—1/16-⅛". Adjust right reach rod only for toe-in. Left rod should be adjusted first for left wheel straight-ahead position (steering wheel centered).
Steering Geometry (toe-out on turns)—Inner wheel turned 22½-23°. Outer wheel turned 20°.

BRAKES:—**Service.** Lockheed hydraulic, single anchor type. Hand lever applies rear service brakes.
For complete data, refer to 1941 Mech. Equip. Index.
Drum—Budd composite. Diameter 9".
Lining—Moulded. Length per shoe 10 3/16". (front), 7 13/16" (rear). Width 1¾". Thickness 3/16".
Clearance—.010" toe (top), .005" heel, for each shoe.
Braking Power—43% rear wheels, 57% front.
Hand Brake:—See Service Brakes (above).
Hill-Holder (NoRol):—Optional Equipment.
For complete data, refer to 1941 Mech. Equip. Index.

HOOD LOCK:—*See Studebaker Shop Notes for data.*

SERIAL NUMBER:—On left front door hinge post. 1st No. 4178801 (South Bend), 4811901 (Los Angeles).

ENGINE NUMBER:—First number H-122201. Stamped on upper left side of cylinder block at center.

ENGINE SPECIFICATIONS:—6 cylinder, 'L' head type. **Bore**—3 5/16". **Stroke**—4⅜". **Displacement**—226.2 cu. ins. **Rated HP**—26.35. **Developed Horsepower**—94 at 3600 RPM (Std. hd.). **Compression Ratio**—6.5-1 Standard cast-iron head. 7.0-1 cast-iron head optional. **Compression Pressure**—105 lbs. at 150 RPM (Std.hd.). *See Studebaker Shop Notes for Cyl. Head Installation.* **Vacuum Reading**—Steady 18-20" idling at 8 MPH.

PISTONS:—Aluminum alloy, T-slot, cam ground, tin plated. **Length** 3¾". **Weight** 14.4 ozs. (stripped). **Removal**—Pistons and rods removed from above. **Clearance**—Top .0125-.0175". Skirt .0015".

Original Bore & Piston Sizes, Replacement Pistons:—*See Studebaker Shop Notes for sizes and markings.*

Fitting New Pistons:—Insert .002" x 1" feeler between piston and wall on camshaft side (pin parallel to crankshaft, T-slot away from camshaft). Pull to withdraw feeler 14-19 lbs. NOTE—Cylinders out-of-round or taper over .002" should be reconditioned.

Installing Pistons:—T-slot away from camshaft.

PISTON RINGS:—3 coated rings, all above pin. #1 and #2 Compression (beveled face up), #3 Sealed Power oil ring. Heat dam groove above top ring.

Ring	Width	End Gap	Side Clearance
Compression	.0925-.0935"	.009-.014"	.0015-.002"
Oil Control	.186-.1865"	.009-.014"	.0015-.002"

Replacement Rings:—Std. & .010", .020", .030" oversize.

PISTON PIN:—**Diameter**—⅞". **Length**—2⅞". Pin locked in connecting rod by lock screw. **Pin Fit in Piston**—.0001-.0003" clearance or light finger-push fit at room temperature (70°).

Replacement Pins:—Std. & .0025", .005" oversize. Use Hone No. PH-1 to obtain proper piston fit. NOTE—Replacement pistons fitted with pins.

CONNECTING ROD:—**Length**—8⅞". **Weight**—33.2 ozs. **Crankpin Journal Diameter**—2.18675-2.18775". **Lower Bearing**—Spun babbitt (cap bearings chamfered on upper edge). New rods furnished on exchange basis standard and .010", .020" undersize. **Clearance**—.0005-.002". **Sideplay**—.005-.009". NOTE—Use reamer HM-591-D to secure correct bearing clearance. Crankpin out-of-round, tapered or scored .0015" max. (use Tool No. 1C for reconditioning crankpins).

Bearing Adjustment:—None. Replace rods. *See Studebaker Shop Notes for 'Palnut' installation.*

Installing Rods:—Narrow portion of bearing to front (#1, 3, 5), to rear (#2, 4, 6). Side marked with cyl. number and oil spray hole toward camshaft.

CRANKSHAFT:—4 bearing, 5 integral counterweights. Vibration damper mounted on forward end of shaft. *See Studebaker Shop Notes for Vibration Damper data.* **Journal Diameter**—2.4995-2.5000". **Bearings**—Removable steel-backed, babbitt-lined. **Clearance**—.0005-.0025".

Adjustment:—None (no shims). Replace bearings (std. size, .010", .020", .030" undersize).

End Thrust:—Thrust plate assembled between front bearing and crankshaft gear. Controlled by shims (furnished .003", .005", .007" thick) between plate and journal face. **Endplay**—.003-.006". NOTE—Install new seals (specially treated wood) whenever rear main bearing cap replaced

CAMSHAFT:—Four bearing with helical gear drive. *See Studebaker Shop Notes for Camshaft Removal.* **Journal Diameters**—#1, 1.9975-1.998"; #2, 1.96625-1.967"; #3, 1.93575-1.9365"; #4, 1.12325-1.124". **Bearings**—Split steel-backed, babbitted bushings. NOTE—Align bushing with oil hole in block. **Clearance**—.00075-.00225" (#1), .001-.00275" (others).

End Thrust:—Taken by thrust plate assembled on front face of engine behind camshaft gear. Spacer assembled back of gear hub. **Endplay**—.004-.008"

Timing Gears:—Crankshaft (cast-iron), Camshaft (Celeron with steel hub). **Backlash** .001-.003". *See Studebaker Shop Notes for Gear Removal and Replacement Gear size selection.*

Camshaft Setting:—Mesh marked camshaft gear tooth between two marked teeth on camshaft gear.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1 15/32"	11/32"	5 7/32"
Exhaust	1 9/32"	11/32"	5 7/32"

	Seat Angle	Lift	Stem Clearance
All Valves	45°	11/32"	.0015-.0035"

Tappet Clearance:—.016" (cold) all valves. Remove hood side panel for access to valves.

Valve Guides:—Pressed in block from above (1 5/32" below upper edge of valve seat) with stepped end down. Ream to inside diameter of .3425-.3445".

Valve Springs:—Install with closed-coil up and dampener on top of spring. Replace springs if 10% weak (test with Tool U-15). **Free Length**—2½". *See Studebaker Shop Notes for Valve Spring installation.*

	Spring Pressure	Spring Length
Valve Closed	54-60 lbs.	2 3/32"
Valve Open	125-135 lbs.	1¾"

Valve Lifters:—Barrel type (remove from above with valve, valve spring and adjusting screw removed). Furnished std. size and .0005", .001" oversize. **Diameter** .9985-.999". **Clearance** .0005-.00175".

Valve Timing:—See Camshaft Setting above. **Intake Valves**—Open 15° BTDC. Close 49° ALDC. **Exhaust Valves**—Open 54° BLDC. Close 10° ATDC. **Valve Timing Check**—With .020" tappet clearance #1 intake valve should open with #1 piston 15° or .0942" BTDC with vibration damper mark 'IN.OP1-6/' aligned with pointer on timing gear cover. Reset tappet clearance .016" (cold).

LUBRICATION:—Pressure (pump on right of engine). *See Studebaker Shop Notes for Oil Pump installation.* **Oil Pan Note**—Place #2 piston at approx. top dead center to facilitate Oil Pan Removal & Installation.

Normal Oil Pressure:—40 lbs. at 25-30 MPH.

Oil Pressure Relief Valve:—On lower right front corner of engine. Opens at 30-40 lbs. Not adjustable.

Crankcase Capacity:—6 quarts.

COOLING SYSTEM:—**Capacity**—13 quarts.

Water Pump:—Centrifugal with adjustable packing, lubricant fitting and grease cup for bushings. *For complete data, refer to 1941 Mech. Equip. Index.* **Removal**—Drain water, remove fan belt, fan blades and pulley, pump hose. Take out mounting bolts.

Thermostat:—Bishop & Babcock or Fulton., In cylinder head outlet. Install with bellows down. **Setting**—Starts to open 151° F. to 155° F.

Drain Valves:—At radiator lower tank and plug on left side of cylinder block at rear. If heater used, disconnect hose at cylinder head and hold hose below level of heater.

CLUTCH:—**Borg & Beck Model 9A7 with 'Borglite' driven member.** Clutch Assembly No. 943 stamped on cover. Single plate, dry disc type. *For complete data, refer to 1941 Mech. Equip. Index.* **Facings**—Molded-metallic (spiral-grooved), 2 used. Inside Diam. 6". Outside Diam. 9¼". Thickness ⅛".

Adjustment:—Free travel 1" (min.). Turn adjusting sleeve on pedal connector link. **Hill-Holder (NoRol) Note**—Check whenever clutch pedal adjusted. Set so that Hill-Holder releases just as clutch engages (change rod length).

Removal:—Remove transmission (see below), take off clutch housing, take out 6 mounting screws in clutch cover flange, lift off cover assembly. *See Studebaker Shop Notes for Clutch Release Shaft Lubrication instructions.*

TRANSMISSION:—**Warner.** Model AS1-T86D (Std), AS2-T86D Type R7C (optl. overdrive with electrical 'kick-down' control). All helical gear type, synchromesh (second & high), sliding gear (low & reverse). *For complete data, refer to 1941 Mech. Equip. Index.*

Transmission Control:—Mechanical steering col. shift. *For complete data, refer to 1941 Mech. Equip. Index.*

Removal:—Disconnect rear universal and withdraw propeller shaft from transmission. Disconnect shift levers and speedometer cable at transmission. Place jack under engine rear plate and free rear engine support. Remove transmission-to-clutch housing capscrews, pull transmission out to rear. **Overdrive Note**—On cars with overdrive, disconnect overdrive control cable and solenoid wires.

UNIVERSAL JOINTS:—**Spicer Model 1268-102.** Needle bearing type. Two used. *For complete data, refer to 1941 Mech. Equip. Index.* NOTE—1 piece driveshaft used. Slip joint formed at rear of transmission ahead of front universal.

REAR AXLE:—**Spicer Model 41-2.** Semi-floating, Hypoid gear type with Hotchkiss drive. *For complete data, refer to 1941 Mech. Equip. Index.* **Ratio**—4.55-1 standard. 4.82-1 optional. **Backlash**—.005-.007". Shim adjustment.

Removal:—Hoist rear of car, disconnect propeller shaft at rear universal, hydraulic brake lines, brake cables, and shock absorbers. Remove spring U-bolts, disconnect rear spring shackles and withdraw axle. NOTE—Use Puller HM-931 to remove axle shaft, Handle J-270-1 and disc J-270-6 to install inner shaft oil seal.

Wheel Bearing Adjustment:—Shims between backing plate and axle housing. With wheel and hub removed (use Hub Puller ST-500) check endplay with dial indicator. To adjust, remove backing plate, add or remove shims (.003", .005", .010", .030" thick). **Endplay**—.001-.005".

SHOCK ABSORBERS:—**Houdaille, Model BBFS2 (front) ACHS2 (rear).** Double acting, hydraulic, adjustable type with thermostatic control (rear only). *For complete data, refer to 1941 Mech. Equip. Index.*

STEERING:—**Steering Gear**—Ross Model T-14. Cam-and-Twin lever type. *For complete data, refer to 1941 Mech. Equip. Index.*

Front Suspension:—Planar type independent suspension with transverse spring. Specifications below apply with car weight on wheels but without load. *For complete data, refer to 1941 Mech. Equip. Index.* **Kingpin Inclination—5½°.** **Caster**—Negative ¼° to Positive ¾°. **Camber**—¼° to ¾°. Shim adjustment. **Toe In**—1/16-⅛". Adjust right reach rod only for toe-in. Left rod should be adjusted first for left wheel straight-ahead position (steering wheel centered). **Steering Geometry (toe-out on turns)**—Inner wheel turned 22-22½°. Outer wheel 20°.

BRAKES:—**Service.** Lockheed hydraulic, double anchor type. Hand lever applies rear service brakes. *For complete data, refer to 1941 Mech. Equip. Index.* **Wheel Cylinders**—Stepped or two-stage bore type. **Drum**—Budd composite. Diameter 11". **Lining**—Moulded. Width 2". Thickness 3/16". Length per shoe (each wheel): 11⅛" front, 8 9/16" rear. **Clearance**—.010" toe (top), .005" heel, for each shoe. **Braking Power**—45% rear wheels, 55% front.

Hill-Holder (NoRol):—Standard equipment. *For complete data, refer to 1941 Mech. Equip. Index.*

HOOD LOCK:—*See Studebaker Shop Notes for data.*

SERIAL NUMBER:—On left front door hinge post. 1st no.: 7139101 (South Bend), 7803901 (Los Angeles).

ENGINE NUMBER:—First number B-45001. Stamped on upper left side of cylinder block at center.

ENGINE SPECIFICATIONS:—8 cylinder, 'L' head type. **Bore**—3 1/16". **Stroke**—4¼". **Displacement**—250.4 cu. ins. **Rated HP**—30. **Developed Horsepower**—117 HP at 3800 RPM. **Compression Ratio**—6.5-1 standard cast-iron head. 7.0-1 cast-iron head optional. **Compression Pressure**—105 lbs.@150 RPM (Std.hd). *See Studebaker Shop Notes for Cyl. Head Installation.* **Vacuum Reading**—Steady 18-20" idling at 8 MPH.

PISTONS:—Aluminum alloy, T-slot, cam ground, tin plated. **Length** 3¾". **Weight** 13.6 ozs. (stripped). **Removal**—Pistons and rods removed from above. **Clearance**—Top .0115-.0165". Skirt .0015" selective. **Original Bore & Piston Sizes, Replacement Pistons:**—*See Studebaker Shop Notes for sizes and markings.* **Fitting New Pistons:**—Insert .003" x 1" feeler between piston and wall on camshaft side (pin parallel to crankshaft, T-slot away from camshaft). Pull to withdraw feeler 7-15 lbs. NOTE—Cylinders out-of-round or taper over .002" should be reconditioned. **Installing Pistons:**—T-slot away from camshaft.

PISTON RINGS:—3 coated rings, all above pin. #1 and #2 Compression (install with step down). #3 Oil Control (slotted type with expander ring installed behind this ring). Heat dam groove (no ring) above top ring groove. Oil drain holes in bottom groove.

Ring	Width	End Gap	Side Clearance
Compression	⅛"	.013-.021"	.0015-.002"
Oil Control	3/16"	.013-.021"	.0015-.002"

Replacement Rings:—Std. & .010", .020", .030" oversize.

PISTON PIN:—**Diameter**—⅞". **Length**—2⅝". Pin locked in connecting rod by lock screw. **Pin Fit in Piston**—.0001-.0003" clearance or light finger-push fit at room temperature (70°). **Replacement Pins:**—Std. & .002", .005" oversize. Use Hone No. PH-1 to obtain proper piston fit. NOTE—Replacement pistons fitted with pins.

CONNECTING ROD:—**Length**—8". **Weight**—32 ozs. **Crankpin Journal Diameter**—1.87425-1.87525". **Lower Bearing**—Precision type, removable steel-backed, lead-bronze lined. **Clearance**—.00075-.00275". **Sideplay**—.005-.009". NOTE—Turn crankpins for bearing clearance (Tool No. 1C). Do not ream bearings. **Bearing Adjustment:**—None. Replace bearings. Furnished Std. and .005", .010", .020" undersize. Align oil hole in rod and bearing shell. See that tongues on bearing engage grooves in rod and cap. *See Studebaker Shop Notes for 'Palnut' installation.* **Installing Rods:**—Oil hole toward camshaft.

CRANKSHAFT:—9 bearing, 12 bolted counterweights. Vibration damper mounted on forward end of shaft. *See Studebaker Shop Notes for Vibration Damper data.* **Journal Diameters**—2.3435-2.3440". **Bearings**—Removable steel-backed, babbitt-lined. **Clearance**—.001-.003". **Adjustment:**—None (no shims). Replace bearings (furnished Std. and .010", .015" undersize). **End Thrust:**—Thrust plate assembled between front bearing and crankshaft gear. Controlled by pinned bronze washers (furnished .003", .005", .007" thick) between plate and journal face. **Endplay**—.003-.006". NOTE—Install new seals (specially treated wood) whenever rear main bearing cap replaced.

CAMSHAFT:—Six bearing with helical gear drive. *See Studebaker Shop Notes for Camshaft removal.* **Journal Diameters:**—#1, 1.935-1.9355"; #2, 1.90275-1.9035"; #3, 1.87225-1.873"; #4, 1.84075-1.8415"; #5, 1.80975-1.8105"; #6, 1.74725-1.748". **Bearings**—Split steel-backed, babbitted bushings. NOTE—Align bushing with oil hole in block. **Clearance**—.00075-.00225" (#1), .002-.00375" (others). **End Thrust:**—Taken by thrust plate assembled on front face of engine behind camshaft gear. Spacer assembled back of gear hub. **Endplay**—.004-.008" **Timing Gears:**—Crankshaft (cast-iron), Camshaft (Celeron with steel hub). **Backlash**—.001-.003". *See Studebaker Shop Notes for Gear Removal and Replacement Gear Size selection.* **Camshaft Setting:**—Mesh marked camshaft gear tooth between two marked teeth on crankshaft gear.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1 13/32"	11/32"	5 7/32"
Exhaust	1 9/32"	11/32"	5 7/32"

	Seat Angle	Lift	Stem Clearance
All Valves	45°	11/32"	.001-.003"

Tappet Clearance:—.016" (cold) all valves. Remove hood side panel for access to valves. **Valve Guides:**—Pressed in block from above (1 5/16" below upper edge of valve seat) with stepped end down. Ream to inside diameter of .343-.344". **Valve Springs:**—Install with closed-coil up and dampener on top of spring. Replace springs if 10% weak (test with Tool U-15). **Free Length**—2½". *See Studebaker Shop Notes for Valve Spring installation.*

	Spring Pressure	Spring Length
Valve Closed	54-60 lbs.	2 3/32"
Valve Open	125-135 lbs.	1¾"

Valve Lifters:—Mushroom type in bolted-on guide brackets (clusters of four). Assemblies may be removed through valve opening on side of engine. **Valve Timing:**—See Camshaft Setting above. **Intake Valves**—Open 15° BTDC. Close 49° ALDC. **Exhaust Valves**—Open 54° BLDC. Close 10° ATDC. **Valve Timing Check**—With .020" tappet clearance #1 intake valve should open with #1 piston 15° or .0915" BTDC with vibration damper mark 'IN.OP.1-8/' aligned with pointer on timing gear cover. Reset tappet clearance .016" (cold).

LUBRICATION:—Pressure (pump in crankcase). *See Studebaker Shop Notes for Oil Pump installation.* **Normal Oil Pressure:**—40 lbs. at 25-30 MPH. **Oil Pressure Relief Valve:**—On lower right front corner of engine. Opens at 40 lbs. To adjust, loosen locknut, turn adjusting screw to right to raise pressure, to left to decrease pressure. **Crankcase Capacity:**—8 quarts.

COOLING SYSTEM:—**Capacity**—15 quarts. **Water Pump:**—Packless, sealed ball-bearing type. *For complete data, refer to 1941 Mech. Equip. Index.* **Removal**—Drain water, remove fan belt, fan blades and pulley, pump hose, and pump mounting screws. **Thermostat:**—Fulton. In cylinder head outlet. **Setting**—Starts to open 151° F. to 155° F.

CLUTCH:—**Inland.** 'Diaphragm' type, single plate, dry disc type with Long 9½CF-CS driven member. *For complete data, refer to 1941 Mech. Equip. Index.* **Facings**—Spirally grooved. Moulded (flywheel side). Woven—Man. Hycoe (pressure plate side). Inside Diam. 6". Outside Diam. 9½". Thickness .125". **Adjustment:**—Free travel 1" (min.). Turn adjusting sleeve on pedal connector link. **Hill-Holder (NoRol) Note**—Check whenever clutch pedal adjusted. Set so that Hill-Holder releases just as clutch engages (change rod length). **Removal:**—Remove transmission (see below). Support engine at rear, disconnect rear engine mountings, remove clutch housing. Take out 6 mounting screws in clutch cover flange. Lift off cover assembly. **Replacement Clutch Note**—Clutch assemblies have three spacers installed (one at each driving lug) which must be removed after clutch installed. *See Studebaker Shop Notes for Clutch Release Shaft Lubrication instructions.*

TRANSMISSION:—**Warner.** Model AS1-T86D (Std.), AS2-T86D Type R7C (optl. overdrive with electrical 'kick-down' control). All helical gear type, synchromesh (second & high), sliding gear (low & reverse). *For complete data, refer to 1941 Mech. Equip. Index.* **Transmission Control:**—Mechanical steering col. shift. *For complete data, refer to 1941 Mech. Equip. Index.* **Removal:**—Disconnect rear universal and withdraw propeller shaft from transmission. Disconnect shift levers and speedometer cable at transmission. Remove transmission-to-clutch housing capscrews, remove transmission. **Overdrive Note**—On cars with overdrive, disconnect overdrive control cable and solenoid wires. Disconnect Overdrive Rear Support at frame ends. *See Studebaker Shop Notes for Overdrive Rear Support installation instructions.*

UNIVERSAL JOINTS:—**Spicer Model 1268-102.** Needle bearing type. Two used. *For complete data, refer to 1941 Mech. Equip. Index.* NOTE—1 piece driveshaft used. Slip joint formed at rear of transmission ahead of front universal.

REAR AXLE:—**Spicer Model 41-2.** Semi-floating, Hypoid gear type with Hotchkiss drive. *For complete data, refer to 1941 Mech. Equip. Index.* **Ratio**—4.55-1 Std., 4.82-1 Optl. (Std. on Overdrive). **Backlash**—.005-.007". Shim adjustment. **Removal:**—Hoist rear of car, disconnect propeller shaft at rear universal, hydraulic brake lines, brake cables, and shock absorbers. Remove spring U-bolts, disconnect rear spring shackles and withdraw axle. NOTE—Use Puller HM-931 to remove axle shaft, Handle J-270-1 and disc J-270-6 to install inner shaft oil seal. **Wheel Bearing Adjustment:**—Shims between backing plate and axle housing. With wheel and hub removed (use Hub Puller ST-500) check endplay with dial indicator. To adjust, remove backing plate, add or remove shims (.003", .005", .010", .030" thick). **Endplay**—.001-.005".

SHOCK ABSORBERS:—**Houdaille, Model BBFS2 (front), ACHS2 (rear).** Double acting, hydraulic, adjustable type with thermostatic control (rear only). *For complete data, refer to 1941 Mech. Equip. Index.*

STEERING:—**Steering Gear**—Ross Model T-14. Cam-and-Twin lever type. *For complete data, refer to 1941 Mech. Equip. Index.* **Front Suspension:**—Planar type independent suspension with transverse spring. Specifications below apply with car weight on wheels but without load. *For complete data, refer to 1941 Mech. Equip. Index.* **Kingpin Inclination**—5½°. **Caster**—Negative ¼° to Positive ¾°. **Camber**—¼° to ¾°. Shim adjustment. **Toe In**—1/16-⅛". Adjust right reach rod only for toe-in. Left rod should be adjusted first for left wheel straight-ahead position (steering wheel centered). **Steering Geometry (toe-out on turns)**—Inner wheel turned 22-22½°. Outer wheel 20°.

BRAKES:—**Service.** Lockheed hydraulic, double anchor type. Hand lever applies rear service brakes. *For complete data, refer to 1941 Mech. Equip. Index.* **Wheel Cylinders**—Stepped or two-stage bore type. **Drum**—Budd composite. Diameter 11". **Lining**—Moulded. Width 2¼". Thickness 3/16". Lgth. per shoe (each wheel): 11⅛" front, 8 9/16" rear. **Clearance**—.010" toe (top), .005" heel, for each shoe. **Braking Power**—45% rear wheels, 55% front. **Hill-Holder (NoRol):**—Standard equipment. *For complete data, refer to 1941 Mech. Equip. Index.*

HOOD LOCK:—Alligator type hood. Hood lock control on instrument panel to left of headlight switch.

SERIAL NUMBER:—First number 441-5001 (Americar and Pick-up), 441-P-5001 (Panel Delivery). On plate on frame front cross-member (All Models), and on right side of cowl under hood (Americar and Pick-up), right front door riser (Panel Delivery).

ENGINE NUMBER:—First number same as Serial No. Stamped on right front upper corner of engine.

ENGINE SPECIFICATIONS:—4 cylinder, 'L' head type.

Bore—3⅛". **Stroke**—4⅜".

Displacement—134.2 cu. ins. **Rated HP**—15.63.

Developed Horsepower—63 (Americar—cast-iron hd.), 65 (Americar Plainsman—Al. hd.), 61 (Pick-up and Panel Delivery—cast-iron hd.) at 3800 RPM.

Compression Ratio—Cast-iron: 6.48-1 (Americar), 6.1-1 (Pick-up & Panel Del.). Aluminum: 7.0-1 (Plainsman—Optl. on other Americar models). NOTE—6.81-1 cast-iron hd. Optl. high altitudes.

Compression Pressure—At cranking speed of 185 RPM: 107 lbs. (Pick-up & Panel Del.), 111 lbs. (All others).

Vacuum Reading—Steady 21-23" idling at 8 MPH. NOTE—Cylinders offset ⅛" from center-line of crankshaft toward camshaft side of engine.

PISTONS:—Lynite Lo-Ex aluminum alloy, 'T' slot, Cam ground, tin-plated type.

Weight—12.5 ozs. (stripped). **Length**—3¾".

Removal—Pistons and rods removed from above.

Clearance—.0205-.0225" top, .003" skirt.

Original Bore & Piston Sizes:—Engines and pistons graded in four .0005" steps as shown in table below and marked as follows: **Piston**—Letter stamped on head. **Cylinder Bore**—Letter stamped on top of block between valve ports and bore at center.

Grade Letter	Cylinder Bore Size	Piston Size
A	3.1255-3.1250"	3.1235-3.1230"
B	3.1260-3.1255"	3.1240-3.1235"
C	3.1265-3.1260"	3.1245-3.1240"
D	3.1270-3.1265"	3.1250-3.1245"

Replacement Pistons:—Finished pistons furnished Std. (see Table above), .002", .005", .010" oversize.

Fitting New Pistons:—Use .0025" feeler stock ¾" wide inserted between piston and cylinder wall on side opposite slot. Pull to withdraw feeler 5-10 lbs.

Installing Pistons:—Slot toward left (valve) side.

PISTON RINGS:—Two compression, one oil control ring per piston, all above pin (heat dam groove above top ring). Oil ring groove drilled for drainage.

Ring	Width	End Gap	Side Clearance
Compression	3/32"	.008-.013"	.0015-.002"
Oil Control	3/16"	.008-.013"	.0015-.002"

NOTE—Install compression ring with mark TOP up.

Replacement Rings:—Std. & .005", .010", .020", .030" OS.

PISTON PIN:—**Diameter** .8117-.8119". **Length** 2 25/32". Pin locked in connecting rod by clampscrew.

Pin Fit in Piston—.0001-.0009" clearance or light push fit at 60°F.

Replacement Pins:—Std. & .001", .002", .003", oversize.

CONNECTING ROD:—**Weight** 34 ozs. **Length** 9 3/16".

Crankpin Journal Diameter—1.9395" (1 15/16").

Lower Bearing—Spun babbitt-lined type.

Clearance—.0008-.0023". **Sideplay**—.005-.009".

Bearing Adjustment:—None (no shims). Replace or rebabbitt rods. Do not file rods or bearing caps. Rods furnished Standard and .010" Undersize.

Installing Rods:—Short side of bearing to front (#1, #3), to rear (#2, #4). Oil hole away from camshaft.

CRANKSHAFT:—3 bearing with 4 counterweights.

Journal Diameters—2.3340" all bearings.

Bearings—Removable slip-in steel-backed, babbitt-lined. Furnished Standard and .010" Undersize.

Clearance—.001".

Bearing Adjustment:—None (no shims). Replace bearings. Do not file bearing caps.

End Thrust:—Taken by #1 front bearing. Adjustable by adding or removing shims between crankshaft thrust washer and shaft. **Endplay**—.004-.006".

NOTE—Crankshaft thrust washer furnished .002" thick.

CAMSHAFT:—4 bearing. Non-adjustable chain drive.

Bearing Type—Removable bushing (front), machined in crankcase (all others).

Bearing Clearance—.002-.0035".

End Thrust:—Taken by thrust plate behind camshaft sprocket and spring-loaded plunger in forward end of camshaft bearing against thrust stud on chain case cover. NOTE—Make certain that plunger and spring in place when replacing chain case cover.

Timing Chain:—Link-Belt. Width 1". Pitch ½". Length 47 links or 23½".

Camshaft Setting:—With #1 piston at TDC, mesh chain with sprocket marks adjacent and in line with a straightedge across the shaft centers.

VALVES:—	Head Diameter	Stem Diameter	Length
Intake	1 17/32"	.373"	5¾" (overall)
Exhaust	1 15/32"	.3725"	5¾" (overall)

	Seat Angle	Lift	Stem Clearance
Intake	45°	23/64"	.0015-.00325"
Exhaust	45°	23/64"	.002-.00375"

NOTE—Separate valve seat inserts not used.

Tappet Clearance:—.014" all valves, with engine cold. Remove hand hole in left front fender splash shield by taking out screws for valve adjustment.

Valve Guides:—Remove from above. Press new guides in (taper end up) until lower end extends ¾" below valve spring seat recess in block.

NOTE—Exhaust valve guides counter-bored on upper inner diameter to .399" diameter, 5/16" deep.

Valve Springs:—Free length 2½".

	Spring Pressure	Spring Length
Valve Closed	50 lbs.	2 7/64"
Valve Open	116 lbs.	1¾"

Valve Lifters:—Mushroom type (remove from below). Guide holes reamed in block. Serviced by reaming guide hole for .004" oversize lifter.

Lifter Diameter—.6245".

Lifter Clearance—.0005-.002".

Valve Timing:—See Camshaft Setting above.

Intake Valves—Open 9° BTDC. Close 50° ALDC.

Exhaust Valves—Open 47° BLDC. Close 12° ATDC.

Valve Timing Check—With .020" tappet clearance #1 intake valve should open with #1 piston 9° or .039" BTDC with flywheel mark 'I.O' centered in inspection hole in right front side of engine rear support (¼" variation permissible). Reset tappet clearance at .014" (cold).

LUBRICATION:—Pressure (pump on left of engine).

Oil Pump Installation Note—Install pump with #1 piston on compression, 'TC-IGN' flywheel mark centered in inspection hole in right front side of engine rear support and distributor shaft turned so that rotor is at #1 segment in distributor cap.

Normal Oil Pressure:—40 lbs. (75 lbs. on instrument panel gauge) at 30 MPH.

Oil Pressure Regulator:—Under plug on oil pump cover. Opens at 40 lbs. Adjustable by adding or removing shims within plug above spring.

Oil Pressure Gauge:—King-Seeley Electric. K-S No. 8190 (Dash Unit), K-S No. 6425 (Engine Unit).

For complete data, refer to 1941 Mech. Equip. Index.

Crankcase Capacity:—4 quarts.

COOLING SYSTEM:—**Capacity**—11¾ quarts.

Water Pump:—Packless, sealed ball-bearing type.

For complete data, refer to 1941 Mech. Equip. Index.

Removal—Drain water, remove fan belt and fan blades, loosen radiator mounting nuts, take out pump mounting bolts and lift pump out.

Thermostat:—Harrison. In outlet elbow on head.

Setting—Starts to open 148-155° F. Fully open 173°.

Temperature Gauge:—King-Seeley Electric. K-S No. 8184 (Dash Unit). K-S No. 7000 (Engine Unit).

For complete data, refer to 1941 Mech. Equip. Index.

CLUTCH:—**Atwood Model TP28-7 (Americar), TP28-7-1 (Pick-up & Panel Delivery).** Single plate, dry disc type with new hydraulic type dampener.

NOTE—1940 type Borg & Beck driven member used on some 1941 cars.

For complete data, refer to 1941 Mech. Equip. Index.

Facings—Moulded, 2 required. Inside Diameter 5⅛". Outside Diameter 7⅞". Thickness .125".

Adjustment:—Pedal free travel ¾-1" (provides 1/16" clearance between release bearing & release levers). To adjust, change length of clutch fork connecting cable.

Removal:—Remove Transmission (see below) and flywheel bell housing. Take out mounting screws in clutch cover. Remove clutch assembly.

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TRANSMISSION:—Warner. Model AS5-T84G. All helical gear type with synchro-mesh (second and high), sliding gear (low & reverse). Overdrive with electrical 'kick-down' control Std. on Plainsmen, Optl. on other Americar models.

NOTE—Pick-up and Panel Delivery transmission equipped with shielded bearing on main drive gear. ***For complete data, refer to 1941 Mech. Equip. Index.***

Transmission Control:—Mechanical steering col. shift. ***For complete data, refer to 1941 Mech. Equip. Index.***

Removal:—Disconnect accelerator pedal from rubber socket, remove toeboards. Disconnect control rods at transmission and front universal. Remove bell housing and hole cover and disconnect clutch throw-out bearing retracting spring. Remove lower nuts on engine mounting bolts at rear of transmission, jack up rear of engine (CAUTION—See that fan blades do not damage radiator) to clear frame cross-member. Remove transmission mounting bracket and bell housing-to-transmission case bolts. Pull transmission straight back and lift out.

Overdrive Removal—Same as above plus the following: Disconnect solenoid wires and overdrive control cable at transmission. Remove overdrive rear support by taking out bolts at frame ends. NOTE—When installing overdrive rear support, install equal number of shims between frame and each end of support until bottom of overdrive case just touches rubber insulator, then remove shims equal to 3/16" thickness from each end of support to give proper compression of insulator.

UNIVERSAL JOINTS:—Detroit Series 4100. Ball-and-trunnion type with needle bearings. 2 used. ***For complete data, refer to 1941 Mech. Equip. Index.***

REAR AXLE:—Own Model 441 (Americar), Spicer Model 21-1 (Pick-up & Panel Delivery). Semi-floating, hypoid gear (Americar), spiral bevel gear (Pick-up & Panel Del.) with Hotchkiss drive. ***For complete data, refer to 1941 Mech. Equip. Index.***

Ratio—4.44-1 (Americar). 4.7-1 (Pick-up). 5.1-1 (Panel Delivery).

Backlash—.006-.008". Shim adjustment.

Removal:—Hoist rear of car. Disconnect rear universal, brake tube and cables, shock absorbers, spring U-bolts, rear spring shackles. Pull assembly to rear.

Wheel Bearing Adjustment:—To adjust, remove wheel, hub assembly, oil seal and bearing retainer. Remove shims from between retainer and backing plate to decrease endplay. **Endplay**—.004-.006" total.

SHOCK ABSORBERS:—Monroe. STANDARD 11422 (front), 11425 (rear). HEAVY DUTY 11429 (front), 11430 (rear). Hydraulic (permanently sealed assembly), direct acting, adjustable type. ***For complete data, refer to 1941 Mech. Equip. Index.***

STEERING:—Steering Gear—Ross Model T-12 Cam-and Twin lever type. ***For complete data, refer to 1941 Mech. Equip. Index.***

Front Suspension:—Own Model 441 Front Axle. Conventional 'I' beam section with Reverse-Elliott ends.

Kingpin Inclination—7½° crosswise.

Caster—3°. Adjustable by installing wedge shims between spring and spring pad on axle.

Camber—2°. Not adjustable.

Toe In—1/32-5/32". Adjustable by loosening tie rod clamp bolts and turning tie rod.

Steering Geometry (toe-out on turns)—With outer wheel turned 20°, inner wheel should turn 23°15'. Not adjustable (check for bent steering arms).

BRAKES (ALL MODELS):—Service. Bendix (Lockheed) hydraulic, double anchor type. Hand lever applies rear wheel service brakes. ***For complete data, refer to 'Lockheed Double Anchor' Brake in 1941 Mechanical Equipment Index.***

Drums—Nickel chromium alloy iron. Diameter 9".

Lining—Moulded type. Width 1¾". Thickness 3/16". Length per wheel 18⅝".

Clearance—.008" toe (top), .005" heel, for each shoe.

Braking Power—43% rear wheels, 57% front.

Hand Brake:—See Service Brakes above.

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BUICK
1941 MODELS

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Main Bearing Bolts	120-130	1440-1560
Connecting Rod Bolts (40,50)	45-50	540-600
Connecting Rod Bolts (60,70,90)	60-65	720-780
Piston Pin Clamp Bolt	25-30	300-360
Rocker Arm Bracket Capscrew	30-35	360-420
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Wheel Bolts	60-65	720-780
Pitman Arm Nut	70-75	840-900
Front Shock Abs. to frame	60-65	720-780
Lower Control Arm to frame	45-50	540-600
Body Bolts	25-30	300-360

CADILLAC
1941 MODELS

	Ft. Lbs.	In. Lbs.
Cylinder Head Bolts	70-75	840-900
Main Bearing Caps	130-140	1560-1680
Connecting Rod Bolts	50-60	600-720
Flywheel to Crankshaft	65-70	780-840
Engine Rear Supports	50-60	600-720
Intake & Exhaust Manifold	25-30	300-360
Crankshaft Counterweights	145-155	1620-1740
Fan Support to Bracket	85-95	1020-1140
Clutch Cover Mounting Screws	18-22	216-264
Diff. Carrier to Axle Hous'g	25-30	300-360
Axle Shaft Hub Nuts	285-315	3420-3780
Wheel Mounting Nuts	110-120	1320-1440
Brake Backing Plate to Axle	35-40	420-480
Steering Gear to Frame	40-45	480-540
Steering Wheel Nut	45-50	540-600
Front Shock Absorber Bolts	100-115	1200-1380
Front Susp. Arm to Frame	60-70	720-840
Hydra-Matic Drive Cars:		
Trans. to Bell Hous'g	80-90	960-1080
Bell Hous'g to Crankcase	70-75	840-900
Flywheel to Flywheel Cover	20-25	240-300
Flywheel to Crankshaft	80-90	960-1080

CHRYSLER—DE SOTO—DODGE—PLYMOUTH
1941 MODELS

	Ft. Lbs.	In. Lbs.
Spark Plugs (14 MM. Type)	26-32	312-384
Cylinder Head Capscrews	65-70	780-840
Main Bearing Cap Nuts	75-80	900-960
Main Bearing Capscrews	80-85	960-1020
Connecting Rod Nuts	45-50	540-600
Flywheel Nuts	55-60	660-720
Manifold Stud Nuts	15-20	180-240
Starting Crank Jaw	108 min.	1296
Trans. to Clutch Housing Studs	45-50	540-600
Differential hous'g to axle hous'g	25-30	300-360
Axle Shaft Nuts	142 min.	1704
Wheel Hub Bolts	58½-66½	702-898
Brake Backing Plate to Axle	30-35	360-420
Steering Gear to Frame Screws	45-50	540-600
Pitman Arm Nut	112-125	1344-1370
Front Susp. Con. Arms to Frame	54-63	648-756
Axle Ring Gear Bolt Nuts	35-40	420-480
Hand Brake Anchor Sup. Screws	50-55	600-660
Bumper Bolts	60-70	720-840

CHEVROLET
1941 MODELS

	Ft. Lbs.	In. Lbs.
Spark Plugs (10 MM. Type)	15 Max.	180
Cylinder Head Bolts	75-80	900-960
Main Bearing Bolts	105-110	1260-1320
Rocker Arm Support Bolts	25-30	300-360

FORD
1941 MODELS

	Ft. Lbs.	In. Lbs.
Aluminum Cylinder Heads	40	480
Cast Iron Cylinder Heads	50	600
Spark Plugs:		
14 MM. Aluminum Head	20-24	240-288
14 MM. Cast Iron Head	24-28	288-336

GRAHAM
1941 MODELS

	Ft. Lbs.	In. Lbs.
Aluminum Cylinder Heads	40-45	480-540
Cast Iron Cylinder Heads	55-60	660-720

HUDSON
1941 MODELS

	Ft. Lbs.	In. Lbs.
Spark Plugs (14 MM. Type)	28	336
Cylinder Head Stud Nuts (6)	40	480
Cylinder Head Stud Nuts (8)	50	600
Main Bearing Bolts	75	920
Connecting Rod Bolt Nuts	40	480
Flywheel to Crankshaft	45	540
Water Jacket Cover Bolt	15	180
Front Engine Support Bolt	45	540
Clutch Cover Mounting Bolts	22	264
Differential Carrier Nuts	37	444
Axle Shaft Nut	95	1140
Wheel Nuts	65	780
Brake Anchor Pin Nuts	85	1020
Clutch & Brake Pedal Nuts	22	264
Steering Wheel Nut	25	300
Pitman Arm Nut	140	1680
Steering Arm Nut	105	1260
Steering Center Arm Bolt Nut	65	780

LINCOLN—MERCURY
1941 MODELS

	Ft. Lbs.	In. Lbs.
Aluminum Cylinder Heads	40	480
Cast Iron Cylinder Heads	50	600
Spark Plugs:		
14 MM. Aluminum Head	20-24	240-288
14 MM. Cast Iron Head	24-28	288-336

NASH
1941 MODELS

	Ft. Lbs.	In. Lbs.
Cylinder Head Stud Nuts:		
'600' 4140—Dry	61-64	732-768
'600' 4140—Oiled	57-60	684-720
4160 & 4180—Dry	65-70	780-840
4160 & 4180—Oiled	60-65	720-780
Main Bearing Capscrews (Sixes)	66-70	792-840
Main Bearing Capscrews (Eight)	73-75	876-920
Connecting Rod Bolt Nuts ('600')	27-30	324-360
Connect. Rod Bolt Nuts (4160,80)	50-55	600-660
Tappet Screw '600'	4 1/6	50 min.

OLDSMOBILE
1941 MODELS

	Ft. Lbs.	In. Lbs.
Spark Plugs (14 MM. Type)	28-35	336-420
Cylinder Head Bolts	60-70	720-840
Main Bearing Bolts:		
All (except Rear)	100	1200
Rear Only	140	1680
Connect. Rod Nuts (slotted lock)	50-55	600-660
Piston Pin Lockscrews	9-11	108-132
Flywheel to Crankshaft Bolts	55-60	660-720
" " " (Hydra-Matic)	60	720
Front Engine Mounting to Frame	25-30	300-360
Rear Eng. Mtg. to Clutch Hous'g	45-50	540-600
Exh. to Int. Manifold Bolts	22-26	264-312
Manifold to Block Nuts	11-14	132-168
Crankshaft Front End Bolt	130-140	1560-1680
Clutch Cover Mounting Bolts	22-26	264-312
Transmission to Housing	60-70	720-840
Differential to Axle Housing	30-35	360-420
Wheel Nuts	65-70	780-840
Steering Gear to Frame Bolts	25-30	300-360
Steering Wheel Nut	15-20	180-240
Pitman Arm Nut	100-110	1200-1320
Front Shock Abs. to Frame	55-60	660-720
Lower Control Arm to Frame	55-60	660-720
Body Bolts	25-30	300-360

PACKARD
1941 MODELS

	Ft. Lbs.	In. Lbs.
Spark Plugs (10 MM. Type)	4	50 Max.
Cylinder Head Stud Nuts	61⅔-63⅓	740-760
Main Bearing Nuts (6 & 8)	82⅔-85	980-1020
Connecting Rod Nuts (6 & 8)	59½-60½	715-725
Tappet Screws (6 & 8)	23½-25	280-300

PONTIAC
1941 MODELS

	Ft. Lbs.	In. Lbs.
Cylinder Head Bolts	60	720
Main Bearing Capscrews	85	1020
Connecting Rod Bolts (slotted type)	45	540
Flywheel to Crankshaft Bolts (6)	105	1260
Flywheel to Crankshaft Bolts (8)	70	840

STUDEBAKER CHAMPION
1941 MODELS

	Ft. Lbs.	In. Lbs.
Cylinder Head Capscrews	50-54	600-650
Main Bearing Capscrews	91⅔	1100
Connecting Rod Cap Bolt Nuts	25-27	300-325

STUDEBAKER (EXCEPT CHAMPION)
1941 MODELS

	Ft. Lbs.	In. Lbs.
Cylinder Head Capscrews	83⅓	1000
Main Bearing Capscrews	91⅔	1100
Connecting Rod Cap Bolt Nuts	54	650

WILLYS-AMERICAR
1941 MODELS

	Ft. Lbs.	In. Lbs.
Cast Iron Cylinder Heads	60-65	720-780
Aluminum Cylinder Heads	40	480
Main Bearing Cap Bolts	65-70	780-840
Connecting Rod Cap Bolt Nuts	50-55	600-660

FOR ALL CYLINDER HEAD DIAGRAMS (HEAD NUT TIGHTENING ORDER) REFER TO 1940 SUPPLEMENT PAGE ME-67

AUTOMATIC VALVE TAPPET TAKE-UP 1941

WILCOX-RICH ZERO-LASH HYDRAULIC TYPE

Used On:

CADILLAC, 41-60S,61,62,63,67,75 (1941)
LINCOLN, MODELS 16H, 168H (1941)
PACKARD SUPER 8, 1903,3A,4,5,6,7,8 (1941)

DESCRIPTION:—This type automatic take-up is hydraulically operated and is built inthe valve lifter or tappet (engines are 'L' head type). The conventional tappet clearance adjusting screw is not used and the lifter plunger contacts the end of the valve stem directly. The lifter is made in two parts; a lower or lifter section (mushroom or barrel type) which contacts the camshaft cam, and an upper or plunger section which contacts the end of the valve stem. The plunger fits into a cylinder in the head of the lifter body and is raised to contact the valve stem end by a spring under the plunger head. Oil from the pressure lubricating system of the engine flows through the oil reservoir in the lifter bracket and the oil passage in the lifter body to fill the cylinder below the lifter plunger. When the lifter is raised by the cam to open the valve, the ball check valve in the bottom of the cylinder closes, preventing the escape of oil from the cylinder and the cam motion is transmitted directly through the lifter to open the valve. The combination of plunger spring (to take up any clearance between lifter and valve stem end) and oil trapped in the plunger cylinder by the check valve (so that cam pressure is transmitted solidly through the lifter assembly) result in an entirely automatic take-up with positive valve opening action.

SERVICING:—**Removal.** On mushroom lifter types with removable brackets, disconnect oil supply tube (when external oil line used), take out capscrews in each lifter bracket, lift bracket out taking care that lifters do not fall out of bracket (on some installations, lifters prevented from falling through bracket by locking ring at upper end of cylinder). On barrel type lifters which operate in guide holes in block (no guide brackets), lifters may be removed from upper end after valves and springs removed. NOTE—Mushroom type lifters are used on Cadillac and Packard engines, Barrel type lifters on Lincoln engines.

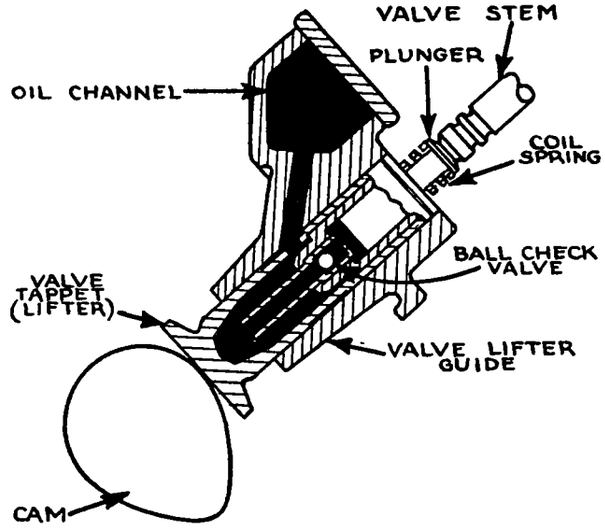
Disassembly. On mushroom types, remove locking ring at top of cylinder, withdraw lifter unit from below. Pull plunger and cylinder assembly out of lifter body. Unlock plunger spring by twisting plunger, pull plunger and spring out of cylinder (plunger is selective fit in cylinder and must be re-installed in same cylinder). Ball check valve in bottom of cylinder may be unseated if necessary by using small blunt tool.

Servicing—Wash all parts in gasoline, wipe with soft cloth or dry with air (air hose must not be held closer than 2"). If plunger or cylinder scored or clearance excessive, replace as a unit (old lifter body may be used if clearance in bracket or block guide holes not excessive). Check ball check valve tightness (see Testing). Ball should rattle when unit is shaken. Clean out oil reservoir and oil passages in brackets and engine block. See that plunger spring has sufficient tension so that force of 6-7 lbs. required to compress spring (valve unit must be dry when making this test—see also 'Plunger Fit in Cylinder' in Testing section below).

Reassembly—Place plunger spring on plunger, insert plunger in cylinder, lock spring in cylinder by twisting plunger. Make certain that same plunger and cylinder used together (plungers must not be interchanged). Install plunger and cylinder assembly in lifter, insert lifter assembly in bracket and install locking ring at upper end of lifter body above bracket (when used).

Installation—Valve lifters should be installed without oil in the cylinder (mechanical clearance must be checked if new parts installed or valves serviced) and engine should be run to quiet valve action (may require running for as long as an hour, if oil seals off air escape between plunger and cylinder before all air expelled, valve may not quiet until oil is warm—if more than one hour required to quiet valves, check as directed under Trouble Shooting below). Connect oil supply pipes at supply end only and crank engine until all air expelled and pipes filled with oil before connecting to lifter brackets.

Cadillac Note—Lifters can be installed in engine filled with oil if special tool J-827 used which prevents pumping and introduction of air while lifters being installed. Oil should be applied to tops of lifter assemblies after they are installed.



Checking Clearance—When new parts installed or valves reseated, check clearance between plunger and valve stem with plunger held down at bottom of stroke (no oil in cylinder). Clearance must be .030-.070". If clearance less than .030", grind off lower end of valve stem slightly.

Cadillac V8 Note—Use tool J-1055 to check valve stem length before installing lifters (measures distance from heel of cam to valve stem). Grind off end of valve stem until tool slides into place. Use tool J-827 to compress plunger springs when installing lifter bracket assemblies.

TESTING:—***Plunger Fit in Cylinder.*** With all oil washed out and unit dry, pull plunger up to release spring from counterbore in cylinder, raise plunger as high as possible while still guided in cylinder, push plunger down into cylinder quickly and release. If unit holds air to extent that plunger tends to bounce back when released, clearance is satisfactory. **Plungers are selective fit in cylinders and must not be interchanged** (clearances cannot be measured directly).

Check Valve Tightness. Check by filling cylinder with kerosene and noting rate at which this leaks past the ball check valve. Maximum allowable leakage is 1 drop per second.

Cadillac Note—This leak-down rate may be tested with special tester J-1297 and adapter J-1297-41. To make this test install adapter J-1297-41 in right hand socket of tester, fill reservoir with #1 grade kerosene, release ball check and pump tester in inverted position until all air expelled. Insert special master unit in left socket of tester and engine unit being tested in right socket. Rest tester handle weight on beam pilot and set indicator at zero. Press down quickly on handle several times and note indicator reading. Pointer must stay at zero or move up (indicating engine unit equal or better than master unit). If pointer goes down (leak-down rate greater than master unit), lifter should be replaced.

Engine Oil Pressure. Oil pressure at lifters not ordinarily indicated by instrument panel oil pressure gauge (reduced by metering restriction, etc. in oil lead to lifters). Pressure at lifters should be 4 lbs. minimum at idling speed, 12 lbs. minimum at high speed. Pressure in excess of 55 lbs. may cause noisy valve operation. Check by connecting pressure gauge in lifter oil line (where external oil lines to lifters used, disconnect line; on Lincoln Zephyr remove plug between banks at rear of engine directly above lifter metering hole.

TROUBLE SHOOTING:—If operation not satisfactory, check as follows:

All Valves are Noisy.

NOTE—Hydraulic lifters should be installed without oil and operation will not be quiet until engine has been run for a short time. Oil in lifters when installed will hinder this quieting operation.

1. **Oil Level Low**—Oil level in crankcase must not be allowed to become excessively low which may permit air to enter pump inlet.
2. **Oil Level High**—Oil level in crankcase should not be above 'Full' line on indicator. Higher level may cause foaming.
3. **Oil Pressure Low**—Oil supply to lifters will be inadequate. Must be sufficient to replace normal relief leakage between plunger and cylinder. Check oil pressure (See Testing above).
4. **Oil Pressure High**—High pressure may lift entire hydraulic unit against plunger spring tension causing excessive wear. If noise particularly noticeable when oil is hot, check pressure in oil supply line at lifter assembly (See Testing above).
5. **Oil Supply Insufficient**—Examine supply pipes and connections for leaks or restrictions preventing proper flow of oil to lifters. Check for dirt or sludge clogging oil lines and clean out all oil channels.

Valves Noisy when Hot.

1. **Oil Pressure Low**—Check oil pressure at lifter units by connecting gauge in supply line at lifter bracket.

One or More Valves Noisy.

1. **Incorrect Clearance**—Check mechanical clearance for particular unit (see directions above). Check clearance between plunger and cylinder (if parts interchanged, replace as a unit), check clearance between cylinder and lifter body.
2. **Sticking Caused by Dirt or Grit**—Disassemble and clean units as directed above. Drain crankcase, clean oil pan, flush engine, refill crankcase with new oil to prevent repetition of trouble.
3. **Weak Plunger Springs**—Will permit excessive plunger movement and wear. Disassemble lifter unit and check spring. See Testing above.

CHRYSLER, DE SOTO, DODGE TYPE

Std. or Optl. On:
CHRYSLER 6, MODEL C28 (1941)
CHRYSLER 8, MODELS C30, C33 (1941)
DE SOTO, MODEL S8 (1941)
DODGE, MODEL D19 (1941)

NOTE:—Fluid drive is used singly with conventional transmission or in combination with Vacamatic Underdrive Transmission (Chrysler 6), Vacamatic Overdrive Transmission (Chrysler 8), Simplimatic Underdrive Transmission (DeSoto). See separate articles for Clutch and Transmission data.

TYPE:—Same design as used on 1940 models except for new type runner hub nut on Chrysler 6, DeSoto, and Dodge models. This nut, which retains clutch driving plate on runner hub, is threaded in end of runner hub and does not incorporate an oil seal as used on Chrysler 8 models. Driver flange plug is used on all models although design is slightly different on Chrysler 6, DeSoto, and Dodge cars.

Bellows Seal Assembly—Consists of a floating carbon-graphite seal ring between the bellows seal ring and the bearing surface on the runner hub (same as 1940 type). Seal servicing is limited to replacement of seal ring and bellows assembly.

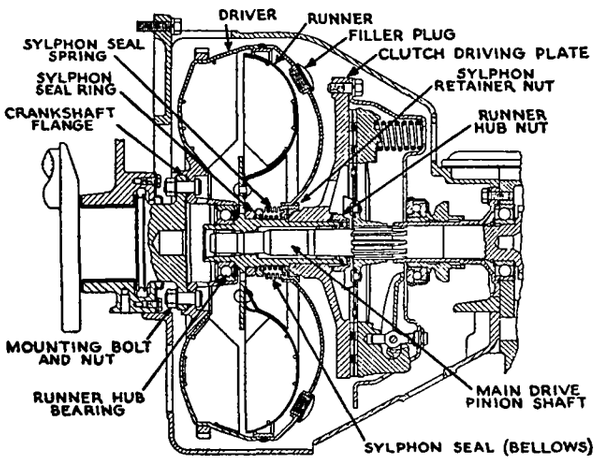
NOTE—Fluid drive oil is a light highly refined mineral oil which has uniform viscosity over wide temperature range and other types of fluid should not be substituted.

FLUID DRIVE ASSEMBLY REMOVAL & INSTALLATION:—**Removal**—Remove Transmission and Clutch (see car model 'M' pages for instructions). Use special box wrench C-589 (all models) to remove nuts on fluid drive mounting studs on forward face of crankshaft flange and pull unit back free of crankshaft flange, remove from below.

Installation—Carefully clean face of crankshaft flange and mounting face of fluid drive assembly to remove all dirt and burrs which might prevent flat, even contact of mounting faces. Install fluid drive assembly on crankshaft so that mounting studs and locating dowels enter holes properly, install nuts on studs and draw all nuts down evenly and securely.

SERVICING:—Unit is sealed and no adjustment required. Service operations are restricted to keeping unit filled with oil (inspect at end of first 1000 miles and at 15000 mile intervals in service) and to renewal of bellows seal and floating seal ring to correct oil leakage. See Removal & Installation directions below if Fluid Drive assembly being removed from car.

Checking Oil Level & Adding Fluid:—Recommended at end of first 1000 miles and 15000 mile intervals. Fluid drive case is filled to approximately 80% of volume and level should be checked as follows to prevent overfilling. Turn crankshaft until one fluid drive filler (2 plugs—180° apart) is at filler hole in upper right hand surface of clutch housing, remove filler plug. Fluid level should be even with bottom of filler plug opening. Add fluid as required (see Note below). Use new gasket on filler plug, replace plug and tighten securely (tap wrench with hammer to make certain that plug is tight).



Capacity—Approximately 6 qts. (Chrysler 6, DeSoto, Dodge), 8 qts. (Chrysler 8).

Bellows Assembly & Seal Ring Renewal:—With fluid drive unit removed from engine (see Removal directions above), remove both filler plugs and drain unit. Bend down tab on lockwasher, use special socket wrench C-607 (Chrysler 6, DeSoto, Dodge), C-541 (Chrysler 8) and remove clutch driving plate retainer nut. Mark one spline on runner hub and mating spline on clutch driving plate (to insure reassembly in correct position), use special puller C-606 (Chrysler 6, DeSoto, Dodge), C-542 (Chrysler 8) to remove clutch driving plate. Use special bellows seal spring compressing sleeve C-613 (Chrysler 6, DeSoto, Dodge), C-614 (Chrysler 8) to compress spring within bellows (use clutch driving plate retainer nut to push sleeve in to compress spring), remove spring retainer snap ring, remove nut, sleeve, and spring (CAUTION—Spring must be removed before bellows seal removed or seal will be damaged). Use special spanner wrench C-545 to unscrew bellows seal, remove bellows seal and floating seal ring.

IMPORTANT NOTE—Bearing surfaces on runner hub, seal ring, and bellows seal must be perfectly clean and free from scratches or marks and should show continuous contact over entire circumference. Bearing surfaces cannot be reconditioned and parts should be replaced if damaged (replace fluid drive assembly if runner hub bearing surface damaged).

Installation—Install floating ring and bellows seal (see that gasket in place), tighten bellows retainer securely. Install seal spring and retaining snap ring (use sleeve to compress spring so that retainer can be installed), install clutch driving plate making certain that marks on plate and runner hub are lined up, tighten clutch driving plate retainer nut securely. Fill unit with fluid (see directions above) and install in car.

CADILLAC, OLDSMOBILE HYDRA-MATIC TYPE

Used On:
OLDSMOBILE & CADILLAC 1941 MODELS WITH HYDRA-MATIC DRIVE TRANSMISSION

DESCRIPTION:—This Fluid Coupling replaces the conventional clutch on cars with Hydra-matic drive (no clutch used and clutch pedal omitted). Design is unlike other Fluid Drives in that, although the assembly is mounted in a case bolted on the engine flywheel, the drive is not direct from the engine crankshaft through the fluid drive (see Operation below). Fluid drive case is kept filled with same oil used in transmission case and oil is pumped into case by the transmission front oil pump. A return line and control valve allows the oil to circulate between the fluid drive and transmission so that temperatures are equalized and overheating is prevented.

OPERATION:—The engine drives the fluid coupling case which is bolted on the flywheel. The case is splined on a sleeve integral with the ring gear (drive gear) of the front planetary gear unit so that this gear is driven positively by the engine. This gear drives the planetary gear pinions and pinion plate (which is keyed on tubular intermediate shaft) and the rear unit or driver of the fluid coupling which is bolted on a mounting flange splined on the forward end of this tubular shaft. At idling speed, the driver rotates freely and does not transmit engine torque to the forward unit or runner of the fluid coupling. As soon as the engine speed is increased slightly (when accelerator pedal depressed to start car in motion), the fluid coupling driver causes the runner to rotate (driving through the oil with which the case is filled). The runner is bolted on a mounting flange which is splined on the forward end of the intermediate shaft (within the tubular shaft) and the engine torque is transmitted back through this shaft through the transmission to the rear wheels. NOTE—See separate Oldsmobile & Cadillac Hydra-matic Transmission article for complete description of transmission operation in each of the four forward speeds.

SERVICING:—**Lubrication**—Fluid Coupling case is kept filled with oil, and oil is automatically circulated, by pump in transmission case. Fluid coupling case is sealed and requires no attention. Fluid level of Transmission should be checked every 1000 miles (Cadillac), 2500 miles (Oldsmobile) and fluid added, if required, to maintain correct fluid level. Unit should be drained and refilled with new fluid at end of first 6000 miles and every 12000 miles aferward (Cadillac), end of first 5000 miles and every 10000 miles afterward (Oldsmobile). Check fluid as directed below (see Hydra-matic Transmission article for draining and refilling data and capacities).

Checking Fluid Level—Raise right edge of front compartment rug, remove all dirt from around inspection hole so that it cannot fall into transmission case, remove small sheet metal cover from top of transmission cover over indicator stick. Run engine for at least 1 minute, stop engine and wait 1 minute, then check level with indicator stick. Add fluid as required, to bring level up to 'Full' mark on indicator. CAUTION—Use genuine Cadillac or Oldsmobile Hydra-matic Drive Fluid only (use of other fluid voids warranty on Cadillac units).

DESCRIPTION:—This is an Electric gauge of the 'balanced coil' type and consists of a Dash Unit or recording gauge and an Engine Unit or temperature reacting unit mounted in the cylinder head or engine block in contact with the cooling water in the engine. Dash unit is connected to the 'Gauge' side of the ignition switch (controlled by switch and operative only with switch on) and to the engine unit and each unit is grounded (see wiring diagram). Dash unit consists of two coils at a 90° angle with an armature (on which the pointer is mounted) at the intersection of the coil axis. One coil is connected directly between the 'IGN' (feed) terminal and ground on the gauge case, the other coil being connected between the two gauge terminals (in series with the engine unit). Engine unit consists of a fixed resistance unit which has a high resistance value Cold and a relatively low resistance value Hot (gauge operated by this change in resistance due to temperature changes in the engine—gauge engine unit has no moving parts).

Pressure Cooling Note—Gauges used on cars with pressure cooling (pressure valve in radiator filler cap) are calibrated so that dash unit reads 212° (boiling point) when the cooling system water is actually at the temperature at which water boils with the pressure at which the system is designed to operate (boiling point increase with increase in pressure) which will be somewhat higher than 212°. This is done so that the dash unit will not indicate 'boiling' before the cooling water actually reaches the boiling point and must be kept in mind if the gauge is tested by immersing the engine unit in a heated pan of water.

OPERATION:—When the ignition switch is turned on with the engine cold, current flows directly through coil 'A' to ground. The high resistance of the engine unit causes a relatively smaller current to flow through coil 'B' (which is connected in series with this resistance) so that the pointer is deflected toward the 'Low' or coil 'A' side of the scale. As the engine warms up, the resistance of the engine unit decreases, allowing an increasingly greater current flow through coil 'B' so that the pointer is drawn over toward the 'High' end of the scale. The balanced action of the two coils compensates for battery voltage variations and in addition an inertia dampener is built in the armature assembly to prevent pointer vibration on rough roads, etc.

SERVICING:—All defective units should be replaced.

TROUBLE SHOOTING:—If gauge operation not satisfactory, check as directed under correct heading in following table, being careful to turn ignition switch off when disconnecting or re-connecting leads on terminals and using extreme care not to reverse connections at dash unit terminals. Do not allow dash unit to be placed in strong electric field which will affect magnetic armature.

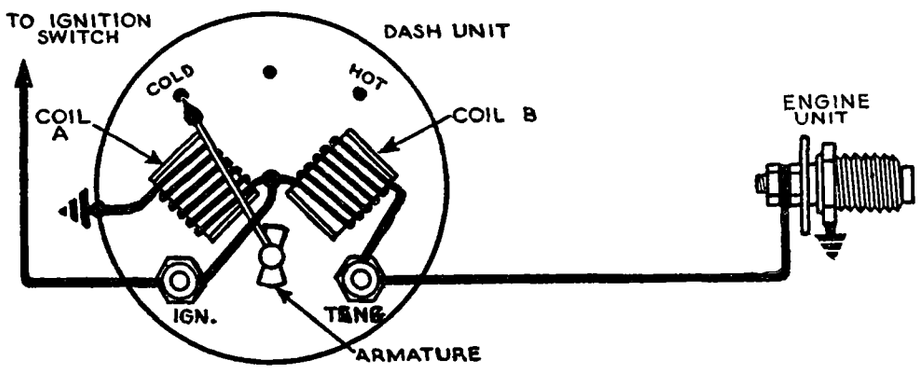
CONNECTION NOTE—Left hand (small diameter) terminal on dash unit should be connected to ignition switch, right hand (large diameter) terminal connected to engine unit. Terminals marked for identification.

Gauge does not register with Ignition Switch turned on:
1. Lead between Ignition Switch and Dash Unit broken or grounded (open or short-circuit). Check by connecting test lead between these two points with regular lead disconnected at both ends.

Gauge register 'Cold' under all conditions:
1. Lead between Dash Unit and Engine Unit broken (open-circuit). Check by connecting test lead between these two units.
2. Coil 'B' (right hand coil) in dash unit defective or lead to coil broken.

Gauge registers 'Hot' under all conditions:
1. Lead between Dash Unit and Engine Unit short-circuited. Check by disconnecting this lead at engine unit terminal and noting gauge reading. If gauge still reads high, this lead is shorted. If gauge reads low, engine unit is shorted and must be replaced.
2. Dash Unit not grounded. Clean all paint from under dash unit mounting flange, tighten mounting screws.
3. Engine Unit burned out. See check under (1) above or install replacement engine unit and note operation.
4. Coil 'A' (left hand coil) in dash unit defective or lead to coil broken.

Gauge registers Inaccurately:
To check, disconnect lead at engine unit terminal, remove engine unit, ground engine unit shell to car frame with test lead, re-connect engine unit, immerse inner end of unit in pan of water at known temperature (use reliable thermometer and heat water as required), note gauge reading.
CAUTION—When making this test, do not completely immerse engine unit in water which may allow leakage within shell or short-circuit lead on terminal.



AC & AUTO-LITE (MOTOMETER) TYPES

DESCRIPTION & OPERATION:—Vapor tension type temperature gauges consist of a dash unit gauge connected to an engine unit bulb by a hermetically sealed tube. The entire system is evacuated and partially filled with a liquid which has a low boiling point. When the engine unit bulb is exposed to the heat of the cooling water (bulb is installed in cylinder head or block so as to be immersed in the cooling water), the resulting expansion or vaporizing of the liquid in the gauge causes an increase of pressure which is indicated on the dash unit. Dash units are calibrated so as to read directly in degrees of temperature.

SERVICING:—No service operations required and units cannot be repaired. Replace all defective gauges as an assembly (dash unit and engine unit).

CAUTION—Do not cut tubing or attempt to disconnect dash unit or engine unit. The entire assembly is a sealed unit and will not operate satisfactorily if disturbed.

REMOVAL & INSTALLATION:—When removing gauge for work on engine or other parts of car, use extreme care not to kink or damage connecting tubing or to distort engine unit bulb which would cause dash unit to read incorrectly. Tubing should not be bent at sharp angles (loop tubing where change in direction required) and must not be flattened or kinked. When installing new gauge do not attempt to remove excess tubing (form tubing into fairly large loop).

OIL PRESSURE GAUGE

DESCRIPTION:—This is an electric oil pressure gauge comprising an engine unit, and a dash or recording unit connected by a wire. The dash unit is also connected to the ignition switch (gauge operative only with engine turned on) and the gauge circuit is completed to ground through the engine unit contacts. The dash unit consists of a thermostatic bi-metal arm linked to the instrument pointer around which is wound a heating coil. The engine unit has a similar bi-metal arm and heating coil. One of the engine unit contacts is mounted on this bi-metal arm and the other contact is mounted on a diaphragm which is deflected when oil pressure is built up in the engine so as to increase the contact pressure and lengthen the time period over which the contacts are closed. The diaphragm contact completes the gauge circuit to ground.

OPERATION:—When the engine is operated and oil pressure is built up, the pressure deflects the diaphragm in the engine unit and, with the contacts closed, a current flows through the heating coils of the dash and engine unit. The heating effect of the coil in the dash unit tends to bend the bi-metal arm which is linked to the pointer and record a reading on the gauge. At the same time, the heating coil in the engine unit causes the bi-metal arm to flex to a point where the contacts open and the current is interrupted. When this occurs the bi-metal arm in the engine unit flexes in the opposite direction and again closes the contacts. Contact pressure and length of time (amount of flexing necessary to open contacts) is directly proportionate to the oil pressure in the engine, and as this determines the amount of current flowing in the gauge circuit and the deflection of the bi-metal arm in the dash unit, the dash unit indicates the oil pressure. The opening and closing of the contacts is extremely rapid (approximately 120 cycles per minute with engine oil pressure of 25 lbs.). The dash unit is calibrated in pounds and the accuracy of the gauge is established at the time of assembly by the use of calibrating shunts.

SERVICING:—No service operations are necessary other than to see that connections are tight and that lead is properly connected to engine unit. If gauge operation is unsatisfactory, check Trouble Shooting Table and make tests outlined below. Repair or calibration of units is not practical and manufacturer recommends replacement of Receiver or Sender units which are defective.

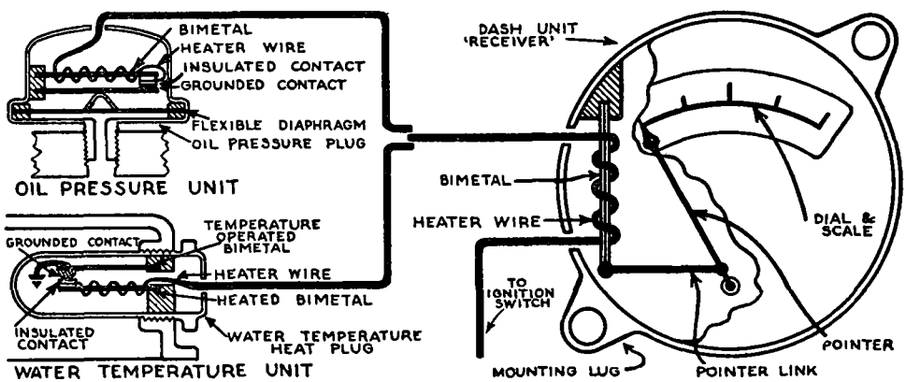
Trouble Shooting Table

1. **Gauge pointer is erratic.** Engine unit probably defective.
2. **Gauge reading inaccurate.** Engine unit probably defective.
3. **Gauge does not register.** Engine unit defective or dash unit burnt out as result of short-circuit in lead between units.
4. **Gauge registers with engine not running (ignition on).** Short-circuit in lead between dash unit and engine unit or short-circuit in dash unit (a short-circuit of this type will usually result in dash unit burning out, resulting in no reading).

TESTING (ALL UNITS):—Use a gasoline gauge tank unit which is known to be OK. for test purposes. Connect flexible test lead to terminal on this test unit and second lead to test unit mounting flange (for ground circuit). Make tests in order as given below before removing units from car.

Testing Dash Unit Receiver. Disconnect engine unit Sender, connect test unit terminal lead to this wire, ground test unit to engine block. Turn on ignition switch. With float of test unit at bottom (tank empty) position, dash unit receiver pointer should be even with lowest mark on dial. Move test unit float rod up to top position. Dash unit receiver pointer should move to top mark on dial (allow one minute for pointer to come to rest). If dash unit receiver does not operate satisfactorily, see that connections at receiver and ignition switch are tight, check line to ignition switch and line to engine unit, then replace receiver. NOTE—When testing temperature gauges, readings will be reversed (Hot reading with test unit float at bottom, Cold reading with test unit float at top).

Testing Engine Unit Sender. If receiver tests OK. (above), see that motor unit is well grounded, disconnect and check radio condenser (shorted condenser will cause high reading on dash unit). Then replace engine unit sender, connect to dash unit receiver and note performance.



KING-SEELEY TEMPERATURE GAUGES

IMPORTANT NOTE:—**All Models.** Temperature gauges will read 'Hot' or 212° with the ignition switch turned off (engine not running). This reading does not mean that gauge is defective and is caused by the linkage design which is designed to conserve current (less current consumed when engine is at normal running temperatures). Gauge readings should only be taken with the ignition switch turned on.

Ford & Mercury 1941 Models—A temperature switch King-Seeley No. 8355, Ford No. 01A-10990, is used in the temperature gauge circuit (between the dash unit and the engine unit) so that temperature can be measured in both engine blocks. The regular engine unit or heat plug King-Seeley No. 7000, Ford No. 99A-10884, is used in conjunction with this temperature switch.

DESCRIPTION:—Dash unit or Receiver same design as for Oil Pressure Gauge. Engine Unit or Sender consists of two bi-metal arms within a heat bulb which is designed to be screwed in the engine block so that cooling water temperature is transmitted to the arms. Heating coil (connected to dash unit) is wound on one arm and connected to insulated contact at free end of arm. Ground contact is mounted on free end of second bi-metal arm which is so located that contacts are normally closed (with arms not flexed) and gauge circuit is completed through heating coil and contacts to ground when ignition is turned on.

OPERATION:—When heating coil on bi-metal arm in engine unit is energized, the temperature rise tends to flex the arm and open the contacts. This interrupts current flow, allows bi-metal arm to cool off and flex back so that contacts are again closed. This action is extremely rapid and arm has a vibrating motion. Second bi-metal arm is longer and thinner than heater arm so that flexing action, as engine temperature increases, is greater and tends to increase contact pressure and length of time contacts are closed. Consequently current flow in gauge circuit increases in proportion to the rise in engine temperature and this increased current produces a greater deflection of the dash unit bi-metal arm so that a higher reading is indicated on the dial.

TESTING & SERVICING:—Same as for Oil Pressure Gauges (above). See Note for reversed readings secured on temperature gauges when using special gas gauge tank unit as a test sender.

Used On:
BUICK, CADILLAC, CHEVROLET, OLDSMOBILE, PACKARD, PLYMOUTH, PONTIAC 1941 CONVERTIBLE CAR MODELS.

NOTE:—Power tops on all cars are of similar design with differences in power cylinder mounting, linkage design and control hook-up as noted below.

Electric & Hydro-electric Types—These types used on other car models and have direct motor driven geared power, or hydro-electric power cylinders linked to same type top mechanism. See separate articles (following) for data on these types.

DESCRIPTION:—Convertible tops used on cars with power actuation have the conventional top bows and braces modified for connection of the vacuum power cylinders and are equipped with counterbalancing springs. Two vacuum power cylinders are mounted at sides of car behind seat trim (one on each side) and are linked to the top frame. Each cylinder is double acting type, with vacuum line hose connection to upper and lower end, and operate when control valve button on dash is manipulated to connect either end of cylinder to engine manifold vacuum line (both strokes of cylinder piston rod are positive and top is both raised and lowered by vacuum power). Control valve is double acting type and is normally centered in the 'off' position by a spring within the valve. When the control valve button is pushed in, or pulled out, vacuum connection is made through the valve to one end or the other of both power cylinders. Button must be held in or out during entire time cylinders are operating to raise or lower top.

OPERATION:—Engine should be running (idle engine with closed throttle) and car should be stopped when top control is operated. CAUTION—Top should never be raised or lowered when car is in motion.

Lowering Top—Unlatch top from widshield header on both sides, raise top slightly so that locating dowels or pins are free of header, press in or pull out on control valve button (pull out on button on Buick, Cadillac, Chevrolet, La Salle, Oldsmobile, Pontiac, Packard; in, Plymouth) and **hold in this position** until top is completely lowered. In this position, control valve connects lower end of each cylinder to engine manifold vacuum line and opens upper end of each cylinder to atmospheric pressure.

Raising Top—See that top straps or boots are removed so that top is free. Press in on control valve button (Buick, Cadillac, Chevrolet, La Salle, Oldsmobile, Pontiac, Packard; pull out, Plymouth) and **hold in this position** until the top is raised. Top should come to rest within 1-2" of windshield header and side rail should be straight (see Adjustment section below). Top must then be pulled down and fastened in place by hand.

ADJUSTMENT:—**Chevrolet**—If top does not come to rest within 1-2" of windshield header and side rails do not straighten out when top is raised, or if top travel is excessive so that it comes to rest on windshield header, adjust as follows: Lower top, remove mounting screws and take out rear quarter trim panels. Loosen two nuts anchoring adjustment plate on control link bracket (directly above and forward of top of vacuum power cylinder on each side of car), tap adjustment plate down ⅛" (if travel insufficient), up ⅛" (if travel excessive), tighten anchor nuts. **Adjust both sides of car exactly alike.** Check performance, repeat adjustment until correct operation secured.

Top Alignment—Top alignment to insure correct registering of locating dowels or pins and sockets on top and windshield header can be adjusted by shimming body at mounting bolts.

SERVICING:—**Vacuum Cylinder**—To remove vacuum cylinder, remove rear quarter trim panel, take out bolt linking piston rod to top, disconnect both connections, remove bolt mounting cylinder on body bracket at lower end (on General Motors cars, remove locknut on end of bolt, then remove bolt with a 5/16" Allen setscrew wrench), lift cylinder out. When replacing cylinder, use care not to bend or distort piston rod or cylinder, make certain that cylinder and piston rod lined up between mounting bolt and top connector bolt (if cylinder out of alignment, piston rod will bind and operation will be faulty). See that vacuum line hoses are properly connected to top and bottom of cylinder.

NOTE—Use care not to reverse hose connections.

Lubricating Vacuum Power Cylinder—If piston is tight in cylinder, lubricate with half-and-half mixture of Neatsfoot Oil and Kerosene by submerging hose connection at upper end of cylinder (hose removed) in 1 oz. glass of lubricant and operating piston downward which will draw lubricant into cylinder. Work piston up and down several times.

Control Valve—To remove valve, disconnect and tag hose connections (to insure correct reassembly), remove mounting nut and withdraw valve assembly. To disassemble valve, remove large nut on stem end of valve and withdraw plunger. On General Motors cars, an air cleaner is mounted under the perforated plate on the end of the valve and is retained by a locking ring.

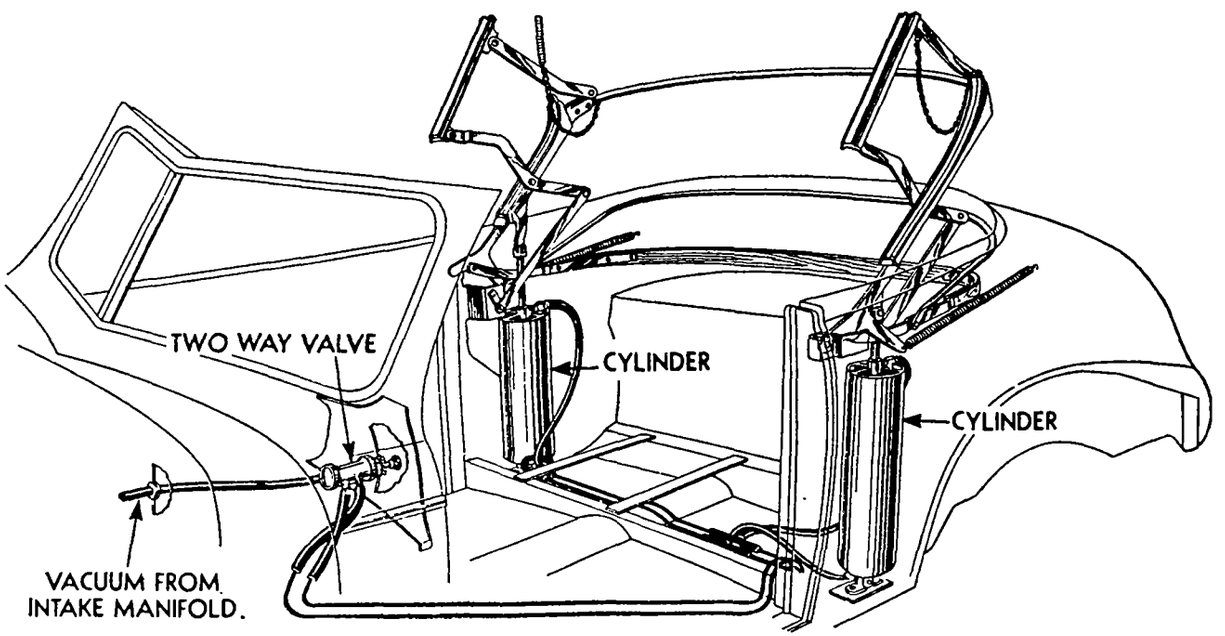
Vacuum Line Connections (Buick, Cadillac, Chevrolet, La Salle, Oldsmobile, Pontiac)—Rubber tubing should extend over ends of metal tubing connections 1" or more (except at control valve which should be ½"). Joints should be cemented tight with rubber cement such as Fisher F.S. 621.

TROUBLE SHOOTING:—If top does not operate satisfactorily, check the following points:

Vacuum Lines—Check all connections for leaks, see that hose connections and metal tubing are not kinked or broken. NOTE—Lines can be checked with vacuum gauge by noting gauge reading at engine manifold, and then connecting gauge to each hose connection at cylinder (hose to opposite cylinder must be plugged, and control valve button must be operated to open valve in order to secure gauge reading). See Vacuum Line connections in Servicing section above.

Vacuum Power Cylinder—Check piston rod for binding or tightness caused by lack of lubrication (see Cylinder Lubrication in Servicing section above). To check cylinder, disconnect bolt linking piston rod to top, see that piston moves freely in cylinder. Check alignment by raising top in stages, and checking piston rod in each position. Check piston rod seal for damage caused by misalignment or binding of the piston rod. A leak at the seal will cause sluggish action or complete failure of the mechanism to raise the top.
IMPORTANT NOTE—Cylinder rocks on pivot bolt as top is raised and lowered. Any mis-alignment caused by top and bottom mounting bolts not being in same plane (so that cylinder or piston rod cocked sideways) will cause binding and faulty operation.

Top Mechanism—See that top folding arm assembly operates freely without binding. This can be checked by operating top with vacuum cylinders disconnected, or by operating top manually with engine not running (operate control valve in usual manner so as to permit piston to move up or down in vacuum cylinder).



Used On:
CHRYSLER, DE SOTO, DODGE, HUDSON 1941 CONVERTIBLE CAR MODELS.

NOTE:—This hydro-electric control not same as 'Electric' type where separate electric motors are geared directly to power screws linked to the top mechanism on each side of the car. See separate article (following) for data on Electric Top Controls.

DESCRIPTION:—This type control consists of an electric motor and pressure pump assembly which supplies fluid under pressure to two double acting hydraulic cylinders which raise and lower the top. Motor operation is controlled by a switch on the instrument panel. Top design is conventional with the top bows and side-irons modified somewhat for power actuation.

Top Motor—Consists of a reversible motor mounted as an assembly on the left frame side rail with the oil pump, oil reservoir, and solenoid switches. Motor field is divided into two sections connected to separate terminals on motor frame (each section connected to one solenoid switch).

Pump & Valve Unit—Pump and valve assembly is built-in motor endplate. Pump is conventional gear type with driving gear mounted directly on armature shaft. Valve assembly consists of a double spring-loaded disc type valve which allows fluid flow from pump to one end of cylinders and at the same time allows the fluid displaced from the other end of cylinders to flow to fluid reservoir. Valves are correctly adjusted during assembly and adjustment should not be changed.

Control Switch—Switch is two-way type and is spring-loaded so that it returns normally to the center 'off' position. Switch button should be pulled out to raise top or pushed in to lower top and must be held in or out until the operation is completed.

Power Cylinders—Double acting type, 2 used. One cylinder is mounted on each side of car between trim panel and body panel with piston rod linked to the top upper hinge brace through a connector yoke. Cylinders are mounted on a pivot bracket on the car floor with flexible connections from upper and lower ends of cylinders to pressure lines on car frame which connect to valve outlets on motor and pump assembly. Same ends of both cylinders are connected to the same pressure line (upper ends to one line, lower ends to second line).

OPERATION:—Top can be raised or lowered with engine running or stopped but the **control should be operated only with car standing still to avoid damage to top.** When control switch is pulled out (and held out) to raise top, this actuates one solenoid switch which completes motor circuit through correct field section so that motor and pump operates to supply fluid to line connected to lower end of each power cylinder (left hand or lower connection on valve assembly). Fluid forces piston and rod up in each cylinder and raises the top (fluid displaced from top of cylinder flows back to reservoir through valve assembly). Top header should approach within ½" of top of windshield and top should then be pulled down over locating dowels by hand and the 3 attaching clamps fastened. When top is to be lowered, attaching clamps should first be freed (free center clamp first) and top raised free of locating dowels. Then, when control switch is pressed in (and held in), this actuates the other solenoid switch and completes motor circuit through the other field section so that the motor and pump revolve in the reverse direction to supply fluid to line connected to tops of power cylinders (right hand or upper connection on valve assembly). This causes piston and rod to move down in cylinder and lower top.

TESTING:—If top does not operate or operation is not satisfactory check as follows:

Top does not Raise or Lower Freely. When raising top, see that top is free and not obstructed or binding on body. When lowering top, make certain that header is free of locating dowels (top must be raised off dowels by hand). Check following points:

1. Top Mechanism. See that all joints in top irons are free and not binding (disconnect power cylinder piston rods and operate top by hand).
2. Power Cylinders. Check piston alignment in upper end plate (disconnect piston rod at yoke, see that rod not sprung when connecting yoke). Check cylinder floor mounting, see that cylinder free to move on bracket pivot and that pivot aligned so that cylinder and top control pivot in same place as top raised and lowered.
3. Pressure Lines. Check all lines and fittings for loose connections and fluid leaks. Check all lines and hoses for kinked or obstructed opening. Check fluid level in reservoir and make certain that tank is at least one-half full.

Top does not raise or Lower—Make certain that top not binding or obstructed in raised or lowered position (see above). Check following points:

1. If motor operates satisfactorily, check fluid level in reservoir (must be at least one-half full), check all lines and fittings for damaged pipes and fluid leaks.
2. If motor operates in one direction only, check the other solenoid switch, control switch and motor field lead, and motor field for grounds or open-circuits.
3. If motor operates slowly or not at all, check battery condition, check feed wire from ignition switch 'GA' terminal to control switch, and wires from control switch to solenoid switches and from solenoid switches to motor. See that motor grounded, check motor for worn or sticking brushes, dirty or burnt commutator, grounded or open field coils and armature coils.

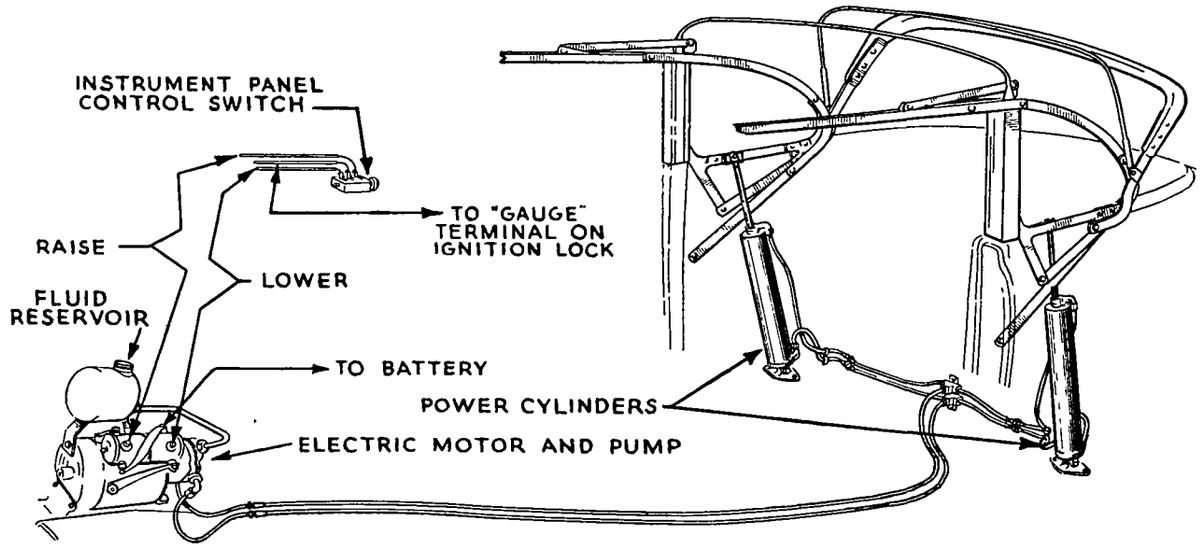
SERVICING:—**Power Cylinder**—Power cylinder parts not supplied separately and cylinder should be serviced by replacement. To remove power cylinder, remove rear quarter trim panels, disconnect hose connections at top and bottom of cylinder (place hoses in container to prevent fluid running out on floor), disconnect piston rod yoke by taking out attaching screw, disconnect cylinder from floor mounting bracket by taking out cotter pin, plain washer, and clevis pin, lift cylinder out. Install cylinder in same manner and make certain that lower connection is free so that cylinder pivots freely on bracket and that hose connections securely fastened and not kinked. Expel air from cylinder by raising top part way and then working top back and forth slightly by manipulating control switch.

Power Unit—To remove complete power unit, disconnect flexible hose connections at valve assembly, take out two bolts attaching unit to left frame side rail, lift unit out. Disconnect pipe from reservoir to valve assembly.

Valve Assembly—Remove four Phillips head screws attaching valve assembly to pump body, remove assembly. To disassemble valve, remove large end fittings (power cylinder connections), gaskets, check valve springs, and check valve assemblies. See that valve seats in housing are smooth and not nicked or burred (will cause loss of pressure). CAUTION—Valves are adjusted during assembly and adjustment should not be changed.

Pump Assembly—To remove pump, take off rear mounting bracket, remove four screws and lockwashers mounting pump housing on end of motor (if rear solenoid interferes, loosen two solenoid attaching screws). Pull pump assembly off motor housing (armature will come out with pump). Pump drive gear is keyed to armature shaft and can be removed by tapping on end of shaft, then remove gear and key. Lift driven gear off shaft. If oil seal is being replaced, old seal should be turned out in a lathe and a new seal pressed in place. Reassemble pump in same manner **using all new gaskets.**

Motor—Motor is Auto-Lite unit similar to starter motors (except for special field) and is serviced in same manner as starter motors.



Used On:
CHRYSLER, DE SOTO, DODGE, FORD, LINCOLN, MERCURY 1941 CONVERTIBLE CAR MODELS

Auto-Lite Equipment List

Car Model	Top Motors	Control Relay
Chrysler C28,C30('41)	EWG-4002	HRF-4001
DeSoto S8 (1941)	EWG-4002	HRF-4001
Dodge D19 (1941)	EWG-4002	HRF-4001

DESCRIPTION & OPERATION:—This type control control consists of two electric motors each mounted as a unit with its worm-and-gear type power screw at sides of car with the power screw linked directly to the top frame (conventional top bows and braces are modified for this power connection). Motors are reversible and are controlled directly by a switch on the instrument panel so that they operate to raise or lower the top when the switch is actuated. A control relay is connected in the circuit to protect the motors from unequal loading which would cause damage to motors and top.

Motors—Series wound type with field connected in two sections to separate terminals on motor frame. When the control switch is actuated one-half of the field is energized which causes the motor to revolve in the correct direction to raise or lower the top. The motors are geared directly to the power screw which is connected to the top frame.

Control Switch—Consists of a two-way switch which is spring-loaded so that it is normally in the 'off' position and must be held in the 'up' or 'down' position while the top control is operating.

Control Relay—Relay has two opposed windings, one of which is connected in series with each top control motor. This results in relay contacts remaining closed as long as load and current of each motor is equal. A differential of 20-30 amperes between the two motor circuits (caused by binding or obstruction on one side of top) causes relay contacts to open so that the motors stop.

Circuit Breaker—On control switch. Protects motors and relay from overload. Circuit breaker kicks out in one minute or less with current of 80 amperes.

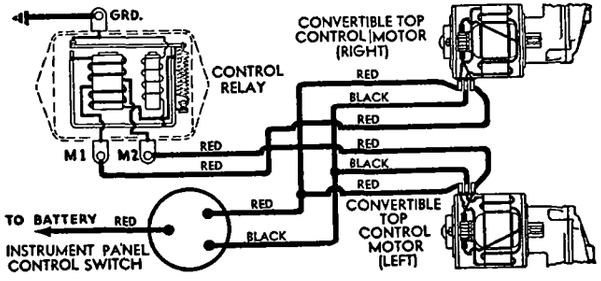
SERVICING:—To check operation of top, disconnect top from power screw, see that folding arm assembly works freely without binding at any point. Check control switch to make certain that circuits are completed through switch in 'up' and 'down' positions. To check power screw for sticking or binding, remove motor (see below) and operate screw by inserting screwdriver in slot in pinion shaft. Shaft should turn easily and freely. If it does not, check for bent power screw. See that power assembly is not binding on base pivot (entire assembly must pivot on this pivot screw as top moves up and down).

Power Unit—To replace power unit, remove trim side panels in rear seat compartment, disconnect motor wires, remove bolt linking power screw to top and pivot bolt in mounting bracket, lift out power screw and gear box assembly. Install new assembly in same manner, taking great care not to kink or bend the power screw and see that power screw installed in top bracket so that it is perfectly straight between top attaching bolt and body mounting pivot bolt. Connect motor leads and check top operation before replacing trim panels.

TESTING:—If top control does not operate satisfactorily, test each unit as follows:

Control Switch—Disconnect motor leads at switch. Connect one test lamp lead to ground, touch other lead to switch 'up' terminal, place switch in 'up' position. Lamp should light. Test 'down' terminal in same manner.

Top Motor—Disconnect guide mechanism from top slat irons and operate motors. If motors do not run freely when disconnected, check motor brushes for sticking or wear, see that commutator clean and not burnt, check field coils for grounds and open-circuits.



Motor Performance
(Auto-Lite EWG-4002)

Load	Amperes	Volts
No Load	11	6
Normal Load	20-40	6
Stalled	105	6

NOTE—Operating voltage is 4.5-5 volts and stalled torque should be 15 oz. ft.

Control Relay—If motor does not operate with switch in up or down position, ground relay terminals. If motors run, check relay contacts. If contacts are open and motors run when contacts held closed, check motors for unequal load (relay should operate in this manner if motor loads unequal). If relay buzzes and contacts do not hold open, check relay voltage coil for open-circuit.

Relay Specifications
(Auto-Lite HRF-4001)

Contacts Open—25-35 amperes through either series winding at 5.0 volts (or 20-30 ampere differential between both coils). Opening amperage for each coil must be equal within 2 amperes. Adjust by bending lower spring hanger.
Contacts Close—.2 volt minimum.
Air Gap—.030-.034" with contacts closed. Measure between current coil (series winding) core and armature. Adjust by shifting upper stationary contact up or down. CAUTION—See that both sets of contacts open and close simultaneously.
Contact Servicing—Clean contacts with strip of clean linen tape moistened with carbon tetrachloride and then rub with clean dry tape (draw tape through between contacts). If contacts burned or pitted, resurface by filing lightly with very fine contact file (ST-290) parallel and lengthwise of armature and then clean contacts as directed above. See that no lint is left on contact surfaces.
Voltage (Shunt) Winding—Winding resistance is 4.68-5.18 ohms. Measure between stationary contact and movable contact with contact points held open.

STEWART-WARNER ELECTRIC WINDSHIELD WIPER

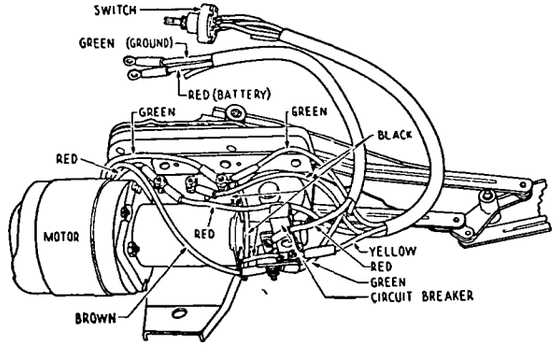
Model 645-E.
Packard Clipper, Model 1951 (1941)
Packard '110' Six, Model 1900 (1941)
Packard '120' Eight, Models 1901,1A (1941)

DESCRIPTION:—Windshield wiper consists of an electric motor and gear driven crank arm linked to two wiper arm assemblies mounted on the cowl at the lower edge of the windshield. Motor assembly includes an off-on control switch, a Dynamic Breaker mechanism which causes motor to stop in the correct parking position when the switch is turned off, and a new Klixon type circuit breaker to protect the motor and circuits. Design differs from type used on 1940 models mainly in that wiper arm linkage has been redesigned and that new circuit breaker replaces fuse used on previous type.

Klixon Circuit Breaker—Thermostatic type circuit breaker mounted on dynamic breaker housing. Circuit breaker is not adjustable.

ADJUSTMENT:—**Parking Position**—Both blades should park evenly at base of windshield when control switch is turned 'off' (within several strokes after switch operated). If blades do not park properly or if blades are not synchronized, adjust linkage as follows:

Parking Adjustment—Loosen each wiper arm nut several turns to free arm on shaft. With control switch turned off, move each wiper blade to correct parking position and tighten slotted head nut securely. CAUTION—Some clearance should be provided between blades and edge of windshield at lower end of stroke to prevent pounding when windshield wiper is operated.



Wiper Blade Replacement—To remove blades, hold arm away from glass slightly and pull blade out. Install new blade in same manner.
CAUTION—Do not move arm away from glass further than required to remove blade to avoid damage to spring within wiper arm.

SERVICING:—**Lubrication**—No lubrication required in service. Motor bearings are oilless type and gears are lubricated for life when assembled.

Dynamic Breaker—Can not be adjusted or repaired in the field and should be serviced by replacement only. Do not dismantle Dynamic Breaker

Motor—Motor can be disconnected from gear housing by disconnecting lead and taking off nuts on mounting studs. Average motor current consumption is 4 amperes.

Std. Equipment On:

Car Model	Model No.
Chrysler C28, C30 (1941)	EWD-5001, EWD-5003
Chrysler C33 (1941)	EWD-5001
DeSoto S8 (1941)	EWD-5001, EWD-5003
Dodge D19 (1941)	EWD-5001, EWD-5003
Plymouth P11,P12('41) Spec'l	EWD-5001, EWD-5003
Studebaker 11A Comm. (1941)	EWD-5002
Studebaker 7C Pres. (1941)	EWD-5002

NOTE—Model EWD-5003 is used on Chrysler, DeSoto, Dodge & Plymouth Convertible Coupe models only.

DESCRIPTION & OPERATION:—Two-speed type of same general design as used on 1940 models except for new wiring diagram (see illustration) and new simplified 'Parking' mechanism as follows:

Parking Switch—Consists of a simple pushbutton type switch mounted on a bracket on the drive gear housing and actuated by a cam on one of the crank-arm shafts. When control switch is turned 'off' motor circuit is completed through parking switch and motor continues to operate until the blades reach the parking position when the cam strikes the pushbutton and opens the switch. Switch bracket is adjustable (see Parking Angle Adjustment below).

Motor Resistor—Consists of a carbon block resistor in the drive gear housing (see illustration) which is connected in the field circuit. In the low speed position, the resistor is short-circuited by the switch, while in the high speed position, the resistor is in series with the motor field.

CIRCUIT BREAKER:—Chrysler, DeSoto, Dodge, Plymouth Models—Windshield wiper is protected by a thermostatic type circuit breaker mounted on the back of the control switch. Circuit breaker begins to operate when the current reaches 12 amperes and vibrates to prevent an excessive current flow.

Studebaker Models—Circuit breaker is not used but windshield wiper is protected by a 14 ampere fuse in a connector in the feed wire between the control switch and the regular car fuse block.

ADJUSTMENT:—Park Angle—Crank arms must stop at correct parking angle to insure wiper blades being parked in correct position on windshield. See illustration for 'park angle' measurement on each model.

Car Model	Parking Angle
Chrysler, DeSoto, Dodge, Plymouth	26°
Studebaker	18°
EWE (12 volt types)	26°

To Adjust—Remove motor cover, loosen lockscrew 'E' (see illustration), turn parking switch bracket as required so that cam on crank arm opens switch contacts with crank arm in correct parking position, tighten lockscrew securely.

SERVICING:—Armature & Gear Replacement—Complete armature and gear set must be installed together if either armature or gears requires replacement. Armature shaft worm gear and crank arm gears are run-in at the factory.

Crank Gear Assembly—When installing crank arms and gears, use Crank Aligning Tool ST-298 to insure correct position of crank arms. Turn crank arms so that they point toward each other, slip aligning tool over both arms so that pivot pins at ends of arms fit into holes in fixture, hold arms in this position and assemble gears on cross-shafts. See that gears are assembled with punchmark up and that the slot in the lockplate lines up with the flats on the side of the cross-shaft and that ears on ends of lockplate fit in holes in gears.

Bearing Alignment—After motor completely assembled (but before running), strike frame several sharp blows with rawhide hammer to insure correct alignment of bearings with armature shaft.

Armature Endplay—Must be .005" minimum, .010" maximum. To adjust endplay, remove gear housing cover, expand or contract armature stop button support arms (in housing at end of armature shaft).

Motor Lubrication—No oilers provided and motor bearings do not require lubrication in service. Gear box should be filled ¾ full with special Auto-Lite ST-295 gear grease (do not use any other type) before assembly and both crank cross-shafts should be coated for entire length with this same grease before installed in housing. Use care not to get grease on motor commutator or control contacts. CAUTION—See that both crank arms are installed in correct position.

Motor Specifications

Starting (Under Load)—4.0 volts (6 volt units), 8.0 volts (12 volt units) with control switch in High Speed position.

Current Draw—Depends on motor speed (less at high speed) as follows:

	Voltage	Amperes Low Speed	Amperes High Speed
6 Volt Units	5.8 volts	4.5 max.	4.0 max.
12 Volt Units	11.6 volts	2.25 max.	2.0 max.

Field Current—2.45-2.85 amperes at 6.0 volts (6 volt units), 1.25-1.45 amperes at 12 volts (12 volt units).

Motor Speed (Full Load)—32-40 crank RPM. (Low speed), 55-60 crank RPM. (High Speed).

TESTING:—Control Switch—Use a test lamp with one lead connected to a 'hot' terminal (such as the ammeter), connect other lead as follows: With all wires disconnected from control switch, and switch turned off, connect test lamp lead to switch 'A' terminal and ground 'F' terminal. Lamp should light. Turn switch to Low Speed position, connect test lamp lead to switch 'B' terminal. Lamp should light when either 'A' or 'F' terminal grounded. Turn control switch to High Speed position, connect test lamp lead to switch 'B' terminal and ground 'A' terminal. Lamp should light.

Parking Switch—With control switch wires disconnected, connect test lamp lead to park switch lead (green wire), ground other park switch lead (black wire on Chrysler—on Studebaker, touch ground wire to other park switch terminal). Lamp should go out when parking switch contact button is pressed in and should light when button released (crank arms must not be in park position when this test made).

Motor—Connect wire from negative terminal of 6 volt test battery to black wire disconnected from control switch, ground positive terminal of battery to motor frame. Motor should operate at full speed. If motor does not run, check for open armature or field circuit, worn or stuck motor brushes, binding or jammed armature or gears (armature and gears should turn freely by hand).

TROUBLE SHOOTING:—If wiper action not satisfactory, check as follows:

Motor Will Not Start or Run

1. **Fuse Blown (Studebaker only).** Before replacing blown fuse, check following possible causes: Check all connections, check motor ground, check all motor leads for grounds and open-circuits.

2. **Loose Connections in Wiper Circuit.** Check all wiring. Tighten connections at Windshield Wiper, Control Switch, and Ignition Switch.

3. **Crank Arm Shafts Binding.** Make certain that cross shafts greased for entire length with special ST-295 grease before installing.

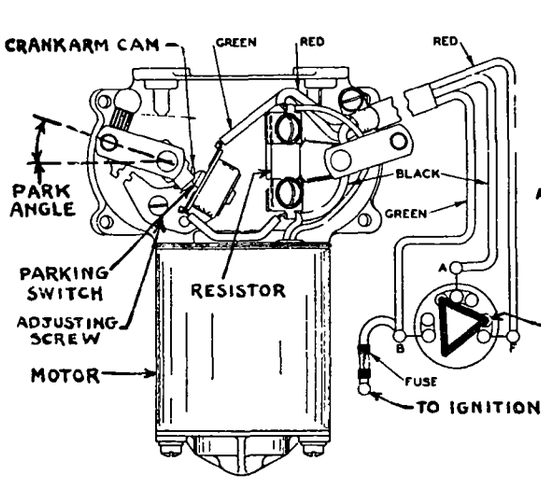
4. **Linkage Binding.** Make certain that linkage between crank arm and pivot arms is not binding and that wiper blades and pivot arms operate freely.

Motor Stops with Blades in Wrong Position

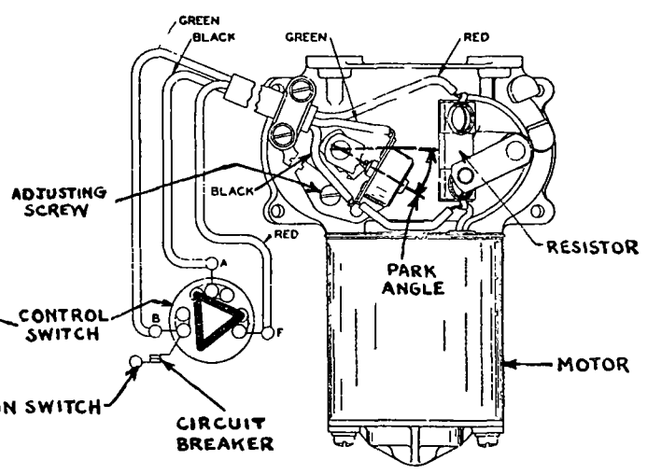
1. **Park angle incorrectly set.** See adjustment section above.

Motor Will Not Stop

1. **Parking mechanism out of adjustment.** Check Park adjustment (see Adjustment section above).



EWD-5002



OTHER 'EWD' & 'EWE' TYPES

1941 HYDRO-ELECTRIC WINDOW REGULATORS

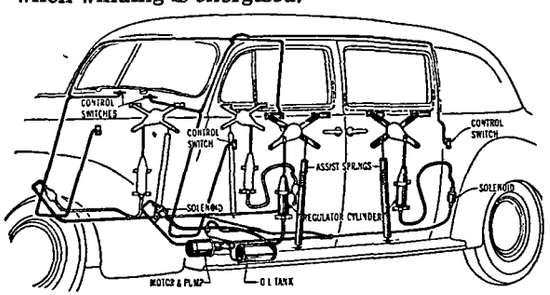
Used On:
BUICK LIMITED SERIES 41-90 (1941)
CADILLAC, MODELS 41-67,75 (1941)
CHRYSLER, MODELS C30,C33 (1941)
LINCOLN, CUSTOM MODEL 168H (1941)
PACKARD, CUSTOM SUPER 8, 1906,7,8 ('41)

NOTE:—On some models, only the partition glass (at rear of front seat) is provided with automatic control, on other models, both front and rear door windows have automatic control with duplicate control buttons in front and rear compartments.

DESCRIPTION & OPERATION:—Windows are operated by hydraulic cylinders and assistor springs in each door which are supplied with oil under pressure by a motor driven pump from a central supply tank. Control consists of a relay and set of solenoid operated valves by which the reversible motor is turned on and oil is directed to a particlar door cylinder when the control switch button is operated. System operates as follows:

Motor & Oil Pump—Motor is similar to starter motor except that field consists of two opposed sets of two coils each. Energizing one set of field coils causes motor to rotate in one direction (supplying oil to window cylinders to raise windows), energizing opposed set of field coils causes motor to revolve in opposite direction (withdrawing oil from cylinders to lower windows). Oil reservoir consists of tank which must be kept filled with hydraulic brake fluid. Oil pump is conventional gear type and is built on one end of motor housing. A non-adjustable spring-loaded maximum pressure regulating valve is built in the pump cover with a dashpot to prevent chatter. This pressure valve by-passes the fluid when the window reaches the upper limit of its travel or when the window strikes an obstruction and prevents damage to the window and the operating mechanism.

Relay—Consists of a set of contacts controlled by a single winding and connected in the circuit so as to protect the motor when several control buttons are operated at once. Relay contacts open when winding is energized.



Control Switches & Valves—Control buttons are two-way type and when operated turn on the pump motor for desired rotation (to raise or lower window) and also actuate the solenoid valve to direct oil to particular window. Relay prevents closing switches for both up and down operation at one time and is designed to give control to down operation (if up and down switches closed simultaneously, both windows will move down).

Window Operating Cylinders—Consist of a long hydraulic cylinder and assistor spring in each door which are linked to the window operating mechanism. When window is raised, oil is pumped into cylinder and remains trapped in cylinder to hold window closed. To lower window, motor driven pump is reversed to withdraw oil from cylinder (solenoid valve opens to permit oil to flow out). The piston in the window operating cylinder is connected to the piston rod through a calibrated compression spring which prevents pressure building up in system due to heat expansion of the fluid in the cylinders and the lines with the windows closed.

SERVICING:—Supply Tank Oil Level—Check level with all windows down (some fluid will be trapped in cylinders and oil level goes down when windows closed). Tank will overflow if filled when windows or partition glass are raised. Use only genuine brake fluid to fill the window regulator system.

CAUTION—Mineral oil will ruin rubber parts in system and require replacement of all rubber parts.

Motor & Oil Pump—Requires no attention other than oiling of armature end bearing at 3000 mile intervals. Pump should deliver pressure of 120-130 lbs. (in one direction) and vacuum of 15-18" (in opposite direction). Check only with combination pressure-vacuum gauge. When overhauling pump, use care not to interchange end thrust plates (these plates and gears ground to close-fit and will not operate satisfactorily if interchanged). Remove all traces of old gasket and use only correct type new gasket when reassembling pump. CAUTION—Reuse of old gaskets or installation of gaskets of incorrect thickness will cause leakage, binding of pump gears, or loss of pressure.

Relay—Auto-Lite Model HRD-4001 Relay specifications are as follows:

Contacts Open—3.5-4.5 volts. Adjusted by bending lower spring hanger to increase or decrease armature spring tension.

Contacts Close—1.0-1.8 volts below opening voltage (after voltage has been increased to 6 volts). Adjusted by turning brass cam on contact side of yoke (apply drop of air-drying varnish to cam after completing adjustment).

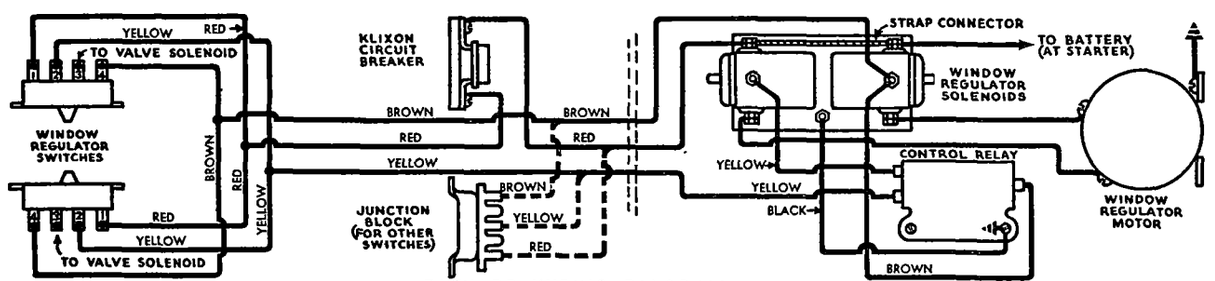
Contact Gap—.005" minimum.

Air Gap—.044-.046". Measure at center of core with contacts closed. Adjust by raising or lowering stationary (upper) contacts.

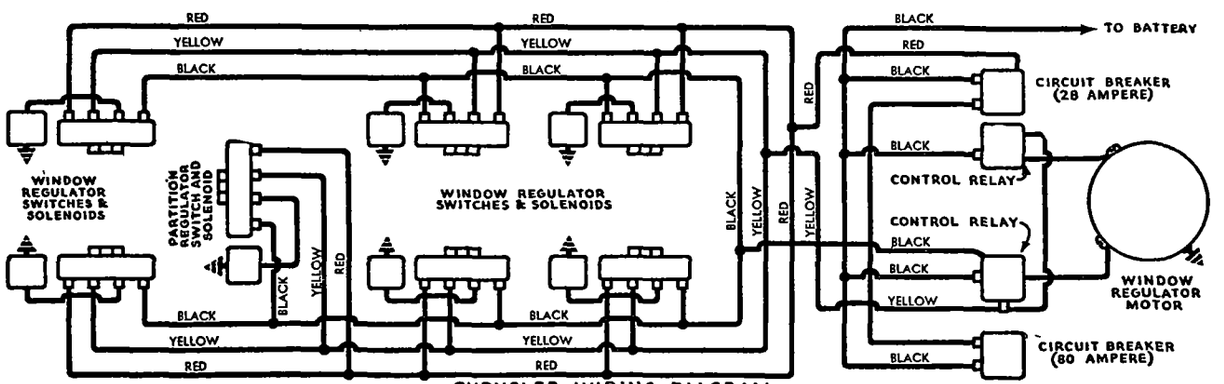
Window Cylinders—When disassembling cylinder, use care not to damage piston rod boot. Use only correct type replacement piston spring (piston rod connection) and piston sealing ring. Power cylinder will not operate satisfactorily if other parts installed. Pour one ounce of brake fluid into cylinder above piston when reassembling (necessary to lubricate upper end of piston).

Window Glass Replacement—When replacing window, attach regulator arm to lower glass channel without connecting piston rod. Move window up and down by hand to make certain that it moves freely without binding. Adjust piston rod length so that window is supported by piston resting on bottom of cylinder when fully lowered. To make this adjustment, loosen locknut and turn piston rod in or out of connector rod as required. Use great care not to damage rubber boot or allow dirt to drop into cylinder while adjusting, tighten locknut and make certain that washer and hairpin lock are in place to prevent connector rod being disconnected from regulator arms in service. Assistor spring tension should not be changed and spring should be serviced by replacement.

Control Valves, Switches, & Lines—Valves and switches should be serviced by replacement. When connecting lines at solenoid valves, motor or cylinders, hold connection with wrench while tightening line to prevent damage. Solenoid valves are grounded through mounting clamp and clean, tight connections must be made at this point.



PACKARD WIRING DIAGRAM



CHRYSLER WIRING DIAGRAM

BENDIX HYDRAULIC, SINGLE ANCHOR (WITHOUT ECCENTRIC ADJUSTMENT)

Used On:

BUICK, SERIES 41-40, 50, 60, 70, 90 (1941)
CADILLAC V8, 41-60S, 61, 62, 63, 67, 75 (1941)
HUDSON SIX, MODELS 10, 11, 12, 18 (1941)
HUDSON EIGHT, MODELS 14, 15, 17 (1941)
LINCOLN, ZEPHYR & CONTINENTAL 16H (1941)
LINCOLN, CUSTOM MODEL 168H (1941)
NASH SIX, AMBASS. MODEL 4160 (1941)
NASH EIGHT, AMBASS. MODEL 4180 (1941)
OLDSMOBILE SIX, 66, 76, 96 (1941)
OLDSMOBILE EIGHT, 68, 78, 98 (1941)
PACKARD CLIPPER, MODEL 1951 (1941)
PACKARD SIX, '110' MODEL 1900 (1941)
PACKARD EIGHT, '120' MODEL 1901 (1941)
PACKARD SUPER 8, '160' 1903, '180' 1906 (1941)
PONTIAC SIX, 41-24, 25, 26 (1941)
PONTIAC EIGHT, 41-27, 28, 29 (1941)
WILLYS AMERICAR, Model 440 ('41)—SEE NOTE

These brakes same design as used on corresponding 1940 car models (except Hudson—not used previously).

NOTE:—Packard Super Eight (Other Models)—Models 1904, 5 Super Eight and 1907, 8 Custom Super Eight have Bendix Hydraulic Brakes with Eccentric Adjustment. See separate article for adjustment directions on this type.

Willys Americar—Brake shoes on this model are Lockheed Double Anchor type. See Lockheed Double Anchor Brake article for adjustment directions on this type.

SPECIAL SERVICE NOTES:—Hudson Pedal Connection—For less sensitive brakes with harder pedal action, particularly at low speeds, brake pedal link may be changed to right hand hole in master cylinder operating lever. On all production cars, link is regularly assembled in left hand hole for soft pedal action.

Oldsmobile Wheel Cylinder Stops—Stops are formed on backing plate which prevent pistons being forced out of wheel cylinder for any reason. These stops make it unnecessary to use piston clamps to retain pistons when brake drums and shoes are removed but wheel cylinder must be removed from backing plate before it can be dismantled or pistons taken out.

Pontiac Wheel Cylinder Piston Stops—Stops are provided on backing plate which prevent pistons being forced out of cylinder when drums or shoes removed. These stops make it unnecessary to use piston clamps to retain pistons when drums and shoes removed but wheel cylinder must be removed from backing plate before it can be dismantled or pistons taken out.

DESCRIPTION:—These brakes same design as used on 1940 cars and are similar to other Bendix single-anchor brakes except that the eccentric adjustment is omitted and all adjustments are made at the adjusting screw and the anchor pin as given below.

ADJUSTMENT:—Before making adjustments, jack up all four wheels, loosen or disconnect parking brake cables at intermediate lever or equalizer bar, remove adjusting hole screw covers on backing plate (see Pontiac Note below), check brake pedal clearance (See Brake Pedal Adjustment below), adjust brakes at each wheel as follows. CAUTION—If hand brake cables not disconnected, shoes may be held 'on' by cables (if adjusted too tight) so that correct brake adjustment cannot be secured.

Pontiac Adjusting Hole Covers—Covers are rubber and have lip on inner edge to engage slot in backing plate. To remove, insert screwdriver under lip of cover and pry out. To install, moisten cover with water or brake fluid, start one end in adjusting hole slot, strike cover with hammer to seat it in slot.

Minor Adjustment—For Wear (Except Cadillac & Packard):—At each wheel, make certain that the anchor pins are tightened (check with 16" wrench, if anchor pins loose, adjust as directed under Major Adjustment below). Insert special tool or screwdriver through adjusting hole in backing plate, turn notched adjusting screw by moving tool handle up toward center of wheel until brake drum can just be turned by hand. Adjust and connect hand brake cables (see Parking Brake Adjustment below), then back off adjusting screw 17 notches or 'clicks' (Buick), 14 notches (Hudson, Lincoln, Nash Pontiac), 20 notches (others) until shoes are just free and drum revolves without any drag. If brakes are not free after making this adjustment, or if shoes drag at anchor pin end, adjust anchor pin as directed under Major Adjustment below.

Hudson Note. Check mechanical 'follow-up' setting after adjusting brakes (see separate article following).

Parking Brake Adjustment—Before connecting hand brake cables, adjust cable lengths on each model as follows:

Buick. With rear wheel brake shoes expanded so that drums can just be turned, tighten adjuster nut on rear end of hand lever cable (at wheel cable equalizer on torque tube near rear axle) until cables are taut with hand lever in released position, back off adjusting screw in each wheel 15 notches so that wheels free of any brake drag, check equalization by applying brakes with hand lever until drums can just be turned. Equalize wheels by backing off adjusting screw in tight wheel not more than 2 notches (if this does not equalize wheels, check centering of wheel cables in equalizer).

Hudson—With rear brake shoes expanded tightly against drum, pull hand lever 'on' two notches so that clearance between hand brake cable lever and end of slot in guide plate is ⅛", pull cables tight, adjust clevis at forward end of each cable so that clevis pins just enter holes in toggle on lever, connect cables, back off adjusting screw in each wheel until wheels are free, check equalization.

Lincoln Models. Do not expand rear wheel brake shoes. Pull hand lever 'on' one notch, apply brakes by depressing brake pedal with 30 lbs. pressure (use pedal jack, hold pedal in this position while adjusting). Remove slack in cable by adjusting conduit clamp. Release hand lever and brake pedal, see that brakes are free.

Nash. With rear brake shoes expanded tightly against drum, pull hand lever 'on' 2 notches, loosen two bolts on adjusting clamp (connecting lever and wheel cables), pull cables tight and tighten bolts. Return lever to 'off' position. Back off adjusting screw in each wheel to free brakes and check equalization. See that hand brake lever on each wheel backing plate has ⅛" free travel with hand lever in off position. Equalize hand brakes by loosening rear bolt in cable adjusting clamp and applying hand brakes (this will allow cable to shift on adjusting clamp). Check position of hand brake cable guide on rear spring. Guide should be exactly 17½" to rear of spring front eye bolt center-line.

Oldsmobile. With rear wheel brake shoes expanded so that drums can just be turned, pull wheel cables forward to eliminate all slack, adjust clevises on forward ends of cables so that clevis pins can just be inserted with equalizer link held parallel to propeller shaft, connect cables (insert clevis pins with head toward top), back off adjusting screw in each wheel approximately 20 notches until wheels are free, check equalization.

Pontiac. Check hand brake cable tension by moving clevis pin at cross lever wheel cable spreader, pin should move up and down with thumb and finger pressure (hand lever in released position, rear wheel brake shoes not expanded), and both rear wheels should lock with hand lever in third notch. To adjust, remove cross lever clevis pin and engage pin in another of the several holes in the cable spreader (approximate setting), remove hand lever clevis pin and turn clevis on cable (exact setting) using extreme care not to twist the cable. To equalize wheel cables after adjusting, loosen clampscrews on wheel cable spreader at cross lever (if necessary pry clamp ears apart with a screwdriver so that cable free in spreader), apply brakes hard by pulling back on hand lever, tighten spreader clampscrews before releasing hand lever.

Minor Adjustment—For Wear (Cadillac & Packard Models):—Manufacturer recommends that adjusting screw and anchor pin be adjusted to secure .015" clearance at each end of Secondary Shoe as directed in 'Major Adjustment' below (wheels must be removed for this adjustment). Then adjust Parking Brake as follows:

Cadillac Models. With brakes released (shoes not expanded in drums), loosen nut on rear end of hand lever cable rod at wheel cable sheave. Expand rear wheel brake shoes by turning adjusting screw at each wheel until drums can just be turned by hand. See that hand lever in fully released position, tighten nut at rear wheel cable sheave (locknut must be backed off to permit this adjustment) until cables are taut, tighten locknut. Back off adjusting screw in each wheel 15-20 notches so that wheels are free.

Packard Models. With rear brake shoes expanded so that drums can just be turned by hand, pull hand lever on to first notch, pull each rear wheel cable forward with 20 lbs. pull to take up all slack and lost motion, adjust clevis on forward end of each cable so that clevis pin can just be inserted in equalizer link with link centered, connect cables. Back off adjusting screw in each rear wheel until drums turn freely without drag, check equalization. Equalize by backing off adjusting screw in tight wheel slightly.

Major Adjustment (For New Shoes, Relined Brakes or when Minor Adjustment not satisfactory):—Jack up all four wheels, loosen or disconnect parking brake cables at equalizer or intermedate lever, remove adjusting screw hole cover on backing plate and inspection hole cover on drums (remove wheels for access). Check pedal clearance (see Brake Pedal Adjustment below). Adjust each wheel brake as follows. CAUTION—If hand brake cables not disconnected or loosened, shoes may be held on by cables (if adjusted too tight) so that correct brake adjustment cannot be secured.

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Anchor Pin & Adjusting Screw Adjustment—Turn drum so that inspection hole is at center of secondary shoe (rear shoe on each wheel), insert screwdriver and pry secondary shoe away from drum so that primary shoe (other shoe) is seated solidly against drum. Insert screwdriver or special adjusting tool in hole on backing plate and turn notched adjusting screw by moving handle of tool up toward center of wheel until .015" feeler is snug between lining and drum at adjusting screw end of secondary (rear) shoe. Check clearance at anchor pin (opposite) end of this same shoe. If clearance not .015", adjust anchor pin by loosening locknut and tapping anchor out toward drum (slotted hole type with plain end) or turn anchor pin in direction of forward wheel rotation (eccentric type with slotted end) until .015" clearance secured, hold anchor pin from shifting and tighten locknut securely with 16" wrench. Recheck clearance at adjusting screw end of shoe. Make any necessary readjustments at adjusting screw and anchor pin to secure clearance of .015" at both ends. It is very important that primary shoe be out in solid contact with drum while this adjustment being made. Adjust hand brake cables as directed in Parking Brake Adjustment under Minor Adjustment above.
CAUTION—When checking clearance with feeler gauges, gauge should be inserted approximately 1½" from end of shoe lining.

Brake Pedal Adjustment:—On all models, brake pedal must be checked and adjusted to insure master cylinder piston being back against its stop in the master cylinder for correct compensating action with brakes released. To adjust, loosen locknut on piston connector rod, turn clevis or rod to secure clearances specified below with master cylinder piston against the stop.

Buick—Clearance between pedal and underside of toeboard should be 1" on all models.

Cadillac—The rubber grommet on the pedal under toeboard should be compressed to overall length of ¾" with brakes released.

Hudson Models—Clearance between pedal shank and underside of toeboard should be ¼" with brakes released. To adjust, remove clevis pin at forward end of connecting link (between pedal and master cylinder bellcrank), loosen locknut and turn link.

Lincoln—Brake pedal should have ¼-½" free movement or play (measured at pedal pad) in released position.

Nash—Brake pedal should have ¼-½" free movement or play in released position.

Oldsmobile—Sponge rubber pedal seal on underside of toeboard should be compressed not more than 3/16" with brakes released.

Packard—Brake pedal should have ¼-½" free movement or play in released position.

Pontiac—Pedal height should be adjusted so that brake pedal is even with clutch pedal. Distance from floor mat to pedal pad should be 4 3/16" (Deluxe Torpedo 6 & 8 41-25, 41-27), 5 3/16" on all other models (41-24, 26, 28, 29).

SERVICING:—For instructions on all service operations (Bleeding of brake lines, Brake shoe removal and installation, Master Cylinder & Wheel Cylinder disassembly and overhaul, Lubrication of brake cables) ***refer to 'Bendix Hydraulic Type, Single Anchor, Rigid cylinder' brake article or 'Hydraulic Brake Servicing' article in Mechanical Equipment Section of manual for complete data.***

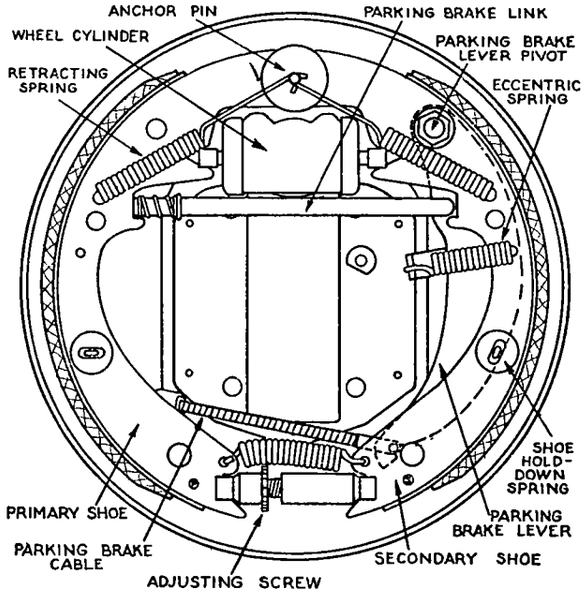
BENDIX HYDRAULIC, SINGLE ANCHOR (WITH ECCENTRIC ADJUSTMENT)

Used On:

PACKARD SUPER 8, '160' 1904, 5 (1941)
PACKARD CUSTOM SUPER 8, '180' 1907, 8 (1941)
PACKARD COMMERCIAL, 1901A, 1903A (1941)
These Brakes same design as used on corresponding 1940 Packard models.

NOTE:—Packard (Other Models)—These other models with Bendix Hydraulic Brakes do not have Eccentric Adjustment and are adjusted differently. See separate article for adjustment directions on type without Eccentric.

ADJUSTMENT:—Before making adjustments, jack up all four wheels, loosen or disconnect parking brake (hand lever) cables at intermediate lever, remove adjusting screw hole covers on backing plates and feeler gauge hole cover on drum (remove wheels for access). Check brake pedal clearance (see Brake Pedal Adjustment below), then adjust at each wheel as follows. CAUTION—If hand brake cables not disconnected, shoes may be held 'on' by cables (if adjusted too tight) so that correct brake adjustment cannot be secured.



Minor Adjustment (For Wear):—Adjust at each wheel as follows:

1. **(All Models).** Loosen eccentric locknut, turn eccentric in direction of forward wheel rotation until .010" feeler is snug between lining and drum at each end of this secondary shoe, hold eccentric from turning, tighten locknut. Clearance at both ends of shoe should be alike (slightly less at anchor pin end). If clearance at anchor pin end not correct, anchor pin must be re-located (see Major Adjustment below). NOTE—When using feeler gauge to check clearance, gauge should be inserted at point approximately 1½" from end of shoe lining.

2. **(All Models).** Insert special tool, or screwdriver, in adjusting screw hole on backing plate, turn adjusting screw by moving outer end of tool up toward center of wheel to expand shoes until wheel can just be turned (if necessary to turn adjusting screw more than 50 notches or clicks, examine linings for wear and replace if necessary). Adjust and connect hand lever cables (see Hand Brake Adjustment below). Then back off adjusting screw until wheel is just free of drag (approximately 20 notches). Check equalization by depressing brake pedal (use pedal jack) until wheel with least drag can just be turned by hand, equalize by backing off adjusting screws on tight wheels not more than 2-3 notches. Do not tighten loose wheels.

3. **Hand Brake Adjustment (All Models).** Adjust hand brake cables for each model as follows:

Packard Models. With rear brake shoes expanded so that drums can just be turned by hand, pull hand lever on to first notch, pull each rear wheel cable forward with 20 lbs. pull to take up all slack and lost motion, adjust clevis on forward end of each cable so that clevis pin can just be inserted in equalizer link with link centered, connect cables. Back off adjusting screw in each rear wheel until drums turn freely without drag, check equalization. Equalize by backing off adjusting screw in tight wheel slightly.

4. **Brake Pedal Adjustment.** Brake pedal must have ¼-½" free travel or play in the released position to insure master cylinder piston being back against its stop for correct compensating action with brakes released. To adjust, loosen locknut on piston rod, turn rod or clevis making certain that piston is against the stop.

Major Adjustment (For New Shoes or Relined Brakes):—If shoes with new linings being installed, adjusting screw and eccentric adjustment must be backed off to allow drums to be installed. Disconnect parking brake cables, remove adjusting screw cover on backing plate and inspection hole cover on drums. Adjust brakes at each wheel as follows:

1. **Anchor Pin & Eccentric Adjustment (All Models).** Loosen eccentric locknut, turn eccentric in direction of forward wheel rotation until .010" feeler is just snug at adjusting screw end of this secondary shoe, hold eccentric from turning and tighten locknut. Check clearance at anchor pin end (opposite end) of this same shoe. If clearance not .010", adjust anchor pin as follows: Loosen anchor pin locknut one turn, turn anchor pin in direction of forward wheel rotation until the clearance at anchor pin end of shoe is exactly .010", hold anchor pin from moving and tighten locknut securely with 16" wrench. Recheck clearance at adjusting screw end of shoe. Make any necessary readjustments at eccentric and anchor pin until .010" clearance secured at both ends of this shoe. Then proceed with adjustments (2), (3), and (4) as given under Minor (Wear) adjustment above.

SERVICING:—All servicing operations including Bleeding of Lines, Brake Shoe Removal & Installation, Master Cylinder and Wheel Cylinder Overhaul are same as previous models. ***See 'Bendix Hydraulic Type, Single Anchor, Rigid Cylinder' brake article or 'Hydraulic Brake Servicing' article in Mechanical Equipment Section of manual for complete data.***

HAWLEY TYPE

Used On:

CROSLEY, MODEL CB-41 (1941)

TYPE:—Hawley Neutral Shoe type with floating brake lining. Lining consists of a single piece of sufficient length to reach entirely around shoes with gap of 1/16" at ends. Lining is centered on shoes by rib on backing plate and conical retainer on wheel side.

DESCRIPTION & OPERATION:—Wheel Brakes. Two shoes per wheel, anchored at adjusting screw end and operated by cam at opposite end. Shoes are held against adjusting screw and cam by small coiled spring hooked between shoes at each end.

Linkage:—Wheel brakes operated by cables from main cross-shaft on frame. Cables enclosed in conduits at wheel ends and provided with adjusting clevises at cross-shaft.

Hand Brake:—Hand lever is linked to main cross-shaft on frame. Cables enclosed in conduits at wheel ends and provided with adjusting clevises at cross-shaft.

Hand Brake:—Hand lever is linked to main cross-shaft and applies all four wheel service brakes.

ADJUSTMENT:—Jack up all four wheels, remove clevis pins and disconnect all four wheel cables at cross-shaft. At each wheel, loosen locknut and tighten brake adjusting screw on backing plate (turn screw counter-clockwise) until slight drag noticed when wheel turned by hand, then back adjusting screw off (turn screw clockwise) until wheel is just free, tighten locknut.

Linkage Adjustment—Depress brake pedal 1" and hold in this position. Adjust clevis on cross-shaft end of each wheel cable so that brakes barely drag when cable connected to cross-shaft. Release pedal. Road test car and equalize brakes by turning adjusting screw on tight wheel slightly (turn screw clockwise to loosen brakes).

SERVICING:—Brake Lining Replacement—To remove and renew brake linings, jack up wheel, remove hub cap, wheel, and hub assembly. Remove conical brake lining retainer. Take out old lining. Insert new lining and re-install wheel.

Brake Lining Note—Use only genuine Crosley lining—furnished in correct length to fit around shoe with 1/16" gap at ends. Lining is not riveted on shoes and is installed loosely in drum.

Brake Cable Lubrication:—Whenever brake cables adjusted, fill cable conduits with grease. When connecting cables use care not to twist or buckle cables excessively.

HUDSON MECHANICAL FOLLOW-UP

Used On:

ALL SIX & EIGHT CYLINDER MODELS (1941)

DESCRIPTION:—Same design as used on previous models. Consists of linkage connecting brake pedal and hand brake cable lever so that rear wheel brakes applied mechanically by brake pedal with additional pedal travel (beyond point where brakes applied by hydraulic system).

ADJUSTMENT:—See that brake pedal properly adjusted and that hand brake cable lever is against its stop (end of slot in guide plate). Loosen locknut on brake pedal pushrod (linking pedal and idler lever), turn rod until distance from rear face of lug on rod to forward end of pushrod tube is exactly 1¼", tighten locknut.

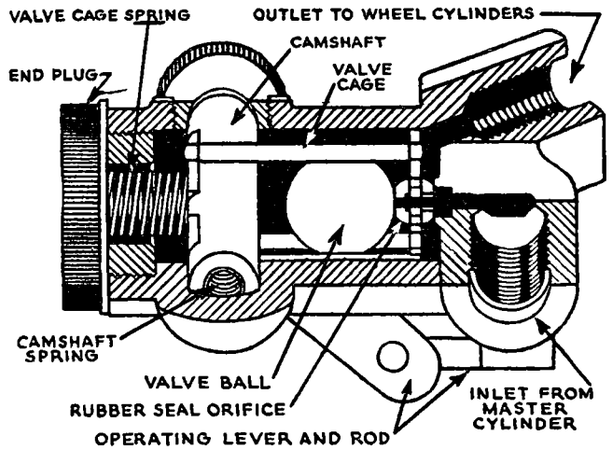
HILL-HOLDER & NOROL

Optl. Equipment On:

CAR MODELS WITH HYDRAULIC BRAKES (1941)

These units same design as used on 1940 car models.

DESCRIPTION:—Same design as units used on previous car models. Both units consist of a gravity and clutch pedal controlled check valve in the hydraulic brake line so that brakes are held 'on' with car heading uphill on grade and clutch disengaged. Brakes are released through clutch pedal connection when clutch is engaged.



ADJUSTMENT:—Adjust whenever clutch pedal adjusted or when linkage disconnected. Mounting of unit should be checked whenever unit removed or disturbed in any manner.

Adjustment:—Check adjustment by operating car and noting point at which brakes release (brakes should release just before clutch engages). To adjust, loosen locknut on operating rod (linking unit and clutch pedal), turn adjustment so as to shorten rod for earlier release, lengthen rod for later release, tighten locknut after adjusting and check operation.

Mounting:—Unit must be level (crosswise and lengthwise of car) when installed for correct operation. To check mounting, use spirit level placed on bosses on top of housing with car standing on level floor and all tires inflated to correct pressure. Adjust by loosening mounting bolts and shifting entire unit slightly (this adjustment not provided on all models).

LOCKHEED HYDRAULIC SINGLE ANCHOR TYPE

Used On:

STUDEBAKER CHAMPION, MODEL 3G (1941)

This Brake same design as used on 1940 Champion.

ADJUSTMENT:—Before making adjustments, jack up all four wheels, check pedal clearance or free travel (see Brake Pedal Adjustment below), release hand brake. Then adjust brakes at each wheel as follows:

Minor Adjustment (For Wear):—Install wrench on eccentric adjusting cam on backing plate with wrench handle up, turn cam by moving wrench handle out toward wheel until shoe contacts drum (brakes drag when wheel revolved), then turn cam in opposite direction until wheel is just free of any brake drag. Adjust all eccentric cams in this manner (one cam for each shoe, two cams on each backing plate). Cams are held in position by spring tension and no locking nuts are used.

Major Adjustment (For new linings, etc):—With wheels removed, rotate brake drums so that inspection hole in drum is at heel (anchor pin end) of shoe, loosen eccentric anchor pin locknut, turn anchor pin until clearance between lining and drum is exactly .005" (measured with feeler gauge 1½" from end of lining). Check to see that heel clearance on opposite shoe is likewise .005", tighten anchor pin locknut. Turn drum so that slot is 1½" from end of lining at toe end of shoe, adjust eccentric cam (as directed under Minor Adjustment above) so that clearance is exactly .010". Recheck clearance at anchor pin end and make any necessary re-adjustments to secure correct clearance at both ends of shoe. Adjust eccentric cam on opposite shoe, then repeat adjustment at other wheels.

Brake Pedal Adjustment:—Pedal must have ¼" min., ⅜" max. free travel to insure master cylinder piston being back against its stop (in cylinder) for correct compensating action when brakes released. To adjust, loosen locknut and turn large adjusting nut on master cylinder end of connector rod.

Parking Brake Adjustment:—Adjust whenever brakes adjusted for wear or new shoes installed. To adjust, place the hand lever in second notch 'on' position, remove pin linking brake cable to parking brake lever on rear wheel backing plate, pull on cable to eliminate slack and press forward on lever to take up play, install pin through holes in lever and cable end which line up with slight drag noticeable at wheel. Adjust both wheels in same manner, then release hand lever and check to see that both wheels free from any drag.

SERVICING:—All service operations including Bleeding of Lines, Master Cylinder and Wheel Cylinder Overhaul are same as for other Lockheed Brakes. ***See Lockheed Hydraulic Type brake article in Mechanical Equipment Section of manual for complete data.***

LOCKHEED HYDRAULIC DOUBLE ANCHOR TYPE

Used On:

CHRYSLER 6, C28 ROYAL & WINDSOR (1941)
CHRYSLER 8, C30 SARATOGA & NEW YORKER (1941)
CHRYSLER 8, C33 CROWN IMPERIAL (1941)
DE SOTO, S8 CUSTOM & DELUXE (1941)
DODGE, D19 DELUXE & CUSTOM (1941)
GRAHAM HOLLYWOOD, MODELS 109, 113 (1941)
NASH SIX, '600' MODEL 4140 (1941)
PLYMOUTH, P11 & P12 MODELS (1941)
STUDEBAKER COMMANDER, MODEL 11A (1941)
STUDEBAKER PRESIDENT, MODEL 7C (1941)
WILLYS AMERICAR, MODEL 441 (1941)
WILLYS COMMERCIAL MODELS 441, 441P (1941)

These Brakes same design as used on corresponding 1940 car models.

NOTE:—**Chrysler C30, C33**—Rear brakes only are Double Anchor type. Front wheel brakes are Two-Cylinder type (see separate article for data on Two-Cylinder brakes). Rear brake design changed from type used on 1940 cars by addition of piston cup spring in wheel cylinder (no spring used on 1940 cars).

Willys Americar—These brakes are Bendix type but have Lockheed type brake shoes which are adjusted as directed below.

Willys Commercial Models — Hydraulic brakes (same as Passenger Car) now used on these models. Mechanical brakes used on 1940 models have been discontinued.

SPECIAL SERVICE NOTES:—**Chrysler C30, C33 Wheel Cylinders**—Wheel cylinder pistons have rubber 'piston ring' installed in groove in each piston. Separate piston cups are not used but a piston spring has been added on 1941 cars.

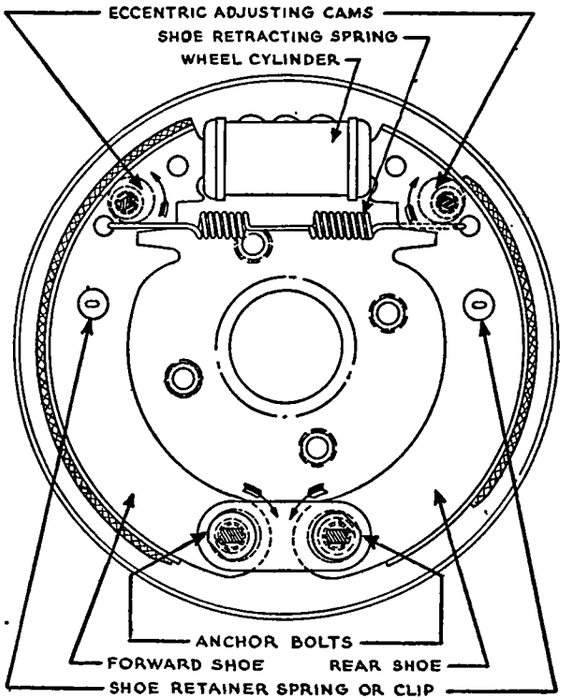
Chrysler, DeSoto, Dodge, Plymouth Brake Anchor Pins—Marked by arrow on inner end to indicate point of minimum adjustment (same as for 1940). See special anchor pin adjustment directions given under Major Adjustment below.

ADJUSTMENT:—Before making adjustments, jack up all four wheels, check brake pedal clearance or free travel (See Brake Pedal Adjustment below), check pedal travel (Chrysler—see below), release hand brake and make certain that rear wheels are free. Then adjust at each wheel (see following article for adjustment of Two-Cylinder type used on Chrysler C30, C33 front wheels) as follows:

Chrysler, DeSoto, Dodge, Plymouth Note—Total pedal travel on these models should be 1¾-2" (includes free play of ⅛-¼" and ⅝-¾" additional travel before master cylinder primary cup closes off relief port and begins to apply brakes). If Minor Adjustment does not give correct pedal travel, or if relief port is cut off with less than ¾" pedal travel, brake pedal adjustment (free play) should be checked.

Minor Adjustment (For Wear):—On Willys only, loosen eccentric cam locknut, on all models turn eccentric cam adjustment on backing plate out until brake shoe contacts drum solidly (install wrench on cam adjuster with handle up, move wrench handle toward rim of wheel), then back eccentric cam off until wheel is just free of any drag, tighten locknut (Willys only). Adjust all eccentric cams in this manner (one cam for each shoe, two cam adjusters on each wheel backing plate. On all models except Willys, cams are held in position by spring tension and no locking nuts are used.

Major Adjustment (For New Linings, etc.):—On Willys model slot provided in brake drum so that feelers can be inserted to check shoe clearance. On all other models special adjusting fixture or gauge (or cutaway drum) must be used to check setting. With gauge installed in place of brake drum and turned so that gauging is at heel (anchor pin end) of shoe approximately 1½" back from end of lining (do not gauge relieved or chamfered end of lining), loosen anchor pin locknut on backing plate, turn



anchor pin (see special directions for Chrysler, De Soto, Dodge, Plymouth models below) until clearance between lining and drum is correct (see table below), tighten anchor pin locknut. Turn gauge to toe (wheel cylinder end) of shoe, adjust eccentric cam as directed in Minor Adjustment above until clearance is correct (see table below). Adjust each shoe in all wheels in same manner. Check Parking Brake Adjustment as directed below.

Brake Shoe Clearances

Car Model	Heel (Anchor End)	Toe (Cyl. End)
Chrysler 6	.006"	.012"
Chrysler 8 (Front Shoe)	.006"	.007"
Chrysler 8 (Rear Shoe)	.007"	.007"
DeSoto, Dodge	.006"	.012"
Graham	.006"	.010"
Nash	.004"	.008"
Plymouth	.006"	.012"
Studebaker	.005"	.010"
Willys	.005"	.008"

Chrysler, De Soto, Dodge, Plymouth Note—Inner ends of anchor pins are marked by an arrow and flattened so that adjusting wrench can be applied at this end of pins. Before making adjustment, loosen anchor pin bolt nuts on backing plates, turn each anchor pin so that arrows line up with arrow heads together. Then adjust anchor pins by turning right hand pin counter-clockwise, left hand pin clockwise (pins turned toward each other at top) to secure correct clearance. CAUTION—Shoes will not be centralized in drum (even though set for correct clearance) unless anchor pin arrows lined up first and adjustment made exactly as specified above.

Brake Pedal Adjustment:—Brake pedal must have sufficient free travel or play to insure master cylinder piston being back against its stop with brakes released so as to provide correct compensating action. To adjust, loosen locknut on master cylinder end of pedal rod, turn large adjusting nut until pedal free travel is ⅛-¼" (Chrysler, DeSoto, Dodge, Plymouth), ¼-½" (Nash), ¼-⅜" (Studebaker), ½" (Others), tighten locknut.

Chrysler C33 Note—See Bendix Vacuum Power Cylinder article for master cylinder pushrod adjustment (power cylinder adjustment will be disturbed unless adjustments made exactly as directed).

Parking Brake Adjustment:—Adjust hand brake cables on models where hand lever applies rear wheel service brakes as follows (On Chrysler, De Soto, Dodge and Plymouth models, an independent hand brake located on propeller shaft at rear of transmission. See car model 'M' page for adjustment).

Graham—With hand lever in released position, remove any slack between hand lever and intermediate lever by adjusting turnbuckle at rear end of hand lever cable. Then pull hand lever on to second notch, adjust each wheel cable by turning adjusting clevis at forward end of cable until slight drag felt at rear wheels, connect cables and release hand lever. Wheels should be free of any drag.

Nash—Set hand lever two notches 'on', loosen locknuts on wheel cable spreader (hand lever cable connection), remove all slack from cables by pulling forward on wheel cables and to rear on hand lever cable, tighten locknuts. Release hand lever and check to see that rear wheels are free of any drag.

Studebaker—Set hand lever two notches 'on'. Loosen locknuts and turn turnbuckle on hand lever cable (below and to left of transmission) until slight drag noticeable at both rear wheels when wheels turned by hand. Tighten turnbuckle locknuts. Release hand lever and check to see that both rear wheels free from any drag.

Willys—Set hand lever two notches 'on'. Loosen locknuts on hand lever cable connection at wheel cable spreader (equalizer), take up cable slack by turning up rear nut until slight drag noticeable at rear wheels, tighten locknuts. Release hand lever and check to see that rear wheels free from any drag.

SERVICING:—For instructions on all service operations (Bleeding of brake lines, Brake Shoe removal and installation, Master Cylinder and Wheel Cylinder disassembly and overhaul, Lubrication of brake cables), ***refer to 'Lockheed Double Anchor Type' brake article or 'Hydraulic Brake Servicing' article in Mechanical Equipment Section of manual for complete data.***

LOCKHEED HYDRAULIC TWO-CYLINDER TYPE

Used On:

CHRYSLER 8, C30, 33 ('41) FRONT WHEELS ONLY.

This Brake same design as used on 1940 Chrysler Eight Front Wheels except as noted below.

NOTE:—These brakes used on front wheels only. Rear brakes are conventional Lockheed Double Anchor Type with single double-acting wheel cylinder (see preceding article for rear brake data).

1941 Changes—Piston spring now used in each wheel cylinder behind piston (no springs used on 1940 cars).

Chrysler C33 Power Brake—This model has Bendix Vacuum Power Cylinder (internal valve type). See separate article for adjustment and servicing data.

DESCRIPTION:—Each brake shoe actuated by individual wheel cylinder with single acting piston (forward shoe anchored at lower end and operated by upper cylinder, rear shoe anchored at upper end and operated by lower cylinder) the effect being similar to that of two 'forward' shoes on other Lockheed brakes. Brake cylinders are connected in tandem with a connecting tube extending from one cylinder to the other within the brake drum (brake line is connected to upper cylinder in usual manner), the principal difference being an additional bleeder connection on the backing plate at the lower cylinder. Double retracting springs are used (hooked between shoes at each end).

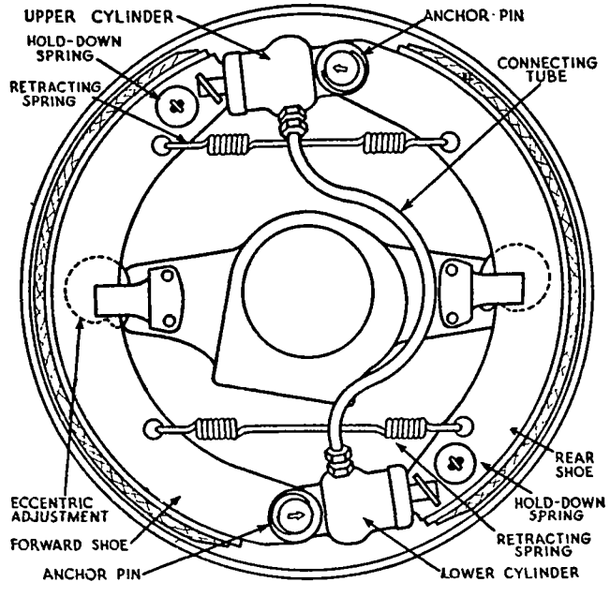
CAUTION—When bleeding brake lines, **both** wheel cylinders must be bled—see directions below.

ADJUSTMENT:—Before making adjustments, jack up all wheels, check brake pedal free travel (should ⅛-¼" (to take up pushrod play) plus additional ⅝-¾" (to close off master cylinder relief port) before brakes begin to be applied. Total pedal travel to apply brakes should be 1¾-2". If Minor Adjustment does not give correct pedal travel, or if relief port is cut off with less than ¾" pedal travel, check brake pedal free play adjustment.

Minor Adjustment (For Wear):—Turn eccentric cam adjuster on backing plate out until shoe is solid against drum and wheel is locked, then back eccentric off until wheel is free. Adjust each eccentric in this manner (one eccentric for each shoe, two on each wheel backing plate). Eccentric is held in position by spring tension and no locknuts are used. Adjustments should be made with brakes at room temperature (will drag when cold if adjusted hot).

Major Adjustment (For New Linings):—Special adjusting gauge (MT-19-C) or cutaway drum must be used to check shoe clearance. Before making adjustments, set both anchor pins in minimum position by loosening locknuts on backing plate and turning anchor pin until arrow on inner end points toward adjacent wheel cylinder. Install gauge and turn so that gauging point is at heel (lower end) of forward shoe. Turn anchor pin in clockwise direction (left hand side of car), counter-clockwise direction (right hand side of car) to move shoes out toward drum until clearance is exactly .006", tighten anchor pin locknut. Rotate gauge to toe (wheel cylinder end) of shoe, adjust eccentric cam adjuster on backing plate until clearance is exactly .007". Repeat these adjustments for rear shoe (keeping in mind that anchor pin end and wheel cylinder end of shoe reversed from those on forward shoe), then adjust wheel on opposite side of car in same manner (anchor pin must be turned in opposite direction as directed above).

CAUTION—Anchor pins must always be turned to minimum adjustment position (with arrow on inner end pointed toward adjacent wheel cylinder)



before adjustments are made. If this is not done, shoes will not be centralized in drum even though clearances are correct. Anchor pin inner ends are flattened so that wrench can be applied at this point and arrows checked while pins are being turned.

Brake Pedal Adjustment:—Brake pedal must have ⅛-¼" free travel to insure the master cylinder piston being back against its stop and compensating port uncovered when brakes released in order to provide for correct compensating action (brakes will drag if this port blocked). To adjust, loosen locknut on master cylinder end of pedal rod, turn large adjusting nut.

Chrysler C33 Note—See Bendix Vacuum Power Cylinder article for master cylinder pushrod adjustment (power cylinder adjustment will be disturbed unless adjustments made exactly as directed).

SERVICING:—Bleeding Brake Lines—Fill master cylinder supply tank with fresh fluid, attach bleeder hose to bleeder screw in center of **upper** wheel cylinder, submerge end of hose in fluid in clean glass container. Loosen bleeder screw ½-¾ turn, bleed line by pumping brake pedal slowly through one-half of pedal travel until fluid flow from hose is continuous and no air bubbles are evident. Then close upper bleeder screw. Connect hose to lower cylinder bleeder screw in center of **lower** wheel cylinder, open bleeder screw ½-¾ turn and bleed line between two brake cylinders in same manner. This is important.

Wheel Cylinders—Wheel cylinders (two per wheel) are single acting type with one piston. Pistons have rubber 'piston ring' in groove on piston (no separate piston cups used). To remove piston ring from piston, roll ring off end of piston. Install this rubber ring with lip on ring in toward inner end of cylinder and install piston spring with small end in (large end toward piston).

Master Cylinder—Same as for other Lockheed Brake systems.

Refer to 'Lockheed Double Anchor Type' brake article or 'Hydraulic Brake Servicing' article in Mechanical Equipment Section of manual for servicing data.

BENDIX VACUUM CYLINDER INTERNAL VALVE TYPE

Std. Equipment On:

CHRYSLER, CROWN IMPERIAL C33 (1941)

TYPE:—This vacuum cylinder is internal valve, reactionary (vacuum suspended) type similar to design used on previous Chrysler models. An intake air cleaner has been added and linkage has been redesigned due to new location of brake master cylinder and new type brake pedal mounting.

ADJUSTMENT:—Note—Adjustment required only when master cylinder or vacuum power cylinder removed from car or disassembled (setting not disturbed by minor brake adjustment). CAUTION—Do not readjust vacuum cylinder linkage to compensate for normal brake wear—see Lockheed brake articles for brake adjustment instructions.

Adjustment:—Make following adjustments in order:

1. Remove clevis pin connecting power cylinder pullrod to operating lever and pin connecting brake master cylinder pushrod to operating lever, loosen screws in valve lever and loosen vacuum cylinder mounting stud locknuts.

2. Adjust brake pedal toeboard clearance by loosening locknut and turning stopscrew on pedal shank to rear of pedal shaft.

3. Adjust master cylinder pushrod for correct free play by loosening locknut and turning pushrod. CAUTION—Make certain that all clearance of pedal shaft is to front of shaft while making this adjustment.

4. Hold brake pedal back against its stop and adjust vacuum cylinder so that all clearance of pedal shaft is to front of shaft and vacuum cylinder pullrod clevis pin will just slip in clevis, tighten vacuum cylinder mounting stud locknuts and install clevis pin, tighten valve lever screws.

5. Check to see that all clearance between vacuum cylinder valve rod bushing and pin is to front of pin.

SERVICING:—Lubrication—At 6000 mile intervals, lubricate power cylinder by removing plug on front of cylinder and inserting one ounce of shock absorber fluid, transformer oil, or ice machine oil. At the same time, disconnect vacuum line connection at rear end of cylinder and insert an additional ounce of oil at this point.

FORD-LOCKHEED TYPE

Used On:

FORD, ALL PASS. CAR & TRUCK MODELS (1941)
MERCURY, MODEL 19A (1941)

These Brakes same design as used on 1940 models.

TYPE:—Same design as used on corresponding 1940 models with independent hand brake on propeller shaft on some truck models as follows:

¾ & 1 Ton—Hand lever actuates rear wheel service brakes. Adjustment instructions given below.

All Trucks except ¾ & 1 Ton—Parking brake consists of an independent drum and brake band on the propeller shaft directly back of the transmission. For hand brake adjustment on these models, see Ford Truck 'M' page.

ADJUSTMENT:—Before adjusting, jack up all four wheels, remove one front wheel and inspect lining (to determine if new linings required), re-install wheel. Check front wheel bearing adjustment, spring shackles, shock absorber links, and radius rod mountings, tighten steering connections. Place hand lever in released position. Adjust each wheel as follows:

Minor Adjustment (For Wear):—Install wrench on eccentric adjusting cam on backing plate with wrench handle upward, turn cam by moving wrench handle out toward wheel rim until shoe is tight in drum, then turn cam back until wheel just turns freely without drag (do not turn cam back more than enough to free wheel, desired setting is with least possible amount of clearance). After adjusting forward shoe, repeat adjustment on rear shoe, then adjust all other wheels in same manner. Check pedal reserve, if reserve less than half total travel, repeat adjustment (if pedal is 'spongy', bleed lines). Check brake pedal clearance and adjust hand brake (see instructions below).

Major Adjustment (For relined brakes, etc.):—NOTE—Before installing brake drums, loosen eccentric anchor pin locknuts and turn each anchor pin so that marks on flatted ends of pins are together (marks indicate 'high' side of eccentric and in this minimum position will allow drums to be installed over new linings). Adjust eccentric adjusting cam for each shoe (see Minor Adjustment above), then adjust anchor pins as follows: Depress brake pedal with 25-35 lbs. pressure (hold in this position while making adjustments), use wrench with 3" handle and turn eccentric anchor pin so that mark moves down until brake shoe is felt to contact drum, hold anchor pin from turning and tighten locknut securely. Release brake pedal, check wheel to see that it turns freely without any drag, repeat adjustment if wheel drags. This setting designed to secure less clearance at anchor pin or heel end of shoe than at toe with only slight clearance for entire shoe. Adjust both shoes in each wheel in this manner, check brake pedal clearance and adjust hand brake as directed below.

Brake Pedal Adjustment:—Brake pedal must have ¼-½" free movement (measured at pedal pad) to insure master cylinder piston being against its stop for correct compensating action when brakes released. To adjust, loosen locknut on pedal rod, turn rear section of rod (integral with large adjusting nut—not necessary to disconnect clevis pins), tighten locknut.

Parking (Hand) Brake Adjustment (Passenger Cars):—Place hand lever in fully released position. Use pedal jack to depress brake pedal so that rear brake shoes applied firmly against drums (leave in this position while adjusting). Pull forward on cables to remove all slack, adjust clevis on end of hand brake cable. Release pedal jack and check adjustment. End of hand brake lever should move ½" before all slack in cable is taken up and wheels should be free with hand brake lever released.

¾ & 1 Ton Models—Place hand lever in fully released position, use pedal jack to depress brake pedal so that rear brake shoes applied firmly against drums (leave in this position while adjusting). Disconnect both wheel cables at intermediate lever on frame, loosen locknut and adjust clevis on forward end of each cable so that all slack removed when cables re-connected. Release pedal jack, adjust clevis at intermediate lever end of hand lever so that ½" movement of hand lever tip required to remove all slack from cables and that bolt on intermediate lever bracket is in center of slot with hand brake applied.

Other Trucks—These models have independent hand brake on propeller shaft. See Ford Truck 'M' page for data.

SERVICING & OVERHAUL: — Same as for previous models with Hydraulic Brakes. ***Refer to manual (or 1939 Supplement) Mechanical Equipment Index for 'Ford-Lockheed Type' Hydraulic Brakes for servicing data.***

CHEVROLET (OWN) HYDRAULIC TYPE

Used On:

ALL PASSENGER CAR & TRUCK MODELS ('41)

These Brakes same design as used on corresponding 1940 car and truck models except for minor changes.

DESCRIPTION:—Brakes are same general design as used on 1940 models with following features:
Front Brake Adjustment Slots—Slots provided in front wheel backing plates (closed by snap covers) on Passenger Cars and Trucks so that brakes can be adjusted without removing wheels.

Hand Brake (Passenger Cars)—New type idler lever mounted on bracket welded to second cross-member (at rear of transmission) and linked to each rear wheel by cable with adjustment on each cable at idler lever end (see adjustment data below).

ADJUSTMENT:—Jack up all four wheels. Disconnect hand brake cables at idler lever (Pass. Cars), hand brake rods at cable connectors (Trucks). Adjust each wheel as follows.

CAUTION—Hand brake rods must be disconnected to eliminate any possibility of shoes being held on by cables which would make it impossible to secure satisfactory brake adjustment.

Adjustment (Except 1½ Ton Rear Wheels). Insert screwdriver in slot on backing plate at each end of wheel cylinder so as to engage notched adjusting covers on cylinder (adjusting cover on each end of cylinder controls one shoe), turn adjusting covers until shoe has slight drag on drum, then back cover off exactly 4 notches (all models except 1½ Ton Truck front wheels), 5 notches (1½ Ton Truck front wheels) to provide correct clearance. Adjust all wheels in this manner, then adjust parking brake (see below) and check brake pedal clearance.

Adjustment (1½ Ton Truck Rear Wheels). Wheel cylinder adjusting covers turned by means of hexagonal-headed pinion shafts on backing plates. Turn each pinion shaft clockwise until shoe has slight drag on drum, then turn pinion shaft back ¾ turn for correct clearance, adjusting parking brake (see below) and check brake pedal clearance.

Parking Brake Adjustment (Passenger Cars):—Place hand lever in fully released position. Loosen both check nuts on each wheel cable at idler lever on frame cross-member at forward end of cables, pull cables forward out of conduit until definite stop is felt, hold cable in this position and tighten both check nuts on each cable so that cable is locked to idler lever toggle. Check to make certain that rear wheels are free.

Adjustment (Truck Models). Place hand lever in fully released position. Pull wheel cable end fitting (at front of rear frame cross-member) forward until a definite stop is felt, hold cable in this position, turn nut on forward rod down until it contacts (turn by hand only, do not use wrench), lock cable by turning rear nut up securely. Check equalization and make any necessary re-adjustment by loosening wheel cable to tight wheel slightly (do not change wheel cylinder adjusting cover setting).

Toggle Lever Adjustment (When new Shoes Installed). With brake drum removed, loosen eccentric bolt locknut (on web of one shoe), hold toggle lever against shoe, turn eccentric bolt until there is only slight clearance between lever and bottom of slot in hand brake extension link, tighten eccentric bolt locknut and recheck clearance.
NOTE—This toggle arrangement not used on 1½ Ton truck models.

Brake Pedal Clearance:—Clearance between pedal and underside of toeboard must be ¼" to insure master cylinder piston being back against its stop for correct compensating action when brakes released (clearance between edge of master cylinder piston primary cup and center of compensating port must be .035" min.). Adjust each model as follows:

Passenger Cars. Loosen locknut on eccentric bolt (linking pedal and master cylinder piston rod), turn bolt until correct toeboard clearance secured, tighten locknut.

Truck Models. Loosen locknut at clevis on rear end of master cylinder pushrod, turn pushrod until correct toeboard clearance secured, tighten locknut.

SERVICING:—All service operations including Bleeding of Brake Lines, Brake Shoe Removal & Installation, Master Cylinder & Wheel Cylinder Overhaul same as for previous models. ***See 'Chevrolet (Own) Hydraulic Type' brake article in Mechanical Equipment Section of manual for complete instructions and note following data:***

Brake Shoe Installation (Pass. Cars, ½ & ¾ Ton Models)—When installing shoes, make certain that they contact pads on anchor plate (3 pads for each shoe) by checking clearance between shoe and each pad with .002" feeler gauge. If shoes do not contact all pads, bend anchor plate.

Brake Drag (Trucks)—With severe service, wheel cylinders and pistons may become gummy from fluid and lining dust deposit. Correct by thoroughly cleaning cylinders and pistons (should also be done when brakes relined).

HUDSON VACUMOTIVE TYPE

Optl. Equipment On:
HUDSON, ALL MODELS (1941)

SPECIAL SERVICE NOTE & PRODUCTION CHANGE:—To correct complaints of Governor Switch not functioning or operating at incorrect speed (see Governor Switch data below) on first cars, install new Governor Switch, Part No. 162866, marked by Orange dots on terminal screws and Orange band around switch body. This new type Governor Switch has shaft bushings with reversed oil groove to prevent transmission lubricant working up into switch body and is installed at the factory on later cars.

DESCRIPTION & OPERATION:—Vacumotive Clutch Control consists of an internal valve type Vacuum Power Cylinder linked to the clutch throw-out mechanism so that the clutch can be operated manually (by depressing clutch pedal) or automatically (with engine running and 'off-on' switch control button on instrument panel pushed in) with accelerator pedal control. Clutch is disengaged whenever accelerator pedal released (except at speeds above 15 MPH. in high gear—see High Gear Lock-out below) and engages as soon as accelerator pedal is depressed to accelerate car. Solenoid valve mounted on forward end of cylinder controls High-gear lock-out control and special open-throttle rapid-engagement only (see description below) and does not affect normal clutch control operation. Control operates as follows: When engine is started, vacuum line to forward end of cylinder will be open (solenoid valve open), control valve within piston rod will be drawn forward admitting air to rear end of cylinder and piston will move forward to disengage clutch. When accelerator pedal is depressed, first motion of linkage moves control valve lever forward (rapid motion permitted by clearance between cushion point stop-screw and valve lever cam) pulling control valve to rear so that vacuum admitted to rear end of cylinder, piston spring then engages clutch rapidly until cushion point is reached when piston overtakes control valve and seals off rear end of cylinder. Further movement then possible only as valve lever cam is rotated under cushion point stop-screw so that very soft cushioning action or initial clutch engagement is secured. As soon as accelerator linkage play is taken up and carburetor throttle begins to open, final clutch engagement takes place rapidly (valve lever cam has special contour to secure this action). Clutch control designed to modify this normal engagement for special conditions as follows:

Compensator (For Initial Engagement)—When clutch disengaged manually (necessary to start engine), the end of the bell-crank yoke strikes a pin on the end of the intermediate lever (on which valve lever is mounted) swinging lever so that valve lever pivot is moved forward permitting clutch to engage deeper at the cushion point to compensate for oil on clutch disc cork inserts. As soon as clutch engages automatically, trip lever on piston rod yoke rotates compensator lever back to normal driving position. No adjustment is required but compensator must be in normal driving position when other clutch control adjustments are made.

Accelerator Switch (For wide-open throttle Engagement)—Consists of a switch on the dash operated by the accelerator pedal which controls vacuum cylinder solenoid valve circuits. With throttle closed, circuit completed through switch to both Governor Switch (left hand terminal—RW wire) and to High Gear Shift Rail Switch and Selector switch (right hand terminal—Y wire). When throttle opened sufficiently to rotate accelerator switch lever 5-10°, circuit to Governor Switch is broken (eliminating Governor control). When throttle opened approximately 1/2, circuit to Shift Rail Switch and Selector ground switch is broken. With all solenoid circuits to ground broken, solenoid valve cuts off vacuum and admits air to vacuum cylinder so that clutch engages rapidly (which is desirable when car started with throttle more than half open).

High Gear Lock-out (At speeds above 15 MPH)—This device consists of a Shift Rail Switch on the transmission case which is opened by the shift rail when the transmission is in High Gear. This prevents clutch disengaging with transmission in high gear at speeds above 15 MPH. (when Governor Switch contacts will be open).

ADJUSTMENT:—Before making adjustments, engine must be properly tuned and warmed up so it idles smoothly at correct idle speed with vacuum reading of 18-21" of mercury (see Tune-up data on car model 'T&E' page). Car should be driven suffciently to bring clutch units to normal operating temperatures. See that Compensator is in normal running position (see Compensator above) and make all Clutch, Throttle, and Automatic Clutch linkage adjustments listed below in order before adjusting 'Cushion Point' which controls clutch performance.

Clutch Pedal Adjustment—Remove clevis pin at lower end of clutch pedal connecting link, loosen locknut and turn clevis so that center of pedal shank clamp bolt is 1½" from toeboard with clutch fully engaged.

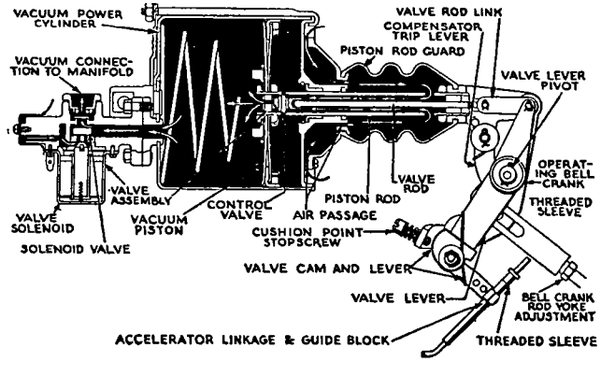
Clutch Control Linkage Adjustment—See that linkage works freely without binding. Adjust accelerator switch to bell crank rod so that clevis pin at switch end just slips into place with switch lever against the stop. See that valve lever cam operating rod is connected in correct hole in accelerator pedal link bell crank, adjust threaded sleeve on rear end of the valve lever cam operating rod so that distance from end of threaded sleeve to end of rod is 11/16" (10,11,12,18), 1 5/32" (14,15,17).

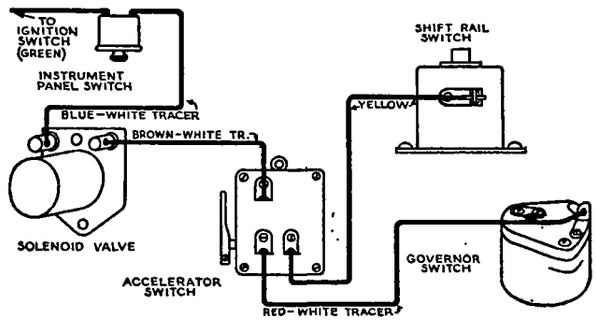
Vacuum Cylinder Bell-crank Yoke—With engine not running, and vacuum cylinder piston in extreme rear position, take out cotter pin in valve lever pivot and at end of valve-rod-and-lever link, remove valve lever, adjust yoke at bell-crank end of operating rod so that clearance between front edge of clevis pin on bell-crank and front end of slot in yoke is ⅛". This setting will provide clearance at clutch throw-out bearing (with clutch engaged) without excessive play in operating linkage.

Piston Travel (Valve Linkage)—Make certain that valve cam lever operating rod guide block is mounted in rear (end) hole of cam lever, and compensator pin in extreme rear position, operate engine to provide vacuum. With clutch disengaged, screw threaded sleeve (on operating rod at valve cam lever guide block) toward dash until piston rod just reaches its extreme forward position, then screw threaded sleeve away from dash until piston moves ¼" toward rear.

Cushion Point Adjustment—With all linkage adjustments correctly made (above), block wheels and start engine (do not set brakes). Accelerate engine and manually engage and disengage clutch to dry clutch disc corks. Make certain that carburetor is not in fast idle position, back out accelerator cross-shaft stopscrew for clearance of 1/16". Swing compensator lever to rear (normal running position) turn cushion point stopscrew clockwise or in until screw contacts cam. Shift transmission to Low Gear, hold cam against stopscrew by pressing on back of cam lever, slowly turn stopscrew out or counter-clockwise until clutch drag slows engine noticeably (car will tend to move forward. Check throttle rod adjustment and then make final adjustment as directed below.

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Throttle Rod Adjustment—See that valve lever cam operating rod is in correct hole in accelerator pedal link bellcrank for each model. With transmission in Low Gear and engine running, move accelerator pedal bell crank lever until valve lever cam just contacts cushion point stopscrew, hold throttle linkage in this position and turn accelerator cross-shaft stopscrew until carburetor throttle just begins to open and engine speed picks up. This adjustment should be rechecked whenever carburetor is removed from engine or linkage is disturbed.

Final Adjustment:—Shift transmission into second gear, depress accelerator pedal slowly with engine running. Car should begin to move slightly upon initial throttle opening. If clutch engagement slow and engine speed excessive, turn cushion point stopscrew counter-clockwise or out slightly. If clutch engagement too rapid (engine stalls), turn screw clockwise or in slightly. Do not turn screw more than ½ turn without rechecking performance.

TROUBLE SHOOTING:—If Automatic Clutch operation slow or erratic, check vacuum lines for leaks, tighten connections, check gaskets, solenoid for sticking plunger, all linkage for excessive friction or binding (operate accelerator and watch operation of entire linkage system). To check vacuum cylinder for piston leaks, slide piston rod guard forward until 4 ports in piston rod are exposed, start engine and allow clutch to disengage automatically, close off piston rod ports by covering with fingers, excessive leakage will cause a perceptible suction at the ports (see Piston Lubrication under Servicing below).

SERVICING:—Vacuum Cylinder Piston Lubrication—At 10000 mile intervals, remove pipe plug in end of cylinder, inject exactly one ounce of Hudson Shock Absorber fluid. Take out piston rod bolt at bellcrank and disconnect valve-rod-to-lever link, rotate piston to spread lubricant over entire piston and oil wick. Place 2-3 drops of oil in bell-crank bracket oil hole every 1000 miles.

Piston Rod Guard Replacement:—To remove rubber boot or guard on piston rod, take out cotter pin in valve lever pivot and also in valve rod trunnion at upper end of valve lever, remove lever. Take out piston rod bolt in bell-crank, remove guard from groove in piston rod end, hold piston rod from turning with drift in bell-crank bolt hole, loosen locknut against rod end, remove piston rod end, remove guard. Install guard in same manner, adjust piston rod length, adjust cushion point stopscrew when valve lever reassembled (see Adjustment above).

Piston Rod Adjustment:—Whenever piston rod end removed or disturbed, position end on rod so that distance from center of tripod mounting hole to center of bell-crank bolt hole in rod end is exactly 13 11/16", lock setting with locknut.

TESTING:—Where test lamp required in making following tests, make up test lamp using 15 cp. Mazda No. 87 bulb and suitable leads. Make tests in order given below.

Valve Solenoid:—Disconnect Blue-White (BLW) wire from valve solenoid terminal and connect this wire to one test lamp lead. Ground the other solenoid terminal to which Brown-White (B-W) wire attached. Touch the second test lamp lead to the solenoid terminal from which BLW wire removed. With ignition turned on and dash 'Off-On' switch on, lamp should show dull glow. If lamp does not light, solenoid is open. If lamp burns brightly, solenoid is shorted. If circuit is normal, remove vacuum pipe connection, bushing, and bakelite valve disc. Insert narrow scale in opening and check plunger travel under light pressure. If plunger does not move 1/16-3/32" freely, check valve disc rubber and plunger interference. Tighten vacuum connections tightly.

Dash 'Off-On' Switch & Upper Wiring Harness:—If clutch does not disengage with fully closed throttle, valve lever rod in fully forward position, and dash switch 'on' (pushed in), connect jumper wire from battery cable terminal to solenoid BLW terminal. If clutch operates, check dash switch for poor contact, check wiring from dash switch to gas gauge to ignition switch for open-circuit.

Accelerator Switch:—Disconnect Governor Switch Red-White (RW) wire at accelerator switch terminal, place transmission shift lever in High Gear, see that ignition switch and dash 'off-on' switch turned on and accelerator pedal in idle position. Ground one test lamp lead, touch other lead to accelerator switch terminal from which RW wire removed. With 5° step of No. J-1190 test gauge between switch lever and its stop, lamp should show red glow. When 10° step of gauge inserted between lever and stop, lamp should go out. Transfer test lamp lead from RW terminal to Y terminal on switch. Lamp should show red glow until throttle half open and then go out. Replace switch if defective.

Shift Rail Switch:—Disconnect the Red-White (R-W) wire at Governor Switch, check Automatic Clutch operation. Automatic Clutch should operate in all gears except High Gear. If it does not, ground shift rail switch terminal. If clutch operates satisfactorily, check switch for sticking operating ball or replace switch. If correct clutch operation not secured with shift rail switch grounded, check Yellow wire between shift rail switch and accelerator switch for open-circuits and replace wire. If automatic clutch operates with transmission in High Gear, replace switch.

Testing Wiring Harness—After testing switch for correct operation, and with Red-White wire disconnected from Governor Switch, shift transmission to high gear, turn on ignition, ground one test lamp lead, connect other lead to lower harness connector. Test lamp should show red glow. If lamp does not light, wiring is defective. Repeat test at Shift Rail and Governor Switch terminals. Recheck Accelerator switch before replacing wiring harness.

Governor Switch:—Check by road-testing or operating car with rear wheels blocked up so that engine can be run with transmission in gear. See that Red-White wire connected to Governor switch, operate engine, engage high gear. Check to see that Automatic Clutch operates when accelerator pedal is depressed and released. If it does not, replace Governor Switch. With high gear engaged, increase engine speed until speedometer reading is 25 M.P.H., release accelerator and note when clutch disengages. Clutch should be engaged at 20 M.P.H. but should disengage before speed decreases to 15 M. P.H. If clutch disengagement is not within this 15-20 M.P.H. speed range, replace Governor Switch.

PACKARD ELECTROMATIC TYPE

Optl. Equipment On:
PACKARD, ALL 1941 MODELS

SPECIAL SERVICE NOTES:—Clutch Adjustment—Clutch pedal free travel should be set at 2" on all cars with Electromatic Clutch and should be checked whenever car is serviced. To adjust, turn adjusting nut on connector link at clutch fork.

Governor Switch on Cars With Aero-Drive (Overdrive)—Governor switch has two sets of contacts and two terminals marked 'EC' and 'AD'. The 'AD' contacts are used for Aero-Drive control. See separate article on Packard Aero-Drive for data on this unit.

DESCRIPTION & OPERATION:—Electromatic Clutch Control consists of a vacuum power cylinder linked to the clutch throw-out mechanism by an overrunning type of linkage so that the clutch may be operated either manually (using clutch pedal with 'Lock-out' switch button on instrument panel pulled out), or automatically (power cylinder operation controlled by accelerator pedal). Power cylinder is actuated by manifold vacuum with accelerator pedal control (so that clutch disengaged whenever accelerator pedal released at car speeds below 17 MPH. in high gear—Governor switch prevents disengagement at speeds above 17 MPH). modified by electrically operated solenoid valves and switches to provide smooth clutch engagement under all operating conditions. Control valves and switches are used as follows:

Clutch Control Valve:—Mounted on left hand side of cylinder block and linked to accelerator pedal. Direct Speed Solenoid is mounted on underside and Low & Reverse Solenoid mounted on rear of control valve assembly. Control Valve is compound type and consists of a valve spool linked to the accelerator pedal and a valve sleeve actuated by a spring-loaded vacuum diaphragm which is subjected to same vacuum as exists in power cylinder. These two valve elements operate together to control the rate of air bleed into the power cylinder so as to provide proper clutch engagement for all normal operating conditions. Operation is modified for special conditions by Direct Speed Solenoid, Low and Reverse Solenoid and Second Speed Solenoid as follows:

Direct Speed Solenoid:—Consists of a solenoid operated master valve mounted on the control valve assembly and connected in the manifold vacuum line. This valve is closed when solenoid is de-energized so that entire Electromatic Clutch mechanism is inoperative. Solenoid is controlled by Lock-out Switch, Direct Speed Switch, Accelerator Switch and Governor Switch as follows:

Lock-out Switch—On instrument panel. This switch is connected to 'gauge' side of ignition switch and operates as a master switch for the Direct Speed Solenoid (solenoid de-energized and Electromatic Clutch inoperative when lock-out switch button pulled out). When lock-out switch button pushed in, direct speed solenoid is energized and Electromatic Clutch is operative except when circuit opened by other switches as follows:

Accelerator Switch & Governor Switch—These two switches are wired in series to control the Direct Speed Solenoid and make the Electromatic

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Clutch inoperative while the car is being operated. Accelerator switch is mounted on the dash and linked to the accelerator pedal so that the switch contacts are open and the Direct Speed Solenoid de-energized (Electromatic Clutch inoperative) while the accelerator pedal is depressed. When the accelerator pedal is released (as for gear shift), switch contacts close and solenoid is energized if car speed is below 17 MPH. At car speeds over 17 MPH., governor switch contacts 'EC' are open and direct speed solenoid is de-energized (Electromatic Clutch inoperative) except for over-riding action of Direct Speed Switch (below). NOTE—The 'AD' or second set of contacts in the Governor Switch control the Second Speed Solenoid as detailed below. These 'AD' contacts also control the Aero-Drive (Overdrive) cut-in point (overdrive operative only with these contacts closed).

Direct Speed Switch—Mounted on left side of transmission case and operated by Second-high shift lever. This switch over-rides Governor Switch so as to permit Second & High Gear shifts to be made at speeds above 17 MPH. (point where governor switch contacts open to de-energize Direct Speed Solenoid and make Electromatic Clutch inoperative). Switch contacts are closed except when transmission is in high gear and open when high gear engaged. When shift to Second Gear is desired at speeds above 17 MPH., first movement of shift lever closes switch contacts so that direct speed solenoid is energized as soon as accelerator pedal is released (circuit completed through accelerator switch).

Second Speed Solenoid Valve:—Consists of a solenoid operated choke valve in the air intake line between the air cleaner and the control valve assembly. When solenoid is energized, this valve restricts air bleed action and retards clutch engagement so as to prevent lurching or surging caused by too rapid clutch engagement with engine speed below that of car speed (retarded engagement allows engine speed to come up to that of car). Valve is controlled by Second Speed Switch and 'AD' contacts of Governor Switch as follows:

Second Speed Switch—Mounted on end of Second-High shifter rail on ride side of transmission case. Switch contacts closed (to energize Second Speed Solenoid) only when Second Gear is engaged and circuit is completed through control relay (relay contacts closed) only when Governor Switch 'AD' contacts are closed (speeds above overdrive cut-in point of 22 MPH.).

Low & Reverse Solenoid:—Mounted on rear of control valve assembly. Consists of a solenoid plunger which increases the load on the control valve diaphragm spring so as to provide slower rate of clutch engagement when starting in low or reverse gear. Operates only when solenoid energized by Low & Reverse Switch.

Low & Reverse Switch—Mounted on end of Low-Reverse shift rail on right side of transmission case. Switch contacts are closed (to energize Low & Reverse Solenoid) only when Low or Reverse Gear is engaged and are open at all other times.

Control Relay:—Three-unit, eight terminal relay mounted on dash. Relay completes Electromatic Clutch circuits as shown on wiring diagram.

ADJUSTMENT:—**Note**—Before making adjustments, clutch pedal free movement should be checked and set to 2", engine must be tuned up and adjusted for smooth idling performance. With engine warm and idling at correct hot or slow idle speed of 8-10 MPH., make following adjustments in order:

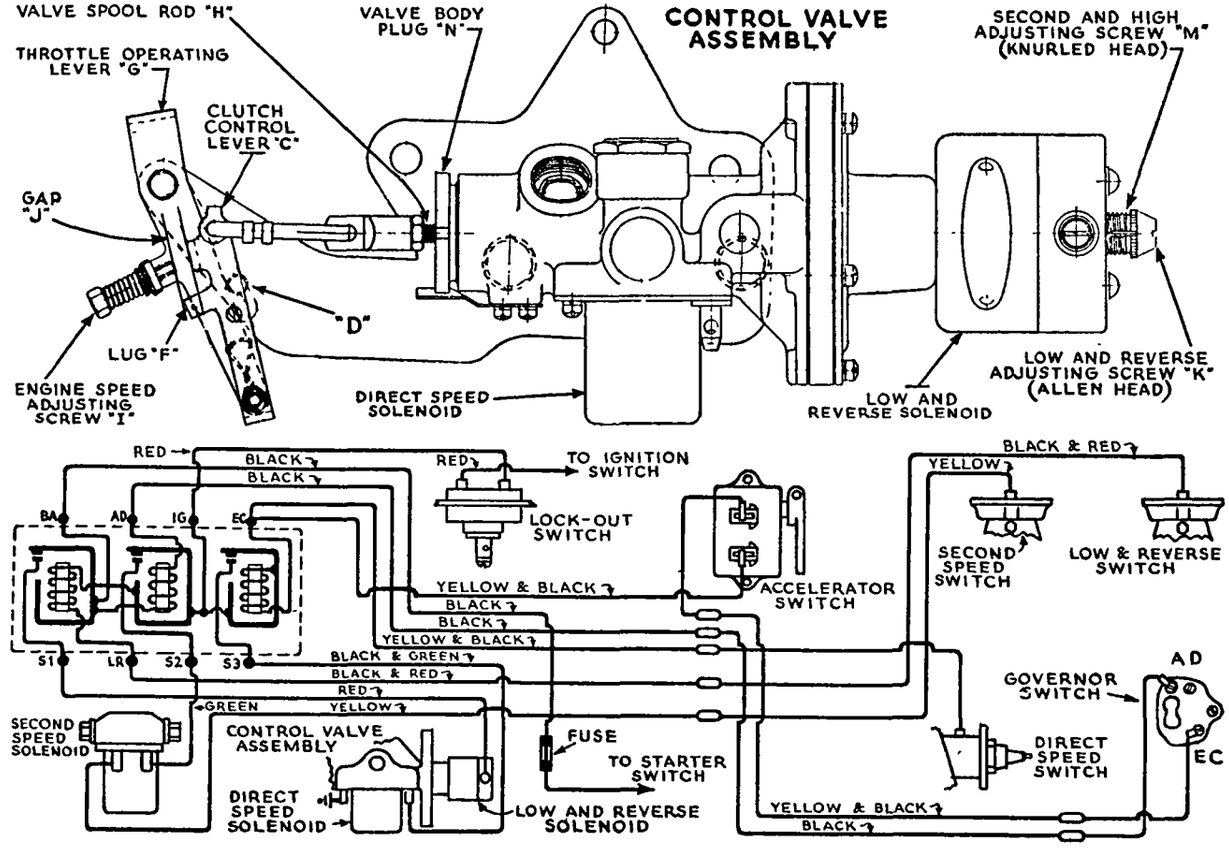
Accelerator & Throttle Linkage—Adjust carburetor cross-shaft lever linkage so that, with throttle operating lever 'G' (refer to Control Valve illustration) against stop pin 'D', the carburetor throttle lever is against the throttle stopscrew and the linkage is free and has normal play. Loosen locknuts and adjust turnbuckle on rod linking lever 'C' to accelerator pedal so that, with lug 'F' on lever holding lever 'G' against stop pin 'D', the clearance at the stop on the right end of the accelerator cross-shaft is 1/32-1/16".

Engine Speed Adjusting Screw Gap—With throttle control valve lever stop against throttle lever 'G', adjust engine speed adjusting screw 'I' so that gap between end of screw and lever 'C' is 7/32" as shown at 'J'.

Valve Rod Adjustment—Depress accelerator pedal just enough to take up clearance between engine speed adjusting screw and clutch control lever ('J' on illustration), adjust valve spool rod at 'H' until power cylinder piston rod just begins to move out of power cylinder (if piston rod begins to move before clearance taken up, screw valve spool rod out of clevis; if piston rod does not move when clearance taken up, screw rod into clevis). To check adjustment, with engine warmed up and idling and gear shifter lever in neutral, shift into Low Gear and slowly press on accelerator pedal. Car should start to creep forward at engine speed of approximately 900 RPM. If engine speed too high, increase gap by turning engine speed adjusting screw 'I' out, if engine speed too low, decrease gap by turning screw in (adjust ¼ turn at a time and recheck performance). IMPORTANT—Recheck engine speed adjusting screw gap (above) after making this adjustment. If original setting of 7/32" changed by more than 1/32", readjust valve spool rod by turning rod ½ turn out of clevis (gap too small), ½ turn in (gap too great). Recheck performance and readjust engine speed screw gap and valve spool rod until correct performance secured (low gear start at 900 RPM. with engine speed screw gap of 7/32" ±1/32").

Low & Reverse Engagement—This adjustment changes Second & High Engagement adjustment and should be made first. To check operation, turn ignition switch on (engine need not be started), place gear shift lever in Low Gear position, note whether adjusting screw 'K' on end of Low & Reverse Solenoid moves into solenoid body. If screw moves, adjustment is satisfactory. Check performance by operating engine, shifting into low gear, and depressing accelerator pedal. If clutch grabs (engagement too rapid), turn adjusting screw 'K' (Allen head screw—not knurled screw which is Second & High Engagement adjustment) ¼ turn at a time until smooth engagement is secured at engine

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speed not in excess of 900 RPM. If clutch slips (engagement too slow), turn adjusting screw out ¼ turn at a time until smooth engagement secured at not more than 900 Engine RPM. CAUTION—Adjusting this screw 'K' changes engine speed (turning screw in increases engine speed, turning screw out decreases engine speed). Check Valve Rod Adjustment (above) after making this adjustment. Then adjust Second & High Engagement as follows:

Second & High Engagement—After completing Low & Reverse Engagement adjustment (above), check second and high performance by making a Second Gear start. Car should just start to creep forward in Second gear at engine speed of 700 RPM. If clutch grabs (engagement too rapid), turn knurled adjusting screw 'M' (not Allen head screw) on end of Low & Reverse Solenoid body in ¼ turn at a time until smooth engegement is secured with engine speed not to exceed 700 RPM. If clutch slips (engagement too slow), turn adjusting screw 'M' out ¼ turn at a time until clutch begins to grab, then turn screw in ¼ turn at a time until smooth engagement is secured with engine speed not to exceed 700 RPM. CAUTION—Adjusting this screw changes engine speed (turning screw in increases engine speed, turning screw out decreases engine speed). Check Valve Rod adjustment (above) after making this adjustment.

Full Throttle Engagement—Check by road testing car and starting in Second Gear with full throttle. Adjust by turning Control Valve body plug 'N' (see illustration) out until clutch grabs, then turn plug in one notch at a time until smooth engagement is secured without causing engine to 'stumble'. (NOTE—Plug should not be turned in more than necessary, this setting should be made to secure fastest possible engagement without engine stumbling). If clutch slips and engine races during intermediate part of clutch engagement, back out Second & High Engagement adjusting screw 'M' (see above) to reduce slip.

Second Gear Shift-down from High—Adjust Direct Speed switch (on transmission case) as follows: Remove wire from switch terminal and connect test light in line between this wire and terminal on switch. Place steering column shift lever in High Gear position. Turn on ignition switch without starting engine. Test lamp should not be lighted. Move gearshift lever toward neutral. Lamp should light just after all slack in linkage is taken up but before shifter lever on transmission case moves out of detent. Adjust switch bracket to secure this setting (rotate bracket to move switch toward front of car for earlier closing of switch and lighting of lamp).

Accelerator Switch Adjustment—Adjust Accelerator Switch as follows: Remove either wire from switch terminal, connect test lamp between this terminal and battery terminal on control relay (hot lead). With ignition switch turned off and accelerator pedal fully released, lamp should light. Depress accelerator pedal slowly and note point at which lamp goes out. Lamp should go out just after stop on control valve lever 'C' contacts engine speed adjusting screw 'I' and gap 'J' has been taken up (refer to Control Valve illustration) but before carburetor throttle lever starts to move. Adjust by loosening locknuts and turning turnbuckle on rod linking accelerator switch to accelerator crossshaft. Shorten the rod if the lamp goes out too soon, lengthen the rod if the lamp does not go out until after carburetor throttle lever starts to move.

Final Performance Check:—After making above adjustments, road test car and note performance when starting under all conditions. If clutch grabs or slips, readjust as directed above.

CHECKING ELECTRICAL UNITS:—Check Fuse, Control Switches, Control Relay, and Solenoids in order as directed below. NOTE—Switches should not be repaired and defective units should be replaced.

Control Relay Fuse:—Located in lead between starting switch and relay. If fuse is blown, check for shorted relay terminals (particularly 'BA' and 'S1' terminals), and shorted relay as follows: Disconnect lead at relay 'BA' terminal, connect test lamp between this wire and ground, install new fuse. Move wire back and forth to check for shorts. Lamp should burn steadily, if lamp blinks or fuse blows, lead is grounded. Examine relay terminals and make certain they are not shorted to dash. Check relay by removing grounding clip and touching test lamp lead to 'BA' terminal. If lamp lights, terminal or relay is shorted and relay should be replaced.

Control Switches:—Check each switch as follows (replace defective units):

Direct Speed Switch—Turn on ignition without starting engine, depress accelerator pedal to open accelerator switch, move gearshift lever back and forth between High Gear and Neutral. Relay should click when switch makes and breaks circuit. If no click noted, check switch adjustment (see 'Second Gear Shift-down from High' above) before replacing switch.

Low & Reverse Switch—Turn on ignition without starting engine. Move gearshift lever back and forth between Neutral & Low and Neutral & Reverse. Relay should click when contact is made as gear is engaged and also when contact is broken when gear disengaged. If no click noted, check Low & Reverse Switch adjustment (see Adjustment section above) before replacing switch.

Second Speed Switch—Remove Yellow wire from second speed solenoid, connect test lamp between this wire and 'hot' terminal on starter switch. Lamp should light when gearshift lever placed in Second Gear position and go out when gearshift lever moved out of second gear.

Accelerator Pedal Switch—See adjustment directions in Adjustment section above.

Governor Switch—To check 'AD' contacts, disconnect wire from 'AD' terminal on control relay, connect test lamp between this wire and the 'AD' terminal. Lamp should not light with ignition turned on or off. To check 'EC' contacts, disconnect wires on both 'AD' and 'EC' terminals on control relay, connect test lamp between wire removed from 'EC' terminal and the 'AD' terminal of the relay. Place gearshift lever in High Gear position. Lamp should light.

Lockout Switch—Connect test lamp between 'IG' terminal on control relay and ground on dash. Turn ignition on. Lamp should light with lock-out switch button pushed in and should go out when button is pulled out.

Control Relay:—Check each winding (3 units) individually as follows:

S1 Winding—Connect test lamp between 'BA' and 'IG' terminals, see that ignition turned off, disconnect one wire from accelerator switch, place gearshift lever in high gear position, disconnect wire from 'LR' terminal. Grounding this terminal should cause test lamp to light. If lamp does not light, relay winding is open. See also S3 Winding test below.

S2 (Center) Winding—Connect test lamp to 'BA' terminal, touch other test lamp lead to 'AD' terminal. If lamp lights, S2 winding is shorted or Governor Switch 'AD' contacts are sticking closed (see Governor Switch testing above).

S3 Winding—Connect test lamp between 'BA' and 'IG' terminals. Lamp should be lighted with ignition turned off. Place gearshift lever in High Gear position, disconnect one wire from accelerator switch and disconnect wire from relay 'LR' terminal. If lamp remains lighted, 'EC', 'IG', or 'LR' terminals are grounded, S1 or S3 windings are grounded, or lockout switch or wiring is grounded. Install accelerator switch wire. Lamp should light, if lamp not lighted move gearshift lever to Neutral. If lamp lights, Accelerator Switch or Governor Switch 'EC' contacts are sticking open. If lamp does not light, S3 winding is open or direct speed switch does not close properly.

Relay Specifications

Contacts Close—2.8-3.6 volts (all units). Adjust by bending lower spring hanger slightly.

Contacts Open—1.8-2.6 volts (all units) when decreasing voltage from 6 volts. Adjust by varying height of stationary contact.

Contact Gap—.010" minimum (all units).

Air Gap—.030-.034" (all units) measured at center of core. Adjust by bending armature stop.

Solenoids:—Check each solenoid as follows:

Second Speed Solenoid—Make certain that ignition turned off and that gearshift lever in Neutral. Connect one test lamp lead to 'hot' terminal on starter switch, touch other test lamp lead to both terminals of Second Speed Solenoid Valve. If lamp lights, solenoid winding or terminals are grounded. To check for open-circuit, connect test lamp lead to one terminal, ground other terminal with ignition turned on. If lamp lights, winding is not open.

First & Reverse Solenoid—With one test lamp lead connected to 'hot' terminal on starter switch, touch other test lamp lead to Low & Reverse solenoid terminal. If lamp lights, winding is not open. Disconnect wire at Low & Reverse Solenoid terminal, connect test lamp between this wire and ground. Turn ignition on and ground relay 'LR' terminal or place gearshift lever in Low or Reverse position. Lamp should light. If lamp does not light, check Low & Reverse engagement (see Adjustment section above).

Direct Speed Solenoid—With one test lamp lead connected to 'hot' terminal on starter switch, touch other test lamp lead to Direct Speed Solenoid terminal. If lamp lights winding is not open. To check solenoid wiring, turn ignition on, ground one test lamp lead and touch other lead to direct speed solenoid terminal. Lamp should light. If lamp does not light, Governor Switch 'EC' contacts are open or accelerator switch is defective or out of adjustment. Check both switches as directed above.

SERVICING:—Power Cylinder—Piston seal is oiled when assembled and does not require periodic lubrication. If piston becomes dry or sticks (piston rod motion will be jerky or rough), piston should be removed from cylinder and dipped in Bendix Vacuum Cylinder oil before being re-installed. NOTE—Above data applies to Piston type power cylinder. Diaphragm type power cylinder used on later cars.

Air Cleaner—Cleaner is dry type (do not oil cleaner element). When cleaner becomes dirty, filter should be replaced.

Control Valves—Valves are calibrated for particular model on which installed and should not be interchanged from one model to another.

ATWOOD TYPE

Model TP-28-7

WILLYS AMERICAR & PLAINSMAN, MODEL 441 (1941)

Model TP-28-7-1

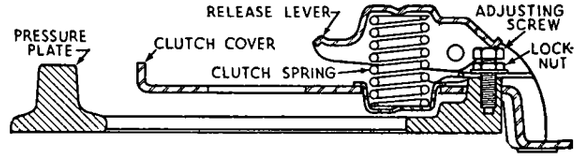
WILLYS, PICK UP MODEL 441 (1941)

WILLYS, PANEL DELIVERY MODEL 441P (1941)

NOTE:—These models equipped with new Atwood-Thelander Driven Member TD-22-14 with hydraulic type dampener. NOTE—If Borg & Beck Driven Member used, this is same type used on 1940 models.

TYPE:—New design, single plate, dry disc type. Clutch cover consists of a three-legged spider with channel section legs in which the clutch springs and release levers are mounted. Release levers pivot on pins riveted in cover legs and actuate pressure plate through adjustable screws in pressure plate under outer end of each lever. Springs are mounted in cups on cover under each lever. Hairpin type retracting springs are mounted on each adjusting screw and are retained by the adjusting screw locknut.

SERVICING:—Disassembly—Release lever pivot pins need not be removed for pressure plate servicing. To remove pressure plate, back off adjusting screw under outer end of each release lever until screws are free from pressure plate, remove pressure plate from beneath clutch cover spider.



Clutch Springs:—Three springs used (one spring under each release lever). Spring pressure should be 195 lbs. compressed to 1 9/16".

Release Lever Adjustment:—Lever height should be checked with special ring gauge (hardened, ground ring .310"±.010" assembled in clutch (or under pressure plate if clutch mounted on servicing fixture) in place of regular driven member. Loosen locknut on adjusting screw under outer end of each lever, and adjust each screw so that lever height (from face of flywheel or top face of servicing fixture to upper contact point on inner end of lever) is 1 15/16" ± 1/64" or 27/32" from outer face of clutch cover to top of release levers. All levers must be set exactly alike.

Reassembly:—When reassembling pressure plate, thread adjusting screws through locknut and retracting spring, and into pressure plate hole. Adjust release levers (above) before tightening locknuts.

DRIVEN MEMBER:—Atwood-Thelander Model TD-22-14. This model has hydraulic type dampener in hub which consists of four coil spring and plunger units operating in oil which provide dampening action similar to that of a direct-acting shock absorber. Entire dampener assembly is sealed within two cupped discs and cannot be serviced.

Facings—Facings are riveted individually to plate which is made up of spring segments riveted on hub. See car model 'M' page for facing specifications.

BORG & BECK
MODELS 8A7; 9A7; 10A6, 7; 11A6

Assembly Number — Used On:

MODEL 8A7

959—NASH '600', MODEL 4140 (1941)
925—STUDEBAKER CHAMPION, MODEL 3G (1941)

MODEL 9A7

953—CHRYSLER 6, C28 (1941) WITH FLUID DRIVE
952—DE SOTO, MODEL S8 ('41) WITH FLUID DRIVE
DODGE, MODEL D19 (1941) WITH FLUID DRIVE
924—OLDSMOBILE 6, MODELS 66, 76, 96 (1941)
955—PLYMOUTH, MODELS P11, P12 (1941)
943—STUDEBAKER COMMANDER, MODEL 11A (1941)

MODEL 10A6

939—CHRYSLER 8, C30 (1941) FLUID DRIVE STD.
CHRYSLER 8, C33 (1941) FLUID DRIVE STD.

MODEL 10A7

940—CHRYSLER 6, C28 ('41) WITHOUT FLUID DRIVE
957—DE SOTO, S8 (1941) WITHOUT FLUID DRIVE
928—DODGE, D19 (1941) WITHOUT FLUID DRIVE
950—NASH AMBASS. 6, MODEL 4160 (1941)
NASH AMBASS. 8, MODEL 4180 (1941)
927—OLDSMOBILE 8, MODELS 68, 78, 98 (1941)

MODEL 11A6

941—CHRYSLER, C28 TAXICAB (1941)
931—DE SOTO, S8 TAXICAB (1941)
DODGE, D19 TAXICAB (1941)
PLYMOUTH, P11, P12 TAXICAB (1941)

NOTE:—Assembly Number—This number stamped on each clutch cover and may be used to identify each installation.

Borg & Beck Driven Members—Used with clutches of other makes on the following car models: Buick 40, 50, 60, 70, 90 (part production only—these cars also use Long 'CF' type driven member). NOTE—If Borg & Beck driven members used on Willys models (with Atwood Clutch), these are same as types used on corresponding 1940 cars.

Chrysler C28, De Soto, Dodge Models with Fluid Drive—These cars use smaller (9¼") clutch than cars without Fluid rive and clutch does not have Baffle Plate. These models require special lever setting as given below.

Oldsmobile 6 & 8—These clutches used only on cars with conventional transmission. No clutch used on cars with Hydra-matic Drive which has a Fluid Coupling.

SPECIAL SERVICE NOTES:—Chrysler Clutch Fixture—New type, No. C-585, Clutch Fixture available for servicing of all Chrysler Clutches. This fixture has special spacers for different lever settings of all 1941 Chrysler clutches. Old type C-411 fixture can be used for servicing of 1941 clutches if new 'E' feeler gauge No. C-411-40, secured for use in setting levers on Chrysler C28, De Soto, Dodge clutches used on cars with Fluid Drive (these clutches require new lever setting). See Service data below for instructions in use of both the C-411 and C-585 clutch fixtures.

DESCRIPTION:—Same design as used on corresponding 1940 car models with following special features:

Chrysler C28, De Soto, Dodge (Without Fluid Drive); Plymouth; Chrysler, De Soto, Dodge, Plymouth Taxicab Models—These models have Pressure Plate Baffle and Borglite Driven Member. Baffle plate installation directions and special release lever settings are given below.

Chrysler C28, De Soto, Dodge (With Fluid Drive)—These cars have smaller clutch with Borglite Driven Member but do not use a Baffle Plate. Special release lever settings are required as given below.

De Soto, Plymouth Models—Clutches on these cars have special grease pads installed on top of driving lugs on pressure plate. See Assembling Note below for grease pad data.

Chrysler C-30, C33 (With Fluid Drive)—Driven member has solid hub (no spring dampener) and has oil deflector discs on plate at inner rim of facings (baffle has inner rim cupped in deflector).

Oldsmobile—These clutches same as 1940 types and have Pressure Plate Baffle, Borglite Driven Member, and special 'duck-bill' type release levers (lever ends flattened so that no release bearing plate required). Baffle plate installation directions and release lever settings are given below.

SERVICING:—Mark all parts before dismantling clutch and reassemble in same position (necessary to maintain balance). Replace grooved, checked or warped pressure plates. Replace springs when pressure plate discolored from heat (test springs as directed below).

Dismantling:—Place clutch on fixture or arbor press (support pressure plate under release levers), place block across cover resting on spring bosses, compress cover slightly, remove metal staking in adjusting nuts, remove nuts, release pressure slowly, remove cover and springs. Remove release levers by grasping lever and eyebolt between thumb and forefinger, so that inner end of lever and upper end of eyebolt are pressed together. Lift strut over ridge in end of lever (press lower end back against lug), lift lever and eyebolt out.

Clutch Springs:—Note spring color and install in same relative position (groups of two different springs used on some clutch models). Springs should check with table below. Replace springs if weak or burned or if clutch has been subjected to excessive heat.

Clutch Springs

Car Model	Spring Part No.
Chrysler C28 Std.	4039 (9)
Chrysler C28 Fluid Drive	4190 (9)
Chrysler C28 Taxicab	3951 (6), 3814 (6)
Chrysler C30, C33	4039 (12)
De Soto S8 Std.	3951 (9)
Dodge D19 Std.	3951 (6), 3814 (3)
De Soto & Dodge Fluid Drive	4190 (9)
De Soto & Dodge Taxicab	3817 (4), 3814 (8)
Nash 4140	4446 (6)
Nash 4160, 4180	4039 (9)
Oldsmobile 6	4190 (9)
Oldsmobile 8	4214 (9)
Plymouth P11, P12	4308 (9)
Plymouth Taxicab	3817 (4), 3814 (8)
Studebaker Champ. 3G	4211 (6)
Studebaker Comm. 11A	4331 (9)

NOTE—Number shown thus (9) indicates number of springs used (for each type where several types used).

Spring Specifications

Part No.	Pressure (at 1 11/16")	Color
3814	130 lbs.	Purple
3817	105 lbs.	Green
3951	150 lbs.	No Color
4039	160 lbs.	Light Blue
4190	155 lbs.①	Tan
4211	165 lbs.①	Orange
4214	170 lbs.	Light Green
4308	145 lbs.①	Lavender
4331	135 lbs.①	Yellow
4449	170 lbs.①	Orange

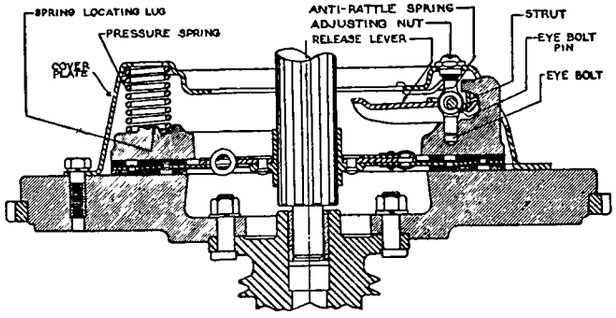
①—Spring length 1½".

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Assembling:—Place pressure plate on fixture or arbor press supporting plate under release lever lugs. Install baffle plate (some models only—see data below), install lever, eyebolt, and strut assemblies by reversing removal procedure. Place pressure plate springs on plate, install anti-rattler springs in cover, place cover on pressure plate. Make certain that springs are seated in cover recesses and anti-rattler springs in place on release levers. Compress cover slowly and guide eyebolts through holes in cover. If assembly made in fixture, use clamps to clamp cover flange to plate at mounting holes. Install eyebolt nuts and turn nuts down flush with head of bolt. Compress and release clutch several times to seat all working parts. Then adjust release lever heights.

De Soto, Plymouth Grease Pads—Install grease pads on top of driving lugs making certain that holes in pads are over eye bolts. If pads are dry, dip them in



good quality high-melting point grease which has been heated and allow pads to drain before installing. Pads are not furnished for service.

Baffle Plate Installation (9A7, 10A6, 10A7)—Install baffle plate on pressure plate with baffle plate ears on special low spring seat ribs (adjacent to release lever lug on plate in counter-clockwise direction) so that flanged edge of baffle fits depressions in pressure plate at base of each lug and baffle is retained by springs when installed (spring seat on baffle plate ears). See that baffle plate ears are flat on spring seat ribs and that baffle seats fully in machined recess in plate (straighten baffle ears if bent by handling).

Model 11A6 Clutch—Install baffle in same manner as above except that baffle ears must be seated on spring seats adjacent to lugs in clockwise direction.

Release Lever Adjustment (On Borg-Warner Universal Clutch Fixture UF-300):—Except when rebuilding clutches, lever adjustment should not be changed unless levers are out of parallel more than .030". Place clutch on fixture with special lands under pressure plate lever lugs (all models with 3 levers, on models with 4 levers space lands equally). Set adjusting arm on sleeve so that height of lower face of arm above bottom of sleeve is correct for each model (see table below), install indicating plate on levers (except as noted), adjust each lever so that it just contacts indicating plate or adjusting arm, lock lever adjustment by peening nut into slot of adjusting screw (slotted screws), or against two flats on screw.

Lever Settings

Clutch Model & No.	Lever Height
8A7 —925, 959	2⅛"
9A7 —924	See Note
9A7 —943, 952, 953, 955	2 3/16"
10A6—939	2 3/16"
10A7—927	See Note
10A7—928, 940, 950, 957	2 5/32"
11A6—931, 941	2¼"

9A7, 10A7 Note—These models have 'duck-bill' type release levers and must be adjusted in special manner (longer length of levers makes it impossible to install height sleeve on fixture). With clutch installed on fixture, place special extension sleeve '3Z' on spindle (this sleeve correct height for lever adjustment), place indicating plate on levers with counterbored side up. Set adjusting arm flush with bottom of calibrated adjusting sleeve, install sleeve on spindle and adjust release levers in usual manner.

Release Lever Adjustment (Chrysler, De Soto, Dodge, Plymouth Models—Using Chrysler Clutch Fixture C-411 (Old Type)—Use same C-411-37A gauge set used on 1940 cars ('Y' shaped extension gauge and double ended 'C' and 'D' feeler gauge) and new 'E' feeler gauge No. C-411-40 (for Chrysler C28, De Soto, Dodge cars with Fluid Drive on which clutches do not have baffle plate). Install 'Y' extension gauge directly over release lever, tighten extension gauge locknut. Use correct feeler gauge (see table below), turn release lever adjusting screw nut until feeler is just snug between lever tip and extension gauge, lock adjusting nut by peening nut into adjusting screw slot or against screw flats. Check levers for uniform setting after completing adjustment.

New Type Clutch Fixture C-585—On this new fixture, feeler gauges are located in base of fixture under clutch assembly. Install clutch assembly on fixture with release levers directly above feeler gauges (on 4-lever type 11" clutches, install clutch with two levers directly over two of the feeler gauges, adjust these levers, then rotate clutch so that other levers are over feelers and adjust these levers). Place correct spacer on center screw of fixture (see table below), install compression plate on center screw making certain that it rests directly against all release fingers (plate can be reversed to provide proper clearance on all models), install self-aligning washer, plain washer, and compression nut. Tighten compression nut until clutch fully compressed, install clutch housing clamps over cover bolt holes and tighten clamps securely. Adjust each release lever adjusting nut until slight drag secured on each feeler (all feelers alike), lock adjusting nuts and recheck adjustment.

Chrysler Clutch Fixture— Car Model	C-411 Feeler	C-585 Spacer
Chysler C28, De Soto, Dodge Std.	'D'	#21
Above models with Fluid Drive	'E'	#20
Chrysler, De Soto, Dodge Taxicab	'C'	#19
Chrysler C30, C33	'D'	#21
Plymouth Std.	'D'	#21
Plymouth Taxicab (11A6)	'C'	#19
Plymouth Taxicab (10A7)	'D'	#21

Release Lever Adjustment (Without Fixture)—Types with Borglite Driven Member:—Use special gauge plate, Borg-Warner #4234 (see note on car manufacturer's gauge nos. below), and install clutch on flywheel with gauge plate in place of regular driven member with machined lugs on gauge directly under release levers on 3 lever types (on 4 lever types, place lugs in any position). Use short straightedge placed on edge on gauge plate hub and adjust release lever adjusting screw nuts until levers just contact edge of straightedge for all models marked 'flush' in table below (if lever setting marked 'high', a cut-out or step must be made in the edge of the straightedge at one end so that levers can be set higher than hub; if lever setting marked 'low', recess or step should be cut in straightedge at gauge hub so that end of straightedge extends below hub), lock adjustment by peening nut into screw slot or against flat on screw.

Clutch Model	Lever Settings	Lever Height
8A7 (Without Baffle)		3/16" Low
9A7 (Except Oldsmobile)		1/16" Low
9A7 (Oldsmobile)		Flush
10A6, 10A7		Flush
11A6 (With Baffle)		1/16" High

Gauge Part No. Note—Gauge plates furnished by car manufacturers as follows: Nash—J-1507 (levers set 3/16" below top of hub on 4140, flush with top of hub on 4160, 4180), Oldsmobile—J-1048.

Release Lever Adjustment (Without Fixture)—Types with standard driven member (not Borglite):—The #4234 gauge plate can be used on these models and levers should be set as shown in table below (adjust levers in same manner as directed above for types with Borglite Driven Member).

Lever Settings

Clutch	No Baffle—Lever Height	With Baffle
8A7	3/16" Low	
9A6	Flush	1/16" High
9A7 (exc. Olds)	⅛" High	
10A6	⅛" High	
10A7 (exc. Olds)	⅛" High	3/16" High
11A6 (See Note)	3/16" High	¼" High

NOTE—Model 11A6 Nos. 908 & 910 were set ¼" High (Without Baffle).

Driven Member (Borglite Type):—New type composite plate consisting of a small diameter disc with separate clock-spring type cushion segments (to which facings are riveted) riveted to outer rim. Segments are dished to provide soft engagement. This type of construction results in less weight at rim of driven member (which reduces spinning and allows quiet, fast gear shifting) without loss of strength in plate. Plate is balanced by additional rivets placed at rim of disc. Facings are riveted individually on cushion segments by one or two rivets in each segment. **Manufacturer recommends that driven member not be relined and that replacement driven member (with new facings installed) be used.**

Driven Member (Other Types)—Same as used on previous models with separate cushioning springs or spring tabs on plate. See Borg & Beck Clutch article in manual for data on these types.

LONG MODEL 11CFS SPECIAL TYPE

MODEL 11CFS-CI

PACKARD SIX TAXICAB, MODEL T1900 (1941)
PACKARD SUPER 8, '160' 1903, 3A, 4, 5 (1941)
PACKARD CUSTOM SUPER 8, '180' 1906, 7, 8 (1941)

IMPORTANT NOTE:—This model has special riveted construction and cannot be dismantled.

PRODUCTION CHANGE NOTE:—Long Model 11CF-CI used on late cars in production and this model also available as optional replacement on cars and Taxicabs with the 11CFS-CI clutch. See Long 'CF' Clutch article on following page for data.

DESCRIPTION:—Same design as other Long 'CF' type semi-centrifugal clutches except for added spring segments as follows:

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Spring Segments—Consists of three flat springs located between release levers. Springs are riveted to pressure plate at inner end and on clutch cover flange at outer end so that all clutch parts are permanently joined in one assembly (one clutch spring of each group extends through clearance hole in each spring segment).

SERVICING:—Cover assembly cannot be dismantled and is serviced on exchanged basis (spring segments must be removed first and will be damaged if any attempt made to remove clutch cover).
WARNING—Clutch will not operate satisfactorily with spring segments removed.

DRIVEN MEMBER:—Long 'CF' type. See Long 'CF' clutch article in Mechanical Equipment Section of manual for driven member data.

LONG 9CF, 9½CF, 10CF, 11CF MODELS

MODEL 9CF-CS
FORD '85', 11A,C PASS. CARS & COMM'L. (1941)
FORD 4 CYL., COMM'L. & TRUCK MODELS (1941)
MODEL 9½CF-CS
GRAHAM HOLLYWOOD, MODEL 113 (1941)
GRAHAM SUPERCH'G'D HOLLYWOOD, 109 (1941)
PACKARD SIX, '110' MODEL 1900 (1941) STD.
MODEL 10CF-CI
PACKARD SIX, 1900 ('41) WITH ECONO-DRIVE.
PACKARD EIGHT, '120' MODELS 1901,1A (1941)
PACKARD CLIPPER, MODEL 1951 (1941)
MODEL 10CF-TI
LINCOLN, ZEPHYR & CONTINENTAL 16H (1941)
LINCOLN, CUSTOM MODEL 168H (1941)
MERCURY, MODEL 19A (1941)
MODEL 11CF-CI
FORD '85' & '95', ALL TRUCK MODELS (1941)
PACKARD TAXICAB MODEL T-1900 (LATE 1941)
PACKARD SUPER 8, 1903,3A,4,5,6,7,8 (LATE '41)
MODEL 11CF-10½TI
CADILLAC, SERIES 41-60S, 61, 62, 63 (1941)
MODEL 11CF-TI
CADILLAC, SERIES 41-67, 75 (1941)
CADILLAC, COMM'L. SERIES 41-62, 75 (1941)

NOTE:—Cadillac Models—This clutch used only on cars with Std. Transmission. Cars with Optl. Hydra-matic Drive do not have any clutch.

Packard Taxicab & Super Eight—This 11CF-CI clutch used in late production and as optional replacement for 11CFS-CI clutch used on first cars. See preceding article for 11CFS-C1 data.

Long Driven Members (On other cars)—Long driven members used with clutches of other makes on the following car models:

Car Model	Long Driven Member
Buick 41-40, 40A, 50	10CF-TS
Buick 41-60, 70, 90	10½CF-TI
Pontiac 6, 41-24, 25, 26	9CF-TS
Pontiac 8, 41-27, 28, 29	9½CF-TS
Pontiac Taxicab	10CF-CS
Studebaker Pres. 7C	9½CF-CS

NOTE—Borg & Beck 'Borglite' type Driven Members also used on Buick models.

SPECIAL SERVICE NOTES:—Cadillac Clutch Squeaks—To correct squeaks in clutch mechanism, apply thin coat of water pump grease to pressure plate driving lugs at point where they contact cover (apply by coating feeler gauge with grease and inserting feeler between lug and edge of slot). If release bearing squeaks, remove flywheel housing pan, turn clutch until grease plug is down, replace plug with lubrication fitting and lubricate bearing with wheel bearing grease. CAUTION—Do not over-lubricate bearing and make certain that fitting removed and plug re-installed.

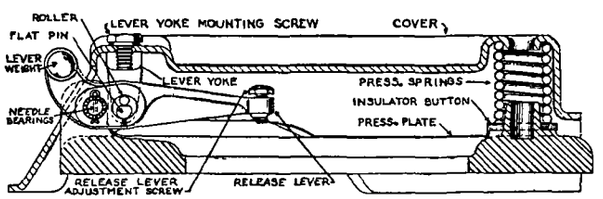
Cadillac Service Clutches—Clutches furnished for service have locking pin or block at each release lever. **These blocks must be removed** after clutch installed on flywheel (blocks may drop down in housing and cause damage when engine operated).

Cadillac Clutch Balancing—See Cadillac Shop Notes in 'M' section for balancing instructions after clutch installed on flywheel.

TYPE:—Semi-centrifugal, single plate, dry disc type. Same design as used on corresponding 1940 car models.

SERVICING:—Mark all parts before dismantling and reassemble in same position. Replace grooved, warped, or checked pressure plates. Replace springs when pressure plate discolored from heat (see Spring Testing below).

Dismantling:—Place clutch on fixture (supporting pressure plate on special lands under lugs) or arbor press. Compress cover plate slightly, take out assembly screws (lever yoke mounting screws) on cover, release pressure on cover plate slowly, lift off plate. Note whether washers used on yokes under assembly screws (these washers must be reinstalled if old pressure plate used again). See special directions below on removing and reinstalling release levers. Remove and test clutch springs.



Release Lever Assembly:—Mount lever yoke on release lever, fasten by inserting flat-sided lever pin (flat side out or toward cover) and roller (place roller on flat side of pin). Insert lever in pressure plate lug, use roller pin sawed off to length of lever width as a guide and insert needle bearings, insert roller pin, pushing guide pin out, lock both lever pins with cotter pins. Thread release lever adjusting screws in ends of levers, turning screws down completely.

Assembling:—Place pressure plate on fixture or arbor press. Assemble pressure springs, locator washers or insulator washers on plate, place washers on lever yokes (if washers used previously and old pressure plate being used). Place cover plate in position (lining up marks made before dismantling), compress cover slowly guiding lever weights through holes in cover and lining up yokes under cover plate holes. See that pressure springs are seated, insert cover screws in yokes, using lockwasher under screw head, tighten screws down securely. Compress and release clutch several times (using weight on release levers) to seat all parts. Then adjust release lever heights.

Pressure Plate Servicing:—Regrinding or resurfacing pressure plate will throw levers out of adjustment and this must be compensated for by installing washers between lever yoke and clutch cover. Manufacturer recommends that when .020" removed from plate, washer thickness of .015" be used (washers should be approximately same size as end of lever yoke). CAUTION—If washers are found installed at this point when clutch is disassembled, make certain that these washers re-installed when clutch is assembled (if old pressure plate re-used), or discarded (if new pressure plate installed).

Clutch Springs:—Springs should check with table below. NOTE—Number shown thus (9) indicates number of springs used on each model.

Clutch Springs

Car Model	Spring Part No.
Cadillac (exc. Comm'l.)	C-2686 (9)
Cadillac 62, 75 Comm'l.	C-4188 (9)
Ford (9CF)	C-4873 (6)
Ford (11CF—BL1440)	C-1965 (9)
Ford (11CF—BL1478)	C-4873 (9)
Lincoln	C-2096 (9)
Mercury	C-5333 (9)
Packard (9½CF)	C-4905 (6)
Packard (10CF)	C-2096 (9)
Packard (11CF—Taxicab)	C-4873 (9)
Packard (11CF—Super 8)	C-4905 (9)

Spring Specifications

Spring Number	Pressure @1 9/16"	No. of Coils	Color Marking
C1965	90-100 lbs.	8¾	Green
C2045	110-120 lbs.	8¾	Lgt. Green
C2096	125-130 lbs.	8½	Red
C2686	145-150 lbs.	8¾	Yellow
C4873	145-153 lbs.	8¼	Brown
C4188	170-180 lbs.	7.4	Plain or Orange
C5333	125-135 lbs.	8¾	Blue

Release Lever Adjustment (On Borg-Warner Universal Clutch Fixture UF-300):—Install special lands on fixture under pressure plate, set lever adjusting arm on sleeve so that distance from bottom end of sleeve to bottom of arm is correct for each model (allowable variation plus or minus 1/32") as given in table below. Adjust levers by turning lever adjusting screw in each lever tip in or out, lock adjustment by peening lever into slot on screw.
CAUTION—Support screw on metal surface when peening lever to prevent distorting lever and screw.

Release Lever Settings

Clutch Model	Lever Height
9CF (all)	2 3/32"
9½CF (all)	2"
10CF (Lincoln)	2"
10CF (Mercury)	1¾"
10CF (Packard)	2⅛"
11CF (Cadillac)	1⅞"
11CF (Ford Truck)	2 7/32"
11CF (Packard)	2 7/32"

Above settings are plus or minus 1/32".

Release Lever Adjustment (without Fixture):—When using dial indicator to set release levers, on Model 9½CF install special Borg-Warner indicating plate on levers and lever setting should be 2½" plus or minus 1/32" with this plate in place. On other models this indicating plate is not used and lever settings are same as above. Lever heights must be equal within .005".

Cadillac Models—Manufacturer recommends that adjusting gauge J-285-C be installed on flywheel in place of regular driven member and short straight-edge used as guide on gauge boss. Release lever mounting clevis screw heads should be bumped lightly with 8 oz. hammer to bend cover slightly until lever tips contact edge of straightedge.

DRIVEN MEMBER:—Manufacturer recommends that driven member not be relined and that replacement driven member (with new facings installed) be used. See Car Model 'M' Page for facing specifications.

INLAND MODELS

Used On:

PONTIAC SIX, 41-24, 25, 26 (1941)
PONTIAC EIGHT, 41-27, 28, 29 (1941)
PONTIAC, TAXICAB MODELS (1941)
STUDEBAKER PRESIDENT, MODEL 7C (1941)

SPECIAL SERVICE NOTES:—Pontiac (Except Taxicab)—Pressure plate is permanently assembled as part of cover assembly with four shallow 'U' shaped segments of flat spring steel riveted to pressure plate at center and to clutch cover flange at ends. These spring segments replace the driving lugs and separate retracting springs used on previous models. CAUTION—Do not remove pressure plate or disturb spring segments. Clutch cover and pressure plate are serviced as an assembly (parts not furnished separately).

Pontiac Taxicab—This model has flat anti-rattle spring assembled in one of clutch cover holes adjacent to driving lug which is marked 'O'. Anti-rattle spring should be wired in place before clutch is disassembled (balance will be destroyed if spring assembled in any other cover hole).

Studebaker Service Clutches—Clutches furnished for service have spacers installed at each pressure plate driving lug. These spacers must be removed after clutch has been installed on engine.

DESCRIPTION:—Single plate type with diaphragm spring disc. Same design as used on corresponding 1940 car models except for new flat retracting spring and riveted assembly on Pontiac models (see Special Service Note above for description).

SERVICING:—Pontiac Note—Clutch used on all models except Taxicab cannot be disassembled and is serviced as an assembly. Disassembly data given below applies only to Pontiac Taxicab and Studebaker clutches.

Caution—Do not allow pressure plate to hang on retracting springs in clutch cover. When handling clutch cover assembly, support pressure plate by hand or invert assembly so that pressure plate is up.

Disassembly. On Pontiac Taxicab, wire anti-rattle spring (flat tension spring in hole on side of clutch cover adjacent to balance marked pressure plate lug slot) to cover so that it will be retained when pressure plate is removed—**shifting spring to any other position will upset clutch balance.** Working through holes in clutch cover, take out retracting spring mounting screws, withdraw three retracting springs, lift pressure plate out. This completes disassembly (cover, diaphragm, and release bearing plate serviced as an assembly only and should not be dismantled).

Assembly. Place cover and diaphragm assembly over pressure plate making certain that pressure plate lug marked '0' is engaged in cover slot which is similarly marked (mark on cover will be found on mounting flange below slot), install retracting springs and tighten mounting screws. On Pontiac Taxicab, make certain that anti-rattle spring is in place in cover in hole adjacent to balance-marked slot and that it bears on pressure plate edge. No release lever setting, etc., required.

NOTE—Manufacturer recommends that new retracting springs be used with clutch whenever a new or relined driven member is installed.

DRIVEN MEMBER:—Long 'CF' type driven members used on all models. See Long 'CF' type Clutch article for driven member data.

TROUBLE SHOOTING:—Clutch Poor Release Complaints—On Pontiac Taxicab, faulty release of clutch caused by anti-rattle spring wearing into plate and binding at end of spring. To correct this condition, examine pressure plate and spring for indication of interference. Smooth up pressure plate to provide good bearing surface for face of spring. See that spring does not have end thrust on pressure plate lug (shorten end of spring if necessary). Lubricate spring with Lubriplate when reassembling. CAUTION—Driving lug slots must not be widened to correct poor release. Clearance in excess of .005" at either side of lug will cause clutch noise and roughness. When installing clutch, make certain that dowel in flywheel engages hole in cover (cover will be distorted and clutch out-of-balance result from installation in any other position).

Clutch Release Noises (Pontiac)—If clucking noise noted when pedal depressed to release clutch, examine felts at each end of clutch control countershaft (clutch linkage cross-shaft) and lubricate if dry. IMPORTANT—These felts should be lubricated at regular lubrication periods. Refer to 'Clutch Pedal Rattle Correction' for 1940 models in 1941 Pontiac Shop Notes in 'M' Section.

Intermittent Buzzing (Pontiac)—A buzzing noise at about 28 MPH. which is not continuous may be caused by loose dampener spring in clutch driven member hub.

ROCKFORD MODELS

Assembly Number	Used On: MODEL 8½SP

UCLA-3-1748—BANTAM, SUPER FOUR MODEL 65 ('41)

SPECIAL SERVICE NOTE:—Facing Installation—Front facing is free and floats between driven disc and flywheel. Rear facing is riveted to pressure plate (driven member is unlined).

DESCRIPTION:—Single plate, dry disc type. Same design as used on corresponding 1940 model. Clutch release levers are built with a fulcrum lug which engages cover and are linked to studs inserted through pressure plate (facing riveted on face of pressure plate and must be removed to remove these studs). Twelve short springs (¾" working height) are mounted in pockets in pressure plate and cover.

SERVICING:—Pressure plate assembly need not be dismantled when replacing driven member unless pressure springs are to be tested or replaced or other service work performed.

Dismantling:—Place cover assembly in arbor press with pressure plate down, compress cover slightly, remove cotter pins, lever pins, unhook lever springs, remove levers, release pressure slowly, lift off cover.

Clutch Springs:—Check springs and replace if weak or burnt. Springs should check with following figures:

Spring Specifications

Car Model	Spring Pressure & Height
Bantam	23-27 lbs. at ¾"

Assembling:—Place pressure plate and release lever stud assembly on arbor press or clutch fixture (studs must be installed before facing riveted on pressure plate). Install clutch springs (12 used), install cover plate with lever studs extending through plate. With release lever springs in place, install levers and insert lever pins.

Release Lever Adjustment:—Levers not adjustable but lever tips should be exactly 1" above outer surface of facing on pressure plate (check with facing installed). Clearance between lever tips and face of release bearing should be 1/16" with clutch engaged.

DRIVEN MEMBER:—Driven plate consists of an unlined steel disc. Rear facing is riveted to face of pressure plate, front facing floats between driven member and flywheel. See car model 'M' page for facing specifications.

ROCKFORD (CROSLEY) TYPE

Used On:

CROSLEY, MODEL CB41 (1941)

DESCRIPTION:—Single plate dry disc type. Clutch assembly consists of three fulcrum brackets (mounting brackets) which are bolted individually on the flywheel. Release levers are pivoted on pins in fulcrum brackets and engage lugs on pressure plate with pressure spring mounted on pressure plate under each lever (3 springs used).

SERVICING:—Disassembly. Take out cotter pin and remove pin linking release lever to fulcrum bracket, remove release lever and spring. Repeat this operation at each of the three fulcrum brackets.

Assembly—Install fulcrum bracket on pressure plate lug, install spring, place release lever in position with hole in lever and fulcrum bracket lined up, install pin and secure with cotter pin.

DRIVEN MEMBER:—Consists of a steel disc with slotted rim on which linings are riveted in four separate segments. Each lining segment retained by three rivets with rivet heads reversed on alternate segments (rivet heads toward flywheel on adjacent segments).

Servicing—Facings not furnished separately and driven member should be serviced by replacement.

BUICK 40, 50 (OWN MAKE)

Used On:

BUICK, SPECIAL SERIES 41-40, 40A (1941)
BUICK, SUPER SERIES 41-50 (1941)

SPECIAL SERVICE NOTE:—Both Borg & Beck 'Borglite' and Long 'CF' type driven members used on these cars. Both types have woven facings which are grooved for quicker release. Driven members are balanced by installation of extra rivets or clips on driven member hub and these balance weights should not be removed. Driven members should be installed with large oil baffle toward transmission. Driven members are serviced as an assembly (parts not furnished separately).

TYPE:—Single plate, dry disc, 'Crown Spring' type. Same design as used on corresponding 1940 cars.

SERVICING:—Mark pressure plate, spring disc and cover before disassembling clutch to insure reassembling in same positions (do not prick-punch spring disc, use paint or chalk for marking).

Disassembly. Use special tools J-1039-1 and J-1039-2 to unhook retainer springs from clutch cover ears working springs slightly toward center to permit tool engagement (do not hammer on tool which will distort cover), lift clutch cover off. Unhook retainer springs from spring disc by working one leg of each spring in through pressure plate lug toward center of clutch and other leg out, lift off spring disc, remove retainer springs from pressure plate lugs.

Assembly. Intall retainer springs in pressure plate lugs with curved legs of springs up toward spring disc (push one leg of each spring in toward center of clutch and other leg out so that it is just entered in hole in lug). Apply 'Lubriplate' lightly on spring disc at points where it contacts pressure plate and retainer springs (excess will ruin clutch facings), place spring disc on pressure plate, maneuver retainer spring loops over disc by turning springs so that they are properly aligned. Install cover, use special tools to engage retainer spring loops on cover ears. Make certain that marks on pressure plate, spring disc, and cover are lined up. This completes clutch assembly (no release lever adjustment, etc., required).

DRIVEN MEMBER:—Borg & Beck 'Borglite' or Long 'CF' type (both used). See Special Service Note (above) and separate articles on Borg & Beck and Long 'CF' type clutches for driven member data.

BUICK 60, 70, 90 (OWN MAKE)

Used On:

BUICK, SPECIAL SERIES 41-60 (1941)
BUICK, ROADMASTER SERIES 41-70 (1941)
BUICK, LIMITED SERIES 41-90 (1941)

SPECIAL SERVICE NOTE:—Both Borg & Beck 'Borglite' and Long 'CF' type driven members used on these cars. Both types have woven facings which are grooved for quicker release. Driven members are balanced by installation of extra rivets or clips on driven member hub and these balance weights should not be removed. Driven members should be installed with large oil baffle toward transmission. Driven members are serviced as an assembly (parts not furnished separately).

TYPE:—Single plate, dry disc type. Same design as type used on corresponding 1940 car models.

SERVICING:—Mark all parts before dismantling and reassemble in same relative positions to maintain balance.

Disassembly:—Place cover assembly on flat surface or arbor press so that it is supported on pressure plate only, place block on cover so that it clears release levers, compress cover sufficiently to relieve tension on adjusting nuts, remove nuts, release pressure slowly. Lift off cover. This will expose all parts for servicing and inspection. Replace all worn parts, check clutch springs.

Clutch Springs:—Check springs and replace if weak or burned. Twelve springs used (installed in groups of two between each release lever and adjacent pressure plate driving lug).

Spring Pressure	Length
144 lbs.	1¾"

Assembling:—Place pressure plate on flat surface (use support under plate only). Install pressure springs on plate, place cover in position on springs lining up marks on cover and pressure plate. Compress cover slowly, making certain that driving lugs on plate enter slots in cover, and use tool J-857 to line up lever pivot screws with hole in cover, install adjusting nuts on screws, adjust lever heights as directed below.

Release Lever Adjustment:—Assemble special gauge plate, No. J-1036, in flywheel in place of driven member, tighten all cover mounting screws evenly and securely. Mount dial indicator and service tool J-1013 on clutch, adjust each release lever by turning nut on adjusting screw so that dial indicator reads zero (lever tip height equal to top of hub on gauge plate) and all levers are equal within .005". Lock adjustment by crimping nut flange against flat on adjusting screw.

DRIVEN MEMBER:—Borg & Beck 'Borglite' or Long 'CF' type (both used). See Special Service Note above and separate articles on Borg & Beck and Long 'CF' type clutches for driven member data.

CHEVROLET (OWN MAKE)

Used On:

MASTER DELUXE AG, SPECIAL DELUXE AH ('41)
ALL COMMERCIAL & TRUCK MODELS (1941)

NOTE:—Clutch is same as 1940 type in that Clutch Cover, Diaphragm Spring, and Pivot Rings are riveted together in a permanent assembly. This assembly cannot be dismantled and parts are not furnished separately (furnished as an assembly only).

SPECIAL SERVICE NOTES:—1941 Driven Member—Pass. Cars. New type driven member disc used has heavier (.024") clock spring facing cushions which have a maximum drag release of .070" (.058" on 1940 model) for deeper cushioning action and improved engagement. **This new 1941 type driven member must not be installed on previous models.** If used on previous models, driven member would not release properly and resulting drag would cause gear clashing.

Clutch Balance Marks—When installing pressure plate make certain that '0' marks on one lug of plate and on clutch cover flange are lined up. When installing clutch in engine, line up 'X' marks on clutch cover and flywheel. This is necessary to maintain clutch balance.

Clutch Rattles at idling speed (released)—Can be corrected by renewing retracting spring without removing clutch from engine by removing clutch housing underpan and turning flywheel until retracting springs are at the bottom (3 springs used). Remove spring bolt, withdraw spring, install new spring in same manner. Renew all three springs in same way. If new springs do not correct rattles, check clearance between pressure plate lugs and edge of clutch cover slot. Clearance should be .002-.008" and clutch cover assembly or pressure plate should be replaced if clearance exceeds .010".

Clutch Fork Installation—If retainer in groove in fork is worn, install new retainer being certain that high side of retainer is up (away from bottom of ball opening), and open end of retainer on the horizontal.

TYPE:—Single, plate, dry disc, diaphragm spring type. Same design as used on previous models except for new type driven member (see Special Service Note above).

SERVICING:—Disassembly Note—Diaphragm disc, clutch cover, and pivot rings are permanently assembled as a riveted unit and cannot be dismantled. Disassembly is limited to removal of pressure plate as described below.

Disassembly:—Take out screw in each retracting spring (3 used), working through holes in clutch cover, remove springs, lift cover assembly off pressure plate. Cover assembly cannot be dismantled further (diaphragm disc and cover riveted together).

CAUTION—Do not allow pressure plate to hang on retracting springs in cover. Always support pressure plate by hand when lifting clutch assembly.

Servicing:—Wash all parts except throw-out bearing is gasoline (see Caution below), examine pressure plate and flywheel face for scored or rough surface, check pressure plate drive lugs for burrs, see that lugs move freely in cover slots and that clearance in slots is .002-.008" (replace pressure plate or cover if clearance exceeds .010").

Check diaphragm spring and pivot rings for distortion or cracks. See that throw-out bearing is not rough and moves freely on clutch shaft sleeves, check transmission pilot hole in housing for run-out (must be less than .008"). Check clutch fork ball seat and ball fit, check driven disc and clutch shaft splines (replace disc if splines worn).

CAUTION—Throw-out bearing permanently lubricated and must not be soaked in gasoline which may dissolve lubricant on balls.

DRIVEN MEMBER:—Two types used—9⅛" diameter on Pass. Cars & ½ Ton, 10¾" on all other trucks. To install new facings, drill old rivets out from head side. Use riveting fixture to install new facings (fixture will flatten rivets exact correct amount of 7/32"), and reverse rivets in pairs (two each way). Facings are grooved type.

CAUTION—Passenger Car 1941 type Driven Member must not be used on previous models (will not disengage properly). See special service note above for description of new driven member.

HUDSON (OWN MAKE)

Used On:

HUDSON, ALL MODELS (1941)—SEE NOTE

NOTE:—Two clutch types (9" and 10") used on 1941 models as listed below. Special combinations of inner and outer clutch springs are used on the different models (see Clutch Spring data below) and two types of driven members are used (see Driven Member data).

Model	Clutch Size
10, 11 (No Overdrive)	9"
10, 11 (With Overdrive)	10"
12, 14, 15, 17, 18	10"

DESCRIPTION:—Single plate, cork insert type, operating in oil. Same design as used on previous models.

SERVICING:—Clutch assembly need not be dismantled when replacing driven member unless springs are to be tested or replaced, pressure plate replaced, or other service work performed.

Dismantling:—Check punch marks near outer edge of pressure plate in line with mark on cover flange or make new marks to insure reassembly in same position. Place clutch assembly on special clutch fixture (#J-298-H) or in arbor press supporting pressure plate so that cover is free. Compress cover slightly, take off 3 nuts on clutch finger retainer bolts on cover, release pressure slowly, lift cover off.

Pressure Plate:—Examine plate, replace if scored. Check for warping (particularly if plate 'blued' due to overheating). Replace if warped more than .010".

Clutch Springs:—Outer and inner springs (inner springs on some models only) should be checked with tool U15. If spring pressure does not check with specifications shown below, or if pressure plate is blued indicating overheating, springs should be replaced.

Car Model	Outer—Springs—Inner No.	Part No.	No.	Part No.
10 Std.	9	45148	3	155224
10L, 11 Std.	9	45158	6	155224
12 Std.	12	45149		
18 Std.	12	45148		
10, 11, 12, 18 (Overdrive)	12	45149	3	155224
14, 15, 17 Std. & Overdrive	12	45149	3	155224

NOTE—Model 10L has large (3x5") engine.

Spring Specifications

Spring Part No.	Pressure & Length
45148	155 lbs. at 1¾"①
45149	135 lbs. at 1⅝"①
155224	80 lbs. at 1⅝"①

①—Plus or minus 5 lbs.

Assembling:—Check clutch throw-out fingers, see that they are straight and do not show wear at tip or retainer lug. Replace retainer washers if necessary. Place pressure plate on fixture with face down. Assemble springs, clutch fingers, retainers and retainer washers on plate. Place cover on top of pressure plate assembly (lining up marks on cover and plate), compress cover slowly, guiding retainer bolts through holes in cover, install nuts on retainer bolts, tighten securely. Check clutch finger heights after clutch installed on flywheel.

INSTALLATION & ADJUSTMENT:—Shellac new gasket on face of cover flange, see that flywheel face smooth and clean, use clutch aligning arbor (#J-449) inserted through clutch cover and driven plate to align driven plate, mount clutch assembly on flywheel, install cover screws, tighten screws evenly and securely (draw down screws diametrically opposite together to avoid distorting cover). Then align clutch fingers.

Clutch Finger Alignment:—Use special clutch finger adjusting gauge (#J-774) resting gauge on clutch cover so that pin is directly above clutch finger tip. Turn thumbscrew down until pin contacts finger. Repeat at other clutch fingers to secure final gauge setting equal to lowest finger. Turn gauge to higher finger, strike end of retainer bolt with soft hammer until gauge bar rests squarely on cover hub. With final setting, gauge bar should rest squarely on hub over all fingers and clearance between pin and end of thumbscrew must be less than .005" (all fingers equal within this amount—check with feeler gauge).

Throw-out Bearing & Oil Seal:—Oil seal is pressed on collar behind throw-out bearing. When installing new oil seal, press firmly near inner diameter (pressure at point near rim may distort outer stamping and allow inner stamping and oil seal leather to revolve with shaft, this will cause noise similar to noisy throw-out bearing). Use arbor press to install throw-out bearing (do not drive on). See that bearing revolves smoothly and that oil seal inner stamping is tight in outer stamping before installing collar in clutch cover.

DRIVEN PLATE:—Driven plate has spring-dampener type hub and facing consisting of cork inserts. Examine driven member, see that plate runs true and is not warped or distorted, and that springs in hub do not have appreciable free play. See that hub splines are not worn and are free from burrs. Corks must be in good condition. Black glaze indicates use of wrong lubricant. Soak driven plate in Hudsonite and clean corks, or replace driven member.

Driven Member Specifications

Car Model	Outside Diam.	No. of Corks
10, 10L, 11 Std.	9"	90
10, 10L 11 Overdrive	10"	108
12, 18 Std. & Overdrive	10"	108
14, 15, 17 Std. & Overdrive	10"	108

BUICK TYPE

Used On:

BUICK SERIES 41-40, 40A, 50, 60, 70, 90 (1941)

TYPE:—Independent 'parallelogram' type with coil springs. Design same as used on 1940 Series 40, 50, 60, 70 (1940 Series 80, 90 type no longer used) with following features:

Lower Control Arms—Fabric bushings used at inner ends of lower control arms (frame connection). These bushings swaged on grooved shaft and lower control arms pressed on bushing and shaft assembly with .002-.007" press fit. Control arm, bracket shaft, and spring seat cannot be dismantled and serviced as an assembly only. Rubber seals are used on knuckle support bolt at outer end of control arm.

Upper Control Arm (Shock Absorber Assembly)—Interchangeable on right and left side of car (same as 1940). Caster adjustment located at rear of control arm (left side of car), front of arm (right side). Seals are not used on knuckle support eccentric pin at outer end of upper control arm.

CHECKING & ADJUSTMENT:—Before making adjustments, place front wheels in straight ahead position (measurement from center of tire tread to lower arm frame bracket shaft should be same on each side of car), and check following points:

Frame Height—Distance from lower face of frame cross-member to upper face of lower control arm should be 3⅝" (40,50,60,70), 4" (90) with regular springs and 4" (All Series with Optl. High Springs). If height not correct, or unequal by more than ¼", install shim on spring on lower side of car, or replace springs (see Spring data below).

Tire Inflation—Check tires and inflate to 25 lbs. (front), 30 lbs. (rear) **when tires are cold** or 27 lbs. (front), 34 lbs. (rear) **when tires are warm.**

King Pin Inclination—3½° (40,50,60,70 with 1⅛° Camber), 4¾° (90 with ⅞° Camber).

NOTE—Car weight must be on wheels when checking adjustments.

Caster:—Should be ⅜° ± ⅜° Positive (all cars). Machined bosses provided on ends of knuckle support for protractor mounting (use tool J-1521).

To Adjust—Jack up front wheels, loosen clamp bolt in upper end of knuckle support, remove lubrication fitting in end of upper support bushing (at front on right side of car, at rear on left side of car), insert Allen wrench through hole in bushing and turn upper support pin so as to move upper end of knuckle support to rear (to increase caster) to front (to decrease caster). One quarter turn of pin will change caster ¼°. Use care not to turn support pin beyond end of threads or bind knuckle support on upper control arm. Tighten clamp bolt and recheck with car weight on wheels.

Camber:—Negative ⅛° to Positive 1⅛° (40,50,60,70 with Std. Springs), Positive ⅛° to Positive 1⅜° (40, 50,60,70 with Optl. High Springs), Negative ⅜° to Positive ⅞° (90 with Std. Springs). Check camber by placing protractor (or tool J-1521) on machined end of bearing hub with dust cap and hub cap removed, or by measuring between center of tire tread at top and bottom of wheel. Top distance should be from 58 21/32" to 59 9/32" (40,50), 59 5/32" to 59 25/32" (60,70), 58½" to 59¼" (90). Bottom distance should be from 58 25/32" to 58 7/32" (40,50), 58 9/32" to 58 23/32" (60,70), 58⅞" to 58 5/16" (90). First figure is for Negative Camber (above), second figure for maximum Positive Camber (above).

To Adjust—No adjustment provided. Special eccentric upper support pin, Group 6.178, Part No. 231760, may be installed and will permit slight camber corrections (turning eccentric pin will increase or decrease camber).

Toe-In:—Should be 0-1/16" depending on average camber (half sum of camber for each wheel). To check toe-in, measure between outside of tire treads at rear, roll car ahead ½ revolution and measure between same points on tires at front.

To Adjust—Loosen clamp bolts and turn adjusting sleeve at outer end of each tie rod equally (turn wrench toward rear to lengthen rods to increase toe-in). Three-eighths turn of adjusting sleeve on each side of car will change toe-in ⅛".

Steering Geometry (Toe-out on Turns):—With outer wheel turned exactly 20°, inner wheel should be turned 22° ± ¾°. No adjustment provided.

SERVICING:—Lower Control Arm & Support Pin—Lower control arm cannot be dismantled and is serviced as an assembly. When assembling control arm on knuckle support, first place rubber seal over end of each arm, make certain that bushing tight in lower end of knuckle support with head toward rear, center knuckle support between control arms and thread lower support bolt through arms and bushing from front, install nut on rear end. Then pull rubber seals down over ends of arms and see that they seat on bolt between arm and end of knuckle support bushing.

Upper Control Arm—Both bushings threaded on upper support pin (rear bushing also threaded in control arm, front bushing plain type and locked by clamp bolt in control arm. Seals not used.

SPRINGS:—On all models, upper end of front spring has smaller end coil which pilots on cup attached to frame by shock absorber mounting bolts and end coil at lower end is not ground flat (must be fitted in recess in lower spring seat). All springs marked with part number on coil near end and are paint marked for identification. If spring length incorrect by more than ¼", install special spacer shim, No. 1310413 (⅛" thick), on top coil of spring (if spring too short), replace spring (if too long).

Standard Spring Specifications

Car Model	Part No.	Color Mark
41, 46, 46S, 49	1317791	Blue & Green
51, 51C	1317791	Blue & Green
56, 56S, 56C	1317791	Blue & Green
61, 66, 66S	1317792	Blue & White
71, 71C, 76S, 76C	1317792	Blue & White
Optl. High Springs		
41, 46, 46S	1314950	White
51, 51C	1314950	White
56, 56S, 56C	1314950	White
61	1315045	Green
66, 66S	1314950	White
71, 71C, 76S, 76C	1315045	Green

FRONT STABILIZER:—Consists of an anti-sway bar mounted on rubber bushings in stamped brackets on frame and linked to lower control arm by links which have rubber grommets at stabilizer arm and control arm. Stabilizer should not require servicing but if links disconnected or trouble experienced with frame bracket rubber bushings, service these parts as follows:

Stabilizer Bracket Bushings—If bushings pop out of place in brackets (usually caused by excessive soaping when installed), re-install bushings as follows: Remove stabilizer shaft and bracket assembly from car, break welds between brackets and back plates, clean outside of bushings with steam or gasoline to remove all traces of soap and grease, locate bushing on shaft in correct position, install bracket bushings, clamp brackets and back plates together in vise and wire together (need not be welded), install assembly on car and remove wires as bracket bolts are installed and tightened. To install new bushings, cut old bushings off, use weak soap sud and water solution to slide bushings over end of shaft (do not use strong soap or mineral lubricants).

Stabilizer Links—When installing links, install link rod with nut at lower (control arm) end with spacer on rod between upper and lower grommet assemblies, tighten nut to limit of threads and check over-all length of upper and lower grommet assemblies. If distance from outside of upper and lower grommet metal cups is not 1 11/16", adjust nut for correct dimension.

CADILLAC TYPE

Used On:

CADILLAC, SERIES 41-60S,61,62,63,67,75 (1941)

TYPE:—Independent 'parallelogram' type with coil springs. Design same as type used on 1940 Series (except Series 75 type which is not used). All models are similar and adjusted in same manner.

ADJUSTMENT:—Before making adjustments check wheels for balance, run-out, and tracking; check front wheel bearing adjustment, see that shock absorbers filled with fluid and operating properly, check steering gear adjustment, see that control arms operate freely and that control arm and knuckle support bushings are correctly installed. Place front wheels in straight ahead position and check following points first:

Tire Inflation—Check tires and inflate as follows: 41-60S,61,62,63—28 lbs. (front & rear), 41-67,75—24 lbs. (front), 32 lbs. (rear).

Wheel & Tire Run-Out—Check wheels for run-out and mark high point on tire. Place this mark vertically (at top of wheel) when checking Toe-in and Toe-out, horizontally (at one side of wheel) when checking Caster, Camber and Kingpin Inclination.

Kingpin Inclination—5°51' crosswise (All Series) with 0° Camber.

NOTE—Car weight must be on wheels when checking adjustments.

Caster:—Negative 1¾° to Negative 2¾° (All Series). Must be equal within ½° on both sides of car.

To Adjust (All Series)—Loosen the clampscrew in upper end of knuckle support, remove lubrication fitting in front bushing of upper control arm, insert Allen wrench, Tool J-720, through lubricant fitting hole, turn eccentric upper support pin **in complete turns only,** clockwise to increase caster, counter-clockwise to decrease caster. IMPORTANT—Camber will be disturbed unless pin turned in complete turns only.

Camber:—Positive ⅜° to Negative ⅜° and preferably 0° (All Series). Must be equal within ½° on both sides of car.

To Adjust (All Series)—Same as for the Caster Adjustment on these same cars (see Caster Adjustment above) except that entire range of adjustment secured in ½ turn of eccentric pin. Pin must not be turned more than ½ turn from point where correct caster secured or caster will be upset when this camber adjustment made.

Toe In:—Should be 1/32"-3/32" with car at rest (All Series). Measure with 'high point' of tire run-out in vertical position (at top of wheel).

To Adjust (All Series)—Loosen the clamp bolts and turn tie rod adjuster (at wheel end of each tie

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rod) equally on both sides of car (to maintain correct position of steering gear).

Steering Geometry (Toe-out on turns):—With outer wheel turned exactly 20°, inner wheel should be turned exact amount shown in table below for right and left turns.

Car Model	Inner Wheel—Right Turn	Inner Wheel—Left Turn
41-60S,61,62,63	24°42′	25°25′
41-67, 75	23°6′	24°7′
41-62, 75 Comm'l.	23°6′	24°7′

SERVICING (ALL SERIES):—Lower Control Arm & Knuckle Support Pin—Control arm mounted on inner frame bracket shaft by threaded bushings (bushings threaded on shaft and in control arms) with rubber seals on shaft. Shaft can be removed from control arms after bushings have been removed. Support pin at outer end of control arm is threaded through both control arms and bushing in lower end of knuckle support and has nut on rear end. Rubber seal is installed on support pin at front end of bushing (between knuckle support and front control arm).

Upper Control Arm Support Pin—This eccentric pin is threaded in bushings in each upper control arm and in upper end of knuckle support (rear bushing is threaded type and is screwed in control arm, front bushing is plain type and is locked in control arm by clamp bolt). A clampscrew in the upper end of the knuckle support locks the pin in the support to maintain caster and camber setting.

SPRINGS:—Part number is stamped on end coil of each spring. When installing springs see that insulator at top and bottom of each spring.

NOTE—Frame height or spring height when installed on car should be 4½-5¼" (from top of lower spring seat to lower edge of frame side rail).

Spring Specifications

Car Model	Part No.	Color Mark
41-60S, 61, 63	1428431	None
41-62①	1428432	Green
41-62②	1428431	None
41-67, 75	1428433	Pink
41-62, 75 Comm'l.	1428429	Yellow

①—Before Engine Number 8340211.
②—After Engine Number 8340210.

CHEVROLET TYPE

Used On:

MASTER DELUXE AG, SPECIAL DELUXE AH ('41)

SPECIAL SERVICE NOTES:—Where excessive bumping occurs on cars operated on rough roads or heavy service, check front end to make certain that lower control arm rubber bumpers are in place and replace any missing bumpers. Install heavy duty shock absorber valves (see Delco Parallel Cylinder Shock Absorber article for data) and if these measures do not correct complaints, heavy duty front springs may be installed (see Spring data below).

TYPE:—Independent 'parallelogram' type with coil springs. Design same as type used on corresponding 1940 models except as follows:

Lower Control Arm—Spring seat now riveted to lower control arms (need not be dismantled for frame support shaft removal). Frame support shaft seals installed in grooves in shaft (separate metal retainers not used).

Springs—Free length increased ⅛" (to 14 1/16") to offset added weight of car.

CHECKING & ADJUSTMENT:—Check the following points first before checking or adjusting front suspension unit.

Tire Inflation—26 lbs. (front), 28 lbs. (rear).

Wheel Runout—Check and adjust front wheel bearings. Check wheel for tire and rim runout and eccentricity. Mark tire midway between high and low spots (mean point) and place this mark at top (vertically) when checking Camber, at side (horizontally) when checking Toe In.

Steering Gear & Connections—Check mounting bolts and tighten if necessary. Check tie rod ball and socket joints for excessive looseness.

Frame Height—Install special gauges at front and rear ends of car to level frame when checking. Front gauge has holes to engage lower control arm shaft (inner end) and pivot pin (outer end) to hold control arms rigid in correct position. Rear gauge clamps axle housing and frame so that clearance between top of axle housing and frame siderail is correct.

NOTE—Make all checks with car weight on wheels (curb weight—car ready for road but no load).

Kingpin Inclination:—4¾° plus or minus ½°.

Caster:—0° plus or minus ½°. Adjusted by turning knuckle support eccentric upper pivot pin (same adjustment as for camber—See Camber Adjustment).

Camber:—Neg. ¼° (Wheel tilts in at top) plus or minus ½°.

Adjustment—Remove lubricant fitting on knuckle support upper pivot pin front bushing, loosen clamp bolt in upper end of knuckle support which clamps pivot pin. Insert ¼" Allen wrench through lubricant fitting hole in bushing to engage pivot pin, turn pivot pin clockwise to increase caster, counter-clockwise to decrease caster (pin is eccentric and this same movement will change Camber from minimum to maximum every half turn of the pin) until both caster and camber are correct within limits given above, tighten clamp bolt and replace lubricant fitting. One half-turn of pivot pin will change caster angle 39′ and change camber angle from 0° to 1°2′ (depending on initial position of pin).

Toe In:—0" to 1/16". **Adjustment**—Loosen clamp bolts and turn left hand (short) tie rod. When tightening clamp bolts, make certain that both tie rod ends are in alignment with the ball studs.

NOTE—Right hand (long) tie rod is not adjustable.

Steering Geometry (Toe out on Turns)—Outer wheel turned in 20°, Inner wheel turned 24° plus or minus 2°. Not adjustable (replace steering arm).

SERVICING:—Suspension Unit Assembly Removal—Remove Front Fenders, Radiator, and Radiator Grille Assembly as a unit (see Chevrolet Shop Notes in 'M' Section for directions). Remove front bumper, disconnect stabilizer from frame horns, remove pitman arm from steering gear. Take out bolts holding front cross-member to frame side rails, slide suspension unit assembly off over frame side rails at forward end. Install in same manner.

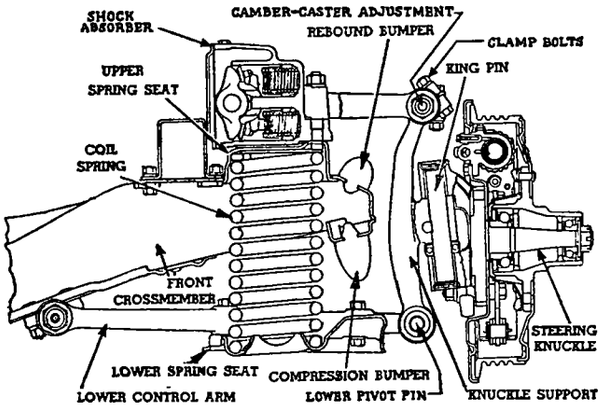
Upper & Lower Control Arm Pivot Pins:—Serviced in same manner as on previous models. Neoprene seals used on each end of both upper and lower pivot pins.

Lower Control Arm Shaft:—To remove shaft, disconnect stabilizer link at lower spring seat, remove front spring, remove lower control arm pivot pin, remove lower control arm assembly by taking out bolts mounting shaft on cross-member. Place assembly in vise, remove front and rear control arm shaft bushings, maneuver shaft out of control arms (not necessary to disturb spring seat).

Assembly—Install new Neoprene seals on each end of shaft so that seals seat in recess at shoulder on shaft, install shaft in control arm assembly with letter 'F' (forged on one bracket) toward front of car. Hold shaft centered between control arms, screw front and rear bushings on shaft and in control arms, tighten bushings securely, install control arm assembly on car.

Front Stabilizer Shaft:—To remove, disconnect links by removing nut on upper end of link bolts and withdrawing bolts, then remove bolts from frame mounting brackets. To install stabilizer, make certain that steel spacer installed between frame and bracket, bolt bracket loosely to frame, install links, tighten bracket bolts only with links connected and car weight on wheels.

Stabilizer Links—Spacer must be installed on center of link bolt and steel retainer at outer end of bushings. Tighten link bolt nut to limit of threads.



SPRINGS:—Removal—Disconnect stabilizer link from lower spring seat, support weight of car on stand jack at inner side of lower spring seat, remove cotter pins and nuts from lower control arm shaft bracket bolts, drive out bolts and install long drift punch through bolt hole in bracket and cross-member to maintain alignment, raise car with chain hoist to remove spring pressure. Remove jack from beneath lower control arm allowing control arm and spring seat to drop down to free spring.

Assembly—Make certain that spring installed with ground end (flat surface) up and that lower end-coil of spring fits in recess in spring seat. Reverse removal directions given above.

SPRINGS:—Springs have end coil at upper end only ground flat. When installing springs, make certain that this flat end placed up and that end coil at lower end of spring is fitted in recess in lower spring seat.

Heavy Duty Springs—Use only for severe operation. Will prevent spring bottoming and provide more clearance at front end. Install 5245543 to correct severe bumping, 5246233 in extreme cases.

Spring Specifications

Part No.	Free Length	Deflection Rate	Car Hgt.
Production	14 1/16"	300 lbs.	Std.
3653059	13 15/16"	300 lbs.	Std.
5245543	13 13/32"	346 lbs.	Std.
5246233	13 9/16"	400 lbs.	1" Higher

Used On:
CHRYSLER, MODELS C28, C30, C33 (1941)
DE SOTO, MODEL S8 (1941)
DODGE, MODEL D19 (1941)
PLYMOUTH, MODELS P11, P12 (1941)

TYPE:—Independent 'parallelogram' type with coil springs. Design changed from type used on 1940 models as follows:

Upper Control Arm & Pivot Pin—Control arm is new design one piece type with forked outer end and separate pivot pin screwed in eyes in forked outer end of arm. New type eccentric bushing installed on pin within fork for steering knuckle support. See Control Arm service data below.

CHECKING & ADJUSTMENT:—Before making adjustments, check wheel and tire balance and run-out, front wheel bearing adjustment and king pin bushing clearance, steering gear adjustment, and shock absorbers. See that springs and shock absorbers in normal position (grasp bumper and work front end of car up and down several times). Then check following points first:

Frame Height—Use tool C-592 to measure distance from lower face of frame front cross-member lower plate (measure through hole in lower flange of frame side rail) to dimple on lower spring seat directly below this point. Distance should be 3⅜" (all models) and must be equal within ⅛" on both sides of car. If height not correct, install spacer on spring on low side (see Spring data below).

Tire Inflation—Check tires and inflate to 28 lbs. front and rear (except Chrysler C28, DeSoto, Dodge & Plymouth 7 Pass.—30 lbs. front and rear or 32 lbs. with larger 18" wheels).

Kingpin Inclination—4¾-6° crosswise (all models). NOTE—Car weight must be on wheels when checking adjustments.

Caster:—Negative 1° to Positive 1° (all models). Not adjustable. Controlled by distance knuckle support upper pivot pin bushing (eccentric camber adjustment) turned in on upper control arm. See Camber adjustment following.

Camber:—Positive ¼° preferred (0° to ¾° permissible) for all models. Correct kingpin inclination before adjusting camber.

NOTE—Special tool (narrow wrench designed to fit between knuckle support and upper control arm fork so as to engage eccentric bushing) must be used for Camber adjustment. This tool is No. C-611 (Chrysler C28, DeSoto, Dodge, Plymouth—except 7 Pass. models), C-619 (Chrysler C30, C33 and all other 7 Pass. models).

To Adjust—Loosen clampscrew in upper end of knuckle support, turn eccentric bushing in upper end of knuckle support not more than ½ revolution from place where correct caster is secured (bushing eccentric and entire range of adjustment secured in ½ turn). Bushing must not be turned so as to bind on upper control arm forks.

Toe-In:—1/16" preferred (0-⅛" permissible). To check toe-in, set wheels straight ahead, move car forward one full revolution of wheels. Measure between center of tire treads, hub high, at rear, then roll car forward ½ revolution and measure to same points on tires at front.

To Adjust—Loosen clamp bolts on each tie rod (long rod right side, short rod left side), turn tie rods equally. CAUTION—Make certain that steering gear turned so that roller on 'high' point of worm with wheels in straight ahead position after toe-in adjustment completed. Steering gear position can be corrected by shortening one tie rod and lengthening opposite rod equally.

SERVICING:—Steering Knuckle & Kingpin Bushings—To remove, remove wheel and hub, block brake pedal, remove nuts fastening brake support to steering knuckle, remove steering arm from knuckle, lift complete backing plate & brake shoe assembly off and hang up on frame (Caution—assembly must not be allowed to hang on flexible brake tube, on Chrysler Eights, brake tube must be disconnected before assembly can be removed and lines must be bled when reconnected). Drive out kingpin taper lockpin. Drive punch into kingpin upper oil seal disc and pry disc out. Use soft brass drift to drive kingpin down which will force out lower oil seal disc, remove knuckle. Pull upper bearing out toward bottom (use puller C-328—bushings used at this point on Dodge & Plymouth except 7 Pass.—all 7 Pass. models have roller bearing at top), pull lower bushing with same tool (roller bearing used at lower end on Chrysler C30, C33 only). Install new lower bushing and line-ream with special tool using pilot in place of upper bearing (on Dodge and Plymouth, install upper bushing from top and line up oil hole with oil hole in knuckle. Install all roller bearings with trademark facing out (up on top bearing, down on lower bearing) and see that oil hole lines up with oil hole in knuckle. Use new seals, install seals with convex side in toward kingpin and use tool C-618 to seat seals securely. On Chrysler C30, C33 only, seals should be staked or peened in place.

Upper Control Arm & Bushings:—New one piece type with forked outer end and separate pivot pin. Ordinarily serviced as complete assembly with frame mounting pivot bar (same design as 1940) but new pivot bar and bushings can be installed as follows: Use new bushings when installing pivot bar and use special spreader tool C-608 to maintain correct control arm spread while bushing being installed. Install spreader tool on inner ends of control arm so that jaws seat firmly against inner faces of control arm ends, expand tool until it is just snug in arm, then expand tool so that arms spread exactly 1/16" from the 'at rest' position. Install pivot bar (with seal on each end of bar) in control arm so that center line of rear frame mounting bolt holes is 1 5/16" to rear of line through center of fork on outer end of arm, start bushings on both ends of pivot bar, lubricate bushings with tapping compound or other suitable lubricant (bushings cut own threads), turn bushings in until shoulders contact surface of control arm, tighten bushings to 90-140 ft. lb. (45-70 lbs. on 24" lever). Check to see that pivot bar moves freely before installing control arm on car. CAUTION—Do not rotate pivot bar as this will result in incorrect position of bar in relation to arm.

Knuckle Support Upper Pivot Pin—Consists of a bolt threaded through both eyes of upper control arm from rear with nut on forward end. Seals are installed on pin at each side of eccentric bushing which is threaded on pin within control arm fork (bushing is clamped in upper end of knuckle support by clampscrew). With pin installed, over-all width of control arm fork (from front face of front eye to rear face of rear eye) should be 3⅛" and eccentric bushing should be centered in fork.

Lower Control Arm & Bushings:—Control arms and spring seat are riveted assembly. Bushings at inner end (frame connection) are self-threading type and new bushings should be used when a new control arm assembly is installed as follows:

Control Arm Shaft Bushings—Special tool C-594 must be used to maintain control arm alignment when bushings installed. Insert bracket shaft in control arm, install special tool so that it engages legs of control arm and studs on tool enter shaft mounting bolt holes, install nuts on studs and tighten securely. Tool will position arm correctly so that rear face of arm is 2 5/32" (Chrysler Six, DeSoto, Dodge, Plymouth except 7 Pass. Sedans), 2 7/32" (Chrysler Eights and all 7 Pass. Sedans) in back of rear shaft mounting bolt hole center-line. Start both bushings on shaft, use lubricant such as tapping compound and turn bushings in until bushing shoulders contact faces of control arms (bushings will cut own thread in control arm bosses), tighten bushings with 165 ft. lb. force. Remove tool and make certain that shaft pivots freely in arms.

Knuckle Support Lower Pivot Pin & Bushings—Pin should be inserted through rear arm and is locked by nut and cotter pin on forward arm. To assemble control arm and knuckle support, see that bushing installed in knuckle support with head toward rear, position knuckle support between control arms so that distance from rear face of support to rear face of support pin boss on rear arm is exactly 15/16" (Chrysler Six, DeSoto, Dodge, Plymouth except 7 Pass. Sedans), 1 1/32" (Chrysler Eights & all 7 Pass. Sedans). Thread support pin bushing, front rubber seal, and front arm. Install nut on forward end of pin and lock with cotter pin.

SPRINGS:—Springs used on Chrysler Six, DeSoto, Dodge, Plymouth (except 7 Pass. Sedans) do not have lower end coil ground flat and must be installed with spring end fitted into recess formed in lower spring seat (frame height will be incorrect if spring not properly installed). On Chrysler Eights and on all 7 Pass. Sedans, both ends of springs are ground flat and lower spring seat is also flat. When installing springs on all cars, see that silencer installed on lower end of all springs (in spring seat), and on upper end of spring (in seat in cross-member). If spacers used, these should be installed between upper end of spring and upper silencer.

Spring Specifications

Car Model	Chrysler Models	Part No.
C28S Royal Std.		857305
C28W Windsor Std.		857306
C28 7 Pass. & Limo. only		674532
C28 18" Whls., Comm'l. & Extreme Duty		860073①
C30 Std.		674534
C30 Comm'l. & Extreme Duty		860074
C33 Std.		852957
C33 Comm'l. & Extreme Duty		861113
DeSoto Models		
S8 Std.		864844
S8 7 Pass. & Limo. only		674532
S8 18" Whls., Comm'l. & Extreme Duty		860073①
Dodge Models		
D19 Std.②		864843
D19 4 door Sedan③		864844
Plymouth Models		
P11, P12 Std.		864842
P12 7 Pass. Std.		674531
P11, P12 (18" Wheels)		860071
P12 7 Pass. (18" Whls.)		860073

①—When this spring installed to replace Std. Spring No. 857305 or 857306 (Chrysler), 857306 (DeSoto), following parts must be installed also: #691144 Lower Spring Silencer (2 used), #691144 Upper Spring Silencer (2 used), #633295 Spacer (driver's side only), #859665 Lower Control Arm Assembly (right), #859666 Lower Control Arm Assembly (left).

②—Including 4 door Sedans before Serial No. 30,345,250.

③—4 door Sedans only after Serial No. 30,345,250.

HUDSON TYPE

Used On:

SIX, MODELS 10, 11, 12, 18 (1941)

EIGHT, MODELS 14, 15, 17 (1941)

TYPE:—Independent 'parallelogram' type with coil springs. Design is same as used on 1940 cars.

CHECKING & ADJUSTMENT:—Before checking specifications and making adjustments, always perform the following operations first:

Wheels & Tires—Check wheels and tires for balance and runout, correct if required. Inflate all tires to correct pressure. Check front wheel bearings and adjust if loose. Runout must not exceed 1/16-3/32". mark 'high' point on tire and place this mark at top of tire (vertical) when checking toe-in, at front of tire (horizontal) when checking Camber and Caster.

Steering Linkage & Kingpin Looseness—Check kingpin bushings, drag link and connecting rod ends, and steering gear for looseness. Adjust steering gear and replace worn bushings and end joints.

Shock Absorbers—Check shock absorber action.

Frame Level and Spring Height—Level car by rocking car sideways (not endwise) several times and allowing it to come to rest. Check spring height at each side of car. If heights not equal within ½", replace or shim low spring (see Springs below).

NOTE—Car weight must be on wheels when checking following specifications.

Kingpin Inclination:—4°36' crosswise. Must be equal on both sides of car within ½°.
NOTE—Kingpin inclination affected by Camber Adjustment (decreases as Camber increased).

Camber:—Should be Pos. ¼° to Pos. ¾° and equal within ½° on both sides of car. NOTE—Toe-in setting depends on Camber and should be checked when Camber adjusted.

To Adjust—Adjusted by turning knuckle support upper eccentric pivot pin (Same as Caster Adjustment). See Caster Adjustment below and turn eccentric bushing not more than ½ turn from point where correct caster is secured.

Caster:—Should be 0° (plus or minus ¼°) and equal within ½° on both sides of car.

To Adjust—Loosen clamp bolt in upper end of knuckle support, turn eccentric bushing into support to increase caster, out of support to decrease caster. One complete turn of bushing will change caster ½°. Correct caster of 0° should be secured with center of knuckle support (clamp bolt center) exactly 1 11/32" ahead of face of upper support arm. After correct caster secured, turn bushing not more than ½ turn in either direction to adjust Camber (½ turn will give maximum camber adjustment of plus or minus ½°). Tighten clamp bolt.

Toe-In:—Should be 0-1/16" measured at wheel rim with wheels set straight ahead and intermediate steering arm centered by means of centering tool J-1442.

To Adjust—Loosen clamp bolts and turn both tie rods equally. NOTE—Tie rod lengths must be equal.

Steering Geometry:—With inner wheel turned 30°, outer wheel should be turned exactly 25°. Allowable variation ½°. No adjustment provided (if incorrect, check for bent steering arms).

SERVICING:—Spring Removal & Installation—To remove spring, support front of car on jack stand under inner side of lower support arm on side from which spring to be removed, remove shock absorber (see below), remove bolts from lower support arm inner pivot shaft bracket, raise car slowly and carefully until spring fully expanded. Install spring in same manner. Make certain that spring installed with flat end up and rubber-and-fibre silencer on upper end of spring, and see that lower end of spring properly seated in spring seat on lower support arm. Check spring height (see Springs below).

Shock Absorber Removal & Installation:—Remove retainer nut on upper mounting stud (on upper support arm frame bracket), remove washer and rubber bushing. Remove two screws holding shock absorber lower anchor plate on underside of spring seat on lower support arm, turn shock absorber ¼ turn, and lower through hole in spring seat, remove from below. Replace shock absorber in same manner.

Lower Support Arm:—When installing inner pivot shaft, use tool J-1052 to maintain exact distance of 11½" between inner faces of lower support arms while bushings are being installed. Distance from inner face of support arm to center-line of frame mounting bolt holes must be exactly 1½" for correct alignment. Make certain that seals installed on shaft so that end of seals extends over inner ends of bushings.

Upper Support Arm:—When installing frame mounting shaft bushings, use tool J-1360 installed on center stud of pivot shaft mounting, center arm in tool when bushing installed. See that seals installed on pivot shaft so that ends extend over ends of bushings. When installing knuckle support eccentric bushing, hold support 9/32" from shoulder on arm, screw into support and on arm until support is ⅞" from shoulder on arm. Check Caster & Camber.

SPRINGS:—Install springs with flat end up and silencer on upper end of spring. If spring height (measured from upper face of lower support arm to lower edge of upper rubber bumper support bracket) is not equal within ½" on each side of car, spring should be replaced (rock car sideways and allow it to come to rest naturally before checking heights). A maximum of 2 shims .120" thick may be installed on top of low spring to correct minor height differences (replace springs if more than 2 shims required).

Spring Specifications

Car Model	Part No.	Color Mark
10, 11, 12	162530	Brick Red
18	162531	Pink
14, 15, 17 (Right)	162532	Violet
14, 15, 17 (Left)	162533	Steel Gray

Identification Note—Part No. marked on flat end of spring with Brinell mark, and Limit Mark as follows: 1 Grind Mark—Low Limit, 2 Grind Marks—High Limit.

NASH 4160 & 4180 TYPE

Used On:

AMBASSADOR SIX, MODEL 4160 (1941)

AMBASSADOR EIGHT, MODEL 4180 (1941)

TYPE:—Independent 'parallelogram' type with coil springs. Design changed from type used on 1940 cars as follows:

Upper Control Arm—New design mounted on pivot bar bolted to bracket on frame cross-member with Caster and Camber adjusting shims on bar and at frame mounting bracket (see Adjustments below). Shock Absorbers are independently mounted (direct acting type). Knuckle support bushing on pivot pin at outer end of upper control arm is not eccentric (not used for Caster and Camber adjustment).

Shock Absorbers—Front shock absorbers are Direct Acting type mounted within front coil springs. Shock absorbers are not incorporated in front suspension upper control arm as on 1940 cars.

CHECKING & ADJUSTMENT:—Always check following points first before making any adjustments:
CAUTION—Always place 2" blocks, Tool J-886, between frame top flange and front suspension upper control arms before jacking up car so as to remove weight from front wheels. Wheels must not be allowed to hang on control arms without these blocks being installed first.
Tire Inflation—Check tires and inflate to recommended pressure of 28 lbs. (4160), 26 lbs. (4180).
Front Wheel Bearings—Check for looseness and adjust front bearings if required.
Wheel & Tire Balance & Runout—Check wheel and tire assemblies for balance. Check front wheels for runout which must not exceed ⅛". Mark high point (point of greatest runout) on tire and place this mark on top (vertical) when checking toe-in and toe-out (steering geometry), place mark on side (horizontal) when checking Camber, Caster, and Kingpin inclination.
Frame Leveling—Before checking and adjusting front end, level car by rocking it sideways and allowing it to come to rest.
Kingpin Inclination:—Should be 4½° crosswise for all models. No adjustment.
Caster:—Should be 0° to Neg. ½° for all models with car weight on wheels.
Adjustment—Caster controlled by 'C' washers installed on upper control arm pivot bar mounting bolts (between bar and frame bracket). These washers furnished in two thicknesses—1/16" (equal to 1/3°) and 1/32" (equal to 1/6°) and standard factory installation consists of two 1/32" washers on each mounting bolt. To adjust Caster, loosen pivot bar mounting bolts, add shim on rear mounting bolt (to increase caster positively), add shim on front mounting bolt (to decrease Caster), tighten pivot bar bolts. Then check camber.
Camber:—Should be Positive ¼° to Positive ¾° for all models with car weight on wheels and car level crosswise.
Adjustment—Camber controlled by same 'C' washers used for Caster setting (see Caster Adjustment above). To adjust Camber, 'C' washers should be added (to decrease Camber), removed (to increase Camber) **equally at both pivot bar mounting bolts.** One 1/16" thick 'C' washer will change Camber by 1/3°. Standard factory installation consists of two 1/16" 'C' washers on each mounting bolt.

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Toe-in:—Should be 1/32-3/32" measured 10" from floor with wheels in straight-ahead position.
Adjustment—Loosen clamp bolts and turn each outer tie rod equally toward front of car to decrease toe-in, toward rear to increase toe-in. Center connecting rod is not adjustable.
CAUTION—See that center connecting rod ball stud is not raised from its normal position while making toe-in adjustment and that outer tie rod ends are horizontal with ball studs fitting squarely in seats before tightening clamp bolts.

Toe-out (Steering Geometry):—With outer wheel turned 20°, Inner Wheel should be turned 21° (plus ¾°). No adjustment. If toe-out incorrect, check for bent steering arms, recheck Caster, Camber and Toe-in.

SERVICING:—Upper Control Arm—Upper control arm frame mounting pivot bar is mounted on bushings threaded in through arm at each end of bar with seals at inner end of each bushing. When installing pivot bar, position bar within arm so that clearance at each end is equal, thread bushings in arm and on bar, tighten bushings to 150 ft. lbs. (use Torque Wrench J-1254). When installing control arm assembly on car, make certain that insulators installed on mounting bolt at each side of frame mounting bracket and that 'C' washers installed between pivot bar and frame bracket. See Caster & Camber Adjustment (above) for 'C' washer data). CAUTION—These 'C' washers control Caster and Camber and correct washers must be installed on each bolt.

Upper Control Arm Pivot Pin—Consists of a bolt threaded through both eyes at outer end of upper control arm from the rear with a lockwasher and nut on the forward end. Bolt is locked in one eye by a clamp bolt. Knuckle support is mounted on plain (not eccentric) bushings threaded on pivot pin between control arm eyes with seal at each end of bushing. When assembling pivot pin, see that bushing centered in control arm (clearance 3/16" and equal at each end of bushing), thread bolt in through control arm and bushing from rear, install lockwasher and nut on forward end of bolt and tighten nut securely.

Lower Control Arm Outer Pivot Pin. Pivot bolt is threaded in knuckle support bushing and in front and rear lower arms. Bushing is threaded on bolt and in lower end of knuckle support with rubber seal on bolt between each end of bushing and control arm. When assembling, bushing should be centered in control arm with equal clearance of 3/16" between each end of bushing and control arms.

Lower Control Arm Frame Bracket. Lower control arm inner ends are bushed on frame bracket shaft with washer and nut on shaft ends. Shaft is bolted directly to frame cross member.

SPRINGS:—Springs are not interchangeable between models. Model 4180 springs are paint marked for identification (4160 springs unmarked). Check spring heights on car with special height gauge J-709 which should fit between lower face of front frame cross-member and upper face of lower spring seat. If spring height not correct, replace spring or install special ¼" spacers under spring.

Spring Specifications

Model	Free Length	Color Mark
4160	13⅛"	None
4180	13⅛"	Yellow

NASH TYPE

Used On:

NASH AMBASSADOR '600', MODEL 4140 (1941)

TYPE:—New design independent suspension consisting of a sliding steering knuckle on a vertical fixed kingpin with the coil spring on the kingpin above the steering knuckle. Steering knuckle is mounted on 'hour-glass' type roller bearings and entire suspension system is covered by rubber boot or bellows to exclude dirt (bellows provided with breather with air cleaner mounted on frame). Kingpin is rigidly mounted on the front frame cross-member at the bottom and is positioned by two frame strut rods (Caster & Camber adjusters) at the top. In addition, both kingpins are tied together by a strut rod extending across the car between them and this rod serve also as the top mounting for the direct acting shock absorbers which are connected to the steering knuckles at the bottom (see illustration). With this type construction, wheel movement causes steering knuckle to slide up and down on the kingpin and is controlled by coil spring and shock absorber.

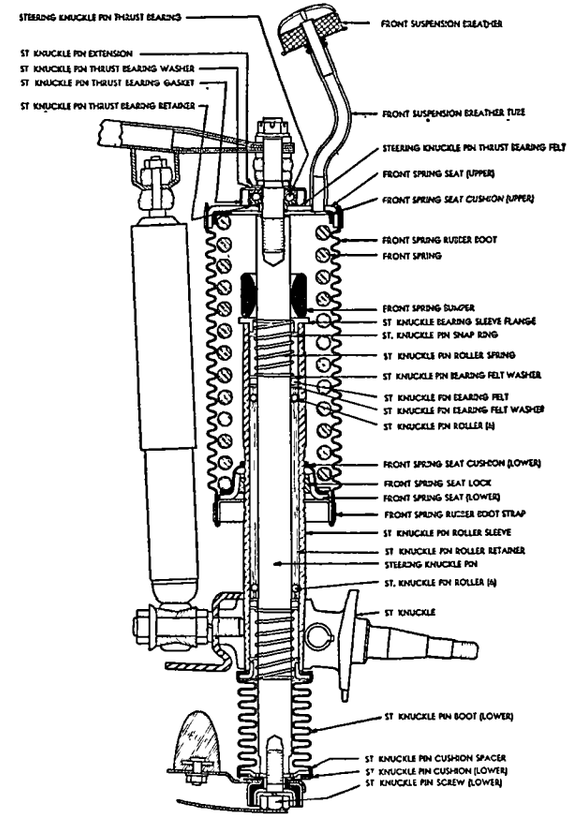
CHECKING & ADJUSTMENT:—Always check following points first before making any adjustments:
Tire Inflation—Check tires and inflate to 28 lbs. (Std. 5.50x16 tires), 22 lbs. (Optl. 6.00-16).
Front Wheel Bearings—Check for looseness and adjust bearings if required.
Wheel & Tire Balance & Runout—Check front wheels and tire assemblies for balance. Check front wheels for runout which must not exceed 1/16". Mark high point on tire (point of greatest runout) and place this mark vertically (at top of wheel) when checking toe-in and toe-out (steering geometry), place mark horizontally (on one side) when checking Caster, Camber, and Kingpin Inclination.
Wheel Straight-ahead Position—Wheels must be in straight ahead position with steering gear roller on 'high' point of worm. See Steering Gear article for adjustment directions. Place wheels in straight ahead position when checking front end.
Spring or Frame Height—Springs should be same height so that car is level crosswise when at rest. See Spring data (below) for adjustment directions NOTE—Car weight must be on wheels when following specifications are being checked.

Kingpin Inclination:—5½° crosswise. Not adjustable but kingpin inclination affected by Camber Adjustment (see Camber below).

Caster:—0° ± ¼°. Controlled by brace rods attached to top of kingpin and frame on each side of car.
To Adjust—Loosen nuts on frame bracket end of both brace rods attached to top of kingpin, turn nuts so as to shorten rear rod and lengthen front to increase caster, lengthen rear rod and shorten front rod to decrease caster. One and one-half turns of nut on each rod will change caster approximately ¼°. Tighten all nuts securely after adjustment completed. CAUTION—Rod can be adjusted only after nuts on second rod have been loosened to permit movement. Do not attempt to adjust one rod only.

Camber:—0° to Pos. ½°. Controlled by brace rods at upper ends of kingpin (same as Caster). NOTE—Kingpins are tied together by non-adjustable strut rod at upper ends so that any increase of camber at one wheel causes equal decrease of camber at opposite wheel.
To Adjust—Adjust in same manner as Caster (above) except that nuts should be turned so as to lengthen or shorten both the front and rear brace rods equally (Caster will be changed if rods adjusted unequally) and nuts must be loosened on brace rods on opposite side of car to permit movement of the rods.
CAUTION—Rods on one side of car can be adjusted only after rods on opposite side have been loosened.

Toe-in:—0-1/16" measured approximately 10" up from floor. Do not move wheels while toe-in being checked.
To Adjust—Loosen clamp bolts on adjusters at wheel end of each tie rod, turn both adjusters eqully. CAUTION—After toe-in adjusted, tie rod adjuster clamp bolts must be turned toward ground to prevent interference with body sill as wheel moves



Toe-out (Steering Geometry):—With outer wheel turned 20°, inner wheel should be turned 21° plus ½°. No adjustment. If toe-in incorrect, check for bent steering arms. Recheck Caster and Camber.

SERVICING:—Suspension Unit Removal—Loosen two clamps holding upper rubber boot (bellow) lower boot, install special clamps J-1608-SA-1 on lower coils of spring, raise wheels off floor and hook upper ends of clamps on top coil of spring, lower wheels and tighten clamps (clamps will hold spring compressed while unit being dismantled). Disconnect tie rods at steering knuckle arms, raise front end of car, remove wheel and brake drum, brake backing plate, and shock absorber. Remove steering knuckle pin screw holding lower end of kingpin on frame front cross-member (front axle channel), raise lower boot and install wrench on flats of kingpin to prevent it turning. Loosen nuts on brace rods at upper ends of both kingpins, remove strut or

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tierod extending across car between upper ends of kingpins, slip brace rods off top of kingpin, remove suspension unit from car.

Suspension Unit Disassembly—To dismantle assembly after removal from car (with upper boot loosened and clamps installed on springs), unscrew kingpin extension on upper end of kingpin, remove extension (with upper spring seat), lift off spring with clamps intact. Remove retainer spring and flange from upper end of kingpin by tapping lightly with hammer, remove lower spring seat and spring locks (locks are split washers installed in grooves in sleeve), remove screw, cushion and lower boot. Push kingpin toward upper end of sleeve and remove snap ring in groove in lower end of sleeve, then push kingpin toward lower end of sleeve and remove upper snap ring in same manner. Withdraw kingpin, roller retainer tube, and rollers from sleeve using care not to lose rollers (rollers will drop out of slots in retainer tube as it is withdrawn). Tap steering knuckle off lower end of sleeve. Wash all parts in clean gasoline and use extreme care to prevent dirt or other foreign matter entering assembly.

Suspension Unit Assembly—Clamp steering knuckle in vise and install sleeve. Lubricate kingpin, roller retainer and rollers with special Nash No. 3107687 lubricant (pack lubricant between roller retainer and kingpin), install assembly in sleeve (CAUTION—make certain that all rollers in place in retainer slots when retainer installed). Check to see that sleeve moves up and down and rotates freely on kingpin. Clamp unit in vise so that kingpin horizontal, install steel washer, felt washer, and second steel washer on upper end, push kingpin toward lower end of sleeve and install upper snap ring. Install same washer assembly on lower end of kingpin and install lower snap ring. Install lower retainer spring, flange, lower boot, cushion, disc and screw (do not tighten screw as it must be removed to install unit on car). Place unit vertically and install lower spring seat and locks (locks regularly installed in center groove—see spring data below), tap upper spring and flange in place using special driver. Install upper bumper and spring, install kingpin extension and tighten securely (hold kingpin from turning by wrench on flats at lower end). Leave clamps on spring until unit installed on car.

Installing Suspension Unit on Car—Reverse removal directions given above. Check Caster, Camber, Kingpin Inclination and Toe-In.

Lubrication:—Unit is packed with special lubricant, Nash No. 3107687, and requires no attention in service (see Assembly directions above). Dirt must be prevented from entering assembly and upper and lower boots must be in place. Lower boot must be kept free from excessive lubricant (lower end of kingpin wiped clean before boot installed).

Air Cleaner:—On frame and connected to vent tube leading to upper boot. Air cleaner should be removed and washed in gasoline every 5000 miles.

SPRINGS:—Front springs are same on all models and can be raised or lowered to compensate for unequal length and to level car crosswise. Spring height controlled by position of locks in slots on sleeve below lower spring seat. Shifting locks up or down one slot on sleeve will change spring length 3/8". Locks are regularly installed in middle slot on sleeve.

Spring Specifications

Car Model	Part No.
4140	3107019

NOTE—Right and Left springs are the same.

OLDSMOBILE-PONTIAC TYPE

Used On:

OLDSMOBILE SIX, 66, 76, 96 (1941)
OLDSMOBILE EIGHT, 68, 78, 98 (1941)
PONTIAC SIX, 41-24, 25, 26 (1941)
PONTIAC EIGHT, 41-27, 28, 29 (1941)

TYPE:—Independent 'parallelogram' type with coil springs. Design changed from type used on 1940 models as follows:

Camber Adjustment (Upper Pivot Pin)—Amount of eccentricity increased from 1/16" to 3/32" for greater range of Camber adjustment (see Camber Adjustment below).

CHECKING & ADJUSTMENT:—Check and adjust front wheel bearings, check kingpins for looseness, check shock absorbers and following points:

Tire Inflation—Check tires and inflate to 28 lbs. front and rear (Oldsmobile 66 and all Pontiac models), 26 lbs. front and rear (Oldsmobile 68, 76, 78), 24 lbs. front and rear (Oldsmobile 96, 98).

Wheel Runout—Check wheels and tires for run-out. Must not exceed 1/8". Mark 'high' point on tire and place this mark at top (vertically) when checking Toe-in and Toe-out, at one side (horizontally) when checking Caster, Camber & Kingpin Inclination.

Frame Height—Raise and lower front end of car several times by grasping front bumper to allow frame to come to normal level.

NOTE—Car weight must be on wheels and wheels should be set in straight ahead position when checking adjustment.

Kingpin Inclination:—4°51'10" crosswise (Oldsmobile), 4 3/8 to 4 7/8° crosswise (Pontiac).

Caster:—0° to Negative 3/4° (Oldsmobile), Negative 3/4° (limits Neg. 1/2° to Neg. 1°) on Pontiac models. Must be equal within 1/2° on both sides of car. Machined bosses provided on front side of knuckle support for protractor mounting.

To Adjust—Loosen clamp bolt in upper end of knuckle support, remove lubricant fitting on front bushing of upper support pivot pin, insert Allen wrench J-720 through lubricant fitting hole and turn upper pivot pin clockwise to increase caster, counter-clockwise to decrease caster. CAUTION—Pin must always be turned in complete turns only to avoid disturbing camber adjustment (below).

Camber:—Negative 1/4° to Positive 3/4° (Oldsmobile), 0° (Neg. 1/4° to Pos. 1/4°) Pontiac.

NOTE—Camber adjustment (upper pivot) pin eccentricity has been increased from 1/16" to 3/32" to provide greater range of Camber adjustment.

To Adjust—Same as for Caster (above) except that entire range of adjustment secured in 1/2 turn of eccentric pivot pin. CAUTION—Do not turn pin more than 1/2 turn when adjusting camber to avoid disturbing caster adjustment.

Toe-In:—1/16-1/8" (Oldsmobile), 0-1/16" (Pontiac) measured 9-10" above floor with wheels straight ahead.

To Adjust—Loosen clamp bolts at wheel end of each tie rod, turn tie rod adjuster on each rod equally. On Oldsmobile, turn both adjusters in direction opposite to that in which wheel revolves to increase toe-in. On Pontiac, turn right hand adjuster in same direction wheel revolves, and left hand adjuster in opposite direction to increase toe-in.

Steering Geometry (toe-out on turns):—With outer wheel turned exactly 20°, inner wheel should be turned 23° ± 1/2°. No adjustment provided (check for bent steering arms if incorrect).

SERVICING:—**Lower Control Arm & Pivot Shaft**—Serviced as an assembly and not interchangeable on right and left sides of car. Pivot shaft at inner ends of control arms can be removed by taking out bushing in each arm. To install shaft, install tool J-1052 or block between arms adjacent to shaft eyes so that distance between inner faces of arms at shaft eyes is exactly 11 1/2" (necessary to prevent distortion of arms when bushings installed). Install shaft with seal on each end adjacent to mounting bracket, thread bushing in on shaft and in arm simultaneously (new bushings cut their own thread in arm as they are turned in), tighten bushings with 150 lb. pull on 16" wrench (200 lbs. on 12" wrench) so that there is no clearance between bushing flange and control arm. See that distance between shaft bracket mounting holes and inner face of control arm is exactly 1 1/2" at each end (turn shaft to centralize), and that seal ends lap over bushings.

Knuckle Support Lower Pivot Pin—To install pin, slip rubber seal over outer end of each lower control arm, center knuckle support between lower control arms (approximately 1/8" between end of bushing and front arm, same distance between head of bushing and rear arm). Screw pivot pin through front arm, knuckle support bushing, rear arm, install nut on rear end of pin. Pull seals down over end of arms so that they seat on pin between arm and bushing at each side.

Knuckle Support Upper Pivot Pin—To install, center knuckle support in upper control arm yoke, screw pivot pin in until larger center section is centered in knuckle support, tighten clamp bolt. Install seal on pin at each side, start front bushing in on pin, then screw rear bushing in control arm and on pin and tighten securely. Turn front bushing in until clearance between front face or arm and head on bushing is 1/32" and tighten clamp bolt.

Kingpin Installation (Oldsmobile)—Bushings should be installed with oil hole lined up with oil hole in knuckle support and short groove on inner surface leading from oil hole to outer end of bushing (up on top bushing, down on lower bushing). Bushings should be burnished with J-722-1 burnishing tool and line-reamed to size with tool HM-592.

Kingpin Installation (Pontiac)—Bushings are floating type and should be installed with lubrication groove on inner face leading toward outer end of bushing (up on top bushing, down on lower bushing).

SPRINGS:—Lower end of spring not ground flat and must be installed with end coil fitted into recess in lower spring seat. Upper end of spring is ground flat. CAUTION—Spring must be installed with flat (ground) end up and lower end fitted in spring seat. Oldsmobile springs are paint marked on end coil for identification.

Oldsmobile Springs

Model	Wire Diameter	Color Mark
66	.587"	Green & Orange
68	.625"	Aluminum
76, 96	.619"	Green & Yellow
78, 98	.635"	Green & Brown

Pontiac Springs

Model	Wire Diameter	Free Length
41-24, 26, 27	.608"	15 3/16"
41-25	.608"	14 27/32"
41-28, 29	.625"	15 15/32"

PACKARD SAFE-T-FLEX TYPE

Used On:

'110' SIX, MODEL 1900 (1941)
'120' EIGHT, MODELS 1901, 1A (1941)
'160' SUPER EIGHT, 1903,3A,4,5 (1941)
'180' CUSTOM SUPER EIGHT, 1906,7,8 (1941)

NOTE:—Packard Clipper—This model has new 'parallelogram' type Independent Suspension. See separate article (following) for data on this model.

PRODUCTION CHANGE NOTE:—Kingpin Thrust Bearing (Six & Eight)—Special antimony-lead type thrust bearing used on first cars with roller bearings at each end of steering knuckle kingpin. These bearings changed on later cars to ball thrust bearing and bronze bushings on kingpin. Later type unit bearings only furnished for service. NOTE—New type ball thrust bearing can be installed without replacing roller bearings on kingpin if these bearings in good condition. Antimony-lead thrust bearing has tendency to bind and cause steering stiffness if not lubricated frequently.

Kingpin Bushings (Super Eight)—Antimony-lead bushings used on steering knuckle kingpin on first cars with ball thrust bearing. Changed to roller bearings on later cars (no change in thrust bearing). Roller bearings only furnished for service (antimony-lead bushings have tendency to bind and cause steering stiffness if not lubricated frequently).

TYPE:—Independent 'Safe-T-Flex' type. Same design as used on corresponding 1940 models (see Production Change Note above for different type bearings used).

CHECKING & ADJUSTMENT:—Check front wheel bearings and set wheels in straight ahead position, check following points first:

Tire Inflation—Check tires and inflate to correct pressure for each model.

Frame Height—Must be correct when checking caster and camber. To check, load car with 300 lbs. (front—all models), 225 lbs. (rear—Coupe), 375 lbs. (rear—5 Pass. Sedan), 675 lbs. (rear—7 Pass. Sedan), 500 lbs. (rear—1901A Hearse), 800 lbs. (rear—1903A Hearse). Measure from floor to top of frame side rail at front spring center-line (front) from underside of frame to top of axle housing (rear). If height not correct, install spacer or replace spring (see Springs below).

Car Model	Front—Frame Height—Rear
1900 Six	17⅝"—5⅜"
1901 Eight	18⅛"—5¼"
1901A Comm'l.	18¾"—5¾"
1903, 4, 5, 6, 7, 8	18¾"—5¼"
1903A Comm'l.	19¼"—5¾"

Kingpin Inclination—2½° crosswise (all models). NOTE—Car weight must be on wheels when checking following adjustments.

Toe-in:—0" to 1/16" at hub height (all models).

To Adjust—Loosen clamp bolts and turn both tie rods equally. Tie rod lengths must be equal within ⅛" after adjusting with intermediate steering arm centered and steering wheel roller on 'high' point of worm (adjust by shortening one rod, lengthening opposite rod equally). NOTE—If tie rod lengths not equal within ½" with intermediate steering arm centered and steering gear in straight ahead position, check for bent steering knuckle arms.

Caster:—Positive ½° ± ½° (Six & Eight), Negative ¾° ± ½° (Super 8 except 1903A), Positive 2½° ± ½° (1903A).

To Adjust—Install wedge shims (furnished in ½° and 1° taper) between front face of lower torque arm and lower control arm. Install shims with thick end up to decrease caster, thick end down to increase caster. If 1° shim does not correct caster, check for bent parts. Check torque arm alignment (end of arm must be square with face of lower control arm).

Camber:—½° (limits ½° to 1¼°) for all models.

To Adjust—Remove support pin linking upper control arm and knuckle support, change pilot thimbles in outer end of each upper control arm. Thimbles furnished with offset of 0", 1/16", ⅛", 3/16", and change of 1/16" in offset will change camber ⅓°. CAUTION—Make certain that thimbles installed in both arms with offset in same direction (reversing offset will change camber).

Steering Geometry (toe-out on turns):—With outer wheel turned exactly 20°, inner wheel should be turned 23½° (all models). No adjustment provided (check for bent steering arms if incorrect).

SERVICING:—Upper Control Arm Damper—To check, remove knuckle support upper pivot bolt at outer end of shock absorber arms and damper bolt at center of arms. Clearance between arms at damper friction disk should be .125-.135". If clearance not correct arms should be straightened or replaced. Damper tension spring pressure should be 105-115 lbs. compressed to 13/16". To assemble damper, install spring on bolt, insert bolt through arm which has larger hole, tighten nut securely so that opposite arm seated against shoulder on bolt.

Upper Control Arm Pivot Pin—Knuckle support is mounted on two Harris type rubber bushings on pivot pin at outer end of upper control arm. When installing pivot pin, tighten nut securely (bushing compression regulated by spacer sleeve on pin).

Lower Control Arm Pivot Pin—Pivot pin is clamped in knuckle support and is mounted on special roller bearings in control arm ends with ball thrust bearing between knuckle support and rear arm. Bearing should be pre-loaded by installing thrust bearing shims (furnished in .001" thickness steps) between arm and support so that pull of 1-6 lbs, required to move upper end of knuckle support with upper pivot bolt removed. CAUTION—Roller bearings are caged type and one of the two bearings must be renewed whenever pivot pin or either bearing is removed.

Lower Control Arm Frame Mounting—Arm is rubber bushed on frame bracket pin (two Harris type bushings used, bushings held by locking ring on pin at one end-washer). Bushings can be installed without using arbor press but must be aligned in neutral position (flat on pin must be in line with flat on special gauge bolt installed in hole in outer end of arm—use special gauge No. ST-5157.

Torque Arm Frame Mounting (Six, Eight, Super 8 1903, 6 Only)—Mounting at frame consists of two Harris type rubber bushings in end of arm. When installing torque arm, tighten mounting bolt until frame mounting bracket bottoms on bolt shoulder. NOTE—Frame mounting on other models consists of a hollow rubber ball installed on end of torque arm and clamped in frame bracket. Dip the hollow rubber ball in soap water to facilitate installation of torque arm ball.

Kingpin Bushings—See Production Change Note above. When installing the service bronze bushings, bushings should be finished to size by burnishing with Packard Burnisher ST-5046 or reamed to inside diameter of .866". Kingpins also furnished .005" oversize to compensate for worn spindle bushing holes. NOTE—When installing kingpins, adjust thrust bearing pre-load by installing shims (furnished in thickness steps of .001") so that force of 3½-5 lbs. applied at end of spindle is required to turn spindle on kingpin.

SPRINGS:—Springs paint-marked for identification as shown in table below. If frame height not correct, install not more than two spacers #326836 (¼" thick) between upper spring cup and insulator on top of spring (if two spacers used, install Insulator #326706 between spacers). If height cannot be corrected by this means, replace springs.

Spring Specifications

Model	Part No.	Color Marks
1900 Std.	362823	Red & White
1900T Taxicab	326860	Green
1901 Std.	348377	Yellow & Blue
1901 FW.	326860A	Green
1901 Sedan Exp. Std.	351223	Red & Purple
1901 Sedan Exp. FW.	351224	Red & Brown
1901 Coupe Exp. Std.	351225	Red & Silver
1901 Coupe Exp. FW.	351735	Orange & Yellow
1903 Std.	335692	Red & Silver
1903 FW.	338166	Yellow & Silver
1903 Exp. Std.	338269	Blue & Silver
1903 Exp. FW.	351708	Silver & White
1906 Std.	326861	Silver
1906 Exp. Std.	326861	Silver
1906 Chassis Std.	335692	Red & Silver
1906 Chassis FW.	338166	Yellow & Silver
1906 Chassis Exp. Std.	338269	Blue & Silver
1906 Chassis Exp. FW.	351708	Silver & White
1904, 7 Std.	354690	Orange-Red-Blue
1904, 7 FW.	354691	Orange-Red-Purple
1905, 8 Std.	351256	Purple & Silver
1905, 8 FW.	354710	Yellow-Red-Silver
1908 Std. (See Note)	354710	Yellow-Red-Silver
1908 FW. (See Note)	364609	Green-Red-Purple

Std.—Spare at rear. **FW.**—Cars with Fender Wells.
1908 Note—LeBaron Sedan & Limousine only.

PACKARD CLIPPER TYPE

Used On:

PACKARD CLIPPER, MODEL 1951 (1941)

TYPE:—Independent 'parallelogram' type with coil springs. Design not like that used on other Packard models in that torque arm not used. Lower control arm consists of a double arm pivoted on a bracket shaft bolted on the front frame cross-member near the center with the lower spring seat riveted on the arms. Spring seat also serves as a mounting for the lower rubber bumper and has a connection for the front stabilizer bar link.

CHECKING & ADJUSTMENT:—Check front wheel bearings and set front wheels in straight ahead position. Check following points in order:

Tire Inflation—Check tire pressures which should be 26 lbs. (front), 28 lbs. (rear) warm.

Frame Height—See that car is level crosswise and check springs for equal height.

Kingpin Inclination:—5°35' crosswise.

Toe-in:—0" to 1/16" measured at hub height.

To Adjust—Loosen clamp bolt and turn tie rod adjusters (at wheel end of each tie rod) equally.

Caster:—Negative 1° plus or minus ½°.

Camber:—¼° plus or minus ½°.

STUDEBAKER PLANAR TYPE

Used On:

CHAMPION, MODEL 3G (1941)

COMMANDER, MODEL 11A (1941)

PRESIDENT, MODEL 7C (1941)

SPECIAL SERVICE NOTE:—Raising Front of Car—Whenever front end of car is raised to provide clearance for work under front end, special supports must be used so that weight properly distributed on suspension system. Use Planar Lifting Bar, Tool No. S-15, for this purpose, installing bar on jack and engaging bar under front spring.

TYPE:—Independent 'Planar' type suspension with leaf type spring serving as lower control arm. Design changed from type used on 1940 models as follows:

Control Links (all models)—Stamped steel control links are used on all cars. These are pivoted on front spring plate (Champion), front frame crossmember (Commander & President) at center of car (inner end) and are attached by spring bolt to steering knuckle lower yoke at outer end.

CHECKING & ADJUSTMENT:—Adjust front wheel bearings, check shock absorbers, steering gear adjustment, steering arm and tie rods for looseness. Check following points first:

Frame Height—Raise and lower front end several times by grasping bumper so that frame will assume normal position.

Tire Inflation—Check tires and inflate to 26 lbs. (Champion—front), 28 lbs. (Champion—rear), 28 lbs. (Commander—all), 26 lbs. (President—all).

Kingpin Inclination—5½° crosswise (all models).

Caster:—1-2° (Champion), Negative ¼° to Positive ¾° (Commander & President). Caster angle is determined by front spring and is not adjustable.

Camber:—½° (¼—¾°) for all models.

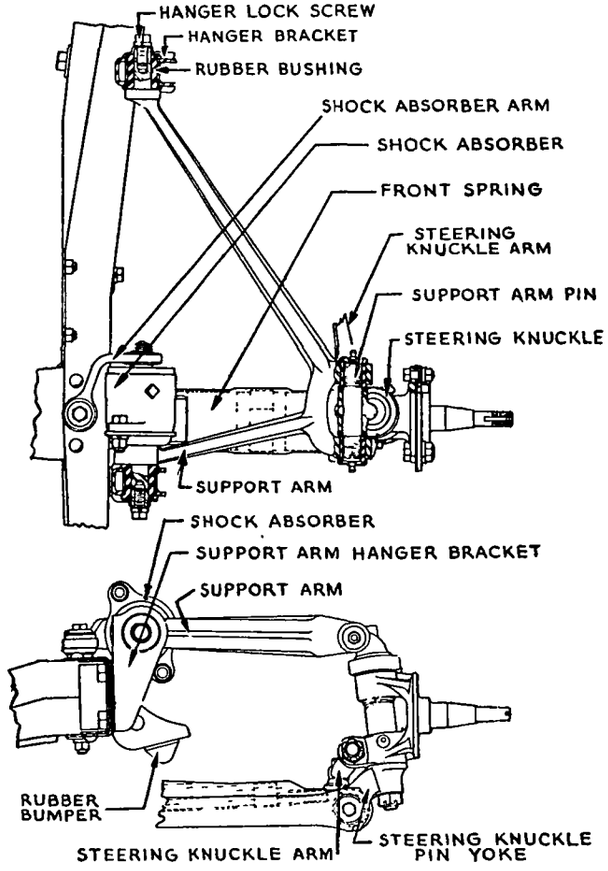
To Adjust—Loosen upper support arm frame mounting bracket bolts, remove shims from between mounting bracket and frame to decrease camber, add shims to increase camber (shims slotted). One thin shim will change camber ¼°, thick shims are equal to four thin shims. Tighten bracket bolts securely after adjusting. CAUTION—Make certain that shim thickness equal on both mounting brackets (add or remove shims equally at each bracket when making adjustments).

Toe-in:—1/16-⅛" (all models).

To Adjust—Set steering gear in straight ahead position (center of travel with lever lugs on 'high' points of cam), loosen clamp bolts and turn **left hand** reach rod until left hand wheel is in straight ahead position (parallel to rear wheel). Then loosen clamp bolts and turn **right hand** reach rod (between steering idler arm and right hand wheel) to adjust toe-in. CAUTION—Toe-in adjustment must be made exactly as detailed above to insure correct steering gear position.

Steering Geometry (toe-out on turns):—With outer wheel turned exactly 20°, inner wheel should be turned 22½-23° (Champion), 22-22½° (Commander & President). No adjustment provided. Check for bent steering arms if incorrect.

SERVICING:—Support Arm & Steering Knuckle Removal—Disconnect reach rods at steering arms. Support front end of car, remove spring bolt (lower pivot pin) by unscrewing bolt from lower steering knuckle yoke, spring eye, and lower control link. Take out two bolts mounting front shock absorber on upper control arm, take out shock absorber arm bolt in frame rail, remove shock absorber. Remove screws and washers on inner ends of upper control arm which retain frame mounting bracket rubber bushings, loosen control arm front frame bracket,



remove shims from between bracket and frame (these shims control Camber and exact same number must be re-installed to avoid disturbing camber adjustment), slip frame bracket off control arm bushing and remove. Disengage steering knuckle lower yoke from spring eye, shift entire assembly forward to free upper control arm from rear frame mounting bracket bushing, remove assembly from beneath car.

Installation—When installing assembly on car, dip rubber bushing in gasoline before installing bushing in frame suport bracket (CAUTION—Oil, soap or hydraulic brake fluid must not be used on bushings as this will allow bushings to turn in brackets in service). Make certain that correct shim pack installed between support bracket and frame (re-install same shims removed when bracket taken off). See that steering knuckle lower yoke centered on spring eye (equal clearance at each side) when installing spring bolt. Hold control arm in horizontal position while tightening control arm screws at frame bracket (to insure proper position of rubber bushings in frame bracket).

Steering Knuckle Assembly:—Lower yoke is press fit on end of steering knuckle pin and must be removed and installed in an arbor press. To dismantle steering knuckle assembly, drive out taper lock pin in upper end of steering knuckle pin (this pin locks upper control arm pin in knuckle), remove pin bushings and pin, remove upper control arm. Remove nut and cotter pin from lower end of knuckle pin, press knuckle pin out of lower yoke, remove yoke and knuckle pin from steering knuckle.

Steering Knuckle Bearings—Knuckle pin mounted on needle bearing (top), bushing (bottom) with ball thrust bearing between upper end of pin and steering knuckle (endplay adjustment shims installed between bearing and knuckle). Use special Arbor, No. J-1294 (Champion), J-1277 (Commander & President—with sleeve), to press out bushing and needle bearing. Install new bushing first on Champion (bushing need not be reamed), then install spacer tube (oil holes in spacer and knuckle must line up), and needle bearing using arbor J-1294 to press bushing and needle bearing in place. On Commander & President, install bushing and needle bearing in same order (no spacer tube used) using arbor and sleeve J-1278. When installing knuckle pin, check endplay as follows:

Thrust Bearing & Endplay Adjustment—Install knuckle pin and thrust bearing in steering knuckle, check endplay which should be .003-.006" by placing feeler gauge on lower face of knuckle. Face of feeler gauge should be flush with edge of shoulder on steering knuckle pin. Add or remove shims between thrust bearing and upper face of steering knuckle to secure this desired endplay of .003-.006".

Upper Control Arm Pivot Pin—Before installing upper control arm pivot pin bushings, measure outside dimension of yoke at outer end of control arm with .010" feeler under one leg of caliper gauge (dimension will be total width plus .010"). Then use special spreader tool, No. J-1524 installed on outer end of control arm yoke to spread yoke exactly .010" so that caliper is snug on yoke without feeler gauge. With arm spread in this manner, assemble knuckle pin and pivot pin in control arm yoke, install bushings. After bushings have been tightened securely, remove spreader. See that taper lockpin installed in upper end of knuckle pin to lock pivot pin in place.

Insulated Steering Arm—To remove assembly from steering gear shaft, remove cotter pin, nut, and washer from steering gear lever shaft, use puller J-871 to remove assembly from shaft (On Champion, nuts on steering arm bushing studs can be removed and arm pulled off without disturbing adapter arm on steering gear lever shaft). Adapter shaft and steering gear shaft are marked and marks should be lined up when assembly re-installed.

SPRINGS:—Front spring is transverse leaf type. Spring eye is formed in main leaf and second leaf is wrapped around eye for additional strength.

SPICER SPIRAL BEVEL & HYPOID TYPES

SPIRAL BEVEL TYPES

Model 10

BANTAM, SUPER FOUR MODEL 65 (1941)

Model 11

CROSLEY, MODEL CB41 (1941)

Model 21-1

WILLYS, PICK-UP MODEL 441 (1941)
WILLYS, PANEL DELIVERY 441P (1941)

HYPOID GEAR TYPES

Model 23

STUDEBAKER CHAMPION, MODEL 3G (1941)

Model 41-2

STUDEBAKER COMMANDER, MODEL 11A (1941)
STUDEBAKER PRESIDENT, MODEL 7C (1941)

Model 41-3

GRAHAM HOLLYWOOD, 109, 113 (1941)

CROSLEY NOTE:—Crosley Axle is new design with Torque Tube drive. Serviced in same manner as other Spicer models after torque tube has been removed. Torque type on 1941 models is modified for new Universal Joint mounting (in adapter at rear end of transmission case).

TYPE:—Spiral Bevel or Hypoid Gear, semi-floating type with Hotchkiss drive (except Crosley—see note above). Shim adjustment provided for Pinion Bearing and Pinion Setting, Ring Gear Backlash and Differential Bearing adjustment. Same design as used on corresponding 1940 car models.

SERVICING:—Paint gears to check mesh or check pinion setting. See Ring & Pinion Gear Backlash and Pinion Setting data below.

Axle Shaft Endplay—Total endplay for both shafts should be .005" (Bantam), .001-.005" (Studebaker), .002-.007" (others). When adjusting, shims should be removed equally at both wheels to keep thrust block at inner ends of axle shafts centered on differential pinion shaft (excessive shim removal at one wheel will cause block to bind on shaft).

Ring & Pinion Gear Backlash—Should be .006-.008" Bantam), .005-.007" (Studebaker), .004-.008" (others). Adjusted by shifting differential bearing shims from one side to the other (total must be kept the same to avoid disturbing differential bearing adjustment).

OVERHAUL:—**Disassembly.** To remove differential assembly (with axle shafts out), take out bearing cap screws, remove bearing caps, pull differential assembly out. Remove nut on end of pinion shaft, take off rear universal joint flange, press pinion out of housing toward rear to avoid damage to oil seal and bearing. Pry oil seal out toward front. Use new oil seal when reassembled if old seal worn or damaged.

Pinion Bearing Assembly:—Make certain that pinion setting shims installed in housing ahead of rear bearing cup, insert pinion and rear bearing cone in housing from rear, install spacer and pinion bearing adjusting shims on pinion shaft, tap front bearing cone in place, assembly universal joint flange, tighten nut securely (if bearing adjustment to be checked, oil seal assembly may be left out until adjustment completed).

Pinion Bearing Adjustment. With pinion shaft nut tight, pinion should rotate with slight drag (no endplay). Adjust by removing front bearing cone and adding or removing shims between cone and spacer or shoulder on shaft. Shims furnished .003", .005", .010", .030" thick.

Pinion Setting:—Use special Pinion Setting Gauge, Salisbury No. J-772 or Studebaker No. J-589-D (see note below for Hypoid Gear Fittings). Set micrometer on gauge to correct figure for each axle model (see table below—this figure correct for standard pinions marked '0' on end) and correct micrometer for each pinion as follows: Figure etched on pinion, indicates amount (in thousandths) that pinion should be set in toward ring gear (— figures) or out away from ring gear (+ figures). Install gauge in axle housing in place of differential assembly with side discs seated on differential bearing bores, add or remove shims located between rear bearing cup and shoulder in housing until micrometer pointer just contacts ground face of pinion gear (or adapter on hypoid gears—see note below).

Hypoid Gear Pinion Setting. Pinions are offset and micrometer gauge pointer will not contact ground face of pinion. Use special adapter on face of pinion and adjust so that micrometer pointer contacts face of offset plate on adapter. Special clamp can be bolted on face of axle housing which has setscrew to hold adapter on pinion.

Axle Model	Zero Cone Setting
10	.218"
21-1	.407"
23, 41-2, 41-3	.719"

Model 10 Note—Special smaller pinion gauge must be used for this model (endplate diameter of 2.714-2.716"). Pointer extends 2.000" beyond differential bearing bore center-line with micrometer set at zero.

Model 11 Note—This is special small axle and regular pinion setting gauge cannot be used.

Differential Bearing Adjustment:—Shims installed on differential case hub at inner end of each bearing cone. To adjust differential bearings (with axle dismantled), remove bearing cones, add or remove shims until differential assembly will just slide into housing (no endplay when installed), then add additional .003-.006" (except Studebaker), .008" (Studebaker) shim thickness to secure correct bearing preload. Shims furnished .003", .005", .010", .030" thick. With correct adjustment, fairly heavy drag should be felt when ring gear revolved by hand (test preferably with pinion out to avoid added drag of pinion bearings and oil seal). When installing differential assembly, tighten bearing cap screws securely.

Ring Gear Backlash Adjustment—When adjusting backlash, shift shims from one side of differential case to the other. Total shim thickness must not be changed as this would disturb differential bearing adjustment.

COLUMBIA TWO-SPEED TYPE

Optl. Equipment On:

FORD, ALL PASS. CAR MODELS (1941)
LINCOLN, ZEPHYR & CONTINENTAL 16H (1941)
LINCOLN, CUSTOM MODEL 168H (1941)
MERCURY, MODEL 19A (1941)

TYPE:—Two-speed type rear axle consisting of a planetary gear reduction unit built in a special differential assembly case. Same design as used on 1940 car models.

SERVICING & ADJUSTMENT:—All specifications and servicing operations same as for previous models. ***Refer to manual (or 1939 supplement) Mechanical Equipment Index for 'Columbia Two-Speed Type' axle article for data.***

BUICK HYPOID TYPE

Used On:

SERIES 41-40,40A,50,60,70,90 (1941)

SPECIAL SERVICE NOTES:—Axle Markings—Axle ratios may be identified by figures stamped on underside of axle housing or paint marks on outer ends of both axle shaft flanges as follows:

Model	Ratio	Paint Mark
40 Single Carb. Std.	4.4-1	White
40 Single Carb. Optl.	3.9-1	Red
40,50 Compd. Carb.	4.1-1	None
50 Optl., 60,70 Std.	3.9-1	Red
60,70 Optl.	3.6-1	Blue
90 Std.	4.2-1	None

Axle Shaft Retainer 'C' Washer—New type reduced throat self-locking retainer washers are used. Special service tool, J-1515, is required to remove these new washers (tool is slotted driver used to engage ends of washer so that it can be driven out. NOTE—this new type self-locking washer used on late 1940

TYPE:—Hypoid gear, semi-floating type. Same design as used on corresponding 1940 models (see special service notes above).

SERVICING:—Gear Adjustment. Check pinion setting (see instructions below) or paint gears to check mesh. Backlash should be .006-.010" for new gears (slightly more for worn gears). Total lash measured at outside diameter of tire (one wheel jacked up) should not exceed ¾". To adjust backlash, back off one differential side bearing adjusting nut, tighten opposite nut equal amount (see Differential Bearing Adjustment below).

Axle Replacement:—Axles retained by 'C' washer at inner end (all models). To remove axle shaft, take out locking pin, remove differential pinion shaft and spacer block, push axle in and remove 'C' washer at inner end within differential side gear, pull shaft out (wheel bearing inner race is press fit on shaft and will be removed with it, outer race is light press fit in axle housing and can be removed with J-528-B puller).

NOTE—'C' washer is new self-locking type and tool J-1515 must be used to remove washer from shaft.

Axle Shaft Endplay. Controlled by spacer block between axle ends in differential case and should be .000" minimum, .008" maximum. Four block sizes used in production, replacement spacer block ground on all sides for min. and max. production sizes. **Important**—New bronze side gear thrust washers should be installed back of differential side gears before new axle shaft spacer block installed to correct endplay (not possible to secure correct endplay of .008" maximum with spacer block only if thrust washers worn).

NOTE—Right hand axle shafts are ¾" longer (40,50,60,70), 15/16" longer (90) than left hand shafts and must not be interchanged.

Propeller Shaft Front Bearing (90)—Consists of a bronze bushing and seal in a cast iron body installed in forward end of torque tube and retained by setscrew. Bearing is lubricated from transmission but when new torque tube being installed, ½ pint of transmission oil should be poured in end of torque tube before it is attached to ball joint at transmission.

Torque Tube (40, 50, 60, 70). Do not disturb bolted connection between torque tube flange and carrier flange unless installation of new gasket required to stop oil leaks (special gasket required). Tube and carrier are matched and must be kept lined up (furnished as an assembly only, separate parts not available).

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OVERHAUL:—Disassembly. Mark differential bearing adjusting nuts and bearing caps before disassembling. To remove pinion and shaft assembly, loosen locknuts and take out taper setscrews on side of housing. To remove pinion from propeller shaft, file off head of pin and drive out, use tool J-1292-B to pull pinion from propeller shaft (this tool used also to install pinion). Pry up staked portion of pinion bearing nut, remove nut, dismantle bearing assembly.

Pinion Bearing Assembly:—Bearings should be press fit on pinion shaft (use tubing of correct diameter to engage inner race when pressing bearings on shaft). No inner race used for rear pinion bearing (outer race and rollers furnished as assembly) and spacer must be installed between rollers and pinion to prevent creeping. Tighten pinion bearing nut securely and stake into notch on shaft. Assemble pinion to propeller shaft riveting pin to prevent it loosening in service (see propeller shaft straightening below). When installing assembly in housing, tap outer race of rear bearing in against shoulder in housing or bearing collar (90) to prevent the race rubbing on pinion. Make certain that adjusting shims installed ahead of front bearing and tighten setscrews and locknuts securely.

Pinion Rear Bearing Tool—With some optional gear ratios, pinion is larger in diameter than rear bearing and special forked tool must be inserted between pinion and bearing so that pinion bearing can be driven in place (use bronze driving block to drive on face of pinion), remove tool after bearing seated in carrier bore.

Propeller Shaft Run-out. With propeller shaft supported on 'Vee' blocks at point just behind splines at forward end and rear pinion bearing outer race at rear, run-out on tubular shaft 1½" back of forward end should be less than .005", run-out at center of tubular shaft should be less than .010", run-out at front pinion bearing outer race should be less than .001". With these limits, run-out at universal joint end (before joint connected) should be less than 1/16" (greater run-out will cause universal joint bushing wear and possible oil leak from transmission).

CAUTION—Do not put oil in propeller shaft when installing pinion. This will cause roughness at high speed.

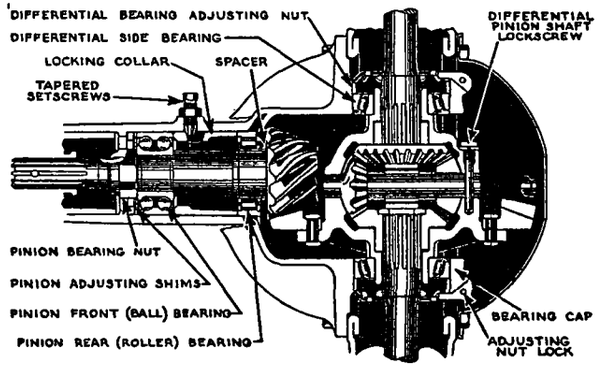
Ring Gear Installation:—Ring gear and pinion furnished only in matched sets. To remove old gear, drill out rivets with ¼" drill on differential case flange side (cutting rivets with chisel will distort case). Case run-out must be less than .002" with gear removed. Bolt ring gear in place with 5/16" bolts in alternate holes, then install opposite rivets between bolts, remove bolts and finish riveting. Run-out at back of gear must not exceed .004".

Pinion Setting:—Pinions marked on rear face by etched figure and plus or minus sign for necessary correction of standard setting (micrometer reading for standard settings given below). Plus sign indicates that pinion should be moved away from axle shaft center-line, minus sign toward axle center-line, the amount (in thousandths) of the figure following this plus or minus sign. Use J-681-A Pinion Setting Gauge, check micrometer '0' on test fixture, set micrometer to standard figure (as given in table below for each model, turn micrometer pointer in (for plus figure) or out (for minus figure) the amount stamped on face of pinion, install gauge in axle housing (with differential carrier removed) seating gauge rings on differential bearing posts, add or remove shims between pinion front bearing and shoulder in housing until micrometer pointer contacts face of adapter installed on pinion (adapter must be used on all hypoid gears). Shims furnished .011", .012", .015", .018", .060" and 3/16" thick. **Pinion Setting Note**—In production, pinions are not ground on face and have definite tooth for pinion setting gauge measurements. When using gauge, measure to blank tooth (between tooth which has factory inspection mark of letter and number, and tooth with + or — mark) and again at opposite side of pinion (place adapter on pinion with blank tooth up and then with blank tooth down) and average these two readings to determine shim correction.

Standard Pinion Setting

Model	Micrometer Setting
40, 50, 60, 70	.379"
90	.203"

Ring & Pinion Gear Meshing Note—On 4.4 ratio axle, marked gear teeth must be meshed together (ring gear marked '26', pinion tooth marked '18'). This precaution should be taken on all gear sets where number of ring gear teeth and number of pinion teeth have common divisor (44 and 10 on this 4.4 axle).



Differential Bearing Adjustment:—Remove adjusting nut locks, mark adjusting nuts, loosen right bearing capscrews ¾ turn and tap cap lightly to free nut, back off right hand nut slowly and note point where bearing race stops turning with nut, mark this new position, return nut to original position and repeat check. Race should stop turning at same point and number of notches nut has been turned is 'notches tight' of old setting. Correct setting is 2-2½ notches tight (all models). If bearing did not turn when nut backed off, turn up adjusting nut until bearing starts to turn and note number of notches that bearing was free. If this free setting not caused by bearing wear (lapped free or race turning on hub of case), equalize adjustment by turning each adjusting nut up 1 notch from point where race started to turn. Tighten both bearing capscrews and replace bearing locks.

Ring Gear Backlash Adjustment. When adjusting ring gear backlash, make certain that differential side bearing adjustment not disturbed (back off one nut and tighten opposite nut equally). Check bearing adjustment. If adjusting nuts marked before dismantling, setting nuts up to original marks should give correct ring gear position.

NOTE—Backing off one nut, and tightening other nut, one notch will change backlash .004-.005".

BUICK REAR SUSPENSION

Used On:

SERIES 41-40,40A,50,60,70,90 (1941)

TYPE:—Coil springs of same design as used on 1940 car models with special shock absorber mounting as follows:

Shock Absorbers (40, 50, 60, 70). Shock absorbers are double-acting, parallel cylinder Delco type mounted on brake backing plate by two bolts (remove wheel and brake drum to remove shock absorbers). Upper end of shock absorber arm link is attached to inner face of frame side rail (link extends through slot in lower flange).

Shock Absorbers (90)—Delco double-acting, end-to-end discharge type mounted on frame side rail and linked to axle housing at spring seat.

SERVICING:—No adjustment required except that spring heights ('Trim' dimension) must be correct to insure satisfactory shock absorber action and special directions necessary to remove and replace springs.

Spring Removal:—Disconnect lower ends of shock absorbers at axle bracket, raise rear of car to distend springs, remove bolts in upper and lower spring cups (upper bolt has right hand thread, lower bolt threaded up through spring bracket has left hand thread).

Spring Installation:—Make certain that insulator is in place between top of spring and frame, turn spring cups on bolts so that they are snug in end coils, see that rubber insulator in place on upper bolt, tighten bolts securely.

Trim Dimension:—At curb weight, distance from top of axle housing at center to raised flange on bracket on lower face of frame rail slightly forward of axle housing should be 5⅛-6" (40,50,60,70), 5½-6¼" (90). Replace rear spring if trim dimension too small (see Spring data).

Rear Spring Specifications—Springs have identical ends at top and bottom. Spring part number stamped on coil near end and spring paint marked for identification as follows:

Standard Springs

Car Model	Spring Part No.	Color Mark
41, 51, 51C	1317788	Blue-Yellow
46, 56	1321053	Blue-Brown
46S, 56S, 56C, 66	1317790	Blue-Aluminum
49	1315231	Red-Red
61, 71, 71C	1317789	Blue-Red
66S, 76S, 76C	1317788	Blue-Yellow

Optl. High Springs

41, 51, 51C	1312433	Yellow
46, 56	1315105	Brown
46S, 56S, 56C	1315047	Aluminum
61, 71, 71C	1310399	Red
66, 66S	1315047	Aluminum
76S, 76C	1312433	Yellow

Heavy Duty (Overload) Springs. If spring bottoms excessively when loaded, a spring from a heavier model car may be installed providing that new spring does not increase trim dimension (above) more than 1". Make certain that same type spring installed on both right and left sides of car. For use with trailers or when heavy loads carried in rear compartment (not to exceed 500 lbs. in addi-

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tion to normal passenger load of 500 lbs.), special rear springs may be installed as follows:

Heavy Duty Rear Springs

Car Model	200 Lb. Overload	300 Lb. Overload
41, 51, 51C	1310399	1315233
46S, 56C, 56S, 66	1312433	1315231
46, 56	1315047	1315231
49	1315233	
61, 71, 71C	1315231	1315233
66S, 76C, 76S	1310399	1315233
90, 90L, 91, 91F	1304586	1305366

Rear Stabilizers:—When installing stabilizer links, nuts should be tightened down to ends of threads which should compress rubber grommets to over-all length of 1 11/16" (to outer face of metal cup on each end of grommet), adjust nuts as required to secure this dimension. Over-all free length of new grommets is 7/8".

NOTE—Rear Stabilizer not used on Model 90.

Rear Radius Rod:—Tubular type attached to brackets on right hand axle spring seat and on frame at left side. Rubber bushings used at each end.

CADILLAC HYPOID TYPE

Used On:

SERIES 41-60S, 61, 62, 63, 67, 75 (1941)

TYPE:—Hypoid gear. Same design as used on 1940 car models with pinion bearing adjusting spacer as follows:

Pinion Bearing Adjusting Spacer—Compressible steel spacer is installed on pinion shaft between pinion bearing cones. Tightening of rear universal joint companion flange nut causes the spacer to "buckle" and pre-loads bearings.

SERVICING & OVERHAUL:—Differential carrier assembly should be serviced by replacement. Manufacturer recommends that no attempt be made to disassemble axles further than removal of carrier assembly or replacement of pinion shaft and axle shaft oil seals.

CHEVROLET TWO-SPEED (DOUBLE REDUCTION) TRUCK TYPE

Optl. Equipment On:

CHEVROLET TRUCK, ALL MODELS (1941

SERVICING, OVERHAUL & ADJUSTMENT:—All operations same as 1939-40 Two Speed Rear Axle except as noted below. *See 'Chevrolet (Double Reduction) Two Speed Type' Rear Axle article in Mechanical Equipment Section of manual (or 1939 Supplement) for complete instructions and note following new data:*

Axle Shaft Gasket—Soft aluminum gasket used between wheel hub and axle shaft flange. Install new gasket whenever axle shafts are removed.

Wheel Bearing Servicing—Wheel bearings installed in same manner as on regular full-floating axle (see preceding article).

Shifter Sleeve Installation Note—Shifter sleeve has three tapered teeth which must line up with poppet balls and springs in shaft. These tapered teeth are unevenly spaced on the shaft and in the sleeve (two groups of 8 teeth and one group of 9 teeth between these tapered teeth). Determine the 9 tooth group on the sleeve and the 9 space-between-teeth group on the shaft and mesh these together. CAUTION—If sleeve and shaft not meshed in this manner, one or more lock balls will be out of position in the sleeve.

CHEVROLET SEMI-FLOATING PASS. CAR & TRUCK TYPE

Used On:

PASSENGER CAR TYPE

MASTER DELUXE AG, SPECIAL DELUXE AH ('41)

TRUCK TYPE

HALF-TON MODELS AJ, AK (1941)

¾ TON MODELS AL, AN ('41)—SEE NOTE.

1940 SPECIAL SERVICE NOTES:—Axle Vent Production change on 1940 Truck—On first ½ & ¾ Ton trucks, if lubricant pumps out through vent in torque tube, remove torque tube vent and plug this opening with pipe plug, provide new vent by drilling 1/8" hole through first axle housing cover bolt to left of top bolt and inserting 1/16" cotter pin through this hole (bend cotter pin to prevent it loosening in service).

CAUTION.—If late type differential carrier and torque tube assembly (without vent) is used with first type Axle housing (without vent), a vent must be provided by drilling 11/32" hole in top of axle housing 8" to left of vertical centerline of axle. Thread hole with 1/8" tapered pipe tap, install #3652364 regular production vent. Use extreme care to remove all metal chips when drilling and tapping this hole. NOTE—If desired, the vent may be provided by drilling the housing cover bolt as directed above instead of installing this regular vent.

PASSENGER CAR AXLE NOTE:—Axles may be identified by prefix letter of serial number stamped on top right hand side of differential carrier as follows: Std. 4.11-1 Ratio—'AG' or 'AJ'. Optl. 3.73-1 Ratio—'AH' or 'AP'.

TRUCK AXLE NOTE:—Truck axles are same design as those used on Passenger Car Models except they are of heavier construction. Truck axles also have improved lubrication system as follows:

Pinion Bearing Lubrication—Drilled passage in differential carrier provided for greater oil flow to front (double row ball) pinion bearing. Oil retainer installed in carrier in front of rear (roller) pinion bearing retards oil return to axle housing so that front bearing operates in an oil bath.

¾ Ton Models—These axles are new Hotchkiss Drive type with rear universal joint yoke bolted on forward end of propeller shaft and oil seal installed in axle housing (no torque tube used). Serviced in same manner as other Axles except for oil seal data (see below). Disregard data on torque tube and propeller shaft when servicing these models.

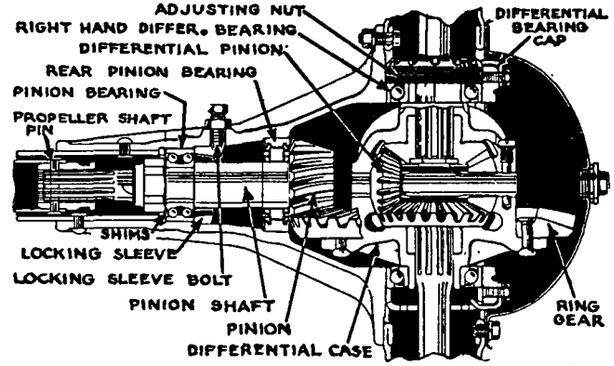
TYPE:—Hypoid gear, semi-floating type with torque tube drive. Pinion integral with shaft which is splined and pinned in bushing in rear end of tubular propeller shaft. Pinion shaft mounted on double row ball bearing (front) which takes thrust in both directions, roller bearing (rear) which takes radial load only. Rear bearing does not have inner race and is assembled directly on shaft. Differential assembly mounted on 'barrel' type roller bearings with adjusting nut under bearing cap at outer end of each bearing.

SERVICING:—Gear Adjustment. Paint gears to check mesh. Backlash should be .005-.007" (Passenger Cars), .005-.008" (Trucks). Adjusted by backing off one differential bearing adjusting nut and tightening opposite nut equally. See Differential Bearing Adjustment and Pinion Setting below.

Axle Shaft Removal. Remove wheels, take out two 'Zipon' nuts mounting brake drum on the axle shaft flange and remove drum. Remove axle housing rear cover, take out pinion shaft screw, withdraw pinion shaft, lift out axle shaft spacer block. Push shafts in toward center of axle, remove 'C' washer at inner end within differential side gears, withdraw axle shaft. When replacing shaft, check endplay.

NOTE—Axle shafts are of unequal length. Install longer shaft on right hand side.

New Axle Shaft Installation. Wheel hub bolts are press fit in axle flange and must be installed in new shafts (these bolts hold oil deflector assembly on flange). Coat new gasket with heavy shellac or paint, install gasket and oil deflector on flange lining up oil holes (extra center hole of three closest together should be lined up with notch in flange, oil pocket in deflector should also line up with this notch), insert special wheel bolts and force heads



down to deflector, peen shoulder on bolts into countersink around bolt holes in flange (this is very important). Check shaft endplay.

Axle Shaft Endplay (Passenger Cars)—Controlled by spacer assembled on differential pinion shaft between inner ends of axle shafts. Endplay should be from a Free Fit to .014" max. Spacer blocks now furnished in three types providing four sizes as follows: Narrow—1.0105". Medium—1.0195" and 1.0295", Wide—1.0345". These dimensions taken across ground faces of block and block should be installed with these ground faces toward axle shaft ends. NOTE—Medium block ground on all four sides and may be installed either way to secure either of these two sizes.

Axle Shaft Endplay (Trucks)—Same as for Passenger Car (above) except that spacer blocks furnished in two types for three sizes as follows: Narrow—1.1485", Wide—1.1575" & 1.1675" (this block ground on all four sides and may be installed either way to secure both sizes).

Propeller Shaft Front Bearing. Consists of a bushing and leather oil seal seated against shoulder in housing at forward end of torque tube, and an additional bushing at the extreme end of the torque tube which engages the stub shaft of the universal joint. Both bushings are doweled in place. Replace bushings when clearance exceeds .010". To remove bushings (front bushing must be removed to take out rear bushing), drill out dowel pins, drive bushings out from rear end of torque tube. Install oil seal with open end of leather toward front, insert rear bushing, use J-968 bushing driver to seat bushing and oil seal firmly. Drill new dowel hole in bushing (being careful not to break through wall), coat dowel with Permatex to prevent oil leaks, peen dowel in place. Install new front bushing in same manner, using arbor to prevent damage to bushing while drilling dowel hole and installing dowel (bushing has very thin wall).

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Front Propeller Shaft & Support Bearing (¾ Ton Truck):—Consists of an enclosed type shaft with front universal ball joint assembled on forward end, and special intermediate support bearing and front yoke for intermediate universal joint bolted on rear end. Support bearing is of the permanently lubricated and sealed type and is mounted in a rubber cushion in the support bracket sleeve.

Disassembly—Clamp universal joint yoke in vise, remove cotter pin and nut from rear end of shaft, tap yoke off shaft with soft hammer, remove bearing dust shield. Wet rubber cushion (to soften soap used when cushion assembled), clamp support bracket in vise and move shaft housing from side to side to work cushion out of support, then slide cushion off housing, remove front universal ball retainer over rear end of housing. Remove bearing retainer snap ring in rear end of housing (compress ends of ring with pliers), use brass drift to drive propeller shaft and bearing out through rear end of housing. Press bearing off shaft in arbor press. CAUTION—Do not wash bearing in gasoline or attempt to lubricate it (bearing is permanently lubricated and sealed). Remove oil seal from housing only if seal being replaced (drive seal out toward front of housing). Soak new seal in light engine oil and install with free end or lip toward front end of housing.

Front Propeller Shaft Bushing—Consists of a thin wall bushing pressed in forward end of housing which engages front universal joint rear yoke. This bushing installed in same manner as Passenger Car type (see directions above).

Assembly—Press bearing on shaft in arbor press, assemble shaft and bearing in housing, seat bearing by tapping around outer race using soft drift, install snap ring. Install new cork packing in universal joint ball retainer (shellac cork in place), install retainer over housing, install rubber cushion on machined rear end of housing. Coat rubber cushion lightly with soft soap, assemble support bracket on cushion, install bearing dust shield and intermediate universal front yoke, tighten nut securely and install cotter pin.

OVERHAUL:—Pinion Bearing Assembly. To remove assembly from torque tube, loosen locknuts and take out retaining screws on side of housing, withdraw assembly from torque tube. To dismantle assembly, drill out head of rivet pin in propeller shaft, loosen pinion bearing locknut, disassemble pinion from propeller shaft. Use J-996 pinion bearing remover to press double row ball bearing from pinion shaft, remove locking sleeve or bearing retaining collar, remove lock ring from pinion shaft, take off roller bearing. Front double row ball bearing must have no perceptible endplay (new bearings may be .001" tight or have some drag). Assemble in reverse order making certain that lock ring installed on shaft ahead of roller bearing (to prevent rollers creeping) and that locking sleeve installed with beveled edge toward pinion. Tighten bearing locknut securely and stake nut into slot in shaft. Use new rivet pin when assembling pinion and propeller shaft and rivet both ends of pin securely. Make certain that pinion setting shims installed in housing (see Pinion Setting below), insert propeller shaft assembly and drive it down to seat bearings (use drift in hole in end of pinion, do not drive on pinion teeth). Make certain that locking sleeve down against bearing, install the three tapered lockscrews, tighten screws evenly and securely, tighten locknuts.

Pinion Bearing Assembly (½ Ton)—When assembling pinion bearings on shaft, install rear roller bearing and lock ring, then thread pinion front bearing oil retainer on shaft with bevel of large diameter of retainer toward pinion, assemble bearing lock sleeve with bevel side toward pinion, install front double row ball bearing and bearing retainer nut. All other assembly and adjustment instructions same as for passenger car models.

Pinion Bearing Assembly & Oil Seal (¾ Ton)—Assemble pinion bearings in same manner as ½ Ton (above) except that rear universal joint yoke and oil deflecter (pressed on outer diameter of yoke) must be installed on pinion shaft and yoke retaining nut must be securely tightened before ring gear and pinion adjustments are made. When installing new pinion bearing retainer oil seals, soak seal thoroughly in light engine oil before it is installed.

Pinion Setting:—Pinion position controlled by shims installed in housing ahead of front bearing. Standard assembly .033" shim thickness (one .015" shim, one .018" shim) and should be used for new gears. Shims furnished .012", .015", .018", .021" thick and shim pack can be varied from .030" to .036".

Differential Bearing Assembly:—Use special puller to remove bearings from differential case hubs (notches provided in case for puller so that pressure applied to inner races only). Use J-994 bearing replacer to install bearings. When installing differential assembly in carrier (third member), make certain that marks on bearing caps and carrier line up.

Differential Bearing Adjustment:—With carrier or third member assembly out of axle housing, tighten differential bearing cap screws until lockwashers are just flattened, turn right hand adjusting nut up until it is just snug, then turn nut additional 1-2 notches to locking position, tighten bearing cap screws securely and install adjusting nut locks.

Ring Gear Backlash Adjustment. To set up differential assembly for correct backlash when installing assembly in carrier, turn left hand adjusting nut in slowly until all backlash between ring gear and pinion taken up (revolve ring gear while making this adjustment), then back adjusting nut off one notch. Adjust differential bearings by turning right hand adjusting nut as directed above. This setting should give correct backlash of .005-.007" (Passenger Cars), .005-.008" (Trucks). If backlash not correct, back off one adjusting nut, turn up opposite nut equal amount.

Ring Gear Replacement:—Run-out of differential case flange must not exceed .001" with ring gear removed. When installing ring gear, use guide pins in alternate bolt holes to position gear while bolts are being installed, use new lockwashers under bolt heads, tighten all bolts evenly and securely and lock with wire. Ring Gear run-out .004" maximum.

CHEVROLET FULL-FLOATING HYPOID TRUCK TYPE

Used On:

1½ TON & CAB-OVER-ENGINE TRUCKS (1941)
SCHOOL BUS MODEL YT (1941)

NOTE—Two axle ratios used (5.43-1 and 6.17-1) and each type may be identified by prefix letter of part number stamped on top surface of top rib on right side of differential carrier casting as follows: 5.43-1 Ratio—'AT' or 'AW', 6.17-1 Ratio—'AR' or 'AS'.

TYPE:—Hypoid Gear, full floating type. Similar to design used on previous Chevrolet Truck models (Hypoid Gear, full-floating type) except that Hotchkiss Drive is now used with rear universal joint yoke bolted on pinion shaft and new pinion bearing retainer and oil seal bolted on forward end of differential carrier (no torque tube used).

SERVICING:—Gear Adjustment—Pinion not adjustable. Backlash should be .005-.008" (see Differential Bearing Adjustment below).

Axle Shaft & Wheel Bearings:—Wheels mounted on double barrel type roller bearings on outer end of axle housing and axle shafts can be removed without disturbing bearings. To remove axle shaft, bend lugs of lock plate away from bolt heads (on axle shaft flange on wheel hub), remove eight ½" capscrews, remove and discard lock plate. Install two 7/16x14 capscrews in tapped holes in flange (between mounting screw holes), turn these screws up evenly to loosen axle shaft, remove axle and aluminum gasket. When installing shaft, use new aluminum gasket and new lock plate, tighten capscrews evenly and securely, then bend lock plate lugs against screw heads.

Wheel Bearing Adjustment—Remove axle shafts (above), remove adjusting nut locknut and lock (within wheel hub), use special wrench J-870 (see Note below) and turn adjusting nut up tight, then back nut off 45° (⅛ turn). Rotate wheel hub by hand to make certain that it turns freely. Install lock and see that tangs line up with slots in adjusting nut, bend lock tang into slot in nut. Install and tighten outer locknut, bend lock tang into notch in nut. Re-install axle shaft. NOTE—Wheel bearing adjusting nuts on later trucks do not have slots extending entirely across face of nut (slotted at outer edge only) and the J-870 wrench must be reworked for use on these models as follows: Remove wrench handle, mount wrench body in lathe and machine inner ends of wrench lugs to inside diameter of 2½".

Wheel Bearing Assembly—To remove wheel bearings, remove axle shafts (above), take out locknut, lock, adjusting nut, remove hub and drum assembly. Install clamp on brake cylinder. Use puller J-918 to remove inner bearing and oil seal. To remove outer bearing from wheel hub, tap outer race to relieve tension on snap ring, remove snap ring on inside of hub, use long ⅛" punch inserted through mounting screw holes in end of hub and tap outer race out of hub (inner race and roller assembly will come out with outer race—use extreme care to tap on outer race only and to drive race out evenly). Wash bearings in gasoline and pack roller assemblies with #2½ cup grease. To replace outer bearing, place inner race, roller assembly and outer race on wheel hub with thin edge of outer race toward hub, use bearing replacer J-872-1 in an arbor press and press bearing in hub just far enough so that snap ring can be installed, install snap ring, then tap bearing out against snap ring (use driver J-872-3 inserted through mounting screw holes and tap on outer race only). To install inner bearing, use special driver J-872-4 to press outer race in against seat (install with wide side of race toward hub), install inner race and roller assembly. Press oil seal in place using oil seal replacer J-872-2 in arbor press, stake oil seal in place by prick punching at three equally spaced points on edge. Install wheel hub and drum assembly (turn wheel to seat bearings) and adjust bearings (above).

NOTE—Oil slinger on rear axle housing must be installed with special tool J-973 so it will be correctly positioned in relation to slinger in wheel hub. Always install new slinger whenever removed.

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Front Propeller Shaft & Support Bearing:—Consists of a tubular shaft with integral rear yoke for front universal joint at forward end, intermediate support bearing and front yoke for intermediate universal joint bolted on shaft at rear end. Support bearing is of the permanently lubricated and sealed type and is mounted in a rubber cushion in the support bracket sleeve.

Disassembly—Clamp universal joint yoke in vise, remove nut on rear end of shaft with 1½" socket wrench, tap yoke off shaft. Wet support bearing rubber cushion (to soften soap used when cushion assembled), clamp support bracket in vise and move shaft from side to side to work cushion out of support, then pull rubber cushion off bearing by hand. Use special puller J-1619 (clamp puller in vise) to remove bearing from shaft, tap dust shields off outer race of bearing. CAUTION—Do not wash bearing in gasoline or attempt to lubricate it (bearing is permanently lubricated and sealed type).

Assembly—Press outer dust shield on outer race of bearing, install forward inner dust shield on shaft with offset away from bearing, drive bearing on shaft (use universal joint yoke as a driver), install rear inner dust shield with offset away from bearing, install rubber cushion on bearing. Coat outer surface of cushion lightly with soft soap, slide support bracket over cushion. Install universal joint yoke (turn yoke 90° from front universal yoke on opposite end of shaft) and securely tighten yoke nut.

OVERHAUL:—Disassembly—Remove ring gear thrust pad, adjusting nut locks, bearing cap bolts and lock-washers, take off bearing caps (bearing caps now piloted on carrier by sleeve type dowels to maintain alignment), lift differential case and ring gear assembly out of carrier. Take out bolts mounting pinion bearing retainer and oil seal on forward end of carrier, remove pinion and shaft assembly from carrier.

Pinion Bearing Assembly:—Remove cotter pin, nut and washer on end of pinion shaft, remove universal joint and bearing retainer and oil seal from shaft. To remove rear pinion bearing, remove lock ring, use special press plate J-1453 to press shaft and pinion out of bearing (CAUTION—make certain that raised portion of plate against bearing inner race to avoid damage to bearing). Use special pinion bearing remover J-1439 (6 tooth pinion), J-1440 (7 tooth pinion) installed over pinion so that it engages inner race of double row ball bearing, press shaft and pinion out of bearing. Wash all parts in gasoline, inspect for wear or damage. To reassemble, press front double row ball bearing on shaft making certain that extended portion of bearing inner race is toward gear teeth (CAUTION—If bearing not installed in this manner, rapid wear and gear failure will result). Press rear bearing on end of shaft with chamfered side of inner race toward pinion and install lock ring. Install pinion bearing retainer and oil seal on end of pinion shaft, install gasket and universal joint yoke so that it contacts inner race of bearing, install flat washer and nut, tighten nut with force of 160-280 ft. lbs. and install cotter pin.

Bearing Retainer Oil Seal—If oil seal being replaced, soak new seal in light engine oil for one hour, install felt packing in bottom on seal recess, then install seal with open end of leather toward pinion bearing and press seal down against felt packing.

Pinion Setting:—Pinion position not adjustable. Double row bearing should be seated against shoulder in carrier and is retained by torque tube IMPORTANT SERVICE CAUTION—This double row bearing must be installed with the ⅛" projection of the bearing inner race extending **back toward the pinion.** If bearing incorrectly installed, it will cause excessive backlash and early failure of the ring and pinion gears.

Differential Bearing Assembly:—Bearings are press fit on differential case hubs. Use special puller to remove bearings (puller fingers must fit in notches in case so that pressure applied to inner races only). Mark differential case halves before dis-assembly to insure reassembling in same position—this is very important. Remove twelve ½" bolts holding case halves and ring gear together, lift off case cover, remove differential pinions and side gears, tap ring gear off case with soft-faced hammer. When reassembling, oil pinions and side gears and install in left side of case, assemble right side of case being careful to line up marks made before disassembly, install guide pins in two opposite bolt holes (guide pins can be made up of two #2652253 ring gear screws with heads removed and end slotted to permit removal). Make certain that ring gear seat on case is clean and not burred, install ring gear on guide pins, install bolts in all holes (except guide pin holes), tighten all bolts evenly and securely until ring gear face is flush with flange on case, remove guide pins, install remaining bolts and tighten all bolts. Use special driver to install differential side bearings on case hubs and see that wide side of inner race is toward case. Check differential case run-out which must not exceed following maximum figures: .004" at ring gear pilot on case and face on which ring gear is bolted, .007" on back of ring gear after gear bolted in place.

Differential Bearing Adjustment:—When installing differential assembly in carrier, make certain that bearing cap marks line up with marks on carrier, tighten bearing capscrews until lock washers just flatten out, screw both bearing adjusting nuts up until snug to seat bearings. Back off right hand adjusting nut, tighten left hand nut until all clearance or backlash between ring gear and pinion is just taken up, then back off adjusting nut two notches to locking position (slot in nut in line with lock). Tighten right hand adjusting nut solidly, back nut off until free of bearing, then tighten right hand adjusting nut until all play in bearing is taken up, and then tighten nut one to two notches more to locking position, tighten bearing cap screws and install adjusting nut locks. Check backlash.

Ring Gear Backlash Adjustment—If backlash not correct after setting up bearings as directed above, loosen left hand adjusting nut one notch and tighten right hand nut one notch (if backlash less than .005-.008"), or loosen right hand nut one notch and tighten left hand nut one notch (if backlash greater than .005-.008"). In making any backlash adjustment both adjusting nuts must be turned an exactly equal number of notches (in opposite directions) to avoid disturbing bearing adjustment.

Ring Gear Thrust Pad Adjustment:—Examine bronze tip on ring gear thrust pad and replace if worn. To adjust, tighten thrust pad adjusting screw until bronze tip engages back of ring gear lightly (turn gear while making adjustment), then back screw off 1/12 turn, hold screw from turning and tighten locknut. This adjustment will give clearance of .005-.007" between thrust pad and ring gear.

CHRYSLER HYPOID TYPE

Used On:
CHRYSLER, C28 ROYAL & WINDSOR (1941)
CHRYSLER, C30 SARATOGA&NEW YORKER ('41)
DE SOTO, MODEL S8 (1941)
DODGE, MODEL D19 (1941)
PLYMOUTH, MODELS P11, P12 (1941)

TYPE:—Hypoid gear, semi-floating type with Hotchkiss drive. Same design as used on corresponding 1940 car models.

SERVICING:—Gear Adjustment—Paint gears to check mesh. Ring & Pinion Gear backlash should be .006-.010". When making this adjustment (by backing off one differential bearing adjusting nut and tightening opposite nut), note new differential bearing adjustment data below.

Axle Shaft Endplay—Should be .003-.008". When dismantling axle, make certain that shims installed between backing plate and axle housing flange are saved and replaced when axle reassembled. If new shaft installed, adjust shim thickness for correct endplay as noted above (adjust equally at both wheels).

Axle Shaft Replacement—To remove axle shaft, remove wheel, axle shaft nut, hub and brake drum assembly (use Puller C-319), block brake pedal at toeboard, disconnect brake line at wheel cylinder. Remove nuts on studs holding oil seal and brake support on axle housing, remove and save shims from between support and housing (see Axle Shaft Endplay below), withdraw axle shaft using special puller C-158. To remove bearing from shaft, use puller C-293.

Wheel Bearing Oil Seal—Use special Seal Puller C-358 to remove seal and special drift C-201 or C-202 to install seal.

OVERHAUL:—Disassembly—With differential carrier out of axle housing, mark both bearing adjuster nuts and bearing caps so that they can be installed in correct position and approximately right adjustment, remove bearing cap screws, lift out differential and ring gear assembly. To remove pinion, take off nut on end of pinion shaft, use tool C-452 to pull pinion flange. Pull pinion out through rear end of carrier housing. Use special puller C-293 to remove bearing from pinion shaft. Reassemble in same manner using tool C-496 to install pinion flange.

Pinion Bearing Adjustment—Bearings should be .0015-.0025" tight (draw or tension). Use dial indicator to check with sufficient shim stock installed between spacer and front bearing cone so that pinion shaft has some endplay, then remove shim stock equal to this measured endplay plus .0015-.0025" so as to provide this amount of draw or tension when installed on car. Universal joint flange must be in place on shaft and pinion shaft nut must be tight when checking bearing adjustment. Oil seal need not be installed until after bearing adjustment completed (use special drift C-359 to seat oil seal in carrier bore).

Differential Side Gear Assembly—Differential pinion gear shaft retained by pin (except 7 Pass. cars), lock screw (7 Pass. cars). Gears can be dismantled (with ring gear removed) by taking out this pin or lockscrew, pulling out shaft and removing thrust block (on center of shaft). When reassembling, make certain that this thrust block installed on shaft with spacer on shaft between block and each differential pinion, and that thrust washers installed in back of each differential pinion and side gear. Clearance between side gears and pinions

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should be .004-.012" (controlled by thrust washers in back of gears).

Pinion Setting—Controlled by washer (Chrysler Six, DeSoto, Dodge, Plymouth except 7 Pass. cars), shims (Chrysler Eight & Chrysler Six, DeSoto, Dodge, Plymouth 7 Pass. cars) between pinion and pinion shaft rear bearing cone. Shims or washer thickness should be varied to secure correct pinion mesh (pinion assembly must be dismantled to remove or install these washers or shims. If old pinion being re-installed, use same washer and shims as removed when axle disassembled. If new Ring and Pinion gears being installed, install washer or shim thickness of .090" and then check gear mesh and pinion bearing adjustment.

Differential Bearing Adjustment—When checking adjustment, both bearing adjusting nuts should be tightened sufficiently to seat bearing cups solidly against rollers, then back off adjusting nuts to relieve strain and tighten until assembly turns with slight drag. NOTE—Adjustment can be checked by setting up dial indicator to measure bearing post 'spread' as adjusting nuts are tightened. With correct adjustment, bearing support pedestals should spread or move out .008-.010" measured at the bearing caps.

Ring Gear Backlash Adjustment—When adjusting backlash, note number of notches one adjusting nut is backed off and tighten opposite nut exactly same number of notches to avoid disturbing bearing adjustment.

CHRYSLER C33 HYPOID TYPE

Used On:

CHRYSLER, C33 CROWN IMPERIAL (1941)

TYPE:—New design Hypoid Gear, semi-floating type with 'barrel type' differential case. Differential case has open end on right hand side through which differential gears are installed, this opening then being closed by cap which is threaded into case and locked by pin extending through drilled hole in case and cap. Right hand differential case side bearing is seated on shoulder on cap. Pinion shaft bearing cups are seated against shoulders in carrier bore and front bearing cone seats against shoulder on shaft (spacer washer between cone and shaft shoulder), no tubular shaft spacer being used. Special ring gear thrust pad and adjusting screw is installed in left hand side of differential carrier so as to contact back of ring gear.

SERVICING:—**Gear Adjustment**—Paint gears to check mesh. Backlash should be .006-.010". Adjusted by backing off one differential bearing adjusting nut and tightening opposite nut equally. See Differential Bearing adjustment below.

Axle Shaft Replacement—To remove shaft, remove wheel, axle shaft nut, hub and shaft key (use special hub puller C-476. Disconnect brake line, remove stud nuts holding oil seal and backing plate on housing, remove oil seal, backing plate, and wheel bearing adjusting shims (save shims and reinstall when assembling). Use shaft puller C-158 to pull shaft and bearing (if bearing to be removed from shaft use puller C-293). When installing new shaft, adjust shim thickness at each wheel equally for desired endplay of .003-.008" (shims furnished .010", .0125", .015", .030" thick). NOTE—Shims must be installed or removed equally at each wheel to maintain correct position of spacer block on differential pinion shaft at inner end of axle shafts.

Wheel Bearing Oil Seal—Use special puller C-358 to remove oil seal washer from housing, special drift C-201 to install new seal washer.

OVERHAUL:—**Disassembly**—Mark differential bearing adjusting nuts and bearing caps to insure replacement in correct position. Remove adjusting nut locks, back off adjusting nuts, take out bearing cap screws, remove bearing caps, lift differential assembly out of carrier. Remove drive pinion shaft nut, pull universal joint drive pinion flange, remove pinion and shaft through rear end of carrier. Use special puller C-293 to remove rear bearing cone from pinion shaft. Use special puller C-358 to remove pinion oil seal from carrier bore, special drift C-359 to install new seal. NOTE—Seal can be serviced without disassembling carrier assembly. New seals should be soaked in thin oil for 30 minutes and leather should be worked by rolling with smooth bar until it is pliable.

Pinion Bearing Adjustment:—Bearing should be .0015-.0025" tight (draw or tension) with pinion shaft nut securely tightened. To check bearings, mount dial indicator so as to measure pinion shaft endplay. Install pinion bearing washer of sufficient thickness between front bearing cone and shoulder on pinion shaft so that shaft has measurable endplay (pinion assembly must be dismantled to change this washer). Then install washer which is thin enough to take up all endplay plus .002" to provide proper draw or tension on bearings (subtract measured endplay plus .002" from first washer thickness to find correct final washer thickness).

Differential Gear Assembly:—To disassemble differential gears, use special puller C-293 and puller blocks to remove right hand differential bearing from differential case cap. Drive cap locking pin through hole in case so that pin is entirely within cap. Heat differential case in boiling water, then unscrew cap from right hand end with special spanner wrench. Drive differential pinion shaft locking pin out of case, withdraw pinion shaft and all differential gear parts. When reassembling, make certain that thrust washers installed behind each differential pinion and side gear and that thrust block installed on center of pinion shaft with spacer between block and each pinion. Peen edge of differential pinion shaft locking pin hole after pin installed to prevent pin working out in service. Heat differential case in boiling water before installing end cap, tighten end cap securely, drill new hole through cap and case and drive new groove pin in hole until flush (do not reuse old groove pins). Clearance between differential pinions and side gears should be .004-.012" and is controlled by thrust washer thickness installed in back of gears.

Differential Bearing Adjustment:—When installing carrier assembly, turn adjusting nuts up to marks made before disassembly, then check bearing adjustment as follows: Tighten both bearing adjusting nuts sufficiently to seat bearing cups solidly against rollers, then back off nuts to relieve strain and tighten until differential assembly turns with slight drag or bearing support pedestals 'spread' .008-.010" as measured at bearing caps (use dial indicator to measure this spread or outward movement of pedestals as nuts are tightened). Replace bearing and adjusting nut locks and tighten bearing cap screws securely.

Ring Gear Backlash Adjustment—When adjusting backlash, note number of notches one adjusting nut is backed off and tighten opposite nut exactly same number of notches to avoid disturbing bearing adjustment. Make certain that ring gear thrust pad has sufficient clearance to permit ring gear movement and adjust thrust pad after correct backlash of .006-.010" is secured.

Ring Rear Thrust Pad Adjustment:—Clearance between thrust pad and back face of ring gear should be .006-.008". To adjust, loosen locknut on thrust pad stud (on left hand side of carrier housing), turn stud up finger tight, then back stud off slightly less than ⅛ turn, tighten locknut.

FORD (PASSENGER CAR) & MERCURY

Used On:

FORD, MODEL 11A PASS. CARS (1941)
FORD, 1NC, 11C, 19C COMMERCIAL (1941)
MERCURY, MODEL 19A (1941)

TYPE:—Spiral Bevel gear, ¾ floating type with Torque Tube drive. Same design as used on corresponding 1940 models.

SERVICING:—**Gear Adjustment.** Backlash should be .012" maximum (Ford), .010" maximum (Mercury). Controlled by gasket thickness between pinion housing (axle center section) and right and left axle housings. See Differential Bearing Adjustment below.

Axle Replacement. Axle shafts must be removed from inner end after axle dismantled and differential case bolts removed (side gears integral with shafts). When installing axles see that free travel or play at wheels keyway does not exceed .010" or endplay exceed .015". If play excessive, check differential gears for wear (pinion clearance .005" maximum).

Propeller Shaft Forward Bearing:—In forward end of torque tube behind speedometer drive gear. Two types used (use B-4645-A roller assembly with split sleeve, 68-4645 with small rollers with solid sleeve). Use special puller SV-245 to remove solid sleeve from torque tube. Install new grease retainer (use tool A-310) with sharp edge of leather toward universal joint (old grease retainer will be damaged by sleeve removal).

Propeller Shaft Center Bearing:—In torque tube at center. On types with solid propeller shaft, front bearing sleeve must be removed before center bearing can be removed with SV-186 tool (see above).

OVERHAUL:—**Disassembly.** Remove speedometer driven gear assembly. Remove snap ring on forward end of propeller shaft, withdraw speedometer drive gear and thrust washer. Take out flange mounting screws at rear of torque tube, withdraw propeller shaft from tube toward rear. Drive out rivet in coupling, disconnect propeller shaft from pinion. Use AATA-1 driver to remove pinion assembly from housing, BV-92 puller to remove bearings.

Pinion Bearing Assembly:—Assemble bearings on pinion shaft (see Note below), tighten bearing locknuts so that bearing cup turns on cones with heavy drag. Heat housing (use approved heater or immerse housing neck in boiling water or hot oil for 1-2 minutes), install outboard bearing (use BV-94 driver), then with housing still hot install pinion assembly making certain that bearing cup is against shoulder in housing. Check pinion bearing adjustment only after installed in housing.
NOTE—Only bearings marked 'P' on end of cone should be used next to pinion

Pinion Bearing Adjustment:—Use approved gauge ABV-129 to check bearing adjustment. The setting must be 17-20 in.lbs. (straddle mounted pinions). To

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adjust, tighten pinion bearing nut until correct gauge reading secured (check only after pinion assembly installed in axle housing), then tighten locknut securely and turn lockwasher ears over on nuts.

Differential Bearing Adjustment:—Assemble axle with one 18-4035-A gasket (.008-.010" thick) between right and left hand axle housing and pinion housing. Check bearing adjustment by rotating both axle shafts simultaneously (rotating one shaft will not turn differential assembly). Differential assembly should turn with a heavy drag. If clearance too great, replace gasket between right hand axle housing & pinion housing with B-4035-BR gasket (.004-.005" thick). Then check gear for backlash.

Ring Gear Backlash. Use dial indicator mounted to show pinion gear shaft movement with ring gear stationary. Backlash .012" (Ford), .010" (Mercury) maximum. Adjust by increasing or decreasing thickness of gasket between left hand axle housing and pinion housing. Total gasket thickness must not be changed in order not to disturb bearing adjustment (increase or decrease right hand gasket thickness equally).

FORD FULL-FLOATING TRUCK TYPE

Used On:

FORD, ALL 4 CYL., V8 '85' & '95' TRUCKS ('41)

TYPE:—Spiral bevel, full-floating type with Hotchkiss drive. Same design as used on corresponding 1940 models.

¾ & 1 Ton Truck—Axle used on these models same as on other trucks except that pinion bearing sleeve (double bearing cup) is not flanged and is retained in housing by separate bearing retainer which is bolted on front end of housing with separate grease retainer assembly.

SERVICING:—Gear Adjustment—Backlash should be .004-.016". No adjustment provided.

Axle Shafts—Shafts can be removed without disturbing wheels and hubs as follows: Take out two screws in hub cap, remove cap. Remove nuts on 8 studs on axle shaft flange, turn two bolts (located between studs) in evenly to loosen axle shaft flange from hub. Then back off these two bolts, strike sharp blow on center of axle shaft flange to loosen locking cones on studs. Remove locking cones, pull axle shaft out. When installing shaft, see that gasket in place under axle shaft flange, back off loosening bolts sufficiently to allow axle shaft to seat on hub, install locking cones on studs, tighten stud nuts evenly and securely, then tighten the two loosening bolts just enough to prevent their loosening in service.

Wheel Bearing Adjustment—Remove axle shaft (above), remove outer locknut, lockplate, and grease retainer (except on ¾ and 1 Ton). Turn inner bearing adjusting nut up tight, then back nut off ⅛ turn, install lockplate being certain that locking pin in nut engages notch in lockplate (except ¾ & 1 Ton), bend lockplate tang against nut (¾ & 1 Ton). Install outer locknut and tighten securely. Rotate wheel by hand and see that it turns freely. Re-install axle shafts.

Wheel Bearing Assembly—To disassemble wheel bearings, remove axle shafts, remove outer locknut, grease retainer, lockplate and inner adjusting nut, remove wheel hub. Remove snap ring in inner end of hub, use puller BB-139 to remove grease retainer, remove inner bearing roller assembly, use puller BB-148 to remove inner bearing cup from hub. Remove outer bearing roller assembly from hub, use puller BB-148 to remove bearing cup from hub. Re-install parts in same manner using BB-150 to install both bearing cups in hub and to install grease retainer. Make certain that grease retainer snap ring installed in inner end of hub. Adjust bearings after hub installed on axle (see above).

OVERHAUL:—Disassembly—Remove axle shafts and wheel hubs, take out capscrews holding left hand axle housing on right hand housing, remove left hand housing using care not to lose thrust pin and plate. Withdraw ring gear and differential assembly from housing (differential side bearing roller and cone assembly will come out on differential case hubs, bearing cones will remain in housing halves). Remove and service pinion assembly and differential assembly as directed below.

Pinion Bearing Assembly (Except ¾ & 1 Ton):—To disassemble, take out screws mounting grease retainer and pinion sleeve flange on forward end of axle housing, remove grease retainer and pinion assembly. To disassemble pinion, remove locknut, lockplate, adjusting nut, and washer on end of pinion shaft, use tool AATA13 to remove pinion from sleeve (rear bearing roller and cone will come out with shaft). Use BB-142 to remove and install this rear bearing on pinion shaft. If bearing cups to be removed from sleeve, use puller BB-143 to remove cups and BB-144 press to install bearing cups. Use puller BB-145 to remove outboard bearing from axle housing and BB-147 to install this bearing. Reinstall pinion and bearings in sleeve in this same manner, tighten adjusting nut until force required to turn pinion shaft is 12-16 inch lbs. (use ABV-129 gauge which reads directly in in. lbs.). Tighten locknut securely and see that lockplate tangs turned over against both nuts.

¾ & 1 Ton Models—Pinion bearing sleeve is not flanged and pinion assembly should be removed from axle housing with special driver (after grease retainer and bearing retainer removed). Bearings are removed from pinion shaft as an assembly with special puller (after pinion bearing adjusting nut and locknut have been taken off). When installing bearings, install rear bearing first, then install front bearing and bearing sleeve or cone as an assembly. Heat axle housing before installing pinion assembly and check bearing adjustment only after assembly installed in housing. Force required to turn shaft should be 16-20 inch lbs. (same as other models) and is adjusted in same manner .

Pinion Setting:—Pinion position not adjustable. If pinion mesh with ring gear not correct, replace all worn parts.

Differential Assembly:—To disassemble take out capscrews holding right hand half of differential case on left hand half, remove right half of case and lift out differential gears, pinions and pinion shaft. To remove differential bearing rollers and cones from differential case hubs, use special puller AATA1. Replace these bearings with tool BB-147. Use BB-148 to remove bearing cups from axle housing and BB-149 to install these bearing cups. Ring gear is serviced as a unit with the differential case and should not be removed. Differential bearings are not adjustable and use of additional gaskets between axle housing halves to control bearing adjustment is not recommended.

Assembly Note:—When reassembling axle, see that thrust block and thrust pin not worn and properly installed in left hand axle housing, use one 61-4035 gasket (¾ & 1 Ton), BB-4035 gasket (Others) between axle housing halves.

FORD TWO-SPEED TRUCK TYPE

Optional Equipment On:

FORD TRUCKS, ALL MODELS (1941)

SERVICING & OVERHAUL:—All specifications and service operations same as for 1939 model. *See 'Ford Two Speed Truck Axle' article in Mechanical Equipment Section of manual (or 1939 Supplement) for complete data and note following new specifications:*

Pinion Bearing Setting—Force required to turn pinion shaft should be 8-12 inch lbs. (measure with ABV-129 gauge).

HUDSON SPIRAL BEVEL TYPE

Used On:

SIX, MODELS 10, 11, 12, 18 (1941)

EIGHT, MODELS 14, 15, 17 (1941)

NOTE:—Axles used on all models are identical except for axle shaft diameter and wheel bearing size. Axle shafts on Models 10P & 10T are 1 5/16". All other six cylinder models (with 3x5" engine) and Eight Cylinder models have larger 1⅜" axle shafts and correspondingly larger wheel bearings.

TYPE:—Spiral bevel gear, semi-floating type with Hotchkiss drive. Same design as used on 1940 models (see Note above) except for change in pinion setting shim pack as follows:

Pinion Setting Shims—Differential carrier dimensions changed so that normal shim thickness in back of rear pinion bearing is .006" (was .056"). See Pinion Setting below.

SERVICING:—Gear Adjustment—Paint gears to check gear mesh. Pinion position controlled by shims between pinion and rear bearing cone. Backlash should be .0005-.0035". Adjusted by backing off one differential bearing adjusting nut and tightening opposite nut equally. See Pinion Setting and Differential Bearing Adjustment below.

Axle Shaft Replacement. Remove rear wheels, axle shaft nut and washer, use wheel puller to remove hub and brake drum assembly (do not use knock-out type puller). Take off 4 nuts on wheel bearing adjusting cap, remove cap and bearing adjusting shims, use puller J-352 to remove shaft and bearing assembly. Use bearing Remover J-1301 to remove bearing cone and rollers from shaft, tool J-358-H to re-install bearing.

Oil Seals—Use oil seal replacer tool J-353-1 to install new oil seal in bearing adjusting cap. Use tool HM-555 to remove old seal from axle housing, and use driver J-353-2 to install new seal assembly.

Axle Shaft Thrust Button Renewal. Thrust button consists of hardened steel plug in inner end of axle shaft. To remove button, grind end flush with shaft, center punch button and drill through center with 11/32" drill, tap hole with ⅜-16 tap, screw in 3/8-16 capscrew, place head of screw in vise and tap end of shaft with soft hammer to remove button. Drive new button into place in shaft.

Axle Replacement. When replacing axle or adjusting wheel bearings remove shims equally at each wheel of .002-.004". Adjust each wheel separately so that thrust spacer on differential pinion shaft is centered on shaft.

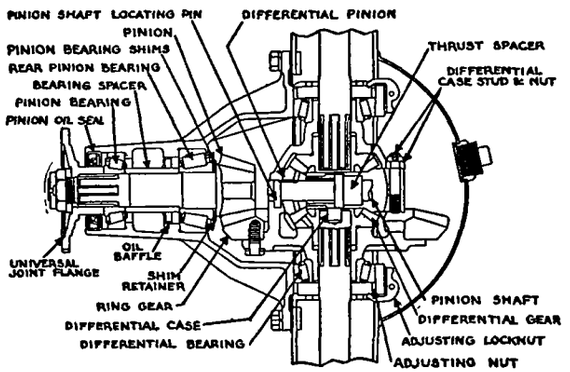
OVERHAUL:—Disassembly—Mark differential bearing caps and adjusting nut positions (to facilitate reassembly), remove bearing caps and lift out ring gear and differential assembly. Use special puller J-354-A to remove differential bearing cones from

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differential case hubs making certain that puller fingers installed in notches in case so that they engage bearing cone. Remove bolts and lockwashers to remove ring gear. To disassemble differential gears, remove cotter pins and nuts and separate right and left halves of differential case. When reassembling differential gears, select thrust washers of correct thickness so that gears have no appreciable endplay when installed (it should be possible to turn gears by hand by grasping axle shafts). Install thrust washers with smooth side toward gears and rough side toward case.

Pinion Bearing Assembly:—To disassemble pinion and bearings from carrier, remove nut and washer on end of shaft, pull rear universal joint companion flange using puller J-456, withdraw pinion, spacer, and shims through rear of carrier. Use tool J-489 to remove oil seal from carrier, lift out front bearing cone, use tool HM-63 to remove bearing cones from carrier bore. Use tool J-1301 to remove rear bearing cone from pinion shaft. When reassembling, seat bearing cups in carrier with tool HM-64, insert front bearing cone, install new oil seal with replacer tool J-353-1 (see Note below), install pinion, spacer and adjusting shims (see



Bearing Adjustment and Pinion Setting below), install companion flange and tighten nut with torque wrench to 200 ft. lbs. while holding flange with special tool J-789.

Oil Seal Note—Two types used (with concave or flat outer surface). Both types installed in same manner but clearance must be maintained between edge of dust shield on companion flange and oil seal (will cause noise if there is contact at this point).

Pinion Bearing Adjustment—Re-install same pinion bearing adjustment shims between bearing spacer and front bearing cone, tighten pinion shaft nut securely with rear universal joint flange in place, check bearing adjustment. It should be just possible to turn pinion shaft with one hand. Add thin shim if bearings too tight. Pinion bearing endplay should be .000-.001".

Pinion Setting:—When reassembling pinion install same shim thickness between pinion and rear bearing cone to retain correct pinion position. Adjust pinion by adding or removing shims at this point. NOTE—Shim pack for 1941 axles is .006" (reduced from .056" shim pack used on previous models by change in carrier bore dimensions).

Differential Bearing Adjustment:—To set up bearings when installing differential carrier, tighten differential bearing cap capscrews finger tight, turn left hand adjusting nut in until all play eliminated between pinion and ring gear, then tighten right hand adjusting nut securely. Set up dial indicator to check gear backlash, back off left hand adjusting nut one half notch and tighten right hand nut equal amount until gear backlash is .0005-.0035". Tighten bearing capscrews securely on left hand adjusting nut, turn right hand adjusting nut in one additional notch to secure correct bearing pre-load of .009" bearing tension. Tighten right hand bearing capscrews securely and install locks on both nuts.

Ring Gear Replacement:—With gear removed, run-out of gear mounting flange on differential case should not exceed .002". When installing gear, see that gear and case are clean and smooth and not nicked or burred. Use lockwashers on all gear mounting screws and tighten all screws uniformly and securely.

LINCOLN HYPOID TYPE

Used On:

ZEPHYR & CONTINENTAL MODEL 16H (1941)
CUSTOM MODEL 168H (1941)

TWO-SPEED AXLE NOTE:—Optl. on all models. This axle is Columbia Two-speed type. See separate article for data on this type.

TYPE:—Hypoid gear, ¾ floating type with Torque Tube drive. Same design as used on corresponding 1940 models.

SERVICING:—Replacement Exchange Axles — Furnished in assemblies consisting of differential housing (axle housing center section) with pinion gear installed (set up for correct bearing adjustment and ring gear mesh) and mated ring gear. This assembly is Part No. 86H-4020 and can be used on 86H ('38), 96H ('39), 06H ('40) as well as on 1941 Models 16H and 168H.

OVERHAUL:—Limited to installation of new Differential Housing Assembly (see Exchange Axle data above) and reassembly of right and left axle housings. When assembling axle, note the following points:

Ring Gear Backlash—Should be .002-.004" and should be set at figure etched on the particular ring gear being used (ring and pinion gears mated and it is very important that these individual clearance figures be used for each set of gears).

Pinion Bearing Adjustment—Correctly set at factory and should not be disturbed in service. Bearing pre-load should be 18-20 in. lbs. (force required to turn pinion shaft with bearings properly adjusted). Use ABV-129 gauge to measure this setting.

Differential Gear & Ring Gear Backlash Adjustment—Controlled by gasket thickness between axle housing halves and differential housing. Normal gasket thickness for correct backlash and differential bearing adjustment is .005-.008" at each side of differential housing. Gasket furnished in three thicknesses as follows: .008-.010" (86H-4035-A), .004-.006" (86H-4035-B), .013-.018" (86H-4035-C). Vary thickness at left hand housing to adjust backlash (keep total thickness for both sides same to avoid disturbing differential bearing adjustment), vary thickness at right hand side to adjust differential bearings (do not change thickness on left hand side to avoid disturbing backlash).

NASH 4160 & 4180 HYPOID TYPE

Used On:

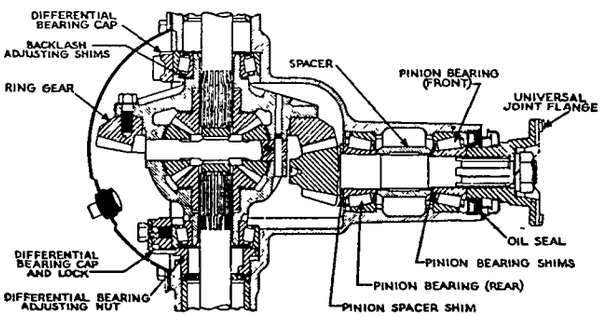
AMBASSADOR SIX, MODEL 4160 (1941)
AMBASSADOR EIGHT, MODEL 4180 (1941)

TYPE:—Hypoid gear, semi-floating type with Hotchkiss drive. Same design as used on corresponding 1940 models.

NOTE—Axles on all models similar except for size. May be identified by diameter of tubes (pressed and welded in center casting). Tubes are 2½" (4160), 3" (4180) in diameter.

SERVICING:—Gear Adjustment—Paint gears to check mesh. Backlash should be .005-.007". Adjusted by adding or removing shims located between shoulder on differential case and cone of left hand differential side bearing. See Pinion Setting and Differential Bearing Adjustment below.

Axle Shaft Replacement—To remove shaft with wheel and hub removed, take off nuts on bearing retainer (rear brake support plate), remove oil seal, retainer plate, bearing adjusting shims, then pull axle shaft and bearing assembly. When installing shaft, add or remove shims between retainer plate and axle housing flange to secure desired axle shaft endplay of .003-.006".



OVERHAUL:—Disassembly—With axle shafts out, remove rear housing cover, mark adjusting nut on right hand differential side bearing to insure replacing in same position, back adjusting nut off, remove bearing cap bolts and bearing caps, lift differential assembly out. To remove pinion, remove nut on end of pinion shaft, pull universal joint flange, press pinion out of housing toward rear. Remove pinion shaft oil seal, use special pullers to remove bearing cups from housing.

Pinion Bearing Assembly:—Bearing adjustment controlled by shims located on pinion shaft between spacer and forward bearing cone. When installing pinion, install correct washer and shim pack for correct pinion mesh (see Pinion Setting below) on shaft against pinion, install rear bearing cone and bearing spacer. Install sufficient shims on shaft in front of spacer to insure positive endplay of shaft when installed in housing, install front bearing cone, universal joint companion flange or special tool (splined sleeve) and tighten nut on shaft securely. Then check bearing adjustment as directed below. NOTE—Do not install oil seal until after bearing adjustment has been made.

Pinion Bearing Adjustment—Use dial indicator to check pinion shaft endplay with companion flange nut securely tightened (oscillate shaft in both di-

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rections while applying end pressure to insure bearings seated). Disassemble pinion shaft and remove shims from between spacer and front bearing cone equal to the observed endplay **plus .003"** to insure correct bearing pre-load or set (.003" tight).

Pinion Setting:—Pinion mesh controlled by washer or washer and shim pack installed on shaft between pinion and rear bearing cone. Use Pinion Setting Gauge SE-534-A to determine washer thickness for each pinion as follows: Make certain that rear bearing cup properly seated in housing, coat bearing with film of light oil, install bearing and bearing cone, roll bearing back and forth while applying pressure to insure bearing being seated. Install rectangular checking block on bearing cone, install gauge and make certain that end discs seated in differential bearing bores in housing (tap lightly with hammer to insure seating). Turn gauge micrometer until end of shaft just contacts ground surface of checking block while pinion bearing is being rotated under pressure. Subtract gauge reading from .408" which will give correct washer thickness for standard pinions (marked by figure =0 following the set number stamped on the end of the teeth). If pinion marked by + or — figure, subtract shims (if pinion marked +), add shims (if pinion marked —) equal in thousandths to the figure following this plus or minus mark. Install washer and shims equal to this final figure on the shaft between the pinion and the rear bearing cone

Pinion Adjusting Washer Note—Pinion Adjusting Washers furnished in six thicknesses as follows: .117", .118", .119" and .129", .130", .131". These washers can be used with not more than three .003" shims to make all necessary thicknesses from .117" to .140". CAUTION—Install washer with chamfered side toward pinion and shims (if used) between the washer and the bearing cone.

Pinion Setting without Gauge—If new pinion being installed and pinion setting gauge not available, note washer and shim thickness used for old pinion, secure standard washer thickness for this housing by adding (if pinion marked +), subtracting (if pinion marked —) shims equal to figure following this plus or minus mark on the old pinion, finally correct this standard washer thickness in accordance with new pinion marking as directed under Pinion Setting above.

Differential Gear & Bearing Assembly:—To dismantle differential gear assembly, drive out pin in differential pinion shaft, remove shaft, axle shaft thrust block, pinions, side gears and thrust washers. When reassembling, make certain that thrust washers installed in back of each side gear and pinion and that thrust block is installed on pinion shaft (this block transmits thrust from one shaft to the other).

Differential Bearing Adjustment:—With lock on right hand bearing adjusting nut removed, and bearing cap loosened so that adjusting nut can be turned, turn adjusting nut up until all bearing endplay is just removed and notch on nut is in line with lock on cap, then tighten adjusting nut two notches additional for correct bearing pre-load. Tighten bearing cap bolts and install adjusting nut lock.

Ring Gear Backlash Adjustment—Check backlash with dial indicator at several points around ring gear. If backlash not within limits of .005-.007", dismantle axle, remove left hand differential side bearing, add or remove shims on hub behind bearing (add shims to decrease backlash, remove shims to increase backlash), reassemble axle, readjust differential bearings.

NASH '600' HYPOID TYPE

Used On:

AMBASSADOR '600', MODEL 4140 (1941)

TYPE:—Hypoid gear, semi-floating type with Torque Tube Drive and coil springing. Axle is similar in design to that used on other Nash models except for Torque Tube and Propeller Shaft data as given below.

SERVICING & OVERHAUL:—This model disassembled and serviced in same manner as axles used on other Nash models after Torque Tube and Propeller Shaft have been removed and these units are serviced as directed below.

Torque Tube & Propeller Shaft Removal—With axle assembly removed from car, unscrew Trunnion Bracket from forward end of torque tube, remove rubber boot. Remove nuts from bolts holding truss rod clamp bracket and from truss rods, remove clamp bracket and truss rods (locating screw in upper half of bracket positions center bearing in torque tube). Take out bolts mounting torque tube on rear axle housing, remove torque tube, withdraw propeller shaft and center bearing assembly. NOTE —Universal joint (front) and sleeve (rear) are press fits on ends of propeller shaft (see propeller shaft data below).

Torque Tube & Propeller Shaft Assembly—Reverse disassembly directions given above. Make certain that nuts on both truss rods are drawn up uniformly and securely locked so that torque tube and axle are properly aligned and that locating screw in clamp bracket upper half enters hole in center bearing so that bearing is properly positioned in torque tube. Adjust trunnion bracket when axle installed in car as directed below.

CAUTION—Stamped steel slinger which is press fit on universal joint rear yoke must not interfere with shoulder on front face of trunnion bracket (slinger prevents dirt entering torque tube at this point but noise will result unless some clearance exists).

TORQUE TUBE TRUNNION BRACKET:—On front end of torque tube. Must be properly installed and adjusted before rear axle and torque tube assembly installed on car. Follow adjustment and installation instructions listed below. Propeller shaft center bearing must also be lubricated at 5000 mile intervals. See data following.

Trunnion Bracket Adjustment—Position trunnion bracket on torque tube (with assembly out of car) so that distance between front face of trunnion bracket and rear face of flange at rear end of torque tube is 70 15/16" (regular transmission), 63 7/16" (with overdrive), plus or minus 1/16". After bracket properly positioned, adjust clampscrew on underside of bracket to remove all excess clearance between threads on bracket and tube without setting up excessive friction. Bracket must be free to move on threaded tube. Lock clampscrew nut with cotter pin. Rubber boot must be installed behind bracket to protect threads on tube from road dirt. Threaded parts require no lubrication except at time of assembly. Lubricate these parts sparingly.

Trunnion Bracket Installation—After bracket adjusted as directed above, torque tube and rear axle assembly can be assembled to transmission as follows: Thread 2 special trunnion bracket studs (with tapered ends to rear) on trunnion bracket and lock with nuts and lock washers. Assemble plain stamped steel retainer, rubber cushion block (with small extension to front), steel retainer with pilot flange over extension on rubber block, on each stud. Install torque tube and rear axle assembly with trunnion bracket studs passing through holes in transmission (or overdrive) rear bearing retainer. Assemble steel retainer with pilot flange to rear, rubber block with extension to rear, and plain steel retainer on front end of studs. Tighten retainer nuts on studs until rubber cushions held under slight tension. Lock nuts with 'palnuts'.

Propeller Shaft Center Bearing Lubrication—Bearing must be lubricated every 5000 miles as follows: Take out locating screw on top side of upper clamp on torque tube at front end of truss rods, fill with light engine oil to overflowing in screw hole, replace screw.

NASH '600' REAR SUSPENSION

Used On:

AMBASSADOR '600', MODEL 4140 (1941)

TYPE:—Consists of special coil springs installed in pockets in frame cross-member at upper end and in spring seats bolted to axle housing by clamp bolts at lower end. Direct acting shock absorbers are installed within springs (clamped in spring seat at lower end, bolted in extension bracket on frame cross-member at upper end) and extend through holes in cross-member. A transverse radius rod is bolted to frame cross-member (right side), and to axle housing (left side) with rubber cushions at each end.

SERVICING:—No servicing operations required. See separate Shock Absorber article for shock absorber servicing data and spring data below.

SPRINGS:—Same spring used on right and left sides of car. Spring is Nash Part No. 3107067.

OLDSMOBILE REAR SUSPENSION

Used On:

SIX, MODELS 66, 76, 96 (1941)

EIGHT, MODELS 68, 78, 98 (1941)

TYPE:—Coil spring type with support arms. Design changed from type used on 1940 car models as follows:

Spring & Support Arm Axle Mounting—Mounting consists of an insulator bracket on the axle housing, insulators installed in upper and lower faces of bracket, insulator cups on outer ends of insulators, and spacer extending through entire assembly. This assembly is clamped between spring mounting plate (top) and support arm (bottom) by two bolts. Lower end of coil spring is clamped on this top spring mounting plate by the rear bolt (bolt threads into lower spring clamp).

Coil Springs—Spring are larger in diameter but shorter length than 1940 types.

Shock Absorbers—Shock absorbers now mounted on brake backing plates and linked to frame.

SERVICING:—Spring Removal—Disconnect brake hose at axle, disconnect propeller shaft at rear universal joint and remove, disconnect shock absorber arms from links. Remove upper spring bolt and axle housing rear insulator bolt (this bolt threads into lower spring clamp and anchors lower end of spring). Raise car to remove weight from spring, remove spring and upper insulator washer. CAUTION—Although rear springs can be removed by raising rear end of car until flexible brake connection is just taut (without disconnecting brake line), this method not recommended and brake line should be disconnected (bleed lines when re-connected).

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Spring Installation:—Spring must be installed with curled end of small diameter end coil at bottom (if both ends curled, spring may be installed either end up—some springs may have straight end which must be installed at top). Install spring with curled end of coil to rear and 1/16" to right of center-line through support arm. With spring in position, install insulator washer on top of spring and spring clamps in upper and lower end coils (lower clamp has grommet nut, upper clamp does not have nut which is located in frame side rail). Turn clamps so that they grip end coils snugly (clamps are cam shaped—assembly will be facilitated if clamps taped to spring). Line up holes in clamp and frame, lower car slightly to hold spring in place, install upper clamp bolt, thread rear insulator bolt up through insulator assembly and in to lower spring clamp, tighten both clamp bolts securely. CAUTION—See that spring clamps are seated snugly in springs and that spring does not ride on raised portion of mounting plate.

Axle Housing Insulators & Bolts:—See 'Spring & Support Arm Axle Mounting' description above for insulator assembly details. Upper and lower insulator halves are different sizes (upper half is longer) and must not be interchanged. Insulators are marked by words 'upper' and 'lower' molded in the rubber. Front axle housing insulator bolt is 5¾" long with right hand thread and should be installed with hexagon head at top. Rear bolt is 6" long with left hand thread and should be installed with hexagon head at bottom (bolt threads into lower spring clamp, no separate nut being used).

CAUTION—Both insulator bolts should be tightened uniformly. Do not tighten either bolt without tightening other bolt evenly.

Support Arms:—To remove support arms, proceed as directed for spring removal above (do not disturb spring upper clamp bolt), removing both axle housing insulator bolts, push lower end of coil spring out of the way and remove insulators, plates, and cups. Free forward end of support arm from frame and remove arm. Install arm in same manner.

Track Bar:—Mounted on rubber bushings at each end. To remove bar, remove nut on stud at axle end, pry forward on arm to loosen serrated bolt, disconnect bar from frame cross-member bracket, rotate plate on frame end of track bar and remove bar. Install track bar in same manner.

REAR SPRINGS:—Spring part number stamped on outside of one end coil (will not be visible when installed on car) and are paint marked for identification as follows:

Rear Spring Specifications

Car Model	Wire Diameter	Paint Mark
66,68 5 Pass.	.568"	Green & White
66,68 2 Pass.	.540"	Green & Orange
76,78,96,98 5 Pass.	.587"	Green & Yellow
76,78,96,98 2 Pass.	.580"	Green & Aluminum

OLDSMOBILE HYPOID TYPE

Used On:

SIX, MODELS 66, 76, 96 (1941)

EIGHT, MODELS 68, 78, 98 (1941)

AXLE IDENTIFICATION NOTE:—Ring and pinion gear ratio stamped on upper outer surface of differential carrier of all axles for identification purposes as follows: 41:10—4.1-1 Ratio, 43:10—4.3-1 Ratio, 41:9—4.55-1 Ratio, 39:10—3.9-1 Ratio, 41:12—3.42-1 Ratio, 40:11—3.63-1 Ratio. Refer to car model 'M' page for Std. and Optl. axle ratios on each model.

TYPE:—Hypoid gear, semi-floating type with Hotchkiss drive. Same design as used on corresponding 1940 car models.

SERVICING:—Gear Adjustment. Paint gears to check mesh. Backlash should be .004-.008". Adjusted by backing off one differential bearing adjusting nut and tightening opposite nut equally. See Pinion Setting and Differential Bearing Adjustment below.

Axle Replacement. Wheel mounting flange integral with axle shaft. To remove shafts, remove wheel (wheel nuts on left side of car have left hand threads), take out two bolts holding brake drum on axle shaft flanges, remove drums, take off nuts on 4 bolts holding backing plate on axle housing flange, remove static collector, pull axle shaft bearing retaining plate away from backing plate (be careful not to disturb backing plate which will damage brake lines), withdraw axle shaft and bearing assembly using puller J-942, replace one nut to hold backing plate in position.

Wheel Bearings & Oil Seal. Bearings are shielded type (lubricated at factory) and pressed on axle shaft against shoulder at wheel end of shaft. Remove bearings only when new bearings installed (see Bearing Collar Note below). To remove, use tool J-947-2 (to prevent bursting of race), and plate J-947-1 and press bearing off shaft in arbor press. Install new bearings in same manner using tool J-947-3 and plate J-947-1 to insure pressure being applied to inner race only. Before installing shaft, make certain that double feather edge of leather oil seal is in good condition or install new seal with oil seal installing tool J-1049 and coat outer rim of seal with Permatex or white lead to prevent oil leaks.

Bearing Collar Note—On all models, collar is installed on shaft behind bearing. Collar must be split with chisel before bearing removed. After new bearing installed, press new collar on shaft firmly against bearing with tapered end toward bearing.

Wheel Bearing Note—New wheel bearings have .008-.010" sideplay and should not be replaced unless sideplay exceed .015" or bearings are noticeably rough.

OVERHAUL:—Disassembly. Mark both differential bearing adjusting nuts and caps to insure correct reassembly, remove bearings caps and adjusting nuts, lift differential assembly out of carrier. Remove rear universal companion flange nut, use tool J-962, remove flange from shaft, press pinion shaft back through front ball bearing inner race and remove, remove and save shims installed on shaft directly back of this bearing. Do not remove snap ring on pinion shaft directly in front of pinion gear (this gear prevents rear bearing rollers from creeping on shaft). Remove rear bearing rollers (rollers cannot be removed singly on new bearings), use tool J-983 to pull outer race out of housing, take out 3 lockscrews in housing, remove locking sleeve, tap front bearing out.

Pinion Bearing Assembly:—Push front ball bearing into housing and tap lightly on outer race to seat bearing against shoulder in housing, insert bearing retainer sleeve (tapered end toward rear) and lock sleeve firmly in place against ball bearing race by turning up the three cone-pointed lockscrews evenly and securely and tightening lockscrew locknuts. Use tool J-940 to drive rear roller bearing outer race in place in carrier, coat the 14 bearing rollers with heavy grease and install in place in bearing race. Install correct shim thickness for each pinion against shoulder on pinion shaft (see Pinion Setting directions below), make certain that roller lock ring in place on pinion shaft at pinion end, install pinion in carrier guiding shaft through washer at forward end of carrier. Install companion flange, tighten flange nut (hold flange in vise). NOTE—Front ball bearing has slight 'pre-load' when new and should be replaced if any endplay noted. Pinion shaft should not be worn more than .0007" (compare with unworn shaft ahead of bearing). If any radial play noted at pinion when assembled, gears will not run quietly (replace roller bearing if shaft not worn).

Pinion Setting:—Standard shim thickness for each carrier indicated by marking on flange as follows: D5—.049", D4—.048", D3—.047", D2—.046", D1—.045", C—.044", S1—.043", S2—.042", S3—.041", S4—.040", S5—.039". 'D' indicates bearing shoulder deeper than standard, 'C' on center or standard, 'S' shallower than standard. These figures correct for standard or unmarked pinions. When pinion marked by plus or minus figure on face, shims should be added (+ sign), subtracted (— sign) from this standard shim thickness equal (in thousandths) to the figure following this plus or minus sign. Pinions which are unmarked do not require any correction to be made to the shim thickness as indicated by the carrier marking. Shims furnished in four sizes and colored for identification as listed below (use combinations of shims for all required thicknesses).

Shim Thickness	Part No.	Color
.012"	499528	Plain
.014"	503063	Blue
.015"	499529	Copper
.018"	499530	Plain

Pinion Marking Note—Standard pinions (which require no shim correction) are unmarked.

Differential Gear & Bearing Assembly:—To remove the differential side bearings, use tool HM-986 installed so that pressure applied to bearing cone only. Use J-941 driver to install bearings. To dismantle differential gears and pinions, take out pinion shaft lockscrew and shaft, revolve pinions until aligned with openings in case, withdraw pinions, remove side gears and thrust washers. Install in same manner (thrust washers may be installed with either face toward gears).

Differential Bearing Adjustment:—Adjusting nuts and bearing caps should be marked before disassembly to insure correct replacement. To adjust bearings, loosen each bearing cap bolt one-half turn, remove locks, back off right hand adjusting nut until bearing outer race stops turning with nut, turn nut up until race begins to turn, tighten 3 notches, then repeat adjustment and turn nut up 3-4 notches from point where bearing race begins to turn with nut, tighten bearing cap bolts and replace locks.

Ring Gear Backlash Setting—When installing differential assembly, back off right hand adjusting nut four turns, then turn left hand adjusting nut up until all backlash removed from between ring and pinion gears, finally back off left hand adjusting nut exactly four notches. Adjust differential bearings by turning right hand adjusting nut as directed above. This procedure should give correct backlash of .004-.008".

PACKARD HYPOID TYPE

Used On:

CLIPPER, MODEL 1951 (1941)
'110' SIX, MODEL 1900 (1941)
'120' EIGHT, MODELS 1901, 1A (1941)
'160' SUPER 8, MODELS 1903, 3A,4,5 (1941)
'180' CUSTOM SUPER 8, 1906,7,8 (1941)

TYPE:—Hypoid type. Same design as used on corresponding 1940 car models. Ring Gear Support Roller used on Super Eight '160' and '180' models only.

SERVICING:—Gear Adjustment—Backlash should be .003-.005". Adjusted by backing off one differential side bearing adjusting nut and tightening opposite nut equally. See Differential Bearing Adjustment below. Pinion position not adjustable (for gear mesh adjustment).

Axle Shaft Replacement—To remove axle shaft, remove wheel and hub, disconnect brake lines, remove backing plate and wheel bearing adjusting shims, pull axle and bearing assembly. When installing axle shaft, select shim thickness between housing flange and backing plate on each side so that total axle shaft endplay is .004-.007".

OVERHAUL:—Pinion Bearing Adjustment—Pinion bearing pre-load controlled by compressible spacer on pinion shaft between bearings and adjusted by tightening universal joint companion flange nut. Bearing pre-load must be adjusted whenever this nut is loosened or disturbed. To adjust, tighten nut until spacer is felt to buckle, then check pull required to rotate pinion shaft. If less than 25 inch pounds (5 lbs. pull on end of 5" lever arm), tighten nut further until pre-load is 25-30 inch pounds. Special scale, Packard ST-5087, may be used to check this pre-load. Adjust only with both wheels jacked up or differential carrier out to eliminate drag on pinion shaft.

IMPORTANT NOTE—If nut is tightened so that pinion bearing pre-load exceeds 30 in. lbs. when making this adjustment, install new sleeve and readjust as directed above. Do not back off nut to secure correct adjustment.

Pinion Assembly:—Pinion position not adjustable. Pinion mounted on taper roller bearings with bearing cups seated directly against shoulders in carrier bore and compressible spacer on pinion shaft between bearing cones. Bearing pre-load must be adjusted by compressing or "buckling" spacer whenever universal joint companion flange nut is loosened (see above).

Differential Gear Assembly:—Differential side gear endplay should be .002-.005". Adjust by installing thrust washer of correct thickness between side gear and differential case. These washers furnished in various thicknesses as follows: .031" (No. 330797), .036" (324583), .041" (324584), .046" (324585). When assembling differential gears, make certain that thrust block installed between inner ends of axle shafts (this block transmits thrust from one shaft to the other).

Differential Bearing Adjustment:—Bearings should be pre-loaded so that "spread" of bearing support pedestals of .010-.012" is secured. To make this adjustment, free adjusting nut locks. Loosen bearing cap nuts slightly to free adjusting nuts, make certain that there is some backlash between ring gear and pinion and clearance between ring gear and support roller (Super 8 only). Then back off right hand bearing adjusting nut until ring gear and differential assembly is loose in its bearings. Use accurate caliper and set caliper so that it will just slide over differential carrier with one leg resting on machined boss (adjusting nut lock pin boss) on each side of carrier **with .010" feeler between boss and caliper on one side.** Remove feeler, tighten right hand adjusting nut until caliper will just slide in place with the feeler removed (pedestals will have 'spread' this .010"). Correct pedestal spread should be .010-.012". Then adjust ring gear backlash and support roller clearance (Super 8 only).

Ring Gear Backlash Adjustment—After adjusting differential bearings (above), check ring gear backlash with dial indicator. If not within limits of .003-.005", adjust by backing off one differential bearing adjusting nut and tightening opposite nut exactly the same number of notches (to avoid changing bearing adjustment). Back off right hand nut to decrease backlash, left hand nut to increase backlash, use extreme care to tighten opposite nut exactly same amount. Then tighten bearing cap nuts and install adjusting nut locks.

Support Roller Adjustment (Super 8 Models):—Clearance between roller and back face of ring gear should be .005". To adjust, loosen lockscrew on roller stud sector plate, turn roller shaft (apply wrench to square end of shaft) until correct clearance secured, tighten sector plate lockscrew securely.

PACKARD REAR SUSPENSION

Used On:

'120' EIGHT, MODELS 1901, 1A (1941)
'160' SUPER 8, MODELS 1903, 3A,4,5 (1941)
'180' CUSTOM SUPER 8, MODELS 1906,7,8 (1941)

TYPE:—Consists of a special Lateral Stabilizer and Fifth Shock Absorber assembly used in conjunction with Direct Acting Rear Shock Absorbers. With exception of these new directing acting shock absorbers, design is same as used on corresponding 1940 car models (direct acting shock absorbers used on some 1940 models only).

SERVICING:—Shock Absorber Refilling—See separate articles on Delco, Monroe, and Houde (Fifth Shock Absorber) for capacity and filling data.

Fifth Shock Absorber Adjustment:—Check adjustment by mounting shock absorber in vise with arm pointing up, attach 50 lb. weight to bolt hole in end of arm, check time required for arm to make complete stroke (from extreme upper to extreme lower position with weight attached). Time should be 18 seconds minimum, 24 seconds maximum at room temperature. If outside these limits, remove plug on end of shaft (at arm), turn adjusting needle valve in or out as required and recheck performance. Standard setting of valve is ¼ turn out from inner seated position. Tighten packing nut to correct leakage at valve.

Rear Springs:—Rear springs are conventional leaf type but special interleaf inserts (3 different types used) are inserted in pockets at ends of leaves. Do not lubricate springs. When replacing springs, make certain that same insert combinations are used (different on various models).

PONTIAC HYPOID TYPE

Used On:

SIX, MODELS 41-24, 25, 26 (1941)
EIGHT, MODELS 41-27, 28, 29 (1941)

AXLE IDENTIFICATION NOTE:—Rear Axles and Propeller Shaft marked for identification by paint mark on end of right hand axle shaft (Rear Axles), band of paint at rear end (Propeller Shaft) as follows:

Car Model	Rear Axle	Color Marks Propeller Shaft
24,26 Std.	White	Yellow
25 Std.	Green	Green
27 Std.	Green	Red
28,29 Std.	White	Blue
3.9-1 Econ.(all)	Red	
4.55-1 Hvy.Duty(all)	Yellow	

TYPE:—Hypoid gear, semi-floating type with Hotchkiss drive. Same design as used on corresponding 1940 car models.

SERVICING:—Gear Adjustment. Paint gears to check mesh. Make certain that pinion flange nut, ring gear mounting screws, and pinion thrust bearing wedging screws are tight and that differential bearing adjustment is correct before checking gears. Backlash .003-.012". Adjust by backing off one differential bearing adjusting nut and tighten opposite nut equally. See Pinion Setting and Differential Bearing Adjustment below.

Axle Shaft Replacement. Wheel mounting flange integral with axle shaft. Bearings are special shielded type (lubricated at factory) pressed on axle shaft and held by retainer collar pressed on shaft. To remove shaft, remove wheel and brake drum, remove nuts from four bolts holding backing plate on housing, withdraw axle shaft (use puller J-942) taking care not to drag shaft on oil seal or to dislodge backing plate which will damage brake line. New bearings must be installed whenever removed from shaft. To remove bearings, use chisel to split retainer, press bearing off using special tool J-947 on outer race (pressure exerted on outer race which may burst if tool not used). Use same tool to install new bearing (pressure on inner race only) and retainer, pressing bearing on shaft against shoulder. Install shaft with left hand wheel studs on left hand side of car, shaft with right hand studs on right side of car. To renew oil seal, use tool J-943 to remove seal assembly, lubricate new seal with oil and coat outside rim of retainer with Permatex, use tool J-1049 to install seal assembly.
NOTE—If edge of brake drum flange is not flush with surface of shield on backing plate when installed, use sufficient gaskets, Part No. 499776 or 499930, installed between drum and axle flange for correct alignment.

Rear Axle Oil Seal Leak Correction—Oil may leak out around outer edge of axle shaft seal (between seal and bore of axle housing). To correct this trouble and to prevent oil leaking at this point in service, always make certain that Permatex, Permagasket or other sealing compound is spread in bore of housing before installing oil seal. Also use this same sealing material on both sides of rear brake oil deflector gasket when gasket is installed.

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OVERHAUL:—Axle Disassembly. Mark differential bearing caps and adjusting nuts (to insure correct replacement), remove bearing caps and adjusting nuts, lift out ring gear and differential assembly. Remove universal joint flange nut, use puller J-962 and remove flange. Press pinion out of carrier taking care not to damage pinion shaft threads or oil washer. No further disassembly required if pinion setting only being adjusted (see Pinion setting below). Loosen locknuts and remove three wedging screws on outside of housing, press bearings and locking sleeve out of housing using tool J-964.

Pinion Bearing Assembly:—Double row ball bearing should have no endplay (replace if endplay is perceptible). Roller bearing may have moderate amount of radial clearance on pinion shaft (no inner race). Bearings are drive fit in carrier housing. To install, drive ball bearing in against shoulder in housing (use tool J-939), install locking sleeve against bearing, back off locknuts and install locking sleeve wedge screws (oil screws before installing, tighten each screw one-half turn at a time, finish with full arm swing on 6-8" wrench), tighten locknuts, drive rear roller bearing in against shoulder in case (use tool J-940). Install rear bearing spacer on pinion shaft, select correct shim thickness for each carrier and pinion (See Pinion Setting below), install shims on pinion shaft, press pinion in carrier through bearings being careful that no pressure exerted on pinion teeth and that bearing rollers are not wedged against shaft. Install universal joint flange (at right angles to cotter pin hole), tighten pinion nut securely.

Pinion Setting:—Standard shim thickness for each carrier (indicated by mark on carrier flange) is as follows: D5—.049", D4—.048", D3—.047", D2—.046", D1—.045", 0—.044", S1—.043", S2—.042", S3—.041", S4—.040", S5—.039" ('D' indicates carrier bore deeper, 'S' shallower, than standard '0' dimension). To this standard shim thickness (which is correct for all unmarked or standard pinions), add additional shims (when pinion marked +), subtract shims (when pinion marked —) equal to amount of figure following this plus or minus mark on pinion (figure indicates shim thickness in thousandths). This total shim thickness will position pinion for correct mesh with ring gear. Shims furnished in four sizes and colored for identification as listed below (use combinations of these shims for all required thicknesses).

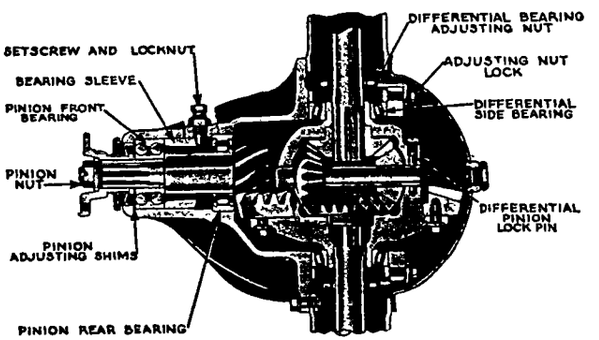
Shim Thickness	Part No.	Color
.012"	499528	Plain
.014"	503063	Blue
.015"	499529	Copper
.018"	499530	Plain

NOTE—Unmarked pinions are standard and indicate no correction need be made to indicated carrier flange shim thickness.

Differential Gear & Bearing Assembly:—To disassemble, take out locking screw (in case at end of pinion shaft), withdraw shaft, take out differential gears, thrust washers and pinions. Shaft must be removed before 'mountain-ratio' ring gear can be removed. Differential bearing inner race is .0012" press fit on hub (if less than this amount, replace case or copper-plate hub). To remove bearing, use puller J-986 (exert pressure on inner race only), install in same manner using tool J-941. Replace bearings if rough or pitted.

Differential Bearing Adjustment:—Remove adjusting nut locks, back off bearing cap nuts just enough to relieve strain so that nuts can be turned, mark nut and cap to establish original position, back off right hand nut slowly until bearing race just stops turning with nut (amount nut turned indicates 'notches tight' of nut. Turn adjusting screw in until race just starts to turn with nut, then tighten nut additional 1½ (minimum), 2½ (maximum) notches for correct bearing pre-load. Tighten bearing cap nuts securely and replace locks.

Ring Gear Backlash Adjustment—When adjusting differential bearings (above), if ring gear has slight backlash (.005"), equalize differential bearing adjustment by tightening each adjusting nut one notch (do not make entire adjustment at right hand nut). Backlash can be adjusted without disturbing differential bearing adjustment by backing off one adjusting nut and tightening opposite nut exactly same number of notches. Recheck bearing adjustment after adjusting backlash.



Ring Gear Replacement:—Replace ring and pinion gears as matched sets. Ring gear mounted on differential case by special heat treated alloy steel capscrews (do not use ordinary screws). Use new heavy type lockwasher on each screw each time screws are removed.

WILLYS HYPOID TYPE

Used On:

AMERICAR & PLAINSMAN, MODEL 441 (1941)

COMMERCIAL NOTE:—Rear axle on Pick-up and Panel Delivery is Spicer (Salisbury) Model 21-1. See Spicer Rear Axle article for data on this model.

TYPE:—Hypoid gear, semi-floating type with Hotchkiss drive. Pinion is integral with shaft and is mounted on taper roller bearings seated directly in housing with pinion bearing adjusting shims between front bearing cone and spacer, pinion adjusting shims in housing in front of rear bearing cup. Differential assembly is mounted on taper roller bearings with bearing and backlash adjusting shims installed between bearing cups and housing at each side.

SERVICING:—Gear Adjustment—Paint gears to check mesh. Backlash should be .006-.008". Adjusted by shifting shims from one differential bearing cup to the other (total shim thickness must be kept constant to avoid disturbing differential bearing adjustment). See Pinion Setting and Differential Bearing Adjustment directions below.

Axle Shaft Removal—Remove rear wheels, take off axle shaft nut and washer, pull hub and brake drum assembly (use puller), remove nuts on brake backing plate bolts, remove oil deflector, oil seal, bearing retainer, and bearing adjusting shims (Save shims for re-installation). Use puller to remove axle shaft and bearing assembly using extreme care not to disturb brake backing plate which would damage brake lines (or disconnect brake line and remove backing plate—if line disconnected, bleed brake lines when re-connected). Use puller to remove bearing from shaft.

Wheel Bearing Adjustment — When installing axle shaft, select shim thickness for installation between backing plate and bearing retainer so that axle shaft endplay is .004-.006". Wheel bearings designed to take thrust in one direction (transmitted through spacer on differential pinion shaft to opposite shaft in other direction).

OVERHAUL:—Disassembly—Remove differential housing cover, remove differential bearing caps, remove shims on right hand side of differential assembly first, then left hand shims (keep shims separate and install same shim pack at each point when reassembling axle). Take off nut and remove rear universal joint companion flange, use brass drift and drive pinion out of housing toward rear (rear bearing cone, rollers and bearing spacer will come out with shaft). Drive front bearing cup, rollers, and oil seal out toward front as an assembly. Drive rear bearing cup out toward rear in same manner.

Pinion Bearing Adjustment:—Bearing pre-load controlled by shims installed between front pinion bearing cone and bearing spacer. When installing pinion, install same shim thickness at this point as removed when old pinion disassembled, install universal joint companion flange, tighten pinion shaft nut securely and check bearing adjustment. Adjust by adding or removing shims furnished .004", .010", .030" thick.

Pinion Setting:—Pinion position controlled by shims installed on pinion shaft between pinion and rear bearing cone. Install same shim thickness as removed from old pinion at this point when installing pinion, check mesh. Add shims to move pinion in toward ring gear, remove shims to move pinion out away from ring gear. Shims furnished .004", .010", .030" thick.

Differential Bearing Adjustment:—Shims located between bearing cups and housing on either side. Furnished .180", .184", .188", .192", .196" thick. Select shims for correct bearing adjustment. When removing differential assembly, take off bearing caps, remove shims on right hand side first, install same shim thickness when reassembling.

Ring Gear Backlash Adjustment. Transfer shims from behind left hand differential bearing to right hand bearing to increase backlash, or from right to left to decrease backlash. Total shim thickness must not be changed to avoid disturbing differential bearing adjustment.

DELCO SINGLE ACTING TYPE

Car Model	Delco Model Number Front	Rear
Chevrolet AK,AJ ½ Ton	1430-CA,DA	1430-LA,MA
Chevrolet AL,AN ¾ Ton	1430-CA,DA	1431-X,Y
Crosley CB41	1201-G,H	1201-J,K

TYPE:—Single acting, hydraulic type. Same design as used on corresponding 1940 models.

SERVICING:—Disassembly. Use special fixture to clamp shock absorber on bench (clamping cylinder in vise will cause piston to bind). Take out relief valve plug, relief valve. Remove end cover screws, take off cover and gasket. Rotate arm, remove piston spring and intake valve. Do not remove shock absorber arm or shaft, replace shock absorber if bearing wear excessive or if packing washers worn so oil leaks around shaft (caused by operation with low oil level). Intake valve or intake and relief valve assembly can be removed from open end of piston after piston and spring have been separated.

Assembly. Use new gasket under cover and new lead washer under filler and relief valve plugs. Tighten cover screws securely to prevent leaks.

Filling. Remove filler plug, fill reservoir to level of plug hole with genuine Shock Insulating Fluid, replace plug, work arm up and down vigorously to work oil into cylinder, then remove plug and adjust fluid level so that it is level with lower edge of filler plug hole.

ADJUSTMENT:—Performance can be changed only by changing valves. Standard valve calibrations are shown in table below.

Car Model	Rebound Relief Valves Front	Rear
Chevrolet AJ, AK, AL, AN	4CG	3CG
Crosley	2D	1C

IMPORTANT NOTE—Shock Absorbers on both sides of car must have same valve calibration (Right & Left Front same, Right & Left Rear same).

DELCO PARALLEL CYLINDER TYPE

Car Model	Delco Model Number Front	Rear
Buick 40,50,60,70 (1941)	See Note	2105-C,D
Chevrolet AG, AH (1941)	2200-A,B	2100-A,B
Oldsmobile 66,68 (1941)	See Note	2105-G,H
Oldsmobile 76,78,96,98 (1941)	See Note	2105-E,F

NOTE:—Buick, Oldsmobile Front Shock Absorbers—Front shock absorbers on these models are Delco Double Acting Type (part of Front Suspension). See separate article (following) for data on this type.

SPECIAL SERVICE NOTES:—Chevrolet Valve Change to correct noise—If front shock absorbers on first cars develop 'crunching' noise, new type Compression Valve, Part No. 1069124, should be installed on both front shock absorbers. This new valve used in production on later cars.

NOTE—Valve is same calibration and marked in same manner as preceding valve but may be identified by fact that spring top coil is wound close to valve stem body.

CAUTION—New valves should be installed in both front shock absorbers at same time even though noise correction being made for one shock absorber only.

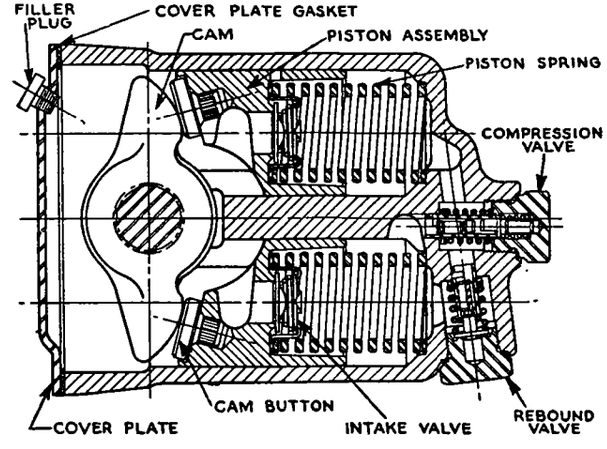
Chevrolet Valve Change to correct excessive bumping—Passenger cars operating on unusually rough roads or in Oil Field work may have excessive bumping in front end. To correct this condition heavy duty front shock absorber valves may be installed to slightly stiffen front end. Valves are as follows:

	Marking	Part Number
Compression Valve	0F	5334612
Rebound Valve	3F	1069146

NOTE—Lower control arm rubber bumpers should be checked to make certain that they are in place. Heavy duty front springs are available for correcting above condition where shock absorber valve changes above fail to correct bumping. Refer to Mechanical Equipment Index for Chevrolet Front Suspension article for spring data.

TYPE:—Double acting, parallel cylinder type with end-to-end discharge and plug type compression and rebound valves.

REFILLING:—Fluid level in shock absorber should be checked twice yearly and level maintained at bottom of filler plug hole. When adding fluid, move car up and down several times to displace all air in cylinder. When filling to correct poor performance complaints, disconnect shock absorber link and move arm through full stroke several times, then recheck fluid level. Use only Delco Shock Absorber fluid.



SERVICING:—No service operations possible other than tightening valve and filler plugs and tightening cover or replacing cover gasket to stop leaks. Pistons, springs, and intake check valve assemblies cannot be removed or serviced.

ADJUSTMENT:—Standard valve calibration for all models shown in table below. Valves can be changed for special operating conditions, if necessary, by removing valve plug and taking out valve assembly. Make certain that valve plugs are securely tightened to prevent leaks. Valve calibration is stamped on valve for identification.

Car Model	Compression & Rebound Valves Front Compr.	Reb'd.	Rear Compr.	Reb'd.
Buick 40, 50, 60, 70	2D	2	5J	
Chevrolet AG, AH	Ad-.5	1.5D	D-5	.70J
Oldsmobile (all)		.40E	2	.80M

IMPORTANT SERVICE NOTE—Shock absorbers on both sides of car must have same valve calibration (Right & Left Front same, Right & Left Rear same).

DELCO DOUBLE ACTING TYPE

Car Model	Delco Model Numbers Front	Rear
Buick 40,40A,50,60,70 ('41)	1948-A	See Note
Buick 90 (1941)	1948-A	1757-A,B
Cadillac 60S,61,62,63 ('41)	1946-G,H	1754-N,P
Cadillac 67 (1941)	1946-G,H	2008-C,D
Cadillac 75 (1941)	1946-G,H	2007-N,P
Cadillac 62,75 ('41) Comm'l.	1946-G,H	1751-V,W
Chevrolet AJ,AK ('41) Optl.	1731-C,D	1731-T,U
Chevrolet AL,AN ('41) Optl.	1731-C,D	1722-C,D
	1731-C,D	1722-E,F
Chevrolet YR,S,T ('41) Optl.	1731-C,D	2000-V,W
Chevrolet YU,V,W ('41) Optl.	1730-C,D	2000-V,W
Chevrolet Spec. ('41)	1721-V,W	2004-C,D
Oldsmobile 66,76,96 ('41)	1947-C,D	See Note
Oldsmobile 68,78,98 ('41)	1947-C,D	See Note
Packard Clipper (1941)	1946-J,K	See Note
Packard All Others ('41)	1966-C,D	See Note
Pontiac 6 & 8 (1941)	1947-C,D	See Note
Pontiac 41-25,27 Exp. ('41)	1947-C,D	1754-R,S
Pontiac Others Exp. ('41)	1947-C,D	1754-T,U

NOTES:—Buick 40, 50, 60, 70—Front Shock Absorber interchangeable from right to left side of car (single model used). Rear Shock Absorbers on these models are Delco Parallel Cylinder type (see separate article for data).

Buick 90—Front shock absorber same as other Buick models (see note above). Rear shock absorber is double acting type for which data is given below.

Oldsmobile—Rear shock absorbers are Parallel Cylinder type. See preceding article for data on this type.

Packard—All models have Delco or Monroe Direct Acting Type (rear) shock absorbers. 'Fifth' Shock Absorber (lateral stabilizer control) is Houde (Houdaille) double acting type. See separate articles for data on these types.

Pontiac Models—Rear Shock Absorbers are Delco Direct Acting type (see separate article for data).

TYPE:—Same design as previous Delco double-acting opposed-piston types with valve arrangement and fluid flow as follows:

Types 1721, 1722, 1730, 1731, 2000, 2004—Center discharge type with outside rebound valve (rebound valve is plug type installed in tapped hole in housing). Compression valve is combined with intake valve and located in compression piston head. Valve in rebound piston head is simple intake valve.

Types 1946, 1957, 1966, 2007, 2008—End-to-end discharge type with outside compression and rebound valves (both valves are plug type and installed in tapped holes in housing). Spring-loaded intake check valve located in piston housing. Types used on front end of car are combined with Independent Suspension (shock absorbers have double arms which form upper control arms of suspension system).

Types 1947, 1948—Center discharge type with compression and rebound valves combined with intake valves in piston heads. These shock absorbers are combined with Independent Suspension systems (shock absorbers have double arms which form upper control arms of suspension system).

REFILLING:—Remove filler plug on side or top of shock absorber body, use genuine shock absorber fluid to fill reservoir to level of filler plug hole, replace plug, move car up and down several times to expel air from shock absorber cylinders, remove filler plug and add additional fluid (if required to

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bring level up to plug hole). Install filler plug and tighten securely.

NOTE—When filling shock absorber after servicing, or if fluid level low, or if unsatisfactory performance being corected, disconnect shock absorber link and work shock absorber arm up and down to insure all air being expelled from cylinders.

SERVICING:—Disassembly. Use special fixture to clamp shock absorber on bench (do not clamp cylinder in vise). Use special wrench to remove end cap at each end of cylinder. Remove retainer ring or snap ring which locks valve assembly in piston head, remove valve assemblies. On types with compression, rebound, or control valves mounted under plugs on side of case, unscrew plugs, remove valve assemblies. When installing valve assemblies, use special tool to compress spring while snap ring installed. Make certain that snap ring installed with open end out (to facilitate snap ring removal).

Assembly—Use new gasket under end caps, apply small amount of Lubriplate or soft soap between end cap and end plate, and between end plate and gasket to prevent damage to gasket when end cap tightened, tighten end cap securely.

NOTE—Shock absorber can be filled with fluid after one end cap installed by mounting shock absorber so that open end is up and filling with fluid while arm is being worked to expel air. Always check fluid level by removing filler plug after assembly completed and with shock absorber in same position as when mounted on car.

ADJUSTMENT:—No adjustment provided other than changing control valves. Standard valve calibration for all models is shown in table below.

Std. Compression & Rebound Valves

Car Model	Front Compr.	Front Reb'd.	Rear Compr.	Rear Reb'd.
Buick 40,50,60,70	1.25FX	1.25FX		
Buick 40A	1.5FX	1.5FX		
Buick 90	1.5C	1.5C	1.5C	.40J
Cad. 60S,61,62,63	2D1	2.5E	1n1	1T
Cadillac 67,75	2Ed1	.90G	2Ad1	1H
Cadillac 62,75 Com.	2Ed1	.90G	2Ad1	1.75T
Chevrolet AJ,AK①	G2	2J	G2	2G
Chevrolet AJ,AK②	G2	2R	G2	2R
Chevrolet AL,AN①	G2	2J	GO	1J
Chevrolet AL,AN②	G2	2R	GO	1R
Chevrolet YR,S,T①	G2	2J	G2	2E
Chevrolet YR,S,T②	G2	2R	G2	2L
Chevrolet YU,V,W①	G2	2J	G2	2E
Chevrolet YU,V,W②	G2	2R	G2	2L
Chevrolet Spec.①	G2	2J	G2	2E
Chevrolet Spec. ②	G2	2R	G2	2J
Oldsmobile 66,68	3C	4H		
Oldsmobile 76,96	2C	3H		
Oldsmobile 78,98	2.5C	3H		
Packard 1900,1	2A1	3.5A5		
Packard 1901A	1.5B1	2E5		
Packard 1903,6	1.75A3	3.5B5		
Packard 1903A	3Ad5	3E5		
Packard 1904,7	2A3	3B5		
Packard 1903,4,6,7③	1.75A3	3.5B5		
Packard 1905,8	2Aa3	3Bd5		
Packard 1905,8 Exp.	3Ad3	2C5		
Packard 1951	3B2	3C		
Pontiac (All)	4C	3F		
Pontiac (All) Exp.	4C	3F	1DX	1L

①—First Cars. ②—Later Cars. ③—Export Cars.

IMPORTANT SERVICE NOTE — Shock Absorbers on both sides of car must have same valve calibration (right&left front same. Right&left rear same).

DELCO DIRECT ACTING TYPE

Car Model	Delco Model Numbers Front	Rear
Chrysler C28,30,33 ('41) Exp.	1000-C	1001-T
Chrysler C28 (1941)①	1000-C	1001-W
DeSoto S8 (1941)	1000-C	1001-T
Dodge D19 (1941)	1000-C	1001-T
Dodge D19 (1941)②	1000-C	1001-W
Graham 109, 113 (1941)		
Hudson 12 (1941)③	1007-C	1008-S
Hudson 14,15,17 ('41)③	1007-C	1008-S
Nash 4140 ('41) Sedans	1026-N	1023-BB
Nash 4142,3,5 ('41)	1026-N	1023-Z
Nash 4160, 80 ('41)	1016-B	1023-BB
Packard 1901,1A,3A ('41)		1021-V
Packard 1904,5,7,8 ('41)		1021-V
Plymouth P11,P12 (1941)	1000-C	1001-T
Pontiac—All Models (1941)		1024-V

①—Cars with 18" wheels.
②—Cars with 20" wheels.
③—Except Coupes which have Monroe equipment.

NOTE:—Chrysler, DeSoto, Dodge, Plymouth Models—Delco Direct Acting Adjustable Shock Absorbers are used as Export equipment on these models. Monroe Direct Acting Shock Absorbers are used on Chrysler C28 and C30 as standard equipment. See separate articles for data on these types.

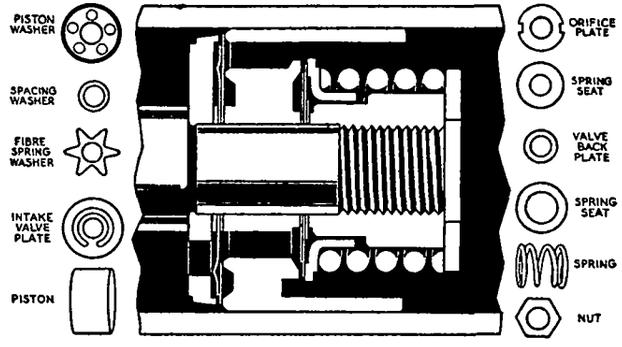
Hudson—Monroe Direct Acting Shock Absorbers are used on Coupes and on other Hudson models. See separate article for data on this type.

Packard—Front Shock Absorbers are Delco Double Acting type (part of Independent Suspension). Rear Shock Absorbers on other Packard models are Monroe Direct Acting type. See separate articles for data.

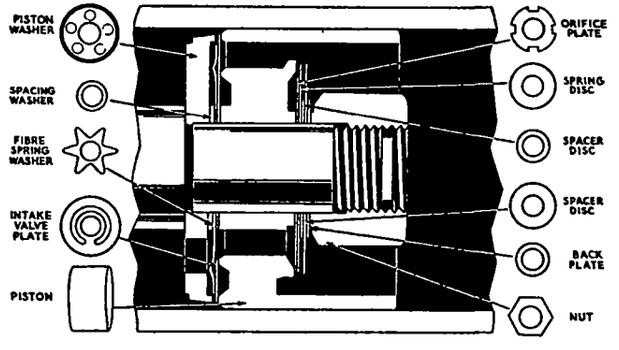
Pontiac—Front Shock Absorbers are Delco double acting type (part of front suspension assembly). See separate article for data on this type.

TYPE:—Double acting, three-tube, piston type similar to types used on preceding 1940 car models in that piston rod diameter is ½" and seal can be replaced (requires new service tools). NOTE—These models do not have filler plugs and must be disassembled for refilling (see Refilling directions following).

REFILLING:—Shock absorbers must be removed from car and disassembled as follows: Clamp lower eye in vise with shock absorber vertical (use special two-piece fixture #730 to hold bayonet end types—do not clamp bayonet end or shock absorber tube in vise). Pull shock absorber out to fully extended position, insert prongs of special wrench through holes in dust cover tube so as to engage slots in top guide (at upper end of reservoir tube—use care not to mar piston rod), unscrew guide, lift entire top assembly off, remove wrench. Remove lower end assembly (reservoir tube) from vise and pour out old fluid. Tap inlet and compression valve assembly out of lower end of pressure tube (top assembly), pull pressure tube out of dust tube and piston rod assembly so as to remove all old fluid from cylinder. Clamp top eye of shock absorber in vise with top assembly vertical and pressure tube fully extended. Measure exact correct amount of new fluid (see Fluid Capacity data below) and pour fluid into pressure tube until it is filled within ¼" of top, pour remainder of fluid into reservoir tube before it is installed. Install inlet and compression valve assembly in end of pressure tube. Clamp reservoir tube in vise, install new rod guide retainer gasket in top of reservoir tube (soak gasket in fluid and see that it seats properly in upper end of tube), install top assembly and turn in clockwise direction to engage threads on guide in reservoir tube, then extend shock absorber fully and use special wrench to tighten rod guide securely.



Types 1000, 1001, 1024



Types 1007,8,16,21,23,26

Fluid Capacity:—Fluid capacity differs for each type shock absorber and correct amount can be determined by suffix letter of model number or collapsed length as explained below.

Model Suffix Letter—Letter following model number—1000-C—indicates capacity as shown in table below. NOTE—Do not confuse this letter with valve calibration lettering which is also stamped on outer dust tube of shock absorber.

Collapsed Length—Fluid capacity may also be determined by measuring length with shock absorber fully collapsed. On 'Eye End' types, measure from center of eye on each end (on eye end types with one bayonet end, measure from center of eye to base of bayonet stem on opposite end). On 'Bayonet End' types, measure from base of bayonet stem on each end.

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Fluid Capacity

Model Letter	Collapsed Length Eye End	Bayonet End	Capacity Ozs.	CCs.
A	8 3/16"	7¼"	3½	102
B	8 7/16	7½	3⅝	107
C	8 11/16	7¾	3¾	112
D	8 15/16	8	4	117
E	9 3/16	8¼	4⅛	122
F	9 7/16	8½	4¼	127
G	9 11/16	8¾	4½	133
H	9 15/16	9	4⅝	138
J	10 3/16	9¼	4⅞	143
K	10 7/16	9½	5	148
L	10 11/16	9¾	5⅛	153
M	10 15/16	10	5⅜	158
N	11 3/16	10¼	5½	163
P	11 7/16	10½	5⅝	168
Q	11 11/16	10¾	5⅞	173
R	11 15/16	11	6	178
S	12 3/16	11 1/16	6¼	183
T	12 7/16	11½	6⅜	188
U	12 11/16	11¾	6½	194
V	12 15/16	12	6¾	199
W	13 3/16	12¼	7	204
X	13 7/16	12½	7⅛	209
Y	13 11/16	12¾	7¼	214
Z	13 15/16	13	7⅜	219
AA	14 3/16	13¼	7½	224
BB	14 7/16	13½	7¾	229
CC	14 11/16	13¾	8	234
DD	14 15/16	14	8⅛	239
EE	15 3/16	14¼	8¼	244
FF	15 7/16	14½	8⅜	249

SERVICING:—**Disassembly**—Remove top assembly (outer tubes, piston rod, and piston) as directed under Refilling (above). Unscrew piston rod nut (nut is staked in place), remove piston and valve parts (mark piston to insure replacement in same position on piston rod, note position of valve parts to insure correct order of replacement). Withdraw pressure tube and piston rod guide (see guide removal directions below if seal is to be replaced). Wash all parts of shock absorber in gasoline and dry with air (do not use solvents which will damage seal). All parts must be absolutely clean and dry.

Piston Rod Guide Seal Renewal—Remove guide from end of pressure tube by inserting handle of long screwdriver in tube and tapping guide out using care not to damage guide threads. Use Seal Extractor Fixture #724 (for shock absorbers with ½" piston rod) clamped in vise with round end up, place guide assembly on end of extractor and hold firmly while seal is being pried out with screwdriver. Press new seal in being careful to press only on outer edge of seal on types with leather wiper or raised center portion (use old shock absorber piston as press tool). On types without this leather wiper or raised center portion, apply pressure evenly on all sides of seal (use round stock of same diameter as seal).

Piston & Valve Assembly—When re-installing old piston, use care to line up marks on piston and rod (made before disassembly) to prevent piston binding in cylinder and install all valve parts in same order as removed. If new piston being installed, check for binding in cylinder after piston nut is tightened by moving tube up and down. If piston binds, loosen nut and try new position on rod. Piston can also be seated before piston nut is tightened by pulling cylinder out to fully extended position and then rotated 90° and forced down on piston. Nut should then be tightened and staked in position to prevent loosening in service. Recheck for binding by moving shock absorber through entire travel.

Reassembly—If piston rod removed from rod guide (for seal removal, etc.), install special #721 thimble on end of rod when installing rod through seal assembly and rod guide to prevent damage to seal. Install piston and valve assembly (above), then fill with exact correct amount of new fluid and reassemble as directed under Refilling above.

CONTROL VALVE CALIBRATION:—Standard valve calibration for each type shock absorber shown in table below. Valves consist of Compression and Inlet Valve Assemby (seated in lower end of pressure tube) and Rebound and Relief Valve (assembled on piston and held in place by piston nut).

Compression & Inlet Valve Assembly—This assembly cannot be dismantled and must be replaced as a unit.

Rebound & Relief Valve—See illustration for valve assembly which is different for the series 1000 1001, 1024 models, and for the 1007,8,16,21,23,26 models. Performance is controlled by the Orifice Plate (all models), Valve Disc and Valve Spring (1000, 1001, 1024); Spring Discs and Spacing Discs (1007,8,16,21,23,26).

Compression & Rebound Valves

Car Model	Compr. Valve Front	Rear	Reb'd. Valve Front	Rear
Chrysler C28,30,33 Exp.	D1	A1	4C6	D56
Chrysler C28①	FO	B1	1F8	1F8
DeSoto S8③	FO	B1	1F8	1F8
DeSoto S8④	FO	C1	1H8	1H8
Dodge D19②	FO	B1	1F8	1F8
Dodge D19③	FO	B1	1F8	1F8
Dodge D19④	FO	C1	1H8	1H8
Hudson 12	E2	A2	⑪	⑫
Hudson 14,15,17	E2	A2	⑥	⑦
Hudson 14,15,17 Exp.	E2	A2	⑧	⑦
Hudson	G1	C2	⑨	⑩
Nash 4140,2,3,5	B2	AO	1⑬	2⑭
Nash 4140,2,3,5 Exp.	D2	CO	1⑬	8⑮
Nash 4160, 4180	E2	C2	5⑯	6⑰
Nash 4161,81 Cab.	BO	C2	7⑱	6⑰
Packard 1901 Sedan		A1.5		1.5-4/4
Packard 1901 Coupe		A2		2-4/4
Packard 1901A, 3A		D1		0-5/6
Packard 1904,7		A6		2-5/6
Packard 1905,8		B6		2.5-6/6
Packard 1905, 8 (Fender Wells)		B6		2.5-7/6
Plymouth P11,12⑤	F.25	A1	2.5C6	3D6
Plymouth P11,12 Exp.⑤	D1	A1	4C6	5D6
Plymouth P11,12⑲	FO	B1	1F8	1F8
Plymouth P11,12④	FO	C1	1H8	1H8
Pontiac All Domestic		A4		4¼/4

①—Cars with 18" wheels.
②—Cars with 20" wheels.
③—Firm Control
④—Super Control.
⑤—Soft Control.
⑥—2-10 (4) 10-10.
⑦—3-10 (4) 10-10.
⑧—0-8-8 (4) 10-10.
⑨—2-8-8 (4) 10-10.
⑩—4-8-8 (4) 10-10.
⑪—3-8-6 (4) 10-10.
⑫—5-8 (4) 10-10.
⑬—3-10 (6) 10-10.
⑭—0-6 (6) 10-10.
⑮—0-10 (6) 10-10.
⑯—3-10-6 (4) 10-10.
⑰—0-6-8 (4) 10.
⑱—0-10 (4) 10.
⑲—Cars with 20" Wheels (Firm Control).

IMPORTANT SERVICE NOTE—Shock absorbers on both sides of car must have same valve calibration (Right & Left Front same, Right & Left Rear same).

DELCO ADJUSTABLE DIRECT ACTING TYPE

Car Model	Front	Rear
Chrysler C33 (1941)	1134-E	1130-W
Chrysler C28,30,33 ('41) Exp.	1134-E	1130-W
Chrysler C28 ('41) Exp.①	1134-E	1130-Y
DeSoto S8 (1941) Exp.	1134-E	1130-W
DeSoto S8 (1941) Exp.①	1134-E	1130-Y
Dodge D19 (1941) Exp.	1134-E	1130-W
Dodge D19 (1941) Exp.②	1134-E	1130-Y
Packard 1900,1 ('41) Exp.		1130-W
Packard 1903,4,5 ('41) Exp.		1130-W
Packard 1906,7,8 ('41) Exp.		1130-W
Plymouth P11,12 ('41) Exp.	1134-E	1130-W
Plymouth P11,P12 ('41) Exp.②	1134-E	1130-Y

①—Cars with 18" wheels. ②—With 20" wheels.

NOTE:—**Chrysler, De Soto, Dodge, Plymouth**—Delco Direct Acting Shock Absorbers (not adjustable) used as standard equipment on all models except C33 (see preceding article for data). Monroe Direct Acting Shock Absorbers also used on Chrysler models (see separate article for data).

Packard Models—Delco or Monroe Direct Acting Shock Absorbers used on domestic cars. See separate articles for data on these types.

TYPE:—1⅜" piston, double acting, three tube, piston type with adjustment for Soft and Firm control. Same as types used on 1940 car models (see Orifice Plug data below). NOTE—These large type shock absorbers with 1⅜" piston may be readily identified by larger diameter of outer dust tube (approx. 2⅝").

Orifice Plug—Consists of a calibrated metering restriction installed in the piston rod guide at the top of the pressure tube which allows fluid to escape from the cylinder directly into the reservoir tube when the shock absorber is being extended (rebound stroke). See Orifice Plug service data below.

REFILLING:—Shock absorber must be removed from car, disassembled, old fluid poured out, and filled with exact correct amount of new fluid when being reassembled. Procedure same as for non-adjustable types (see preceding article) except as follows: Shock absorber must be set in 'Soft' position before being disassembled (see Adjustment directions following) and knock-out plugs in dust tube slots must be removed before wrench can be inserted. Retainer nut is separate part and not combined with rod guide and oil seal assembly. When assembling shock absorber use new cork and rubber guide gaskets under retainer nut (install cork gasket first and rubber gasket on top). IMPORTANT—Check Adjustment before re-installing shock absorber on car.

Fluid Capacity:—Differs for each type and correct amount can be determined by model letter or collapsed length as follows:

Model Suffix Letter—Letter following model number—1134-**W**—indicates capacity as shown in table below. NOTE—Do not confuse this letter with valve calibration lettering which is also stamped on outer dust tube of shock absorber following model designation.

Collapsed Length—Fluid capacity may also be determined by measuring length with shock absorber fully collapsed. On 'Eye End' types, measure to center of eye on each end (on models with one bayonet end, measure from center of eye to base of bayonet stem on opposite end). On 'Bayonet End' types, measure to base of bayonet stem on each end.

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Fluid Capacity

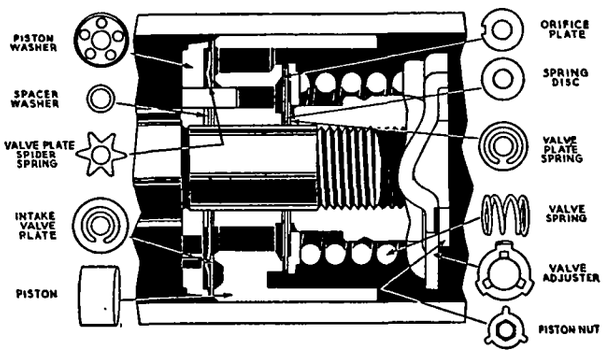
Model Letter	Collapsed Length Eye End	Bayonet End	Capacity Ozs.	CCs.
E	9"		6¾	202
L	10⅜"		8¾	260
S		11 9/32"	10⅞	320
T	12⅛"		11⅛	330
W	12⅞"		12	359
Y	13⅜"		12⅝	379

ADJUSTMENT:—Disconnect lower end of shock absorber or remove unit from car (upper end must be held stationary while adjustment being made). Collapse unit fully and turn lower end in direction of arrow on tube (counter-clockwise) until tang on adjusting cam engages slot in lower end of pressure cylinder within unit (determine engagement by feel). Note position of notch on dust tube in relation to marks on cylinder (3 notches spaced 120° apart on cylinder for two positions—'S' Soft, 'F' Firm; if unit has been disassembled these marks may not indicate setting correctly). To change setting, rotate lower end of unit in **counter-clockwise direction only** until a stop position is felt (unit will tend to lengthen slightly in Soft position, shorten slightly in Firm position). There are six stop positions in one revolution which are alternately Soft and Firm (collapsed length changes approximately 1/16" between positions). In order to line up reference marks on housing in each position, rotate lower end 1/6 revolution to change setting from Soft to Firm or Firm to Soft (one notch will be in line with 'S' or 'F' figure at end of each 1/6 turn). IMPORTANT NOTE—Shock absorbers on both sides of car must be set alike for balanced operation.

SERVICING:—**Disassembly**—Clamp lower eye in vise with shock absorber vertical (use special fixture for bayonet end types—do not clamp bayonet end or shock absorber tube in vise), remove knock-out plugs in dust tube holes, pull shock absorber out to fully extended position, insert prongs of special wrench through dust tube holes and engage slots in retainer nut (use care not to mar piston rod), unscrew retainer nut, lift entire top assembly off. Tap compression valve assembly out of lower end of pressure tube. Use Allen wrench to unscrew nut on lower end of piston rod (nut seats in adjusting cam so that ordinary wrench cannot be used), withdraw piston and valve parts (mark piston to insure replacement in same position on piston rod, note position of valve parts to insure correct order of replacement). Wash shock absorber parts in gasoline (do not use solvents which will damage seal), dry with air. All parts must be absolutely clean and dry.

Rod Guide & Seal Assembly—Seal is integral part of guide assembly and cannot be removed (serviced as an assembly). If guide removed from pressure tube, make certain that baffle ring installed on upper end of tube under guide with open end at seal drain hole (diametrically across from Orifice Plug). See Valve Calibration data for Orifice Plug sizes.

Rebound Valve Assembly—When re-installing old piston, use care to line up marks on piston and rod (made before disassembly) to prevent piston binding in cylinder. If piston not marked, or new piston being installed, align piston in cylinder before piston rod nut is tightened by pulling tube out to fully extended position and then rotating tube 90° and forcing it down on piston. Nut should then be tightened and staked to prevent loosening in service. All valve parts should be installed in same order as removed and adjustment cam should be turned to 'Soft' position (spring not compressed).



Compression Valve Assembly—Serviced as an assembly but can be dismantled to change valve parts. To disassemble, use special tool to press in on valve washer (on lower end of intake valve stem), turn washer until hole registers with square end on stem, remove washer. Remove hairpin retainer spring in upper end of valve mounting and remove valve parts.

Reassembly—If piston rod removed from rod guide, use special thimble #583 installed on end of piston rod when inserting rod through seal and guide (will prevent threads on rod damaging seal). Install piston and valve assemblies (above), then fill with exact correct amount of new fluid and complete assembly by reversing disassembly directions above. Use new gaskets under retainer nut (install cork gasket first, rubber gasket on top). Check setting marks on shock absorber tube (if notch on dust tube not in line with 'S' mark, make new notch in line with mark and fill up old notch). Check shock absorber setting and adjust before installing on car.

CONTROL VALVE CALIBRATION:—Standard valve calibration for each type shock absorber shown in table below. Valves consist of Compression Valve (seated in lower end of pressure tube), Rebound Valve (assembled on piston), and Orifice Plug (in rod guide at top of pressure tube).

Compression Valve—Performance controlled by spring disc and valve spring (heavy inner spring).

Rebound Valve—Performance controlled by Orifice Plate, Spring Disc and Valve Spring (see illustration for valve assembly).

Compression & Relief Valves

Car Model	Comp'r. Valve Front	Rear	Reb'd. Valve Front	Rear
Chrysler C33	10G	8A	4CG6	6Ad4
Chrysler C28,30,33 Exp.	10L	8C	1CR8	1CL8
DeSoto S8 Exp.	10L	8C	1CR8	1CL8
Dodge D19 Exp.	10L	8C	1CR8	1CL8
Packard 1900 Exp.		8c		.50FN-15-10
Packard 1901,3,6 Exp.		8c		1FN-15-10
Packard 1904,7 Exp.		8A		4GR8
Packard 1905,8 Exp.		8p		4DH 15-15
Plymouth P11,12 Exp.	10L	8C	1CR8	1CL8

Orifice Plug

Car Model	Front	Rear
Chrysler C33	1	4
Chrysler C28,30,33 Exp.	1	2
DeSoto S8 Exp.	1	2
Dodge D19 Exp.	1	2
Packard 1900,1,3,6 Exp.		4
Packard 1904,7 Exp.		1
Packard 1905,8 Exp.		3
Plymouth P11,12 Exp.	1	2

IMPORTANT SERVICE NOTE—Shock absorbers on both sides of car must have same valve calibration and be adjusted alike for balanced performance (Right & Left Front same, Right & Left Rear same).

HOUDE (HOUDAILLE) TYPE

Car Model	Houde Model No. Front	Rear
Ford Pass. Car Models (41)	BBCN	BBCZ
Ford Comm'l. (1941)	BBCME	BBCZ
Ford Truck (1941)	BBCME	BBG
Lincoln All Models (1941)	BBCHN	BBCLZ
Mercury Model 19A (1941)	BBCN	BBCZ
Packard 1901,1A,3,3A,4,5,6, 7,8 (1941)—See Note		NFT
Studebaker Champ.3G ('41)	BBFS2	BBDS
Studebaker Comm.11A ('41)	BBFS2	ACHS2
Studebaker Pres. 7C (1941)	BBFS2	ACHS2

PACKARD NOTE:—This Shock Absorber is the 'Fifth' shock absorber of the rear suspension system (lateral stabilizer control). Regular rear shock absorbers on these models are Delco or Monroe Direct Acting Type. See separate articles for data on these types.

TYPE:—Double acting, hydraulic type. Same design as used on corresponding 1940 car models. All models are adjustable and have the following types of Control: Adjustable Relief Valve—Ford, Lincoln, Mercury, Studebaker (All Front Shocks, Rear on Champion only), Adjustable Needle Valve (Packard), Automatic Thermostatic type with adjusting screw in shaft (Studebaker Commander & President Rear Shocks only).

ADJUSTMENT:—Ford, Lincoln, Mercury Models—Adjustment handle and pointer are provided on end of shaft. Original setting is with pointer in line with indicating mark on lever. Pointer can be turned approximately ¼ turn in either direction but must not be forced past stops on shaft. Turn pointer clockwise for firmer action, counter-clockwise for softer action. CAUTION—Do not turn pointer more than 1/32" at a time without road testing car (slight movement has considerable effect on performance). Shock absorbers on both sides of car must be adjusted alike for balanced performance.

Packard 'Fifth' Shock Absorber—Shock absorber must be removed from car, disconnected from lateral stabilizer arm and clamped vertically in vise (regular mounting position) to check timing. Hang 50 lb. weight on shock absorber arm, place arm in extreme upper position, note time required for full travel of arm from upper to lower position which should be 18 to 24 seconds. If not within this time limit, adjust as follows: Remove plug in outer end of shaft which will expose adjusting screw, turn screw in (clockwise) to increase time, out (counter-clockwise) to decrease time, recheck timing.

Studebaker Champion (all), Commander & President (Front Shock Absorbers only)—Adjustment same as for Ford models (above) by turning adjusting handle and pointer on shaft between two end-stops.

Studebaker (Others)—Automatic thermostatic type. Can be adjusted by removing cap in end of shaft which will expose adjusting screw. Original setting is with slot in adjusting screw in line with indicator mark on end of shaft. Screw can be turned approximately ¼ turn in either direction but must not be turned past '0' and 'S' marks on end of shaft which indicate end-points for adjustment. Use special tool (do not use screwdriver) and turn adjusting screw clockwise toward 'S' mark for firmer action, counter-clockwise toward '0' mark for softer action. CAUTION—Do not turn adjusting screw more than 1/32" at a time without road testing car (slight movement has considerable effect on performance). Shock absorbers on both sides of car must be adjusted alike for balanced performance.

REFILLING & SERVICING:—Same as for previous models. Shock absorbers should be inspected at 5000 mile intervals and filled to level of bottom of filler plug hole with genuine Houdaille fluid (unit must be in normal mounting position and arm should be worked up and down several times to allow all air to escape from cylinder—do not overfill).

Fluid Recommendations—Ford, Lincoln, Mercury Models—Ford Shock Absorber Fluid. Packard—Houde 800 second fluid. Studebaker (All Models) Houde No. 1400 fluid.

MONROE ADJUSTABLE DIRECT ACTING HYDRAULIC TYPE

Used On:

Willys, Americar & Plainsman 441 (1941)
Willys, Commercial Models (1941)

Front Shock Absorbers—Part No.

	Willys No.	Monroe No.
Standard Control	639022	11422
Heavy Duty	639187	11429

Rear Shock Absorbers—Part No.

Standard Control	639008	11425
Heavy Duty	639188	11430

TYPE:—Direct Acting, adjustable, piston type. Shock Absorber case is welded in assembly and cannot be dismantled for servicing or refilling.

SERVICING:—Serviced by replacement (case is welded and Shock Absorber cannot be dismantled).

ADJUSTMENT:—Shock absorbers set at factory for standard control (see table below) and performance should be satisfactory for all average riding conditions. Before changing adjustment to correct riding complaints, see that tires are properly inflated, springs and shackles lubricated and properly adjusted.

To Adjust—Remove shock absorber from car or disconnect lower mounting (necessary in order to collapse instrument fully). Collapse shock absorber fully by pressing upper and lower halves together and hold in this position until adjustment completed. Turn shock absorber cylinder to right (clockwise) slowly until adjustment key can be felt to drop into and engage slot in valve (within shock absorber). Continue to turn cylinder to right until a definite stop is felt (4 turns maximum) which indicates that valve is closed. Then turn cylinder to left (counter-clockwise), to open valve desired number of turns as shown in table below.

IMPORTANT NOTE—Shock absorbers on both sides of car must always be adjusted alike (Right & Left Front same, Right & Left Rear same).

Adjustment Table

Control	Valve Opening
Firm Control	0-1½ turns
Standard (Average)	1½-2½ turns
Soft Control	2½-4 turns

CAUTION—Use hand pressure only when making adjustments and do not force beyond fully closed and fully open where definite stop will be felt. Maximum range of adjustment is 4 full turns. Operate shock absorber only in upright position.

MONROE DIRECT ACTING TYPE

Car Model	Monroe Model Nos. Front	Rear
Chrysler C28,C30 (1941)		
Chrysler C28 7 Pass. ('41)		
Hudson 10,18 (1941) ①	160101	160107
Hudson 10,12,18 (1941) ②	161657	161658
Hudson 10,12,18 (1941) ③	161636	160108
Packard 1900 (1941)		364630
Packard 1903,6 Early (1941)		364725
Packard 1903,6 Late (1941)		

①—Sedan Models. ②—Coupe Models.
③—All Models equipped with Heavy Duty Springs.

PRODUCTION CHANGE NOTE:—Packard 1903,6—Shock absorber valves changed in production (see Valve Specification table below). With this valve change, Shock Absorber Assembly Number was changed from Monroe No. 11423 to 11428.

NOTE:—Chrysler Models—Delco Direct Acting Shock Absorbers used on some cars (see Delco article for data).

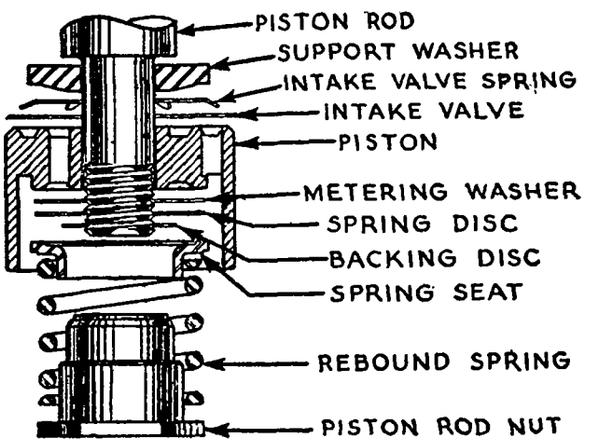
Hudson Models—Delco Direct Acting Shock Absorbers used on other Hudson models (see Delco article for data).

Packard Models—Delco Direct Acting Shock Absorbers used on export cars and other Parckard models. Fifth Shock Absorber (rear suspension control) is Houde Model NFT (see Delco and Houde articles for data).

TYPE:—Double acting, hydraulic, piston type with '3 tube' construction (Inner Pressure Tube and Reservoir Tube are part of lower assembly, Outer Dust Tube part of top assembly). New type rod guide and seal assembly is screwed in upper end of reservoir tube and requires special T-317 wrench for removal (wrench inserted through slots in dust tube with shock absorber fully extended). Compression valve is light press fit in lower end of pressure tube (must be removed for refilling) and is serviced as an assembly. Rebound relief valve (on piston rod) differs on various car models (see Valve Calibration data below).

REFILLING:—Refill at 25000 mile intervals for ordinary driving conditions (more frequently for hard service or if unit shows serious leakage or loss of control). To refill, disassemble unit as directed in Service section below, clean out all old fluid and wash all parts, install correct amount of new fluid when reassembling.

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Fluid Capacity Chart

Car Model	Front	Rear
Chrysler C28,C33	3¾ ozs.	6⅜ ozs.
Hudson 10,12,18	3¾ ozs.	6⅜ ozs.
Packard 1900,3,6		6¾ ozs.

SERVICING:—Disassembly—Remove shock absorber from car, clamp lower eye in vise with unit vertical, (use special T-360 clamping block for Hudson), pull out to fully extended position, insert prongs of special T-317 wrench through slots in outer dust tube so as to engage holes in top of piston rod guide, turn wrench counter-clockwise to unscrew guide from reservoir tube, lift entire head assembly out. Clamp upper eye in vise so that head assembly mounted vertically, remove compression valve assembly by tapping it lightly while working assembly out of pressure tube. Remove nut on end of piston rod, remove piston and valve parts from piston rod. If piston rod seal to be replaced, remove pressure tube and piston rod guide from piston rod, tap guide out of pressure tube (guide is press fit in end of tube). Seal should not be removed from guide (serviced as an assembly). CAUTION—Do not clamp pressure tube in vise and us extreme care not to distort tube. **Servicing**—Wash all parts in clean naptha or gasoline, replace all worn or defective parts, always use new gasket under piston rod guide in reservoir tube when reassembling.

Reassembling & Refilling—Use Thimble T-347 to install piston guide on piston rod to avoid damage to seal, install all valve parts and piston in correct order (see illustration—metering washer not used on all models), tighten piston nut securely. Measure correct amount of new fluid in measuring cup, pull pressure tube and guide up on piston rod, pour fluid into tube above piston until tube is full. Install compression valve assembly on upper end of pressure tube, tapping valves securely in place in tube and using extreme care not to spill fluid out of tube. Clamp base assembly in vise vertically, pour remainder of fluid into reservoir tube. Use new gasket in top of reservoir tube, install head assembly and tighten piston rod guide securely with T-317 wrench. NOTE—See that stone shield (on lower tube) faces forward on rear shock absorbers when installed.

CONTROL VALVE CALIBRATION:—Standard Control relief valve and metering washer calibration should provide satisfactory control for normal operating conditions. Shock absorber performance can be varied for special operating conditions by changing valve calibration to 'Light Control' or 'Heavy Control' as shown in table below.

CONTROL VALVES:—Consists of Rebound Relief Valve (on piston rod under piston) and Compression Valve Assembly (in lower end of pressure tube). Compression valve cannot be dismantled and is serviced as an assembly. Several types of Rebound Relief Valves have been used as follows (see Valve Calibration data below for part numbers for each car model):

Car Model	Metering Washer	Relief Valve Disc Assembly 1st Disc	2nd Disc	Spacer	3rd Disc	4th Disc
Hudson 10,12,18 Front①	10863-2	10849-6	10849-8	10856-4	10849-10	10849-10
Hudson 10,12,18 Front②	10863-3	10849-6	10849-6	10856-4	10849-8	10849-10
Hudson 10,12,18 Front③	None	10849-8	10849-8	10856-4	10849-20	None
Hudson 10,12,18 Rear①	10863-4	10849-8	None	10856-4	10849-10	10849-10
Hudson 10,12,18 Rear②	10863-5	10849-6	None	10856-4	10849-8	10849-10
Hudson 10,12,18 Rear③	10863-2	10849-10	None	10856-4	10849-20	None
Packard 1900 Rear①	10863-2	10849-4 (4 used)	None			
Packard 1900 Rear②	10863-2	10849-4 (3 used)	None			
Packard 1900 Rear③	10863-2	10849-4 (6 used)	None			
Packard Early 1903,6 Rear①	10863-2	10849-4 (4 used)	None			
Packard Early 1903,6 Rear②	10863-2	10849-4 (3 used)	None			
Packard Early 1903,6 Rear③	10863-2	10849-4 (6 used)	None			
Packard Late 1903,6 Rear①	10863-2.5	10849-4	10849-4	None	10849-6	10849-6

①Standard Control. ②Light Control. ③Heavy Control.

Chrysler, Hudson, Packard Types—These Rebound Relief valves are built up of calibrated valve discs installed on piston rod directly below metering washer (two groups of two with spacer disc between each group—total number of valve discs differ on various models, see valve calibration chart below). Chrysler models have a spring below the valve assembly which increases the tension of the valve spring disc (see illustration).

IMPORTANT NOTE—Shock absorbers on both sides of car must have same valve calibration (Right & Left Front same, Right & Left Rear same).

MONROE SINGLE ACTING HYDRAULIC TYPE

Used On:

Bantam, Model 65 (1941)—Passenger Cars.

NOTE:—This type shock absorber used on passenger car models only. See Bantam 'M' page for data on friction type shock absorbers used on other models.

DESCRIPTION & OPERATION:—Single Acting, hydraulic type. Piston within cylinder is held out against cam on shock absorber shaft by spring within cylinder. On outward stroke (when car springs compressed by road shock), fluid flows freely into cylinder through check valve in piston head. On rebound stroke, fluid escape from cylinder is restricted by adjusting needle valve in by-pass channel and by relief valve in piston head.

ADJUSTMENT:—Adjusting needle valve should be turned in for firmer action, out for softer action. To adjust, turn valve in until it is lightly seated, then back valve off required amount to secure desired shock absorber action.

CAUTION—Valve must not be set at less than 1/6 turn open. Shock absorber will be damaged if operated with valve completely closed.

SERVICING:—Refilling. Remove top cover screw, fill case with Monroe fluid to level even with lower edge of screw hole.

Disassembly. Take out cover screws, remove cover and gasket, withdraw piston, spring and valve assembly. When reassembling, see that gasket in good condition and tighten cover screws securely to prevent leaks.

GEMMER WORM-AND-ROLLER WITH PUSH-PULL ADJUSTMENT TYPES 305, 335

Model 305

CHRYSLER 6, C28 (1941)—EXCEPT 7 PASS.
DE SOTO, MODEL S8 (1941)—EXCEPT 7 PASS.
HUDSON 6, MODELS 10,11,12,18 (1941)
MERCURY, MODEL 19A (1941)
NASH AMBASS. 6, MODEL 4160 (1941)

Model 335

CHRYSLER 6, C28 7 PASS. MODEL (1941)
CHRYSLER 8, MODELS C30, C33 (1941)
DE SOTO, S8 7 PASS. MODEL (1941)
FORD, ALL TRUCK MODELS (1941)
HUDSON 8, MODELS 14,15,17 (1941)
NASH AMBASS. 8, MODEL 4180 (1941)

Special Types—See Note

DODGE, MODEL D19 (1941)
FORD, PASS. CARS & COMM'L. (1941)
PLYMOUTH, MODELS P11, P12 (1941)

NOTE:—Chrysler C30, C33 & C28, DeSoto, Dodge 7 Pass. Models—These steering gears are new design with 'three-tooth' roller. Adjustments are made in same manner as on other models.

Dodge & Plymouth Models—These steering gears built by Chrysler but are similar in design to Gemmer 305 (except 7 Pass.), 335 (7 Pass.), and are adjusted in same manner.

Ford Models—These steering gears built by Ford but are similar in design to Gemmer Model 305 and adjusted in same manner.

ADJUSTMENT:—Before making adjustments, jack up front wheels and disconnect drag link to free steering gear (front wheels should turn freely with not more than 10 lbs. pull on drag link in either direction). Align steering column by loosening frame bracket bolts to allow gear to shift in frame, tighten bolts, then loosen instrument board bracket bolts to allow bracket to shift in alignment with column, tighten bracket bolts. Make adjustments in order as follows:

Worm Shaft Bearing Adjustment—Loosen lower cover screws, separate and remove top shim (use care not to damage remaining shims), tighten cover screws and check adjustment. Steering wheel should turn freely without stiffness with drag link disconnected (if stiffness still evident after steering column alignment checked, worm bearings are too tight). On Chrysler, DeSoto, Dodge, Plymouth models wheel should turn with ⅜-¾ lb. pull on rim with cross-shaft out of housing (worm bearing drag only).

Roller Mesh in Worm—To check, turn steering wheel so that roller on 'high' mid-point of worm (count number of turns from one end position to the other, then turn wheel back ½ this number of turns, or place steering wheel in straight ahead position as directed below), shake steering arm to determine play or lost-motion at ball end (with drag link disconnected). If lost-motion exceeds 1/32", adjust as follows: Remove roller shaft adjustment screw locknut on steering gear side cover (accessible through hole in frame rail on Hudson models), slide lock plate off far enough to clear lock boss on cover, tighten adjusting screw just enough to eliminate steering arm lost-motion but without causing roller to bind on worm (slight play preferable to any binding), slide lock plate into position so that it engages boss on cover, install and tighten locknut. Check to see that steering wheel turns freely through entire range without binding. On Chrysler, DeSoto, Dodge, Plymouth models, wheel should turn through this center 'high' point with 1-2¼ lbs. pull on wheel rim (this includes ⅜-¾ lb. worm bearing drag). On Hudson models, pull should be 2 lbs.

NOTE—No separate adjustment required for roller shaft endplay (shaft controlled in both directions by above push-pull adjusting screw).

Steering Wheel Position (Hudson):—Notch in end of shaft should point straight down (visible with horn button and contact plate removed) and steering wheel spokes should be horizontal with roller on 'high' mid-point of worm. If wheel position not correct, adjust by shifting shims from one ball seat to the other in the steering arm end of the drag-link.

Nash Models—Steering wheel marked on underside of hub and mark should point straight down with roller on 'high' mid-point of worm.

Steering Linkage (Chrysler, DeSoto, Dodge, Plymouth models):—Steering gear arm connected directly to each wheel by long (right hand), short (left hand) tie rod. Toe-in adjustments should be made by shortening or lengthening both tie rods equally. If steering gear roller not on 'high' mid-point of worm with wheels in straight ahead position (after toe-in adjustment completed), correct steering gear position by lengthening one tie rod and shortening other rod exactly equal amount (to avoid disturbing toe-in adjustment).

CAUTION—When tightening clamp bolts, make certain that both ends of tie rod against same side of ball end studs (so that rod can rotate slightly on ball ends) and that clamp bolt on left end of long tie rod is below tie rod (to prevent interference on turns).

Hudson—Center-point steering type linkage with intermediate steering arm on center of front crossmember and individual tie rods between this arm and each wheel. Toe-in adjustments should be made by lengthening or shortening both tie rods equally so that tie rod lengths equal and intermediate steering arm centered with wheels in straight ahead position. If steering wheel position not correct, adjust as directed above.

Nash Models—Consists of center connecting rod linked between steering gear arm and idler arm on right frame side rail with individual tie rods from this connecting rod to each wheel. Toe-in adjustments should be made by lengthening or shortening both tie rods equally. If steering gear roller not on 'high' mid-point of worm with wheel straight ahead, correct by lengthening one tie rod and shortening other tie rod equally (to avoid disturbing toe-in adjustment).

CAUTION—When tightening clamp bolts, see that outer tie rod ends are horizontal and that ball stud is square in seat.

GEMMER WORM-AND-ROLLER TYPES 250, 330, 370

Model 250—See Note

NASH '600', MODEL 4140 (1941)

Model 370

FORD, BUS MODELS (1941)

Special Types—See Note

LINCOLN, ZEPHYR & CONTINENTAL 16H (1941)
LINCOLN, CUSTOM MODEL 168H (1941)
PACKARD CLIPPER, MODEL 1951 (1941)
PACKARD SIX, '110' MODEL 1900 (1941)
PACKARD EIGHT, '120' MODELS 1901,1A (1941)
PACKARD SUPER 8, '160' 1903,3A,4,5 (1941)
PACKARD CUST. SUPER 8, '180' 1906,7,8 (1941)

NOTE:—Model 250 (Nash)—This is a new model which is similar to Model 300 except for size and fact that worm is mounted on ball bearings (each bearing takes thrust in one direction). This model adjusted and serviced in same manner as other models.

Lincoln Model 330—Steering gear has a straddle mounted roller shaft with additional shaft bushing mounted in side cover on housing. Adjusted in same manner as other models.

Packard Models—These steering gears built by Packard but similar in design to Gemmer Model 330 and adjusted in same manner.

TYPE:—Worm-and-roller types similar to Gemmer designs used on previous models. See Note above on Model 250 (Nash) type which is a new design.

ADJUSTMENT:—Before making adjustments jack up front wheels and disconnect drag link to free steering gear (front wheels should turn freely with not more than 10 lbs. pull on drag link in either direction. Align steering column by loosening frame bracket bolts to allow gear to shift in frame, then loosen instrument board bracket bolts to allow bracket to shift, tighten bracket bolts. Make adjustments in order as follows:

Worm Shaft Bearing Adjustment—Loosen lower cover screws, separate and remove top shim (use care not to damage remaining shims), tighten cover screws and check adjustment. Steering wheel should turn freely without stiffness (if stiffness still evident after steering column alignment checked, worm bearings are too tight). On Packard models, wheel should turn with 1½ lbs. minimum, 2¼ lbs. maximum pressure at rim except at center 'high' point of worm.

Roller Shaft Endplay—To check, turn wheel to end position and back ⅛ turn. Check endplay at hub of pitman arm (with drag link disconnected). To adjust, loosen locknut and turn adjusting screw on side cover just enough to take up all endplay, tighten locknut. Check to see that steering gear turns through entire range freely but without evident endplay.

Roller Mesh in Worm—To check, place steering wheel in mid-position with roller on 'high' point of worm (count number of turns from one end position to the other, then turn wheel back ½ this number of turns), check play or lost motion at end of pitman arm. If this exceeds 1/32", roller mesh in worm should be adjusted. To adjust, dismantle steering gear and remove roller shaft from housing, remove shim from shoulder on shaft and housing

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so that play at end of pitman arm will be not more than .006" when reassembled and steering gear will turn freely without drag. On Packard, pull of 3-4½ lbs. on rim of wheel should be required to turn wheel through center position. CAUTION—Make certain that thick thrust washer (between adjusting shims and shoulder on roller shaft) installed with bevel face toward roller (away from splined end of shaft. Use special thimble (Packard ST-5032) or wrap splined end of roller shaft with tape when installing roller shaft in housing to avoid damage to oil seal.

Steering Wheel Position (Packard):—Steering wheel height not adjustable but can be raised or lowered by installing instrument panel bracket from other models as follows: **Six**—Wheel cannot be lowered but can be raised approximately 5/8" by installing 1901 steering column bracket. **Eight & Super Eight** Wheel cannot be raised but can be lowered 5/8" by installing 1900 steering column bracket. NOTE—Seat can be lowered approximately ½" by removing two wooden strips under seat frame, or raised approximately 5/8" by installing special No. 337373 tapered wedges.

Steering Linkage (Nash):—Cross type linkage used with steering gear pitman arm connected directly to right hand tie rod (steering arms extend toward front of car). Left hand tie rod is connected to the right hand rod at a point near the steering gear. With front wheels in straight-ahead position and steering roller on 'high' point of worm, wide serration on steering tube should point downward and steering wheel should be installed with line on lower face of hub in line with this wide serration. **Packard Models**—Intermediate steering arm used with individual tie rod for each wheel. If steering gear roller not on 'high' midpoint of worm and intermediate steering arm not centered with wheels straight ahead, check tie rod lengths (must be equal within 1/8") and correct by lengthening one rod and shortening other exactly equal amount (to avoid disturbing tie rod adjustment). Intermediate steering arm bearing is pre-loaded by spring washer on top (nut end) of arm shaft. Bearing not adjustable and nut should be tightened until it bottoms on bearing shoulder.

ROSS CAM & LEVER AND CAM & TWIN LEVER TYPES

CAM-AND-LEVER TYPE
Model S-12

BANTAM, SUPER FOUR SERIES 65 (1941)
CROSLEY, MODEL CB41 (1941)

CAM-AND-TWIN LEVER TYPES
Model T-12

STUDEBAKER CHAMPION, MODEL 3G (1941)
WILLYS AMERICAR & PLAINSMAN, 441 (1941)
WILLYS COMM'L., 441 & 441P (1941)

Model T-14

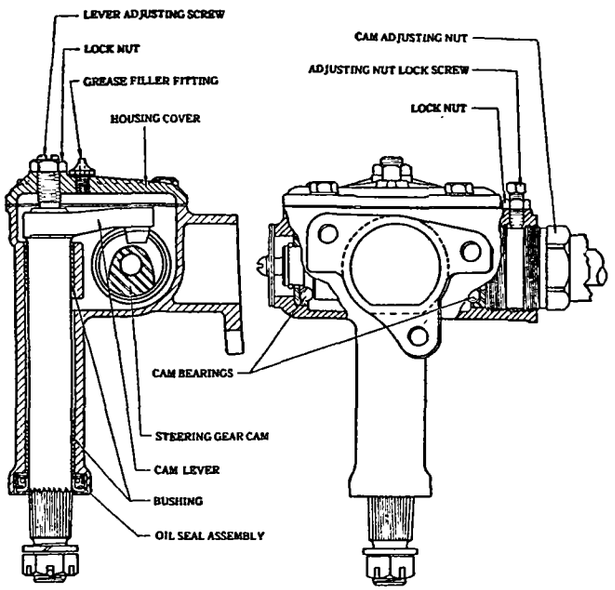
GRAHAM HOLLYWOOD, 109 & 113 (1941)
STUDEBAKER COMMANDER, MODEL 11A (1941)
STUDEBAKER PRESIDENT, MODEL 7C (1941)

NOTE:—Willys Commercial Models—If Gemmer Steering Gears found on these models, these steering Gears are Model 120 and adjusted in same manner as on previous Willys models. Refer to Gemmer Model 120 Steering Gear article in manual.

DESCRIPTION:—Same design as previous S-12, T-12 & T-14 models.

ADJUSTMENT:—Before making adjustments, free steering gear from load by jacking up front wheels or disconnecting drag link (see Studebaker Steering Linkage data below). Check steering gear alignment. If stiffness evident with instrument panel bracket clamp tight, align steering gear as follows: Loosen steering gear frame bracket bolts to allow gear to shift on frame, retighten frame bolts. Loosen instrument panel bracket bolts to allow bracket to shift into alignment with steering column, tighten bracket bolts (if bracket position not adjustable, shim or otherwise change bracket position so that column not sprung when bracket bolts tightened).

Cam Endplay Adjustment—Check up-and-down movement of steering wheel and shaft in steering column jacket. If adjustment required, first loosen locknut and back off adjusting screw on housing side cover to relieve bearings of side thrust. Then remove four retaining screws in top cover on upper end of steering gear housing, move cover up on



column jacket as far as possible (about ¼"), clip and remove a thin shim in shim pack under cover (shims are installed between paper gaskets and are .003", .010", .030" or .002", .003", .010" thick), using extreme care not to damage remaining shims and paper gaskets. Re-install cover, tighten cover screws, check adjustment. Wheel should turn with barely perceptible drag (thumb and forefinger grip on wheel rim) and should have no up-and-down movement. Then adjust Cam and Lever Backlash.

Cam and Lever Backlash—Check end-play or lost-motion of lever shaft at pitman arm with steering gear turned to center position with lever studs on high points of cam. If play evident, adjust by loosening locknut on steering gear housing side cover and turning adjusting screw in until play just taken up and steering wheel turns freely throughout entire range with barely perceptible drag at center position, hold adjusting screw and tighten locknut. CAUTION—This adjustment should be made only with lever studs on high points of cam (straight ahead position). If adjusted in any other position, gear will bind at this center point.

Steering Wheel Position (Studebaker):—Center spoke (3 spoke types) should point straight down, or spokes should be horizontal (2 spoke type) with steering gear in straight-ahead position and lever studs on high points of cam. To check, count number of turns of the wheel from one extreme end position to the other, then turn wheel back exactly one-half this number of turns. If steering wheel spoke position not correct, remove wheel and re-install on shaft in correct position. See Linkage data below for pitman arm installation and location.

Other Models—Before connecting drag link, turn steering wheel to center position with lever stud on high point of cam (count number of turns of wheel from one end position to the other, then turn back ½ this number of turns), place front wheels in straight ahead position, then connect drag link without disturbing position of steering gear or front wheels.

Steering Linkage (Studebaker):—Steering gear pitman arm is special insulated type (see data below) and tie rod for left wheel is connected directly to this arm. A connecting rod is linked between the steering arm and an idler lever on the right frame side rail with tie rod for right hand wheel connected to this idler lever. This design similar to type used on 1940 cars. See that punchmarks on end of steering gear lever shaft and steering arm adapter (short arm on shaft to which insulated steering arm is bolted) are in line and adjacent to each other. Set steering wheel in center position with lever studs on high points of cam (see Steering Wheel Position above), loosen clamp bolts on **left hand tie rod** (between steering arm and left wheel), turn this left hand rod until left front wheel is straight ahead (wheel should be parallel to rear wheel but 3/8" in on Champion, 1 1/32" in on Commander, 1 3/32" in on Pres. due to wider rear tread —Comm. & Pres. new for '41), tighten clampbolt. Then make toe-in adjustment by turning **right hand tie rod only** without disturbing position of left hand tie rod after it has been correctly set for straight ahead position.

Insulated Steering Arm—On Champion, insulated steering arm can be removed by taking off nuts on two studs (on which neoprene insulators are mounted) without disturbing position of adapter on steering gear lever shaft. If adapter being removed, use puller J-871 and make certain that punchmarks on shaft and adapter lined up when adapter replaced. On Commander & President, pull insulated steering arm and adapter as an assembly using puller J-871 after removing cotter pin, nut and washer from lever shaft and disconnecting left tie rod and connecting rod from steering arm. Assembly can then be dismantled by taking off nuts on two mounting studs. When reassembling, tighten nuts on studs until washers seat against shoulders on studs. See that punchmarks on adapter and end of steering gear lever shaft line up when assembly installed.

Connecting Rod Idler Arm—Spring washer used on upper end of idler lever stud on Commander and President models to prevent idler lever rattles. This spring washer not used on Champion and idler lever stud nut should be tightened just enough to eliminate all up-and-down play of lever without causing lever to bind in bracket.

SAGINAW BALL-BEARING WORM-AND-NUT TYPE

Used On:

BUICK, SERIES 41-40,40A,50,60,70,90 (1941)
CADILLAC, SERIES 41-60S,61,62,63,67,75 (1941)
CHEVROLET, ALL TRUCK MODELS (1941)

DESCRIPTION:—New design Worm-and-Nut type steering gear with circulating ball contact. Balls are assembled in groove between worm and nut in two groups with return channels assembled on back of nut so that balls are free to move through circuit as nut moves up and down on worm (each circuit has 33 balls of which 23 or a total of 46 in both circuits carry the load). Gear teeth on nut mesh with sector teeth on cross-shaft so that cross-shaft (and steering gear pitman arm) rotate as the steering wheel is turned and the nut moves up and down on the steering shaft worm.

ADJUSTMENT:—Steering Gear Alignment—Check by loosening frame bracket mounting bolts (Buick), steering column bracket at instrument panel (Cadillac, Chevrolet) and noting clearance between steering gear and frame or bracket. If clearance exists at these points (indicating that column will be sprung when bolts tightened), install shims between steering gear and frame (Buick), loosen frame mounting bolts to allow steering gear to shift on frame to align with steering column bracket, or shim bracket (Cadillac, Chevrolet). Then adjust as follows:

Worm Shaft Endplay—Disconnect the drag link at pitman arm, loosen steering column bracket, loosen locknut and back off pitman shaft adjusting nut a few turns (this adjusting nut on side cover on lower side of housing). Turn steering wheel to within 1 turn of extreme end of travel (CAUTION—do not turn steering wheel hard against stops which will damage ball return mechanism). Loosen locknut and turn worm bearing adjusting screw (on bottom endplate of housing) until pull at wheel rim required to turn wheel (use spring scale such as Chevrolet J-544) is ⅞-1⅛ lbs. (Buick), ¾-1 lb. or 1-1¼ lbs. on cars driven less than 1000 miles (Cadillac), 1-1½ lbs. (Chevrolet), hold adjusting screw and tighten locknut. Tighten steering column bracket bolts and recheck bearing adjustment. If increase in pull noted (indicating that steering column sprung), check steering gear alignment as directed above. NOTE—When making this adjustment on Buick, use special wrenches as follows: J-1592 Locknut Wrench, J-1593 Adjuster Wrench.

Pitman Shaft End-play (Nut and Sector Mesh)—Turn steering wheel to center position with nut on high point of gear. Tighten pitman shaft adjusting nut on lower side cover until pull at wheel rim required to turn wheel through center high point as measured on spring scale attached to wheel rim is 2-2¼ lbs. (Buick), 1½-2 lbs. or 2-2½ lbs. on cars driven less than 1000 miles (Cadillac), 2-2½ lbs. (Chevrolet), hold adjusting nut and tighten locknut.

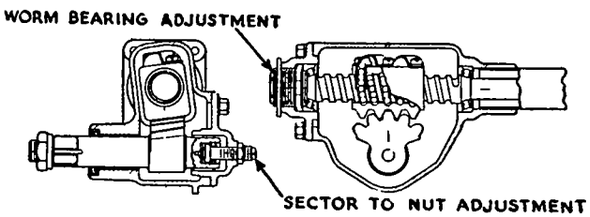
NOTE—This is push-pull type adjustment and controls pitman arm shaft endplay as well as gear mesh (see Lash Adjuster data in Servicing section below).

Steering Wheel Position:—Steering wheel position and height (some models only) are adjustable and should be checked as follows:

Buick (Steering Wheel Position)—Steering wheel spoke with small indentation on underside near hub should point straight down with roller on high point of worm and wheels in straight ahead position. If wheel position incorrect, see that notch on steering tube (visible with horn ring and cover removed) is toward indented spoke. CAUTION—Directional signal switch must be in 'off' position whenever steering wheel removed or replaced.

Buick (Steering Wheel Height)—All cars built with steering column set in highest position. Wheels can be lowered up to 11/16" by installation of two No. 1321253 spacers installed between steering column bracket and lower edge of instrument bracket. When installing shims, loosen steering gear frame mounting bolts (to allow steering gear to shift to new position), use new longer bolts (see note below) to attach bracket to instrument panel, tighten frame mounting bolts after bracket installed and check alignment. NOTE—New bolts required as follows: No. 1321260—4 15/16" (40,50 Left Side), 1321063—4 7/16" (40,50 Right Side, 60,70,90 Left Side), 173030—3 ¾" (60,70,90 Right Side).

Cadillac—Steering wheels should be installed so that middle spoke is vertical and directly opposite notch in end of steering column shaft (Std. 3 spoke type), or both spokes exactly horizontal (Special 2 spoke type) with nut on high center point of worm and front wheels in straight ahead position.



Steering Linkage (Buick):—Design same as 1940 type (long right hand tie rod between steering arm and right wheel, short left hand tie rod between the other tie rod and the left wheel). Adjuster at wheel end of each tie rod should be turned equally when making toe-in adjustments. If steering gear nut not on center high point of worm with front wheels in straight ahead position, adjust by lengthening one tie rod and shortening other tie rod exactly equal amounts (so that toe-in adjustment not disturbed).

Cadillac—Steering linkage design same as 1940 (connecting rod between steering gear arm and idler lever on right side of frame, individual tie rods from connecting rod to each wheel). Tie rods should be adjusted equally when setting toe-in. If steering wheel position not correct and steering gear roller not on high mid-point of worm with wheels in straight ahead position, correct by shortening one tie rod and lengthening other tie rod equally. Recheck toe-in. Idler lever is threaded in bushing and idler arm support should be tightened ¼-1¼ turns after it seats firmly against rubber dust seal.

Chevrolet—These models do not have independent suspension and steering linkage is conventional (drag link between steering gear pitman arm and left front wheel, tie rod between front wheels).

SERVICING:—Disassembly—Remove steering wheel, disconnect drag link at pitman arm, remove steering gear and column assembly from car. Remove steering column upper bearing. Loosen locknuts and back off both adjusting screws (on lower side and bottom cover plates). Remove screws on side cover and remove the cover assembly from housing so that pitman arm shaft and sector gear will be disengaged from nut. Take out bottom cover screws, remove cover, lower worm bearing, cup and thrust washer. Pull steering worm and nut assembly out through lower end of housing. CAUTION—Hold shaft in horizontal position and use extreme care that nut is not allowed to run down on worm against stops which will damage ball return mechanism (nut will move of own weight if shaft tilted or vertical). Manufacturer recommends that worm nut and balls not be disassembled.

Lash Adjuster (Sector shaft endplay)—With lash adjuster screw and shim installed in slot in end of sector cross-shaft, check clearance or endplay with feeler inserted between head of screw and bottom of slot in cross-shaft. Clearance should not exceed .002" and is adjusted by installing lash adjuster shim of correct thickness (Chevrolet Adjuster Shim Unit No. 605142 contains shims .063", .065", .067", .069" thick).

Ball Nut Assembly—To disassemble ball nut (required only if nut binds or is tight on worm), remove screws and ball guide clamp, withdraw guides (use clean pan to catch balls), hold nut upside down and rotate wormshaft back and forth until all balls drop out into pan (use extreme care to save all 66 balls—these are special type and no other types of balls should be used in steering gear under any circumstances), remove nut from worm (nut can be pulled off end of worm after all balls removed). Wash all parts in clean gasoline, dry with clean cloth and examine for signs of wear or damage. To reassemble ball nut, divide balls into two equal groups of 33 each (each group installed separately in one ball circuit). Install nut on wormshaft so that grooves in nut and worm lined up with ball guide holes up and shaft horizontal. Drop balls into one guide hole and turn wormshaft gradually away from this hole until approximately 23 balls have been installed and circuit is filled to bottom of other guide hole on this circuit (if worm reaches end of travel before circuit completely filled, hold balls down with blunt end of clean punch and work wormshaft back and forth until circuit solidly filled with balls). Lay one half of ball guide on bench and install remaining balls (approximately 10) in guide using heavy grease to retain balls, assemble other half of guide, install assembly on nut so that ends of guide enter guide holes of the ball circuit which has been previously filled with balls, tap guide down into place lightly. Fill second ball circuit and install second ball guide assembly in same manner, install guide clamp and tighten clamp screws securely.

CAUTION—Use extreme care to install exactly 33 balls in each ball circuit (count balls as they are installed). Steering gear will not operate correctly if wrong type balls or incorrect number use.

Reassembly—Replacement shaft and nut assemblies are taped to prevent nut moving on worm. When removing tape, hold shaft horizontally and use extreme care that nut does not run down on worm against stops which will damage ball return

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mechanism. Install shaft and nut assembly in steering gear housing, replace worm bearing, cup, thrust washer, gasket, bottom cover plate, insert and tighten cover screws. Install upper bearing spring seat and spring, bearing washer, cotter pin, steering wheel. Adjust worm bearings (see Adjustment above). Rotate steering wheel until nut in center of travel so that center tooth of pitman arm shaft sector gear will engage center tooth space on nut, push shaft and side cover into place, tighten cover screws. Fill housing with steering gear lubricant, re-install steering gear in car.

SAGINAW WORM-AND-ROLLER TYPES

Used On:

OLDSMOBILE 6, 66, 76, 96 (1941)
OLDSMOBILE 8, 68, 78, 98 (1941)
PONTIAC SIX, 41-24, 41-25, 41-26 (1941)
PONTIAC EIGHT, 41-27, 41-28, 41-29 (1941)

SPECIAL SERVICE NOTES:—Pontiac. To correct road noise telegraphed up the steering column on standard steering wheels being amplified by steering wheel center ornament, a new insulated type steering wheel cap, Part No. 506745 can be installed to correct this condition. This new type steering wheel cap was used in production starting with the following car serial numbers:

Model	Pontiac	Linden
Deluxe Torpedo 6	P6JA 55089	L6JA 19092
Streamliner Torpedo 6	P6JB 41866	L6JB 11079
Deluxe Torpedo 8	P8JA 19375	L8JA 6468
Streamliner Torpedo 8	P8JB 33070	L8JB 7630

South Gate Note—Starting car serial numbers when this new insulated steering wheel cap was installed on cars built at South Gate, California, are not available.

TYPE:—Worm and double-tooth roller design. Same as used on corresponding 1940 car models.

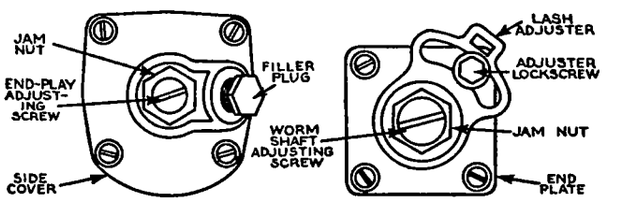
ADJUSTMENTS:—Jack up front wheels, turn steering wheel to straight ahead position, disconnect steering relay rod or drag link from pitman arm (noting ball seat and spring assembly so that parts can be reassembled in same order), see that reference mark on pitman arm and roller shaft are lined up, tighten pitman arm nut with 18" wrench, check column alignment by noting pull at steering wheel rim required to turn wheel through center position (if pull exceeds 1¾-2¼ lbs. on Oldsmobile, 1¼-1¾ lbs. on Pontiac, align steering column as directed below).

Steering Column Alignment—Loosen steering column dash mounting bracket bolts. If this relieves binding, shim bracket out so that column will not be sprung when bolts are tightened.

Roller Shaft Endplay—If endplay perceptible with steering wheel turned to within ⅛ turn of either end position, adjust as follows: Tighten retaining screws on steering gear housing side cover (faces up on some models), loosen adjusting screw locknut, turn adjusting screw in until endplay is just taken up, hold screw and tighten locknut. Check to make certain that wheel revolves freely without binding.

Worm Shaft Endplay—Turn steering wheel to within ⅛ turn of either end position, loosen locknut on adjusting screw at center of lower cover, turn adjusting screw in until steering wheel turns with pull of 1-1½ lbs. (Oldsmobile), ⅜-⅝ lb. (Pontiac) measured at steering wheel rim with wheel turned near the end position. Hold adjusting screw and tighten locknut, recheck pull with locknut tightened. CAUTION—Do not back adjusting screw out which will allow bearings to get out of alignment.

Worm and Roller Backlash—Turn steering wheel to center position with roller on 'high' mid-point of worm (see Steering Gear Position adjustment be low), tighten lower cover screws, loosen lash adjuster lockscrew on lower cover (hexagonal headed capscrew in lash adjuster slot), tap lash adjuster in direction of arrow cut in adjuster above lockscrew not more than 1/16" at a time until pull required to turn steering wheel through center 'high' position is 1¾-2¼ lbs. (Oldsmobile), 1¼-1¾ lbs. (Pontiac), tighten lash adjuster lockscrew. Check to see that wheel turns freely throughout range without binding. CAUTION—Lash adjuster must not be tightened beyond maximum figure given above, and lash adjuster should be tightened only when making this adjustment (do not back adjuster off).



Steering Wheel Position:—Check steering wheels and adjust for correct spoke location in straight-ahead position as follows:

Oldsmobile—On three-spoke wheels, spoke next to horn button connector opening should point straight down with roller on high point of cam and wheels in straight ahead position (mark on hub should be adjacent to and in line with mark on shaft). Adjust by removing wheel and changing position on shaft. Make certain that steering wheel nut staked to prevent loosening when wheel re-installed.

Pontiac (2 Spoke Std. Type)—Spokes should be horizontally even and steering wheel emblem should be horizontal with steering gear and front wheels in the straight ahead position. HORN BUTTON NOISE CORRECTION — See Special Service Notes (in first column) for insulated type steering wheel cap to correct noise on early car models.

Pontiac (3 spoke Deluxe Type)—Lower center spoke of wheel should point straight down (within 5°) and steering wheel emblem should be horizontal with steering gear and front wheels in straight ahead position.

Steering Linkage (Oldsmobile & Pontiac):—Linkage is same design as used on 1940 cars with connecting rod between steering gear pitman arm and idler lever on right hand frame side rail and individual tie rods between connecting rod and each wheel. Idler lever bushing is threaded in arm and on support and arm must be assembled as follows:

Idler Arm Bushing Installation—With arm support removed from frame, screw bushing into idler arm and tighten securely, install seal on support and screw support into bushing until distance from shoulder on support to top face of idler arm is 23/32" plus or minus 1/32". Install assembly on car.

SAGINAW (CHEVROLET PASS. CARS) WORM-AND-ROLLER TYPE

Used On:

CHEVROLET, MASTER DELUXE AG, SPECIAL DELUXE AH, PASS. CARS & SEDAN DELIV. ('41)

TYPE:—Worm-and-roller design with roller mounted on double-row ball bearing. Same design as used on corresponding 1940 models.

ADJUSTMENT:—Make all adjustments in order as follows:

Worm Shaft Endplay. Remove pitman arm, loosen jacket clamp bolt (on lower end of column directly above steering gear housing), loosen adjusting nut clamp bolt in upper end of housing, see that some backlash exists between worm and roller (if necessary, loosen locknut and back off roller shaft adjusting screw on housing). Use 1 9/16" wrench and turn adjusting nut in upper end of housing in until pull of ½ lb. at rim of steering wheel required to turn wheel. Tighten adjusting nut clamp bolt and jacket clamp bolt.

Roller Shaft Endplay—Loosen locknut and turn adjusting screw (on top of housing) in until tight then back screw off until it is free, finally turn screw in until it just contacts end of roller shaft, hold screw and tighten locknut.

Worm and Roller Backlash—Turn steering wheel to center position with roller on high point of worm (count number of turn from one end position to the other, then turn wheel back ½ this number of turns). Check roller shaft backlash or play by shaking pitman arm. To adjust, loosen three steering gear cover bolts ¼ turn, loosen eccentric bolt locknut ½ turn. With one wrench on eccentric bolt and second wrench on eccentric bolt sleeve, turn bolt and sleeve slowly in opposite directions until pitman arm play has been taken up (CAUTION—Use extreme care not to turn eccentric bolt and sleeve more than necessary to take up play, any excess will damage steering gear, normal adjustment is approximately ⅛ turn). Hold eccentric bolt from turning and tighten eccentric bolt locknut, tighten housing cover bolts. Check steering gear to make certain that it turns freely. Pull of 1⅜ lbs. max. at wheel rim should be required to turn wheel through center high point.

Steering Linkage (All Models):—Individual tie rods used and are connected between special rubber-bushed link on steering gear pitman arm and each wheel. Long right hand tie rod is non-adjustable and toe-in adjustments should be made by turning short left-hand rod to insure steering gear roller being on high point of worm with wheels in straight ahead position.

NOTE—Make certain that both tie rod ends are square on ball studs when tightening clamp bolts.

Horn Ring Adjustment (Special Deluxe):—Horn ring tension is adjustable by turning steering wheel lower hub housing. To adjust, loosen lockscrew, turn hub under steering wheel until desired horn ring contact secured, then tighten lockscrew. To adjust tension (pressure required to sound horn), remove ornamental cap in center of wheel, turn two adjusting screws (in recess in wheel) clockwise to increase tension, counter-clockwise to decrease tension.

BUICK TYPE

Used On:

SERIES 41-40,40A,50,60,70,90 (1941)

TYPE—Remote control type with steering column mounted gearshift lever. Design changed from that used on 1940 models as follows:

Gearshift Lever—Lever pivot or bearing formed in housing by fabricated bushing installed in inserted bearing seat and held in place by control housing cap or nut.

Control Shaft—Consists of a tube concentric with steering gear shaft with lower lever welded in place on lower end of tube and control lever housing keyed and clamped on upper end of tube. Tube is mounted on bearing in steering gear housing at lower end and on metal and fabric bearing in direction switch housing at upper end. Lever at lower end of tube is linked to idler lever (pivoted on steering gear housing) by non-adjustable rod with adjustable rod between the idler lever and the shift lever on the transmission case.

Selector Rod—Consists of a square rod within the steering column jacket which is pinned to the selector control lever pivoted on the steering column jacket at the lower end of the rod. This selector control lever is linked to selector lever on transmission case by a rod which has an adjustable trunnion at the steering column end.

Steering Gear Jacket—Two piece type with flanged slot at point where control shaft lower lever emerges. Upper section has mounting bracket for selector control lever and thrust washer assembly consisting of upper fabric and lower plain steel washer for control shaft end thrust installed in lower end. Lower section has bearing for lower end of control rod and shedder to protect bearing from dirt installed in upper end.

ADJUSTMENT:—Adjust selector control rod and shift rod separately as follows:

Selector Rod—Shift transmission to neutral. Disconnect selector rod at selector control lever on steering column, move rod to rear as far as possible, adjust trunnion position on forward end of rod so that trunnion pin engages bushing in selector control lever without disturbing position of lever or gearshift lever, connect rod.

Control Shaft Shift Rod — Shift transmission gears to second speed position. Loosen locknut (at steering column) so that control lever clears edge of slot in steering column mast jacket by ⅛", tighten locknut and connect rod. Shift gears to high speed position and check clearance. Clearance must be maintained at both upper and lower edges of slot in steering column mast jacket.

SERVICING:—Steering Column Unit—Control shaft upper bearing consists of a metal and fabric bearing pressed on upper end of control shaft lever housing in directional switch housing with a flat fabric upper thrust washer, plain steel washer, and spring washer assembled above bearing in that order. Control lever housing is key-slotted in two places and is clamped on upper end of control shaft tube by a clampscrew. Thrust in the opposite direction is taken by a fabric lower thrust washer and a plain steel washer installed between lower end of control lever housing and a plate welded in place in the steering column mast jacket. Control shaft lower bearing consists of a bushing pressed in the upper end of the steering column lower mast jacket with a flanged shedder pressed in the housing above the bearing (shedder fits within cup formed on lower end of control shaft lower lever so that dirt and water excluded from bearing). To service upper and lower bearings, use tool J-1583 to remove bearings, tool J-1585 (upper), J-1587 (lower) to install new bearings. See that thrust washers properly installed when replacing bearings.

CAUTION—When installing control shaft, use great care not to score bearings which will cause hard shifting (bearings are fabric which is soft). Always install new bearings when old bearings removed.

Gearshift Lever—Lever bearing is fabricated bushing which is formed when lever housing nut is tightened. When installing lever, make certain that plunger spring and plunger are in place at upper end of selector rod and that anti-rattle grommet is installed on inner end of gearshift lever. Install bearing seat on lever, then install lever in control lever housing, making certain that inner end engages selector rod properly. Install bearing on lever ball with small outside diameter toward outer end of housing, tighten housing nut securely so that shoulder in nut seats which will lock bearing seat in housing assembly.

Idler Lever—Idler lever on lower end of steering column is fitted with a bushing and pivots on a bolt on the idler lever bracket. When installing lever, make certain that spring washer and plain washer are in place between lever bushing and head of bolt to prevent rattles. Lubricate idler lever at regular intervals (lubricant fitting provided on bolt).

Transmission Case Shifter Mechanism—Selector shaft and shifter shaft mechanism (for gear engagement) similar to type used on 1940 cars with cross-shift selector lever and shaft (vertical shaft and small forward lever on transmission case). See separate Transmission article for disassembly and servicing directions. CAUTION — Selector shaft must be removed through right side of transmission case and installed on left side to avoid damage to oil seal.

CADILLAC TYPES

Used On:

SERIES 41-60S,61,62,63,67,75 (1941)

NOTE:—This control used only with Standard 3-speed synchro-mesh transmission. Control used with Optional Hydra-matic Transmission is different design and is adjusted as directed in Hydra-matic Transmission article.

TYPE:—Remote control type with steering column mounted gearshift lever. Same design as used on 1940 car models.

ADJUSTMENT:—Place gearshift lever in neutral position on Second-High side (normal position). Disconnect Low-Reverse rod at rear lever on transmission case, place lever in neutral (can be checked by feel of detent balls engaging notch in lever shaft sector), adjust rod length by loosening locknut and turning rod end until gearshift lever can be lifted freely into Low-Reverse position with rod connected and without disturbing position of transmission case shift lever. Then adjust Second-High rod (connected to forward lever on transmission case). To adjust this rod, place gearshift lever in neutral, disconnect rod, place transmission case lever in neutral, then adjust rod length so that it can be connected without disturbing position of either rod. Recheck low-reverse rod adjustment to insure smooth cross-over of shift lever from Second-High to Low-Reverse position at neutral.

Shifter Levers—To adjust lever positions on control tube and shaft, disconnect rods on levers, remove anti-rattle spring from second-high lever, install special tool No. J-1204 on lower end of Second-High control shaft, tighten thumbscrew on tool slightly. Loosen clampscrew on Second-High lever (lower lever), tighten thumbscrew on tool until 2 lbs. force required to move this lever back and forth (measure with spring scale attached to outer end of lever), tighten clampscrew and remove tool. NOTE—Low-Reverse (upper) lever does not require adjustment.

SERVICING:—Disassembly—Remove horn button or horn ring and steering wheel, remove anti-rattle spring (at lower end of control shaft). Loosen clampscrew and remove Second-High (lower) lever, loosen clampscrew on Low-Reverse (upper) lever, remove cross-over spring at upper end of control shaft. Loosen clampscrew holding upper shifter housing on steering column, disconnect three wires of direction signal switch, lift upper housing and shifter control assembly up and off steering column. Remove pin and collar on lower end of Second-High (inner) shaft, pull this shaft out of Low-Reverse tube at upper end. Remove gearshift lever and flat anti-rattle spring directly below lever, pull Low-Reverse tube out of housing.

Reassembly—Install Low-Reverse tube in housing with lug pointing away from center, install flat cross-over spring under gearshift lever, hold lever in position and install Second-High shaft. Slip one spring washer with convex side up over bottom end of second-high shaft and hold washer in place against end of low-reverse tube. Install collar at lower end of second-high shaft and press locking pin in place. Push housing assembly with shifting shaft and shifting tube down in place on steering column making certain that direction signal wires pass through hole in steering column bracket on instrument panel and that low-reverse shifter lever installed on end of low-reverse shift tube before entering tube in lower bracket (if bracket has been removed, re-install bracket and install small clip spring washer in bracket hole, then push shaft through bracket). Install one anti-rattle spring washer with concave side up on lower end of second-high shaft, install second-high lever. Position shifter housing below steering wheel so that clearance between underside of wheel hub and top of housing is 1/16". Install steering wheel, connect direction signal wires. Adjust shifter levers and shifter rods as directed above.

Lower Bracket Mounting—If lower bracket removed, make certain that clamping bolt washer on bracket engages slot in steering column. This is important to position bracket properly.

Shifter Shaft & Tube Replacement:—Adjustment between Low-Reverse (outer) tube and Second-High (inner) shaft maintained by collar on lower end of shaft. Shaft must be drilled for correct location of collar locking pin if either tube or shaft replaced. To locate collar pin hole in shaft, assemble control on bench without the two anti-rattle spring washers located between the collar and tube (upper washers). Pull shaft through tube until all clearance taken up between upper ends, place .021" feeler thickness between collar and lower end of tube, drill and ream for locking pin without disturbing position of collar (use #32 drill and ⅛" or .1245-.1255" reamer). Then assemble control as directed above making certain that spring washers properly installed.

CHEVROLET TYPE

Used On:

MASTER DELUXE AG, SPECIAL DELUXE AH ('41)

TYPE:—Vacuum assistor type with gearshift lever mounted on steering colunm and vacuum power cylinder mounted on bracket at left side of transmission case. Design same as used on 1940 models except for new Vacuum Cylinder mounting as follows:

Vacuum Cylinder Mounting Bracket—Bracket is separate part mounted on left side of transmission case by three bolts (was integral part of universal joint ball collar). This new mounting permits rear axle and universal joint to be disassembled without disturbing shift mechanism.

ADJUSTMENT:—If operation unsatisfactory or if shift mechanism dismantled for servicing, adjust as follows:

Steering Column Control Assembly—See Servicing data below for dimensions to which parts should be set up when assembled.

Selector Rod—Loosen check nut on selector rod adjustment (at lower end of steering column), pull selector rod forward as far as possible, adjust swivel on rod by screwing it up or down on rod so that distance between lower side of steering wheel and top of gearshift lever is 1 27/32" with selector rod connected to selector control lever. Install washer and cotter pin on swivel pivot and lock adjustment by tightening selector rod check nut.

Control Rod (Gear Engagement Rod)—Set gearshift lever in horizontal position, loosen checknut on control rod. Push control rod to rear until all clearance has been taken up and note location of swivel with reference to shift control lever, then pull rod forward until all clearance has been taken up and again note swivel location. Neutral valve position is midway these two positions. Hold control rod in this neutral position, adjust swivel position on control rod (screw swivel up or down on rod) until swivel pivot just enters hole in shift control lever. Install flat washer and cotter pin on swivel pivot, lock adjustment by tightening control rod check nut.

SERVICING STEERING COLUMN UNIT:—Gearshift Lever Removal—Lever can be removed without disturbing steering column assembly by shifting into Reverse, depressing pivot pins 3/32" and then lifting up and out on lever. To remove anti-rattle spring and pivot pin spring, compress legs of pivot pin spring and lift up. When reassembling gearshift lever, coat control shaft ball with graphite grease, install anti-rattle spring in control shaft ball and over neck of control shaft, thread pivot pins on ends of spring and in holes in gearshift lever swivel, thread gearshift lever over this assembly, compress pivot pins and press down on top of lever until pivot pins snap into place.

Disassembly—Disconnect gear engagement control rod and selector rod at lower end of steering column by taking out cotter pins and removing flat washers. Remove clamp bolt on shift lever at lower end of control shaft, remove lever and spring. Remove horn button and steering wheel nut, pull steering wheel (use puller J-1618 to protect shaft threads). Remove instrument panel steering column jacket clamp. Take out two screws in upper support on steering column jacket, pull control shaft and upper support up and out of lower support. If gearshift lever to be removed, see preceding paragraph for directions.

Lower Support Bushing Servicing—If bushing worn, press old bushing out, press new bushing in until distance from face of support to lower end of bushing is 19/64".

Reassembly—Screw gearshift lever swivel into upper support until shoulder on swivel extends approximately ⅛" above support. Install control shaft by threading it through upper support and swivel. Install gearshift lever (see above). Install lower support on steering column jacket and see that key engages slot, tighten clamp bolts just snug (excessive tightening will collapse jacket). Screw upper support up or down on swivel until clearance between lower edge of gearshift lever and top of support is 3/32-⅛". Thread toeboard grommet over control shaft, install control shaft through lower support and attach upper support to steering column by installing two screws. Install spring and lever on lower end of control shaft making certain that end of selector operating lever is engaged in slot on control shaft lever, install clamp bolt and tighten securely. With steering wheel removed, check distance from top of horn blowing ring on mast jacket to top of shoulder on steer-gear shaft. Distance should be 1¼" (plus 1/32", minus 0"). If not correct, loosen mast jacket clamp at steering gear housing, move mast jacket up or down as required, tighten clamp. Adjust Control Rod and Selector Rod (see Adjustment above). Check distance from upper face of control shaft lever to lower face of lower support bracket on steering column. If this distance not ¾", adjust by loosening lower support clamp bolts and moving support up or down on steering column.

CAUTION—Do not tighten support clamp bolts excessively which will collapse steering column jacket.

SERVICING TRANSMISSION LEVER LINKAGE:—Note—Reactionary lever assembly is of riveted construction and cannot be disassembled (service as an assembly).

Disassembly—Disconnect shift control rod from reactionary lever assembly, remove vacuum hose from vacuum inlet stack and slip forward end of rubber boot off rear end of metal boot. Remove two screws holding metal boot halves together, lift off outer half of boot. Take out piston rod yoke clevis pin, push cylinder rod into cylinder to disconnect it from reactionary lever, then re-install clevis pin to prevent valve adjustment being disturbed. Loosen operating lever clamp bolt, pull reactionary lever assembly off operating lever shaft, remove second half of metal boot.

Servicing—Clean reactionary lever assembly with clean gasoline, examine rubber seal at front of metal boot and replace if damaged.

Reassembly—Coat reactionary levers lightly with graphite grease, place inner half of metal boot on operating lever shaft, thread rubber seal over idler lever, install reactionary lever assembly on operating lever shaft to point just beyond chamfered end of shaft and tighten clamp bolt. Pull piston rod forward and connect yoke and valve link to reactionary levers, install piston rod valve clevis pin. Assemble outer half of metal boot and install the two retaining screws. Slip end of rubber boot over rear end of metal boot, install vacuum hose and shift control rod.

SERVICING VACUUM CYLINDER:—Removal—Disconnect vacuum and air hose, remove outer half of metal boot and disconnect piston rod and valve links from reactionary levers (see Servicing Transmission Lever Linkage above for directions). Take off cotter pin and nut on cylinder mounting stud, remove vacuum cylinder.

Installation—Install rubber cushion and steel retainer on mounting stud, insert stud through hole in bracket, install steel retainer, rubber cushion, flat washer and nut on stud, tighten nut just sufficiently to allow cotterpin to be installed (mounting must be flexible). Connect piston rod yoke and valve link to reactionary levers, install vacuum and air hoses.

Vacuum Cylinder Lubrication:—Must be removed from car as directed above (cannot be lubricated on car). Stand the cylinder on the mounting end, pull valve link forward to open valve, pour ½ oz. shock absorber insulating fluid into cylinder through vacuum inlet stack. Push valve rod into cylinder as far as possible, pour additional ½ oz. of fluid into vacuum inlet stack. Allow time for fluid to flow into cylinder, then work piston rod in and out several times and turn rod at same time to spread fluid over cylinder walls and piston leather. NOTE—Cylinder can be washed out by following directions given above using 2 ozs. of fluid and draining fluid by inverting cylinder and moving valve rod until fluid flows out. Repeat until fluid drained from cylinder is clean (cylinder need not be lubricated after this process completed).

Vacuum Cylinder Valve Adjustment:—If vacuum valve adjustment disturbed by dismantling or servicing operations, adjust as follows: Disconnect piston rod and valve link from reactionary levers (see Servicing Transmission Lever Linkage above for directions). Install special adjusting bushing J1452-5 within valve link and re-install clevis pin. Run engine to provide vacuum source. Move valve link out or away from cylinder until all clearance between link and adjusting bushing is toward front of car, piston rod should move out of cylinder slowly in this position. Then move link in toward cylinder until all clearance between link and adjusting bushing toward rear of car, piston rod should move into cylinder in this position. If piston rod moves out but does not move in, valve link should be screwed out on valve rod. If piston rod moves in but does not move out, valve link should be screwed in on valve rod. To adjust, remove clevis pin and change valve link position ½ turn at a time until correct operation is secured.

Valve Friction Spring Installation:—To install spring, remove outer half of reactionary lever boot and disconnect reactionary levers from vacuum cylinder (see Transmission Lever Linkage Disassembly directions above), pull out on valve rod in vacuum cylinder, snap friction spring in place on rod midway between valve and valve rod guide with closed end of spring toward back of cylinder, push valve rod back into place, connect reactionary levers and replace metal boot.

NOTE—This spring necessary to prevent 'flutter' in gearshift lever at idling speed.

Air Cleaner Servicing:—At 10000 mile intervals, remove cleaner, wash in gasoline, and dip in engine oil before re-installing.

STANDARD TYPE

Used On:

CHRYSLER, MODELS C28,C30,C33 (1941)
DE SOTO, MODEL S8 (1941)
DODGE, MODEL D19 (1941)
PLYMOUTH, MODELS P11, P12 (1941)

NOTE:—Power Shift—Power shift with vacuum power cylinder is Optional Equipment on all models. This type is adjusted differently. See separate article (following) for Power Shift adjustment.

Vacamatic Underdrive (Chrysler) & Simplimatic Underdrive (DeSoto) Transmission—Special controls are used in conjunction with these optional transmissions. See Transmission articles for adjustment directions.

TYPE:—Remote control type with gearshift lever mounted on steering column. Steering column unit is new design (not same as 1940 type) with gearshift rod at right side of steering column (not within column jacket as on 1940 cars). On all models except Plymouth, steering column and shift rod are enclosed by additional casing extending from upper lever pivot bracket to edge of instrument panel. Gearshift lever is mounted on bushing in pivot bracket (shift control rod slotted at this point to clear bearing) so that the lever pin engages the yoke on the outer end of the control rod. Control rod is mounted in bushings at upper and lower ends (upper bushing in gearshift lever pivot bracket, lower bushing in mounting collar on steering column jacket). Gear engagement lever bolted on lower end of control rod is linked to shift lever on transmission case by two rods with an idler lever mounted on bracket on flywheel housing between the front and rear rods (this idler lever not used on Dodge and Plymouth models with one shift rod only). A collar on the lower end of the control rod engages the selector lever pivoted on the steering column and linked to the cross-shift lever on the transmission case by a single rod. A spring installed on the control rod below the steering column bushing collar holds the control rod down so that the selector lever and rod is in the Second-High position except when gearshift lever is raised for Low-Reverse engagement which pulls control rod up against spring tension and rotates the selector lever and rod to the Low-Reverse position.

Transmission Case Shifter Mechanism—Same design as used on 1940 cars. Refer to Chrysler Transmission article for servicing data.

ADJUSTMENT:—Control Rod (Gear Engagement) — Loosen nut on control rod connector stud on lever at lower end of steering column control rod, make certain that transmission gears and shift lever are in neutral position (can be determined by feel of detent balls engaging neutral notches in shifter shafts), see that steering column gearshift lever is horizontal, tighten stud nut securely (stud hole in lever is slotted to permit this adjustment).

Selector Rod (Cross-shift)—See that transmission gears are in neutral position. Adjust selector rod as follows: On all models except Plymouth, loosen locknut on forward end of selector rod at trunnion on steering column selector lever, tighten adjusting nut until all play removed from rod and lever, then back nut off ½ turn to provide correct operating clearance, tighten locknut. On Plymouth, loosen locknut on rear end of selector rod at transmission case cross-shift lever, tighten adjusting nut on rod to take up all play, back nut off ½ turn and tighten locknut.

SERVICING:—Disassembly—Remove horn button, horn wire and steering wheel. Disconnect selector rod and gearshift rod at steering column. Take off nut on lower end of control rod and remove rod end (selector lever collar), lever and spring from lower end of rod. Take out two screws attaching gearshift lever pivot bracket to steering column (except Plymouth). On Chrysler models, gearshift lever and control rod can then be withdrawn at upper end of steering column. On DeSoto & Dodge, remove attaching bolts and separate steering column bracket at dash, then withdraw gearshift lever and control rod as an assembly. On Plymouth models, remove gearshift lever (see below), then withdraw control rod at upper end without disturbing lever pivot bracket. Install control rod in same manner and adjust rods as directed above.

Gearshift Lever Removal—To remove lever from control rod, remove shift lever bearing and screw from lever and pivot bracket. Press down on end of lever so that end clears control rod, then pull lever out to disengage lever pin from fork on rod. Install lever in same manner.

POWER SHIFT TYPE

Optl. Equipment On:

CHRYSLER, MODELS C28, C30 (1941)
DE SOTO, MODEL S8 (1941)
DODGE, MODEL D19 (1941)
PLYMOUTH, MODELS P11, P12 (1941)

TYPE:—Power shift consists of a vacuum power cylinder linked to the gear engagement rod at the transmission case so that all of the effort required to shift gears is supplied by the power cylinder. Power is not used for the selector rod or cross-shift mechanism and this operates in the same manner as on the standard manual gearshift.

Steering Column Control—Design is same as used on cars without power shift (see preceding article) and is serviced in same manner. Adjustments are not made in same manner and rods should be adjusted as directed below.

Power Linkage—Consists of a valve lever, reaction lever and relay lever assembly pivoted on a shaft on a bracket bolted on the left side of the transmission case. Control rod from steering column control rod lever is linked to valve lever and an additional short non-adjustable rod is linked between the relay lever and the shift lever on the transmission case.

Power Cylinder—Consists of an internal-valve type vacuum power cylinder mounted on a bracket at the left of the transmission case with the piston rod linked to the relay lever so that power is applied to transmission case shift lever. Control valve is located within piston rod with valve rod extending out though piston rod and linked to lever assembly. Vacuum line (from manifold) is connected to inlet pipe extending out through side of piston rod boot and air intake hose from cylinder is connected to air cleaner mounted on frame.

ADJUSTMENT:—See important Caution below when making adjustments. Before making adjustments, see that all linkage moves freely and does not bind at any point, lubricate all linkage bearing points. See that piston rod boot is intact and that vacuum line and air line connections are tight. Examine air cleaner and clean filter element if required. Make Neutral Adjustment and also adjust valve if gear engagement is slow or sluggish in either direction (Low & High or Second & Reverse).

Power Cylinder Valve Adjustment—To adjust valve, remove piston rod boot, take out valve rod clevis pin (which links valve rod clevis to lever assembly), shorten valve rod by turning clevis in on rod (if Low or High shift sluggish), lengthen valve rod by turning clevis out on rod (if Second or Reverse shift sluggish) one-half turn at a time, reconnect valve rod by inserting clevis pin and check performance (too much adjustment will cause shift to be sluggish in the other direction). Repeat adjustment until performance is satisfactory in both directions. If proper performance cannot be secured, lubricate power cylinder (see Servicing below) or replace power cylinder assembly.

Neutral Adjustment—This adjustment properly locates boss on detent spring (mounted on lever bracket) in relation to notch in valve lever which is connected to steering column shift control rod. Adjust with engine running to supply vacuum and with rear wheels jacked up so that car will not move if gears are engaged. Disconnect selector rod and loosen detent spring mounting bolt (see Note below). Move power lever and links back and forth slightly and at same time move selector lever until a positive and clean 'cross-over' is felt at neutral position. Hold levers in this position, move detent spring so that boss indexes with notch in lever and tighten detent spring bolt. Connect selector rod and adjust this rod as follows: On all models except Plymouth, loosen locknut and tighten adjusting nut on forward end of selector rod (at trunnion on steering column selector lever) until all play has been taken up in rod and lever, then back off nut ½ turn for correct operating clearance and tighten locknut. On Plymouth, loosen locknut at rear end of selector rod (at transmission case cross-shift lever), tighten adjusting nut until all play taken up, then back off nut ½ turn and tighten locknut. Check performance.

Detent Spring Note—Two types of detent springs have been used. First type consisted of a flat spring with boss for lever notch engagement. Second type consists of a ball and spring assembly to provide more positive detent action. Both types are adjusted alike as directed above.

ADJUSTMENT CAUTION—Always jack up rear wheels free of floor and securely block in this position when making adjustments. This is particularly important when running engine to supply vacuum for power shift performance tests as tests may result in gear engagement which would cause car to move. This is particularly important if work being performed under car.

SERVICING:—Power shift serviced as a unit and service parts furnished for boots and linkage only. Vacuum power cylinder should be serviced by replacement as a unit.

Power Cylinder Lubrication — Power cylinder must be removed from engine for lubrication. To remove, remove leather boot, disconnect vacuum line and air cleaner line at cylinder. Take out power pin linking piston rod yoke to relay lever (pin should be re-inserted as soon as lever freed from yoke to prevent valve clevis turning on rod which would disturb valve setting). Remove nut on anchor stud at mounting bracket on rear end of cylinder, remove cylinder from engine. Clamp cylinder in bench vise in horizontal position (clamp at mounting stud). Locate piston rod in midposition, press in on valve rod and pour ½ oz. of shock absorber fluid or ice machine or transformer oil

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in vacuum inlet pipe. Allow sufficient time for oil to run down into cylinder, pull out on valve rod and pour in additional ½ oz. of oil. This will lubricate both sides of piston. Work piston through full travel several times, rotate piston in cylinder meanwhile so that oil distributed over entire cylinder and piston packing surfaces. Re-install power cylinder on car.

Air Cleaner—Should be cleaned and re-oiled at 15000 mile intervals or more frequently if car operated in dusty territory. To service cleaner, remove two screws mounting cleaner on frame, remove cleaner element, clean element in kerosene, re-oil by dipping in SAE. #50 engine oil and re-install on car.

Transmission Case Shifter Mechanism — Same type as used on cars with standard shift control. See Chrysler Transmission article for servicing data.

FORD, LINCOLN, MERCURY TYPE

Used On:

FORD, MODEL 11A PASS. CARS (1941)

LINCOLN, MODELS 16H, 168H (1941)

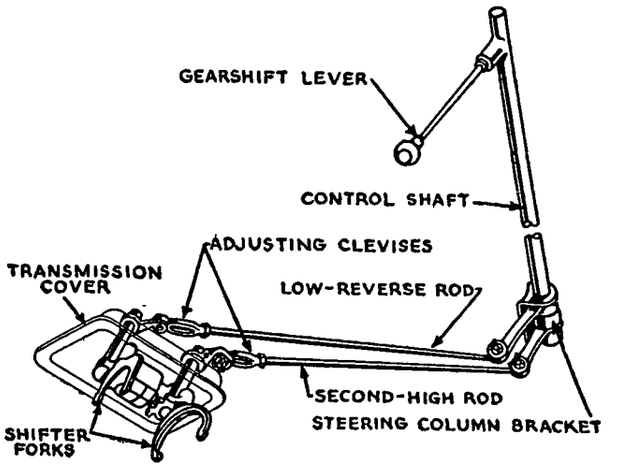
MERCURY, MODEL 19A (1941)

TYPE:—Remote control type with steering column mounted gearshift lever. Used in connection with transmission having special shifter mechanism on transmission case side cover which consists of separate Low-Reverse (rear) shift lever and Second-High (front) lever. Steering column unit consists of a control tube with a clutch pin at the lower end which normally engages the lower (second-high) lever on the steering column. When the gear shift lever is raised to engage Low or Reverse, the control tube is lifted up so that the clutch pin engages the upper (Low-Reverse) lever. These levers are connected to shift levers on transmission case by control rods with adjusting clevis at transmission case end.

ADJUSTMENT:—Adjustment should be checked whenever steering column position is changed or when linkage disconnected. Before making adjustments, make certain that both shift levers on transmission case are in neutral with detent balls engaging neutral notch in shifter shaft sectors (can be determined by feel with control rods disconnected). Disconnect Low-Reverse control rod at rear lever on transmission case, loosen locknut and adjust clevis on end of rod so that gearshift lever moves up and down freely (cross-shift at neutral) with control rod connected. Second-High control rod will not ordinarily require adjustment. Make certain that gearshift lever has full travel in both directions so that gears are fully engaged (detent balls should engage end notches in shifter shaft sectors with gears engaged).

SERVICING:—Steering Column Unit—Steering column unit is mounted on steering column by retainer clamped in bracket bolted on column and can be dismantled after bracket has been loosened and retainer setscrew removed. Gearshift lever is pivoted on pin in control tube elbow and inner end engages fulcrum pin within upper end of control tube. If assembly dismantled, make certain that spring installed at lower end of fulcrum pin and that bushing and boot installed on upper end of fulcrum pin when it is reassembled. Sleeve type insulator should be installed on end of gearshift lever before lever is installed.

Transmission Case Shifter Mechanism—See Transmission article for servicing data.



HUDSON TYPE

Used On:

SIX, MODELS 10, 11, 12, 18 (1941)

EIGHT, MODELS 14, 15, 17 (1941)

TYPE:—Remote control type with steering column mounted gearshift lever. Design same as used on 1940 models except as follows:

Steering Column Unit—Cross-shift control cable ends protected by boots at both steering column and transmission case ends. Operating rod (gear engagement rod) has new type ends with adjusting clevis at forward (steering column) end of rod.

Transmission Case Shifter Mechanism — New type design used in conjunction with new synchro-mesh transmission. Gears are engaged by lever on inner end of shaft in side of transmission case which engages upper or lower shifter rail in case. This shaft and lever are shifted in or out (for cross-shift at neutral) by an inner lever on a vertical cross-shift shaft. Selector cable is connected to outer lever on this vertical shaft.

ADJUSTMENT:—Operating Rod (Gear Engagement)—With gearshift lever and transmission gears in neutral position, disconnect operating rod at lever on steering column by removing cotter pin and clevis pin, loosen locknut and turn clevis on rod until clevis pin can just be installed without disturbing position of transmission case shift lever and with gearshift lever in neutral and at right angles to centerline of car. Tighten locknut and connect rod.

Selector Cable (Cross-shift)—Place steering column shift lever in Low-Reverse or 'up' position at neutral and block in this position while adjustment being made. Loosen selector cable conduit bracket capscrew at lower end of steering column and move conduit bracket up until all slack removed from cable and shift lever at transmission case is fully over in Low-reverse position (lever to rear), tighten bracket capscrew securely. See that anchor on steering column end of cable (at lower end of control lever pushrod) has clearance at top and bottom of travel.

SERVICING:—Removal of steering column unit requires that horn button and steering wheel be removed first. Steering column can then be serviced as follows:

Gearshift Lever Removal—Remove control tube upper bracket clamp bolt (use Phillips type screwdriver), remove upper bracket and fulcrum bracket ring. Use Allen wrench to remove control lever fulcrum, withdraw lever and anti-rattle washer. Remove selector cable anchor (at lower end of steering column unit), push end of pushrod up for access to control lever upper end. Assemble in same manner applying small amount of viscous chassis grease to bracket before installing.

Steering Column Unit—Remove front seat cushion, accelerator pedal, floor mat, transmission opening cover, horn button and steering wheel. Disconnect control rod at steering column end, remove selector cable anchor bracket bolt, remove cable anchor and jacket tube bracket cap, pull jacket tube and control tube off steering column tube. Remove control tube upper bracket clamp bolt (Phillips type screw-driver), bracket, and bracket ring. Remove gearshift lever (see above). Remove fulcrum bracket setscrew, mark control tube and fulcrum bracket (to insure reassembly in same relative positions), press tube out of bracket. To remove lower bracket, remove clamp bolt and slide bracket off. Reassemble in same manner being careful to line up marks on control tube and fulcrum bracket. Adjust control rod and selector cable as directed above.

Transmission Case Shifter Mechanism—Refer to Hudson Transmission article for servicing data.

NASH TYPE

Used On:

AMBASSADOR '600', MODEL 4140 (1941)

AMBASSADOR SIX, MODEL 4160 (1941)

AMBASSADOR EIGHT, MODEL 4180 (1941)

TYPE:—New design remote control type with steering column mounted gearshift lever. Steering column unit consists of a single control shaft mounted in upper and lower brackets on steering column with key in lower end which engages one or the other of the two levers mounted on the lower bracket. These levers are linked to shifter shaft levers on transmission case by rods which have adjustment at transmission case end. Control shaft is normally held down in the lower position (engaging lower Second-High lever) by a spring installed on the lower end of the shaft. Shaft is raised so as to

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engage upper Low-Reverse lever by lifting up on gearshift lever (lever pivots on bearing screwed in upper bracket and engages integral arm on upper end of control shaft).

ADJUSTMENT:—With gearshift lever in neutral, install special aligning pin J-1390 through holes in both flanges of steering column lower bracket and through holes in both levers so that levers are aligned in this neutral position. Loosen locknut and back off setscrew on each rod trunnion on transmission case shifter shaft levers. Carefully position each shifter shaft so that gears are in neutral (can be determined by feel of detents engaging neutral notch in sector on inner end of shafts), tighten setscrews securely and lock with locknuts. Remove aligning pin.

SERVICING:—**Caution**—Do not remove two screws in control shaft upper bracket on steering column below gearshift lever unless steering column jacket is disassembled from steering gear. These screws thread into loose tapped plate within jacket and this plate will drop down out of position if screws removed so that steering gear must be disassembled in order to re-install screws.

Steering Column Unit—Disconnect rods at levers on steering column, remove cotter pin in lower end of control shaft, remove plain washer, pull-down spring, rubber sleeve, and second washer from end of shaft. Raise control shaft up to engage Second-High lever, then rotate shaft until key lines up with slot in upper flange of lower mounting bracket, raise shaft up and free of lower bracket. Control shaft can then be removed from upper end (with steering wheel removed) by removing key from shaft and loosening setscrew in limiting plate so that plate will slide off lower end of shaft as shaft withdrawn through upper mounting bracket. CAUTION—Do not remove upper bracket mounting screws—see Caution note above.

Gearshift Lever & Upper Bracket—Lever pivot consists of pointed setscrew and nut installed in lever and upper bearing. When installing lever, make certain that anti-rattle grommet installed on end of control shaft arm, tighten clampscrew in upper bracket for minimum clearance between bracket and threaded bearing without binding.

Lower Bracket & Lever Assembly — If lower bracket removed from steering column, make certain that locating tongue on bracket engages hole in jacket tube when bracket installed. Install bracket with slotted hole uppermost. See that levers and spring installed properly (fibre washer between each lever and bracket flange, spring within bearing tube between levers). Install pulldown spring and washer assembly on lower end of control shaft and install cotter pin.

Limiting Plate Adjustment—Must be adjusted so that control shaft selector key does not rub on lower flange of mounting bracket. To adjust, loosen locknut and back off adjusting setscrew. Engage control shaft with Second-High lever fully, then raise shaft slightly to provide clearance between key and lower flange of bracket, position limiting plate so that rubber cushioning washer is against top flange of bracket, tighten setscrew and lock with locknut.

OLDSMOBILE HANDI-SHIFT

Used On:

SIX, MODELS 66, 76, 96 (1941)

EIGHT, MODELS 68, 78, 98 (1941)

NOTE:—This control used with Std. 3-speed synchromesh transmission. Control used with Optl. Hydra-Matic Transmission is different design and is adjusted as directed in Hydra-Matic Transmission article.

TYPE:—Remote control type with steering column mounted gearshift lever. Design same as used on 1940 car models except for new shift rod linkage as follows:

Control Rod (Gear Engagement) Linkage—New relay lever (idler lever) mounted on left side of engine with front non-adjustable rod connected between this idler lever and lever on steering column and additional rear adjustable rod connected between idler lever and gear shift lever on transmission case. Rear rod has adjusting clevis on transmission case end.

ADJUSTMENT:—**Selector Rod (Cross-shift)**—See that shift lever and transmission gears in neutral, check vertical distance from top of gearshift lever to lower face of steering wheel rim. This distance should be 2 11/16—2 13/16". To adjust, remove cotter pin and take out lock pin in lever which engages adjusting screw on lower end of selector rod, turn adjusting screw up to reduce lever-to-wheel distance, down to increase this distance. Install lock pin from engine side making certain that it passes through waved spring washer on inside of lever, install cotter pin.

Control Rod (Gear Engagement)—With transmission gears in neutral, gearshift lever should be approximately ½" above horizontal position. To adjust, disconnect shift rod at lever on transmission case (upper gear engagement lever), see that this lever in neutral position (can be determined by feel of detent balls engaging notches in shifter shafts). Install special aligning gauge J-1609 over lower end of control shaft and steering column so that notch in gauge engages control shaft lever (gauge will hold gearshift lever and shaft assembly in correct neutral position which is ½" above horizontal). Loosen locknut and turn adjusting clevis on transmission end of shift rod until clevis pin can just be inserted without disturbing position of transmission shift lever. Tighten locknut and connect rod, remove gauge. NOTE—This adjustment should be made each time shift rod is disconnected at either end. Improper adjustment may cause interference with brake pedal.

SERVICING:—**Gearshift Lever**—To remove lever, slide rubber cover toward outer edge to expose retainer ring, remove retainer ring, take out shift lever pivot pin, remove lever being careful not to lose shims and washers between lever and bracket. When reinstalling lever, make certain that anti-rattle spring in place on inner end of lever and that spring washer installed on pin on one side of lever and install shims (as required) on opposite side of lever so that lever operates freely without excessive sideplay or rattles.

Transmission Case Shifter Mechanism—Selector shaft and shifter shafts (for gear engagement) are same design as used on 1940 models. See Transmission article for dismantling and servicing directions. CAUTION—Selector shaft must be removed through right side of case and installed on left side to avoid damage to oil seal. Lower lever must be removed from vertical cross-shift shaft before selector shaft is driven out (to permit upper lever on shaft to disengage from selector shaft).

PACKARD TYPE

Used On:

CLIPPER MODEL 1951 (1941)

'110' SIX, MODEL 1900 (1941)

'120' EIGHT, MODEL 1901, 1A (1941)

'160' SUPER EIGHT, 1903, 3A, 4, 5 (1941)

'180' CUSTOM SUPER EIGHT, 1906,7,8 (1941)

SPECIAL SERVICE CAUTION:—Always insert 3/16" lock pin aligning gauge through holes in both levers at lower end of control tube on steering column when working on engine in proximity to control rods and levers to prevent accidental gear engagement which would prevent operation of gearshift lever until gears and rods had been reset in neutral.

TYPE:—Remote control type with steering column mounted gearshift lever. Same design as used on 1940 car models except as follows:

High Gear Steering Column Lever Stop—Consists of an adjustable rubber bumper on steering column bracket which engages lever in third or high gear position so as to take up all slack in linkage. See Adjustment directions below.

Idler Lever Assembly—Second & High Idler Lever mounted on roller bearings on bracket shaft mounted on brake master cylinder (Low & Reverse idler lever mounted on plain bushings). Bearings are packed with lubricant at assembly and require lubrication only when disassembled. Over-center type assist spring is used on Second & High Idler lever (not used for Low & Reverse lever).

ADJUSTMENT:—See that gearshift lever in neutral, install 3/16" rod through alignment holes in both levers at lower end of control tube on steering column and leave this pin in place while adjustments being made. Disconnect both control rods at levers, place both shifter levers on transmission case in neutral position (this can be determined by feel of detent balls engaging neutral notch on each shifter lever shaft sector within transmission). Adjust each control rod at bellcrank (loosen locknuts and turn adjusting sleeve on upper rod, adjusting clevis and locknut also provided at bellcrank end of lower rod) so that lengths are correct and rods can be connected without disturbing position of shift levers, connect rods and remove pin from alignment hole in levers.

High Gear Lever Stop Adjustment—Loosen locknut and adjust stop by turning mounting stud so that rubber cap on stop is compressed at least ⅛" with shift lever and transmission gears in 3rd. speed or High Gear position.

PONTIAC SAFETY-SHIFT

Used On:

SIX, MODELS 41-24, 25, 26 (1941)

EIGHT, MODELS 41-27, 28, 29 (1941)

SPECIAL SERVICE NOTES & PRODUCTION CHANGES:—Streamliner & Custom Torpedo Models 41-24,26,28,29. New type single shifter rod (between steering column lever and shift lever on transmission case) used on these models beginning with the following Serial Numbers:

	Pontiac	Linden	South Gate
41-24	P6JB-25488	L6JB-6379	C6JB-4044
41-26	P6JC-4884	L6JC-2404	C6JC-1789
41-28	P8JB-19031	L8JB-4349	C8JB-3246
41-29	P8JC-7794	L8JC-3274	C8JC-1957

Installing New Single Rod on First Cars—New type single rod furnished for service replacement on all cars. When installing new single rod on first cars (with front and rear rods and intermediate idler lever), proceed as follows: Remove clutch and brake pedal toe plate, cut off shifter rod idler lever bracket and re-install plate. Install the following new parts—506712 Gearshift Control Rod, 506713 Transmission Shifter Lever, 505760 Gearshift Control Shaft Idler Lever (these are levers to which rod attaches at front and rear ends). Discard old parts.

Hard Shifting Complaints—To correct complaints, examine linkage and make following corrections:

Rear Shift Rod Alignment—On cars with front and rear control rods and intermediate idler lever, check rear shift rod and see that ends are parallel so that rod does not bind in transmission shift lever as gears engaged. See note above for installation of new type single rod to replace this double rod and idler lever assembly.

Idler Lever Bracket—Check idler lever bracket for looseness allowing lever to bind on rods. If bracket loose at mounting rivets, remove toe plate and securely weld bracket or remove idler lever and install new type single rod.

Control Shaft Toeboard Grommet—See that rubber grommet on steering column and shift control shaft at toeboard does not bind on shaft and prevent free up-and-down movement (required for cross-shift at neutral). Correct by trimming rubber at point where bind occurs and applying few drops of brake fluid to shaft.

Control Shaft & Gearshift Lever Clearance—If shoulders on shaft not machined low enough, they will strike gear shift lever fulcrum cups and prevent full Low and Reverse gear engagement causing hard shifting. To check this dimension, remove control shaft, place small square on shaft so that upper edge even with tops of shoulders on shaft, measure perpendicular distance from top of square to bottom of fulcrum ball on end of shaft. Distance should be 1 1/16". If incorrect, rework shaft as follows: If over-all length of shaft (from lower end to tops of shoulders at upper end) is more than 32 11/32"±1/32", file shoulders down to secure correct 1 1/16" fulcrum ball height. If over-all length of shaft within limits given above, bend ball end of shaft to secure correct fulcrum ball height.

TYPE—Remote control type with steering column mounted gearshift lever. Same design as used on 1940 cars except for control rod on some models (see Production Change Note above).

ADJUSTMENT:—Gearshift Lever Clearance—Clearance between upper edge of control shaft upper support and shoulder on upper control shaft bearing which is screwed in the bracket must be ⅛" minimum, 5/32" maximum, to avoid interference when engaging gears. If clearance incorrect, adjust by removing gearshift lever (see Servicing data below), screw bearing in or out of support bracket.

Selector Rod (Cross-shift)—With gearshift lever in neutral on Second-High side (normal position), distance from lower edge of steering wheel rim to upper edge of gearshift lever should be 2⅞" (plus or minus ⅛"). To adjust, loosen clamp bolt holding selector control lever and selector control idler lever together (these are levers pivoted on lower suport bracket on steering column), see that selector rod and levers are in Second-High position (rod moved to rear as far as possible), place gearshift lever in correct position and tighten lever clamp bolt.

Control Rod (Gear Engagement)—With gearshift lever in neutral, lever should be approximately horizontal but can be varied approximately 1½" to suit individual operators. To adjust, loosen clamp bolt holding control shaft lever and control shaft idler lever together (these are levers mounted on lower end of control shaft on steering column), see that control rod and transmission case shifter lever are in neutral, move gearshift lever to desired position and tighten lever clamp bolt. Check to make certain that gearshift lever has full travel required for gear engagement without interference after making this adjustment.

SERVICING:—Disassembly—Remove front compartment floor mat, center floor panel, and steering wheel (use puller J-452). Remove gearshift lever using tool J-1044 to remove shift lever pins and springs, use care not to lose spring washer and shims, disconnect return spring hooked to clip on lower end of control shaft, remove selector control lever pivot pin. Take out screw in lower end of control shaft, remove selector lever collar, control shaft lever and idler lever assembly from shaft. Remove screws in upper support bracket at upper end of control shaft (use Philips #2 screwdriver). Pull upper support and control shaft assembly up parallel to steering column and lift out being careful not to lose anti-rattle spring and spring cup (in upper support), flat anti-rattle spring (in lower suport).

Reassembly—Reassemble by reversing disassembly directions given above. Make certain that anti-rattle spring installed in lower support bracket and upper support bracket (spring and cup must be installed in upper bracket before bracket mounted on steering column). Lubricate all moving parts (including anti-rattle springs) with Lubriplate before assembling. Use caster oil in insulators at rod connections in levers (oil or grease will cause insulators to swell and bind on rods).

Gearshift Lever Assembly—One anti-rattle spring washer must always be used on gearshift lever pivot pin and shims should be installed as required to take up excessive clearance so that lever operates freely without excessive play or rattles.

Transmission Case Shifter Mechanism—Selector shaft and shifter shafts (for gear engagement) similar to design used on 1940 car models. See separate Transmission article for dismantling and servicing instructions. CAUTION—Selector shaft must be removed through right side of case and installed on left side to avoid damage to oil seal. Lower lever must be removed from vertical cross-shift shaft before the selector shaft is driven out (to permit upper lever on shaft to disengage from selector shaft).

STUDEBAKER TYPE

Used On:

CHAMPION, MODEL 3G (1941)

COMMANDER, MODEL 11A (1941)

PRESIDENT, MODEL 7C (1941)

SERVICE TOOL NOTE:—Gauge No. J-1308-A required for transmission control adjustment. This gauge is same type used on 1940 models and differs from first type used on Champion cars (see Service Tool Note in 1940 Supplement).

TYPE:—Remote control type with steering column mounted gearshift lever. Same design as used on 1940 models.

ADJUSTMENT:—Pry out inspection plug in engine side of control housing cover on steering column at lower end of control shaft, insert forked end of adjusting gauge J-1308-A (see service tool note above) in hole and press up on control shaft until gauge prongs enter above and below the selector lever on the control shaft which hold control levers and shaft assembly in neutral position while adjustments are being made. Disconnect both connecting rods at shift levers on side of transmission case, place each lever in neutral position (can be determined by feel of detent balls engaging neutral notch in shift lever shaft sectors). Loosen locknut and adjust clevis on transmission end of each rod so that clevis pins can be inserted without disturbing lever positions, tighten locknuts and connect rods. Remove gauge and replace inspection hole cover.

SERVICING:—If control mechanism removed from steering column, coat upper bracket pin threads and shift lever ball with Lubriplate, turn pin into upper bracket so that end of thread on pin is flush with lower face of bracket. Make certain that key on lower control housing mounting bracket engages notch in steering column. Adjust rods as directed above when control re-installed on car.

Lubrication—Lubricate gear shift control box on steering column at 10000 mile intervals using chassis lubricant.

WILLYS TYPE

Used On:

AMERICAR & PLAINSMAN MODEL 441 (1941)

WILLYS COMM'L. MODELS 441, 441P (1941)

TYPE:—Remote control type with gear shift lever on control shaft under steering wheel. Shaft has dog clutch at lower end (pin in shaft engages slots in levers) by which it is engaged with upper lever (connected to rear lever on transmission case) for Low-Reverse, or lower lever (connected to front lever on transmission case) for Second-High engagement. Control rods connecting steering column levers and transmission case levers have adjusting clevises at transmission case end.

ADJUSTMENT:—Disconnect both control rods at transmission case levers by removing clevis pins, make certain that both levers are in neutral position (can be determined by feel of detents engaging notches in shifter lever shaft sectors). Place steering column shift lever in neutral position, install aligning tool (short piece of ¼" drill rod) through hole in each lever and hole in boss on steering column clutch

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housing (at lower end of control shaft) to hold levers in neutral position while adjustment being made. Loosen locknut and adjust clevis at transmission end of each control rod until clevis pin can just be inserted without disturbing position of transmission case lever. Tighten locknut and install clevis pin. Remove aligning tool. Check operation. If shaft pin strikes edges of slots in lever clutches, disconnect low-and-reverse control rod at transmission lever (rear lever) and lengthen or shorten rod slightly so that shaft pin engages both clutch slots smoothly.

SERVICING:—Removal & Installation—To remove assembly from steering column, remove steering wheel, remove floor boards, disconnect control shaft dampener at cowl. Assembly can then be removed by taking out gearshift lever and freeing housing assembly clamp bracket at lower end of steering column. When re-installing, note following points:

Clutch Clearance—Clearance between faces of shift clutches must be .015-.031" (1/64" to 1/32"). Can be checked by removing lubrication fitting on clutch housing and inserting narrow feeler gauge through this hole. If clearance not correct or if clutch assembly has been dismantled, check clutch pin clearance in slots (must not exceed .009"—replace Clutch Lever and Housing Assembly #116221 if clearance excessive) and set up levers as follows: Screw upper clutch lever in housing as far as possible, then back lever out one full turn until alignment holes line up. Then screw lower clutch lever into housing until clutch face contacts upper clutch lever face, then back off lever exactly ¼ turn which will give correct clearance of .015-.031" between clutch faces. If alignment holes do not line up in this position, remove lower clutch lever and grind off clutch face squarely not more than .015". It is very important that lower clutch lever be backed off exactly ¼ turn from position where it contacts upper clutch lever and that alignment holes line up in this position. If correct clearance between clutch faces cannot be secured by this method, or if control shaft clutch pin has more than .009" clearance in clutch slots, replace entire Clutch Lever and Housing Assembly #116221.

Control Shaft Bracket Position—When installing steering column assembly, see that steering gear outer casing or jacket is positioned so that gear shift control shaft clutch pin bottoms in upper clutch slot when gear shift lever and shaft is in the uppermost position (Low-Reverse). If jacket and brackets installed too far down on steering gear shaft, gear shift control shaft will bottom in upper bracket and prevent clutch pin fully disengaging from lower (Second-High) clutch slots.

Gearshift Lever Clearance—Lever sideplay at fulcrum pin must not exceed .005" (excessive play will cause rattles). To reduce sideplay, add thin washer (.005-.010") under head of fulcrum pin or grind down shoulder on pin so that it will squeeze stamping closer to lever when installed. Also see that anti-rattle trigger spring on gearshift lever has suffcient tension on lever to dampen rattles.

TROUBLE SHOOTING:—Shift not smooth and positive—Adjust control rod lengths (see Adjustment above).

Shift sticks or does not disengage—Check adjustment. If adjustment does not correct trouble, check Clutch Clearance (Servicing—above) and adjust clearance or replace Clutch Lever and Housing Assembly.

WARNER MODELS

Model AS1-T84E
BANTAM, SUPER FOUR SERIES 65 (1941)
Model AS1-T84G
STUDEBAKER CHAMPION, MODEL 3G (1941)
Model AS3-T84G
NASH '600', MODEL 4140 (1941)
Model AS5-T84G
WILLYS AMERICAR & PLAINSMAN 441 (1941)
WILLYS COMM'L. MODELS 441, 441P (1941)
Model AS1-T86D
STUDEBAKER COMMANDER, MODEL 11A (1941)
STUDEBAKER PRESIDENT, MODEL 7C (1941)
Model AS9-T88
GRAHAM HOLLYWOOD, MODELS 109, 113 (1941)

NOTE:—Steering Column Gearshifts—Standard equipment on all models except Bantam and Crosley models. See separate 'Transmission Control' articles for servicing and adjustment data on each car model.

Overdrive—Transmissions with Overdrive optional on all models except Bantam and Crosley. See following articles on Warner Overdrive for data on Overdrive Transmissions.

1940 SPECIAL SERVICE NOTES:—Studebaker Champion ('39-40). To correct shifting into 2 gears at once which may occur on '39 and early '40 cars when gears shifted forcibly with car standing still or with heavy lubricant, install special No. 199652 Interlock assembly as follows: Remove transmission cover drive out pin in low-reverse shaft pull shaft out of case as far as possible, remove old detent plungers and spring, install new assembly, reassemble transmission. When installing low-reverse shaft pin, coat pin with shellac and drive pin in ⅛-3/16" beyond surface of pin hole. NOTE—This trouble should not be experienced on later 1940 cars and this new interlock assembly should only be installed on early cars when trouble has actually occurred.

TYPE:—Same design as used on corresponding 1940 car models (Nash Transmission is new type but similar to other 'T84' models). Synchronizer design and gearshift mechanism on each model are as follows:

Synchronizer Assemblies:—Type used on each car as follows (no Synchronizer on Crosley—see description of Transmission below).

Double Blocker, Double Spring Type (Studebaker, Nash, Willys Models) — The two Synchronizer Rings are free in ends of inner clutch sleeve and are actuated by three shifting plates or struts which fit in slots in the inner clutch sleeve and engage notches in the synchronizer rings. Struts are centered in outer clutch sleeve by two wire springs (within struts on either side of inner clutch web) and move with the outer clutch sleeve to engage the synchronizer rings with the cones on the gear hub. The inner clutch sleeve is stationary on shaft does not move (retained with second speed gear by single snap ring at forward end of sleeve).

Wire Bound Strut Type Blocking Synchronizer (Graham)—Similar to double blocker type (above) except that struts are centered by single locking wire or ring in outer clutch sleeve which engages notches in center of each strut.

Poppet Ball Type (Bantam Model)—Both Inner and outer clutch sleeves centered by spring-loaded poppet balls. Synchronizer rings are fixed in ends of inner clutch sleeve (inner clutch moves with outer sleeve to engage rings, second speed gear mounted separately and retained by thrust washer and locking plunger at forward end of gear).

Gearshift Mechanism:—Consists of shifter shafts and lever assemblies mounted in side of transmission case, each lever operating entirely independently (rear lever for Low & Reverse, forward lever for Second & High) with forks on inner ends of shafts engaging the sliding gear (Low-Reverse) or synchronizer clutch sleeve (Second-High). Interlock and detent plungers are mounted in boss in case between shafts and engage notched sectors on each shifter shaft. NOTE—On T86D, separate detent plungers are located in holes in ends of case and are accessible after plugs which close these holes are taken out.

Graham Models—Shift lever (for gear engagement) and selector lever (cross-shift) are mounted in side cover on transmission case with conventional shifter plates or rails within the transmission case. **Bantam & Crosley Models**—Have conventional gear shift lever mounted on transmission case cover.

Crosley Transmission:—This transmission is a conventional sliding spur gear type. Forward gear on mainshaft is moved backward to engage Second, forward to engage High (clutch teeth on inner rim of gear engage clutch teeth on main drive gear). Rear gear on mainshaft engages low and reverse in same manner.

SERVICING: — Disassembly — Remove transmission cover, mark both synchronizer rings and inner and outer synchronizer clutch sleeves to insure reassembly in same positions. Drive out shift lever shaft lockpins (in holes in shaft bosses on outside of case) from below, pull levers out as far as possible to allow removal of mainshaft and gears. On Studebaker models, remove main drive gear bearing retainer (on front of case), remove large snap ring from bearing outer race and small snap ring from shaft, install pinion thrust yoke J-1525 (Champion), J-1526 (Comm. & President) to take up thrust and prevent damage to synchronizers, use puller plate J-1298 and puller HM-925 to remove main drive gear bearing from front of case. On other models, main drive gear and bearing can be removed as a unit after countershaft has been removed to drop countergear cluster and disengage drive gear from countergear. Remove nut on rear end of driveshaft, use puller to remove universal joint yoke (on models where separate front yoke used), remove speedometer pinion, take out rear bearing retainer (transmission extension) mounting screws and remove retainer, slide main shaft and rear bearing assembly to rear until bearing free of case. On Studebaker models (where main drive gear bearing previously removed), lift drive gear up so that it clears countergears, remove drive gear from front of case. On all models, push mainshaft assembly away from shifter shafts, remove second & high shifter fork, remove snap ring from forward end of mainshaft (in front of synchronizer unit inner clutch sleeve), slide synchronizer unit, second speed gear, and low speed gear off mainshaft and withdraw shaft from rear of case, lift synchronizer and gears out through top of case. To remove countergear assembly, remove lockplate from slot at rear end of countershaft, drive countershaft out toward rear using dummy shaft or arbor and leaving this arbor in countergear cluster to retain bearing rollers until asssembly re-installed in case (arbor will be driven out by countershaft as shaft installed). Lift out countergears and thrust washers noting locations of washers to insure correct reassembly.

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Crosley Note—On this model, no rear bearing retainer is used and bearing is held in case by lock ring on each side of bearing outer race. To remove mainshaft and bearing, remove speedometer gear snap ring, speedometer gear and key, rear bearing snap rings, rear bearing and oil retainer washer, then pull mainshaft out through rear of case.

Reassembly:—Reverse disassembly directions above. When installing mainshaft, see that low & reverse gear properly engaged with shifter shoe when installing gear on shaft. When installing countergear cluster, install thrust washers at each end in same relative positions as removed and insert countershaft through rear end of case. Make certain that countershaft lockplate engages slots in both countershaft and reverse idler shaft before installing rear bearing retainer.

Transmission Extension Housing Bearing (Studebaker Commander & President) — Consists of a needle bearing and outer race assembly installed in housing. Use bearing remover tool J-1606 to remove old bearing and to install new bearing assembly.

Synchronizer Assembly (Double Blocker—Double Spring Type):—Install struts with open face toward inner clutch sleeve and hooked end of each spring wire engaged in the same strut (free end of spring will be between this strut and next strut in clockwise direction). See Second Speed Gear Assembly for installation instructions.

Wire Bound Strut Type—Install struts in inner sleeve and install lock wire so that it engages notches in struts with open end of wire midway between two struts (synchronizer will not operate if wire installed with open end at strut so that strut free to move endwise). When installing inner sleeve and strut assembly in outer sleeve, narrow strips of .003" feeler stock can be installed directly over each strut to prevent wire disengaging from strut slot when it is contracted to enter outer sleeve. CAUTION—Make certain that open end of wire is engaged between two clutch teeth in outer sleeve and remove feeler strips before assembling synchronizer on mainshaft. See Second Speed Gear Assembly below for installation instructions.

Poppet Ball Type—Synchronizer is free on shaft and can be removed as an assembly. If outer clutch sleeve removed use extreme care not to lose poppet balls and springs (will fly out when sleeve removed).

Second Speed Gear Assembly (With Double Blocker—Double Spring & Wire Bound Strut Type Synchronizers):—Gear and inner sleeve or hub of synchronizer are mounted on mainshaft as an assembly and retained by a snap ring at the forward end of the synchronizer. To disassemble, remove snap ring, withdraw synchronizer assembly and gear. When reassembling make certain that second speed gear has .004-.008" endplay with synchronizer hub pressed forward against snap ring (endplay adjusted by installing snap ring of correct thickness). See that synchronizer ring turns freely after assembly (with gears not engaged).

Gearshift Mechanism:—Shifter shafts can be withdrawn through case after nut on outer end of lever has been removed and lever taken off. When reassembling shafts, see that interlock and detent plungers and springs are properly installed and engage notches in sectors on shifter shafts, install oil seal in recess in case at outer end of shafts. Coat shaft lock pins with Permatex or shellac, drive pins in so that they are 1/8-3/16" past flush.

WARNER MODELS WITH OVERDRIVE

Used On:

GRAHAM HOLLYWOOD, 109, 113 (1941)
WILLYS AMERICAR & PLAINSMAN 441 (1941)

Model AS4-T84G
NASH '600', MODEL 4140 (1941)

Model AS2-T84G
STUDEBAKER CHAMPION, MODEL 3G (1941)

Model AS2-T86D
STUDEBAKER COMMANDER, MODEL 11A (1941)
STUDEBAKER PRESIDENT, MODEL 7C (1941)

TRANSMISSION CONTROL NOTE:—These models have 'kick-down' type electrical control. See Warner Overdrive Control article (following) for complete adjustment data and specifications for Solenoid, Relay, and Throttle Switch adjustment.

Steering Column Gearshift—See separate Transmission Control articles for adjustment directions on gearshift on each car model.

TYPE:—These Overdrive Transmissions consist of a conventional transmission with an additional Overdrive unit. Transmission is modified for overdrive mounting by the use of an extended mainshaft which projects into the overdrive case and serves as a mounting for the sun gear, pinion gears and centrifugal clutch pawl assembly, and freewheel cam and roller assembly. Transmission and Overdrive units can be serviced separately as directed below.

SERVICING:—**Transmission**—Disassembled and serviced in same manner as standard transmissions without overdrive. See preceding Warner Transmission article for complete data.

Overdrive:—See Warner Overdrive article (following) for complete servicing data. See Warner 'Kick-down' Overdrive Control article for all adjustment and servicing data on the 'kick-down' operating solenoid, relay, and throttle switch used on each car model.

WARNER OVERDRIVE

Used On:

GRAHAM HOLLYWOOD, 109, 113 (1941)
WILLYS AMERICAR & PLAINSMAN 441 (1941)

Type R7C
NASH '600', MODEL 4140 (1941)
STUDEBAKER CHAMPION, MODEL 3G (1941)
STUDEBAKER COMMANDER, MODEL 11A (1941)
STUDEBAKER PRESIDENT, MODEL 7C (1941)

Model AS1-R7B
CHRYSLER, MODELS C30,C33 (1941)—SEE NOTE

Model AS1-R7C
NASH AMBASSADOR 6, 4160 (1941)
NASH AMBASSADOR 8, 4180 (1941)

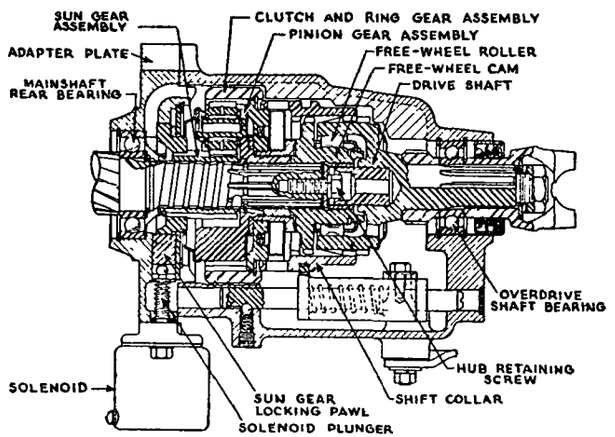
NOTE:—These Overdrive units are used in conjunction with Warner Transmissions (see preceding article on Warner Overdrive Transmissions) or with transmissions built by the car manufacturers (Chrysler, Nash 4160, 4180 only). See separate articles for Transmission servicing data.

Chrysler—This Overdrive unit is assembled as part of the 'Vacamatic Overdrive Transmission' which is Std. Equipment on these models. See separate article on 'Chrysler Vacamatic Overdrive Transmission' for transmission servicing data.

Hudson, Lincoln, Packard Models—Overdrive on these models is special electrical type (no centrifugal clutch pawls) and is serviced differently. See separate article on Warner Electrical Type Overdrive for data.

TYPE:—Same design as used on 1940 car models with sun gear normally locked in position by solenoid controlled pawl and overdrive engagement controlled by clutch pawls. When accelerator pedal depressed fully to operate 'kick-down' feature, solenoid is energized and withdraws pawl from sun gear, allowing gear to rotate freely, resulting in a direct drive from the engine to the rear wheels.

SERVICING:—**Chrysler Note**—Adapter plate and overdrive case are held together by three special screws inserted in holes in front face of adapter plate. Overdrive assembly must be removed from the transmission as a unit with the adapter plate and mainshaft assembly. Special tool C-577 must then be used to take out screws in adapter plate before overdrive can be disassembled.



Nash 4140 Note—No universal joint companion flange used and rear bearing retained by snap ring on shaft at rear of bearing. This snap ring must be removed first in order to remove overdrive case without disturbing shaft and free-wheeling roller assembly (shaft will come out with case otherwise which will allow rollers to drop out).

Studebaker Note—No universal joint companion flange used and rear bearing retained by oil seal and retainer housing bolted on rear end of overdrive case and snap ring on shaft at rear of bearing. When removing overdrive case, first remove retainer and take out snap ring (use special pliers No. 187) so that case can be withdrawn without disturbing shaft and free-wheel roller assembly.

Disassembly:—See special notes above. Remove speedometer drive pinion assembly, take off retainer screw and washer on rear end of shaft and use puller to remove universal joint companion flange (not used on all models—see notes above). Remove screws and nuts holding overdrive case and adapter plate to transmission case. Press forward on rear end of driveshaft and pull overdrive case off to rear, using extreme care not to allow adapter plate to separate from transmission case (if transmission not to be disassembled). Clutch collar will remain

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in overdrive case but overdrive assembly will not be disturbed otherwise. Then disassemble sub-assemblies as follows:

Overdrive—Pull driveshaft off at rear, catching rollers as they drop out of free-wheeling assembly. Remove capscrew and washers on end of main-shaft, remove hub bushing and free-wheel cam from shaft. Remove ring gear and clutch pawl assembly, thrust washer, and pinion assembly (pinions are split type and must be properly wound up when re-installed). Take out sun gear thrust plate retaining snap ring in adapter plate, remove thrust plate. Take out two mounting screws and remove kick-down solenoid. Remove solenoid plunger assembly and pawl, disengaging pawl from end of plunger and being careful not to lose mounting gaskets or shims under plunger flange (these shims control pawl clearance). Remove pinion cage stop ring from shaft directly to rear of sun gear, withdraw sun gear and hub assembly.

Overdrive Shift Mechanism—On all models except Chrysler, new Limiting Screw installed in side of case to limit travel of overdrive shift shaft and fork (replaces spring-loaded ball type detent). To disassemble shift control, remove lockwire and withdraw reverse lock-out pin through front of case, rotate shift fork and disengage shift collar, remove shift collar. To remove shift shaft and fork assembly, take out limiting screw on side of case, remove setscrew in fork (work through hole in case after removing plug from this hole), withdraw shaft, lift fork out. To remove shift lever and shaft, take off nut on outer end of shaft, remove lever, loosen setscrew in case, withdraw shaft from within case. Reassemble shift mechanism in same order.

Sun Gear & Hub Assembly:—To dismantle assembly, take out snap ring in hub at forward end of gear, withdraw gear from hub. Check balk ring friction on sun gear hub. Pull required to turn balk ring in clockwise direction on hub should be 8-10 lbs. (if friction less than this amount, balk ring will not block pawl out for 'kick-down' direct drive). When reassembling sun gear and hub,see that oil slots in gear and hub are lined up.

Sun Gear Pawl & Balk Ring Clearance—Clearance between end of pawl and face of lug on balk ring should be .015" with balk ring rotated to block out pawl. If solenoid assembled, clearance can be checked by energizing solenoid so that pawl is withdrawn. Adjust by adding or removing solenoid gaskets.

Pinion Cage Assembly:—To remove pinion assembly, pull pinions out of ring gear. Assembly cannot be dismantled (oil slinger which is spun on pinion cage retains pinion shaft pins). When remeshing split type pinions in ring gear, wind up narrow half of each split pinion 1½ teeth so that marked teeth on wide and narrow halves of pinion are together, mesh ring gear with pinions held in this position. When installing pinion gears, mesh wide half of each split pinion with sun gear, then install ring gear so that it meshes with narrow half of each pinion only, revolve sun gear counter-clockwise (transmission mainshaft must be held from turning which may be accomplished by shifting transmission into two gears at once) until pinions are wound up approximately 1½ turns and marked pinion teeth are together, then push ring gear into place so that pinions fully meshed with ring gear and sun gear.

Ring Gear & Clutch Pawl Assembly:—Take out snap ring in inner rim of ring gear, clutch pawl and core assembly from ring gear. Clutch pawl adjusting screws, washers, and springs can be removed but no further disassembly is possible (clutch core must be concentric with gear teeth and cannot be reamed sufficiently accurately in the field, parts are not furnished separately). CAUTION—If adjusting screws removed, count number of notches or 'clicks' as each screw is turned out so that screws can be replaced in exactly same position. These screws control cut-in speed (see adjustment directions below).

Clutch Pawl & Pinion Cage Thrust Washer—Bronze thrust washer between clutch pawl hub and pinion cage should be installed with projection on washer engaging notch on hub (washer can be retained with cup grease while assembling parts). Clutch core assembly endplay should be .005-.010" with all parts installed on mainshaft and retaining screw tight.

Overdrive Solenoid & Plunger Assembly:—See following article on Warner Overdrive Control for complete solenoid data.

Reassembly:—Use new snap rings if old rings distorted or damaged by removal, reverse disassembly directions given above and note following points: Make certain that snap ring installed on main shaft in back of sun gear assembly (this snap ring controls pinion cage endplay), see that split type pinions are correctly wound up when meshed with ring gear, pack free-wheel rollers with cup grease or use rubber band to retain rollers, start drive shaft over free-wheel rollers and cam (turn rollers and cage counter-clockwise so that rollers on low points of cam), remove rubber band and push drive shaft forward into place. See that rear bearing and oil seal properly installed in overdrive case and that bearing snap rings are in place on both sides of bearing. Install shift collar in case, then install case and collar assembly on shaft assembly, guiding collar by reaching through drain plug hole in case so that it engages teeth on free-wheel cam and clutch pawl assembly, and guiding lock-out reverse pin through hole in adapter plate. Adjust overdrive control when transmission re-installed on car.

ADJUSTMENT:—**Cut-in Speed.** Should not be changed from original standard setting. If clutch pawl adjusting screws removed, make certain that both screws turned in same number of 'clicks' as original setting and screws adjusted alike. Screws must not be turned so far in or out as to cause interference. With standard setting, cut-in speed for each model is as follows:

Car Model	Cut-in Speed
Chrysler C30,C33	25 MPH.
Nash (all)	33 MPH.
Studebaker (all)	32-36 MPH.
Willys	32 MPH.

CAUTION—Both adjusting screws must be adjusted exactly alike. One screw marked by single slot, opposite screw marked by double slot for identification. Use care not to adjust same screw twice.

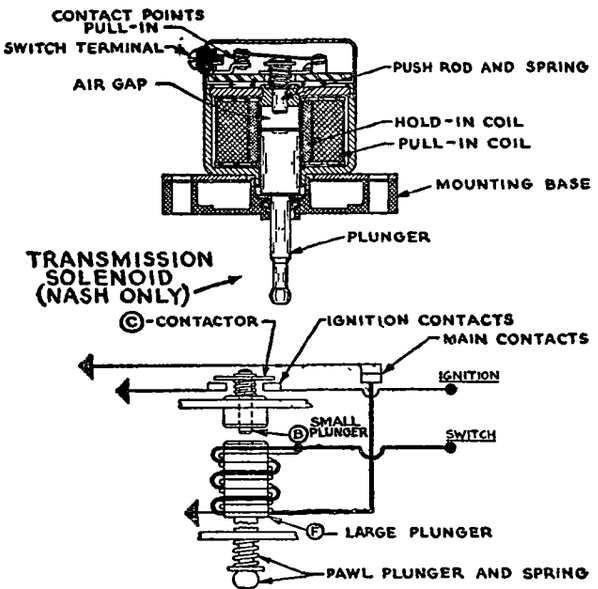
Overdrive Lock-out Control Adjustment:—To adjust lock-out control button cable, loosen clampscrew on lever on overdrive case, move control button on dash to fully 'in' position, then pull button out ⅛", make certain that overdrive case lever moved to rear as far as possible, tighten control wire clampscrew and locknut.

WARNER OVERDRIVE CONTROL 'KICK-DOWN' TYPE

On Following Cars:
CHRYSLER, MODELS C30,C33 (1941)
GRAHAM HOLLYWOOD, 109, 113 (1941)
NASH '600', MODEL 4140 (1941)
NASH SIX 4160, EIGHT 4180 (1941)
STUDEBAKER CHAMPION, MODEL 3G (1941)
STUDEBAKER COMMANDER, MODEL 11A (1941)
STUDEBAKER PRESIDENT, MODEL 7C (1941)
WILLYS AMERICAR & PLAINSMAN, 441 (1941)

NOTE:—This electrical 'kick-down' control is used to control the kick-down or return to direct drive on cars using Warner Overdrives. See preceding article for Overdrive servicing data.

Hudson, Lincoln, Packard Models—Overdrive control is different design. See separate article (following 'Warner Electric Type Overdrive') for adjustment directions on these models.



TRANSMISSION SOLENOID (ALL OTHERS)

TYPE:—Same as for 1940 car models with 'kick-down' feature. Two different types of control solenoids used as follows:

Nash Models—Plain type solenoid (no ignition control contacts) used in conjunction with special two unit relay. Ignition feed wire (from ammeter to ignition switch) is taken through contacts of series relay unit so that ignition is cut out by momentary opening of contacts while the kick-down to direct drive is being effected. The relay also contains a shunt relay unit which operates in the usual manner to control the transmission solenoid.

Other Models—Operate in same manner as in 1940 (small plunger in transmission solenoid closes ignition contacts and shorts out ignition, large plunger then withdraws pawl and opens ignition contacts so that ignition is restored).

CAR WIRING CIRCUITS:—See wiring diagram on car model 'T&E' page for complete transmission control wiring diagrams.

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ADJUSTMENT:—Check and adjust throttle switch linkage on each car model as directed below whenever linkage is disconnected or disturbed by carburetor adjustment, removal of units, etc.

Chrysler Models C30, C33—Gap between switch plunger contact screw and plunger should be 3/32" with throttle valve wide open. To adjust, remove air cleaner (to observe throttle valve), open throttle until throttle valve is just wide open, loosen locknut and turn contact screw until gap is 3/32", tighten locknut.

Graham Models—Adjust position of operating block (on connecting rod linkage ballcrank and throttle valve lever) so that throttle switch plunger is depressed not more than 1/32" with throttle in wide open position. See that linkage over-travel is sufficient to close switch contacts before accelerator pedal bottoms on toeboard.

Nash Models—Throttle switch is mounted on dash and is cable operated. To adjust, loosen locknut and adjust switch position on mounting bracket so that contacts close when throttle is wide open and spring on carburetor throttle shaft pulley just begins to compress. Check accelerator pedal over-travel and adjust stopscrew on floor board so that pedal has sufficient travel beyond wide open throttle position to operate switch.

Studebaker Models—Depress accelerator pedal until throttle valve is just wide open and throttle lever contacts wide-open throttle stop. Hold linkage in this position, loosen locknut on switch mounting stud, turn switch in or out of mounting bracket until contact shoe on idler lever just contacts switch plunger, tighten locknut.

Willys—Adjust position of switch on mounting bracket so that contact shoe on end of accelerator rod just contacts switch plunger (maximum clearance 1/32") with carburetor throttle wide open. See that linkage has sufficient over-travel to close switch contacts.

SERVICING OVERDRIVE SOLENOID:—Removal—To remove solenoid (for transmission and overdrive removal or for servicing), take out two capscrews in mounting flange, withdraw solenoid case without disturbing base plate and plunger assembly.

CAUTION—Do not lose gaskets under solenoid assembly. These gaskets control pawl mesh and must be replaced when solenoid installed.

Servicing—No servicing required other than to keep contacts clean and parallel so as to make good electrical contact. To remove cover for contact inspection, disconnect wires, take out flat headed screw, pull cover off base. See that lower face of contact disc on plunger 'B' and contact plates (which short out ignition) are clean and smooth. Resurface main contacts (which control 'starting coil' circuit with a file, if necessary, to secure smooth parallel contact surfaces. Check contact gaps and solenoid performance (see specifications below).

FUSES:—Fuses located on Solenoid Relay to protect solenoid circuits. If solenoid does not withdraw sun gear pawl for any reason, fuse will blow so that ignition is restored and car can be driven normally except that kick-down feature will not operate.

CAUTION—Do not use fuse of any other capacity than that shown in table below (no fuse used on Graham and Nash models).

Car Model	Fuse Capacity
Chrysler	20 amperes
Studebaker	14 amperes
Willys	20 amperes

SPECIFICATIONS:—Control System units for each car model are of various makes as follows:

Car Model	Solenoid Relay	Solenoid
Chrysler	A-L. HR-4201	A-L. SSB-4001
Graham	R-B-M No. 4740	D-R. No. 1569
Nash	D-R. 1116798	D-R. 1118004
Studebaker	AL. HR-4201	D-R. 1118013
Willys	AL. HR-4201AS	D-R. No. 1569

AUTO-LITE SOLENOIDS

Small Plunger 'B'—Should close with 2.5 volts min., 4 volts max. (6 volt units), 5 volts min., 8 volts max. (12 volt units) with large plunger 'F' 3/8" from bottom.

Large Plunger 'F'—Should exert pull of 21 lbs. min. (70° F.), 15 lbs. min. (210° F.) when 3/8" from bottomed position.

Contact Gap (main contacts)—.047" plus or minus .015" with large plunger 'F' bottomed in coil.

Current Draw (At 70° F.)—'Both coils' figure is for both Holding and Starting coils together (main contacts closed). 'Holding Coil' figure is for Holding coil only (main contacts open—plunger bottomed in coil).

Six Volt Units

	Min.	Amperes	Max.	Volts
Both Coils	29.0		31.0	3
Holding Coil	1.2		1.3	6

Twelve Volt Units

Both Coils	14		15	6
Holding Coil	.55		.65	12

AUTO-LITE RELAYS

Contact Gap—.026". Air Gap—.012-.017" (closed).

Closing Voltage—2.5-3.5 volts (6 volt units), 5.0-7.0 volts (12 volt units).

Current Draw—Measure between 'TH.SW' and 'IGN. SW.' terminals. Current should be 1.07-1.15 amperes at 6.0 volts (6 volt units—winding resistance 5.2-5.6 ohms), .89-.93 amperes at 12.0 volts (12 volt units—winding resistance 12.9-13.5 ohms).

R-B-M RELAYS

Contacts Close—3.5-4.5 volts.

Current Draw—Approximately 3/4 ampere.

DELCO-REMY SOLENOIDS
No. 1569 (6 volt), 1573 (12 volt)
1118001, 1118013 (6 volt).

Small Plunger 'B'—Should close at 5.0 volts (6 volt units), 6-10 volts (12 volt units) with 3/8" gap of large plunger.

Large Plunger 'F'—Should close against 16 lbs. pull with 3/8" plunger air gap at 6.3 volts max. (6 volt units), 12.6 volts max. (12 volt units) with both coils operating.

Contact Gap (Main Contacts)—.020-.060" with large plunger 'F' bottomed in coil.

Contact Spring Tension—10-13 ounces.

Current Darw—'Both Coils' figure is for both coils together (main contacts closed), 'Holding Coil' figure is for holding coil only (main contacts open and plunger bottomed in coil).

Six Volt Units

	Amperes	Volts
Both Coils	28-34	6.0
Holding Coil	.9-1.1	6.0

Twelve Volt Units

Both Coils	24.5-27.5	12.0
Holding Coil	.6-.72	12.0

Model No. 1118004 (Nash)

NOTE—This solenoid does not have small plunger and ignition contacts. Both windings are connected to the single solenoid terminal (starting coil circuit is opened by the opening of the main contacts as the plunger bottoms in the coil, holding coil only then holds plunger in coil).

Solenoid Plunger—Should close against 16 lbs. pull with 3/8" plunger air gap at 6.3 volts maximum.

Current Draw—28-34 amperes at 6.0 volts (Both coils—main contacts closed), .9-1.1 amperes at 6.0 volts (Holding coil only—main contacts open).

DELCO-REMY RELAYS
Model No. 1116798 (Nash)

NOTE—This unit consists of two separate relays which operate as follows: **Series Relay**—Winding connected in series with shunt relay contacts. All current for solenoid goes through this winding. When armature attracted to core, contacts open and break ignition circuit (all ignition current goes through this series relay contacts). Current draw of solenoid holding coil is not sufficient to hold armature down and closing of contacts restores ignition as soon as transmission solenoid operates (which cuts out solenoid starting coil and causes solenoid current to drop from approximately 30 amperes to 1 ampere—see solenoid specifications above). **Shunt Relay**—Winding is connected in throttle switch circuit and contacts control current flow to transmission solenoid (closing of contacts when armature attracted to core completes solenoid circuit, contacts remain closed until throttle switch contacts are opened).

Series Relay Specifications.

Contacts Open (Armature attracted to core)—13.0-16.0 amperes.

Contacts Close (Armature Released)—6.0 amperes min.

Contact Gap—.030".

Shunt Relay Specifications.

Contacts Close (Armature attracted to core)—3.0-4.0 volts.

Contact Gap—.025".

Air Gap—.012" (with contacts closed).

WARNER ELECTRIC TYPE OVERDRIVE

Model AS1-R9B
HUDSON SIX, MODELS 10,11,12,18 (1941)
HUDSON EIGHT, MODELS 14,15,17 (1941)

Model AS2-R9
PACKARD '110' SIX, MODEL 1900 (1941)
PACKARD '120' EIGHT, 1901, 1A (1941)
PACKARD CLIPPER, MODEL 1951 (1941)

Model AS1-R9A
PACKARD SUPER 8, 1903,3A,4,5,6,7,8 (1941)

NOTE:—These overdrives used in conjunction with transmissions manufactured by each of these car manufacturers. Refer to separate transmission articles for transmission servicing data.

TYPE:—Simplified overdrive unit without centrifugal clutch pawls. Ring gear mounting plate is linked directly to final drive shaft by shift collar (shift collar also engages free-wheel cam when overdrive locked out) so that engine drives rear wheels through overdrive pinion gears (when overdrive operative) or through free-wheel mechanism (for direct drive below overdrive cut-in speed and also for the 'kick-down' direct drive—drive is exactly the same in both instances).

OPERATION:—Overdrive cut-in and cut-out is controlled electrically by a solenoid which operates in exactly opposite manner from the kick-down solenoids used on models with centrifugal clutch pawls (solenoid plunger pushes pawl in to engage sun

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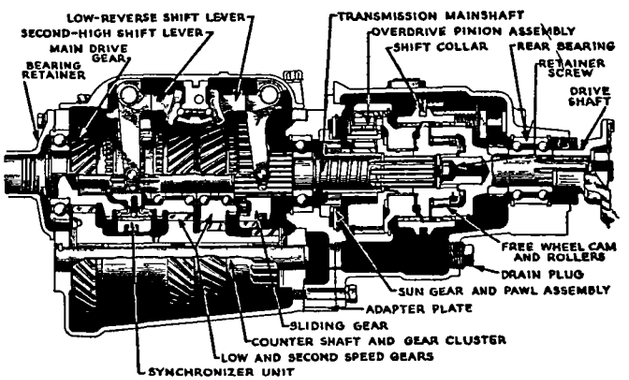
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gear for overdrive, pulls pawl out to disengage sun gear for both direct drive below cut-in speed and for kick-down direct drive). Pawl is pushed in electrically and is pulled out by a spring within the solenoid case. *See Transmission Control article (following) for solenoid description and servicing data.*

SERVICING:—Except for omission of entire centrifugal clutch pawl assembly, these overdrives serviced in same manner as other Warner models. *Refer to preceding Warner Overdrive article for complete instructions and note following additional data:*

Driveshaft Rear Bearing (All Packard)—Bearing is new type double-row ball bearing which is pre-loaded in assembly so that no pre-load adjustment or special installation directions required. Bearing is retained in overdrive case by snap ring at each end of bearing outer race.

Sun Gear Pawl Interlock Plunger (Hudson)—Consists of two plungers and an intermediate lever installed in the adapter plate flange so that one plunger engages the shifter rail and forces the other plunger into engagement with the sun gear pawl with the overdrive locked out which prevents the pawl operating. Long plunger (shift rail plunger) furnished in five different lengths. Install plunger of correct length so that clearance between lower end of plunger and tip of interlock intermediate lever is .008-.021" with long plunger in shift rail groove and top of short plunger against sun gear pawl. CAUTION—See special assembling directions below to insure correct operation of this interlock.



Sun Gear Pawl Interlock Plunger (Packard 6 & 8)—Same design as Hudson (above) with two plungers and intermediate lever. Long plunger is furnished in three different sizes for clearance adjustment.

Sun Gear Pawl Interlock Plunger (Super Eight)—plunger installed in hole in overdrive case engages notch in side of sun gear pawl when the control button is operated to lock-out the overdrive. Plunger prevents pawl engaging sun gear. Clearance between end of interlock plunger and side of pawl should be .010" in overdrive position (pawl engaged in sun gear mounting plate slot).

Governor Switch—Switch is mounted on rear end of overdrive case and is driven by the speedometer drive gear. Remove governor switch assembly before dismantling overdrive.

ADJUSTMENT:—Lockout Control Button Linkage—Button should clear bracket by ⅛" when pushed in to insure full travel of control travel on overdrive case. To adjust, loosen control cable at binding screw on lever on left side of overdrive case, push control button in as far as possible, then pull button out ⅛". Move control lever on overdrive case to rear as far as possible, then move lever forward until a resistance is just felt and tighten control cable binding screw.

Cut In Speed—22 MPH. NOTE—Cut-in speed not adjustable except by installing special Governor Switch springs.

OVERDRIVE INSTALLATION:—Hudson Models—When installing overdrive case, use Overdrive Aligning Pilot J-1579 to align case so that interlock lever and plungers will have clearance for correct operation. Install pilot in lower hole of overdrive case so that it engages hole in adapter plate and transmission. Leave pilot in place until the other four mounting bolts have been installed and tightened, then remove pilot and install last mounting bolt.

WARNER ELECTRICAL OVERDRIVE CONTROL

On Following Cars:

HUDSON, MODELS 10,11,12,14,15,17,18 (1941)
PACKARD CLIPPER, MODEL 1951 (1941)
PACKARD, SIX 1900, EIGHT 1901,1A (1941)
PACKARD SUPER 8, 1903,3A,4,5,6,7,8 (1941)

SPECIAL SERVICE NOTES & PRODUCTION CHANGES:—Hudson Governor Switch—Governor switch changed in production and new type with reversed oil groove in shaft bushings to prevent oil working up into switch body used on later cars. This new Governor Switch, Part No. 162867, used on later cars and may be identified by purple dots on terminal screw heads and purple band around switch body. Install this new switch on early cars to correct complaints of overdrive cutting in late (25-30 MPH.) or not operating.

Packard Governor Switch—On cars with Electromatic Clutch Control, same Governor switch used for both clutch and overdrive control (switch has two terminals and duplicate sets of contacts). Overdrive control should be connected to 'AD' terminal on switch ('EC' terminal is for clutch control).

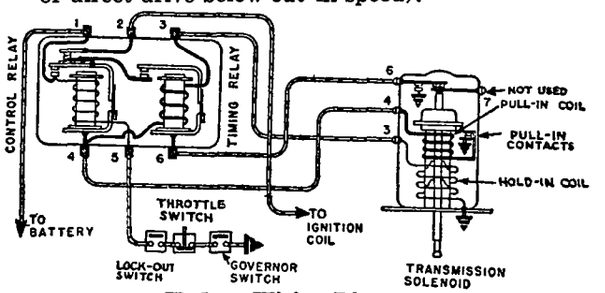
DESCRIPTION:—Special design, electrical control with 'kick-down' direct drive feature. New type Transmission Solenoid is 'push type' and pushes pawl in to engage sun gear mounting plate slot (to hold sun gear stationary for overdrive) when solenoid is energized. Spring in solenoid case pulls pawl out to disengage sun gear (for direct drive) when solenoid circuit is broken. Both solenoid windings (Pull-in Coil and Hold-in Coil) are energized to engage pawl for overdrive, Hold-in coil only is energized during entire period in which car is in overdrive. Solenoid is controlled by a Lock-out Switch (operated in conjunction with the lock-out control knob on the instrument panel), Governor Switch, Throttle kick-down Switch, and two unit relay (Control Relay and Timing Relay) as follows:

Lock-out Switch—Connected in series with kick-down switch and governor switch. Contacts are closed with control knob pushed in (for overdrive) and are opened when control knob pulled out (to lock-out overdrive).

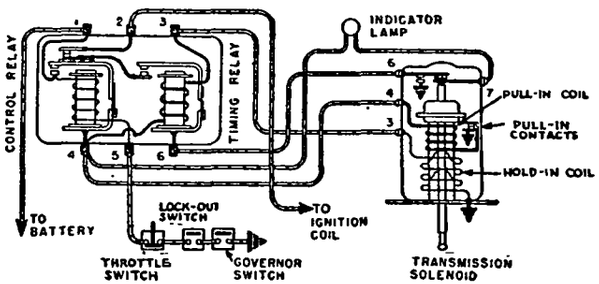
Governor Switch—Centrifugal type switch mounted on rear of overdrive case and driven by speedometer drive gear. Acts as the main switch to engage overdrive (switch contacts close at cut-in speed of 22 M.P.H. and remain closed until speed drops below 17 M.P.H.). Governor switch is not adjustable and cut-in speed can be changed only by installing special switch springs (see Adjustment data below).

Throttle Kick-down Switch—Switch contacts are normally closed (throttle wide open or less) and are opened when the accelerator pedal is fully depressed to operate the kick-down for direct drive.

Control & Timing Relay—Consists of two units, a double contact (upper and lower contacts) Control Relay which controls the transmission solenoid circuit, and a single contact Timing Relay which controls the ignition 'cut-out' which permits the sun gear pawl to be withdrawn from the sun gear for return to direct drive (kick-down direct drive, or direct drive below cut-in speed).



Hudson Wiring Diagram



Packard Wiring Diagram

OPERATION:—Overdrive Engagement—Throttle switch and lock-out switch contacts are normally closed (control knob pushed in). At cut-in speed of 22 M.P.H., governor switch contacts close which completes circuit for Control Relay winding. Control relay upper contacts open and lower contacts close which completes circuit for both pull-in and hold-in coils in transmission solenoid. This causes the solenoid plunger to bottom in the coil, compressing the pawl spring, and causing the pawl to be pushed into engagement with the sun gear mounting plate slot so that the overdrive is operative (spring engages pawl as soon as accelerator pedal released momentarily). On Packard, dash indicator light controlled by solenoid upper contacts lights to indicate that overdrive should be engaged, light goes out as soon as overdrive is engaged). The bottoming of the solenoid plunger in the coil opens the pull-in coil contacts in the solenoid (lower contacts) and cuts this pull-in coil out of action. The hold-in coil remains energized during the entire time the overdrive is engaged and holds the solenoid plunger bottomed in the coil.

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Overdrive Disengagement—When the overdrive engages, the timing relay contacts close (this relay winding is connected in series with the solenoid hold-in coil) and the solenoid upper contacts also close, but the ignition is not cut out because the control relay upper contacts have already opened (all three sets of contacts are connected in series in the ignition cut-out or ground circuit). When the throttle switch contacts are open (when accelerator pedal depressed fully for kick-down direct drive) or governor switch contacts open (for return to direct drive at speeds below 17 M.P.H.), the control relay upper contacts close first and, since the other two sets of contacts are also closed, the ignition is shorted or cut out momentarily to allow the solenoid spring to disengage the pawl from the sun gear for direct drive. The timing relay winding circuit is opened by the opening of the control relay contacts (which occurs before the control relay upper contacts close) but the 'time delay' feature of this timing relay causes a very short interval to elapse before the timing relay contacts open. As soon as these contacts open, or when the solenoid upper contacts open (which occurs as soon as the spring pulls the pawl out of engagement), the ignition ground circuit is broken and ignition is restored (both sets of contacts protect the ignition circuit when the overdrive is not operating).

ADJUSTMENT: — Hudson Throttle Switch — Adjust whenever carburetor linkage adjusted or disconnected. To check setting, remove carburetor air cleaner to observe throttle valve, depress accelerator so that throttle valve just wide open, loosen nuts on accelerator pedal rod and adjust position of contact washer on rod so that it is just contacting throttle switch plunger, tighten both nuts to retain contact washer in this position.

Packard Throttle Switch—Should be adjusted whenever carburetor linkage adjusted or disconnected. To check setting, remove air cleaner (to observe throttle valve), open throttle until valve is just wide open. If tappet screw on accelerator link lever does not contact throttle switch plunger at this point, adjust by loosening locknut and turning screw in or out of lever.

Governor Switch—Governor switch is not adjustable and no attempt should be made to change cut-in speed by stretching spring or shimming cover. *NOTE*—See *Special Service Notes* above for production changes and special Governor Switch data.

Governor Switch

Car Model	Part No.
Hudson (All Models)	Hudson No. 162867
Packard (All Models)	Packard No. 364782

FUSE:—Packard. 30 ampere. Located in fuse container in the line between the starting switch and the Solenoid Relay '1' terminal. Do not use fuse of any other capacity at this point.

SERVICING:—Overdrive Relay—This relay consists of two units which should be checked and adjusted differently as follows:

Control Relay

Air Gap—.012" (lower contacts closed), .032" (lower contacts open). Check first with armature held down so lower contacts closed, adjust by loosening two screws on hinge bracket on back of relay and raising or lowering armature, see that gap uniform across whole surface of core. Then check air gap with armature released (upper contacts closed), adjust by bending upper contact support—do not loosen hinge bracket screws.

Contact Gap—.022" (top contacts) with lower contacts held closed. Should be correct if air gaps correct (above) and contact spring not bent.

Closing Voltage—3.4-4.0 (6 volt units), 6.8-8.0 volts (12 volt units). CAUTION—This voltage will attract armature and close lower contacts (upper contacts open as lower contacts close). To check closing, connect battery and variable rheostat to relay terminals #1 and 5, increase voltage and note when contacts close. To adjust, bend spring hanger at upper and lower end of spiral armature spring.

Timing Relay

Air Gap—.031" with contacts open. Adjust by bending upper armature stop—**do not disturb armature hinge bracket mounting screws.**

Contact Gap—.022". Adjust by bending lower contact support.

Closing Voltage—.6-1.1 volt (6 volt units), 1.2-2.2 volts (12 volt units). To check closing, connect battery and variable rheostat to terminals #3 and 4, increase voltage and note when contacts close.

'Time Delay' Action—.1-.2 seconds (between instant current flow through winding is stopped and opening of contacts). To check timing action on car, operate engine at medium speed, close **control relay** lower contacts by hand (timing relay contacts will close), release control relay contacts and note interval before timing relay contacts open (lag should be noticeable). Adjust by bending spring hangers on upper and lower end of spiral armature spring (increase spring tension to shorten time interval).

Transmission Solenoid:—Solenoid cover can be removed, for inspection and servicing, by taking off two nuts on studs on cover. CAUTION—Pawl rod must not be forced into solenoid with cover removed—this will damage contact plate flat springs.

Solenoid Operation Test—Plunger actuating voltage should be 4.9 volts (6 volt units), 6.8 volts (12 volt units) max. at room temperature. To check performance, block pawl rod so that it cannot move out of solenoid when plunger is actuated, remove solenoid cover, connect voltmeter, battery, and variable rheostat between terminals #3 and 4 (connect these terminals together) and ground on solenoid case. Increase voltage and note voltage reading at point where plunger is actuated.

Pull-in Coil Contact Gap—With solenoid bottomed in coil, pull-in coil contact gap should be .018-.040". Remove solenoid cover to check these contacts. See Pawl Rod Adjustment below.

Solenoid Current Draw—To check current connect battery and ammeter between #4 terminal and ground on solenoid case (Pull-in Coil), or #3 terminal and case (Hold-in Coil). This check must be made at specified voltage. 'Both Coil' figure below is for both Pull-in and Hold-in Coil together, 'Hold-in Coil' figure is for Hold-in coil only.

6 Volt Units

Both Coils	31.0-36.0 amperes at 6.0 volts.
Hold-in Coil	1.4-1.6 amperes at 6.0 volts.

12 Volt Units

Both Coils	14.0-16.0 amperes at 12.0 volts.
Hold-in Coil	1.0-1.2 amperes at 12.0 volts.

Pawl Rod Adjustment—With pawl rod assembly removed from solenoid, check length from lower face of adjusting nut on upper end of pawl rod to lower edge of plunger. This distance should be 2.022-2.037". To adjust, press down on locking spring below adjusting nut so that prong on spring clears notch in nut, turn nut on plunger. CAUTION—Use care not to distort locking spring and see that prong on spring engages notch in nut after adjustment completed.

WARNER (LINCOLN) OVERDRIVE

Model AS1-R10

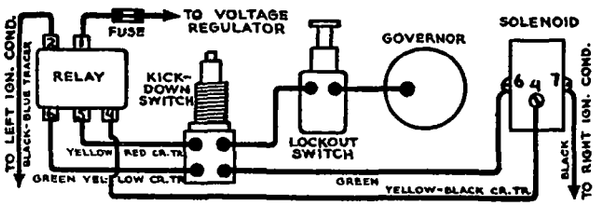
LINCOLN, ZEPHYR & CONTINENTAL 16H (1941)
LINCOLN, CUSTOM MODEL 168H (1941)

NOTE:—This Overdrive used in conjunction with a Lincoln Transmission. See separate article for transmission data.

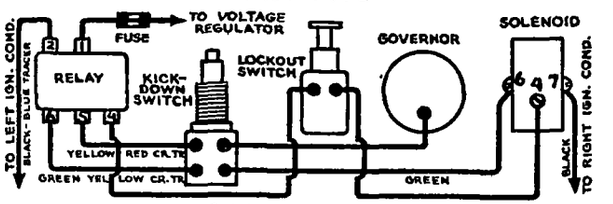
SPECIAL SERVICE NOTES AND PRODUCTION CHANGES:—Recommended Relay Mounting Change on First Cars—On first cars with relay mounted on engine dash with terminals 4, 5, 6 upward, it is advised that relay be dismounted and reversed with terminals 1, 2 upward. Any foreign material lodged on terminals should be carefully cleaned off. Grounding of terminal #5 will prevent overdrive releasing and may damage transmission if attempt made to reverse car.

Throttle Kick-down Switch Caution—If floor tunnel screws removed, use extreme care to install special short screw in hole immediately ahead of kick-down switch. If regular length screw installed in this hole, screw may contact upper switch terminals and cause ground in circuit at this point.

Control Wiring Change—Control circuit wiring changed after approximately first 500 cars. See illustration for first and later type wiring diagrams.



FIRST TYPE



SECOND TYPE

TYPE:—Warner Type R10 (all models). New design overdrive unit with solenoid control (no centrifugal clutch pawls). Design similar to type used on Packard (see data above) except for control circuits and lockout mechanism which are entirely new design as described below. Solenoid pushes sun gear pawl in (to engage Overdrive), withdraws pawl (for Direct Drive). Solenoid is controlled by Governor Switch (Overdrive does not engage above cut-in speed until accelerator pedal released momentarily) and has 'kick-down' direct drive feature.

Lockout Mechanism—Consists of a shift collar positioned on the sun gear by snap rings so that the sun gear can be shifted to the rear to engage clutch teeth in a lock plate mounted on the planetary pinion assembly so that the planetary gears are locked together for direct drive. CAUTION—This lockout action can only take place with overdrive in direct drive (sun gear and lockplate turning at same speed) and overdrive must be 'kicked-down' to direct drive to operate the control as described below.

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Control Mechanism—Overdrive operating solenoid is controlled by a Control Relay mounted on the dash, a Governor Switch mounted on the overdrive case extension and driven from the driveshaft, a Lockout Switch mounted on the overdrive case and operated by the lockout shift rail which is linked to the lockout control button on the instrument panel, and a Kickdown Switch operated by the accelerator pedal. See wiring diagram for wiring circuits for these units. NOTE—Since ignition system for each bank of cylinders is independent, two separate ignition cut-out circuits (for momentary cutting out of ignition to permit kick-down direct drive to be engaged) are required and these ignition connections are shown in the diagram.

OPERATION & ADJUSTMENT:—Lockout Control—If dash control button is to be pulled out (to lockout overdrive), accelerator pedal should first be fully depressed (to place overdrive in direct drive), button then pulled out, and accelerator pedal released. NOTE—Lockout will not engage unless overdrive in direct drive (sun gear teeth will strike lock plate clutch teeth causing 'buzzing' sound) and accelerator pedal must be fully depressed to complete lockout engagement.

Adjustment—If dash control button cable is adjusted too short, buzzing sound will be noticed when button pushed all the way in. Noise will disappear when operated with engine pulling car below cut-in speed and will reappear when accelerator pedal released. To adjust cable, turn adjusting nuts at end of cable where it is attached to lever.

Cut-in Speed—25 MPH (governor switch contacts close). Overdrive does not engage until accelerator pedal released momentarily. Overdrive cuts out at 22 MPH (or at any speed if 'kick-down' operated). No cut-in speed adjustment provided.

SERVICING:—Transmission—See separate articles on Lincoln Transmission for servicing data. Transmission is same as standard type (without overdrive) except that mainshaft is extended back into overdrive case and has pinion assembly and freewheel cam mounted on this extension.

Overdrive:—Serviced in same manner as other Warner electrical type overdrives (see preceding article) except for differences in design as detailed above. If overdrive does not operate satisfactorily, determine trouble as follows:

Overdrive remains engaged, Will not 'kick-down', Car will not roll backward in Neutral—Caused by ground in lead between #5 relay terminal and governor switch. Check by disconnecting lead at #5 terminal and noting if relay 'clicks' when wire touched to terminal (click indicates ground or other defect). Check lead, relay terminals, and kickdown switch for grounds (see Special Service Notes above). To check relay, remove fuse. If relay 'clicks' as fuse removed, relay is defective.

IMPORTANT NOTE—If attempt made to reverse car under above conditions (ground in #5 circuit), overdrive unit may be seriously damaged.

Ignition Cuts Out—If left cylinder bank cuts out when idling, check for grounded relay (internally or at terminals #2 & 6), ground between #6 relay terminal and kickdown switch or in kickdown switch, ground in lead between #2 terminal and distributor or within distributor (if ignition restored when lead disconnected from #2 relay terminal, this lead an ddistributor are not at fault). If right cylinder bank cuts out when idling, check for ground in lead between #7 solenoid terminal and distributor, in solenoid, and in distributor (if ignition restored when lead disconnected from #7 solenoid terminal, this lead and distributor not at fault). If one bank of cylinders cuts out when overdrive engaged, check for defective solenoid or ground between solenoid terminal #6 and kickdown switch lower terminals.

Overdrive will not engage—Check for open-circuit between relay terminal #5 and governor switch. Check by grounding #5 relay terminal (relay and solenoid should 'click' simultaneously). If relay does not click, check for blown fuse or defective relay. If relay clicks but solenoid does not, check for defective relay, defective solenoid or open-circuit between #4 relay and solenoid terminals. If both relay and solenoid click but overdrive will not engage, check for jammed solenoid or damage within overdrive unit.

Overdrive will not kick-down—Check for ground between relay and kick-down switch or at upper terminals of kickdown switch (see Special Service Note above). Check for open-circuit between relay terminal #2 and ignition condenser, solenoid terminal #7 and ignition condenser, solenoid terminal #6 and kick-down switch, relay terminal #6 and kick-down switch, or within relay. Check for defective kick-down switch.

FUSE:—20 ampere. In connector in control relay lead.

BUICK 60, 70, 90 TYPE

Used On:

BUICK, SERIES 41-60,70,90 (1941)

TYPE:—Constant-mesh, synchro-mesh (Second & High), sliding gear (Low & Reverse), all-helical gear type. Same design as used on 1940 car models with following features:

Shifter Mechanism—New cross-shift mechanism used consisting of vertical shaft in side of transmission case with lever on upper end engaging selector shaft so that movement of the selector lever on the transmission case (small forward lever) shifts the selector shaft sidewise in the transmission to engage the Low-Reverse or Second-High shifter rail.

Synchronizer Cones & Gears—Synchronizing cones have 7° angle and are marked 'S' for use with second speed gear. Service gears are marked '7' and must be used with these cones (do not confuse these gears with types used on previous models).

Countershaft & Reverse Idler Shaft Retainers—Shafts are retained by special grooved lockpin which is driven into hole in case so as to enter hole in shaft. Pin must be driven through into shaft before shafts can be removed and new pin must be used when shafts re-installed.

SERVICING:—Disassembly—Remove cover, drive countershaft locking pin in until it is completely within shaft, use service tool J-1001 (dummy shaft) to drive countershaft out through rear of case leaving tool in countergear cluster until it is replaced in case (tool will retain bearing rollers and spacer). Take out mounting screws and remove universal joint ball and cover, remove speedometer drive pinion, take out screw in end of shaft and pull universal joint yoke, then take out mounting screws and remove rear bearing retainer. Loosen lockscrews in both shifting forks, move synchronizer drum assembly to high gear position. Move entire mainshaft assembly back until forward end clears pilot bearing in drive gear, lift shaft up and to left until fork clears collar on synchronizer, move fork to rear in case. Move shaft to right to clear Low-Reverse shifter fork, move fork forward. Remove synchronizer assembly from shaft. Take out second speed gear snap ring, slide second speed gear forward on shaft, take out low speed gear stop ring. Support gears by hand and withdraw mainshaft and bearing through rear of case. Lift out second speed and low speed gears. Remove main drive gear snap ring (on front of case), tap gear through into case and remove through top. Lift out countergear cluster being careful not to lose steel and bronze thrust washers. To remove reverse idler, drive lockpin into shaft, drive shaft out.

Reassembly—Reassemble transmission in same manner. Use new snap rings at all points if possible. NOTE—Main drive gear snap ring increased in wall thickness and inside diameter. This snap ring and others can be used on previous models but previous type snap rings must not be used on 1941 transmissions.

Mainshaft & Bearing Assembly:—Rear main bearing should be .0007" tight to .0002" loose on shaft and .0002" tight to .001" loose in case. Bearing is held on shaft by universal joint front companion flange and is retained in case by snap ring in groove in outer race which is clamped between case and retainer. Low and reverse gear backlash on shaft should be .003" maximum.

Synchronizer Assembly:—Cannot be dismantled and should be replaced as a unit. Clutch sleeve clearance on mainshaft should be .001-.003" and backlash should be .001-.003".

Main Drive Gear & Bearing:—Bearing is shielded type and should be installed with shielded side toward transmission case. Bearing inner race and oil slinger are retained on shaft by snap ring installed in groove in shaft. Bearing should be .0003" tight to .0007" loose on shaft and .0002" tight to .001" loose in case. Pilot bearing in gear hub is composed of 14 loose rollers which are prevented from moving out by snap ring installed in gear hub.

Countergear Assembly:—Mounted on roller bearings in each end with spacer between bearings. When removing gear cluster, leave dummy shaft or arbor within gear cluster to retain rollers until gears replaced (drive arbor out as countershaft installed). Install roller bearing retaining washer on each end of gear cluster with bronze thrust washer between gears and case (front), bronze washer and steel washer (rear). Use new lockpin to retain countershaft (see lockpin data below).

Shifter Mechanism:—Before removing selector shaft, remove lever on cross-shift (vertical) shaft to permit lever on upper end of this shaft to disengage from selector shaft as shaft is driven out. Remove lever on left end of selector shaft, take out locking screws in each selector cam, drive shaft out through right side of case (shaft will dislodge sealing plug in hole). This is important to avoid damage to oil seal on lever end of shaft. Inner selector shaft and lever can then be lifted out of case. When replacing this lever, make certain that spring washer, plain washer, and seal are assembled on shaft within case. When installing selector shaft, insert shaft through left side of case and close shaft hole on right side of case with sealing compound. See Transmission Control article for adjustments when replacing transmission on car.

IMPORTANT NOTE—Interlock bushing must be installed with large diameter toward transmission case (not toward shifter cam). If reversed, no interlock control of second and high shift rail will result and shift into Low or Reverse may lock gears.

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Countershaft & Reverse Idler Retainers:—With countershaft and reverse idler shaft out of engine, remove locking pins from shaft and discard these pins (pins must not be re-used). After shafts reinstalled in transmission case, line up holes in case and shaft, install a new locking pin and drive pin in ⅝-¾" past flush with outer surface of case.

BUICK-OLDSMOBILE-PONTIAC TYPES

Used On:

BUICK, SERIES 41-40,40A,50 (1941)
OLDSMOBILE 6, MODELS 66,76,96 (1941)
OLDSMOBILE 8, MODELS 68,78,98 (1941)
PONTIAC 6, MODELS 41-24,25,26 (1941)
PONTIAC 8, MODELS 41-27,28,29 (1941)

OLDSMOBILE NOTE:—This synchro-mesh transmission is standard equipment on all car models. Hydra-Matic Transmission (with a Fluid Coupling) is optional equipment on these models. See separate article on Oldsmobile Hydra-matic Transmission for data on this type.

TYPE:—Constant-mesh, synchro-mesh (Second & High), sliding gear (Low & Reverse), all-helical gear type. Same design as used on 1940 car models with following features:

Shifter Mechanism—New cross-shift mechanism consisting of a vertical shaft on side of transmission case with inner lever at upper end engaging selector shaft so that movement of selector lever on transmission case (small forward lever) shifts the selector shaft sideways in the transmission to engage the Low-Reverse or Second-High shifter rail.

Countershaft Bearings—Countergear cluster now mounted on roller bearings (loose rollers) at either end with spacer on shaft between bearings. Special service tool (dummy shaft) must be used when removing countershaft to retain bearing rollers.

Synchronizer Cones & Gears (Buick only)—Synchronizing cones have 8° angle and must be used with new gears marked '8' (do not confuse these gears with gears used on previous models). Bronze cones must always be used with Second Speed Gear.

SERVICING:—Disassembly—Remove cover, remove speedometer driven gear assembly. Disconnect spring on shifter lever on left side of case. Take out rear bearing retainer screws, set transmission in high gear position (to prevent sliding sleeve and low speed gear from dropping down into case), withdraw bearing retainer, second speed gear, and mainshaft assembly through rear of case. Remove setscrews from shifter forks and selector shaft cams (use tool KMO-244), take out retainer screw and remove lever from left end of selector shaft, remove lever from lower end of vertical shaft (necessary to permit inner lever on upper end of shaft to disengage from selector shaft), drive selector shaft out through right side of case (this is important to prevent damage to oil seal on lever end of shaft), remove selector cams from case. Remove shifter rails through front end of case (Oldsmobile—welch plug in case at front end of Second-High rail must be removed also), rear of case (Pontiac), being careful not to lose detent balls and springs which are located under rails on all models. Lift out shifter forks, sliding sleeve and low speed gear. Use special tool (arbor or dummy shaft) J-1334 (Buick), J-1449 (Oldsmobile & Pontiac) to drive countershaft out through rear of case, leaving tool within counter gear cluster to retain bearing rollers until shaft is replaced. Remove snap ring on main drive gear bearing (on front of case), tap main drive gear and bearing through into case and lift out. Lift countergear cluster out being careful not to lose thrust washers on either end of cluster or bearing rollers. To remove reverse idler, drive locking pin through into shaft, then drive shaft out and lift gear out.

Synchronizing Unit:—No detent springs used. Synchronizer drums are retained on gears by snap rings and may be removed after snap rings are released.

Buick Note—Make certain that drum used on second speed gear is Bronze (aluminum drums used on some models for high gear).

Mainshaft & Bearing Assembly:—Second speed gear retained on shaft by snap ring at forward end and can be removed after snap ring has been taken off (use tool J-1130). To remove bearing retainer, take out bearing snap ring, tap end of shaft on wooden block. Then remove snap ring on shaft at rear of bearing, press speedometer gear, spacer and bearing off shaft (on Buick, speedometer gear is mounted on universal joint yoke which is held on end of shaft by retainer screw and washer). When installing bearing, see that shielded side is forward (toward second speed gear). Bearing should be .0007" tight to .0002" loose on shaft and .0011" tight to .0005" loose in bearing retainer.

Mainshaft Rear Bushing (Oldsmobile 76, 78, 96, 98)—New type steel-backed, bronze bushing used in transmission extension housing to support mainshaft. Bushing can be replaced after oil seal removed from end of housing by using tool J-1450 to remove old bushing and install new bushing. New bushings must be reamed after installation to provide .0025-.004" clearance on shaft (reamer is part of J-1450 tool set).

IMPORTANT INSTALLATION NOTE (OLDSMOBILE)—When transmission installed on 76, 78, 96, 98, fill the transmission rear bearing housing asembly with ½ pint of transmission lubricant after transmission has been installed in car and propeller shaft installed.

Rear Oil Seal (Oldsmobile)—New oil seal must be installed in rear end of rear bearing retainer whenever oil seal removed. Soak new oil seals in engine oil for 5 minutes, install seal with felt to rear using tool J-1050. NOTE—New type oil seal has shoulder which locates it in housing. See that vent in housing is open.

Rear Oil Seal (Pontiac)—Old oil seals can be removed by prying with a screwdriver. Use tool J-1323 to install new oil seals (seal has extension rim which will be damaged if tool not used).

Main Drive Gear & Bearing:—Bearing can be removed from shaft after lock ring has been removed by tapping end of shaft on wooden block. When installing bearing, see that shielded side is toward gear. Bearing should be .0003" tight to .0007" loose on shaft and .0002" tight to .001" loose in case.

Second Speed Gear:—Clearance on shaft should be .001-.0026" (Buick), .0005-.0027" (Pontiac). Endplay should be .000-.010". When installing gear, make certain that thrust washer installed in front of gear, use special thimble J-1267 (Oldsmobile) to start snap ring on end of shaft.

Countergear Assembly:—If rollers removed from gear cluster, use arbor as assembly tool, make certain that spacer and thrust washers assembled in gear cluster, then install rollers, using grease to retain them in place. Install assembly in case, making certain that small steel thrust washer installed next to bearing rollers and large bronze thrust washer between gear cluster and case at each end, insert countershaft from rear and push arbor out through front of case. See that lock ball in place in rear end of shaft and that ball engages groove in case to prevent shaft from turning. Countergear clearance should be .0005-.0024". Endplay should be .0076-.0196" (Buick), .009-.021" (Pontiac).

Shifter Mechanism:—Selector shaft must be removed when transmission is disassembled (see Disassembly directions above). To remove shaft, use KMO-244 tool to remove shifter cam setscrews, remove lever on left end of shaft by taking out retainer screw, remove lever on lower end of cross-shift shaft (necessary to allow inner selector lever on upper end of shaft to disengage from selector shaft). Drive selector shaft out through right side of case (this is important to avoid damage to oil seal on lever end of shaft). With selector shaft out, inner selector lever and shaft can be lifted out. See that this shaft and hole in case are clean, lubricate with Lubriplate when shaft replaced being certain that spring washer, plain washer and oil seal installed on upper end of shaft within case. Install selector shaft through left side of case and use sealing compound to close hole on right side (this hole originally closed by plug which will be driven out when shaft removed. CAUTION—When installing lever on selector shaft, hold shaft with wrench to avoid damaging selector cams and make certain that lockwasher installed on lever retainer screw. This lockwasher is very important to prevent lever loosening in service.

CADILLAC STANDARD TYPE

Used On:

SERIES 41-60S, 61, 62, 63, 67, 75 (1941)

HYDRA-MATIC DRIVE TRANSMISSION NOTE:—Special Hydra-Matic Drive Transmission is Optional Equipment on all models. See separate article for adjustment and servicing data on this Hydra-Matic Drive Transmission.

TYPE:—Constant-mesh, synchro-mesh (Second & High), sliding gear (Low & Reverse), all-helical gear type. Same design as used on 1940 models.

SERVICING:—Disassembly—Remove speedometer driven gear adapter housing and gear. Take out retaining screw and remove universal joint flange on rear end of shaft, remove extension housing capscrews and pull extension housing off shaft. Remove transmission bottom cover, drive countershaft out through rear end of case, remove countergear cluster, thrust washers, and bearing rollers. Take out lockscrews in front end of case, pry main drive gear and bearing out of case toward front, remove synchronizer assembly from front end of mainshaft. Use Tool J-1007 to remove lock ring in front of second speed gear, tap mainshaft and bearings out through rear of case (second speed and low speed gears will slide off shaft and should be removed from case). Tap reverse idler shaft out through rear of case and remove reverse idler gear and thrust bearing. Loosen clamp bolts and remove

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levers on shifter shafts, remove shifter lever shafts through inside of case being careful not to lose interlock spring, balls, and tube.

Reassembly:—When reassembling transmission, note the following points:

Shifter Shafts & Levers—Install Second-High lever first, see that shaft in neutral position and shoe in place on inner end of shaft. Install interlock assembly, compress interlock spring and install Low-Reverse shifter shaft, see that shaft in neutral position (interlock ball engaging center notch in shaft sector) and that shoe in place on inner end of shaft. Install new cork seals on outer ends of shafts (use tool J-1169) and install levers.

Reverse Idler Gear—Start shaft in through rear of case, install rear steel backed-babbitt thrust washer on shaft with clip in washer fitting into slot in case, install new cork seal on outer end of shaft. Install gear on shaft, use pilot tool J-1010 to hold front thrust washer in position while shaft is tapped into place, see that locking screw hole in shaft and case line up (shaft locked by long cover screw which must be installed in this hole). Idler gear bushing clearance on shaft is .002-.0035" (new), .005" (worn limit). Gear endplay should be .005-.010" (new), .015" (worn limit). Gear backlash should be .008-.010" (new), .011" (worn limit).

Mainshaft Assembly—When installing mainshaft, hold low speed and second speed gears in position and engaging shift lever shoes, insert shaft through gears. Use tool J-1007 to install new second speed gear lock ring, tool J-1170 to install mainshaft front roller bearings in main drive gear (bearing rollers held in place by lock ring). Low speed gear backlash on mainshaft splines should be .004-.007" (new), .010" (worn limit). Synchronizer hub backlash on mainshaft splines should be .0005-.001" (new), .003" (worn limit). Second speed gear clearance on mainshaft should be .001-.0015" (new), .00175" (worn limit) and endplay should be .004-.008" (new), .012" (worn limit).

Countershaft Assembly—Start countershaft through rear end of case, install needle bearings and retaining washers in countergear cluster with tool J-1184, place bronze thrust washers in position on each end of gear cluster and steel thrust washer on rear end, tap countershaft into place in gear cluster with new cork seal on end of shaft, see that locking hole in shaft and case line up (shaft locked by long cover screw which must be installed in this hole). Countergear endplay should be .005-.012" (new), .018" (worn limit). NOTE—If endplay exceeds .018", install oversize thrust washer.

Extension Housing & Oil Seal—Install extension housing on transmission case and tighten mounting screws securely. Then install oil seal in rear end of housing using tool J-1354. Extension housing bushings are not furnished separately and housing should be replaced on exchange basis if bushing require replacing.

NOTE—Extension housing used on approximately first 3500 cars in 1941 permits use of speedometer pinion for standard rear axle ratio only and housing must be replaced if optional rear axle installed. Second type housing (with provision for installation of optional axle ratio speedometer drive pinions) only is furnished for service and is marked 'R' on case under speedometer cable opening. See Cadillac Shop Notes in 'M' Section for complete extension housing data.

CADILLAC & OLDSMOBILE HYDRA-MATIC DRIVE

Optional Equipment On:

OLDSMOBILE SIX & EIGHT, ALL MODELS (1941)

CADILLAC, ALL MODELS (1941)

IMPORTANT SERVICE NOTE:—Towing Car—Control lever must be placed in 'N' (neutral) position if car is being towed.

Starting Engine by Pushing or Towing Car—Control lever should be placed in 'N' (neutral) position until car speed of approximately 20 MPH. is reached, control lever should then be moved to 'HI' position and engine will be cranked through gears.

Parking With Transmission in Gear—To park car in gear (for parking on hills), engine should be stopped with control lever in forward driving position (HI or LO), control lever should then be moved to 'R' reverse position. This locks the drive system so that car will not move.

Reverse Shift—To engage reverse, with car completely stopped, control lever should first be moved momentarily to 'LO' position and then quickly and firmly moved to 'R' position.

DESCRIPTION & OPERATION:—The 1941 type Hydra-Matic Drive is similar to design used on 1940 Oldsmobile models (see Cadillac Note below) except for new Starter Interlock as follows:

Starter Interlock—Consists of a bellcrank linked to the starter motor pinion shift lever which 'kicks' the steering column control lever into the 'N' or neutral position when the starter pedal is depressed to start the engine (if control lever has been left in any other position than neutral). This linkage is adjustable (see Adjustment directions below).

Cadillac Type—Cadillac Hydra-Matic Drive is similar in design to Oldsmobile type except for heavier construction and special double reduction or two-unit rear planetary unit (consists of two sets of planetary gears in tandem). This type also has Interlock device which prevents starting of engine unless control lever is in Neutral.

ADJUSTMENT (OLDSMOBILE):—Linkage should be checked, and adjusted if necessary, whenever it has been disconnected or disturbed by removal of other units, carburetor adjustment, etc. Adjust linkage exactly as follows:

Manual Control Lever Linkage:—Remove clevis pins to disconnect lower control rod (forward rod) at intermediate lever on lower control relay bracket (on cross-member at left of flywheel housing) and lower control relay rod (rear rod) at shift lever (inner lever) on left side of transmission case. Set control lever on steering wheel in 'R' (reverse) position and make certain that poppet ball engages detent notch. Move intermediate lever so that hole in lever lines up with hole in bracket, insert special gauge No. J-1469 through both holes to hold lever in this position while adjustments are being made. Move manual shift lever on transmission (inner lever on outside of case) toward rear as far as possible (to make certain that lever is in extreme rear position, rotate propeller shaft by hand until pawl is felt to engage and lever is against stop). Adjust lower control relay rod length (loosen locknut and turn clevis on rear end of rod) so that rod can be connected to transmission lever without disturbing lever position, connect rod being certain that waved (anti-rattle) washer is in place and that clevis locknut is tightened. Remove tool J-1469 from intermediate lever, press back on intermediate lever so that rear rod and manual shift lever held in rear position against reverse stop, adjust length of lower control rod (forward rod) by loosening locknut and turning clevis on rear end of rod so that rod can be connected without disturbing position of steering column lever or intermediate lever. Connect rod making certain that waved (anti-rattle) washer is in place and that clevis locknut is tightened. Check control lever in all positions to make certain that it operates freely.

Throttle Control Linkage:—Disconnect transmission throttle rod at lever on left side of transmission case (outer lever). Set carburetor throttle stop-screw for 375 RPM engine speed in neutral (hot or slow idle speed—see Oldsmobile article for carburetor adjusting directions). Remove trunnion nut lock on idler lever at rear end of carburetor throttle rod (right side of cylinder head), adjust length of throttle rod by turning trunnion nut until special gauge J-1469 slips freely through holes in accelerator linkage bellcrank and bracket (on left side of engine), tighten trunnion lock and remove gauge. Move transmission throttle lever (outer lever on left side of transmission case) to extreme rear position against idle stop, and with carburetor in slow or hot idle position, adjust length of transmission throttle rod by loosening locknut and turning clevis on rear end of rod so that rod can be conected without disturbing position of levers, then **shorten rod by one additional full turn of the clevis**, tighten locknut and connect rod by inserting clevis pin and installing cotter pin. Adjust rod connecting accelerator pedal idler lever and bellcrank on left side of engine so that clearance between idler lever and bead on toepan is 3/32-5/32" with carburetor in slow or hot idle position. Adjust Throttle Cracker and Fast Idle (see Carburetor adjusting instructions in Oldsmobile article).

Starter Interlock Adjustment:—This adjustment should be made only after manual control has been properly adjusted (see above). Disconnect battery cable at starter motor (to prevent starter cranking engine), place steering column control lever in 'N' or neutral position, fully depress starter pedal and hold pedal in this position while adjustment is being made. Adjust length of rod linking starter pinion shift lever and interlock bellcrank so that clearance between face of bellcrank and lower face of steering column control shaft shift lever is .030-.060". Check operation by placing steering wheel control lever in all other positions than neutral. If control is not returned to neutral 'N' position in each case, recheck adjustment.

ADJUSTMENT (CADILLAC):—Adjust linkage exactly as directed below.

Manual Control Lever Linkage:—Remove clevis pin from lower end of lower control rod (at transmission manual shift lever). Move steering wheel control lever in Reverse position. Move manual shift lever on transmission to rear as far as possible (Reverse position), check this by rotating propeller shaft by hand until reverse anchor is felt to engage. Adjust clevis on lower end of control rod so that clevis pin can just be inserted without disturbing

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position of rod or lever, connect rod. Check control lever for free operation in all positions.

Throttle Control Linkage:—Make certain that carburetor set for hot or slow idle speed of exactly 375 RPM (use tachometer such as KMO-298 electric type). See that throttle valve completely closed with stopscrew against low step of fast idle cam. Remove cotter pin and anti-rattle spring from upper end of intermediate throttle rod and disconnect throttle rod at transmission lever (lower lever on transmission case). Snap special adjusting tool J-1653 in place on upper end of intermediate throttle rod at relay shaft lever on front of dash. Loosen locknut and turn adjusting nut on carburetor end of throttle-to-relay rod until the adjusting tool contacts both the relay shaft at the distributor support and the projection on the intermediate throttle rod. See that throttle lever on transmission case is moved to rear as far as possible, adjust trunnion on transmission end of throttle rod so that pin can be installed without moving throttle lever from rear position against stop and without disturbing linkage, connect rod. Remove adjusting tool, re-install cotter pin and anti-rattle spring.

SERVO-BAND ADJUSTMENT (ALL MODELS):—Servo-bands should be adjusted at end of first 5000 miles and at 10,000 mile intervals afterward. Oil must be drained and oil pan must be removed for this adjustment (can be combined with regular draining and refilling operation).

CAUTION—Front and rear servo bands are adjusted differently and each band must be adjusted exactly as directed below. No band is used on the Reverse planetary unit (pawl on case locks ring gear by engaging teeth on rim of gear).

Front Servo Band—Remove transmission case oil pan and snap-in cover in floor pan over adjusting screw. Loosen adjusting screw locknut, install special adjusting tool J-1459 over capscrew in front unit (insert tool from below through oil pan opening), tighten adjusting screw on top of case until front unit drum just cannot be moved in either direction, then **back off adjusting screw exactly 8 turns,** tighten adjusting screw locknut taking care that adjusting screw does not turn. NOTE—It is extremely important that adjusting screw be backed off exactly 8 turns from point where drum just cannot be turned—mark screw position at this point and count turns carefully as screw is backed off.

Rear Servo Band—Remove transmission case oil pan and snap-in cover in floor pan over adjusting screw. Use servo cam release bar and force rear servo plunger into servo beyond servo gauge. Loosen adjusting screw locknut and turn adjusting screw down to take up all slack in servo band. Install special servo gauge J-1460 on bottom of servo, back off adjusting screw until end of servo plunger is flush with outer edge of gauge (plus or minus 1/32"), tighten adjusting screw locknut. Check adjustment by working servo plunger with cam release bar.

LUBRICATION:—Hydra-matic drive case should be drained and refilled with new Hydra-matic Drive Fluid at end of first 5000 miles and at 10000 mile intervals afterward (Oldsmobile), end of first 6000 miles and at 12,000 mile intervals (Cadillac). Servo-bands can be adjusted at same time with oil pan off—see above. Fluid level should be checked at 1000 mile intervals (Cadillac), 2500 miles (Oldsmobile) and fluid added to keep level at 'full' mark as follows:

Checking Fluid Level—Run engine for several minutes, then stop engine and allow car to stand for at least one minute before checking level (this is important because transmission fluid is supplied to the fluid coupling and fluid coupling must be full of oil when checked). Remove sheet metal cover in floor pan over fluid level indicator (right front corner of transmission case), remove indicator to check level. Keep level at 'Full' mark on indicator.

Draining Hydra-matic Drive—Transmission case and fluid coupling are drained separately. Remove plug at front end of oil pan (to drain transmission), on front face of flywheel (to drain fluid coupling). NOTE—When refilling after draining transmission, add 6 qts. of fluid (Oldsmobile), 8 qts. (Cadillac), run engine for approximately 5 minutes, then add remainder of fluid (see Capacity data below).

Capacity (Cadillac)—11½ qts. when unit has been drained. Use only Cadillac Hydra-Matic Fluid (one type for all-season use).

Capacity (Oldsmobile)—9 qts. (when transmission case and fluid coupling have been drained), 9½ qts. (if oil pan has also been removed for cleaning), 10 qts. (if transmission has been disassembled). Use only Oldsmobile Hydra-Matic Fluid (one type for all-season use). NOTE—For emergency use only, transmission can be operated with good quality SAE. #20W engine oil. Replace oil as soon as possible with genuine Hydra-Matic Fluid.

CHECKING OIL PRESSURE:—If transmission operation not satisfactory check to make certain that oil pressure sufficient for correct operation as follows:

To Check Oil Pressure—Use special service fixture J-1467 and a reliable 100 lb. oil pressure gauge. Remove the plug on the transmission side cover plate, remove plug from governor sleeve by threading standard ¼" capscrew into plug and removing plug through side cover plate hole. Assemble J-1467 fixture in place in side cover plate and governor housing using extreme care not to cause any bind in governor assembly. Assemble pressure gauge to fixture plug so that gauge can be read while car being operated. Operate car on road until transmission fluid is hot, see that control lever in high range, allow car speed to drop to 20 MPH and note gauge reading. Oil pressure must not be less than 75 lbs. (Cadillac), 78 lbs. (Oldsmobile) at 20 MPH.

Low Oil Pressure Correction—If pressure less than 75 lbs., check for excessive oil leakage in transmission or oil regulator valve assembly, see that oil regulator valve body is tight, check for sticking regulator valve or weak valve spring (substitute new spring and recheck pressure). Inspect for leak in main control valve body or at delivery tube connections between main control valve body and governor sleeve.

TRANSMISSION REMOVAL (OLDSMOBILE):—Raise car and jack up all four wheels securely approximately 8" above floor. Remove foot accelerator pad, floor mat, center floor pan. Disconnect propeller shaft at rear universal joint, remove by sliding shaft out at splined joint. Remove flywheel housing pan. Drain transmission and flywheel by taking out both drain plugs. Remove outer throttle lever from transmission case, disconnect control rod from manual shift lever. Remove two upper engine mounting bolts, remove master cylinder to brake shaft bracket, disassemble strut from shaft, remove clevis pin from lower control relay rod. Raise engine approximately 1" off mountings with jack just forward of crankcase drain plug (use block of wood on jack). Remove 3 bolts from each side of cross-member at frame side rail, remove cross-member by tipping top toward front of car and moving cross-member forward. Install transmission lifting tool J-1129 in front compartment over floor pan opening (CAUTION—use safety extension legs J-1129-40-1). Place saddle at bottom of transmission, work cables through pan opening and hook both cables onto lifting tool cable snap. Center saddle on transmission pan, hoist transmission just enough to take strain off mounting bolts, remove 5/16" bolts holding fluid flywheel cover on flywheel, remove five ½" bolts holding rear half of bell housing to front half. Lower engine slightly until top of bell housing is flush with top of opening in floor pan, thread two standard transmission bolts into bell housing (on each side just above dowel pins) to force bell housing from dowel pins, then remove these bolts. Remove transmission and rear bell housing as an assembly by moving it toward rear of car and lowering to floor.

TRANSMISSION REMOVAL (CADILLAC):—Raise car and jack up all four wheels securely approximately 8" above floor. Remove floor carpet and pads, front seat cushion, and center floor pan. Disconnect propeller shaft at front universal joint and remove shaft, remove flywheel housing pan. Drain transmission and fluid flywheel by taking out both drain plugs. Support rear end of engine with jack under oil pan (use block of wood on jack). Disconnect engine rear support at transmission extension, remove cross-member and rear support. Remove throttle lever on side of transmission case, disconnect control rod from shift lever, disconnect speedometer cable. Install transmission hoist J-1616 in front compartment over floor pan opening, screw eyebolt securely into top of transmission, attach hoist cable hook to eyebolt, lift transmission just enough to take strain off mounting bolts. Remove 30 5/16" capscrews holding flywheel cover to flywheel. Lower jack under engine until top of bell housing is just flush with top of floor pan opening. Remove 6 bolts holding bell housing to engine crankcase. Remove transmission by shifting it backward and lowering to floor.

SERVICING:—Front Servo—To disassemble after removal from transmission, remove oil suction line, take out pump cover attaching bolts, remove pump cover. Remove servo pistons, springs and oil pump gear from housing. When assembling, install servo piston and sleeve in housing, slip retracting spring over piston shaft. Install oil pump idler gear. Install accumulator piston, booster spring, booster spring retainer in servo unit cover, install cover assembly in servo housing, tighten cover bolts. Install suction line making certain that gasket is in good condition. When installing servo in transmission case, see that plunger enters anchor on brake band. Adjust servo after installation.

Rear Servo—To disassemble after removal from transmission, place servo in arbor press and hold squarely in steady position on baseplate so that tension removed from spring retainer. Remove retainer screws, release pressure slowly and guide accumulator body out of servo, remove all parts. When assembling, install booster piston, booster spring, large initial spring, accumulator and piston body in servo body, centering small ring on booster spring so that it enters accumulator body freely. Hold accumulator in place on servo, install inner and outer servo springs and spring retainer. Compress assembly in arbor press and tighten spring retainer screws. Adjust servo after installation in transmission.

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Fluid Coupling—To remove fluid coupling members with transmission off car, place manual shift lever in reverse position, loosen mainshaft locknut washer. Use tool KMO.334 to remove locknut retaining driven member (runner) on front end of mainshaft, slide driven member off. Remove drive member (driver) by gripping vanes with pliers at 2 diametrically opposite points and pulling forward while tapping on end of mainshaft with bronze hammer (CAUTION—do not attempt to remove drive member by pushing or pulling on flywheel cover—this will damage oil seal rings).

CHEVROLET THREE-SPEED TYPE

Used On:

MASTER DELUXE AG, SPEC'L DELUXE AH (1941) ½ TON AJ,AK; ¾ TON AL,AN (1941)

NOTE:—Passenger Car Models—These models have new type Shifter Mechanism mounted in side cover on transmission case (no top cover used). All service replacement gears are Carburized type (same as used in Truck transmissions).

Truck Models—Same design as 1940 with conventional shift lever mounted on top cover. All gears are Carburized type (carburized gears furnished for passenger car transmission service also).

Transmission Extension (all models)—All transmissions have extension on rear end so 4 speed transmission can be installed without difficulty on truck models. NOTE—When installing 4 speed transmission on ½ Ton Models, new brake master cylinder must be installed. Special speedometer gear adapter and new speedometer gears must be installed on all models.

Vacuum Power Gearshift (Passenger Cars)—See separate Chevrolet Transmission Control article for complete adjustment, disassembly, and servicing directions.

SPECIAL SERVICE NOTES & PRODUCTION CHANGES:—1940 High Gear Disengagement Complaints—To correct complaints of transmission disengaging in High Gear position, check the following points first: Check Vacuum Cylinder Valve Setting and install No. 3655072 Valve Friction Spring on valve rod (see Chevrolet Transmission Control article for data), check run-out of transmission pilot face on clutch housing and shim between clutch housing and transmission if run-out exceeds .008". If this does not correct complaint, install following parts (furnished in Unit Package No. 605021): Main Shaft, 2nd. & 3rd. Speed Clutch & Synchronizer Assembly, Clutch Gear. New main shaft and clutch are 1941 type with 6 splines (instead of 18) and have ground lands.

Serviceable Interlock Lever & Shaft—On late 1940 cars (as on 1941 models), shifter interlock lever is clamped on shaft by ¼x28x¾" bolt and can be removed so that these parts can be serviced separately (complete cover must be replaced on first type with welded shaft and lever).

Countergear Assembly—On trucks, countergear is mounted on roller bearings and this type countergear only is furnished for service on all models. See special service data below for countergear servicing when roller bearings used.

TYPE:—Constant-mesh, synchro-mesh (Second and High), sliding gear (Low and Reverse), all-helical gear type. Design changed from type used on 1940 models as follows: Shifter interlock lever clamped on shaft by clamp bolt instead of being welded (parts can be serviced separately), mainshaft now has 6 splines instead of 18 and lands between splines ground for more accurate centering of 2nd. and high clutch (see 1940 Special Service Note above), shifter yokes are 'granodized', Reverse Idler Gear bushings staked in place to prevent loosening in service, and speedometer drive gear now mounted on universal joint spacer (instead of on yoke).

SERVICING:—Disassembly—On Pass. cars, take out screws and remove shifter cover on left side of case (see Shifter servicing data below). On trucks, take out screws and remove gear shift lever and transmission cover assembly (turn screws out evenly to relieve spring pressure), remove shifter shafts and forks (see Shifter servicing data below). On all models, remove universal joint capscrew and washer, slide joint off shaft. Remove drive gear bearing retainer screws on front of case, take off retainer. Mark main drive gear, second speed gear, and both synchronizing rings to insure reassembly in same relative positions. Use special puller, J-937, to remove clutch shaft and main drive gear bearing, take out 14 loose rollers (mainshaft front bearing). Use special tool, J-938, installed on back of transmission case and push mainshaft out toward front (IMPORTANT—front synchronizer ring must be turned so that lugs line up with slots in splines on mainshaft to avoid damage to lugs and splines), remove mainshaft from front end. Engage second speed gear and clutch sleeve, remove clutch sleeve assembly, low and reverse gear, second speed gear from case as a unit, remove second speed gear thrust washer. Expand rear bearing lock ring into case (use tool J-935), tap bearing out toward front (bearing must be removed before countershaft can be removed). Drive countershaft out toward front. To remove reverse idler, drive idler shaft lockpin into shaft (pin shorter than shaft diameter), drive out expansion plug at rear of case, remove idler shaft through this hole.

Main Gear Drive & Clutch Shaft Bearing:—Bearing retaining nut and oil-slinger are single unit with left hand thread and are staked in hole in shaft. Use special press-plate J-936 to press bearing on or off shaft. Bearing retainer mounting holes on front of case spaced irregularly to insure assembly in correct position (to align oil return holes).
NOTE—Special Malleable Iron Clutch Gear Bearing Retainer, No. 604932, available for installation on all 1940 & 1941 Three-Speed Transmissions for severe service (will prevent lubricant loss due to cracked retainers).

Clutch Sleeve & Synchronizing Rings:—To disassemble rings, turn ring until ends of ring retainer is visible through slot in sleeve, insert special pliers J-932 in slot, expand retainer to free ring, pull ring out. See that synchronizing cones are tight in sleeve (replace clutch sleeve and cone assembly if cones loose or worn). Check rings to see that they do not rock in cones.

Energizing Springs:—Use new spring whenever spring is removed. When installing springs, do not expand more than necessary to clear clutch teeth. Install springs with offset end between fourth and fifth teeth of any bank of the clutch teeth (offset prevents spring rotation).

Mainshaft & Rear Bearing:—To install bearing, first install bearing lock ring in case, expand lock ring with tool J-935, tap bearing on outer race with soft steel drift until it is halfway in case, release snap ring, continue to tap bearing until lock ring engages slot in bearing race. Lubricate second speed area of mainshaft, install shaft with lugs on front synchronizer aligned with slots in mainshaft spline (to avoid damage to lugs and splines), use replacing tool J-938 to pull shaft into place. Second speed gear endplay should be .010" with shaft installed.

Counter Gear Cluster:—Bushings staked in place and diamond-bored after installation. Not sold separately. Clearance on shaft .002-.004". When installing countershaft, see that thrust washers are in place at each end of counter gear cluster and that flat on forward end of shaft is horizontal and on top (flat engages clutch housing to prevent shaft turning, transmission cannot be installed unless flat properly located).
Roller Bearing Type—Used on trucks and furnished as service replacement on Passenger cars (Carburized Gear type). To install bearing rollers, install shaft in countergear cluster, coat roller recess with cup grease, install 25 rollers in each end, remove countershaft and install gear cluster in transmission case. Install forward thrust washer between gears and case (lubricate washer), feed assembly tool T-1617 in from front end (tapered end first), lubricate countershaft and install at front end and pushing assembly tool out at rear end (lubricate rear thrust washer and install in case before assembly tool reaches this point). See that flat on forward end of shaft is horizontal and flush with case (not more than 1/64" below face).

Reverse Idler Gear:—Remove old lockpin from shaft before installing, line up holes in case and shaft, use new lockpin and drive pin in so that head is approximately 1/16" beyond surface of case, peen hole to prevent pin coming out. Pin must be tight in hole to prevent oil leaks.

Shifter Mechanism (Passenger Cars):—Consists of two shifter forks on 'I' beam type guide bar bolted on inner face of transmission side cover. Forks are operated by toggle lever in cover and one fork is locked by cross-shift lever while the other fork is being moved to engage gears (cross-shift lever has short arc between slots in gears).
Disassembly—With cover off transmission case, remove two bolts holding guide bar and shifter fork assembly on cover, remove assembly, lift shifter yoke lever, anti-rattle spring, and operating shaft out. Slide shifter forks off guide bar being careful not to lose shift lock balls and spring (in hole in guide bar under forks). Wash all parts in gasoline.
Reassembly—Install long shifter fork on guide bar with fork end toward nearest mounting screw hole, line up lock ball recess in fork with hole in guide bar, install one lock ball and spring in hole, start opposite shifter fork on guide bar, assemble other lock ball on spring, use flat tool to compress spring and slide fork into position over lock ball. Check operating shaft cork seal and retainer, replace if worn. Install operating shaft in cover, assemble anti-rattle spring and shifter yoke lever on bell crank end of operating lever, move selector (cross-shift) bell crank over center of shifter yoke lever. Press on outer end of operating shaft so that shifter yoke lever held firmly against selector lever bell crank, make certain that both shifter forks in neutral position on guide bar, then assemble guide bar and shifter fork assembly on cover with low-reverse shifter fork toward bottom (narrow side) of cover. Make certain that selector lever bell crank engages slots in shifter forks and that pins in forks engage slots in end of shifter yoke lever. Bolt guide bar to cover. CAUTION—Low-reverse sliding gear and clutch sleeve must be in neutral position when

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shifter mechanism installed on transmission case. See Chevrolet Vacuum Power Transmission Control article for adjustment of gearshift levers when transmission installed on car.

Shifter Mechanism (Trucks):—Shifter shafts must be removed from front end of case (.003" larger diameter at this end) and can be driven out with a soft steel drift. Shafts are locked in place by two long cover screws which engage holes in shafts (see that holes in case and shafts line up when installed).

CHEVROLET FOUR-SPEED TRUCK TYPE

Used On:

1½ TON & CAB-OVER-ENGINE TRUCKS (1941)

NOTE:—This Transmission is Optional Equipment on ½ and ¾ Ton Truck Models.

SPECIAL SERVICE NOTES & PRODUCTION CHANGES:—Low & Reverse Gear Ratio Change—Gear ratio of Low Gear changed from 7.226 to 7.06 to 1, and ratio of Reverse Gear changed from 7.148 to 6.98 to 1 in production (first type same ratio as 1940 and previous transmissions). These new gear ratios used on transmissions beginning with Transmission Serial No. 7108902 (number stamped on left side of case at rear just below cover). New gears in first transmissions (Serial No. 7108902 to 7114663) not marked but can be identified by transmission serial number and fact that low-reverse sliding gear has 42 teeth. Beginning with Serial No. 7114664, gears marked for identification as follows:

Countershaft & Low Speed Gear—Two grooves in shaft at point between low speed and second speed gears.

Reverse Idler Gear—Two similar grooves on shaft between gears.

Low, Second, Reverse Sliding Gear Assembly—Not marked but may be distinguished by larger low & reverse gear with 42 teeth (first type gear had 43 teeth).

CAUTION—Both types of gears furnished for service and care must be taken to install correct type in each transmission.

TYPE:—Four speed, sliding spur gear type. Same design as used on previous truck models except for new universal joint yoke and oil seal on 1½ ton models only which have Hotchkiss drive and open propeller shaft.

SERVICING: — *Refer to 'Chevrolet Four Speed Truck Type' Transmission article in Mechanical Equipment Section of manual for complete data and note following new data:*

Universal Joint Yoke & Oil Seal—Take out capscrew in end of shaft, pull universal joint yoke with finger type puller. To replace grease retainer, press speedometer drive gear from universal joint yoke, slip old grease retainer off hub. Soak new oil seal in light engine oil for 1 hour, install on yoke hub, press speedometer gear on yoke with chamfered edge toward front of transmission.

CHRYSLER-DE SOTO-DODGE-PLYMOUTH STANDARD TYPE

Used On:

CHRYSLER 6, C28 (1941)—SEE NOTE
CHRYSLER 8, C30 (1941)—SEE NOTE
DE SOTO, MODEL S8 (1941)—SEE NOTE
DODGE, MODEL D19 (1941)
PLYMOUTH, MODELS P11, P12 (1941)

NOTE:—Chrysler 6 & DeSoto Models—Vacamatic Underdrive (Chrysler 6), Simplimatic Underdrive (DeSoto) Transmissions optional on these models. See separate article for complete data on these models.

Chrysler 8 Model—Vacamatic Overdrive Transmission optional on this model and Std. on Model C33. See separate article (following) for complete data on this model.

TYPE:—Constant-mesh, synchro-mesh (Second and High), sliding gear (Low and Reverse), all-helical gear type. Same design as used on corresponding 1940 car models with Double-blocker, double-spring type synchronizer unit.

SERVICING:—Disassembly—On cars with Power Shift, remove link from selector lever, remove power shift assembly. Then remove speedometer drive pinion, remove nut on rear end of driveshaft. pull universal joint yoke flange and brake drum assembly. Take out two plugs on transmission side cover, remove detent balls and springs, remove cover and gear selector assembly. Unscrew shifter fork guide rail and remove guide rail through front end of case. See that gears in neutral, take out lockscrews holding shifter forks on shift rails, remove welch plug in lower shifter rail hole on front of case (collapse plug by striking in center with punch), remove shifter rails through front of case, remove plug on top of transmission case and take out interlock plunger (between rails). Take out capscrews in extension housing on transmission case, remove extension and mainshaft assembly through rear of case using care that synchronizer assembly does not slide off shaft. Use special arbor C-578 and soft hammer to drive countershaft out toward rear of case (remove locking key from shaft as soon as it is exposed at rear of case), allowing counter gear cluster to drop down in case. Take out mounting screws and remove main drive gear bearing retainer from front end of case, pull main drive gear and bearing assembly out toward front. Lift counter gear cluster, thrust washers, and bearing rollers out of case. To remove reverse idler, drive shaft out toward rear (remove locking key from shaft when exposed at rear of case), lift out idler gear, thrust washers and bearings rollers.

Mainshaft & Bearing Assembly:—To remove mainshaft from extension housing, take out snap ring at forward end of synchronizer unit, remove synchronizer assembly, second speed gear, and low speed gear from shaft. Remove snap ring in housing in front of bearing outer race, withdraw shaft from housing, then remove bearing, spacer, and speedometer drive gear from housing. Remove oil seal and bearing from rear end of housing (bearing is press fit in housing and is positioned by spacer on shaft—no snap rings used). When reassembling mainshaft, use new snap rings. If oil seal being replaced, soak leather in thin oil for 30 minutes and work leather with smooth bar. Seal must protrude 7/32" from end of case (use C-579 drift to install seal). If driven in too far, seal and bearing will be damaged.

Synchronizer Assembly:—Install struts or shifting plates in slots in inner clutch sleeve with open face of strut in, assemble outer clutch sleeve and synchronizer springs making certain that hooked ends of both springs engage same strut, install synchronizer rings with notches engaging ends of struts. Synchronizer assembly is retained on shaft with second speed gear by single snap ring (see Second Speed Gear below).

Second Speed Gear:—Gear endplay on shaft should be .003" min., .008" max. To install gear, place gear on shaft, install synchronizer assembly, install snap ring in groove in shaft in front of synchronizer.

Main Drive Gear & Bearing:—Bearing retained on shaft by snap ring and can be removed after snap ring taken out and thrust washer removed. Use snap ring when re-installing bearing. Mainshaft pilot bearing rollers are retained in drive gear recess by snap ring. Use cup grease to hold rollers in position until mainshaft is installed.

Counter Gear Cluster:—When replacing this assembly, use arbor C-578 to position bearing rollers and pack rollers with cup grease to hold rollers in place. Install steel washer next to gear cluster at each end and bronze thrust washer between steel washer and case. Endplay should be .002" min., .008" max. Adjust by selecting washers of correct thickness (furnished in three thicknesses—'A' thinnest, 'B', 'C' thickest). Make certain that locking key is in place in slot in rear end of countershaft when shaft installed in case.

Reverse Idler Gear:—Use C-464 arbor to retain bearing rollers when idler gear being installed. See that thrust washer installed at each end of gear and that locking key is in place in rear end of shaft.

Gearshift Mechanism:—To assemble gearshift mechanism, hold shifter forks in position and insert guide rail through front end of case. Install lower shift rail, insert interlock plunger down through hole in top of case so that plunger engages groove in shift rail, then install upper shift rail (see Note below). Lock shifter forks to rails by installing lockscrews and locknuts, make certain that locking washers are crimped in place. Install welch plug in forward end of lower shift rail. CAUTION—This hole is below lubricant level and plug must be installed tightly to prevent lubricant loss. Install two C-590 cover locating pilots in cover screw holes on case, install cover and gear selector assembly, making certain that selector lever enters shifter fork slots. Install two cover capscrews, remove pilots, install remaining cover screws. Install detent balls and springs, tighten retaining plugs. ***See Chrysler Transmission Control article for adjustment directions when transmission replaced on car.***

Shift Rail Note—Rails are similar in appearance but Low-Reverse rail has detent grooves farther apart. This rail should be installed on top.

CHRYSLER 8 VACAMATIC TYPE

Optl. or Std. Equipment On:

CHRYSLER, C30 TRAVELER & NEW YORKER ('41)
CHRYSLER, C33 CROWN IMPERIAL (1941)

CONTOL BUTTON NOTE:—Button marked 'OD' (at left of steering column can be pulled out—but only when car is standing still—to lockout 2nd & 4th Speed (free-wheeling gears) if desired. Button can be pushed in (to make 2nd & 4th Speeds operative) at any speed under 27 MPH. with the clutch disengaged.

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Starting Engine by Pushing or Towing Car—Control button must be pulled out to insure transmission being in 1st or 3rd gear (2nd & 4th are freewheeling and will not crank engine). CAUTION—Above data applies only to Vacamatic Transmission on Chrysler Eights. *See 'Important Note' at beginning of following article for Control Button data on Chrysler Six which operates differently.*

TYPE:—New type 4 Speed & Reverse Transmission consisting of a two-speed manually controlled unit in conjunction with an Automatic Overdrive unit which provides two additional speeds (similar to previous 3 speed and Overdrive models except that Low Gear has been omitted). Reverse is engaged in the usual manner by shifting the mainshaft sliding gear to the rear so that it meshes with the reverse idler gear. Gearshift lever on steering column has two forward positions—Low (corresponding to conventional 'Second Gear' position) and High—in addition to the usual Reverse position. Each of these lever positions furnishes two gear ratios as follows: Low—**1st.** (Overdrive inoperative), **2nd.** (overdrive operating); High—**3rd.** (Overdrive inoperative), **4th.** (overdrive operating).

OPERATION:—Manual Control—Steering column gearshift lever operates a conventional blocker type synchronizing clutch. With the gearshift lever in 'Low', the synchronizer unit is shifted backward on the mainshaft to engage the intermediate constant mesh gear so that the drive is transmitted through the countergears. When the gearshift lever is moved to the 'High' position, the synchronizer unit is shifted forward to engage the clutch teeth on the clutch shaft main drive gear so that the engine drives straight through without gear reduction (corresponding to the conventional High Gear). Each of these drives is modified by the Overdrive Unit to provide additional gear ratios as follows:

Automatic Overdrive Control:—Overdrive unit is of the conventional 'centrifugal pawl' engagement type and cuts in at approximately 21-25 MPH (if accelerator pedal is released momentarily) to secure 2nd. Speed (with manual control in 'Low'), 4th. Speed (with manual control in 'High'). Overdrive unit has electrical 'kick-down' control (similar to type used on 1940 Chrysler models) so that transmission can be shifted down automatically from 4th. to 3rd. or from 2nd. to 1st. by depressing the accelerator pedal beyond the wide open throttle position.

Lockout Control Button:—'OD' button on left of steering column can be pulled out to lock out 2nd & 4th speeds (car will operate in 1st or 3rd depending on gearshift lever position).

CAUTION—Pull out button only when car standing still. Button can be pushed in at any speed under 27 MPH with clutch disengaged.

ADJUSTMENT:—Throttle Switch Setting—3/32" gap between plunger and contact screw with throttle just wide open (over-travel closes switch contacts).

SERVICING:—Transmission—Serviced in same manner as Std. Chrysler Transmission (see preceding article). When disassembling this transmission, take out capscrews holding overdrive and adapter plate on transmission case, remove overdrive and adapter as an assembly by withdrawing mainshaft from rear of transmission case (adapter fastened to overdrive by screws which will prevent overdrive case separating).

Overdrive Unit:—Overdrive is Warner Type AS1-R7B. Refer to separate article on 'Warner Overdrive' for complete servicing data.

CHRYSLER 6 VACAMATIC TYPE
DE SOTO SIMPLIMATIC TYPE

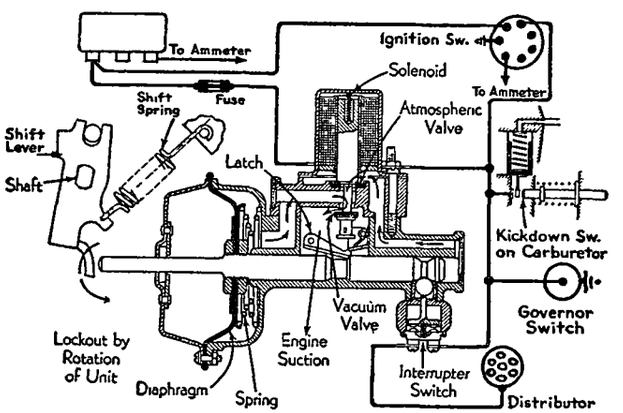
Optl. Equipment On:

CHRYSLER, C28 ROYAL & WINDSOR (1941)

DE SOTO, S8 DE LUXE & CUSTOM (1941)

IMPORTANT NOTE:—Lockout Control button at left of steering column should be used only when it is necessary to start the car by pushing or towing. **Button should never be pulled out at any other time, and must be released (pushed in fully) as soon as engine starts.** To start the engine by pushing or towing car, proceed as follows: Turn on ignition, place gearshift lever in 'High Speed' position, pull out lockout control button at left of steering column, hold lever in this position until engine starts. Disengage clutch, push or tow car with clutch disengaged, when car speed reaches 5 MPH., engage clutch. **Release lockout control button as soon as engine starts.**

SPECIAL SERVICE NOTES:—Interrupter Switch Insulator—To correct complaints of mud and water from road splashing on transmission control interrupter switch which will cut out ignition and cause car to stop, special Interrupter Switch Insulator, No. 870833, can be installed on switch (switch located on underside of vacuum unit assembly at left of transmission).



TYPE:—This type transmission (Vacamatic—Chrysler 6, Simplimatic—De Soto) is used in conjunction with Fluid Drive. Transmission is entirely new design 4-speed type with a two range manual control (Low-High) and an automatic two speed shift (vacuum and spring operated with accelerator pedal control) within each range (First & Second in Low range, Third & Fourth or Direct in High range). Transmission shifts up from First to Second (above 8 MPH. with gearshift lever in Low range) or from Third to Fourth (above 15 MPH. with gearshift lever in High range) when the accelerator pedal is released momentarily. A step-down or 'kick-down' feature is provided by which a shift from Fourth to Third (at speeds below 53 MPH.), or from Second to First (at speeds below 27 MPH.) occurs automatically when the accelerator pedal is depressed past the wide open throttle position. The manual control (gearshift lever shift between Low-High) operates in exactly the same manner as the Second-High shift on previous transmission. The automatic control is entirely new and operation is described below.

OPERATION: — Manual Control — Gearshift lever has three positions corresponding to previous designs with Low Speed omitted (Low Range secured with lever in customary 'Second' position). This lever controls a conventional synchronizer clutch unit on the mainshaft which locks the Low Speed Gear to the shaft (rear position—Low Range) or the Intermediate Gear to the shaft (forward position—High Range). The two speeds in each range are controlled by the automatic synchro-clutch as follows:

Automatic Control:—Consists of a vacuum and spring operated synchro-clutch which locks the mainshaft intermediate gear to the clutch shaft drive gear (for Second and Fourth or Direct Drive with synchro-clutch in forward position). With the synchro-clutch in the rear position, intermediate gear is free to revolve on mainshaft (for First or Low Gear in which drive is transmitted through Low Speed Gear on mainshaft meshing with gear on countergear cluster), or drives mainshaft (for Third Gear when manual synchronizer unit is in forward position). The synchro-clutch shift lever is spring-loaded so that it is in the forward position (Second & Fourth) except when the vacuum unit assembly operates to shift the synchro-clutch to the rear position (First & Third). This vacuum unit assembly operates as follows:

Vacuum Unit Assembly:—Consists of a diaphragm type vacuum unit with solenoid operated valve mounted on a pivot on the side of the transmission case so that the vacuum unit plunger stem operates the synchro-clutch shift lever. With the solenoid not energized, valve is in lower position so that diaphragm chamber is connected to vacuum source (engine manifold). Vacuum causes plunger to move fully to the right until the latch under the solenoid valve engages the notch in the plunger stem holding the plunger in this position with the vacuum diaphragm spring fully compressed (this action permits shift lever spring to move synchro-clutch to forward position). Whenever the solenoid is energized (by the Governor Switch, Carburetor Kickdown Switch or Ignition Switch when turned 'off' as described below), the valve is drawn up, cutting off the vacuum and opening the atmospheric valve so that air is admitted to the diaphragm chamber. This movement of the valve stem also releases the plunger stem latch so that the plunger is free to move to the left to shift the synchro-clutch to the rear position. As the plunger moves to the left, the ridge on the end of the plunger stem rides over the ball of the interrupter switch, closing the switch contacts and cutting out the ignition momentarily, which relieves the torque on the synchro-clutch and allows it to be shifted. As soon as the plunger ridge passes the interrupter switch ball, the switch contacts are opened by a spring and the ignition is restored (this entire action occurs so rapidly that the interruption of the ignition is not apparent).

Control Circuit & Switches:—The vacuum unit solenoid valve is connected through a 30 ampere fuse to a special terminal of the ignition switch and to the control relay so that the solenoid circuit is 'hot' at all times when the ignition switch is turned on and when the generator is rotating above the cut-in speed. The solenoid is energized (to operate the vacuum unit) whenever the solenoid circuit is completed to ground in any one of the various ways:

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Control Relay—Consists of a relay with single winding (similar to horn relay) connected so that the solenoid circuit is completed with relay contacts closed. Relay winding is connected to generator main brush terminal on regulator so that contacts close as soon as generator begins to charge

Governor Switch—Governor switch contacts are closed (so that solenoid is energized) with the car at rest. As the car speed increases, the governor weights move out and open the switch contacts which breaks the solenoid circuit. Governor switch is driven by a special gear of the countergear cluster so that the cut-in and cut-out speeds are approximately twice as high in the 'High' range as in the 'Low' range.

Carburetor 'Kick-down' Switch—Consists of a stationary contact connected to the solenoid and a movable contact mounted on a vacuum controlled piston in the carburetor. A switch plunger operated by the throttle valve lever completes the circuit to ground (so that solenoid is energized) when the accelerator is depressed past the wide open throttle position at car speeds under 27 MPH. (low range for kick-down to First), 53 MPH. (High range for kick-down to Third). Above the speeds, vacuum in carburetor pulls the piston and ground contact up against spring tension so that the plunger does not complete the circuit to ground.

Ignition Switch Ground—A special terminal and ground connection in the ignition switch completes the solenoid circuit to ground whenever the ignition switch is turned off.

Ignition Interrupter Switch—This switch does not ground the solenoid circuit but does ground the ignition primary (short-circuiting the breaker contacts) when the switch contacts are closed (this occurs only momentarily during the vacuum unit plunger movement) to permit the synchro-clutch to be shifted.

CHECKING & ADJUSTMENT: — Vacuum Unit — Clearance between end of vacuum unit stem and shift lever must be 5/32" with vacuum unit in latched position. To adjust, make certain that vacuum unit in latched position and that lockout button is all the way in with vacuum unit against stop on mounting bracket, see that synchro-clutch is in engaged position (spring will engage synchro-clutch if clutch driving plate rocked by hand through fluid drive filler plug hole in clutch housing with engine at rest). Loosen jam nut on shift shaft, loosen locknut and turn adjusting screw on shift shaft until clearance between lever and vacuum unit stem is 5/32", tighten locknut and jam nut (see that lever does not move when jam nut tightened).

Kick-down Switch—Check switch by connecting test light to battery and to switch terminal. Fully depress accelerator pedal. Lamp should light. If lamp does not light, disassemble and examine switch. If lamp lights but solenoid is not energized, replace solenoid.

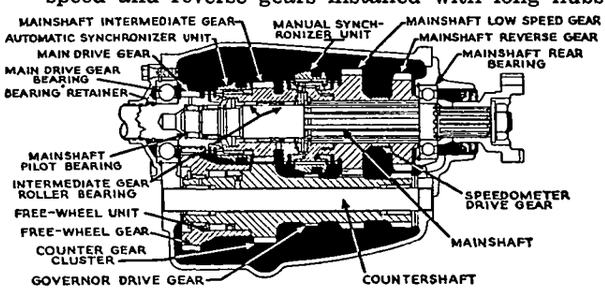
Governor Switch—To check operation, accelerate engine past 1100 RPM (clutch engaged). If vacuum unit does not latch, remove governor wire and repeat test. If vacuum unit latches with wire removed, replace governor switch. If vacuum unit does not latch with wire removed, remove fuse. If vacuum unit latches with fuse removed, check wiring for grounds, check vacuum unit for binding or other mechanical trouble.

Carburetor Slow-closing Throttle — See Slow-closing throttle article in Carburetion Equipment Section for description of two different types used and adjustment directions.

Fuse—30 ampere. In solenoid lead.

SERVICING:—Disassembly—Remove clevis pin and lift off vacuum unit, unscrew and remove governor, remove speedometer pinion. Lock transmission in reverse, shift synchro-clutch sleeve to forward position to lock gears. Remove companion flange nut, take off brake drum, pull oil seal with special puller C-497, remove detent ball retaining screws and spring in gearshift housing. Place gearshift levers in neutral, remove gearshift housing. Remove capscrews in brake support, turn support counter-clockwise to expose shift rail holes, remove shifting fork and reverse idler shaft retaining screws, slide shift rails out through rear of case (top rail first —use care not to lose detent balls and spacer on lower reverse rail), remove reverse fork. Take off drive pinion bearing, retainer, remove main shift fork guide pin (unscrew pin and pull out at front of case), remove manual shift fork. Use puller C-604 to remove reverse idler shaft through rear of case, lift out reverse idler gear. Use special C-605 arbor to drive countershaft out through rear of case and allow countergears to drop down in case. Pull mainshaft and gear assembly out through rear of case, remove drive pinion and synchro-clutch sleeve, lift out countergear assembly. Remove shifter rail selector plug (remove cupped plug in top of vertical hole in case).

Mainshaft Gear Assembly:—Remove blocker ring on forward end of shaft, remove synchro-clutch spreader ring, remove intermediate gear snap ring, remove gear being careful not to lose roller bearings, bronze thrust washer, and roller bearing thrust washer. Remove gear stop ring, thrust washer, clutch sleeve, and shifting plates (synchronizer assembly). Remove brake support housing by tapping rear end of shaft with a lead hammer. Remaining gears can be pressed of shaft in an arbor press or removed with a gear puller. When assembling shaft, use new snap rings, see that low speed and reverse gears installed with long hubs



toward rear. Endplay between low speed gear and speedometer drive gear should be .003-.009" with feeler gauge inserted between shoulders of gears (spacers furnished .041", .045", .050", .055" thick for this adjustment). When installing intermediate (third speed) gear, install 36 rollers in forward end, then install spacer with holes and groove toward rear so that oil holes line up (this is important), then install 36 rollers in rear end, small steel thrust washer next to rollers and bronze thrust washer, then install assembly on shaft (use cup grease to hold rollers in place). Install forward bronze thrust washer with oil groove to rear, steel thrust washer with tapered face to front, use new snap ring. Endplay between steel thrust washer and snap ring should be .003-.009" (adjust by using snap ring of correct thickness—furnished .087", .092", .097", .101" thick).

Automatic Control Synchro-clutch:—When assembling, make certain that teeth on clutch hub mesh with center space of each set of teeth on clutch sleeve (CAUTION—clutch sleeve cannot be shifted unless meshed in this manner). With two capscrews installed in brake support to align mainshaft assembly, install spreader ring and synchro-clutch blocker ring, see that clutch sleeve can be pulled all the way over the dogs of the blocker ring.

Countergear Assembly:—To dismantle free-wheeling gear, remove snap ring in end of cluster gear, remove thrust washer, free-wheeling gear, thrust washer and roller bearings, free-wheeling rollers, roller cage and springs (use care not to lose two springs under the cage). Reassemble in same manner using cup grease to retain free-wheeling rollers, install roller thrust washer with beveled side toward rollers, turn roller cage clockwise and install free-wheeling gear. Install the 36 rollers in forward end of cluster gear for free-wheeling gear (use cup grease to hold rollers in place), install retainer washer and new snap ring. Measure endplay between free-wheeling gear and cluster gear (use feeler stock) which should be .003-.009". Adjust by installing thrust washer of correct thickness (furnished .084", .087", .091" thick).

FORD—LINCOLN—MERCURY TYPES

Used On:

FORD, PASS. CAR & COMM'L. MODELS (1941)
FORD TRUCK, ¾ & 1 TON MODELS (1941)
LINCOLN, ZEPHYR & CONTINENTAL 16 H (1941)
LINCOLN, CUSTOM MODEL 168H (1941)
MERCURY, MODEL 19A (1941)

NOTE:—Four speed transmission is standard on other truck models and optional on these ¾ and 1 Ton

Lincoln Models—Warner Overdrive, Type AS1-R10, optional on all models. See separate article on Warner (Lincoln) Overdrive for complete servicing and adjustment data.

TYPE:—Constant-mesh, synchro-mesh (Second and High), sliding gear (Low and Reverse), all-helical gear type. Same design as used on corresponding 1940 car models.

SERVICING:—Disassembly—Remove transmission cover and shifter assembly. Take out capscrew in rear end of shaft, remove universal joint yoke. Remove screws mounting universal joint housing on rear of case, remove housing. Remove locking pin retaining countershaft and reverse idler shaft, withdraw countershaft. Take out bearing retaining screws on front of case, remove main drive gear and bearing assembly. Remove mainshaft rear bearing, remove mainshaft (synchronizer unit and gears can be removed from forward end of shaft after snap ring removed from groove in shaft directly forward of synchronizer inner clutch sleeve).

Synchronizer Assembly:—To remove synchronizer unit and second speed gear from mainshaft, take out retaining snap ring in groove in shaft in front of synchronizer inner clutch sleeve, slide synchronizer assembly off shaft, remove hub spacer and second speed gear.

Synchronizer Unit—Inner and outer clutch sleeves marked by etched line to insure reassembly in same position. If unit being dismantled, use extreme care not to lose poppet balls and springs (3 each) which will spring out when outer sleeve removed. When

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reassembling unit, place struts in slots in inner sleeve, install springs and balls in holes in struts and sleeve, install outer sleeve (lining up marks on inner and outer sleeves), see that synchronizer ring notches engage ends of struts. Backlash between inner and outer clutch sleeves should be .000-.001". Synchronizer unit is mounted on shaft by same snap ring used to retain second speed gear.

NOTE—This type synchronizer can be distinguished from wire-bound blocking type synchronizer used on previous models by absence of shoulder on second speed end of outer clutch sleeve.

Second Speed Gear—Gear bushing not furnished separately. When installing gear on shaft, select hub spacer of correct thickness so that gear endplay (with synchronizer in place and snap ring installed) is .004-.008". This hub spacer furnished in two thicknesses—81A-7069-A (.0655-.0665"), and 81A-7069-B (.0705-.0715").

Gearshift Assembly:—To dismantle gearshift assembly, remove lockrings on shifter shaft ends of forks, remove forks from shifter shafts. Drive out locking pins in levers at outer ends of shifter shafts, withdraw shafts from inside of cover using extreme care not to lose detent balls, spring, and plunger. Reassemble shifter mechanism in same manner. See that oil seal in recess in cover at outer end of each shifter shaft is in good condition. See Ford & Lincoln Transmission Control articles for adjustment directions when transmission installed on car.

FORD FOUR-SPEED TRUCK TYPE

Used On:

FORD TRUCKS, ALL MODELS EXCEPT ¾ & 1 TON
OPTIONAL ON ¾ & 1 TON MODELS (1941)

TYPE:—Four speed, sliding spur gear type. Same design as used on 1940 models with Hotchkiss drive and propeller shaft mounted hand brake.

Hand Brake—Brake drum mounted on front universal joint companion flange with brake band mounting brackets and linkage mounted on transmission case.

SERVICING:—***Refer to Ford Four Speed Truck Type Transmission article in Mechanical Equipment Section of manual for complete data.***

HUDSON TYPE

Used On:

SIX, MODELS 10, 11, 12, 18 (1941)
EIGHT, MODELS 14, 15, 17 (1941)

NOTE:—**Overdrive Transmission** — Overdrive Transmission is optional on all models. Overdrive unit is Warner Type AS1-R9B and is used in conjunction with a Hudson transmission for which data is given below. ***Refer to Warner Electrical Type Overdrive article for complete servicing and adjustment data on overdrive.***

Transmission Controls—Steering column mounted gearshift is standard on all models. ***Refer to separate Hudson Transmission Control article for adjustment and servicing data.***

TYPE:—New design, constant-mesh, synchro-mesh (Second & High), sliding gear (Low & Reverse), all-helical gear type. Main drive gear is integral with clutch shaft and is mounted on ball bearing in front of case. Mainshaft is mounted on roller bearing in main drive gear hub (front), ball bearing in rear of case or in adapter plate on overdrive models (rear). Countergear cluster is mounted on bushings on stationary countershaft with thrust washers at each end. Second speed gear is retained on mainshaft as an assembly with the synchronizer unit by a snap ring installed in a groove in the shaft directly in front of the synchronizer inner clutch sleeve.

Synchronizer Unit — Double-blocker, double-spring type. Synchronizer rings are free in ends of inner clutch sleeve and are actuated by three shifting plates or struts which fit in slots in inner clutch sleeve and engage notches in rings. Struts are centered in outer clutch sleeve by two wire springs (within struts on each side of inner clutch web) and move with outer clutch sleeve to engage with cones on gear hubs for synchronization. Teeth on rings block or prevent gear engagement until synchronization completed. Inner clutch sleeve is stationary on shaft and does not move (retained with second speed gear by snap ring in groove in shaft).

SERVICING:—**Disassembly Note** — On models with overdrive, overdrive unit can be disassembled and serviced without disturbing transmission providing that adapter plate is not disturbed (must not be allowed to separate from transmission case). Refer to Warner Electrical Type Overdrive article for complete servicing data.

Transmission Disassembly:—On models with Automatic Clutch, unscrew Governor Switch from housing. Remove transmission cover screws, lift cover off carefully to prevent detent ball spring flying out, tilt transmission case to one side and remove spring and detent ball. Remove front universal joint companion flange nut, lockwasher, plain washer. Use puller J-820 to remove companion flange. Take out screws in speedometer gear housing (rear bearing retainer), remove housing and speedometer gear using care not to damage oil seal in housing. Remove low & reverse shift fork lockscrew and shifter lockscrew, slide low & reverse shift rail out through front of case, remove shift fork and reverse shifter from case. Tilt case and remove interlock plunger from hole in side of case. Remove second & high shift fork lockscrew, slide shift rail out, lift fork out of case, tilt case and remove detent ball and spring. Slide mainshaft and gear assembly back so that rear bearing is free of case, tilt front end of shaft up, remove snap ring in shaft directly in front of synchronizer inner clutch sleeve (use special pliers J-1575). Slide synchronizer unit, second speed gear, low speed gear, off shaft and remove through top of case, then withdraw mainshaft and bearing through rear of case. Remove countershaft lockplate screw on rear of case, drive out plate with a drift, drive countershaft out through rear of case using Driver J-1574, remove countergear cluster and thrust washers. Pull main drive gear out through front of case (use driver J-1574 if necessary—gear will be free with clutch housing and bearing retainer removed). Use driver J-1574 inserted through main drive gear bearing hole to drive out reverse idler gear shaft, lift reverse gear out.

Reassembly—Reassemble transmission in same manner and note following points: Install low speed gear on mainshaft with shift fork flange toward front and make certain that four oil holes in flange groove line up with grooves in shaft. Install second speed gear with tapered side of hub toward front, install synchronizer unit with tapered side of shift sleeve toward front, select lock ring of correct thickness (furnished .087", .090", .093", .097" thick) so that synchronizer has no appreciable endplay when lock ring installed. See that detent balls and springs correctly installed (low & reverse spring at top is heavier than second & high spring at bottom and springs must not be interchanged).

Mainshaft & Rear Bearing Assembly:—Use special puller J-1134 to remove bearing from shaft. When installing bearing, see that locking ring on bearing is toward rear of shaft, use replacer tool J-1570 to drive bearing in place.

Main Drive Gear & Bearing Assembly:—To remove bearing, remove lock ring in groove in shaft with J1575 pliers, use puller J-1134-H to remove bearing from shaft (bearing will be damaged if driven off). When installing bearing, see that shielded side is toward gear (to rear when installed), use replacer tool J-1570 to drive bearing in place. Select lock ring of correct thickness (furnished in thicknesses of .090", .093", .096") so that lock ring is snug fit in groove and there is no appreciable endplay. Use grease to retain mainshaft bearing rollers in drive gear hub until mainshaft installed. If oil seal in bearing retainer being replaced, use remover J-1576 to tap old seal out, press new seal in place with J-1569 seal replacer tool. Use new gasket when installing retainer on case. NOTE—Retainer locating pin engages hole in clutch housing so that retainer can only be installed with throw-out bearing oil holes lined up properly.

Synchronizer Unit:—If synchronizer unit being dismantled, mark inner and outer clutch sleeves and rings to insure reassembly in same positions. Install struts with open face toward inner clutch sleeve, install springs with hooked end of each spring in same strut with free ends running in opposite directions. See that undercut on inner sleeve points toward rear of transmission and install synchronizer on mainshaft with tapered side of outer sleeve toward front.

IMPORTANT NOTE—Two types of synchronizer rings and sleeves used in production and must not be interchanged. Rings with 110° chamfer on face of teeth are marked '110' on flange face and must be used with 110° clutch sleeves which are marked by groove on outside face. 90° chamfer rings and sleeves not marked. CAUTION—90° parts must not be used with 110° parts.

Countergear Assembly:—Countergear bushings can be renewed by using J-1573 puller to remove old bushings, J-1572 replacer to install new bushings, and then reaming bushing with KMO-338 bushing reamer (pilot reamer on guide installed in other end of gear cluster while reaming each bushing). When installing countergears in transmission, coat bronze thrust washers with chassis lubricant, install washers in case so that they engage retaining pins in case, install steel thrust washer between gear cluster and rear thrust washer. See that both countershaft and reverse idler shaft are locked in place by lockplate and that lockplate screw tightened securely.

Shifter Shafts & Levers:—Selector shaft can be removed from within case after taking off nut, washers, and lever on outer end of shaft. Bushing is withdrawn from outside after bushing setscrew has been loosened. When removing shift shaft, first punchmark inner lever and shaft to insure correct reassembly (if position lost, use indexing tool J-1571 to re-install inner lever). Remove nut on outer end of shaft, remove lever. Drive out pin in shaft boss on side of case, remove inner lever, withdraw shaft and felt seal. Install levers in same manner.

NASH 4160, 4180 TYPE

Used On:

AMBASSADOR SIX, MODEL 4160 (1941)
AMBASSADOR EIGHT, MODEL 4180 (1941)

NOTE:—Overdrive Transmission—Overdrive or Cruising Gear transmission is Optional on all models. Overdrive unit is Warner Type AS1-R7C and is used in conjunction with a Nash type transmission for which data is given below. ***Refer to Warner Overdrive article for complete servicing and adjustment data.***

Nash 4140 Model — This model equipped with Warner Type AS3-T84G (Std.), AS4-T84G (Optl. with Overdrive). ***Refer to Warner Transmission articles for data on this model.***

TYPE: — New design, constant-mesh, synchro-mesh (Second & High), sliding gear (Low & Reverse), all-helical gear type. Main drive gear is integral with clutch gear shaft and is mounted on ball bearing in front of transmission case. Mainshaft is mounted on roller bearing in main drive gear (front), ball bearing in retainer cap on case (rear). Countergear cluster is mounted on roller bearings on stationary shaft with thrust washers at each end. Second speed gear is retained on mainshaft as an assembly with the synchronizer unit by a splined locking washer retained by a spring-loaded lock plunger installed in the shaft directly in front of the synchronizer inner hub.

Synchronizer Unit — Double-blocker, double-spring type. Synchronizer rings are free in ends of inner clutch sleeve and are actuated by three shifting plates or struts which fit in slots in inner clutch sleeve and engage notches in synchronizer rings. Struts are centered in outer clutch sleeve by two wire springs (within struts on either side of inner clutch web) and move with outer clutch sleeve to engage with cones on gear hubs for synchronization. Teeth on rings block or prevent gear engagement until synchronization completed. Inner clutch sleeve is stationary on mainshaft and does not move (retained with second speed gear by locking washer and plunger on forward end).

SERVICING:—Disassembly Note — On models with Overdrive, overdrive unit can be disassembled and serviced without disturbing transmission. Refer to Warner Overdrive article for complete data.

Transmission Disassembly:—Drive both shift shaft bushing retaining pins out of shift shaft bosses in case toward top. Remove expansion plugs in left front and rear of transmission case, use J-1600 speed finder plunger tool to prevent detent plungers dropping out, work shift shafts out of case as far as possible, remove detent plungers and spring, remove shift forks through top of case. Use special countershaft assembly tool J-1415A (dummy shaft or arbor) to drive countershaft out at front of case and leaving tool within case so that counter-gear cluster drops down on small diameter of tool. Remove capscrews and nuts retaining rear bearing retainer cap (or adapter plate on overdrive transmissions), withdraw mainshaft and gears through rear of case as an assembly (CAUTION—On overdrive models, use extreme care that adapter plate does not separate from overdrive case which would require dismantling of overdrive to reassemble freewheel rollers—install one screw to hold adapter plate and overdrive case together while off transmission). To remove main drive gear, take out screws in bearing retainer on front of case, withdraw drive gear and bearing as an assembly. Shifter shafts can then be removed through top of case by removing levers on outer ends of shafts and pushing shafts through into case.

Reassembly—Reassemble transmission in same manner paying particular attention to following points:

Mainshaft Endplay—Controlled by thickness of shims between rear of transmission case and rear main bearing cap or overdrive adapter. With transmission assembled, install shift collar centering gauge tool J-1410 (.070" thick) between front face of high speed synchronizer ring and rear face of main drive gear. If gauge is tight, add additional shims at rear bearing cap so that clearance at gauge is from 0 to .015" maximum.

Speed Finder Locating Screw—Located on side of transmission case between shifter shafts. Need not be disturbed to remove detent plungers but if removed, screw should be adjusted so that inner end engages flattened portion of plungers to prevent plungers turning but must not cause plungers to bind. Lock adjustment with locknut.

Shifter Shafts—When installing shift shaft forks, see that low and reverse fork installed with longer segment at top. Cork oil seals and retainers are installed on outer ends of shafts and shaft bushing retaining pins should be installed from the top.

Synchronizer & Second Speed Gear:—To dismantle assembly, depress locking plunger under lock ring in front of synchronizer inner clutch sleeve with a sharp pointed tool, revolve lock ring one spline so that it is free and withdraw from shaft, remove synchronizer units, thrust washer, second speed gear, thrust washer. Low speed gear can then also be removed from shaft. Install assembly in same manner selecting retainer washer of correct thickness so that second gear endplay is .004-.006" with retainer installed. See that retainer turned so that it is locked in place in mainshaft splines and that locking plunger prevents retainer from turning.

Synchronizer Unit—Inner and outer clutch sleeves and rings should be marked before disassembly to insure reassembly in same positions. Install struts with open face toward inner clutch sleeve and hooked end of each spring wire engaged in the same strut (free end of this spring will be between this strut and next strut in clockwise direction).

Main Drive Gear & Bearing:—Bearing retained on shaft by snap ring in groove in shaft (plain washer between snap ring and bearing) and retained in case by snap ring in groove in bearing (this snap ring retained by bearing retainer when it is bolted on case). When installing bearing, use thickest possible snap ring (furnished in various thicknesses) so that bearing is a tight assembly. When installing bearing retainer cap, see that notch in gasket lines up with oil holes in case.

Countergear Assembly:—When installing countergear cluster, install thrust washer at each end with tongue in line with slot in case (washers may be held by grease while installing gears. Allow gears to hang down on small diameter of tool J-1415-A while main drive gear and mainshaft are being assembled then push out tool by inserting countershaft from end of case being careful not to damage thrust washers.

PACKARD TYPE

Used On:

CLIPPER MODEL 1951 (1941)
'110' Six 1900, '120' EIGHT 1901,1A ('41)
'160' SUPER 8 1903,3A,4,5; '180' 1906,7,8 ('41)

OVERDRIVE TRANSMISSION NOTE:—Econo-drive or Aero-drive (Overdrive) Optl. on all models. Overdrive unit is Warner Type R9 (Six, Eight, Clipper), R9A (Super 8) and is used in conjunction with a Packard type transmission. ***Refer to Warner Electrical Type Overdrive for complete Overdrive and Control servicing and adjustment data.***

SERVICING:—Overdrive Transmission Note—Transmissions with overdrive can be disassembled without disturbing overdrive unit as follows: Remove overdrive drain plug (on lower rear end of case), transmission cover and shifter mechanism, main drive gear bearing retainer (on front of transmission case). Insert special ST-5043 roller bearing assembly bar through overdrive drain plug hole and hole in front end of case, drive countershaft out through front end of transmission case leaving the assembly bar in the counter gear cluster to retain the bearings until the gear cluster is removed. Take out two short capscrews holding adapter plate to transmission case (do not disturb screws bolting overdrive case to adapter). Remove main drive gear and bearing through front of case, slide synchronizer assembly off front end of mainshaft. Withdraw overdrive unit, adapter plate, and mainshaft assembly from rear end of transmission case as a unit. CAUTION—Do not permit adapter plate to separate from overdrive case which will require complete disassembly of overdrive.

Transmission Disassembly (Without Overdrive):—Remove transmission case cover and shifter mechanism, take off nut on rear end of shaft, pull universal joint flange, take out screws and remove rear bearing cap, remove countershaft lock plate, remove main drive gear bearing retainer on front of case. Use ST-5043 roller bearing assembly bar as a drift and drive countershaft out through front of case (leave bar in counter gear cluster to retain bearing rollers). Remove main drive gear and bearing through front of case. Move mainshaft and gear assembly to rear until rear bearing clears case, tap bearing off shaft, then remove mainshaft assembly through top of case. Lift out counter gear cluster, thrust washers, and bearing rollers. To remove reverse idler gear, drive shaft out toward rear.

Synchronizer Unit:—Conventional poppet ball and spring type. Unit can be dismantled by sliding outer clutch sleeve off inner sleeve using extreme care not to lose poppet balls and springs which will fly out (mark inner and outer sleeves and replace in same position). Use band type ring compressor or ST-5014 clamp to re-install balls and springs.

Synchronizer Travel Adjustment—Check clearance between lug on second-high shifter fork and stop on cover with shift lever in High Gear position. Clearance should be .005" min., .010" max. Adjust by bending lug. CAUTION—If clearance greater than .010", outer clutch sleeve may move too far forward which will allow synchronizer balls and springs to fly out. If this occurs, cover must be removed and synchronizer reassembled.

Mainshaft, Low & Second Speed Gear Assembly:—Both low and second speed gears are furnished as an assembly with the mainshaft and should not be removed. These gears are constant-mesh type and are mounted on double row ball bearings on shaft.

DETROIT 4100, 4200 SERIES

SERIES 4100

Bantam Super Four, Model 65 (1941)
Willys, Americar & Plainsman 441 (1941)
Willys, Pick-Up 441, Panel Del. 441P (1941)

SERIES 4200

①Dodge, Model D19 (1941)
①Plymouth, Models P11, P12 (1941)

①—Series 7200 universals used on 7 pass. Sedans.

DESCRIPTION:—Ball and Trunnion type with Roller Bearings. Same design as used on 1940 car models except as follows:

Dodge & Plymouth Rear Universal Boot—A new synthetic rubber boot (not affected by heat, cold, oil or water) with an inner cone formed at housing end is used in place of leather boot to exclude dirt. NOTE—Rubber boot can be used for replacement only if shaft disassembled.

DISCONNECTING UNIVERSAL:—Take out bolts which mount housing to companion flange. Do not disturb cover clipped to housing flange (cover has notation 'Do not remove cover') unless joint is to be disassembled.

SERVICING:—**Disassembly**—Bend back three lugs only on one side of grease cover, slide cover off sideways, push housing back on shaft, remove centering buttons and balls (CAUTION—do not lose roller bearings out of balls). Wash all parts and inspect for wear. If balls or rollers show wear, replace with complete ball and roller assembly. Check housing, raceways for ball impressions which result in backlash, replace housing if unduly worn. Press out pin in ballhead only if pin or housing is to be replaced.

Assembling—First slip housing over ballhead, press pin in place **being sure that equal amount of pin extends through each side of ball head**—THIS IS IMPORTANT. Place 1/16" washers over ends of pin, install ball & roller assemblies, then install centering buttons with 1/64" spring washers next to pin ends. Pull housing forward to hold parts in place. Apply 1¼ ozs. of fibre grease across face of balls. Install conical spring, being certain that small end of spring rests over pilot on end of ballhead, new gasket, and grease cover, bend down lugs on grease cover. IMPORTANT—When connecting universal, use new lockwashers and **tighten nuts holding universal to companion flange securely.**

UNIVERSAL JOINT BOOTS:—Original equipment boot is seamless leather type (see Dodge & Plymouth Note above) with a cone extending into housing and secured by a clamp on each end. To remove boot, remove clamps and cut off old boot (CAUTION—When removing boot use care not to disturb cone), leave cone in place and install new service boot which is hook-on type and can be installed without removing shaft from car, press metal hooks down tight to close longtitudinal seam and twist wires tight on each end. NOTE—If cone destroyed, install special combination service cone and boot.

DETROIT 4251 SERIES

Used On:

Packard '110' Six, Model 1900 (1941)
Packard Six Taxi, Model T-1900 (1941)

DESCRIPTION:—Roller bearing type. Transmission end equipped with Series 4200 universal (see preceding article for data). Axle end equipped with Series 5150 universal, consisting of conventional cross with individual bearings on cross trunnions. One pair of bearings is pressed into propeller shaft yoke ends and retained by locking rings on inner face of yoke. Other pair of bearings engage half holes in companion flange and are secured by locking rings on inner face of companion flange. Two bolts pass through two U-shaped clamps and companion flange to secure assembly.

DISCONNECTING UNIVERSAL:—Remove two bolts and U-clamp to free assembly from companion flange, taking care not to drop the two free bearings. CAUTION—On Packard models, rear universal flange nut controls rear axle pinion shaft bearings pre-load. Refer to Mechanical Equipment Index for Packard Rear Axle article for complete data.

SERVICING:—**Disassembly**—With U-clamp removed, one pair of bearings will slide off cross trunnion, locking rings remain permanently on these two bearings. Press out other two bearings after removing locking rings.

Servicing—Thoroughly clean all parts. Examine for wear and replace worn or damaged parts. Clean out lubricant holes in ends of cross trunnion, repack holes and bearings with approved lubricant.

Assembling—Reverse disassembly directions

DETROIT 7200, 7300 SERIES

SERIES 7200

Chrysler, Royal & Windsor C28 (1941)
DeSoto, Dodge, Plymouth 7 Pass. only ('41)

SERIES 7300

Chrysler Eight, C30, C33 (1941)

DESCRIPTION:—Cross and roller bearing type. Same design as used on 1940 car models.

DISCONNECTING UNIVERSAL:—Bearing blocks attached to companion flange by screws. Take out screws and lockwashers in blocks to free shaft.

SERVICING:—**Disassembly**—Remove tie spring holding bearing blocks on cross. Remove bearing blocks, dust seals and retainers. Take out locking rings from bearing cups in yoke. Tap on outer end of one bearing cup to start opposite cup out, withdraw bearing cup, tap on end of cross to start opposite bearing cup. Remove dust seals and retainers.

Servicing—Thoroughly clean all parts. Examine for wear and replace all worn or damaged parts. Clean out lubricant holes in cross, repack entire assembly with correct type lubricant.

Assembling—Use new dust seals. Reverse disassembly data above. When shaft installed, arrow on shaft and yoke must be in alignment.

MECHANICS 2C, 3C TYPES

TYPE 2C

①Oldsmobile, Model 66,68,76,78,96,98 ('41)
①Pontiac, Models 41-24,25,26,27,28,29 ('41)

TYPE 3C

Cadillac, Models 41-60S,61,62,63,67,75 (1941)
②Packard Eight & Super 8, 1901A,3A,5,8 (1941)

①—Mechanics Type 2CR also used on some cars.
②—Used on front shaft only, Type 3CR on rear.

DESCRIPTION:—Roller bearing type with conventional cross. Same design as used on 1940 car models.

DISCONNECTING UNIVERSAL:—Turn down locks and take out two capscrews in opposite trunnion bearings on companion flange, wire trunnions together to prevent them coming off ends of cross (unless joint is to be disassembled), tap trunnions lightly with soft hammer to disengage drive lugs (lugs on trunnion bearing engage slot in flange and flange end is turned up to retain trunnions). NOTE—This data applies to Wing type trunnion bearings only. Wing type trunnion bearings used at rear universal only on Oldsmobile & Pontiac and shaft can be removed on these cars by disconnecting rear universal and pulling shaft free of slip joint at transmission. See Disassembly directions below for servicing Round Type trunnions.

SERVICING:—**Disassembly**—Wing type trunnion bearings may be pulled directly off universal joint cross after mounting capscrews have been removed (do not lose loose rollers in bearing). To remove Round type trunnion bearings, shaft must be removed to the bench. Clamp yoke or drive shaft tube (at weld) in vise, take out screws and remove bearing end plates (both sides). Use flat end drift slightly smaller in diameter than bearing, drive on outer end of one bearing, driving bearing in until shoulder on cross strikes inside of yoke lug. This will start opposite bearing out. Grip this bearing in vise (use brass or copper jaws) work shaft back and forth until bearing comes out. Drive other bearing out in same manner (using drift against end of cross).

Servicing—Wash all parts in gasoline. Clean out lubricant passage in cross. Replace worn parts (examine cross journal, trunnion bearing and rollers for wear), repack all space with semi-fluid chassis lubricant or SAE. #160 oil.

Assembling—Use new cork seal or packing washers. Reverse disassembling directions above. When installing Round type bearings, tap bearings in place or if arbor press used, see that pressure is not great enough to spring yoke ends. On Wing type bearings, use new lock plate and see that ears on lock plate turned up against capscrews after screws are securely tightened.

MECHANICS 1½R, 2CR, 3CR TYPES

TYPE 1½R

Nash '600', Model 4140 (1941)

TYPE 2CR

DeSoto, Model S8 (1941)—Except 7 pass.
Nash, Ambassador Six, Model 4160 (1941)
①Oldsmobile, Models 66,68,76,78,96,98 ('41)
①Pontiac, Models 41-24,25,26,27,28,29 ('41)

TYPE 3CR

Nash, Ambassador Eight, Model 4180 (1941)
Packard Clipper, Model 1951 (1941)
Packard Eight & Super 8, 1901,1A,3A,4,5,6,7,8 ('41)

①—Mechanics Type 2C also used on some cars.

DESCRIPTION:—Roller bearing type with conventional cross and individual trunnion bearings fitted on cross ends. Two types of trunnion bearings used: 1) Wing or Flanged type secured to fitting yokes by two capscrews, 2) Round type fitted into bore in yoke arms and retained by snap ring fitted in groove on bearing on inner side of yoke arms. NOTE—Round type trunnion bearings only used on Nash '600' universal joint.

DISCONNECTING UNIVERSAL:—Remove four capscrews securing wing type bearings to companion flange at each end of shaft (wire bearings to prevent them falling off) and remove shaft (NOTE—On cars with flange type bearings at rear only, pull shaft free of slip joint at transmission. NOTE—On Nash '600' rear axle assembly must be removed to expose universal.

SERVICING:—**Disassembly**—Clamp propeller shaft in vise and remove flange type bearings. To remove Round type bearings, use punch and drive out snap rings on all bearings, place cross on vise and strike yoke with hammer until bearing protrudes, repeat operation for opposite bearing, clamp protruding end of bearing in vise and strike yoke with hammer to free yoke from bearings, repeat operation until

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all bearings removed. Remove cross from yoke.

Servicing—If parts show signs of wear, replace with a new cross and four complete bearing assemblies. Care should be taken that no dirt gets into bearings before joint assembled.

Assembling—Use new cork seals on each trunnion (check bearings for lubricant). Install bearing in one yoke with open end flush with inside of yoke fork, insert cross and assemble bearing in opposite yoke, rest assembly on one bearing and drive on opposite bearing until both bearings approximately flush with outside of yoke, insert snap rings on inner end of each bearing, strike end bearing with hammer to centralize assembly on yoke.

SPICER (FORD) TYPE

Used On:

Ford, All Passenger Cars & Comm'l (1941)
Lincoln, Zephyr & Continental 16H (1941)
Lincoln, Custom Model 168H (1941)
Mercury, Model 19A (1941)

NOTE:—Torque tube drive used with a single universal in a ball housing at rear of transmission. Housing flange mounting screws must be taken out and axle assembly pulled back to expose universal.

Ford Trucks—Hotchkiss drive used. See Spicer Needle Bearing Type universal joints for data.

DESCRIPTION:—Conventional cross with individual bearings (bushings on Ford & Mercury, roller bearings on Lincoln) on cross ends. Same design as used on 1940 models.

REMOVAL:—Rear axle ordinarily removed by pulling drive shaft out of splined joint at rear of universal after ball housing flange bolts removed (front yoke bolted on end of transmission mainshaft). Universal can be removed by using special wrench through opening in splined shaft and taking bolt out of front yoke.

SERVICING:—Disassembly. Remove lock ring from each yoke. Drive bushings or caps out with punch (do not lose needle bearings when caps removed).

Assembling—Reverse disassembly directions above (line up lock ring groove in bushing or cap and yoke, install ring). Pack needle bearings with grease before installing. When installing front yoke, see that rear bearing against shoulder on shaft and yoke shoulder against bearing. Tighten mounting screw (see that washer under screw head seated in counterbore in yoke). Fill joint with universal lubricant.

SPICER NEEDLE BEARING TYPE

Used On:

Buick, Series 41-40,50 (1941)—SEE NOTE
Chevrolet Trucks, AL; YR,S,T,U,V,W ('41) SEE NOTE
Crosley, Model CB41 (1941)—SEE NOTE
Ford, All Truck Models (1941)
Graham Hollywood, Models 109,113 (1941)
Hudson, Models 10,11,12,14,15,17,18 (1941)
Studebaker, Models 3G, 11A, 7C (1941)

NOTE:—Buick—Spicer Model 202-5 or Buick type used. For servicing data on both type universals, refer to Buick Type article following.

Chevrolet ¾ Ton AL—Chevrolet type universal used at transmission end, refer to Chevrolet Type universal joint article following. Spicer used at front and rear of rear propeller shaft.

Crosley—Spicer #102 conventional universal joint used with Spicer #98-1182-X torque tube assembly. Universal is enclosed in ball housing secured to adapter at rear of transmission.

DESCRIPTION:—Needle bearing type. Design same as used on 1940 models except as follows:

Chevrolet Trucks—Hotchkiss drive now used.

Studebaker Models—One piece propeller shaft used. Slip joint formed by front yoke of front universal sliding on splines of transmission main shaft

DISCONNECTING UNIVERSAL:—Take out bolts in companion flange or remove nuts on U bolts mounting bearing cups on flange and remove U bolts. When disconnecting this type see that bearing cups do not fall off universal cross.

SERVICING:—Disassembly—Remove locking rings or take out capscrews and remove bearing cups. Tap or press on outer end of one bearing cup until cup on opposite side has been forced out of yoke end. Turn universal joint over and press first bearing cup out (applying pressure on exposed end of universal cross). Bearing cups are light press fit in yoke lugs.

Servicing—Wash all parts in gasoline. Clean out lubricant holes in cross. Examine all parts for wear.

Assembly—Place cross in yoke, install needle rollers in bearing cups, assemble retainer, new cork gasket, and dustcap, pack bearing cup and lubricant passage in cross with SAE. #160 oil, insert bearing cup in yoke end on cross. Use special clamp to press bearing cups in and compress sufficiently so that locking rings can be installed. See that locking rings are firmly seated in recess in yoke. On types using bearing caps, use new lock plate under screw heads, turn up lock tang against capscrew after screws have been securely tightened. On U bolt types, see that lockwashers installed under nuts.

NOTE—When shaft installed, arrows on shaft and yoke at slip joint must line up.

BUICK TYPE

Used On:

Series 40, 40A, 50, 60, 70, 90 (1941)

NOTE:—These models have Torque Tube drive and have a single universal within a ball housing at the rear of the transmission. Universal can be exposed by taking out ball housing flange bolts and sliding ball housing back on shaft.

DESCRIPTION:—Conventional cross type with hardened bushings on cross ends retained in holes in yokes by dowel pins or retainer rings.

Lubrication—Same as for 1940 models.

DISCONNECTING UNIVERSALS:—Rear yoke is integral with stub (splined) shaft and front yoke is bolted directly on rear end of transmission main shaft (speedometer drive gear is cut on yoke shoulder and speedometer drive must be disassembled before yoke is removed). Rear axle should be removed by taking out bolts in torque tube flange at rear end of ball housing and pulling shaft out of stub shaft. If universal is to be removed, special wrench can be inserted through opening in splined shaft and mounting screw removed from front yoke, or universal can be dismounted.

SERVICING:—Disassembly — Remove dowel pins or snap rings to free yoke bushings. Drive out bushings from inner side with flat nosed punch.

Buick Specifications—Clearance between cross journals and bushings should be .002-.004". Bushing clearance in yoke should be .004"-.006". Backlash or clearance of driveshaft splines in splineways in universal rear yoke should be .0005-.0045".

Assembly—Tap bushings in place with soft nosed hammer, being careful to keep bushings lined up so that bearing surface on cross journals is not marred. Install dowel pins or snap rings.

UNIVERSAL BALL HOUSING:—Cork oil seal used at rear end of outer retainer. Inner and outer retainers and universal ball are plated. To correct oil leaks past oil seal, disconnect rear axle, remove cork oil seal, adjust ball housing by removing shims from between inner and outer retainer until joint can be moved by hand at outer end (if bar must be used, housing is too tight), re-install cork seal.

NOTE—Cupped spring washer assembled between outer retainer and cork seal.

CHEVROLET TYPES

Used On:

Passenger Cars AG, AH & Comm'l (1941)
½ Ton Truck & Dubl-Duti AK, AJ (1941)
¾ Ton Truck AL (1941)—Front only

NOTE:—These models have Torque Tube Drive with a single Universal within a ball housing at the rear of the transmission. Universal can be exposed by taking out 4 retaining collar capscrews and sliding ball housing back on shaft.

¾ Ton Truck—This model equipped with Chevrolet type universal within a ball housing at the rear of the transmission but design of rear propeller shaft has been changed to incorporate Hotchkiss drive and Spicer universals are used on rear propeller shaft. Refer to Spicer Needle Bearing Type article above for data.

All Other Truck Models—Hotchkiss drive used on these models with Spicer universals. Refer to Spicer Needle Bearing type article above for data.

DESCRIPTION:—Roller bearing type (Pass. Cars and ½ Ton), hardened steel bushing type (¾ Ton —front). Universals have conventional cross with individual bearings on cross ends.

Hardened Steel Bushing Type—Bushings are installed individually in ends of yokes on cross and are retained in yokes by locking rings (yokes are open sided type and rings inserted through side opening to engage recess in bushing and yoke).

Needle Bearing Types—Two types of trunnion bearings used: 1) Wing type bolted to each yoke by two capscrews in each trunnion (used on front yoke of passenger cars only), 2) Round type fitted directly in yoke ends and retained by locking ring at inner end.

SERVICING:—Disassembly (Pass.Car&½ Ton). Remove 4 capscrews from universal joint ball collar, slide ball and collar back on shaft housing. Take out 4 capscrews in trunnion bearings on front yoke, remove trunnons (use care not to lose rollers—19 rollers used in each trunnion). Slide rear yoke off shaft and remove lock rings from bearings. Take off bearing caps by placing yoke in vise and driving down on center of cross with punch until cross seats on yoke, raise cross, insert 15/16" flat washer over bearing and continue to tap on cross until cap removed (do not lose rollers).

¾ Ton Truck—Same as for pass. cars (above) except that hardened steel bushings in front universal must be driven out after locking rings removed.

Servicing—Thoroughly clean all parts. Examine for wear and replace all worn or damaged parts.

Assembling—Reverse disassembling directions above. When installing needle bearing caps, Round type should be pressed on yoke just far enough to install snap ring, Wing type caps should be fitted to openings in front yoke. Universals and front propeller shaft (trucks) should be filled with transmission lubricant. NOTE—Pack needle bearings with grease before installing.

BUICK TYPE

Used On:

BUICK, SERIES 41-40, 40A, 50, 60, 70, 90 (1941)

TYPE:—Ball bearing, packless type. Same pump used on all series. Pump is same design as used on 1940 Buick models.

OVERHAUL:—Disassembly. Remove fan and fan pulley, use special puller to remove fan hub, take out rear cover screws and remove cover, remove bearing snap ring at forward end of pump body. Support pump in arbor press, press shaft out of impeller, lift impeller out, press shaft and bearing assembly out of pump body toward front.

Seal Assembly. Manufacturer recommends that seal not be disassembled (seal and impeller serviced as assembly). Carbon disc is ground convex on one surface and must be assembled with this face toward pump body.

Assembly. See that face of pump which contacts carbon seal is smooth (replace pump body if rough or burred). Use arbor press to install bearing and shaft assembly supporting pump body on press and applying pressure to bearing outer race only (do not press on shaft or bearing seal), install bearing snap ring. Press fan hub on shaft (support impeller end of shaft allowing pump to float on shaft so that bearings will not be damaged) until shaft projects beyond front face of hub exactly 13/64" (all models). Apply small amount of cup grease to impeller end of shaft, face of pump body and face of carbon disc, press impeller on shaft so that it is flush with end of shaft (support shaft as fan hub end allowing pump to float on shaft while installing impeller).

CADILLAC TYPE

Used On:

CADILLAC, SERIES 41-60S 61, 62, 63, 67, 75 (1941)

TYPE:—Self-adjusting type (spring-loaded packing rings require no adjustment in service) with shaft mounted on ball bearing (pulley end), bushing (impeller end). Same design as used on 1940 V8 models.

Lubrication. Grease fitting provided for rear bushing and packing assembly. Should be filled with water pump grease (G-13) every 1000 miles (front bearing requires no attention).

OVERHAUL:—Disassembly. Remove nut and lockwasher on front of pump pulley, remove pulley and woodruff key in shaft. Remove bearing snap ring in front end of housing, push impeller to rear to expose split washer in back of front bearing, remove washer. Remove snap ring at forward end of rear bushing assembly, withdraw impeller and shaft through rear end of housing. Remove rear bushing assembly toward front noting location of spring, spring seats, bushing and packing rings to insure correct reassembly. If necessary, press front bearing out of housing toward front, press bushing out of bearing.

Bushing & Packing Assembly. To assemble packings on shaft, install special pilot, No. J-831, on end of shaft, insert shaft in pump housing, wind washer groove on shaft with string to avoid damage to packing rings. Coat packing rings with water pump grease, install packing, spring, and bushing parts in same order as removed from pump (make certain that bushing installed with grooved side toward rear packing rings).

Pump Assembly. Reverse disassembling directions given above. Make certain that split washer and snap rings correctly installed and that fan pulley key is in place in shaft before tightening pulley nut.

CHEVROLET TYPE

Used On:

ALL PASSENGER CAR & TRUCK MODELS (1941)

TYPE:—Packless type with ball bearing shaft. Pump design changed over type used on 1940 cars and has two outlets so that water discharged along both sides of cylinders in block. Pump body is new design and is ¼" longer than 1940 type. Shaft bearing is permanently sealed and lubricated and cannot be removed from shaft (shaft and bearing are an assembly).

OVERHAUL:—Pump serviced only as a unit by the factory with no exchange.

Disassembly—Take out screws and remove rear cover plate. Use puller to remove fan pulley from shaft, remove bearing retainer cap. Support pump housing in arbor press, press bearing and shaft assembly out of impeller and housing toward forward end, lift off impeller and remove thrust washer and rubber seal from impeller recess. Do not attempt to remove bearing from shaft.

Seal Assembly—Install rubber seal in impeller hub (spring is integral part of seal), place thrust washer on seal with lugs on washer engaging slots in impeller so that washer bears against ground face of pump housing when impeller installed.

Assembly—Assemble pump in reverse order from disassembly. When installing pump on engine, make certain that correct fan installed for each model.

CHRYSLER TYPE

Used On:

CHRYSLER 6, MODEL C28 (1941)
DE SOTO, MODEL S8 (1941)
DODGE, MODEL D19 (1941)
PLYMOUTH, MODELS P11, P12 (1941)

TYPE:—Packless type with seal assembly located within impeller hub. Shaft mounted on two bushings in pump housing lubricated from single grease reservoir. Same design as used on corresponding 1940 models.

SERVICING:—Lubrication—Single grease fitting provided on lower left side of pump body. Keep reservoir filled with water pump grease (lubricate at 2000 mile intervals).

OVERHAUL:—Disassembly—Drive out fan pulley hub pin, pull hub using C-412 puller (discard old hub, always use new hub whenever hub removed from shaft). Take out screws and remove rear pump cover, withdraw impeller and shaft from rear end of pump body. Take out locking ring within impeller hub, withdraw seal parts. Drive out impeller pin and remove impeller from shaft (if impeller or shaft being replaced singly). To remove pump shaft bushings, drive front bushing pin through into bushing, use puller C-373 to pull both bushings out through front end of pump body.

Pump Bushings—Use Puller C-373 to install new bushings in pump body, make certain that thrust washer installed between bushings with large diameter hole toward rear of pump, install pin in hole in pump body and front bushing. Burnish bushings and reface pump housing with special tool C-384 (insert tool through rear end of pump, turn tool evenly in clockwise direction until cut has been taken on rear face of pump housing, withdraw tool while it is still being turned—this is important as tool will leave ridge on housing if turning stopped while tool is still in contact with pump housing

Seal Assembly—Install seal parts on shaft within impeller hub in following order: Thrust Spring (small end in toward impeller), Seal (use special tool C528 to install seal on shaft and make certain that metal spring cup in toward spring), Seal retainer thrust washer, and locking ring (ring must engage groove in impeller hub).

Assembly—Press impeller on shaft so that back of impeller is flush with end of shaft but do not install pin (assembly must be checked in housing first). Install seal parts in following order: Thrust Spring (small end in), Seal retainer (cupped end out) and seal using special tool C-528 to install seal on shaft, seal retainer washer (engaging ears in slots in impeller), and seal retainer lock ring. Slide impeller and shaft assembly into place in pump body, aligning the shaft and washer. Push shaft assembly into pump body firmly so as to compress seal and spring. Sight through water inlet and note clearance between face of seal retainer washer and lock ring in impeller hub. If clearance less than 3/32", remove assembly and press impeller further on shaft, recheck clearance. When correct clearance of not less than 3/32" secured, drill shaft and install impeller pin. Install impeller and shaft assembly mark location of old hub pin hole on front end of shaft. Press new fan hub on shaft (never use old hubs after they have once been removed from shaft) until clearance between front face of bushing and hub is .003", drill new hole through hub and shaft at right angles to old hole location, install new locking pin. Use new gaskets when installing pump cover and when installing pump on engine.

CHRYSLER BALL-BEARING TYPE

Used On:

CHRYSLER 8, MODELS C30, C33 (1941)

TYPE:—Packless type with ball bearing shaft. Seal is same type as used on other Chrysler models (above). Pump is same design as used on corresponding 1940 car models except for addition of lubrication fitting for pump seal (see Servicing).

SERVICING:—Lubrication—Single fitting on pump body for seal lubrication (shaft bearing is sealed type and does not require lubrication in service). Lubricate pump with Water Pump Grease at 2000 mile intervals.

OVERHAUL:—Disassembly—Use special puller C-498 to remove impeller from shaft (back cover normally left on engine when pump removed). Remove lock ring in impeller hub and withdraw seal parts. Drive out pin in fan pulley hub and remove hub with Puller C-412 (discard both impeller and hub when removed from shaft, old parts cannot be re-installed). Remove bearing lock ring from groove in pump body hub, pull shaft and bearing assembly out of housing (do not attempt to remove bearing from shaft, no inner race used and these parts furnished as an assembly).

Seal Assembly—See directions above for other Chrysler models. Always use new impeller whenever impeller removed from shaft (old impeller will not fit tightly on shaft if re-installed).

Pump Assembly—Install shaft and bearing assembly in pump body (press on outer bearing race only) so that groove in bearing is in line with groove in body and install bearing locking ring. Use special tool C-551 to reface thrust washer bearing face on pump body piloting tool on pump shaft and using **flat (90°) end of tool only** to form perfectly flat surface in pump body for thrust washer bearing. Press the new impeller and seal assembly on shaft so that endplay is .0025-.0045" (measure between fan pulley hub and front face of pump body). If fan pulley hub has been removed, press new hub on shaft, drill hub and shaft and install locking pin.

FORD-MERCURY TYPE

FORD NO. 9N-8501—SEE NOTE

FORD 4 CYL. COMM'L. & TRUCK MODELS (1941)

NO. 78-8501 (RH), 78-8502 (LH)

FORD '85', ALL MODELS (1941)—SEE NOTE
MERCURY, MODEL 19A (1941)

NO. 79-8501 (RH), 79-8502 (LH)

FORD '95', TRUCK MODELS (1941)

FORD '85' TRUCK MODEL NOTE:—This 78-8501 & 2 type pump used on all truck models with '85' engine except Cab-over-Engine models. All Cab-over-Engine models equipped with 79-8501 & 2 pumps (same as used on '95' truck models).

TYPE:—Packless type with shaft mounted on bronze bushing ('78' types), sealed ball bearings packed with grease ('79' types). Pumps are same design as used on corresponding 1940 models (except 4 Cyl. Pump which is new design).

4 Cyl. Pump—Pump is ball bearing type (similar to '79' type) and is mounted on front end of engine block with a back cover plate mounted on the pump body by capscrews. Fan is bolted on shaft in front of water pump pulley. This pump serviced in same manner as '79' type except that screws must be taken out and cover removed for access to impeller.

OVERHAUL:—Disassembly. Place pump in arbor press, press impeller and shaft assembly out of pulley (see note below for '79' types), lift off pulley and front thrust washer, remove impeller and shaft through rear of housing. Press old bushing out of housing. To dismantle seal, remove snap ring within impeller hub at forward end, remove seal parts (note order and assemble in same positions).
NOTE FOR '79' PUMPS. Shaft and bearing assembly must be pressed out of housing toward forward end (bearing seats against shoulder in housing at rear). Do not dismantle this assembly (replace as a unit).

Seal Assembly. When installing seals, install parts in following order: Spring (large end in toward impeller), Spring Guide (tangs out), Seal Clamp Ring, Seal (with projecting face in, and lugs engaging slots in impeller hub), Thrust Washer (engage lugs in impeller hub slots), Snap Ring.

Pump Assembly—Use special tool V-247 to reface front and rear thrust faces of pump housing (necessary to prevent excessive thrust washer wear). Assemble pump by reversing disassembly instructions.

GRAHAM TYPE

Used On:

GRAHAM, HOLLYWOOD MODEL 113 (1941)
GRAHAM, SUPERCHARGED HOLLYWOOD MODEL 109 (1941)

TYPE:—Packless type with ball bearing shaft. Same design as used on previous Graham models.

OVERHAUL:—Disassembly. Take out capscrews and remove rear cover plate, remove bearing locking wire from housing (end of locking wire visible in slot in housing hub at center of bearing assembly). Support pump housing in arbor press, press shaft out of impeller and shaft and bearing assembly out of housing toward front end.

Seal Assembly. Install seal in same order as when taken out (carbon disc next to housing, rubber seal with larger diameter against carbon disc, spring retainer with dished side toward rubber seal, spacer, and spring with large end toward rubber seal).

Pump Assembly. Reverse disassembly directions given above. Make certain that locking wire is installed to retain bearing and shaft assembly.

HUDSON TYPE

Used On:

HUDSON 6, MODELS 10, 11, 12, 18 (1941)
HUDSON 8, MODELS 14, 15, 17 (1941)

TYPE:—Packless type. Shaft mounted on two bushings in housing with single lubricant fitting (both bushings lubricated from central reservoir). Same design as used on corresponding 1940 models.
NOTE—Pump used on Models 15, 17 has second outlet for by-pass. This by-pass not used on other models.

OVERHAUL:—Pump shaft is peened over at each end to retain impeller and fan hub. Manufacturer recommends use of special Tool Set J-733B consisting of special body to be bolted to pump in place of impeller housing, pullers and pushers (for bushing service), and cutter (to remove burr on shaft so that shaft can be pressed out).

Disassembly:—Remove fan and pulley, take out screws and remove impeller housing. Clamp pump upright in vise (grip fan hub in vise jaws), mount tool set body on pump, assemble cutter and thumbscrew and cut burr off shaft at impeller end (turn cutter with wrench while applying pressure with thumbscrew). Install driver and press shaft through impeller, remove shaft from forward end. Lift off impeller and baffle plate, pull old bushings (rear bushing toward rear, front bushing toward front). To dismantle seal, take out locking ring in impeller hub, lift out seal parts.

Bushing Installation—New bushings have inside diameter of .6205-.6206" which is reduced to .6185-.6190" when bushing pressed in place. Bushings cannot be reamed and special bushing pilot must be used to press bushings in (driving bushings with hammer causes bushings to collapse). Shaft clearance will be .0015-.0025" if bushings properly installed.
NOTE—Thrust face of rear bushing must be burnished smooth and flat to prevent thrust washer wear. Use burnishing tool J-733A-5 (spin burnishing tool with socket wrench with thumbscrew 'finger tight' to supply pressure, release pressure while turning tool—this is important). Bushing face must be highly polished and free from all burrs or scratches.

Assembly—Press new bushings into place. Assemble seal in following order: compression spring, seal retainer, seal, thrust washer, locking ring (see that it engages groove in impeller hub). Install shaft assembly, place baffle and new impeller assembly on shaft, peen impeller end of shaft (use ball peen hammer) until endplay as measured between pulley flange and front bushing face is .010-.014". Assemble impeller housing on pump body, fill grease reservoir with aluminum soap base lubricant before installing pump on engine.

SERVICING:—Lubrication—Water pump grease fitting is special type with spring-loaded plunger which cuts off grease inlet when reservoir filled to prevent overfilling and excessive pressure which would force grease past bushings. Lubricate at 1000 mile intervals. Use only an aluminum soap base grease.

LINCOLN TYPE

NO. 06H-8501 (RH), 06H-8502 (LH)
LINCOLN, ZEPHYR & CONTINENTAL 16H (1941)
LINCOLN, CUSTOM MODEL 168H (1941)

TYPE:—Packless type. Shaft mounted on ball bearing (front) bronze bushing (rear) with oiler for rear bearing only (front ball bearing packed with grease and requires no attention). Pumps are same design as used on 1940 later cars and similar to types used on previous models except for longer shaft and other new parts.

SERVICING:—Lubrication—Oiler provided for rear bushing. Lubricate with engine oil at 1000 mile intervals. Front ball bearing requires no attention.

OVERHAUL:—Disassembly—Drive out pin in pulley hub, remove pulley from shaft. Remove bearing lock ring from groove in forward end of pump body hub. Drive out pin in impeller hub, remove impeller and seal assembly from shaft. Press shaft and bearing assembly out of pump body toward front end. To dismantle shaft and bearing assembly, remove locking ring in groove in shaft directly behind bearing, take off bearing felt packing retainer and packing, press bearing off shaft.

Seal Assembly—Seal is assembled in cage which fits on shaft in front of impeller. To assemble seal, install parts in cage in following order: Packing Spring (large end seated in cage), Packing Retainer Washer or cup (cupped end out to receive packing), Seal Packing (fits in cupped end of retainer), Disc or thrust washer. NOTE—Ears on thrust washer disc must engage slots in cage (disc is 4 pronged type).

Pump Assembly—To install new bushing in pump body, press old bushing out, press new bushing in so that rear end is flush with thrust washer face in pump body, ream bushing with special reamer Z-193 and reface rear end of bushing and pump body with special tool Z-191. Install front felt retainer, felt packing, inner spacer, and lock ring on shaft behind front ball bearing, press shaft and bearing assembly in pump body, install outer spacer on shaft in front of bearing and lock ring in pump body groove. Install seal assembly and impeller on rear end of shaft, pin impeller to shaft.

NASH TYPE

Used On:

NASH '600', MODEL 4140 (1941)
NASH AMBASSADOR SIX, 4160 (1941)
NASH AMBASSADOR EIGHT, 4180 (1941)

TYPE:—Adjustable packing type with floating impeller (impeller installed in slotted end of shaft and held in place by tubular brass rivet). Shaft mounted on hard bronze bushing with grease fitting for lubrication. Pumps are same design as used on 1940 models.

SERVICING:—Lubrication—Lubricate with water pump grease at 2000 mile intervals. Use care not to overlubricate which would force grease out into cooling system.

Packing Adjustment—Adjust only with engine idling. Turn packing nut up just enough to stop water leaks.

OVERHAUL:—Take out screws in cover plate, remove cover. Remove rivet in impeller hub, remove impeller, withdraw shaft. When reassembling pump, install impeller and insert tubular brass rivet, support shaft through outlet hole, work through hole in body and rivet impeller on shaft.

OLDSMOBILE TYPE

Used On:

SIX, '66' F-41, '76' G-41, '96' H-41 (1941)
EIGHT, '68' E-41, '78' J-41, '98' L-41 (1941)

TYPE:—Packless type with ball bearing shaft. Same design as used on 1940 car models with special brass moisture slinger on shaft as follows:

Brass Moisture Slinger—Consists of small cup shaped brass slinger installed on shaft at rear of ball bearing. This slinger, No. 413778, serviced separately and new slinger should be installed whenever pump is serviced. See directions below.

OVERHAUL:—Disassembly—Remove cover plate on back of pump housing, remove pulley from pump shaft flange. Take out bearing lock ring in slot in top center of bearing hub on housing. Support outer end of pump body in arbor press, press shaft and bearing assembly out of impeller and housing toward front end. Bearing cannot be disassembled and must be replaced with the shaft as a unit. To remove seal assembly, take out snap ring in seal recess in rear end of housing, withdraw seal parts.

Pump Shaft Moisture Slinger—To install slinger, start slinger on shaft with flared end toward bearing, stand shaft and bearing assembly in arbor press with slinger end up, use special tool J-1446 to press slinger down on shaft until slight drag is felt on .025" feeler placed between end of bearing and slinger. CAUTION—This .025" clearance between slinger and bearing is necessary to secure proper protection for bearing without slinger dragging on bearing which will cause noise.

Seal Assembly—Machined seat in pump housing must be smooth and clean to insure good seating of seal. Make certain that seat not scored, clean with thinner to remove all dirt and gum, wipe dry or use Pump Body Cleaning Reamer, No. J-1455, to clean pump body before installing seal. Install seal using tool No. J-1456 and see that seal does not hang up on sides of casting (wetting housing with soap solution will facilitate seal installation), install seal snap ring.

Assembly—Support pump body in arbor press, press shaft and bearing assembly in until bearing lock ring lines up, install lock ring. Press impeller on shaft until clearance between rear finished face of impeller and rear face of pump body is 1/32". Install rear cover plate (use new gasket) and pulley.

Pump Installation (8 Cylinder Models)—Use new neoprene grommet in by-pass hole in cylinder head when installing pump. This type by-pass not used on 6 Cylinder models.

PACKARD TYPE

Used On:

CLIPPER MODEL 1951 (1941)
'110' SIX 1900, '120' EIGHT 1901, 1A (1941)
'160' SUPER EIGHT 1903, 3A, 4, 5 (1941)
'180' CUSTOM SUPER EIGHT, 1906, 7, 8 (1941)

TYPE:—Packless type with ball bearing shaft. Same design as used on corresponding 1940 models.

OVERHAUL:—Note—Rebuilt pumps available from factory on 'exchange' basis. To service pumps proceed as follows:

Disassembly—Remove fan and pulley, take out bearing locking ring in slot in bearing hub on housing. Support pump housing in arbor press, press impeller off shaft, remove shaft and bearing assembly through front of housing. To remove seal, take out locking ring in impeller hub, withdraw composition thrust washer, rubber seal, spring cup and spring. NOTE—Do not remove fan pulley hub or attempt to remove bearing from shaft. Shaft, bearing, and pulley hub serviced as an assembly.

Seal Assembly—When installing seal in impeller, make certain that small end of spring in toward impeller, coat inner surface of seal with glycerine and install with larger flanged face out toward composition washer, install composition thrust washer with smooth (convex) face out toward pump housing, install locking ring.

Assembly—Install shaft and bearing assembly in pump housing making certain that locking ring groove in bearing lines up with slot in pump housing. Coat impeller end of shaft with glycerine (to prevent damage to seal when impeller pressed on). Heat impeller in water just under boiling point for 1½ minutes, press impeller on shaft until clearance between impeller vanes and housing is .012-.074". Coat pump cover gaskets with Perfect Seal Grade A gasket paste when installing cover. Make certain that bearing locking ring installed in pump housing slot.

PONTIAC TYPE

Used On:

SIX, MODELS 41-24, 25, 26 (1941)
EIGHT, MODELS 41-27, 28, 29 (1941)

IMPORTANT SERVICE NOTE:—1939-40-41 Pumps—Impeller clearance (distance from rear face of impeller to rear face of pump body) should be 3/64" and not 9/64" as previously specified for these models. See Overhaul data below.

TYPE:—Packless type with ball bearing shaft. Same design as pump used on 1940 car models.

Pump Bearing Shield—Consists of a neoprene shield installed in the pump housing between the bearing and the water pump seal. Shield prevents moisture collecting on bearing.

OVERHAUL:—Disassembly. Remove fan and pulley, and cover plate on rear of pump housing. Take out shaft retainer wire (bearing lock ring) in slot at top center of bearing hub on housing. Support front face of pump housing in arbor press, press shaft and bearing assembly out of impeller and housing toward front end. Remove seal assembly from housing. If shaft and bearing assembly being replaced, press fan hub off old shaft and install on new shaft.

Servicing—If bearing retainer wire worn (indicating that bearing rotates and has excessive end thrust), or if impeller scrapes on housing due to excessive end thrust, pump assembly should be replaced. If bearing is rough or bearing seals loose in outer race so that they can be turned by hand, replace bearing and shaft assembly. Carbon washer, rubber seal, and spring are furnished as a package unit.

Assembly—Install seal assembly in pump housing in following order: inner spring cup (cupped side out), spring, outer spring cup (flange out toward seal), rubber seal (smaller diameter out, make certain that flared portion of inner spring cup enters rubber seal so that it is retained in housing when installed), carbon washer with polished side toward impeller (see that ears on washer engage slots in housing). Install neoprene shield in bearing bore in housing with smaller diameter end toward seal and larger diameter end toward bearing. Insert bearing and shaft assembly in from front, lining up retainer groove with slot in housing (if bearing is press fit in housing, remove fan hub install bearing in arbor press applying pressure on outer race only, re-install fan hub applying pressure to impeller end of shaft and allowing housing to float on bearing so that no pressure exerted on bearing or races). Press impeller on shaft (support assembly on fan end of shaft) until clearance between rear face of impeller and face of cover plate flange on housing is 3/64". Install shaft retainer wire through slot in housing, use new gasket and install pump rear cover plate.

STUDEBAKER CHAMP. & PRESIDENT TYPE

Used On:

CHAMPION, MODEL 3G (1941)
PRESIDENT, MODEL 7C (1941)

TYPE:—Packless type with ball bearing shaft. Same design as used on 1940 Champion model except for new seal assembly as follows:

Seal Assembly—Consists of separate spring and spring cups, rubber seal, seal washer, and seal lock ring. Assembly is retained in impeller hub by lock ring which engages notch in forward end of hub.

OVERHAUL:—Disassembly—Remove bearing lock ring from slot in housing hub at center of bearing. Support housing in arbor press and press shaft and bearing out of impeller and housing toward front. Support fan hub in press and press shaft out of hub (if fan hub removed, always use new hub when reassembling pump). To disassemble seal, remove lock ring from forward end of seal recess in impeller hub, withdraw seal washer, seal, seal spring and cups.

Seal Assembly—Install seal parts in same order as removed, make certain that lock ring engages notch in impeller hub to retain seal assembly.

Pump Assembly—Examine thrust face in pump housing which bears against seal washer. Reface this surface with Water Pump Facing Tool No. J-1501 if surface is rough or scored. If fan hub removed, press new fan hub on shaft so that it is flush with end of shaft, install shaft, bearing, and fan hub in housing so that retainer lock ring groove on bearing lines up with slot in housing, install lock ring. Press impeller on shaft so that clearance between impeller and housing is 1/32". On President pump, install rear cover (no cover used on Champion). CAUTION—Always use new fan hub when hub removed from shaft (old hub will not be tight fit on shaft if re-installed).

STUDEBAKER COMMANDER TYPE

Used On:

COMMANDER, MODEL 11A (1941)

TYPE:—Adjustable packing type. Shaft supported on two bushings with pressure gun fitting (front bushing), grease cup (rear bushing). Same design as used on 1940 Commander model.

SERVICING:—Packing Adjustment—Adjust packing by turning up adjusting nut (insert screwdriver between pulley and pump housing). Packing is grapho-metal ring type and requires more pressure than ordinary packing. To renew packing, thoroughly clean out old packing, install four new packing rings, one at a time, tightening adjusting nut down on each ring as it is installed. This special ring packing prevents shaft scoring (with more than ordinary adjusting nut pressure) and gives longer service.

Lubrication—Use chassis lubricant in pressure gun fitting on front bushing, water pump grease (Kasson or other water proof grease) in grease cup at rear bushing.

OVERHAUL:—Disassembly—Remove rear cover plate and fan pulley. Press fan hub off forward end of shaft, withdraw shaft and impeller assembly through rear of pump. Remove packing nut and packing. Press front bushing out toward front, rear bushing out toward rear.

Assembly—Install new bushings. Insert impeller and shaft assembly into housing from rear, press new fan hub on shaft until clearance between hub and pump housing is .003-.005". See Servicing data above for Packing installation and adjustment.

CAUTION—Always use new fan hub when hub removed from shaft (old hub will not be tight fit if re-installed).

WILLYS TYPE

Used On:

AMERICAR & PLAINSMAN MODEL 441 (1941)
WILLYS PICK UP 441, PANEL DELIVERY 441P ('41)

TYPE:—Packless type with ball bearing shaft. Same design as used on 1940 Willys models.

OVERHAUL:—Disassembly—Use special W-116 puller and pull impeller off shaft, lift out bakelite seal washer. Remove bearing lock ring from slot in bearing hub on pump housing, support pump housing in arbor press, press shaft and bearing assembly out of pump housing toward forward end. To remove fan pulley from shaft, use any regular puller (special W-115 puller furnished for this purpose) to pull pulley off shaft. Do not attempt to remove bearing from shaft (shaft and bearing serviced as assembly).

Servicing—If rear face of pump housing (on which bakelite seal washer bears) is not smooth and flat, reface with special tool W-114.

Seal Assembly—Rubber seal is of 'U' section with spring in recess in seal,. Install seal in recess in impeller hub, place bakelite thrust washer on seal, engaging ears on washer in slots in impeller hub.

Assembly—Reverse disassembly directions above. Make certain that bearing lock ring installed in slot in pump housing bearing hub so as to engage groove in bearing shell.